DEALING WITH ECOLOGICAL VARIABILITY AND CHANGE: PERSPECTIVES FROM THE DENESOLINE AND GWICH'IN OF NORTHERN CANADA

by

Brenda L. Parlee

A Thesis submitted to the Faculty of Graduate Studies of

The University of Manitoba

in partial fulfilment of the requirements of the degree of

DOCTOR OF PHILOSPOPHY

Natural Resources Institute

University of Manitoba

Winnipeg, MB

ABSTRACT

Many indigenous peoples have developed knowledge and practices for living with ecological complexity. Indicators and systems of monitoring based on the local and traditional knowledge of the Denesoline and Gwich'in of northern Canada were investigated. Through collaborative case study research we identified indicators of community health, ecosystem health, social-ecological health and ecological variability. Denesoline health indicators are framed around the *Dene way of life* and the journeys of self-government, healing and cultural preservation. Many different kinds of ecosystem health indicators are used by the Denesoline for understanding and communicating about variability and change in wildlife body condition, wildlife abundance, distribution and diversity, water quality, cultural landscapes and land features were also identified. Gwich'in berry picking activities were the basis for the study of social-ecological health; indicators identified related to individual and family health, social connectivity, cultural continuity, land and resource use, stewardship, self-government and spirituality. The berry picking case study also revealed indicators of ecological variability including species related (e.g. timing/rate of maturation of berries), regional (e.g. temperature), local (e.g. habitats) and site specific indicators (e.g. soil conditions).

In addition to indicators, the Denesoline developed a system for monitoring caribou movements using key water crossings known to be bifurcation points to aid them in subsistence harvesting. Monitoring also helps Gwich'in berry pickers make decisions about where, when and with whom to harvest berries. Knowledge generated through monitoring, about variability, appears to be interrelated with the management of this commons resource. Locally developed "rules-in-use" for resource access, sharing information and harvest sharing seem to mirror the relative predictability of the species and also change in response to the abundance and distribution of berries across the region.

How can this kind of traditional knowledge be included in resource management decision-making? Legislation and obligations defined in Supreme Court rulings have created clear opportunities in processes such as environmental assessment, however, even where no legal requirements exist, the culture of co-management created in settled land claim areas seems to have had a spill-over effect into non-settled claim areas. Informal arrangements also appear to increase awareness about the value of Aboriginal participation and traditional knowledge.

DEDICATION

~ To my Dad, Paul Parlee (1942-2005), in memory of his love of learning...
...and to my son Eric,
who reminds us that each day is a gift~

ACKNOWLEDGEMENTS

Scott - for your love and support and
willingness to join me on my research adventures! – Thank you.

I am deeply appreciative of the time, effort and support of my
Doctoral Thesis Committee:
Fikret Berkes - Natural Resources Institute, University of Manitoba,
Micheline Manseau - Natural Resources Institute, University of Manitoba / Parks Canada
John O'Neil – Community Health Sciences, University of Manitoba
Nigel Bankes - Faculty of Law, University of Calgary

Special thanks goes to those in Lutsel K'e who supported the research including: Evelyn Marlowe, Wally Desjarlais, Terri Enzoe, Walter Desjarlais, Marcel Basil, Nancy Drybones, Shawn Catholique, Jeanette Lockhart, Agatha Marlowe, Dennis Drygeese, Marie Catholique, Gloria Enzoe, Charlie Catholique, August Enzoe, Florence Catholique, Bertha Catholique, James Marlowe, Stan Desjarlais, Lawrence Catholique and Chief Archie Catholique, Ellen Bielawski, Anne Kendrick, Phil Lyver and Steve Ellis.

From Fort McPherson, I would like to thank my researcher assistant, Christine Firth; the Teetl'it Gwich'in women from Fort McPherson; members of the Teetl'it Gwich'in Renewable Resources Council; the Gwich'in Renewable Resources Board and the Gwich'in Social and Cultural Institute. Special thanks to Peter Clarkson, Ingrid Kritsch, Janet Winbourne and Pippa Seccombe-Hett.

The research was funded and supported by the Sustainable Forest Management Network and the Gwich'in Renewable Resource Board. I also received support from a University of Manitoba Doctoral Research Fellowship and from the Northern Scientific Training Program (NSTP).

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CHAPTER ONE

INTRODUCTION

1.1 INTRODUCTION

Over many generations, land-based societies have developed sophisticated systems of knowledge and practices that have enabled them to live in complex and dynamic environments (Berkes et al. 2003). Pastoralist societies from east Africa, for example, have developed a variety of social mechanisms for dealing with variability including ways of identifying rainfall and vegetation re-growth patterns as a means of survival in desert conditions (Niamir-Fuller 1998; Mwesigye 1996). Indigenous peoples in Mexico and Nigeria have developed community-based systems of sustainable agriculture that protect biodiversity (Alcorn and Toledo 1998; Warren and Pinkston 1998). There is also a growing literature related to indigenous and community-based fisheries management. (Berkes et al. 2001; Wilson et al. 1994). Monitoring practices based on traditional knowledge are also visible in many parts of the world (Moller et al. 2004; Berkes et al. 2000a). The goal of the Thesis is to contribute to this literature on traditional knowledge and management practices through research on indicators and monitoring practices of the Denesoline and Teetl'it Gwich'in of the Northwest Territories. This goal will be achieved through three interrelated objectives:

i) Identify and discuss indicators based on the local and traditional knowledge of the Denesoline and Teetl'it Gwich'in including indicators of community health, social-ecological health, ecosystem health and ecological variability;

ii) Document and discuss monitoring practices developed by the Denesoline and Teetl'it Gwich'in and their value as tools for dealing with ecological variability and change;

iii) Identify some opportunities for using traditional knowledge in resource management decision-making in the Denesoline and Teetl'it Gwich'in study regions.

The next four chapters of the Thesis (Chapters Two to Five) focus on indicators of community health, social-ecological health, ecosystem health and ecological variability. Indicators of community health or the "Dene way of life" are presented in **Chapter Two** based on the local and traditional knowledge of Lutsel K'e Dene First Nation. In **Chapter Three,** indicators of social-ecological health are presented based on research carried out with Teetl'it Gwich'in berry harvesters about their relationship to the land[1]. This Chapter suggests that individual preference and well-being, family well-being, social connectivity, cultural continuity, land and resource use, stewardship, self-government and spirituality are all important dimensions of berry harvesting and the relationship of Teetl'it Gwich'in women to the land.

Chapter Four deals with indicators or 'signs and signals' used by the Denesoline for understanding and communicating about ecological health. The "signs and signals" used by the Teetl'it Gwich'in for understanding and communicating about variability in the abundance and distribution of berry patches across the Gwich'in Settlement Region is the subject of **Chapter Five**.

[1] These chapters present ideas about health and social-ecological systems which do not have direct relevance to other Chapters in the Thesis.

The monitoring practices that have been developed by the Teetl'it Gwich'in and Denesoline are the subject of the next two Chapters. In **Chapter Six,** I describe a process of monitoring developed by the Denesoline for dealing with variability in caribou movements. **Chapter Seven** describes a process of monitoring developed by the Teetl'it Gwich'in for dealing with variability in the abundance and distribution of good berry patches. The effect of this Gwich'in practice of knowledge generation on institutions or "rules in use" emerges as a main theme of this Chapter.

Many of the indicators presented in Chapters Three to Five and the systems of monitoring described in Chapter Six and Seven were developed by the Denesoline and Gwich'in to assist in their caribou and berry harvesting activities. Can they be useful in other contexts? **Chapter Eight** explores this potential by identifying and discussing the opportunities for including traditional knowledge in resource management decision-making in the north. The Chapter deals specifically with resource management institutions involved in addressing forest fire, non-renewable resource development and climate change, three issues of concern to the Denesoline and Gwich'in.

1.2 BACKGROUND

Modern day hunter-gatherer societies have always been an important focus of study; "nearly everyone looks to hunter-gatherers for foundation insights into the origin of human capacities and inclinations" (Winterhalder 2001:12). The literature on Dene

hunter–gatherer societies is extensive (Slobodin 1962; McKennan 1965; Ridington 1968; Gillespie 1976; Sharp 1977; Noble 1971; Smith 1981; Nelson 1986).

Evolutionary ecology and micro-economics underpin much of research on hunter-gatherer behaviour. Early research took a particularly strong Darwinian approach suggesting that the resource harvesting practices of hunter-gatherer societies today reflect evolutionary processes of natural selection. Others have interpreted this behaviour as simply economic; the hunter makes rational decisions about where and when to harvest based on economic self-interest. Cultural ecologists have defined hunter-gatherer behaviour in terms of cultural adaptations including adaptations to local environments; some tried to draw linear connections between specific environmental factors and specific cultural characteristics. Steward (1955; 1936), dismissed these environmental deterministic arguments; he asserted instead that human creativity and ingenuity could produce any number of possible cultural adaptations in very similar environments. This conceptual framing of cultural adaptation led the way for a new stream of study in cultural anthropology in which hunter gather peoples were viewed as having creative and diverse approaches to living and managing their lands and resources (Lee and DeVore 1968). Many of these creative and diverse approaches have been documented through traditional ecological knowledge research.

1.2.1 Traditional Ecological Knowledge and Management Practices

Traditional ecological knowledge (TEK) or traditional knowledge (TK) is defined as a cumulative body of knowledge and beliefs evolving by adaptive processes and handed down through generations by cultural transmission (Berkes 1999:9).

Northern Aboriginal peoples, and many other indigenous societies, have always acknowledged and respected the knowledge of their elders. Recognition of traditional knowledge in policy and academia, however, has only come in the last two decades. This can be attributed to several factors. In the early 1990s, international forums such as the Rio Summit[2] and Agenda 21[3] focused attention on the role of indigenous peoples and the value of their knowledge in achieving sustainability. In Canada, land claim settlements and other legal advances in the recognition of Treaty and Aboriginal rights have also created opportunities for Aboriginal peoples and their knowledge to be included in processes such as environmental assessment (Usher 2000; Stevenson 1996; Ellis 2005), land use planning and in the co-management of valued resources such as fisheries and caribou (Manseau et al. 2005; Kendrick et al. 2005; Berkes 1999). Public concern over natural resource crises, such as the loss of the cod stocks on the east coast, has also led to interest in traditional knowledge as policy makers seek out alternative perspectives about the state of resources and resource management (Berkes et al. 2005b; Finlayson and McKay 1998).

Recognition of traditional knowledge, indigenous knowledge or ethno-science in the academic literature can be traced back to the work of Levi-Strauss (1966) and the study

[2] Principle 22 of the Rio Declaration states "Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development".

[3] Agenda 21 was an outcome of the United Nations Conference on Environment and Development (UNCED), which was held in Rio de Janeiro, Brazil in June 1992. Chapter 26, the Report of UNCED and GA Resolution 48/163, underscores "the vital role of Indigenous Peoples and their communities in the interrelationship between the natural environment and its sustainable development…"

of classification systems developed by indigenous peoples from Brazil. Since that time, traditional knowledge has emerged as a focus of study in many disciplines including anthropology, archaeology, botany and ecology (Cruikshank 2001; Turner and Davis 1993; Berkes 1999). Among the areas in which traditional knowledge has gained recognition is in the study of complex systems or social-ecological systems (Berkes et al. 2003; Berkes et al. 2000a; Berkes et al., 1998). The reference to social systems most often refers to institutions or rules-in-use. These generally include, but are not limited to the institutions of knowledge and management practices that enable communities to learn and adapt to ecological change (Berkes et al. 1998). Ecological systems are simply those conventionally defined as natural or biophysical systems. A social-ecological system is the combined or integrated sense of humans-in-nature; a bounded network made up of relationships among individual components and systems (Berkes et al. 1998b; Davidson-Hunt and Berkes 2003).

Social-ecological systems can be characterized similarly to other complex systems; they are dynamic and operate at different temporal and spatial scales. Complex systems also exhibit characteristics not visible in simple systems including non-linearity, self-organization and uncertainty. As a result, complex system thinking has been coined the "science of surprise" (Holling 1986). Holling (2001) suggests that the best approach for avoiding "nasty surprises" is to embrace ecological uncertainty and attempt to understand the key elements and processes that drive system dynamics or ecological variability and change (Holling 1992; 1978). Ecological variability refers to the spatial and temporal variations in ecological conditions that are relatively unaffected by people within a given

period of time or geographic area (Landres et al 1999). Also described in terms of "natural variability", "range of natural variation" or "historic variation", ecological variability is a key characteristic of complex systems including social-ecological systems (Levin 1992). Ecological change simply refers to those changes in ecosystem behaviour that are outside the scope of natural variability. Among the tools and practices valued for understanding and dealing with such complexity are indicators and practices of monitoring (Berkes et al. 1998a; Berkes et al. 2003). More specifically, indicators and systems of monitoring can be a guide for understanding, communicating about and dealing with complex and dynamic social and ecological conditions.

1.2.2 Indicators

Indicators are generally defined as tools useful for understanding change over time. More specific definitions vary depending on the context in which they are developed and used. Holling (1978) described indicators as the key elements and processes that underlie ecosystem dynamics. Health researchers and economists often refer to indicators as statistics or "proxy measures" that can summarize or represent a larger body of data (Cole et al. 1998). Ecological indicators have been defined as the "measurable characteristics of the structure, composition, or function of ecological systems" (Niemi and McDonald 2004). In the context of sustainability, indicators are often defined as yardsticks, flags, guideposts or signs and signals of change (Meadows 1998). Indicators developed by scientists have conventionally been expressed in technical language, and targeted aspects of communities and the environment that only scientists considered useful (Niemi and McDonald 2004; Schiller et al 2001). As public interest and concern about social and

environmental conditions has grown, so has interest in indicators that can be easily understood and used by the lay public.

Identifying indicators of interest or value to local communities, has thus become an important area of research, underlying initiatives such as state of environment reporting, quality of life reporting, the healthy communities movement and a range of other sustainability programs (Mitra 2003; Flynn et al. 2002; UNDP 1996). But what can these kinds of indicators contribute to our understanding of communities and ecosystems?

Academics involved in the study of complex systems recognize local perceptions of ecological change are fundamental to understanding and dealing with complex social and environmental issues (Waltner-Toews and Kay, 2005). In their efforts to learn more about health issues of concern to Aboriginal peoples, medical anthropologists and epidemiologists, are also engaging in the study of indicators based on local knowledge (O'Neil et al. 1998; Trostle and Sommerfield 1996). Indicators based on local and traditional knowledge are also being viewed as valuable tools in forest management; they are seen as useful in understanding Aboriginal community interests, cross-cultural planning and meaningfully and appropriately including traditional ecological knowledge in forest management (Karjala and Dewhurst 2003:2).

This Thesis focuses on indicators based on the local and traditional knowledge of the Denesoline and Gwich'in. Four different kinds of indicators are dealt with including

indicators of community health and well-being, social-ecological health indicators, ecosystem health indicators and indicators of ecological variability.

Community Health Indicators

The tendency in much health research, particularly that related to the health of Aboriginal peoples, has been to focus on a narrow set of indicators related to disease and illness and depend vital statistics or administer health care services data (RCAP 1993). There is also a tendency to focus on negative or dangerous behaviours as indicators of health in Aboriginal communities. The Government of the Northwest Territories, for example, regularly monitors rates of drug and alcohol abuse, sexually transmitted diseases and incidences of family violence in northern communities (Government of the Northwest Territories 1998c). The use of these kinds of indicators is being criticized by some Aboriginal groups in Canada; they argue that "surveillance" of these kinds of indicators is politically and socially harmful. It constructs "an understanding of Aboriginal society that reinforces unequal power relationships; in other words, an image of sick and disorganized communities can be used to justify paternalism and dependency" (O'Neil et al. 1998).

Alternative meanings and definitions of health have been documented by medical anthropologists and others engaged in health research with Aboriginal communities. Being healthy to the Whapmagoostui Cree for example, means "being alive well" (*miyupiamaatisiium*) (Adelson 2000). To the Anishinabek of Manitoulin Island, health or the "good life" (*mno bmaadis*) is a matter of balance between the four elements of the

medicine wheel - physical, emotional, mental and spiritual (Wilson 2000: 150). This Thesis aspires to contribute to this literature through research on indicators of community health and well-being based on the knowledge of Lutsel K'e Dene First Nation.

Social-Ecological Health Indicators

Social-ecological health is a concept that is adapted from the complex systems literature (Berkes et al. 2003; Gunderson and Holling 2002). Historically the study of complexity focused on natural or biophysical systems (Holling 1972). The study of complexity has broadened in recent years, however, with the recognition that "the delineation between social and natural systems is artificial and arbitrary" (Berkes and Folke 1998:4); the health and well-being of human systems is fundamentally interconnected with that of natural systems. One framework that explicitly connects "health" in complex systems thinking is the Adaptive Methodology for Ecosystem Sustainability and Health (AMESH) (Waltner-Toews and Kay 2005). The central component of this methodology is the documentation and use of social and cultural narratives to describe system structure and function. "AMESH acknowledges the fundamentally important role that local people play in any endeavor to address ecosystem sustainability and health and supports the full participation of local people and the inclusion of non-expert perspectives to shape and inform our understanding of the ecosystem" (Waltner-Toews and Kay 2005: 12). Using the AMESH, approach researchers have been able to identify aspects of system structure and function including, social-ecological interactions, that local people value as "healthy". Other examples of research aiming to integrate social and ecological health

come from the complex systems literature and the field of medical geography (Walker et al. 2002; Wilson and Rosenburg 2002)

This Thesis focuses on a social-ecological interaction of importance to Teetl'it Gwich'in women – berry picking - and attempts to understand some of the key values associated with that interaction that they identify as important or "healthy" through the study of indicators (Chapter Three).

Ecological Indicators

There is a large body of literature on ecological indicators or ecosystem health indicators. Biologists, ecologists and others have sought to learn more about the complexity of ecosystems by identifying key elements and processes of ecological change. Ecological indicators are not just tools of western science. "They have been used for centuries to guide environmental and livelihood planning and action, long before scientific knowledge attempted to understand the processes of environmental change and development" (Mwesigye 1996:74). Among the Cree and Inuit of Western Hudson's Bay, indicators are the voices of the earth that are always talking to us (Tarkiasuk et al. 1997). For many Aboriginal peoples, physical and spiritual signs and signals that the land is healthy are very important to their own feelings of health and well-being and that of their communities. As described by a Cree man from Chissasibi, "If the land is not healthy, how can we be?" (Adelson 2000a:6). This Thesis will add to this literature through research on indicators of ecosystem health based on the traditional knowledge of

the Denesoline (Chapter Four) and indicators of ecological variability based on the knowledge of the Teetl'it Gwich'in (Chapter Five).

1.2.3 Monitoring

Monitoring, like indicators, is defined in many different ways and has been used to address many different research and management goals. These range from tracking the effects of economic policies, measuring the value of resource management programs and projects, to assessing thee status of valued natural resources (Babu and Reidhead 2000). Monitoring is also valued as a tool for adaptive resource management. Adaptive management is based on an understanding that resources are complex and dynamic and cannot be understood or managed according to static predictions of structure and function (Gunderson et al. 1995; Holling 1978). By monitoring, resource managers do not have to depend only on data in the here and now; systematic observations made over time can instead be fed into the decision-making process, providing resource managers with opportunities to learn and adapt. The feedback between knowledge generation, on the one hand, and resource management decision-making can be helpful in addressing many kinds of complex environmental issues.

In the Canadian north, government departments, industry and environmental organizations are engaged in monitoring the potential effects of resource development and phenomenon such as global warming. Aboriginal groups in many parts of the Canadian north are also seeking to develop monitoring programs based on their local and traditional knowledge. In Labrador the Innu have developed a project focused on

monitoring the dynamic relationship between *ashkui* (areas of early or permanent open water on rivers, lakes and estuaries), ice, and wildlife and local harvesters (Innu 2002). In the Western Hudson's Bay, Cree harvesters monitor change in ice conditions and geese migration to learn more about climate change (McDonald et al. 1997). In 2000, the Beverley Qamanirjuaq Caribou Management Board, represented by nine Aboriginal communities, agreed to create a long-term and ongoing monitoring program to track change in the health of these caribou herds (Wakelyn 2000). Aboriginal groups in the Slave Geological Province are also demonstrating a growing interest in monitoring the environmental impacts of diamond mining. Rather than rely on western scientists from southern Canada, as was the model with the agency created to monitor the effects of the BHP Ekati mine (BHP Diamonds Inc. et al. 1997), Aboriginal groups created their own Board and process for monitoring the effects of the DeBeers Snap Lake Diamond Mine (Government of the Northwest Territories 2004b).

Some northern Aboriginal peoples have also expressed strong interest in socio-economic monitoring. During the negotiation of the Socio-Economic Agreement for the Diavik Diamond Mine, for example, Aboriginal Groups negotiated for the development of a communities' group so that community members could engage in more culturally appropriate and meaningful discussions about the impacts of diamond mining on their health and well-being (Diavik Diamond Mine 1999).

One of the earliest allusions to monitoring based on traditional knowledge in the academic literature focuses on the Tukano of people of Columbia who systematically

observed variances in the availability of wildlife populations valued as traditional food (Reichel-Domaltoff 1976). Other examples of monitoring based on traditional knowledge come from the Sahel region of Africa where locals monitor changes in the condition of pasture lands to guide their decisions about livestock rotation (Niamir-Fuller 1998). In New Zealand, Maori harvesters keep track of their catch and body condition indicators of *titi* birds (*Puffinus griseus*) each year to determine the long-term well-being of this valued species (Lyver 2002). Aboriginal hunters in several parts of northern Canada monitor body condition indicators of barren ground caribou in order to make determinations about herd health (Kofinas et al. 2002; Berkes 1999; Lyver and Gunn 2005; Kendrick et al. 2005). Chisassibi Cree fishers regularly keep track of the number of fish caught in a given area with a particular net as well as the composition of the catch, size distribution and body condition, in order to make decisions about where and when to fish and what size of net to use (Berkes 1999). Harvesters from around the world have thus demonstrated a capacity for systematic observation of change in valued resources and environments (Moller et al. 2005). "The proximity of users to the resource confers an ability to observe day-to-day changes by selected individuals such as community stewards and elders (Berkes et al. 2000b: 1254).

In these examples, monitoring is not simply about observing change. Many such monitoring practices are strongly connected to, or are embedded within, other aspects of the land-based way of life including subsistence, trade, family and community organization. In the Cree fishing for example, fishers depend on their knowledge of fisheries to ensure their own subsistence as well as that of their communities (Berkes

1999). In these same societies, monitoring the status of valued resources is also highly connected to other resource management practices and institutions or rules such as the protection of biodiversity, resource rotation and forest succession management (Berkes et al. 2000a). Strong feedback loops between harvester observations and decision-making was, arguably, critical to successful hunting, fishing and trapping, particularly in cases where the abundance or distribution of the resource was unpredictable or uncertain. In Chapters Six and Seven, I attempt to build on this body of literature by presenting research about monitoring practices of the Denesoline and Teetl'it Gwich'in developed to deal with variability in the movements of barren ground caribou and the abundance and distribution of valued berry patches.

1.3 CASE STUDIES

This Thesis is based on work with two Aboriginal communities from the Northwest Territories. Lutsel K'e is a Denesoline community of 377 people located on the east arm of Great Slave Lake and is part of the Treat#8 Tribal Council. Fort McPherson is a Teetl'it Gwich'in community of 977 people located in the Mackenzie Delta region of the Northwest Territories and is one of four Gwich'in communities who settled the *Gwich'in Comprehensive Land Claim Agreement* in 1992 (Figure 1-1).

My experience working with northern peoples began in Lutsel K'e, Northwest Territories in 1995 (Fig. 1-1). I was a Master's student at the University of Waterloo working under the direction of a group of academics from the Canadian Arctic Resources Committee

involved in the environmental assessment of Canada's first diamond mine. When I was offered the opportunity to visit some of the Dene communities potentially affected by the proposed project, I accepted with a mix of nervous excitement and academic interest. After a few days in Lustel K'e, I was asked by the Chief and Council to help prepare their intervention in the environmental assessment process. Two colleagues from Yellowknife were also involved in that work and together we documented the key issues and concerns of the community in a series of discussion papers. Even at the early stage of the environmental assessment process, it was clear to all involved that the BHP Diamond Mine would be approved; both the Federal and Territorial governments as well as many communities had great expectations of the socio-economic benefits of the project; expectations which seemed to overshadow concerns about social and environmental effects.

Lack of baseline knowledge however, limited the capacity of the regulatory authorities to clearly define strategies for mitigating negative environmental effects and ensuring benefits. Instead, government and the proponent offered up a variety of models for environmental and socio-economic monitoring. The interest of Lutsel K'e in monitoring the effects of the project on the Dene way of life became the impetus for my research on community-based monitoring.

I worked for the Wildlife Lands and Environment Committee in the community from 1996 to 2001. This committee, elected by the community, is responsible for a range of

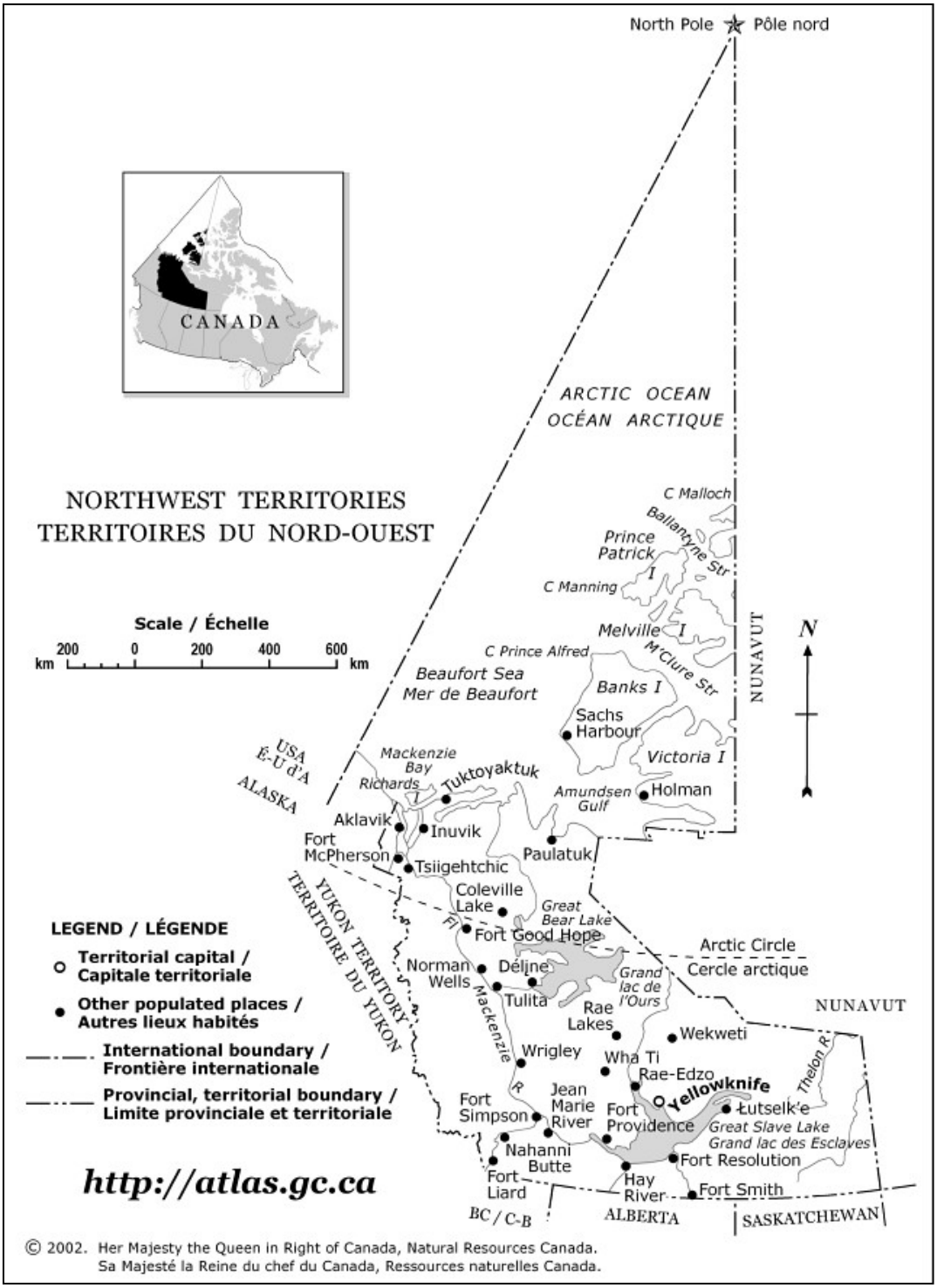

Fig 1-1 – Map of Study Area

research and resource management programs from caribou monitoring to the review of land use permits. Over my five years with the committee I spent a significant amount of time with elders and harvesters involved in the study of many traditional activities – fishing, trapping, hunting, berry and medicinal plant harvesting and learned a great deal about the ways in which they view the health of the community and the environment. Among the activities that captured my imagination and academic curiosity was that of caribou hunting. Travelling with hunters across the crimson orange barren ground landscape, along trails where Dene had travelled for generations, was awe inspiring. I was particularly awed by the capacity of hunters to find the caribou in such a vast region. How did they know which way to travel? How were the hunters, spread out over more than a kilometre, able to communicate with one another? What signs and signals on the landscape told the hunters to move east or west?

Some time after moving from the community of Lutsel K'e, I was able to travel and meet other Dene communities in the region including the Gwich'in of Fort McPherson (Fig. 1-1). I first visited Fort McPherson in 2000 to carry out a traditional knowledge study about the impacts of the ferry landing operations on fish and fish habitat in the Peel River. While there during late August, I made a trip into the mountains with a group of women who were going berry picking. In a few short hours, we picked over six litres of the fruit. The whole experience was breathtaking – there I was wandering through the mountains in the open air, listening to an elder's stories of how she used to pick berries with her mother and grandmother. The connection between the small group of women, a grandmother, a daughter, a sister in law – and their interest in working together and

sharing was also wonderful. But how could they pick so many berries? It was obvious to my companions that I was no expert. One of the women took pity on me and graciously gave me her store of berries from the afternoon. There seemed to be more than enough for everyone.

After I returned to Winnipeg that fall, I thought about the experience from time to time, amazed by the abundance of berries as well as the generosity of the women. But when I returned to the community the following year we found few berries in places we had visited in the previous year. I recognized an element of uncertainty in this resource, not unlike the uncertainty associated with caribou. If berries were fundamental to the traditional diet of the Gwich'in, what did the women do in years when there were no berries around their camps? Back in Winnipeg again, I reflected on the resource management issues of common interest in the north and those highlighted in the literature and wondered why berry picking was not a major focus of study. Women's activities in general, it seemed to me, were sidebars to the focus of most hunter and trapper organizations or wildlife, lands and environment groups in northern communities. Nor were they of interest to resource management agencies and organizations working with northern communities. It was in that context that I began to develop a second case study on the berry harvesting activities of Gwich'in women.

Research in these two case study regions, was not developed around one single research question. Instead, research questions evolved over time; what was learned during the research with the first case study community (Lutsel K'e) led to the development of new kinds of research questions in the second case study. (Teetl'it Gwich'in). After we carried out research to develop indicators of community health in Lutsel K'e, the

community became interested in developing other kinds of indicators related to ecosystem health or the health of valued species such as caribou, fish, ducks and fur-bearing animals. Given that the two research projects in Lutsel K'e were carried out separately, I realized that I had not learned much about how the health of communities and that of the environment are interrelated. As a result, documenting indicators of social-ecological health became a theme of interest in the research with the Teetl'it Gwich'in. I used berry picking as an entry point for exploring these social-ecological relationships, focusing on the research question, "Why is berry picking healthy?".

The research on ecological indicators also evolved from a simple question about ecosystem health to more focused research about the dynamics of one valued resource. In Lutsel K'e I asked the general question– "What are some indicators developed by the Denesoline for understanding and communicating about ecosystem health?". The research carried out subsequently with the Teetl'it Gwich'in focused on one valued resource (berries) and the question, "What kind of indicators have been developed by the Teetl'it to understand and communicate about variability in the abundance and distribution valued berry patches?". There was also an evolution in the research on monitoring. I began by simply describing a process of monitoring developed by the Denesoline, answering the question "How do the Denesoline deal with variability in caribou movements? The subsequent research carried out with the Teetl'it Gwich'in focused on the interrelationships between monitoring, or knowledge generation, and local institutions. I attempted to answer the question, "How does knowledge generated about variability affect local institutions or rules in use governing berry harvesting?".

1.4 METHODOLOGICAL APPROACH

1.4.1 Introduction

The methodological approach taken for the Thesis research is defined here as community-based or participatory research. Although not a "methodology", per se, participatory research draws on many of the principles and methods from established methodologies including participatory action research (PAR) and participatory rural appraisal (Friere 1973). Participatory Action Research (PAR) emerged in the 1960s through the work of Paulo Friere (1973). Over the last thirty years, PAR has bee used and adapted for many different kinds of research including traditional ecological knowledge studies undertaken by the Aboriginal communities in Canada. The Dene Cultural Institute, for example, has used the PAR framework as the basis for many traditional ecological knowledge studies in the north (Ryan and Robinson 1990; Johnson 1992; Ryan and Robinson 1992). PAR emphasizes community involvement in all stages of the research process. According to this approach, non-community members are not objective gatherers of data but are participants in the research.

Issues of Traditional Knowledge Research

Methods for documenting traditional ecological knowledge have come under significant scrutiny in recent years in an effort to ensure appropriateness, validity and rigor, particularly in the north. In the Slave Region of the Northwest Territories for example, such concern resulted in a very involved and intensive research proposal and report review processes (West Kitikmeot Slave Study Society 1998).

Among the most sensitive issues is the role of the researcher in gathering and interpreting results. For many Aboriginal peoples, anthropologists have historically been a nuisance or intrusive and their work seen as having little practical benefit to their community. The old joke about a northern family including a mother, father, five children and an anthropologist reflects on the degree of research fatigue experienced by Aboriginal people in many parts of the north. Those reading and reviewing results outside of the community have also raised questions and concerns about the role of the researcher, and have speculated on the degree of bias at play in the interpretation of research results. As a result of these concerns and questions, there is growing movement in the north towards research as a process of local capacity-building and greater emphasis is being placed on ensuring that the values and biases of the researcher are explicit and methods of gathering and interpreting results are transparent. My approach to dealing with these complex social and political dimensions of traditional knowledge research was to work closely with my case study communities through formal partnerships and training of local personnel.

Traditional knowledge can be held both at the individual and collective level. In this research, these categories of individual versus collective were not mutually exclusive. In both case studies, I depended on a politically elected body, (the Teetl'it Gwich'in Renewable Resource Council in Fort McPherson and Wildlife Lands and Environment Committee in Lutsel K'e) to identify resource experts. Once these experts had been interviewed, results were reviewed and verified by a collective of these resource experts. For example, we held regular elders meetings in Lutsel K'e to review and verify the results of interviews with Denesoline elders and harvesters. We also gathered berry

harvesters together in Fort McPherson to review and verify the results of interviews carried out there. The Teetl'it Gwich'in Renewable Resource Council and Wildlife Lands and Environment Committee also reviewed and verified knowledge documented from resource experts. Where there were discrepancies or questions about the validity of an expert's knowledge, the elders' group, berry harvesters and/or the elected bodies engaged in discussion about the issue to provide clarification. In some cases, the knowledge of one elder or harvester was determined to be more valid than another by these bodies (e.g. The Council may say, "John Smith knows what he is talking about in relation to caribou at Artillery Lake; disregard the comments of Bob Green"). Through this process, the knowledge of the expert became part of the knowledge of the collective.

Partnership

Formal research partnerships were developed with the political representatives in both case study communities. In Lutsel K'e I developed a partnership agreement with the Lutsel K'e Chief and Council and worked directly with the Wildlife, Lands and Environment Committee. In the Gwich'in region, a partnership agreement was developed with the Gwich'in Tribal Council, Gwich'in Renewable Resources Board (GRRB), Gwich'in Social and Cultural Institute (GSCI) and the Teetl'it Gwich'in Renewable Resources Council in community of Fort McPherson, NT (See Appendix A). Research Licenses from the Aurora Research Institute were also acquired.

By working with these agencies I was able to ensure that the research; (i) reflected community priorities, (ii) skills and knowledge were shared between the researcher and the community, and (iii) a capacity-building component is built into the research process.

Information sharing was an important aspect of this partnership. Information about the research and results was shared on an opportunistic basis, however, plain language summaries of papers as well as posters of results were provided at the end of year one and year two to the Gwich'in Renewable Resources Board (GRRB) and the community of Fort McPherson.

Community Capacity Building and Training

Significant efforts towards community capacity building were made in both the communities of Lutsel K'e and Fort McPherson as part of the research process. In the case of Lutsel K'e, my contributions began prior to the Doctoral Thesis research process. During 1996-2001, I carried out four traditional ecological knowledge projects in collaboration with Lutsel K'e Dene First Nation. The results of these studies are currently being used by the community in land claims negotiations, protected areas planning, cumulative effects assessment as well as in the environmental assessment and management of diamond mining exploration and development in the region. A significant practical contribution has thus been made in Lutsel K'e towards community research goals, local training and management practice. During the research process, additional efforts were made to assist the Wildlife, Lands and Environment Committee in dealing with resource pressures and in the development and maintenance of local research programs.

In Fort McPherson efforts at community capacity-building were made to both the Teetl'it Gwich'in Renewable Resource Council, berry harvesters and the locally hired

community researchers. Knowledge sharing was important with all three groups and took place in formal contexts (meetings and workshops) as well as informally during the course of the research process. Training (i.e. on the job training) of the community researcher under the guidance of the GRRB and local elders was also carried out during two field seasons (2003-04). Communication and interaction with the GRRB was also valuable for ensuring that the efforts towards capacity-building and other practical contributions were successful. Communication primarily occurred during the field season. In addition, some meetings, workshops and information sharing took place during the fall and winter regarding the study and its results.

1.4.2 Research Activities and Timeline

The research process began by developing relationships with the communities of Lutsel K'e and Fort McPherson. This included the development of formal research agreements, scoping of local interest in my research topic and identifying detailed research questions of interest to the communities. Once interest was established, funding proposals were developed and funding was successfully attained from the Sustainable Forest Management Network and the Northern Scientific Training Program. Data collection, including interviews, participatory mapping workshops and participant observation activities, was carried out during 2002-04. Other key activities of the research process involved sharing research results with the communities, funding agencies and developing academic publications and the Thesis. Details and the timeline for these activities can be found in Table 1-1.

Table 1-1 – Timeline of Gwich'in and Denesoline Case Studies (2002-04)

Denesoline Case Study

Dates	Objective	Activities	Outcomes
1996-2001	Research on Community and Ecosystem health carried out collaboratively with the community and funded by the West Kitikmeot Slave Study Society	various	Reports to the West Kitikmeot Slave Study Society (Prior to 2001)
2002	Development of a Research Partnership related to the Thesis Proposal	Formal Presentation to the Wildlife Lands and Environment Committee	Formal Research Agreement Research License
2002-2003	Follow-up Research on Questions of Community and Ecosystem Health	Interviews with elders and harvesters; Translation Workshops and meetings with the Wildlife Lands and Environment Committee	Additional data (results) related to questions of community and ecosystem health
2003-04	Share research outcomes in practical form	Development of posters with input from Wildlife, Lands and Environment Committee	Completion of posters for community
2004	Verification and approval of research results with the community including: • development and completion of "Consent Forms" for elders and others quoted in any publication • review and approval of manuscripts by the Wildlife Lands and Environment Committee and consent for co-authorships		Academic Publications
2004	Verification and Approval of Academic Research Outcomes and Thesis	Formal Presentation to the Lutsel K'e Dene First Nation Council, Elders	Thesis Approved by the Local Community

Gwich'in Case Study

Date	Objective	Activities	Outcomes
December 2001	Development of Research Partnership with the Gwich'in Renewable Resources Board	Formal meeting with Robert Charlie Telephone and email correspondence with Gwich'in Renewable Resources Board Office (Peter Clarkson)	Proposal for Funding for the Sustainable Forest Management Network
2002	Development of additional partnerships with the Teetl'it Gwich'in Renewable Council, Gwich'in Social and Cultural	Telephone and email correspondence with organizations and follow-up meetings	Formal Research Agreement Research License Permit

	Institute, Gwich'in Tribal Council		
2002	Initial fieldwork (scoping) to identify key research questions and methods	Interviews, Workshop and Formal meetings with the Teetl'it Gwich'in Renewable Resources Board	Detailed Research questions and methods relevant to the Teetl'it Gwich'in
2003	Fieldwork and data gathering Training of local community members (Christine Firth, Jaida Andre and Stephanie Ross)		Data and results related to research questions
2003-04	Share research outcomes in practical form	Development of a cookbook and posters with input from community researchers	Completion of cookbook and posters for community
2003-04	Community approval of technical reports for funding agency and academic publications	Meetings with Teetl'it Gwich'in Renewable Resources Board and Local Harvesters	Approved reports and academic publications
2004	Follow-up fieldwork	Interviews with Community members	Additional research results on landscape terminology and elders' biographies
2004	Approval of Thesis by community and Gwich'in organizations	Correspondence and Formal Meetings	Approved Thesis

1.4.3 Academic Publications and the Protection of Intellectual Property Rights

A significant body of knowledge was gathered from the Denesoline and Gwich'in through the research process and became the basis for the Thesis as well as academic publications. Informal consultation with the community about the use of these results in the proposed Thesis was ongoing throughout the research process. A formal agreement was developed with Lutsel K'e Dene First Nation through the Wildlife Lands and Environment Committee at the beginning of the research process to ensure respect of the intellectual property rights of the First Nation and their interest as a co-author of papers published in books, journals and in other public forums (Appendix A). A formal agreement was also developed with the Teetl'it Gwich'in respecting the intellectual property rights of the Gwich'in Renewable Resources Board and the Teetl'it Gwich'in

regarding their interest as co-authors of any papers published in academic journals or in other public forums (Appendix A).

1.4.4 Practical Contributions

In addition to the academic outcomes of the Thesis, the results of the study were developed into plain language materials for the Denesoline and Gwich'in communities and organizations dealing with issues of health and the management of natural resources. These include compilations of interview transcripts, posters of research results, plain language summaries of academic papers and in the case of the Gwich'in, a cookbook of berry recipes provided by the harvesters during the research process.

Many of the Chapters of the Thesis have been submitted and/or accepted for publication. As such, the organization and formatting of each chapter differs somewhat in terms of theoretical context, methodological description and presentation of results.

CHAPTER TWO

ALTERNATIVE PERSPECTIVES ON HEALTH AND CULTURE[1]

Summary:

Drawing on the results of 105 individual interviews and workshops, the concept of health or Dene ch'ánieé (Dene way of life) was investigated with the community of Lutsel K'e Dene First Nation in the Northwest Territories. Three major themes and thirteen sub-themes were identified. In addition to interest in the physical, emotional, mental and spiritual health of individuals, and the well-being of families and community members, interviewees emphasized the importance of preserving traditional knowledge skills and language. Interviewees also talked about the need for good infrastructure and services in the community such as housing and water and sewer services. Equal emphasis was given to good leadership, youth participation and working relationships among local people. Economic development that brings jobs to the community without negatively affecting the environment was also emphasized. While it is difficult to generalize about the results of the study, the connection between health and cultural identity and self-determination is one that appears relevant in other health research.

[1] Parlee, B., O'Neil J.D. and Lutsel K'e Dene First Nation. Alternatives Perspectives on Health and Culture: A Case Study from Lutsel K'e, Northwest Territories, Canada. *Social Science and Medicine* (Submitted November, 2004)

2.1 INTRODUCTION

Research on Aboriginal health in Canada has, for many decades, been based on a conceptualization of health as the absence of disease or illness. Little consideration has been given to research issues of priority to Aboriginal communities or to concepts of health based in Aboriginal culture (Young 2003: Wilson and Rosenburg 2002). In recent years, however, health research has broadened its focus considerably. Of particular interest are the advances made in the fields of epidemiology and medical anthropology.

Beginning in the 1960s, researchers began to uncover connections between individual behaviours such as smoking, alcohol and drug abuse, lack of exercise, and poor diet. By the 1970s, these studies were affecting health policy across the country particularly in the area of health promotion; some health promotion strategies specifically targeted Aboriginal peoples to deal with issues such as alcohol abuse, fitness and recreation. (Lalonde 1974: 49).

Epidemiologists began to focus on broader social, economic as well as cultural determinants of health (McKeown 1972) drawing connections between socio-economic factors such as education, housing and income levels (Hayes and Glouberman 1998). It was soon recognized that social and economic environments have a far stronger impact on health than individual behaviours (Evans et al. 1994). In the early 1990s, the concept of "population health" was coined and adopted by Health Canada to help explain apparent health inequalities across the country. Among the revelations emerging from

this body of work was that Aboriginal peoples experience significantly poorer health than other populations in Canada (Waldram et al. 1995). To date however, population health research has had a very limited effect on health policy; there is no coordinated plan to deal with population health issues including those of Aboriginal peoples (Glouberman and Millar 2003: 390).

There are also problems associated with methods of research. In some cases health research itself has had a negative effect on the health of the communities being studied. "Epidemiological knowledge constructs an understanding of Aboriginal society that reinforces unequal power relations; in other words an image of sick, disorganized communities can be used to justify dependency and paternalism" (O'Neil, et al. 1998: 230). Such power imbalances are not limited to epidemiology but are pervasive in Canadian health research and healthcare (RCAP 1993). "Science continues to be the dominant ideology in the community health research environment" (O'Neil, et al. 1998: 237). The challenge in recent years has been to find more culturally appropriate and empowering research approaches.

Many health researchers recognize that language, values, beliefs and local experiences play an important part in how people view the well-being of themselves and others and that local participation in identifying health issues can often lead to more effective health solutions. Medical anthropologists such as Adelson (2000) and Wilson (2000) have uncovered alternative concepts of health through collaborative research with Aboriginal communities. The Whapmagoostui Cree of northern Quebec refer to *miyupiamaatisiium*

or “being alive well” (Adelson 2000: 11). Among the Anishinabek of Manitoulin Island, health is defined as the “good life” (*mno bmaadis*) and is a manifestation of the balance between all things physical and spiritual (Wilson, 2000). There is still a “critical need for more context specific, culturally relevant [health] indicators (Nazarea et al. 1998: 160).

It is in this context, that our research on health indicators in Lutsel K’e, NT is presented. By drawing on the local and traditional knowledge of the Lutsel K’e Dene, we were able to identify themes and indicators for health or the “Dene way of life”.

2.2. STUDY AREA

LUTSEL K’E, NORTHWEST TERRITORIES

The community of Lutsel K’e, formerly called Snowdrift, is a community of 350 Chipewyan Dene (*Denesoline)* located on the east arm of Great Slave Lake in the Northwest Territories (Fig. 2-1). Similar to other communities in the region and elsewhere, Lutsel K’e has undergone significant social, economic and cultural change over the last half century as a result of the residential school system, non-renewable resource development in the region and the development of modern transportation and communication services. As a result there are many complex, social, cultural and political factors that affect the community and their perceptions of what it means to be healthy.

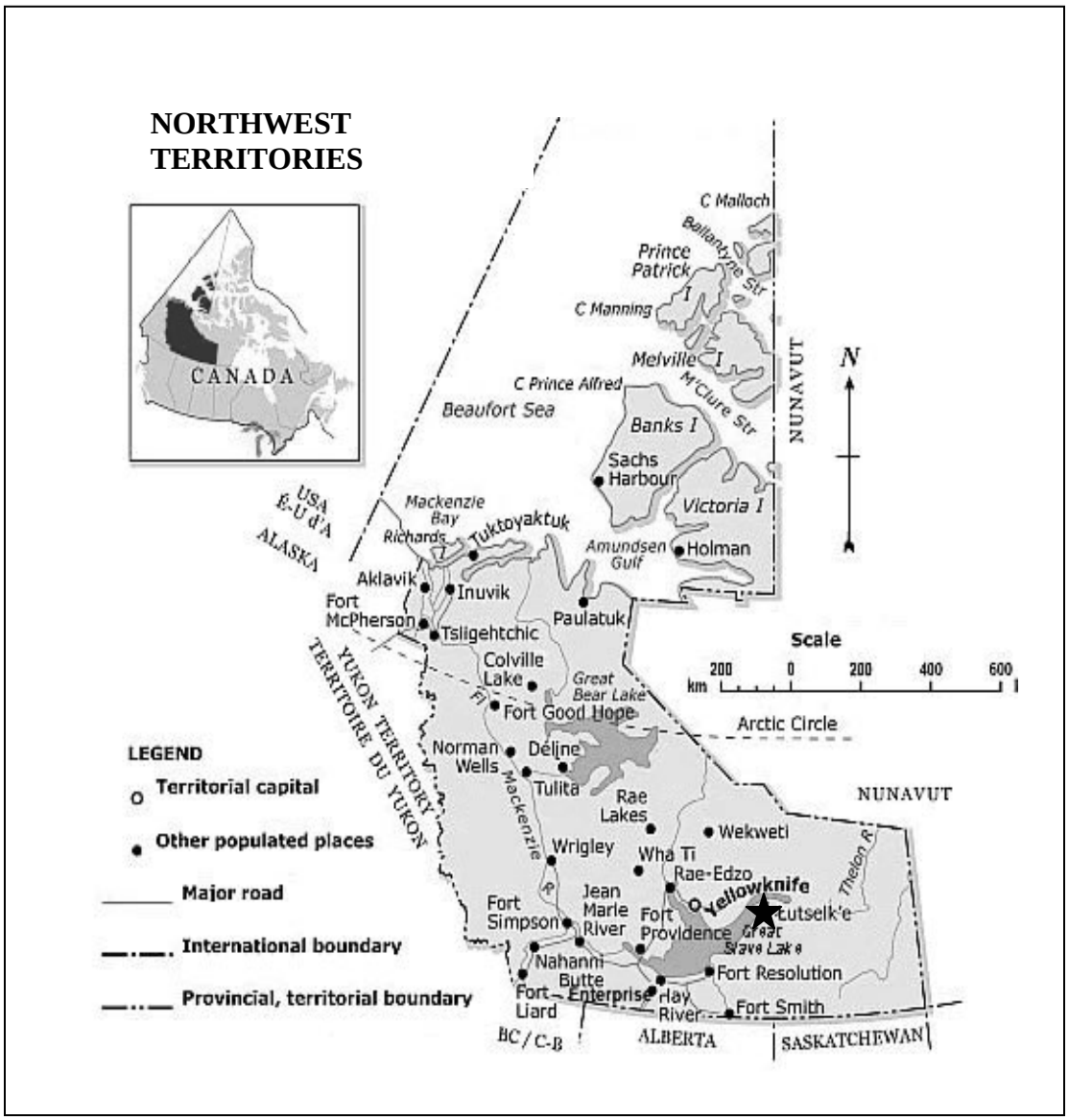

Fig. 2-1 – Study Area: Lutsel K'e, Northwest Territories

2.3. METHODOLOGY

The research aimed to document community health indicators based on local and traditional knowledge of the Lutsel K'e Dene. The research was conducted according to an action research methodology with emphasis on collaboration, community participation and capacity building. The community leadership, primarily the Wildlife, Lands and Environment Committee (WLEC), played a key role in guiding research design and methods. Small group workshops as well as individual interviews provided opportunities for broad participation of the community in the project. Capacity building was achieved through the training of a local research assistant.

Chipewyan language instructors played a key role in understanding concepts of health and well-being that are embedded in the oral tradition of the community. While some translations of health were focused on sickness and disease, the *Dene way of life* emerged as the most powerful and engaging concept during the interviews with community members. The concept was piloted in a number of test interviews; based on positive feedback from the interviewees on the interpretation of health as the *Dene way of life* it became the springboard for a series of semi-directed interviews. On the recommendation of the WLEC, the researchers carried out home-visit interviews with each household in the community. To encourage community members to speak freely, the researchers began the interviews with open-ended questions such as, "What is a healthy community?", "What do you think about (like or dislike) your community?" and "What is it about the Dene way of life that is important?". Interviewees spoke for about 45

minutes on average; their interviews were audio-recorded the interviews where possible and took short-hand notes during each of the interviews.

We used basic qualitative data analysis techniques in order to develop a picture of health or the *Dene way of life* in Lutsel K'e from the interview results (Kohler Riessman 1993). Three interrelated phases of analysis were carried out. As a first step, the researchers reviewed the results to find ideas, issues or processes of common interest to the community. For example, many people spoke about the importance of having good or effective leaders to ensure the community's interests and rights were protected. Some spoke about the importance of children being happy and healthy. Others emphasized the need for elders and youth to spend more time together to ensure Dene culture is passed on. A total of eleven categories were initially identified. Next, the researchers reviewed the interview results a second time to verify the categories and determine if there were broader categories or themes that could be identified. Two categories were added to the eleven initially identified and they were group around the themes of self-government, healing and cultural preservation. The final phase involved reviewing the results again to identify more specific themes or indicators that would provide definition to the previously identified categories. As a final step in the process, the results of the analysis were verified with a sample of the total interviewees and in a workshop with the Wildlife, Lands and Environment Committee, Health and Social Service Committee and during a public meeting. The final result was three themes, thirteen sub-themes and thirty-eight indicators of the Dene way of life (See Figures 2-3, 2-4, 2-5).

2.4. RESULTS

2.4.1 Overview of Results

The approach taken to understanding health in Lutsel K'e revolved around several key assumptions. The first assumption, is that health is not simply the absence of disease; it has multiple social, economic, cultural as well as ecological dimensions that are structurally and functionally interrelated (Fig. 2-2).

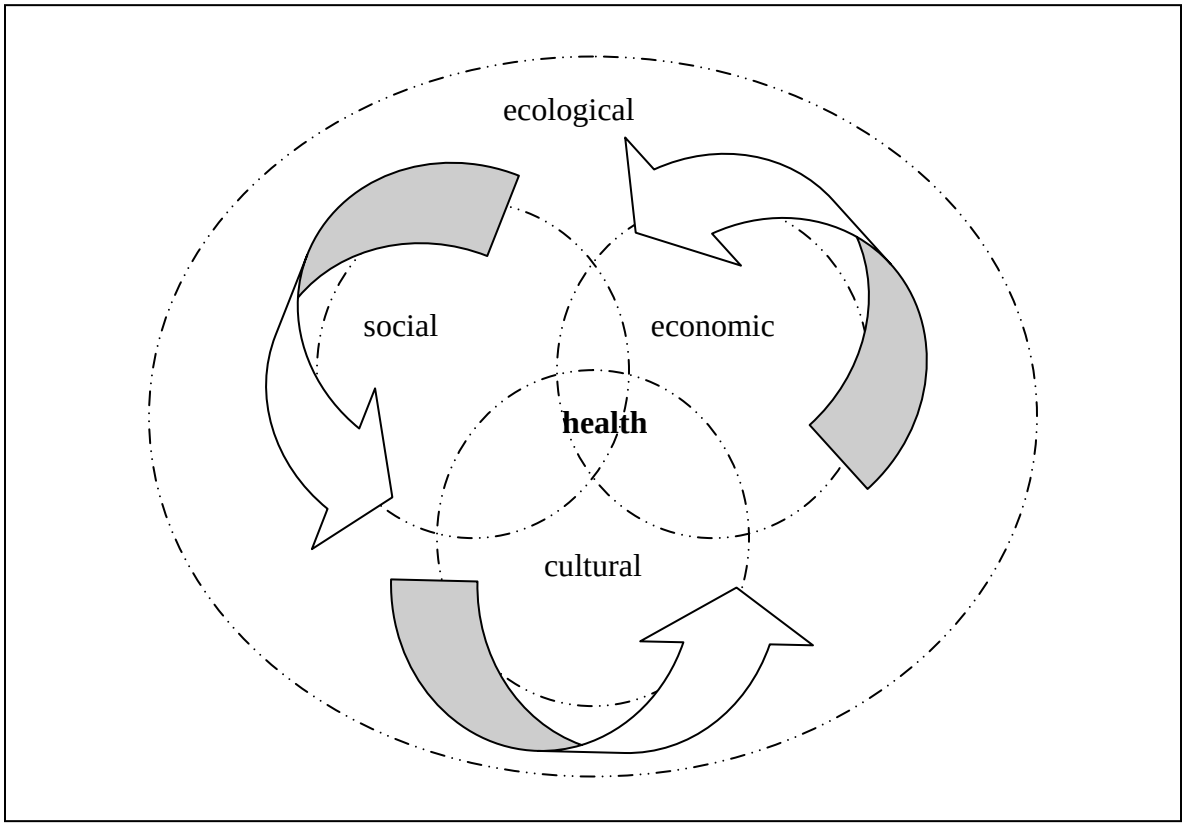

Fig. 2-2 – Conceptual Framework of Community Health

The second assumption is that health is not a static concept that has uniform meaning among all people at all moments in time; it is a living concept, the meaning of which changes as individuals, families and the community experience change in their day-to-

day lives. This assumption that health changes over time, and that this change can potentially be measured, was the basis or rationale for documenting health indicators. By asking community members to share stories about events, experiences or issues they perceived as healthy or unhealthy, we recognized that we could gain insight into the Dene conceptualization of health.

2.4.2 Self-Government

A key theme in many of the interviews was that of self-governance – power and capacity to control and manage their community affairs, lands and resources. Many of the stories shared during the interview process revealed a strong sense of pride in Dene traditions and the traditional Dene way of life. As described in this story by Noel Drybone, self-governance, or the capacity to take care of one's self is an important aspect of the Dene way of life.

> I haven't stopped hunting and trapping. I work for and by myself well. I don't suffer because of someone else's mistakes. That is not to say that I'm better. Who ever wants to doubt my traditions – it's up to them. People know me, how I hunt, how I trap. Other than Dene people, there isn't anyone responsible for me. When I am alone in the bush or on the barren lands, I can stay alone for however, long I want. That is the way I live my life. (Noel Drybone, July 9, 1997)

In addition to individual self-reliance, the capacity of the Lutsel K'e Dene to take care of themselves is also associated with the community leadership or Chief. The elected Chief and Council plays an important role in the community. Issues around the effectiveness of the current elected Chief and Council emerged as a significant theme among (23%) of interviewees. "Its important that the leadership has vision, thinks about the future and

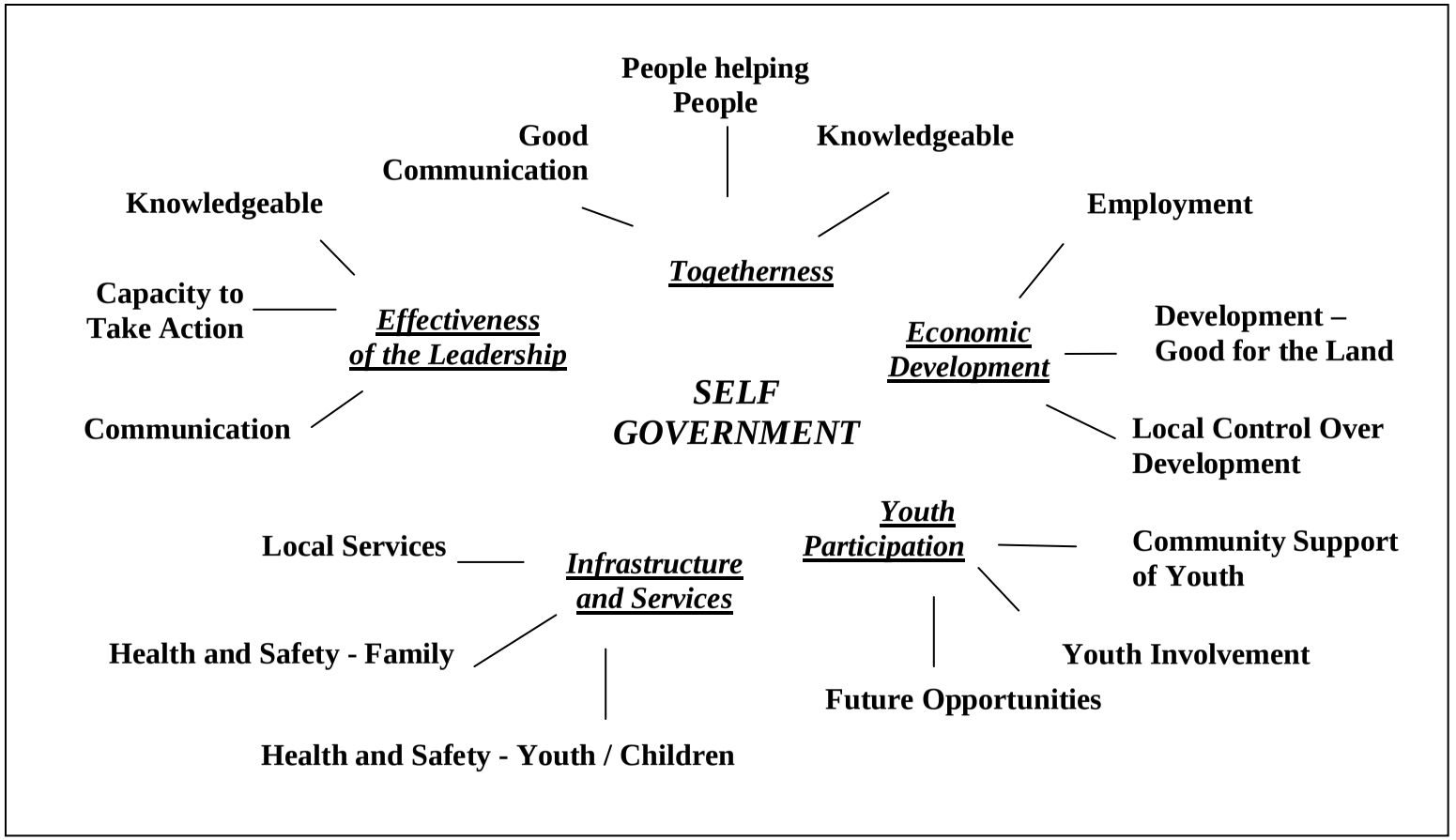

Fig. 2-3 – Themes of Self Government

sets a good example. It would be better if the council had better communication with the people" (LC, July 22, 1996). People suggested that the leadership should also seek to be knowledgeable about issues that affect the community.

In addition to the formal leadership and process of self-government, interviewees stressed the importance of practicing self-governance in their every day lives.

> When people take the initiative to do something – its important. I think we have gotten too spoiled, always having the government providing services and resources for us. This isn't good. We are too dependent on the government. It's important that we be able to do things for our self - practice self-government. (LC, July 22, 1996)

Historically, working together was important for survival in the harsh sub-arctic environment. According to the elders, people shared and helped one another without being paid. The immediate family was the priority, however, people also helped others who were having trouble surviving on their own. Today, the capacity of people to work together is still an important aspect of the Dene way of life and a sign of community well-being. During the interviews, significant numbers of interviewees spoke about the importance of people working together including communicating well and helping one another without requiring payment.

> It's important that we talk to one another with meaningful words. People should listen to each other and what they have to say. The prophecies say, we should respect and speak well to our loved ones – no swearing or calling them down and no violence. If your children does something wrong, you have to talk to them in a positive way and explain the details of what has been done. In the past we taught our children the

> traditional way of life… there was sharing amongst all the hunters and the families. We shared everything, even shared our work. People used to really help one another (Alizette Abel, August 1996)

> I have been trying to get something going for a while with a youth centre… I raised money and organized a youth group. It's important that people support one another – do things for free. A lot of problems we are seeing today are the result of people just working on their own with no support from one another (Floyd Abel, 1996).

Many interviewees (44%) spoke about the role and participation of youth in the community; elders, adults as well as young people felt that youth were not being included and that more should be done to ensure they are heard in community decision-making processes such as public meetings. Recreation was also highlighted as important and a diversity of ideas for recreational and educational activities were suggested including: building a hockey rink, buying better equipment and books for the school, hiring more teachers and developing cultural education camps on the land. Underlying many of the comments was the concern that if the youth are not supported now, the well-being of the community will suffer in the future - "We should concentrate on the youth because they are our future leaders" (Rosa Lockhart Sept 19, 1996).

The quality of infrastructure and services in the community was also a major issue raised during the interview process (40%); there was significant talk of the importance of community control over education and health services and the need for better housing and safe areas for youth and children to play.

> I have moved her from Fort Reliance close to where we gather together in the summer. From what I have seen here, the

> community is doing really well. They are trying to have their own self-government – taking their own action. They are doing a lot of things for the community like providing caribou meat (from the community freezer), they are working on developing a hall for the youth. They also have the gym open from time to time. The health and social service programs are also better than they used to be. Housing has also improved. (JC / SC, 1996)

In the past economic development was not an issue as there was limited wage employment opportunities; however, people worked hard to survive on the land. Today, the Dene continue to spend time on the land and work very hard in hunting, fishing and trapping, however, economic development that benefits the community, respects inherent and treaty rights to the land and does not negatively affect the environment was also identified as important during the interview process.

Employment was a key issue for many people that were interviewed, particularly for younger members of the community; many were focused on employment and business opportunities in the newly emerging diamond mining industry. The following story by a youth employed in the mining industry highlights some of the benefits and challenges associated with this kind of work.

> I was working as a driller's helper. It was pretty dangerous changing the drilling pipes; sometimes they could even bow out or spring out and a person could be hurt. You could lose a finger at any time so you really have to stay focused. I never saw so much money as that - to see that much on one pay check was amazing. I bought a lot of stuff I needed. It was a lot of money. (DC July 1996).

Interest in employment in mining industry was, however, tempered by concerns about the potential impacts of mining development on the land and the desire for it to be

environmentally sustainable. "As for the mining, if it does go through, I feel it is good because it would create jobs. But for the bad signs – it might ruin our land" (BC Sept 19, 96). Many interviewees also emphasized that government and mining companies were not respecting the inherent and treaty rights of the Dene people of the region.

> The Treaties are not being followed. The land is not being protected and now our treaty negotiations have been stalled. We want to be informed about what is happening on our land so we are trying to develop a Memorandum of Understanding with the mining companies. The land where the mining companies are developing – there has been no consent from us yet the mining goes ahead. This ends up with the community being upset. We try and talk about it but some people feel they can't do anything about it. They get used to not having control so they don't come to meetings or don't learn what is going on. They don't want to think about it (not having control) – they keep it inside (LS, August 1996).

Elders expressed particular concern that the development of the diamond mines as well as proposed hydro-electric development would impact negatively on caribou and other resources of importance to community members. Of particular concern are the potential impacts of development on the Lockhart River and the spiritual site known as the "Old Lady of the Falls". This quote from the late elder Zepp Casaway describes the implications of this kind of activity on the health of the community.

> Everything will be destroyed if the dam [on the Lockhart River] is built. That's why when I heard about it I felt sad. I worked on that land, it nourished the Dene people and now we don't even know how many visitors are in that area. (The Lockhart River). These sacred places all might be destroyed... Over here near Fort Reliance, making a dam would destroy the land and everything on it. Whoever hears my voice and what I think, they should try and use it... If everything is destroyed around us, we will be sad people, we will suffer. (Zepp Casaway July 8, 1997)

Through the study, the researchers were able to gain significant understanding of the Dene way of life and what it means to be healthy. As the results from this section reveal, being healthy the Dene way of life has much to do with the practice of self government including, good leadership, working together, economic development, youth participation and the quality of infrastructure and services in the community (Fig. 2-3).

2.4.3 Healing

Interviewees also shared their perspectives on many different aspects of physical, emotional, mental and spiritual health during the interview process. A common theme in many of these stories was that of healing or revitalization of individual, family and community capacity to deal with past, present and future challenges. For many of the interviewees, the healing journey begins with an understanding of Dene values and spirituality.

> Health involves a lot of issues with identity. It means respecting people and the land. A person should be able to practice their Dene way of life. For me, I see our elders were affected by the white people coming; their beliefs and traditional ideas were taken away from them. All of these things have to come back. Different people have their own ways of healing. Dene people adopting white people ways – it doesn't work… We Dene people have our own knowledge about health and healing (Archie Catholique, August 29, 1996).

Many people (46%) spoke about the physical health and well-being of individuals as being particularly important. Historically, diseases such as tuberculosis were of critical concern to the community; according to the elders many hundreds, if not thousands of Dene, died during epidemics of this disease. Today, community members perceive there

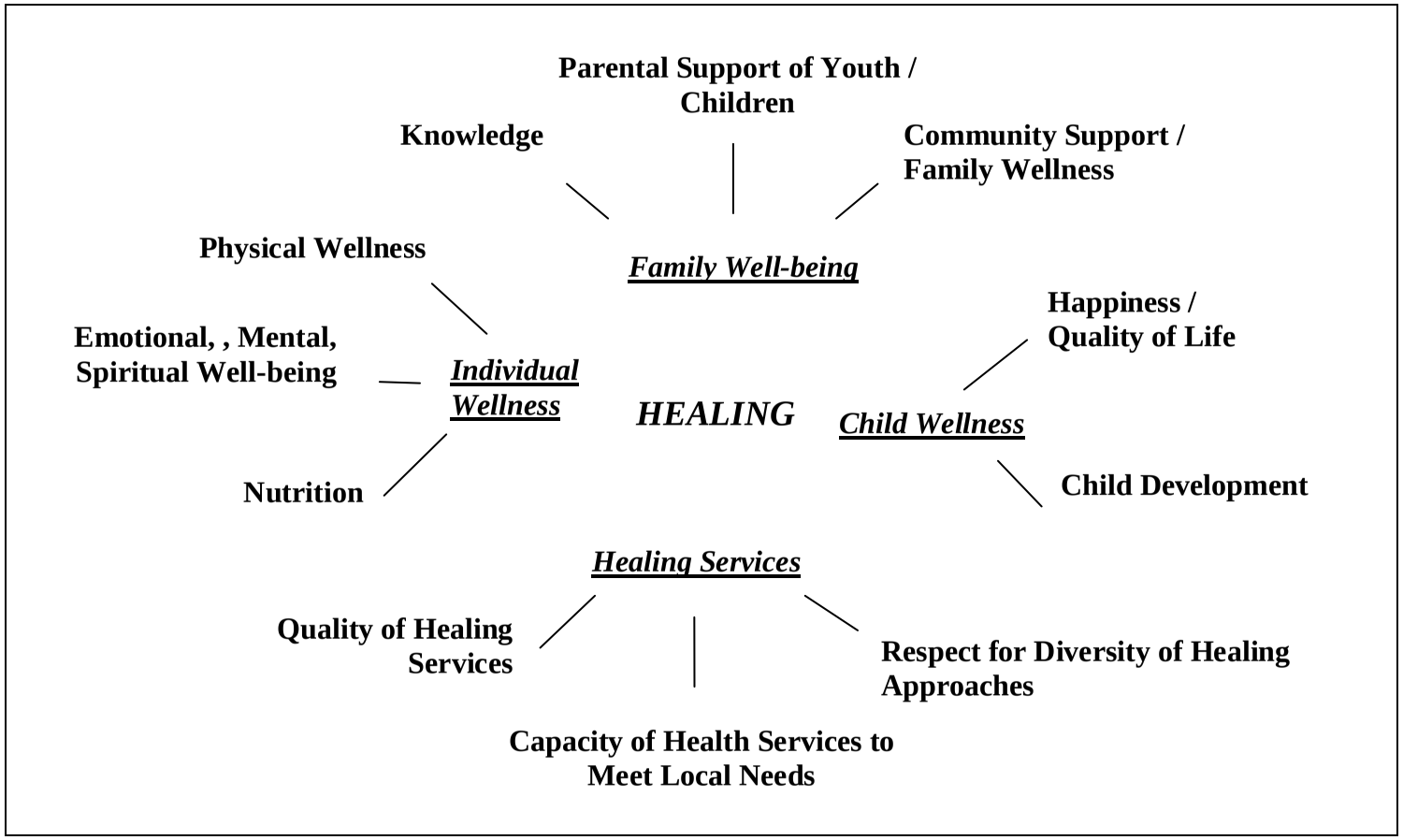

Fig. 2-4 – Indicators of Healing

to be a growing epidemic of diabetes and cancer in the community. Some community members attribute the increase incidence of these diseases to the shift from a diet of traditional food to a diet of food from the store.

> Store bought meat is not good for people – that is why they get cancer. In the olden days, my husband's grandfather developed a hole in his throat from eating non-traditional food. (Judith Catholique August 28, 1996)

> Eating country food is very important… especially the fish and caribou meat. I eat dry-meat (dried caribou meat) all year round. We also eat beaver and muskrat meat too. We use traps to catch these and use the meat and fur for ourselves. We also eat ptarmigan. The young kids now seem to prefer the store bought food. They did a study to make sure the country food is good to eat. That was through the CINE (Centre of Indigenous Nutrition and the Environment). We always check for things like dark coloured organs, red along the stomach lining, pimples on the organs or pus on the meat of the caribou. (Alizette Abel, July 1996)

Some community members perceive cancer as linked to the environmental impacts of mining and hydro-development. People don't like the fish from Stark Lake (because of the uranium mine that was there). They used to be fatter. It's going to get worse for the fish, caribou and small animals that we trap when they develop the other mines. The government is spoiling everything and the land will die… (Judith Catholique August 28, 1996)

Individual physical health is only one dimension of the healing journey. Those interviewed also spoke strongly about the mental, emotional and spiritual aspects of being well.

> Health is not just physical; it is also emotional, mental and spiritual. Not everyone in the community has connected it all

> together yet. But often the nurses say that people will complain about some physical health problem but later they find out that it is tied to an emotional or mental health problem. When we talk about mental health, we are talking about unhappiness, depression, loneliness, sadness, not being able to feel good about oneself; these problems can be related to some abuse in the past. The people who can connect all of these things together – mental, emotional, spiritual and physical are healthier (Addie Jonasson, August 19, 1996).

The well-being of families and children was also emphasized as important during the interviews (30%). Although interviewees identified some challenges in this regard, they also recognized that people have done alot of work over the last few decades to deal with past problems.

> I would say from 1976 since I have been traveling in and out of the community, I have seen a lot of changes. I moved here in 1991. Family lifestyles have changed for the better. Home environments have improved a lot from what I have seen. … there are still some behaviour and attitude problems in the school; this stems from the home… were are trying to develop parenting and life skills workshops. (ES Sept 25, 1996)

> The Drug and Alcohol program has to reflect the community's needs. Healing has to come from within the community. It's important that we develop family activities and programs that support sobriety. For example last New Years eve we had a celebration at the hall with decorations, games and talent show. It's important to see people attending these kinds of family activities (JC. Catholique, July, 1996)

The services needed to support individuals as well as families in their healing journey were also important; drug and alcohol counselling and other related programs were emphasized by many interviewees (28%). Those health workers interviewed in the

community perceived a strong correlation between traditional healing approaches and program success.

> I see a trend toward the use of traditional healing; people want traditional healers. Before these kind of people (healers) were not recognized by the professional health system but now our health department here is providing these services. There are signs it is working well. People are feeling happier about their past and their traditions. We see a lot more people visiting the drug and alcohol workers because of it; people are talking about traditional healing and what it had done for them – it is all positive. It has created knowledge about being healthy; people are learning… – its strengthening our spirit. There are many different signs that it is working – people appear happier, they are more caring, have better self-esteem, more confidence, more positive action is being taken… you can see all kinds of positive things in what they do (Addie Jonasson, August 19, 2003).
>
> It is better when the program reflects our own culture. For example, with the Palm Makers Program a large percentage of the people who take that program stay sober – that is because there is a lot of Aboriginal content in that program. (J.C Catholique, July 1996)

Being healthy, or the *Dene way of* life in Lutsel K'e is also fundamentally about the physical, emotional, mental and spiritual well-being of individuals, families and children, the capacity of the community to heal itself through effective healing services (Fig. 2-4).

2.4.4 Cultural Preservation

The third theme that emerged from the interview results was that of cultural preservation; the cornerstone of Dene culture has always been the land. Land use was identified as important by 43% of interviewees. As described in these excerpts, hunting, visiting the spiritual site known as the "old lady of the falls" or just being out on the land are still of profound importance to people's sense of physical, spiritual and emotional well-being.

> It makes sense to me - my identity as a Dene person - I want things the Dene way. I ask myself, “Why am I Dene?” “Why am I Chipewyan?”, “What is my spirituality?” I think about these things rather than have things imposed on me. I think it is important for spiritual reasons. In my life, I have struggled through different social issues. I looked to the “old lady of the falls” to get help and guidance for a better life. (Archie Catholique, 1996 A27)

> When loneliness comes upon you, you’ve got to do something about it. Maybe take a walk out in the forest. When you get up on the top of a hill and you see all the beautiful scenery around you, like the trees, mountains, lakes and shores, its so beautiful, it makes you wonder who did this all for you? This is how you forget about your loneliness. (Maurice Lockhart 1997).

During the interview process, there was a tremendous emphasis on making sure these cultural traditions, including knowledge and skills are passed on to future generations; about 35% of interviewees highlighted the importance of passing on specific traditional ecological knowledge and skills such as caribou harvesting; 28% of interviewees spoke about the need for more cultural education programs. Many of their comments were in the context of concern about the loss of culture; as described by J.C. Catholique, “we are suffering from an identity crisis” (JC Catholique 1996).

In addition to sharing their fears, many elder as well as youth shared creative ideas for language programs and cultural education Joseph Catholique shares his strategy for preserving culture through programs.

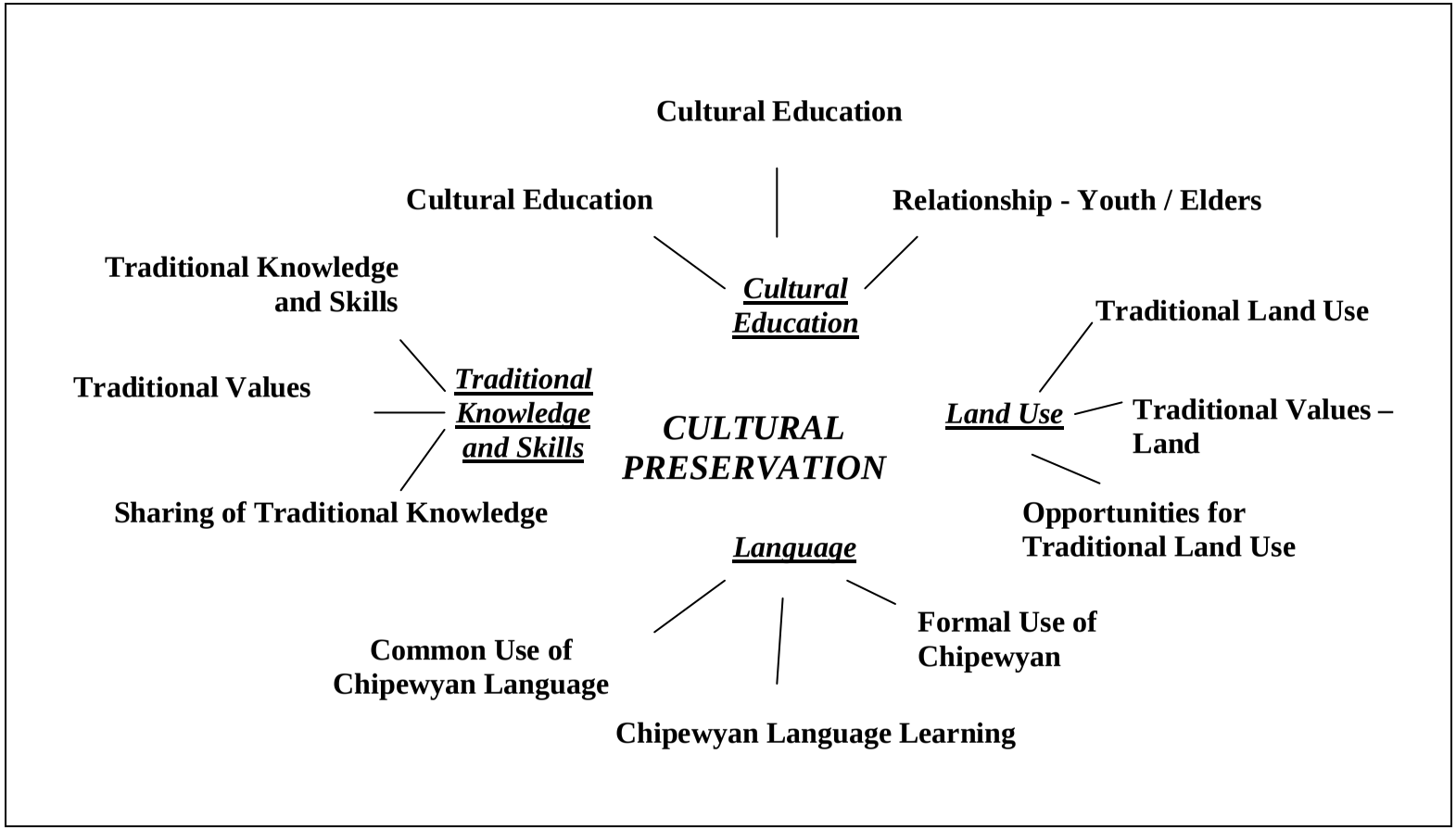

Fig. 2-5 – Indicators of Cultural Preservation

> Elders should teach kids how to do traditional things like skin caribou, make smoke-fish which the ladies can do too… There should be programs and courses in town that teach traditional skills to the youth like canoeing, storytelling. We could develop a small program; we could have an office and fundraise. This way we could create more activities for our youth… (Joseph Catholique Sept.26, 1996)

In addition to preserving the knowledge and skills associated with living off land, people emphasize the importance of preserving the Chipewyan language. For many community members, the continuation of these cultural traditions depends on capacity of the elders and youth to communicate with one another in their Chipewyan language and the effectiveness of community cultural education programs. Although there are concerns that the language is being lost, elders and others are optimistic that it will be passed on to future generations.

> Speaking our language is important; there are more and more people using the language compared to just a few years ago. Kids are trying to use the language now too which is more meaningful for the elders (Alizette Abel 013 August 1996).

And for many community members, the continuation of this way of life is fundamental to their sense of community health and well-being. As described by elder Maurice Lockhart culture provides the Dene with the courage to have a good future.

> The elders used to talk to people about the future… When an elder speaks they give courage to the people, not only at the time they speak, but for future generations… I remember when I was a child I used to listen to our elders talk about the future of the children. What they talked about at that time, we see it today. They said, "When the white man comes into our community, he will help the Dene people with many things." Our ancestors also said, "The Dene people will have a hard time if we don't teach our children our traditional way of

> life." Our ancestors have a lot of knowledge to pass on to the Dene people. (Maurice Lockhart April 21, 1997)

These themes related to cultural preservation provide a third perspective on the meaning of health or the *Dene way of life* in Lutsel K'e (Fig 2-5).

2.5 DISCUSSION AND CONCLUSION

There is a relatively long history of Aboriginal health research in Canada; not all of this research has, however, been relevant to the needs and interests of Aboriginal people themselves (O'Neil, Reading & Leader, 1998; Young, 2003). Relatively littler research explored the connection between health and culture in Aboriginal communities.

One of the key discoveries of this research process is that being healthy has a great deal to do with being Dene and living a Dene way of life. Many of the events, beliefs and experiences people described as healthy are many generations old. People talked extensively about the roles and responsibilities of the Chief, being on the land, hunting, trapping and visiting spiritual sites (such as the "old lady of the falls"), using traditional medicine, speaking the Chipewyan language and enjoying cultural activities such as story telling and drum dances. Many of these practices, such as caribou hunting, are recognized within the community and by others as uniquely Dene. Other stories shared during the interview process also related to wage employment, resource development on Dene land, housing, quality of health and municipal services, youth and support for youth activities, education including cultural education programs. Although not traditional in a historical sense, these issues are considered no less important to the health of the community and their *Dene way of life*.

Photo 1 – Denesoline Elders Noel Abel, the late Jonas Catholique and the late Louis Abel at an elders' meeting in Lutsel K'e, (Photo Credit – Lutsel K'e Dene First Nation).

CHAPTER THREE

HEALTH OF THE LAND, HEALTH OF THE PEOPLE: A CASE STUDY ON GWICH'IN BERRY HARVESTING[1]

Summary:

Many Aboriginal groups in northern Canada and elsewhere, recognize the strong relationship between the well-being of people and environment; we describe this relationship as social-ecological health. Using participatory research methods, we explored the idea of social-ecological health by studying the berry harvesting practices of Teetl'it Gwich'in women of Fort McPherson, Northwest Territories, Canada. For Teetl'it Gwich'in women, their relationship to the land or (*nan kak)* is complex. There are many more social, economic, cultural and political dimensions including individual and family well-being, social connectivity, cultural continuity, land and resource use, stewardship, self-government and spirituality. The commercial value of berries was not identified as important to women. This research discusses the social-cultural values associated with the land and resources and their importance to the well-being of Aboriginal communities.

[1] Another version of this Chapter has been published as:
Parlee, B., Berkes, F., and Teetl'it Gwich'in Renewable Resources Council. 2005. Health of the Land, Health of the People: A case study on Gwich'in berry harvesting. *EcoHealth* 2(2): 127-37.

3.1. INTRODUCTION

Many Aboriginal groups recognize that the health of the land and that of their communities are fundamentally interconnected. Health for the Cree of northeastern Canada, for example, has to do with the ability to live off the land, strong social relations, cultural identity, and body (Adelson 2000). Among the Anishinaabe (Ojibwa), the land is described as Mother. People, like the rocks, animals, and trees are born from her. As one elder commented, "without her we would not live" (Wilson and Rosenberg 2002; Wilson 2000).

There are various ways of conceptualizing these relationships. Terms such as *ahupua'a* in Hawaii, *vanua* in Fiji, *aschii* or *aski* among the Cree and Ojibwa of northeastern Canada, and *nde* or *nene* among some Dene groups of northwestern Canada, when translated, seem to refer to geographically bound units in which abiotic components of the land, plants, animals and humans are interlinked (Berkes 1999). Among the Teetl'it Gwich'in Dene, the land is *nan or nan kak*. Each of these terms may be described as an ecosystem-like concept in that they encompass human-animal-plant relations as an integrated whole (Berkes 1999). They differ from conventional ecosystem definitions, however, in their recognition of spirituality or the relationships between humans, their ancestors and the Creator (Berkes et al. 1998b).

An expanded notion of the concept of ecosystem is the social-ecological system (Berkes et al. 2003; Gunderson and Holling 2002). A social-ecological system is the combined or

integrated sense of humans-in-nature; a bounded network made up of relationships among individual components and systems (Berkes et al. 1998a; Davidson-Hunt and Berkes, 2003). There is a growing literature on social-ecological systems that draws on the knowledge of indigenous and other land-based peoples (Waltner-Toews and Kay 2005; Berkes et al. 2003; Berkes et al. 1998a). The assumption implicit in this literature is that local peoples have a fundamental role in developing the sustainability or health of their communities and environment and as such their perspectives about social-ecological systems, including social-ecological interactions, are important (Waltner-Toews and Kay 2005). Developing indicators based on local and traditional knowledge is one way of capturing local perspectives about human-environment relationships and can be relevant to our understanding of many different kinds of social-ecological systems (Waltner-Toews and Kay 2005).

Indicators related to forest ecosystems have largely focused on the economic opportunities and benefits associated with forests and the forest industry. Interest in developing indicators of forest ecosystem health or forest sustainability began to develop in the early 1990s as a result of forums such as the Rio Summit (UNCED 1992), which acknowledged the value of developing indicators, and the Working Group on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests known as the Montreal Process (Montreal Process Working Group 1995). Since that time there have been numerous initiatives and research projects focused on developing indicators of forest ecosystem health in Canada and elsewhere.

Social indicators for forest management are not, however, well developed in comparison with those related to natural systems. Many of the social indicators used in forest ecosystem management have been objective in nature and refer to conditions at national and regional scales (Beckley and Burkosky 1999). For example, one of the indicators defined by countries involved in the Montreal Process, was the "area and percent of forest land managed in relation to the total area of forest land to protect the range of cultural, social and spiritual needs and values" and "non-consumptive use forest values". (Montreal Process Working Group 1995). Subjective indicators that refer to conditions at a local scale are needed, however, since they can potentially tell us more about a people's sense of well being than quantitative data generated from large data sets. Kusel (1996), suggests that subjective indicators tell us more about how people feel about their communities and their environment than objective indicators; specifically they can reveal details about social conditions, such as inequality and the value of land-based activities, that are not otherwise understood. These kinds of indicators can also increase understanding about the factors that contribute to a sense of community and sense of place (Kusel 2001; Besleme et al. 1999; Diener and Suh 1997).

This Chapter presents results of indicators research carried out with the Teetl'it Gwich'in of northern Canada. Working closely with Teetl'it Gwich'in women, we focused on a locally important harvesting activity and forest resource, berries, as an entry point to identifying indicators of social-ecological health. The next section focuses on the Gwich'in study area and research methods; a detailed description of how the indicators were developed is provided. Some background on berry harvesting and the various approaches for valuing berries and berry harvesting practices is then provided. The results section of the paper

focuses on the nine themes and indicators that were identified from interviewee responses to the question, “Why is berry picking healthy?” The discussion focuses on social-ecological health and lessons for resource management including forest resource management. Some closing comments about the contribution of the research to the literature on social-ecological systems are also provided.

3.2. STUDY AREA, THE PEOPLE AND RESEARCH METHODS

The study was carried out with the Teetl’it Gwich’in or the Gwich’in of Fort McPherson, Northwest Territories, Canada (Figure 3-1). The Gwich’in are a group of Dene people, also known as Athapaskan. The Teetl’it Gwich'in, historically known as Loucheux, are one of ten Gwich’in groups that live in current day Alaska, Yukon and the Northwest Territories. Since the 1950s, the Teetl’it Gwich'in have lived in a permanent settlement at Fort McPherson (Heime et al. 2001). Traditionally they were known as the people of the upper Peel River watershed, and lived off the land hunting caribou and other large mammals, fishing, harvesting small mammals, birds and berries. Rivers served as transportation corridors in earlier times; Fort McPherson is on the Dempster Highway, the major north-south road in the region. The land of the Teetl’it Gwich’in is part of a land claims treaty, the *Gwich'in Comprehensive Land Claim Agreement* of 1992, which gives them joint jurisdiction over their land and resources.

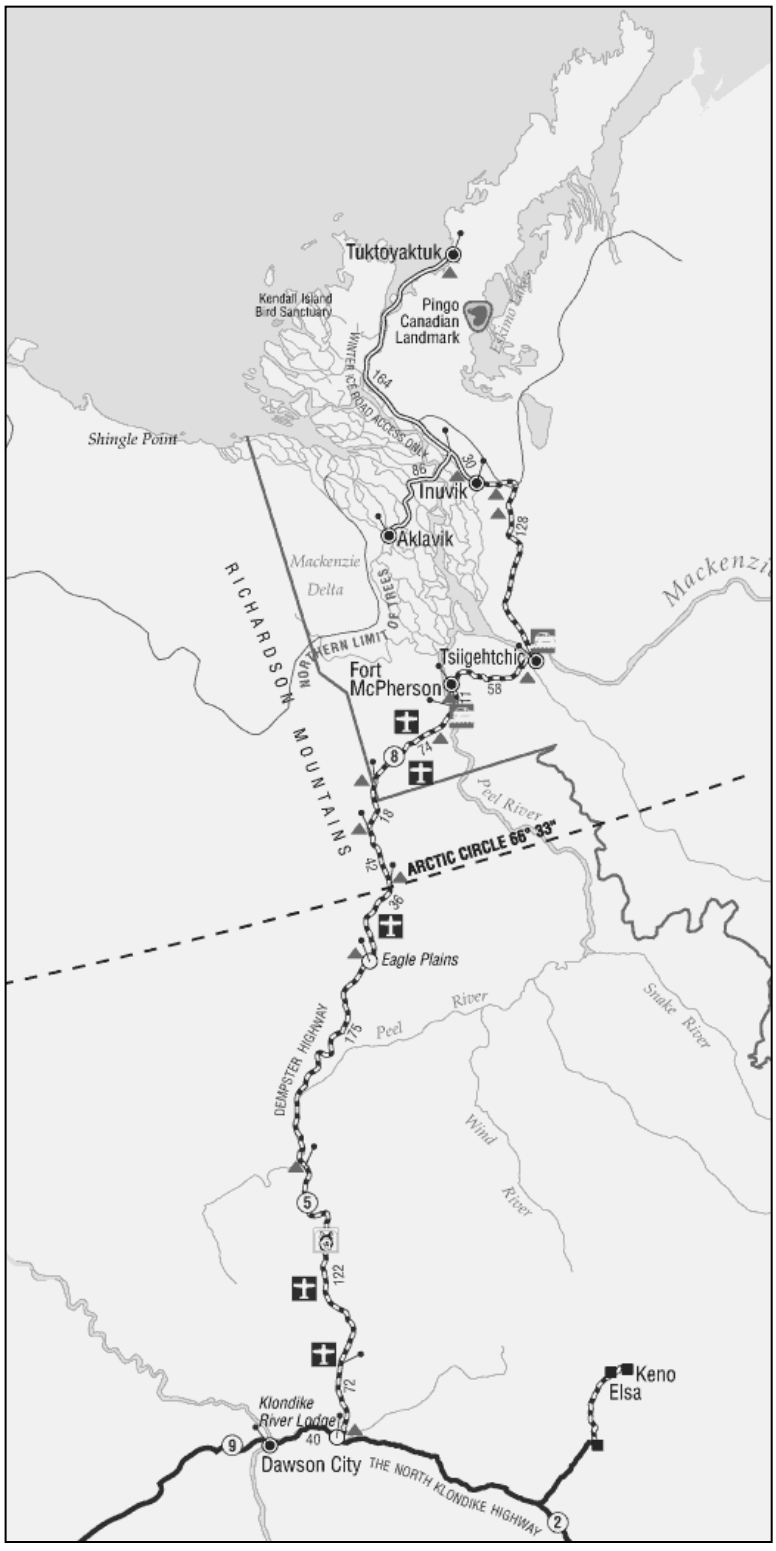

Fig. 3-1 - Gwich’in Region

A significant body of literature has developed about the Gwich'in, their social and economic activities and close connection to the land (Nelson 1986; Slobodin 1962). Earlier anthropological work typically emphasized big game hunting and trapping, and perhaps underestimated women's pursuits such as berry harvesting (Kritsch 2002). More recent research in the Gwich'in region suggests that plant resources are important to the community, including cranberry (*Vaccinium vitis idaea),* blueberry (*Vaccinium uliginosum)* and cloudberry (*Rubus chameamorus)* (Andre and Fehr 2001).

Women from Fort McPherson are well known for their extensive berry harvesting activities, both in terms of the quantity and extent of berry picking areas and the importance of berry-picking as a pursuit. There is no commercial harvesting; berries are gathered for home and community use, and in some years for inter-community trade. Berries are harvested in many different areas in the traditional territory of the Teetl'it Gwich'in. The larger environment may be characterized as boreal forest – barren ground transition (Marles et al. 2000). The dynamics of the Peel River and Mackenzie River Delta and the close proximity of the Richardson Mountains, significantly affect the abundance and distribution of vegetation in the region. Cloudberries are largely harvested in the open alpine areas of the Richardson Mountains. Popular blueberry picking areas are located on the Dempster Highway between Tsiigehtchic and Fort McPherson as well as around family camps up the Peel River, between Fort McPherson south to the Yukon border. Some people go cranberry picking around the community; many people also go picking cranberries around their camps on the Peel River north into the Mackenzie Delta. In 2003, women picked berries along the Dempster highway as far south as Eagle Plains and as far north as Tsiigethchic. On the Peel River, people also

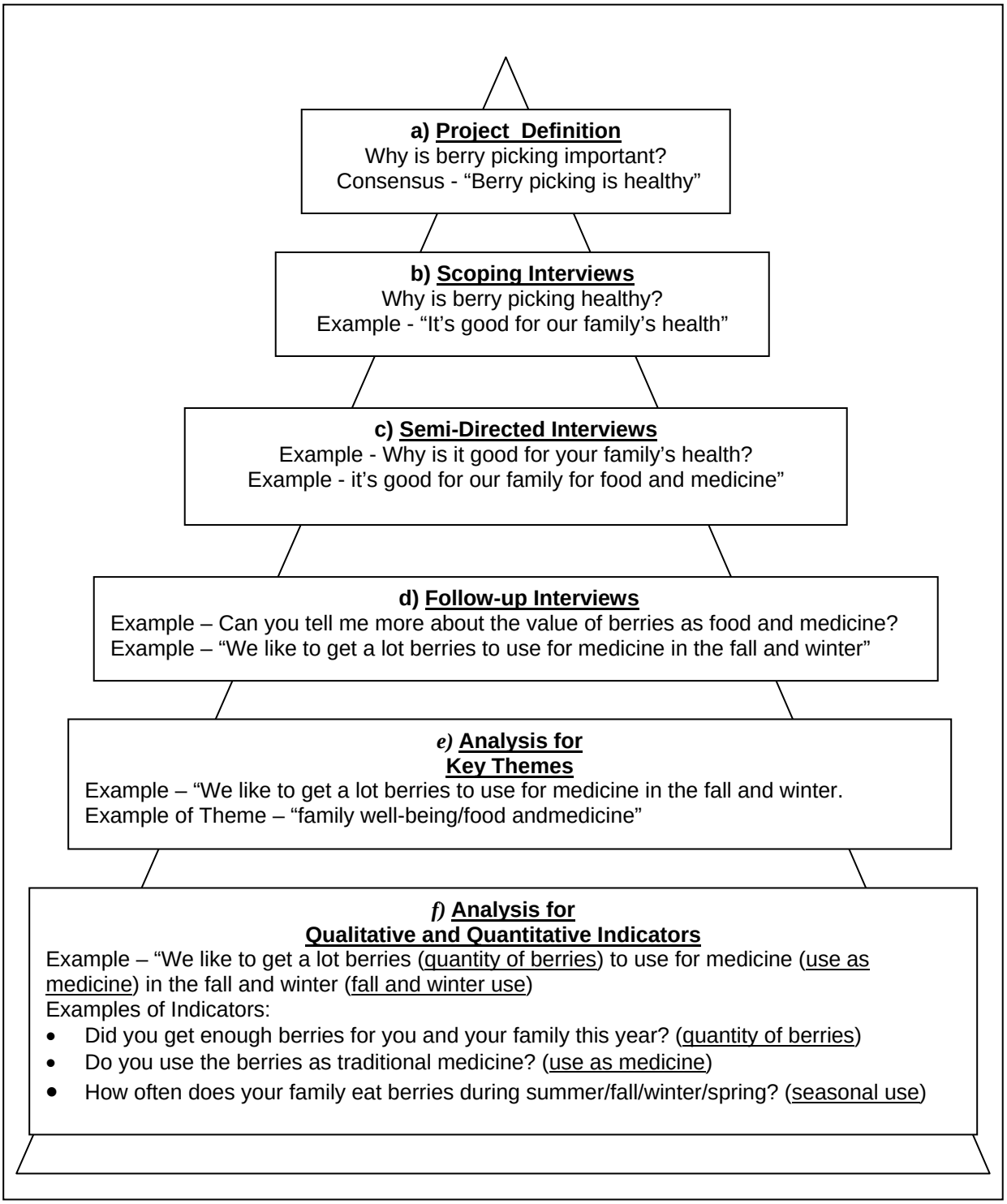

Fig. 3-2 – Process for Developing Indicators

picked berries as far north as Rat River and as far south as the Yukon border (Fig 3-1). In 2002 and 2001, poorer berry years than 2003, the harvest area was significantly larger, as women traveled as far south on the Dempster Highway as Dawson City and as far north as Inuvik (Fig. 3-1). The research methodology was adapted from work previously carried out with Lutsel K'e Dene First Nation (Parlee 1998). The process is outlined in Figure 3-2. The focus on berry harvesting as an important activity was established during research scoping with the regional organization, the Renewable Resource Council, and a group of elders and berry harvesters in the community of Fort McPherson. When we asked local harvesters in Fort McPherson why berry picking is important, there was consensus among most respondents that berry picking is important because it is "healthy" (Item [a] in Figure 3-2).

Open-ended interviews were then carried out with harvesters to unpack this idea of health. Specifically we asked the question, "why is berry picking healthy?" (Item [b] in Fig 3). Interviewees were selected on the basis of their interest and knowledge of berry picking. The methodology aimed at getting a composite picture of health from interviewees. Over 80 people participated in the study; forty-two (42) women, twenty five men (25) and another thirteen (13) individuals from Gwich'in organizations. Group meetings were open to all, including young women and men (See Appendix A for details about the interviews and interviewees).

Responses from this round of interviews became the basis for a set of semi-directed interviews to elicit more detail from interviewees. For example, if the interviewee responded that "berry picking is healthy because it is important as food and medicine for the family",

then we asked for further detail about the value of berries and berry harvesting as food and medicine (Item [c] in Fig 3). Verification and further detail about each theme was obtained during follow-up interviews (Item [d] in Fig 3).

The responses were then grouped into key themes identified during analysis (Item [e] in Fig 3). Indicators were identified for each of the themes during analysis of detailed responses (Item [f] in Fig 3); these are listed in Table 3-1. The themes and indicators are not listed in any particular priority but simply reflect the range of ideas shared during the interview process. A final verification of the themes and indicators was carried out during a workshop with berry harvesters in May, 2004 and through the sharing of a written report to the Gwich'in Renewable Resources Board, Gwich'in Social and Cultural Institute and Teetl'it Gwich'in Renewable Resources Council in the fall of 2004 and winter of 2005.

The indicators found in Table 3-1 are phrased as plain language questions. For example, rather than use conventional indicator language such as - *preferred/actual number of hours / days berry harvesting* –I used expressions that were similar to language used by the interviewees. I also expressed each indicator as a question so that they might be viewed as tools for communication with the community rather than tools of statistical data collection.

3.3. SIGNIFICANCE OF BERRY HARVESTING FOR THE GWICH'IN

Stories shared by Teetl'it Gwich'in about picking berries and storing them in birch bark baskets suggests that this activity dates back great many generations. According to elders,

berry picking was not simply a casual or opportunistic activity; families made harvesting trips specifically for berries so they could pick and store enough to last them through the winter.

> In the past we would all be given a kettle when we went for berries and we all had to fill it up. It was the same for all of us (agreement). I picked so many berries in the past that I was turned off doing it for a while. I did not ever want to go for berries. But I have gotten back into it. I like going for berries now (Meeting notes – Elizabeth Collin, February 20 2003).

In order to keep the berries fresh through the winters, "freezers" were built in the ground by digging down through the topsoil to the permafrost. According to one elder, this permafrost freezer is better, more reliable, than modern freezers.

> People used to really look after their berries… blueberries and *nakals* [cloudberries]. They had those birch bark baskets and would put them under the ground in the moss and it would stay frozen like that… they put grease amongst it too so the grease freezes too and it will stay fresh like that (Rebecca Francis, June 13 2003).

In 2003, we made a quantitative estimate of the berry harvest of the Teetl'it Gwich'in based on calculations of the number of people harvesting berries; the average number of hours spent harvesting; and the harvest per effort. The estimates are based on a three-part data collection method that included (1) participant observations of berry harvesters, (2) interviews with harvesters, and (3) communications with and about harvesters who were not interviewed. We estimated that about 100 people or 10 percent of the community picked some blueberries, cloudberries and/or cranberries during the 2003 season. About 130 people harvested cloudberries, 50 people harvested blueberries and 60 people harvested cranberries. The average number of hours spent picking per visit was 3-4 hours; the average amount of

berries harvested during this time period was 3-4 litres (one large "ziplock" plastic bag) of cloudberries, 2 litres (one medium ziplock) of blueberries, and 6 litres of cranberries (1.5 large ziplocks). Thus, we estimated that the community-wide harvest was over 5,000 litres during the 2003 season.

Understanding the value of berries based solely on estimates of harvest yield is, however, problematic given that there are many ecological factors which affect the abundance and distribution of berries on the landscape. For example, just because Gwich'in women picked fewer berries in 2002 than 2003 does not mean that their value was considered less. In fact, one could make the opposite argument; berries are considered more valuable when scarce.

> When there were no berries around, the people used to look all over and check all the berry patches. They had to check all over until they would find it. It's very hard on people up here when they don't have berries for the winter. It's not a very good sign when there are no berries around (Elizabeth Colin, Oct.15, 2003)

Harvest calculations as a way of establishing value are also problematic since women do not conceptualize harvest yield in terms of quantities but think more in terms of "having enough" to use and share.

> I don't know how many berries I pick because I give a lot away and I cook with it. It's good to have - at least 8 ziplocks of cloudberries and blueberries [24 litres] and maybe 1 egg box [20 litres] of cranberries. We stretch it out over the winter… There is one person who has berries from 2 years ago but that is bad – to not give them out. Some people give out all their berries before the winter is out (Elizabeth Colin, July 4, 2003).

Another approach to understanding the importance of berries involves assessing their nutritional value. For example, Kuhnlein and Turner (1991) suggested that even though

berries may only represent a small percentage of the overall traditional diet of Aboriginal people in northwestern Canada, they are one of the few carbohydrates that were available, and provided energy as well as key vitamins and minerals. Ethnobotanists have identified a diversity of medicinal properties associated with the berries and plants harvested by Aboriginal peoples. They are recognized as important for dealing with a range of illnesses including influenza, headaches and stomach ailments (Andre and Fehr 2001; Marles et al. 2000). Gwich'in women themselves identify the berries in their region as having many nutritional and medicinal benefits. Unlike some earlier research that suggested that berries were a minor part of the diet, (Slobodin 1962), elders suggest that berries were a main source of food and medicine.

> It (berries) was our main source of food; our medicine too. We used cranberries for a lot of things. You would make a tea and it was good for bladder infections. The cranberries from the store are not the same. We made a tea from the store berries for someone with a bladder infection but it did not help. Only our berries from land will work for this (Emma Kay February 20 2003).

Quantifying harvests and identifying nutritional values, while useful in some ways, provides only a small and reductionist view of the value of berries to Gwich'in women. Some ethnobiologists and other scholars studying cultural landscapes take an integrated or ecosystem-based approach, recognizing that berries and berry harvesting activities do not take place in isolation but are integrated with other resource harvesting activities (Main-Johnson 2000; Davidson-Hunt and Berkes 2003). In the case of Teetl'it Gwich'in, berry harvesting activities are integrated with other kinds of harvesting, especially fishing. Harvest of cranberries in the Rat River area, for example, is associated with fishing for *Dhik'ii* or dolly varden charr (*Salvelinus malma*). In other areas along the Peel River, it is associated

with the harvest of burbot or loche (*Lota lota*). The combination of loche liver and cranberries is a traditional delicacy (Rebecca Francis, June 13 / 2003).

3.4. WHY IS BERRY PICKING HEALTHY?

The research involved asking berry harvesters, "Why is berry picking healthy?". The answer to this question are found in Figure 3-3 and in more detail in Table 3-1. The researcher grouped responses according to nine common theme responses or Gwich'in Statements of Value (e.g. "its important to be out there using the land and resources"). For the purposes of this academic discussion, we interpreted these statements as: individual preference; individual well-being; family well-being; cultural continuity; social connections; land and resource use; stewardship; self-governance; and spirituality (Fig. 3-3). We deal with each in turn.

Some of the women spoke about their participation in berry picking activities mainly in terms of their individual interest. The statement, "I like berry picking", speaks to importance of self and individual goal-seeking behaviour in harvesting. However, it was clear from the interview results that not everyone likes berry picking to the same extent. Some people said they would go out every day to pick berries if they could; others simply said they needed a few ziplock bags of cranberries to be satisfied.

Figure 3-3 – A Perspective on Social-Ecological Health

Table 3-1 – Themes and Indicators of Social-Ecological Health

Gwich'in Statement of Value	Indicator
"I like picking berries" (individual preference)	• How many hours/ days would you like to go berry picking? How many hours/days did you go berry picking? • Did you feel you had enough time and support to help you get out on the land? • How many litres (ziplocks) of berries did you pick? • How many places did you visit to find these berries?
"it feels good to be out there" (individual well-being)	• How do you feel when you are out on the land picking berries? (feelings of emotional, mental, spiritual well-being expressed by individuals) • Do you see/hear others expressing feelings of well-being in respect of berry picking?
"it's good for our family" (food and medicine) (family well-being)	• How many days/hours have you spent with family and friends on the land? • Did you get enough berries for you and your family this year? • How often does your family eat berries during summer/fall/winter/spring? • Do you use the berries as traditional medicine? • Does your family have any illnesses such as diabetes?
"it is part of our way of life" (cultural continuity)	• How many seasons / days have you spent with a youth /elder on the land? • Do you know the Gwich'in place names for the areas where you pick berries? • Do you feel you have the knowledge / skills to find good berry picking areas?
"its good for our family and the whole community to be sharing and working together" (social connections)	• Do you share information about where / when to find berries with family / friends or others? • Do you share berries with family / friends or others in the community or region? • Do you respect the berry patches of other people? Do you feel your berry picking areas are respected by others?
"its important to be out there using the land and resources" (land and resource use)	• What kind of berries and plants do you harvest? • Where do you go to find these berries and plants?
"we need to take care of our land and resources" (stewardship)	• How much time do you spend taking care of the land and resources (e.g. maintaining trails)?
"its our land" (self-government)	• How many years have you and your family been picking berries in these areas? • Is the area where you pick berries Gwich'in land? Is it protected under the Gwich'in Land Use Plan or by other laws? • Are there any problems (natural or human disturbances) in the area where you pick berries? • Do you feel confident that the local Renewable Resource Council or other Gwich'in organization will make good decisions about development on Gwich'in land? • Are you confident that these areas will be available for future generations?
"the Creator made this land for us" (spirituality)	• Do you feel closer to the Creator while you are on the land / berry picking? • Do you feel that the Creator is taking care of you, your family and the land?

Women busy working and with children expressed concern that they could not get out berry picking as much as they would like. "If I did not have to work, I would go out more. We could go out together and cook fish on the fire" (Mary Ann Robert July 3, 2003)

Emotional, mental and spiritual well-being at the individual level is also an important dimension of berry harvesting. Some statements made by interviewees, such as "it feels good to be out there" would suggest that the process of harvesting, in particular, the sense of emotional, mental and spiritual well-being achieved from being out on the land close to nature and away from the worries of town life is as important.

> It's good to go for berries because it is so healthy. You are walking all day in the fresh air. If you don't feel good in the morning and then you decide to go for berries, by the end of the day, you feel good again. Walking around out there, it smells so good. You feel good (Dorothy Alexie, February 20, 2003).

For some berry harvesters it seems just going out on the land is more important, than the actual yield of harvest.

> I would be sick if I could not go for berries… We go to these places, even if there are no berries. We go there and make a fire and share some food. We take water from the streams, catch some fish. It is so clean and quiet. It is so nice (Bertha Francis, February 20, 2003)

Some younger women said they like berry picking because the berries from the land are an economical and better quality alternative to the fruit available in the local

stores (Judy Collin June, 2003). Interviewees also responded to the question with references to the physical well-being of themselves and their families.

> If I have to go for berries, its good for me to walk. Even if I fall down. When you are kneeling – you get up and down and your whole body is moving. You can't get any berries sitting still (Elizabeth Colin, July 4, 2003)

> I was raised at 3-Cabin Creek. I know every place for berries in that area because we would go there every year. We don't walk as much as we used to in those days ; not we are spoiled for walking. That [is part of what] makes berry picking healthy (Dorothy Alexie, February 21, 2003)

> Cranberries are good for your eyes; it has a lot of Vitamin C too in it. That is why I like having it around. I make juice out of it. It's good for your cold – for each of my family I make about a gallon for each of them – each of my boys. I always do that. (Rebecca Francis, June 13 2003).

Older women described berries as an important part of the traditional Gwich'in diet and provided many details about how to use berries in traditional medicine.

> I like berries… We used cranberries for a lot of things. You would make a tea and it was good for bladder infections. The cranberries from the store are not the same. We made a tea from the store berries for someone with a bladder infection but it did not help. Only our berries from land will work for this (Emma Kay February 20, 2003).

Women also described berries, in particular cranberries, as preventative medicine against colds, bladder infections and intestinal problems. Other plants such as spruce gum, tamarack and red willow were also described as important for traditional medicine.

Berry harvesting activities can also be interpreted in the context of cultural continuity. Many of the berry patches, particularly cranberry patches, have been passed on from generation to generation. Women go to berry patches year after year to remember and respect their mothers and grandmothers who were there before them.

> You remember a lot of things; we go back to the same places. For example, you can see where people used to make a fire. They would always make the fire in the same place…I know all of the berry patches my mother used to go to because she took us to these places (Dorothy Alexie, February 20, 2003).

> My grandmother used to pick berries a way up the Peel. She always used this place because of her grandmother. The trail to that place is worn into the ground. These places, you really have to walk a long ways to get there but it is worth it (Alice Vittrekwa, February 20, 2003).
> It is like gambling, - climbing up the hill. You slowly go up and if you get to the top and there are no berries but we don't care because we have walked through the places that were my mothers (Alice Vittrekwa, July 4, 2004)

> We feel closer to our parents out there; we make a fire in the same place as they did (Alice Vittrekwa, July 4, 2003)

Some of the women who were interviewed expressed hope that their children and children's children will continue to go to these places and remember them there also (Mary Ann Robert, July 3, 2003). The skills and knowledge associated with traveling to these places and finding good patches of berries is part of their legacy.

> [Berry picking] – its really good for our health, for the family to be out there together. Its good to pass on this information on to our children. This has been passed on to me from elders (Margaret Vittrekwa July 11, 2003)

> Wherever we went with our mother, I can remember today

> what it looks like. Where ever blueberries and yellowberries [cloudberries] grew, I remember all that. My parents taught us all this and today I am thankful to them for that. When I pray I thank my parents for raising me and teaching me how to make my living. Now I can do everything for myself. That is why you should listen to your parents when they talk to you. It is because of how we were raised by our parents and grandparents that we know how to make our living. Talk to your children and grandchildren and tell them good things. We remember our parents and grandparents words (Caroline Kay April 23, 2003)

Social connections are important in traditional societies and the opportunity to socialize is an important factor in going berry picking. Interviewees talked about the benefits of going out on the land with family and friends and working together. Sharing stories with one another is also important part of berry picking

> It would be good to spend time together out on the land and to share stories and tell our secrets about berry patches (Alice Vittrekwa, February 20, 2003)

In some cases working together means sharing the cost of transportation.

> I like going for berries. When someone picks me up to go for berries [its easier]. When you don't have a vehicle to go places, its really hard. Sometimes a bunch of us get together and we get gas money and we ask somebody to take us for berries out on the highway (Elizabeth Colin, March 21, 2003).

Sharing of information about where to find the berry patches as well as sharing the berries themselves was described as important my many women. Keeping berries without sharing is bad. Most women said they would share or trade berries for fish but would never sell their berries.

> I would share maybe about 1 ziplock bag with friends. I don't sell berries but I trade them for fish and drymeat. Sharing is very important in the community. I trade berries for rabbits and tea, sugar and something that I need that is important (Rebecca Francis October 15, 2003)
>
> Sometimes people would give me berries. Last year I caught the flu and was sick for along time. People, especially my family gave me berries. Lots! (Rachael Stewart October 9, 2003.

Socializing however, is also about having fun. Women said they have good memories of telling stories, laughing, sharing food and tea, helping one another to find and pick berries. Memories sparked by the interviews often sent interviewees into peals of laughter.

> There are good memories in these places. We have good laughs and are happy when we go back to these places and remember; we relive it. Here is one story I will share with you. One time I went out to Ross River and I rolled down the hill and I got stuck in a tree and ended up in a mud puddle. It was so funny. (laughter). The girl that was traveling with me did not want to laugh but I said – "Go ahead and laugh, its funny." So we all laughed. These are the things I remember (Bertha Francis, February 20, 2003).
>
> In the past we would go for a long time – from July to October. It was fun doing that. Everyone would have a good time. We would laugh. One time we had to go and cross the creeks so we had to take our pants off. So we did and crossed the river and left our pants to dry. Then we came back and had to cross the creek again. We our pants were wet again (Mary M. Firth, February 20, 2003).

Using the land and resources, and "being out on the land" and away from town is an important factor in why women go berry picking.

> I like going berry picking because it gets me out on the land (May Andre, April 7, 2003)

> Even if there were no berries around we would go there and check for it. We feel we have to check these places every year. Things would not be the same if we did not check them. It feels good to do that. It feels like we are connected to the land (Elizabeth Colin, February 20, 2003)

Among some berry pickers, being out on the land does not simply mean driving 5 km up the Dempster Highway. They prefer to go picking berries in relatively isolated areas on the Peel River near traditional cabin sites. Although it is generally accepted that many people will pick berries near the road, some women expressed concern about the decrease in the extent of Gwich'in land use. "The highway has spoiled everybody. They just look out their truck window and they don't even have to get out and walk around" (Alice Vittrekwa, July 4, 2003). Concern was also expressed that women are not harvesting as many different kinds of berries and other plants as in the past.

Part of the interest in being out on the land and engaged in the practice of berry harvesting relates to stewardship of the land. Some women described the importance of looking after the land including maintaining cabin sites and trails to specific berry patches. The interest is in part related to a concern that unless people continue to go to visit the berry patches each year, the trails as well as the patches themselves will become grown over by invasive species such as willows.

> Willows seem to be taking control of the area [where we used to berry pick]. Pretty soon it will be a jungle out there and we will have monkey's swinging from tree to tree [you

> have to cut back the willows] (Alice Vittrekwa July 4, 2003).

There are some changes in the environment, however, that women recognize that they cannot control.

> The cutbank [on the Peel River] near my camp, its eating away at the campside. The environment is changing. The creek there keeps changing too. Sometimes it goes one way and then another way. We are afraid of a mudslide so we decided to move our fish camp but it was really really hard to move because there are so many memories there. Soon we will really really have to move though because the land is getting smaller and smaller [being eroded by the river]. Then I will only have my memories (Alice Vittrekwa July 4, 2003).

Pride in the Gwich'in land and governance of the land is also important. A few women suggested that their berry patches should be protected under the Gwich'in land use plan or other Gwich'in laws to ensure that their children and future generations would be able to harvest berries in those places.

> I am concerned about the future of my berry patches. Seismic lines, developments like roads and fires too. Back in the 1940s and 1950s and 60s when people from down south brought technology to the north, they did a really sloppy job. Now today we see the damages that this development left behind on our Gwich'in lands. Now today we have better ways of protecting the land [such as the Land Use Plan] and can work together for a clean healthy environment (Christine Firth July 3, 2003)

> I don't want anything to happen to that area [where I pick berries]. They should make sure that people don't spray [herbicides on seismic lines] around there or make campfires. They should protect it from no drilling and no machinery (Dorothy Koe, June 15 2003)

> I think this area [around Three Cabin Creek] should be protected. Maybe we could put up signs – especially on the road and then the tourists won't bother the area (Elizabeth Colin, July 4, 2003).

Most women expressed less concern than anticipated about the loss of berry patches to resource development activities, forestry, forest fires or other land use activities; the greater concern was over the impact of climate change, particularly extreme weather events, on the abundance and distribution of berry patches.

Gwich'in spiritual beliefs, including the idea that the Creator will take care of the community and the land, is an aspect of berry harvesting.

> All the plants and berries that grow on the land must be respected. It grows there for us to use; this is what they (our grandmothers) taught us… everything that we live on from the land – God put it there for us. We will never go hungry as long as we live (Caroline Kay, June 2003).

> I say prayers for [the berries and plants]. When you use this medicine, you pray too. You pray with it, before you take it, and then when you have the medicine (Mary Kendi, February 23, 2003).

The relationship of women to their Creator and their feelings of being close and cared for by the Creator are fundamental to their relationship to the land and sense of health and well-being.

3.5 DISCUSSION

3.5.1 Social-ecological Health

Berry harvesting is an activity that Gwich'in women define as "healthy". When

asked the question, “why is berry picking healthy?”, they shared stories about themselves, their families, the community and their relationship to the land. Their responses are summarized in Table 3-3. These responses, while specific to berry harvesting, may also tell us something about healthy human – environment relationships or social-ecological health.

Social-ecological health is fundamentally about the relationship that human beings have to each other and their environment or the “land”. The relationship of northern Aboriginal peoples to the land is an area of significant academic research. In the Gwich’in region, for example, research has been carried out to document such activities as caribou hunting, trapping and fishing (Nelson 1986; Slobodin 1962). To date, however, research on berry harvesting practices has been limited.

The results presented in this paper suggest that the relationship of Gwich’in women to the land has many different dimensions. The logic is as follows: if the Gwich’in do not spend time on the land harvesting (land and resource use) take care of the land (stewardship) or are not in a position to govern their lands and resources (self-government), then their relationship to the land may not be considered healthy. Conversely, if an individual enjoys spending time on the land (individual preference), is able to provide food and medicine for themselves and their family (individual and family well-being) and has been given skills and knowledge for harvesting by their elders (cultural continuity), then their relationship to the land may be considered healthy. A healthy social-ecological relationship also has a strong social dimension

(social connections). If people are working together well on the land and there is sharing with family and the community then their relationship to the land is healthy. If individuals do not share, particularly what they have harvested from the land, then their relationship to the land is not healthy. Spirituality is also very important. A healthy relationship to the land involves respecting the Creator (spirituality) who has made the land.

Conspicuously absent in the values identified by the Teetl'it Gwich'in berry harvesters is the commercial economic value of berries. Although women value berries as the preferred alternative to store-bought fruit and will share and trade berries for other subsistence resources such as caribou, fish and fresh water, most said say they would "never" sell their berries for money. This disinterest in berries as a commercial resource has implications for planning and management of forest resources in the Gwich'in region.

Many of the indicators presented here are subjective in nature in that they refer to how people perceive and feel about themselves, their families, communities and experience on the land. These kinds of indicators can reveal details about the well-being of individuals and communities and their relationship to the land that are not available from nationally or regionally generated statistics (Kusel 1995). The indicators presented in this paper are local in scale. Most indicators developed for forest ecosystem management are based around regional or national scale data sets; the indicators presented here refer to individual, household and community level

issues. Similar research in other communities in the Gwich'in region and elsewhere could help identify the unique and comparable aspects of social-ecological health in the Gwich'in region. Further research is also needed on the compatibility of these local scale indicators with those already developed at regional and national scales.

3.5.2 Indicators based on Traditional Knowledge: Limitations

The reductionist nature of indicators research may be viewed as incompatible with the integrated and wholistic nature of the knowledge shared by elders and harvesters; as such some of the wholistic perspectives offered by the Teetl'it Gwich'in have been lost in this research process. There are benefits as well. However, given the current interest in indicators, this kind of research may help increase the use of traditional knowledge in resource management processes such as monitoring and increase opportunities for communities, such as the Teetl'it Gwich'in, to be more involved in the management of their lands and resources. For example, the indicators may be useful reference points to guide the development of a forest management plan and decisions about the use of forests in the Gwich'in region, as is the case in other regions of Canada (Karjala and Dewhurst 2003). As shown in other sustainability research, indicators can also be used as tools for local people to learn and communicate with one another and resource managers about the changes that are currently ongoing in their environment and how to deal with them (Waltner-Toews and Kay 2005). Further research on how indicators based on traditional knowledge can be meaningfully and appropriately used in these contexts is needed.

3.6. CONCLUSIONS

There is an emerging body of research on human-environment relationships or social-ecological systems that draws on the traditional knowledge of land-based peoples including Aboriginal peoples (Berkes et al. 2003; Berkes et al. 1998a). The purpose of this study was to contribute to this literature by identifying indicators of social-ecological health based on the knowledge and experiences of Teetl'it Gwich'in berry harvesters.

Photo 1 – The Wilson family of Fort McPherson picking cranberries near their fish camp at Rat River (Photo Credit – Brenda Parlee 2003)

CHAPTER FOUR

UNDERSTANDING AND COMMUNICATING ABOUT ECOLOGICAL CHANGE: DENESOLINE INDICATORS OF ECOSYSTEM HEALTH[1]

Summary:

Indicators of ecosystem health were documented during a traditional ecological knowledge study in Lutsel K'e, Northwest Territories. These indicators reflect many dimensions of the health of the lands and resources valued by the Denesoline people of Lutsel K'e including species body condition, wildlife abundance, distribution and diversity, water quality and Denesoline cultural landscapes and land features. The discussion highlights the potential of the Denesoline indicators to reflect change over a long time period, at different spatial and temporal scales, and change beyond natural variation. There are also important lessons drawn from the Denesoline elders related to learning and adapting to ecological change.

4.1 INTRODUCTION AND BACKGROUND

Ecological indicators are used by many indigenous peoples to understand and communicate about ecological change (Berkes et al. 2000a; Berkes 1999). "They have been used for centuries to guide environmental and livelihood planning and action, long before scientific knowledge attempted to understand the processes of environmental change and development" (Mwesigye 1996:74). Among the Cree and Inuit of Western

[1] Parlee, B., Manseau, M. and Lutsel K'e Dene First Nation. 2005. Understanding and communicating about ecological change: Denesoline indicators of ecosystem health. In: F. Berkes, R. Huebert, H. Fast, M. Manseau, and A. Diduck (Eds.), *Breaking Ice: Integrated Ocean Management in the Canadian North.* Calgary: University of Calgary Press 165-82.

Hudson's Bay, indicators are the voices of the earth that are always talking to us (Tarkiasuk et al. 1997). For many Aboriginal peoples, physical and spiritual signs and signals that the land is healthy are very important to their own feelings of health and well-being and that of their communities. As described by a Cree man from Chissasibi, "If the land is not healthy, how can we be?" (Adelson 2000a:6).

Recent work on traditional knowledge and ecological indicators has focused on specific resource management issues such as agricultural land management, desertification, sustainability in mountain forests and climate change (Kofinas et al. 2002; Berkes, et al. 2000b; Mwesigye 1996). In some cases, the research has provided perspective on the links between environmental and human health. An emerging body of literature on First Nations health in Canada, for example, reveals how indicators of environmental decline correspond directly with many social and human health problems (Hambly 1996). While the most meaningful indicators may be those that are developed on a site specific basis (Berkes et al. 2000b), there are commonalities in the way indigenous peoples interpret changes in the health of their environment. For example, the percentage of body fat of birds, caribou and other animals at harvest is one ecological health indicator which appears to be used by the Cree of northern Quebec (Berkes 1999), the Gwich'in of Alaska (Kofinas et al. 2002) and the Maori of southern New Zealand (Lyver 2002). Many indigenous groups in circumpolar regions use similar indicators related to ice and weather conditions to communicate about complex changes associated with global warming (Reidlinger and Berkes 2001; Krupnik and Jolly 1998). These studies are clear

examples of the sophisticated knowledge systems of local land-based cultures and their capacity to learn and adapt to ecological change.

This chapter focuses on ecological indicators developed by the Denesoline of Lutsel K'e Dene First Nation in the Northwest Territories to understand and communicate about changes in the health of their ecosystem or the "land"; this includes changes that have taken place over a long time period, at different geographic scales and change beyond natural variation. The study of these indicators also builds on previous arguments about the capacity of land-based cultures to learn and adapt to complex ecological change and the value of traditional knowledge in resource management.

4.2 THE DENESOLINE AND THEIR COMMUNITY

Lutsel K'e, formerly called Snowdrift, is a community of 377 Chipewyan Dene (Denesoline) located on the east arm of Great Slave Lake in the Northwest Territories. It is the most northerly Chipewyan speaking Dene community, situated at the tree line (62º24' N / 110º44' W). Like many other northern Dene communities, Lutsel K'e has experienced significant social and economic change over the last fifty years. Traditionally the Denesoline were known as the most widely traveled of the Athapaskan peoples, inhabiting a vast area from Great Slave Lake east to Hudson's Bay and from the mouth of the Coppermine River near the Arctic Circle to Wallaston Lake in present day Saskatchewan (Smith 1981:271).

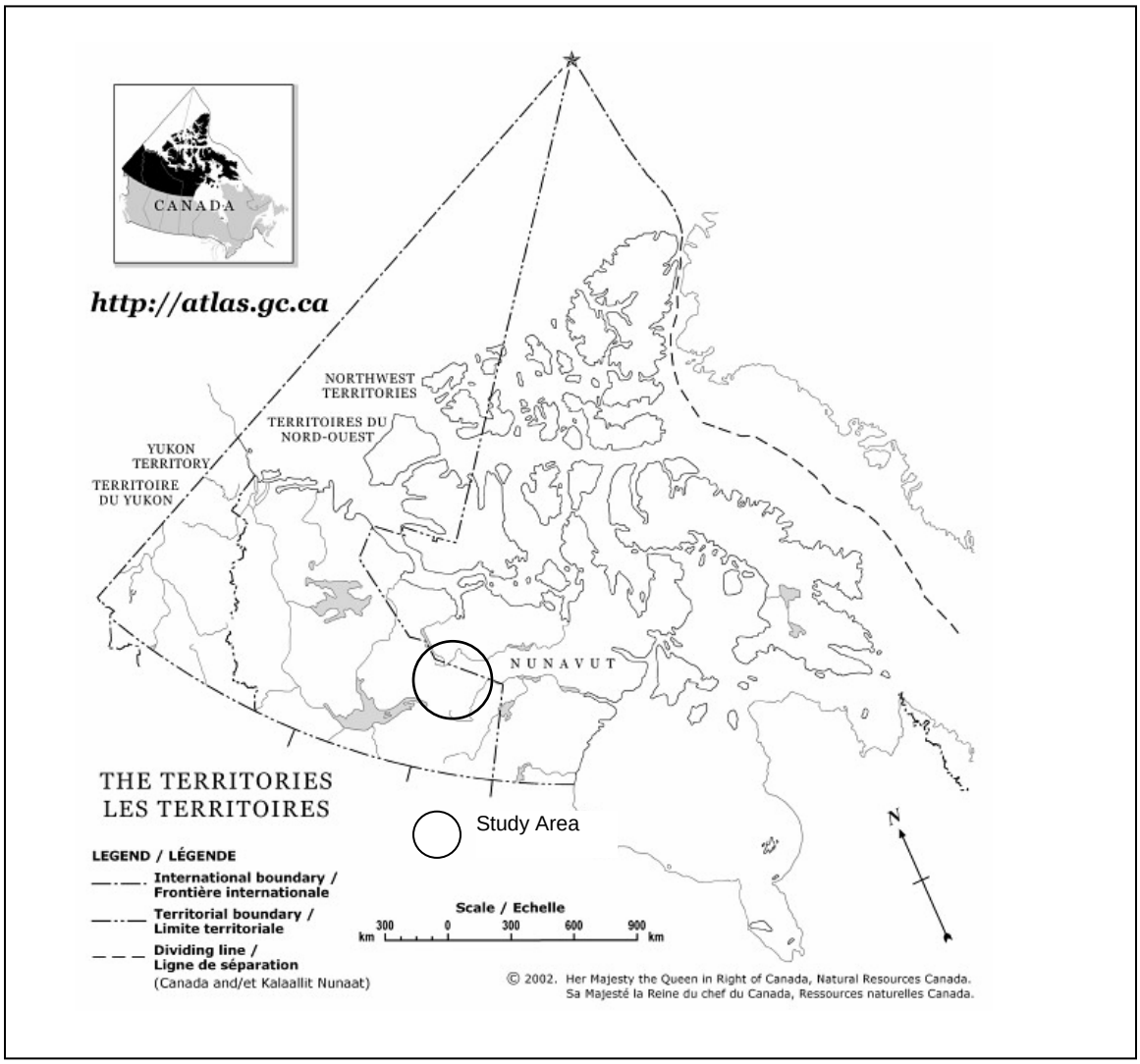

Fig. 4-1 - Lockhart River and Artillery Lake Area

Although the Denesoline now live in a more permanent settlement on Great Slave Lake, they still retain many aspects of their traditional harvesting economy, frequently traveling in an area of over 500 km^2 from present day Yellowknife east to the Thelon River and from Aylmer Lake to Nanacho Lake in the south. Of particular significance is the Lockhart River; its headwaters flow south-east from McKay Lake to Artillery Lake and then to Great Slave Lake (Fig. 4-1). Straddling the border between the boreal forest and the tundra, the Lockhart River and Artillery Lake area is a rich ecosystem hosting a diversity of wildlife, vegetation and landscape features representative of 6 different terrestrial eco-regions (Northwest Territories Centre For Remote Sensing 1998). Negotiations are underway between Lutsel K'e Dene First Nation and the Federal Government to protect this area as a National Park.

4.3 - DEFINING ECOLOGICAL INDICATORS

Denesoline knowledge of this ecosystem was documented during the *Preliminary Traditional Knowledge Study in the Gahcho Kué Study Region* and *The Traditional Ecological Knowledge in the Kaché Kué Study Region.* These projects were carried out in collaboration with Lutsel K'e Dene First Nation Chief and Council, the Wildlife, Lands and Environment Committee and an Elders' Committee. Denesoline elders from Lutsel K'e defined the Artillery Lake and Lockhart River as the area of interest during project scoping in 1996 and again in 1999 (Parlee et al. 2000a; Bielawksi and Lustel K'e Dene First Nation, 1992). On the recommendation of the elders being interviewed, the identification of the indicators followed the Denesoline harvest calendar beginning with

waterfowl in early spring (May) followed by fish (June-August), caribou (August-October) and fur-bearing animals (December-February).

Community researchers were the primary information gatherers for both projects. Additional support was attained from an academic advisory committee. The community-based research effort for these projects was involved and substantial. Data collection occurred through individual and small group semi-directed interviews with 27-50 Denesoline elders and harvesters. Most interviews were audio and/or video recorded by community researchers using translators during on-the-land workshops with elders and caribou harvesters. Data were also collected on 1:250 000 and 1:50 000 scale maps and integrated into the community geographic information system. Stories shared during small group interviews and elders' meetings were also recorded through minutes.

4.4 RESULTS

Over many generations, the Denesoline have developed a significant body of knowledge about the Lockhart River and Artillery Lake area. Much of this knowledge has accumulated through traditional harvesting practices including hunting, trapping and the gathering of berries and plants for food and medicine. Over 112 species of birds, wildlife, fish, and habitats were named and defined in Chipewyan and ecological indicators were documented for those species most commonly harvested.

Barren ground caribou (*Rangifer tarandus groenlandicus)* is the most important source of traditional food for the Lutsel K'e Dene; the movements of the Bathurst and Beverly caribou herd has been recognized as a key driver of their traditional land use patterns and social organization (Jarvenpa and Brumbach 1998; Irimoto 1981). In spring and fall, the Denesoline also include several species of geese and ducks as part of their diet; northern pintail (*Anas acuta*), scaup (*Aythya* spp.), and white winged scoter (M*elanitta fusca).* [2]Lake trout (S*alvelinus namaycush*), lake whitefish (C*oregonus clupeaformis*), round whitefish (P*rosppium cylindraceum*) and lake herring (C*oregonus artedi*) are also an important part of the diet in summer months [3], as are many berries and plants including cranberries (V*accinium vitis-idaea),* blueberries (V*accinium uliginosum),* labrador tea (*Ledum groenlandicum*) and spruce gum (P*icea glauca, P. mariana).* During the winter trapping season, wolverine, wolf and fox are also harvested in the region[4]. The indicators, or signs and signals, used by the Denesoline to understand and communicate about change in the health of these species revolve around four major themes: body condition (Table 4-1), species abundance and distribution (Table 4-2), quality of land and water (Table 4-3) and Denesoline cultural landscapes and land features (Table 4-4).

[2] During the study, elders identified species and Chipewayn terminology for birds commonly harvested in the past including: Northern Pintail, Old Squaw, Scoters, Horned Grebes, Red Neked Grebe, Bufflehead, Common Goldeneye, American Wigeon, Snow Goose, White Fronted Goose, Canada Goose, Tundra Swan, Trumpeter Swan Yellow-bellied Loon, Common Loon, Red Throated Loon, Arctic Loon, Willow Ptarmigan, Semi-Palmated Ploverrs, Spruce Grouse. Additional species known to the elders but not commonly harvested included: Herring Gulls (adults), Bonaparte Gull, Arctic Tern. Lesser Yellowleg Sandpiper, Solitary Sandpiper, Snowbirds, Chickadee, Snowy Owl, Bald Eagle, Golden Eagle, Northern Harrier, Sandhill Crane, Rough Legged Hawk, Red Bellied Woodpecker, Common Flicker, Down Woodpecker, Yellowbellied Sapsucker, Raven, some specie of Songbirds.

[3] In addition to Lake Trout, Round Whitefish, Lake Whitefish and Lake Herring, elders identified species and Chipewayn terminology for other fish commonly harvested in the past including Grayling, Jumbo Whitefish, Loche (Brubot), Northern Pike, Coney, Walleye and Long-Nose Sucker.

[4] Elders identified eleven species of fur-bearing animals commonly harvested in the past including: Wolf, Wolverine, White Fox, Red Fox, Lynx, Weasel, Marten, Mink, Muskrat, Otter and Beaver.

Indicators can be defined and presented in many different ways (Meadows 1998); the indicators presented are purposely framed as questions in terms that have meaning in the community of Lutsel K'e. Framed as questions, they become more than tools for describing ecological change, they become tools for ongoing learning and communication with the elders and harvesters that hold and have ownership of this knowledge.

4.4.1 Body Condition

The percentage of body fat is an indicator commonly used by Denesoline to interpret and communicate about the health of waterfowl, fish, caribou and fur-bearing animals (Table 4-1). "If the animal is fat then the hunter is happy". (JB Rabesca 15 October 1998). In a workshop in 1999, elder, J.B. Rabesca described how a fat caribou could be identified by a wide chest, tail hidden in hindquarter, busy set of antlers and a well-developed coat (JB Rabesca 15 October 1998).

Table 4-1 – Denesoline Indicators of Body Condition

Size / shape	Is the animal of normal size and shape? Is the weight in proportion with the length of the fish? Are there any deformities?
Fat	Is the animal fat? Are they skinny? Is there some fat around their organs?
Clean Organs	Are there cuts, marks or parasites (white spots, dark spots) in their stomach, on their liver or other organs?
Colour /Texture and Taste of Fish Flesh	Is the flesh firm or soft? Is the flesh tasty? Does it taste like stagnant water? Is the trout flesh red? Is the whitefish flesh a good white or is it brownish / greyish?

Wildlife behaviour can also be an important sign of good body condition; if the caribou is jittery it is a signal to hunters that the animal is young and the meat more tender (JB Rabesca 15 October 1998). Hunters can tell if the birds are fat by their behaviour during flight; fatter birds will fly lower over the water and are slower and clumsier when taking off or landing. Harvesters evaluate the length/weight ratio of fish to determine if they are fat; if the fish is expected to be fat but is found skinny, it is considered “sick” (Parlee et al. 2000a).

The outward appearance including well-developed plumage, scales or coat also indicate whether the bird, fish or animal is healthy. Any internal injury or disease such as broken limbs, lesions, parasites, poor colour or smell is often a sign to hunters that the animal is unhealthy. The texture as well as the colour of the fish flesh is also important; if the flesh is too soft, for example, the fish are described as "spoiled". In some cases injuries or diseases are also signals that something is wrong locally or in the broader ecosystem as in the case fish in Nanacho Lake and Stark Lake (Pierre Marlowe, 20 April 2000). For example, caribou arriving from their fall migration with shorn or broken legs are signs to elders that development activities in the region, including roads and other structures, may be negatively affecting caribou.

4.4.2 Wildlife Abundance, Distribution and Diversity

Indicators of species abundance, distribution and diversity are also used by the Denesoline to understand and communicate about ecological health (Table 4-2); the

abundance of caribou is particularly significant. Elders nostalgically describe periods when caribou were more abundant – "there were so many caribou, it would just feel like the ground was moving" (Henry Catholique, 02 February 2000).

Table 4-2 – Denesoline Indicators of Species Abundance, Distribution and Diversity

Animal Population	Are there abundant fish and wildlife of all kinds? Are there abundant fish and wildlife valued as traditional food? Have the population of these species changed from the past? Have people seen some species of fish or wildlife that are uncommon or have never been seen before? Are there some fish that you don't see anymore?

They also describe periods when there were very few caribou and people were very hungry (Alice Michel, 11 June 1997). Today, there is still tremendous joy associated with the return of the caribou and fear associated with a population decline (JB Rabesca, 15 September 1999). The abundance of wolves and foxes is also a sign that the land is healthy and can also signal hunters of caribou in the area. Trappers are particularly happy when animals are abundant for social and economic reasons; as with other harvesting activities, species abundance increases opportunities and success of harvesting.

Species abundance is an indicator of ecological health strongly associated with respect. If people do not respect the animals than they will not come back, give themselves or return to the people. For example, chasing caribou is forbidden. Hunters are also careful not to be arrogant towards the ducks and geese or play with (catch and release) the fish. (JB Rabesca, 15 September 1999).

The Denesoline associate the abundance of each species with different places in the Artillery Lake, Lockhart River area. If large numbers of birds are using the same staging areas and migration routes each year, it is a sign that the birds and the land are healthy. Changes in the range and habitat of different species are often signs to elders that something has changed in the region. For example, some elders have made observations of a new species of "little yellow bird" in the area which may be a sign of global warming[5]. Recent increases in the number of bears around the community and moose along the treeline in the Artillery Lake area have caused anxiety and confusion. To some elders it is a sign of habitat disturbance or loss in their region and to the south (Jonas Catholique, 15 January 2001; Pierre Catholique, 15 January 01).

4.4.3 Characteristics and Quality of the Land and Water

Indicators related to wildlife habitat largely revolve around the cleanliness of the land and water as the base of the food chain (Table 4-3). The cleanliness of the water is of great concern (Pierre Catholique 29 January 2001; Maurice Lockhart, 15 September 1999).

Table 4-3 – Denesoline Indicators of Land and Water Quality

Land	Does the land (in this place) look and smell clean? Has there been garbage left? Is the ground or vegetation disturbed? Have there been any machines or vehicles there? Were there any spills or leaks of fuel or other dangerous material?

[5] The "little yellow bird" is likely a warbler – possibly a Wilson's Warbler. Research north east of the community in the Thelon River area suggests that the range of this species has increased. (Norment 1999). Given that the bird has not been observed before or is new to the elder, it is understandable that there would be no Chipewyan name for this species.

Water Levels	Does the water look higher or lower than normal? Are there any small streams, creeks that have dried up? Is travel more difficult in some areas as a result of lower water levels? Has there been damage to boats and motors as a result of hitting the bottom? Are there portages that were very good in the past but are now too wide or long?
Water Quality	Are there some areas where the water is no longer good to drink and the fish good to eat? Is your drinking water tasty? Does it turn black in tea? Are you worried about contaminants in the water? Are you worried about the chlorine in the water?

That the land and water is free of visible signs of waste is particularly important; leaving garbage is a significant sign of disrespect in Denesoline culture. Many Denesoline are even more concerned about the waste on the land and in the water that they cannot see including long-range pollutants (POPs), leaks and spills from vehicles and equipment, bacteria and disease originating from remote locations. While most people feel that their land and water is generally very clean, there is concern about certain areas, where development has taken place in the past or may occur in the future. Of particular concern is the quality of drinking water from lakes and rivers. Elders often highlight the increased levels of mercury in the Talston River and Nanacho Lake caused by a 1960s hydro-electric project and the perceived contamination of Stark Lake as a result of uranium exploration in the 1950s. The current and potential effects of diamond mining activity on the health of the land and water are also a concern. One elder talking about mining in the region remarked “soon we won’t even be able to drink our water from our own lake” (Pierre Marlowe, April 2, 2000).

4.4.4 Denesoline Cultural Landscapes and Land Features

Signs and signals of ecological changes can also revolve around specific places or areas of the landscape commonly used by the Denesoline (Table 4-4). Places such as *eda cho* "big caribou crossing", "*desnethch'e*" where the water flows out" and *des delghai* "white water river" also refer to specific areas of ecological as well as social significance. In addition to the information they provide about the biophysical landscape, they inform us of the ecosystem as a whole and the role of the Denesoline within the system. For example, the Denesoline associate the fall migration of the caribou with key water crossings or bifurcation points on the caribou range. Caribou movements through these crossings are signals of where and when to look for caribou during the winter months. Large numbers of caribou crossings at *eda cho* at Artillery Lake, for example, is a signal that the herd is likely to over-winter in the eastern part of their range. Their use of crossings from McKay to Benjamin Lake indicate the winter grounds may be further to the west. Another useful land feature are the *ts'u aze di a si* or the small stands of black

Table 4-4 - Denesoline Indicators related to Cultural Landscapes and Land Features

Dechen Nene forested areas south of the treeline dry flatland / wet Marshy Land	How many Denesoline camps are now or used to be in this area? Is there drywood wood available for fuel? Is there green wood available for tent poles and logs for cabins and other structures (e.g. cache)? Is there clean water available in this area? Are there lots of blueberries, cranberries or other berries growing in this area? Are there other plants growing that could be used for traditional medicines?
Hazu Kampa at the treeline	How many Denesoline campsites are now or used to be in this place? Is there clean water available in this area? Is there dry wood available for fuel? Is there green wood available for tent poles?
Hazu Nene Barrenlands	How many Denesoline camps are now or used to be in this area? Is there dry wood available for fuel? Is there green wood available for tent poles and logs for cabins and other structures (e.g. cache)? Is there clean water available in this area? Are there lots of blueberries, cranberries or other berries growing in this area?

	Are there other plants growing that could be used for traditional medicines?
Eda Caribou Crossing	Are the caribou crossing in these places? Did the Denesoline use this crossing for hunting in the past? Do they still use it today?
Ts'u dzaii / Ts'u dza aze Small Stands of Trees at the Treeline and in the Barrenlands	Were there ever or are there now hunting or trapping camps in this place? Was this place ever used for shelter? Is there drywood available for fuel? Is there clean water nearby? Is there green wood available for tent poles?
K'a Heights of Land with Erratics	Was this area ever used as a hunting blind for caribou?
Thai t'ath Eskers	Were there ever or are there now hunting or trapping camps in this place? Was this area ever used for shelter? Are there any wolf, fox or bear dens?
Nikele Dry Flatland	Are there cranberries growing in this area? Are there other berries or plants growing here that might be used for traditional medicine?
Ni horelghas nene Wet Hummocky Land	Are there blueberries, cloudberries or cranberries growing in this area? Are there other berries or plants growing here that might be used for traditional medicine?

spruce (krummolhz) and willow found in the valleys and along rivers on the barrens. Given the scarcity of shelter and firewood on those open landscapes, these clumps of dwarf trees are valuable, particularly during winter. Hunters also use them as campsites and meeting places to exchange information about caribou movements, numbers and behaviour (See Chapter Six).

Some place names reflect on the Denesoline culture and spirituality. One of the most important cultural and spiritual sites is *tsankui theda* or the "old lady of the falls" located on the Lockhart River; the Denesoline visit the site every year to seek spiritual guidance and direction. Other sacred sites in the Artillery Lake area include Beaver Dam and Hachoghe's Shovel; the significance and origins of the landscape features are also explained in Denesoline legends that have been passed on through oral histories.

These place names reflect these many different social, cultural spiritual and ecological values as an integrated whole. *Kahdel*, for example, is more than a physical descriptor for "areas of open water in winter"; the Denesoline have named, used and recognized these places for thousands of years as critical for their own well being as well as that of many wildlife species (Parlee et al. 2000a). Early or permanent open water on rivers, lakes and estuaries or *askui* is valued similarly among the Innu of Labrador (Innu Nation 2003). Birds depend on those areas to feed in spring, when returning from migration. Fish benefit from the high primary productivity of these areas. Fur-bearing animals depend on the abundance of food around those areas of open water at key time of the year when prey become scarce. The potential loss of those areas of open water means more than a change in the ice or freezing pattern, it relates to changes of an entire ecosystem.

4.5 DISCUSSION

The indicators developed by the Denesoline have enabled them to understand and communicate about complex changes in their environment for many generations. They reflect or capture different aspects of ecological health and provide details about their perceptions of the quality and condition of various species of key importance to the Denesoline. Furthermore, the indicators also reflect on the interconnections between individual species and the "land". Similar to the concept of ecosystem, the "land", or *nene* in the Chipewyan language reflects on all aspects of the physical as an integrated whole; the Chipewyan concept also perceives a spiritual dimension. The Denesoline conceptualization of the land is also based on the understanding that human beings and

the environment are interconnected. An undisturbed and productive tundra landscape lends itself to a stronger and healthier caribou population; clean water is critical for healthy populations of whitefish and trout and sustainable harvesting of these species is the foundation of sustainable and healthy communities.

The indicators are based on experiences and observations of elders and land users; they refer to ecological changes that are within their lifetime. For example, the changes in Nanacho Lake identified by elders were the result of a hydro-electric project in the 1960s. Changes of concern in the condition of barren ground caribou have emerged even more recently with the development of the diamond mines. These observations are considered to be part of the traditional knowledge held by the community in that their interpretation that something is wrong in Nancho Lake or in caribou movements (edo aja) is arguably based on knowledge and observation passed on to them from previous generations. This definition is consistent with other definitions of traditional knowledge; specifically traditional knowledge is not a historical body of knowledge but a knowledge-practice-belief complex that evolves over time (Berkes 1999).

The indicators are not necessarily unique from those already in use by NGOs and in government programs such as the Arctic Borderlands Knowledge Coop, EMAN North and the Department of Fisheries and Oceans. Greater perhaps than their technical character, these indicators are cultural symbols that reflect how the Denesoline see, hear and feel about change in their environment. In addition to marking and measuring ecological change as part of their oral history, the Denesoline, like other land-based

peoples have experienced those changes, their sensitivity heightened by their dependence on resources for survival. As explained by one Denesoline elder - *"Some people who don't care so much won't notice the changes" (Maurice Lockhart, 11 May 2000*).

4.5.1 Diachronic Indicators: Reflecting Change over a Long Time Period:

Denesoline legends as well as archaeological evidence provide clues as to the longevity of their knowledge system including their indicators of ecosystem health. For example, Denesoline knowledge of caribou movements around Artillery Lake is likely five thousand years old. Elders say this area has always been good for caribou; stone lanceolates (arrowheads used for killing caribou) found in that area have been dated back to 3000 B.C. (Noble 1981; Macneish 1951). Some Denesoline legends including "the Old Lady of the Falls" and "How the Bear who Stole the Sun" suggest that Denesoline knowledge of this area may date back to the post glacial period.

> After the world was created, things were not always the same. There were ups and downs. One time, the sun disappeared. After the sun was gone, it was only winter and there was lots of snow falling. There was no sun and that is how people stayed. (Zep Casaway, 2001)

> All of the other Dene people followed Hachoghe who was chasing another beaver down the river. They were heading toward the east arm of Tue Nedhe. After a while, the people noticed that the woman was still back at the falls. So Hachoghe picked two healthy people to go back and look for her. They went all the way back up the Lockhart River and they found her sitting at the falls. She had been sitting there a long time and so she was stuck in the earth. The two people told her that Hachoghe was asking for her to return to Tue Nedhe. She said, "I cannot return with you. I have been sitting here too long and now I will be here for all eternity (Zep Casaway, 2001).

The exact time period in which these legends originated is not clear; the connection between such narratives and signs and signals used today to understand ecological change is not always obvious. Both legends describe significant ecological events; glaciation and changing patterns of water drainage. Other Dene legends with similar geomorphological references have been dated to about 8000 (Hanks 1997:182).
The Denesoline also have knowledge about ecological changes that have taken place in the more recent past. These stories about the importance of respecting animals and about the behaviour of men and women, are told more as cautionary tales with very human characters. This might suggest that these stories originated more recently; or within the past several generations. Other knowledge and experience with ecological change, such as the changes that occurred as a result of the Talston Hydro Electric project and the Stark Lake uranium mine (1950-60s) developed in the very recent past.

While the oral history about events that occurred 1000 years ago are clearly less detailed than information generated in the recent past, it is useful to consider how information about critical events have been retained through time and how this information is integrated as a whole over time. The strength of Denesoline traditional knowledge is not in accumulating objective empirical observations or "data" about isolated events that can be compared 1000 years from now. The strength is arguably in the capacity of the Denesoline to interpret and use their empirical observations day after day, year after year and decade after decade. The test of course is survival; for without accurate knowledge of their environment, they would have succumbed to the harsh sub-arctic environment.

4.5.2 Scaling-Up of Denesoline Knowledge

Indicators presented here reflect an understanding of ecosystem health around the Lockhart River and Artillery Lake. However, Denesoline knowledge was not limited to this geographic area; the large-scale movements of the Bathurst caribou herd required that the Denesoline traveled, observed and communicated observations over large areas.

Most Denesoline knowledge of caribou and caribou movements reflect their vantage point on the fall and winter range of the herd (Fig. 4-2). The elders' characterization of the migration cycle begins when the caribou return to the Lockhart River / Artillery Lake region in the fall and ends when the caribou leave the area in March. In contrast, Inuit elders from the Bathurst Inlet area describe the migration from the spring and summer range of the herd (Thorpe et al. 2001).

Denesoline Knowledge of the Bathurst Caribou Migration Cycle (Fall/Winter)

1. *enilas* – caribou returns
2. *etthen narilya* – whole migration stops
3. *bedé ne she* – growing antlers
4. *deladzine enich'ú* – caribou velvet comes off
5. *bedé hegun* – antlers dry up
6. *ek'endalde* – rut
7. *ts'an jâ* – bull meat is not good
8. *narilya* – winter feeding
9. *nalas* – caribou start moving again
10. *tsi halas (betsi)* – the caribou leave

Fig. 4-2 - Denesoline description of the Caribou Migration Cycle

Effective harvesting of the caribou required an understanding of caribou movements beyond the Lockhart River/Artillery Lake area. As a result, the Denesoline hunting parties were known to share information about caribou movements with one another to maximize the opportunities for harvesting (See Chapter Six). Such extensive social networking was made possible in part because of the Denesoline predilection for widespread travel; they are recognized as the most well traveled of all the Athapaskan peoples (Smith 1981). Successful interpretation and communication about ecological events or processes that would affect their movement on the land, such as changes in water levels, ice conditions, weather patterns, or grizzly sightings would also been key to successful hunts.

Traditionally, this scaling up of knowledge was important for successful harvesting; increasingly, there are other issues that make knowledge networking important.
In the western Hudson's Bay region for example, Inuit and Cree observations of weather and sea ice conditions were linked together to provide a regional picture of climate change (McDonald et al. 1997). The Arctic Borderlands Knowledge Coop provides a forum for communities in the Porcupine Caribou range to share their observations and experiences around such issues as non-renewable resource development and climate change (www.taiga.net). A circumpolar project 'Rangifer' aims to pull together local knowledge with respect to caribou (www.rangifer.com). In all those examples, a composite picture of regional ecological change is drawn from the local observations and knowledge of local communities.

4.5.3 Recognizing Change beyond Natural Variation

While these indicators of health provide a general picture of how the Denesoline understand and communicate about the land, they are by no means employed uniformly; they are applied using traditional knowledge of natural variation. Based on continued interactions with the land and communication over the generations, the Denesoline are in a favourable position to determine whether changes are related to natural variation or anthropogenic activities (McDonald et al 1997). For example, female caribou arriving at the treeline in early fall are much skinnier and rougher in appearance than later in the fall because they have been nursing their calves; harvesters do not consider these animals to be unhealthy. Fish in some barren land lakes are softer and skinnier than in lakes along the treeline, however, harvesters interpret this as "normal". Other examples of this natural variation relate to the abundance and diversity of waterfowl and fish. The population of fish in the east arm of Great Slave Lake is perceived as good or greater than in the past (Eddy Catholique 29 June 1999). However, according to the elders, the abundance and diversity of waterfowl has declined. There used to be so many ducks and geese in the past compared to today (Alice Michel, 20 April 2000). They suggest that the population of black ducks or white-winged scoter (*Melanitta fusca*) is much lower today than it was in the past.

The capacity to understand and communicate about change beyond natural variation is expressed in the following way; elders distinguish between natural change as *edo* and change that is perceived as unnatural - *edo aja* - which translates directly as "something has happened to it"; what is considered unnatural disturbance is generally a disturbance

that the community perceives as interrupting or interfering with recognized ecological patterns relationships or cycles [6]. Many of the interferences described as *edo aja* are anthropogenic; the environmental effects of mining, hydro-electric development and long-range contaminants are all perceived as unnatural. Ecological events or changes that have not be documented within the social memory of the community are also described in terms of *edo aja*. For example, decreasing water levels in the region are described here by elder Maurice Lockhart described, "We have been losing water but I don't know why".

> All the small lakes [ponds] on the barrenlands are disappearing as well as the small streams and creeks that flow between them. That is why the water is no longer healthy to drink. (Maurice Lockhart 28 August 2000).

Other elders observing erratic weather events including unseasonably warm weather and unpredictable winds and storms, attribute the change to global warming.

> The climate is changing. The wind blows harder than it did in the past. Its different – the wind picks up quickly and changes quickly. Now I don't know what has happened… A long time ago my sister and I traveled on the Snowdrift River to Siltaza Lake. We never saw any rocks along that river but today you can see lots of rocks [the river is shallow]. (Noel Drybones, 11 June 2000)

Of particular concern is the increased incidence of lightening storms and forest fires in the region. Elders have said that until recently (the last five years) they had never seen a forest fire caused by lightening. (Pierre Marlowe, 06 November 2000).

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[6] Seasonal change, for example is described in Chipewyan by elders in twenty-five stages: (1) early spring, (2) days start getting longer, (3) snow starts to melt around the trees, (4) snow starts to melt everywhere, (5) lake becomes slushy on top, (6) water drains through the ice, (7) snow is gone from the ice, (8) ice candles, (9) ice is floating, (10) flowers are growing, (11) growth begins, (12) last frost, (13) full bloom of flowers, (14) berries are forming, (15) berries are ready, (16) leaves are changing, (17) ground freezes, (18) ice fog comes, (19) snow comes, (20) lake is freezing, (21) days get shorter, (22) deep snow, (23) thin ice, (24) thick ice, (25) blizzards. Some elders are concerned about unforeseen changes in this seasonal cycle, as well as other cycles and patterns such as those associated with caribou migration (See Chapter Six).

> Regarding the forest fires – some scientists say its 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 the forest fires are good, but it's not like that for us. We look after the land and we respect the land and the animals. (Pierre Marlowe 6 November 2000)

This capacity to differentiate between natural and unnatural change in their local environment is key to understanding a variety of resource management problems. One major problem exists in the Nanula Tue area. In the 1960s, a hydroelectric dam developed on the Talston River, flooded Nanula Tue which was once an important fishing, trapping area as well important habitat for over wintering for caribou. As a result of this activity, the Lutsel K'e Dene are no longer able to fish, trap and hunt in that area and winter travel through that area has become dangerous (Reidlinger and Berkes 2001; Bielawski and Lutsel K'e Dene First Nation 1992). Some of the problems that are now visible are described here by elder Pierre Marlowe.

> Long ago at Nanula Tue, before they built the dam there were good fish - just like Great Slave Lake fish. Now they have a dam on the Talston River and the fish are different. I remember before they built the dam, I trapped around there…. When the dam was built there – there were lots of changes. You can't eat the fish now because it's soft and skinny (Pierre Marlowe, 1999).

Another such problem exists in a nearby lake, once a key fishing area for Denesoline hunters. In 1952, however, exploration for uranium in the area resulted in the development of a small mining operation on a peninsula of land in the lake. Today the elders recount their concerns about the water and the fish being spoiled as a result of this uranium exploration.

> The fish in Stark Lake are a problem. Since the mine [uranium exploration site] was put there… the fish are different – the water too. In another ten years, maybe we won't be able to drink the water from our

> own lake. There are lots of elders who have passed away from cancer already because of it. (Pierre Marlowe 20 April 2000)

These changes not only have implications for the long-term health of the biophysical environment; they also have profound effects on the health of the community. People worry about what will happen to the land and their children in the future. As in other communities that depend significantly on the land and resources for their livelihood, these unnatural changes are the cause of significant anxiety.

> People living directly from the land and water around them are acutely aware of indications that things are right or wrong with the natural world… Unnatural disruptions--for example river impoundment and regulation, or environmental contamination--are profoundly disturbing and give rise to deep seated anxiety and insecurity (Usher et al. 1992:114).

As Usher (1992) and others point out, the traditional economy is grounded in peoples' sense of security about their ability to access an abundant natural resource base. If the security of that resource base or their access to it is compromised, or is threatened, so too is the community. Bielawski, in her work on the impacts of the Talston Hydro Electric development, suggested that the greatest impact was the frustration over their inability to prevent the damage that occurred, as much as it was the impact of the damage itself (Bielawski and Lutsel K'e Dene First Nation 1992).

4.5.4 Communicating about Ecological Change

Where indicators have meaning within a community, they can also be vehicles of cultural continuity. Such symbolic indicators are sometimes described as "community indicators" because of their meaning to a specific community or people or "beloved indicators"

(Meadows 1998). At a very basic level these indicators are cultural symbols that help convey or tell others about a given experience or observation.

The symbolic value associated with the indicators developed by the Denesoline is visible in their cultural narratives. For example, the importance of the Artillery Lake as a caribou crossing is well defined in stories passed on by Denesoline elders. Other stories describe changing water levels in different lakes or rivers (ND 05 11 00), common migration routes for ducks and geese and dangerous areas for travel in winter. Stories about the impacts of the Talston River hydro-electric project or the Stark Lake uranium exploration site, are also told and retold to ensure that current and future generations are aware of the dangers of harvesting in those areas. In some cases, stories or words are not necessary to share information. For example, information about the fatness of ducks, can be conveyed through the smells and sounds of meat cooking over an open camp fire. Traditionally, hunters tracked the movements of caribou across their fall range by the numbers of animals harvested at different fall camps. An understanding of the abundance of fish in a given location could be gained by observing family stores of dry-fish.

4.5.5 Learning and Adapting to Ecological Change

Historically, the capacity of the Denesoline to use these indicators to learn and adapt to their changing environment has been critical to their survival. Empirical observation over a long time period is the foundation of that capacity to learn and adapt. Such observations revolve around a diversity of indicators and measures as described in this chapter. Some indicators may be quantitative, as in the abundance of caribou or

whitefish, or based on qualitative perception. In Lutsel K'e Denesoline hunters used the information about movements and abundance of caribou and other wildlife to make decisions about where and when to hunt in order to feed their families. They watched signs of changing weather and ice conditions to ensure safe travel while trapping for furs in the barrens. Careful inspection of the condition of animals being harvested was important in preventing illness. However, empirical observation is only the first stage of knowledge generation (Berkes 1999; Roots 1998). Critical to a discussion on the role of TK in resource management is the recognition of how observation becomes knowledge and wisdom in Aboriginal culture. Observations of one hunter or elder in a community cannot necessarily be construed as traditional knowledge; it is only after these observations are verified and interpreted along with other observations from the past and present that it may be considered to be knowledge. Traditionally, this verification and interpretation would have occurred informally through family groups. Today, elders' committees and harvester councils often fulfill that role.

The capacity of the Denesoline to successfully adapt to their changing environment may be based on the horizontal or non-hierarchical nature of their traditional social order (Smith 1981). Although there were some important and wise elders who excerpted influence over large numbers of people from time to time, decisions about how to work together, where and when to hunt, trap and fish were fundamentally made by individuals within small family groups. The size of camps would increase or decrease depending on the size of the family, social need as well as on the work involved in harvesting. For example, the groups associated with caribou harvesting were traditionally larger than

those associated with duck hunting or fishing because of the uncertainty associated with finding caribou in the vast geography of the fall and winter range.

This non-hierarchical social order still influences how decisions are made today, including how the Denesoline deal with ecological change. In the case of diamond mining activity, for example, individuals representing different family groups seek to be involved at all levels of planning and management of these projects, from the act of observation and monitoring, to data interpretation and analysis, site management and policy making. Although these roles and tasks are framed very hierarchically in a government or industry setting, for the Denesoline, they cannot be separated from one another. This is illustrated in the following quote from JB Rabesca who, in one short statement, shares his empirical observations, hypotheses about potential effects and recommendations for managing and mitigating those effects

> I have seen the caribou around that place [the mine]. I am concerned that if the caribou start eating the food around the mine area. anything that spills on the ground is taken up by the plants. These is muskeg in that area too. The spills will stay in that area. Someone said that they would put up a fence in that area but they haven't done anything yet. If they put a fence in that area – we wouldn't worry about the caribou. It's not good to have caribou in the mining area. (JB Rabesca, 14 February 2001)

This integrated approach demonstrated by the Denesoline, can be a guide to building an integrated resource management approach in which land users play a fundamental role, not simply as technical assistants or stakeholders, but as decision-makers with a well developed understanding of complex ecological change.

4.6 CONCLUSION

> The report that has been put together is about our culture and our way of life. The documents show how we see things… It tells what we understand about the animals and how they behave and how we live on the land… We are not playing around. It is not a game. What we are talking about it is very serious… (Zepp Casaway 28 June 2000)

The health of north ecosystems is changing at an alarming rate; "the earth is moving faster now" (Krupnik and Jolly 1998). The current and potential effects of non-renewable resource development, the presence of POPs and other contaminants in the food chain and the impact of climate change are the cause of significant anxiety for the Denesoline and others who have lived off the land for many generations. Addressing these issues of ecosystem health is complex; "environmental change does not lend itself to analysis by conventional approaches". In addition to addressing tough biophysical questions, there are many complex social, economic and cultural implications to consider. This human dimension of ecosystem change, whether it be non-renewable resource development or climate change, is often overlooked; the debate over climate change is one (Reidlinger and Berkes 2001).

This paper presents some Denesolien observations and experiences with ecological change in their region of the Northwest Territories. Some of these observations and experiences, such as those related to Nanacho Lake and the effects of the hydro-electric project, have been the focus of earlier studies (Bielawski 1993). Other observations, such as those related to mining and climate change, are more recent and require more in depth study. Further research about these observations including the specific time periods

associated with each observation, is needed. In that way, the results presented in this Chapter represent only small portion of what remains a relatively untapped system of local and traditional knowledge about our changing environment.

Photo 3 – Hunter from Lutsel K'e harvesting a caribou during winter
Photo Credit – Lutsel K'e Dene First Nation (2002)

CHAPTER FIVE:

GWICH'IN PERSPECTIVES ON ECOLOGICAL VARIABILITY IN RELATION TO BERRY HARVESTING

Summary:

An important characteristic of social-ecological resilience is the ability to deal with ecological variability. This paper presents perspectives on ecological variability drawn from the traditional knowledge and resource harvesting practices of Teetl'it Gwich'in berry harvesters. A set of ecological indicators or "signs and signals" used by women to understand and communicate about variability in the abundance and distribution of cloudberries, blueberries and cranberries in their region are presented. The second section of results focuses on resource harvesting strategies developed by the Gwich'in to deal with this variability including: use of microclimates, selection of species-specific harvesting areas, selection of harvesting areas with diverse resources and selection of harvesting areas with redundant resources.

5.1 INTRODUCTION

Different societies demonstrate varying levels of social-ecological resilience including capacities to deal with ecological variability. Western models of resource management, guided by neoclassical economics and linear scientific thinking, have been characterized as unresilient (Holling 2002; Berkes et al., 2003). Rather than recognizing and adapting to natural fluctuations in productivity of forests, fisheries, wildlife populations or ecosystems as a whole, resource managers have focused on reducing or

blocking out variability and maintaining ecosystems at highly productive levels. While seemingly successful in the short term, over the longer term this approach has proven to make resources, and the communities who depend on them, vulnerable to sudden shifts in ecosystem behaviour (Berkes et al, 1998a; Holling 1986).

Many indigenous societies have developed knowledge and practices that are viewed as more resilient and enable them to adapt to variability in ways that sustain the well-being of their communities and the ecosystems in which they live (Berkes et al., 1998a: 415). Part of their success is tied to their understanding and ability to adapt to ecological variability. The *Caicaras* and *Caboclos* populations of Amazon Brazil for example, demonstrate significant social, economic and cultural flexibility in their use of resources which can be attributed to their ability to make use of both indigenous knowledge and new knowledge from other cultures (Begossi, 1998: 133). Pastoralists in Sahelian Africa track variability in the productivity of rangelands and adapt their use of these areas accordingly. Communal use and regulation of resources, spatial and temporal flexibility in resource use, flexible drought adapted strategies and multiple use of diverse resources are among the strategies used by the pastoralists to deal with variability in the productivity of this arid and semi-arid ecosystem (Niamir-Fuller, 1998:275). In northern Quebec, the Chisasibi Cree are able to deal with low biological productivity and year-to-year variability through social learning over the long-term and environmental observation in the short term (Berkes 1998: 120).

Part of the distinction between indigenous management practices and western models is

tied to differing perceptions of the environment and human-environment relationships. A useful conceptual framework for exploring indigenous perceptions of the environment is the cultural landscape.

The concept of cultural landscape is decades old; it refers not to a particular type of landscape or geography but of a way of viewing or interpreting the landscape, whether individual resources or whole ecosystems, through specific cultural values and experience. It stems from an awareness that different cultural groups interpret their landscape in different ways. First coined by geographer Sauer (1925), the study of cultural landscapes has evolved to include consideration of many different social, and ecological interactions (Davidson-Hunt, 2003). Most research on cultural landscapes, however, has tended towards static or historical depictions of place and human-environment relationships. It has only been in recent years, that cultural landscape research has considered the dynamic nature of social-ecological interactions (Davidson-Hunt, 2003; Davidson-Hunt and Berkes, 2003). This paper explores cultural perceptions and adaptations to ecological variability based on the traditional knowledge of the Teetl'it Gwich'in.

Ecological variability refers to the spatial and temporal variations in ecological conditions that are relatively unaffected by people within a given period of time or geographic area (Landres et al. 1999). Also described in terms of "natural variability", "range of natural variation" or "historic variation", ecological variability is a key characteristic of complex or non-linear systems (Levin 1992). In northern regions of Canada, ecological variabilities are manifested in many ways: climate and weather

conditions fluctuate significantly over time and space; the fall migration route of barren ground caribou can shift upwards of 200 kilometres from year to year; the populations of some small fur bearing animals are known to explode in some years and crash in others, precipitation and water flows fluctuate dramatically from winter to summer and in some years result in extreme conditions of flood or drought. Forest fires also alter the landscape in highly sporadic ways.

Among the tools developed by northern Aboriginal peoples for understanding and dealing with such variability are ecological indicators. Many scientific models for developing indicators focus on finding objective measures of ecological structure and function; other participatory approaches focus on what is important to local communities (Meadows, 1998). The criteria and indicators approach, involves identifying key values or what is important about the ecosystem, as well as specific quantitative and qualitative measures that can be used to track changes in those values. There is however, no right set of indicators (Holling 1978). Indicators that reflect change at a variety of spatial and temporal scales and from a diversity of social and cultural perspectives are considered most useful in understanding and dealing with ecological variability.

This paper presents a set of indicators that reflect Gwich'in perceptions of ecological variability in relation to the abundance and distribution of berries in the Gwich'in Settlement Region (Fig. 5-1).

5.2 METHODOLOGY

This study of ecological indicators and berry harvesting patterns was part of a larger study aimed at documenting local and traditional knowledge about non-timber forest products in the Gwich'in Settlement Region. The research was conducted according to a participatory methodology and involved partnerships with local organizations and capacity building of local community members. A research agreement was developed with four Gwich'in organizations - the Gwich'in Renewable Resources Board (GRRB), the Gwich'in Tribal Council, the Gwich'in Social and Cultural Institute (GSCI) and the Teetl'it Gwich'in Renewable Resources Council. This agreement details methods for local capacity building, data gathering, analysis, storage and reporting.

The investigation into indicators and resource harvesting patterns was carried out using four inter-related methods including: open-ended interviews, semi-directed interviews, mapping of harvest patterns, and participant observation. A series of open-ended semi-directed interviews were carried out with elder women in the community of Fort McPherson. Through this process, the researchers were able to understand more about the life histories and experiences of individual harvesters with respect to berry harvesting. Key insights were gained into: i) berry and medicinal plant species of value to the Teetl'it Gwich'in ii) social and ecological values associated with berry harvesting areas, and iii) practices and rules associated with berry harvesting. Based on the results of the open-ended interviews, a series of semi-directed interviews were carried out in June-August, 2003 with 28 women and others identified as berry harvesters including women and men

from ages 16-85.

Participant observation was also an important part of the methodology. I calculated that over one hundred (100) Teetl'it Gwich'in from Fort McPherson ventured out for cloudberries, blueberries, and cranberries during the 2004 season[1]. The vast majority of harvesters identified were women between the ages of 20 and 75 years old, however, some men and younger women and children were also involved in berry harvesting activities. Most harvesting was carried out in small groups of 3-5 people and occurred within several hundred kilometers of Fort McPherson. The results of the participatory mapping workshop held in June 2003 was also key to this investigation. The purpose of the mapping workshop was to invite community members to identify areas of importance for harvesting berries. Mapping of approximately 70 key harvesting areas was done at both a 1:50 000 and 1:250 000 scales by 35 community members.

Over 80 people participated in the study; forty-two (42) women, twenty five men (25) and another thirteen (13) individuals from Gwich'in organizations. Group meetings were open to all, including young women and men (See Appendix A for details about the interviews and interviewees).

[1] During the May 2004 workshop, these calculations were reviewed by the berry harvesters and determined and thought to be too low. They said that a far larger number of people in the community harvest berries.

5.3. THE TEETL'IT GWICH'IN AND THEIR LAND

The Teetl'it Gwich'in (Dene), historically known as Loucheux, are one of ten Gwich'in groups that live in current day Alaska, Yukon and the Northwest Territories (Heime et al. 2001). Since the 1950s, the Teetl'it Gwich'in have lived in a permanent settlement at Fort McPherson; traditionally they are known as the 'people of upper Peel watershed'. Like other Dene groups in the Canadian sub-arctic, the Teetl'it Gwich'in way of life is fundamentally interconnected with the seasonal availability of natural resources including caribou, fish and berries. Dene use of berries and medicinal plants was documented as early as the 1800s by Mackenzie (1801), however, little research had been done on the value of this species to the Gwich'in until recently (Andre and Fehr 2001; Murray and Boxall 2002). The most popular species harvested in the Gwich'in region are cranberry, blueberry and cloudberry.

Cloudberry (*Rubus chamaemorus*) is a low lying herbaceous perennial plant of the rose family characteristic of boreal forests north of the treeline to the arctic coast; growth is on average 5 to 20 cm. in height (Johnson et al. 1995). In northern Canada, cloudberries are also commonly known as salmon berries, bake-apple or yellow berries (Marles et al. 2000). Among the Teetl'it Gwich'in, they are known as *nakal* (pronounced knuckle) (Andre and Fehr 2001). It is well known to many northern Aboriginal peoples as a nutritious food rich in Vitamin C and thiamine and other valuable nutrients (Marles et al. 2000). *Vaccinium uliginosum* is a dwarf shrub characterized by dense matted branches; it

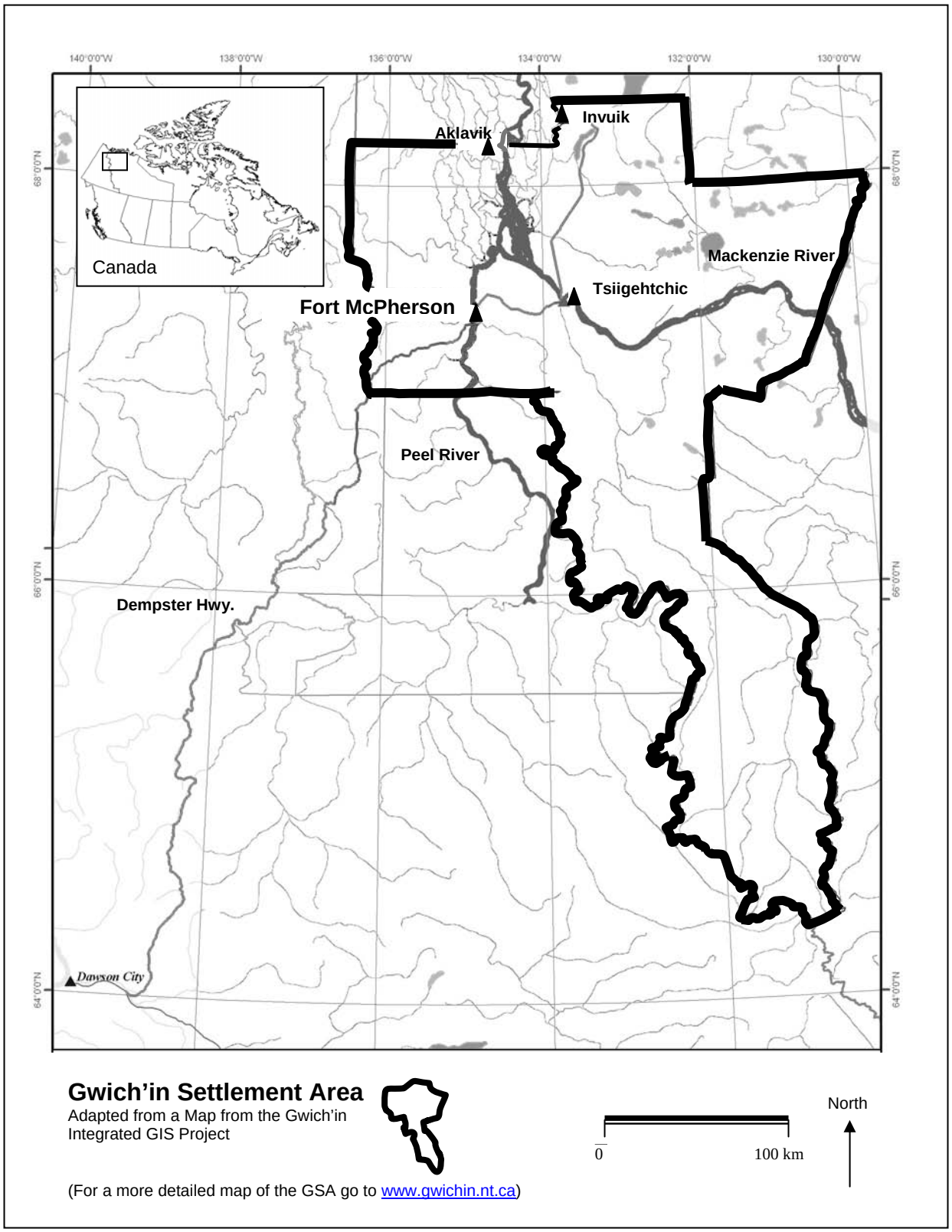

Fig 5-1. Map of the Gwich'in Settlement Area of the Northwest Territories

can grow between 5-30 cm. tall. Although this species is similar and commonly called blueberry, it is known to botanists as bog bilberry because of its preference for more northerly acidic soils (Johnson et al. 1995). Many northern Aboriginal peoples value blueberries for their relative abundance and nutritional value and medicinal properties (Marles et al. 2000):183). Cranberry (*Vaccinium vitis-idaea; Vaccinium oxycocus*) has many matted creeping branches grows upwards to a maximum of 20 cm tall (Johnson et al. 1995) *Vaccinium oxycocus* or dwarf bog cranberry is similar but has smaller thread like stems which tend to creep laterally to 50 cm long (Johnson et al. 1995). It is highly valued for its nutritional value and medicinal properties by northern Aboriginal peoples (Marles et al. 2000). The large palmate leaf structure and glandular fruit of the *Rubus chamaemorus* makes it particularly sensitive to drought and temperature variation; as a result it demonstrates significant phenotypic variation in different microclimates. Plants growing in shady areas are much less sensitive to precipitation and temperature extremes and can, as a result, grow larger leaves and potentially bear larger fruit than those in open areas (Korpelainen 1994). *Vaccinium vitis- idaea; Vaccinium oxycocus,* by contrast have narrow elliptic leather-like leaves as well as smaller fruit which significantly increase their capacity to adapt to variability in temperature and precipitation.

5.4. RESULTS

5.4.1 Perceptions of Forest Resource Availability

Gwich'in women harvest many different kinds of forest resources in their region. During the interview process, we documented local perceptions of the availability of

Table 5-1 – Availability of Forest Resources Harvested by the Teetl'it Gwich'in

Perceived Availability of Species in Gwich'in Settlement Region		Roles and Responsibilities for Harvesting			
		A	B	C	D
I can find it anywhere	Spruce Gum		■		
	Labrador Tea		■		
	Fireweed				■
	Lichen				■
	Red Willow			■	
I can find it in many places	Cranberries	■			
	Crowberries		■		
	Tamarack			■	
I can find it only in some places	Cloudberries	■			
	Blueberries	■			
	Rhubarb		■		
	Prickly Black Currant		■		
I can only find it in a very few places	Moose Berries		■		
	Bear Roots		■		
	Northern Ground Cone			■	
	Raspberries	■			
	Wild Onions		■		
It is hard to find it anywhere	Stoneberries		■		
	Wild Red Currant		■		
			■		

Notes:

A. Everyone is involved in harvest because:
- Plant is easily recognized by most adults and youth; and
- Highly valued as food or medicine; and
- Requires minimal effort in harvesting and no specialized knowledge.

B. Only harvested by some people in family are responsible because:
- Plant is known only to some adults (older family members); and
- Valued as food or medicine; and
- Requires some effort or specialized knowledge for harvesting, preparation or use.

C. Only harvested by some elders or special healers are responsible because:
- Plant is only known to a few elders; and
- Has specialized medicinal value; and
- Requires significant effort or specialized knowledge for harvesting, preparation or use.

D. Only harvested during extreme conditions (i.e. hunger)

these resources in the region or "how easy they are to find". Spruce gum, for example, "can be found just about anywhere", cranberries "can be found in many places". Cloudberries, blueberries and some other plants "can only be found in some places". Red currants, are an example of a plant that is very hard to find (Table 5-1).

Different people use their knowledge of these plants in different ways. For example, many community members, even children, recognize and are able to harvest blueberries; northern ground cone is a plant however, that is usually only sought out by elders or traditional healers with an interest in traditional medicine. The notes in Table 5-1, suggest that the interest in finding this species is also tied to the effort required in harvesting, level of knowledge required in harvesting, preparation and use.

5.4.2 "Where are the berries growing good? – Knowledge of Variability

Through the open-ended and guided interview process, key ecological elements and processes associated with the abundance and distribution of good berry patches were documented – women describe this variability in terms of "change".

> Sometimes there are a lot of changes. One year, there would be a lot of blueberries and no cloudberries; then the next year there would be a lot of cloudberries and no blueberries. It's always been like this but we have never seen a year when there were no berries of any kind (Mary Ruth Wilson, February 20, 2003).

With respect to cloudberries, this variability is in part related to the characteristics of the plants themselves and their unpredictable distribution. Unlike other berries, such as blueberries and cranberries, cloudberries do not grow in dense patches; instead berries

grow close to the ground on individual stems. While a few of the areas we encountered yielded $3m^2$, many of the areas yielded fewer than ten (10) berries in the same area. The average size of the picking areas we visited were 500 m^2. This contrasts sharply with the dense patches of blueberries and cranberries; the average size of those picking areas was 5 m^2. Harvesters were also quick to point out that although there are sometimes many cloudberry plants including plants with blossoms, they do not necessarily produce berries later in the summer. "I have noticed about a five-seven year cycle", said one harvester.

Variability in the abundance and distribution of cloudberry is also attributed to the productivity cycle of this species, as described by Gladys Alexie, however, cloudberries also make people "run around" because they are relative scattered in distribution when compared to the cranberry or blueberry.

> Every year the *nakal* are different (from the cranberry). Some places can be good for *nakals* for a couple of years but they are sneaky, they make you run around. *Nakals* are only good for one or two years and then nothing – it takes a few years for them to come back. It's like a five- seven year cycle. Cranberries and blueberries are more like patches that you can keep going to year after year; it stays there (Gladys Alexie, July 29, 2003).

There also a variety of other ecological factors recognized as affecting the abundance and distribution of good berry patches; continual erosion of the Peel River along cutbanks, spring flooding and the succession of invasive willow into good picking areas are some of the disturbances described during the interview process. Forest fire is also recognized as a major disturbance.

> It takes a very very long time [for the area to recover from forest fires]. We don't pick in those places. [Maybe it takes more than one to two generations for those areas to recover.] We don't know much about berry picking in those areas (Bertha Francis, February 20, 2003).

Although they drastically affect the capacity of women to harvest berries, forest fires, in and of themselves are not perceived as a negative occurrence. Amos Francis describes how burnt areas are used by different animals and people.

> The forest fires are a good thing because it makes everything new – lots of new willows. It must be good because there are a lot of moose in there [after the fire]… People only go to the burnt areas for trapping – the marten and small animals go there – they bring it back (Amos Francis, July 3, 2003).

Spring flooding is also a natural occurrence that women associate with good berry picking.

> We used to stay 75 miles up the Peel; that place floods every year. Some places like that flood every year. It is like a muskeg area. This is the kind of place that you always find cloudberries and blueberries- where it is damp. This is why it floods in these areas. (Dorothy Alexie, February 20, 2003).

Weather was attributed as the main factor affecting the abundance and distribution of berries between 2001 and 2003. The weather is the main thing that affects the berries. (Bertha Francis, February 20, 2003) Different weather conditions from year to year significantly affect harvest yield across the region and from year to year. According to harvesters, the current year (2003) was an extremely good year for picking berries; there was sufficient snowfall and

moisture in the spring and warmer temperatures in the summer to produce many berries of a good size.

> This year it was too much ohh!!! (laughs) There were lots of berries around; especially cranberries. I heard there was a lot down in the Delta. Up in the hills and mountains too. I heard it was lots! All over the place, there were berries! (Rebecca Francis, October 15, 2003)
>
> There was lots!! Yeah! Everywhere you went there were berries (Dorothy Alexie, October 16, 2003)

Berry picking in 1998 and 1999 was very good also (Rebecca Francis, October 15, 03). In 2002, however, a late frost and a very hot dry summer resulted in virtually no berries across the region as a result of many extreme weather events, as described by May Andre.

> I hardly got any cranberries this past fall (2002); nobody did in this area anyway. Out this way, I checked (toward Tsiigehtchic) and there was hardly any where it used to be. I think it was the weather conditions. First, it was too hot – in June. Then in July, it snowed! And I think that was the cause of no berries – extreme weather change (May Andre, April 17, 2003)… I notice a lot of these changes – extreme weather condition changes. Like this last summer – it was extremely hot. It wasn't good for the health of the people. Lots of elders couldn't stand it. It was pretty dangerous. It switched from one extreme of heat to cold rain… then for about five days it snowed. I was at 8 miles and it was very very cold. And that is crazy weather! (May Andre, April 17, 2003)

Variability in weather conditions has always been a factor that women have had to deal with in their berry harvesting activities. As described by May Andre (above), in recent the "weather has changed" in recent years; summers seem warmer, there is less snow in

winter and rain in spring and there are more extreme weather events.

5.4.3 "Finding the Berries" - Using Knowledge about Variability

Teetl'it Gwich'in women hold significant knowledge about where to find good berry patches in the Gwich'in region. The results of the interview process and participant observation suggest that women have developed a variety of strategies to deal with this variability. Many people we interviewed said that they pick berries where their grandmothers or mothers used to pick; some people have been picking blueberries and cranberries in the same patches for more than three generations.

> My grandmother used to pick berries a way up the Peel. She always used this place because of her grandmother. The trail to that place is worn into the ground. These places, you really have to walk a long ways to get there but it is worth it (Alice Vittrekwa, February 20, 2003).

Many of these places are associated with fish camps and/or other resources that are important to women and their families. Elder Mary Kendi describes her mother's berry patch where she finds a variety of berries as well as medicinal plants.

> I know my [mother's] berry patch; and it's a really good one. There is a good berry patch that I know where there are really a lot of cranberries, blue berries, black berries and all kinds of berries around there. When you go for berries you pick berries; you have to go for a picnic; you have something to eat and then you start picking again. You pick until 6pm in the evening. Then you can start your journey back home. On the way back from berry picking, that is when you pick sticky gum; its very good medicine for colds or anything like that (Mary Kendi, February 25, 2003).

Not all women pick in areas where there are so many different kinds of berries. Many, such as Caroline Snowshoe, said they go where they can find the most berries, or where it

is “easy to pick” (Caroline Snowshoe, August 29, 2002). In many cases, the patches where women find the most berries are species-specific or are either blueberry, cloudberry or cranberry patches.

> [There is one place just down the road that we found]… One time, Louisa and I, wanted to come down and get a ride with Ernie and Lanny. They [the blueberries] were that big! They came with us to get to that place. We checked it out. It was just blue! We picked just a little ways back and we heard trucks coming. The boys were playing on the road. The trucks passed and slowed down. They asked them, “What are you doing?”. The told them, our Grandmothers are picking berries (Rachael Stewart, March 11, 2003).

As described here by May Andre, some women pick their berries in different places every year and will often find good berry patches by accident.

> Well, I go anywhere. You know me, I will go anywhere with my dog. Yeah! I check all over. Some places are good, and in some places, I waste my time. Where I think it is good, it’s not good… its just like it changes every year. Every area is not the same all the time. I notice that (May Andre, April 7, 2003).

Whether it is their grandmother’s berry patch or a recently discovered area, most women make use of different micro-climates within their favourite berry patches. Women will pick in open or sheltered areas depending on the time of the season. Cloudberries, for example, that are in open and well-sunned areas tend to ripen and spoil the fastest and so are picked first; berries that are more sheltered and are in cooler areas tend to ripen slower and last longer.

> I usually pick on the hills because it’s cooler and berries last longer there. Around the lakes on the top of the hills – anywhere it’s flat around Red and Black Mountain. Along the shore of the river and up past the bushes towards the mountain is good for blueberries and *nakals*. You can sit there all day and pick – there are no end of berries there (Margaret

Vittrekwa July 11, 2003).

> They seem to grow better in the shade like under the willows. It has not been good berries for a very long time (few years). I told my daughter to check the berries last year- I told her to check under the willows. That is where there are lots. When the trees fall down its good. There is lots of shade. I sometimes think I should tell the boys to cut them down but then I think it might affect the berries so I just leave it – I end up crawling under the willows looking for the berries (Bertha Francis, July 3, 2003)

As described by May Andre, the use of these microclimates is particularly important during extreme weather conditions.

> The [cloudberries] that I got, the ones I found, they were sheltered by the spruce trees and willows so they were in good shape. They were delicious, juicy and plump. But the others, that I found in the open in a different area, those ones were cooked and it was not worth [picking them]. Even the blueberries in that area; there were very little blueberries. [I was thinking that] I went along ways for nothing but [there was one place] - when I got to where that *nakal* [area] was eh, I found em' lots of blueberries. It was just full of it. It was really damp in that area. But it was getting late so I left it. I was thinking that I was going to come back to it, to pick them. Because to me, it looked like two good days of picking for myself. I would have gotten really lots and lots. And then the next day it started raining. I think it rained for a couple of weeks… you remember? And then I went back. After that awful weather started, all the berries were gone. They dropped eh, in the rain. Rain and snow, I think, made them drop early, much too early, plus that extreme heat too that we had. So that's [what I found] berries in certain places that were shaded. That is where I found blueberries and *nakal* [cloudberries]… (May Andre April 7, 2003).

5. 5 DISCUSSION

The knowledge women have developed about variability in the abundance and distribution of resources is not static. Knowledge generated from past observations and the past observations of others, provides a foundation for understanding variability. However, this knowledge is constantly being reinvigorated by new observations made by

Table 5-2 – "Signs and Signals that the Berries are Good" – Species Specific Indicators

Themes	Narrative	Indicators
Changes in flowering plants	• we watch in the spring time to see where the berries are going to grow; you can tell by the flowers. Sometimes when you look the ground will be just white with flowers (cloudberry blossoms)	• number of plants flowering
Changes in maturation of each species	• berries are ready at different times of the summer o cloudberries - mid July o blueberries - late July o cranberries - late August	• rate of maturation of berries
Changes maturation relative to microclimates	• we start picking berries in the open areas where it is warmer; the berries ripen faster there • later on in the summer, after the berries in the open have cooked or dried up because of hot or dry weather, you can still find berries in the woods and under the willows	• survival/spoilage of berries relative to microclimates

Table 5-3 – Regional Scale Knowledge of Variability: "Signs and signals of Change in the Land that affect the Berries"

Themes	Narrative	Indicators
Temperature	• the weather is the main thing that affects the berries • if it is too cold or hot in the summer, the berries will not grow • the weather is changing; winters are warmer and the summer days are too hot	• mean summer and winter temperatures; • temperature extremes (particularly in summer)
Snow, Rain and Water Levels	• the weather is the main thing that affects the berries • there has to be enough snow during the spring and rain to make the berries grow. • there is not as much snow in winter as there used to be; a lot of little ponds and creeks are drying up • the land is dry	• mean precipitation; • incidents of drought; • water levels
Forest Fires	• When there is a forest fire, we don't go there for berries. It takes a long time for the land to recover • There are more forest fires now than in the past	• incidence of forest fires • scale and intensity of forest fire • proximity to valued harvesting areas

women during each harvesting season.

This process of observation is generally focused around different kinds of indicators or signs and signals. Species-specific indicators or signs and signals used by Gwich'in women can be found in the Table 5-2. The number of plants flowering in a given location, the rate of maturation of berries and the condition of the berries, once ripened, are the signs most commonly considered in berry picking.

In addition to watching the berries themselves, some women look for signs of change in other regional, local and site-specific conditions. At a regional scale, women spoke about the weather, including variabilities in temperature and precipitation are described as "the main thing that affects the berries". The other key regional factor described as affecting where the berries grow is forest fire activity

Other signs and signals shared by Gwich'in women reflect an understanding of local scale ecological elements and processes. As described in Table 5-4, incidence of permafrost melt and cut bank erosion on the Peel River, incidence and levels of spring flooding are of concern to Gwich'in women. Also of concern are signs of wildlife disturbance (i.e. black bears and grizzly bears) and the incidence and scale of human disturbance such as roads, seismic lines and cleared areas including camp sites.

Women also watch for change in site specific conditions to identify where the berries are going to grow. Signs and signals include soil conditions and species associations, sun

exposure and soil moisture as well as the density, height/canopy of trees. By watching for changes in these elements and processes, women are able to make better sense of where and when they should harvest.

Table 5-4– Local Scale Knowledge of Variability
"Signs and signals of change in the places that berries grow"

Themes	Narrative	Indicators
Habitats	There are two major kinds of environment – the mud/sand and the moss. Cranberries like to grow in the dry mud (well drained soils). Blueberries and cloudberries are found in the mossy areas	• White spruce communities (well-drained soil areas associated with river delta processes) • Black spruce communities (mossy/ peaty; less well-drained soils)
Erosion along the Peel River	• We have to watch our campsites that are on the cut banks; we have to move the camp to the other side of the river or it would be lost • there are more landslides on the cut banks than in the past	• Incidence of permafrost melt/ cutbank erosion
Flooding	• When the river floods, it cleans the land and helps the plants to grow	• Incidence / levels of spring flooding
Wildlife Disturbance	• You really have to watch out for bears; when you find a good blueberry patch you have to pick it out before the bears get there • When a bear finds a blueberry patch, they don't leave it until it's cleaned out • When the berries are good, you won't see too many bears around the camps but when the berries are bad, there will be bears bothering people	• Sitings of bears around fish camps • Sitings of bears in blueberry patches • Incidence and scale of berry patch disturbance
Human Disturbance	• Some places where there has been seismic lines or cut lines you can find more berries in those areas • You have to keep using the land (keeping trails) otherwise you will lose the berry patches	• Scale and incidence of habitat disturbance including cut lines, seismic lines and cleared areas

Table 5-5 – Site Specific Knowledge of Variability
"Signs and Signals of Change in the Spots where Berries Grow"

Themes	Narrative	Indicators
Soil conditions and species associations	• You will usually find cranberries in the drier areas where there are big trees (white spruce); • Blueberries are usually found where its mossy in areas where there are small trees (young black spruce); • Blueberries and cloudberries sometimes grow together	• Soil conditions • Vegetation communities

Competing Species	• The willows are taking over	• Productivity / succession rates of invasive vegetative species
Sun exposure and soil moisture conditions	• Early in the season you can find cloudberries, in the open areas in areas where it is wet; later in the season they dry up in these areas • Blueberries grow really good near wet areas • Cranberries can grow in open areas and in shady areas under the trees	• Aspect and soil moisture
Density / height / canopy of trees	• If the little trees (black spruce) are too thick, then you won't find many blueberries • You can find good cranberry patches around the big trees (white spruce) • If it is really hot or there has been snow, you can still find berries under the trees	• Incidence of permafrost melt/ cutbank erosion

5.5.1 Using Knowledge of Scale in Resource Harvesting

Gwich'in women use their knowledge of scale in different ways. There are a range of harvesting strategies that have been developed to deal with spatial variability. We describe these strategies as: (1) use of microclimates, (2) selection of species-specific harvesting areas, (3) selection of areas of resource diversity and (4) resource redundancy.

Use of Microclimates

An important harvesting strategy documented during the study involved knowledge and use of microclimates. Rather than simply seek out berries at peak periods and in ideal locations, avid berry pickers seek out berries different kinds of micro-environments depending on the time of season and conditions. Depending on the elevation, slope angle and orientation, moisture availability and associated vegetation, these women are able to find a lesser or greater abundance of berries.

Knowledge and use of microclimates is particularly important in respect of cloudberries.

Early in the season or under relatively warm damp spring and summer conditions, harvesters would find berries in many open areas and would not have to venture far to fill their berry pails. Later in the season, and under dry and hot summer conditions, harvesters would seek out berries near open water or bogs and/or under the cover of black spruce and willow; under such conditions the distribution may increase significantly.

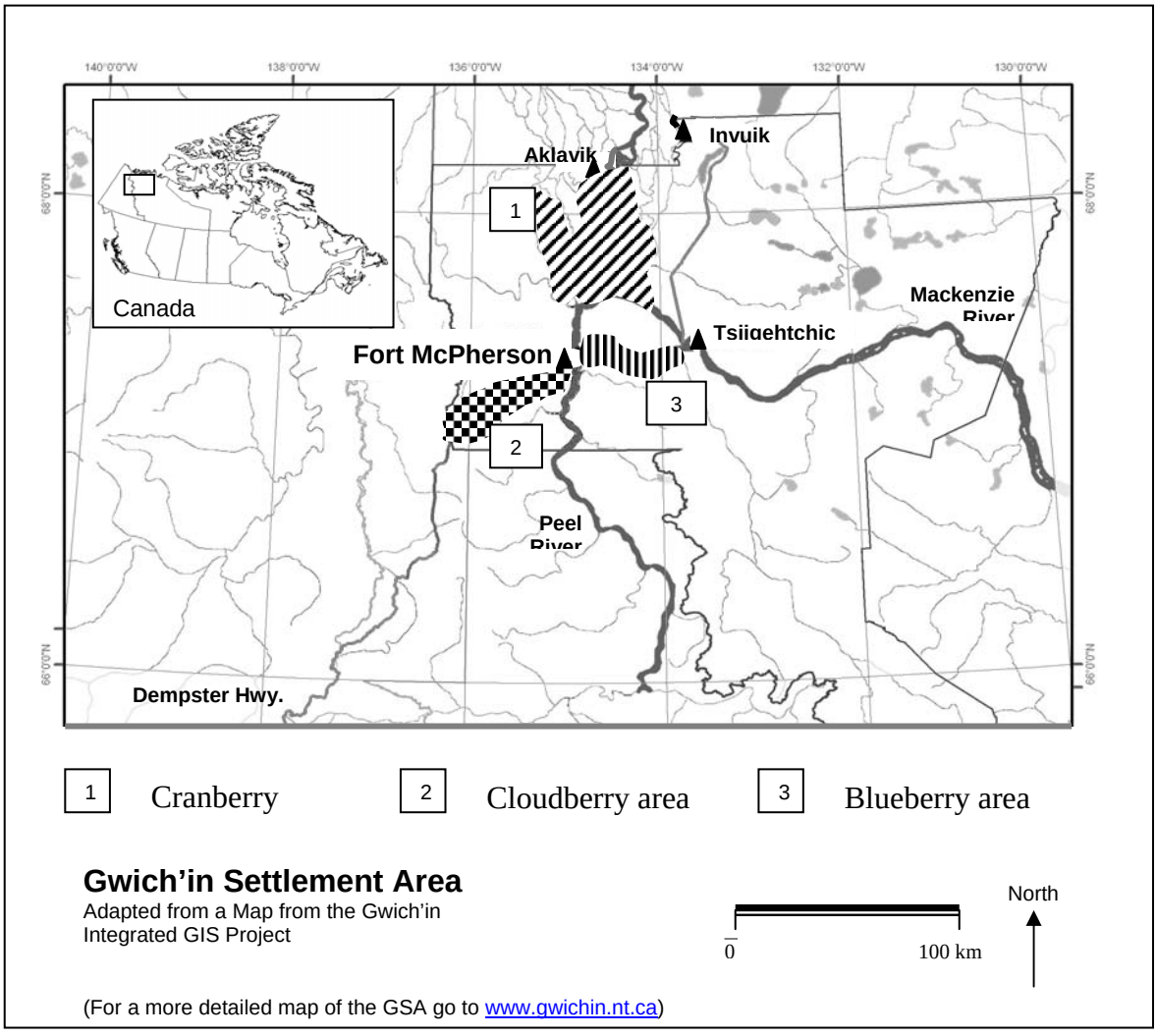

Fig 5-2 - Species specific harvesting areas in the Gwich'in region

Some of the more productive blueberry patches are in wet areas at the edge of small bogs or seismic lines or other disturbed sites. Given the susceptibility of blueberries to the succession of willows and real risks of encountering black bears or grizzlies in the berry patch, men in the harvesting party will carry an axe or machete and a rifle to remove unwanted brush and ensure the safety of the group. Use of microclimates is of lesser concern in the harvesting of *Vaccinium vitis-idaea* or cranberry due to hardiness and predictability of this species. By making use of their knowledge of microclimates, avid berry harvesters are able to maximize their harvest yield of berries; unlike the more casual harvesters, these women are able to start picking earlier and continue picking later as well as pick under less than ideal conditions.

Selection of Species-Specific Harvesting Areas

Another strategy identified in the interview results and through participant observation was the selection of species-specific harvesting areas. When asked, "Where do you pick cranberries? blueberries? and cloudberries?" , the vast majority of women identified different areas. Cloudberries for example, are most commonly harvested in the open alpine areas of the Richardson Mountains.

Those engaged in blueberry picking focus on disturbed sites such as the edges of roads, clearings, bogs and seismic lines in the black spruce forest between Tsiigehtchic and the Peel River. Cranberries can be found in a variety of habitats however, many go cranberry picking on the slopes of the Richardson Mountains on the Dempster highway or near their cabin sites along the Peel River; some of the most productive patches are associated with white spruce forests near cabins on the Husky Channel in the Mackenzie

Delta. As show in Figure 5-2, these picking areas all tend to relatively distinct from one another reflecting the unique habitat characteristics and requirements of these species.

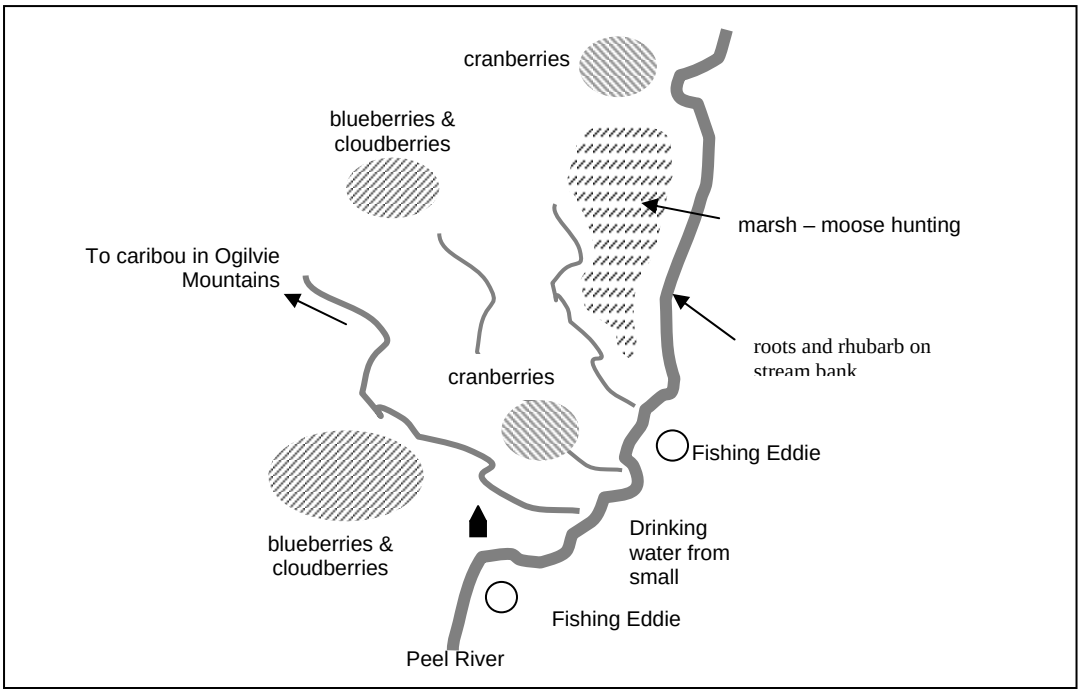

Fig. 5-3 –Harvesting Areas of Resource Diversity

Selection of Areas of Resource Diversity

Not all berry harvesting activities are organized on a species specific basis. The results of the study suggest a third pattern in the berry harvesting activities of Gwich'in women – the selection of areas of resource diversity. In some areas, women have been able to find an abundance of all three berries clustered together. Those staying at the Husky Channel, Rat River, Trail River and Three Cabin Creek for example, can find cranberries, blueberries as well as cloudberries within a reasonable distance from their cabins. From these locations harvesters also take advantage of clean drinking water from small streams, fishing eddies, as well as potentially valuable hunting and trapping habitats (Fig. 5-3).

These resource harvesting areas are relatively uncommon in the region, tending to be located at the edges of three or more kinds of environments. The most significant edges appear to be between the Peel River, Richardson Mountains and the Mackenzie Delta, white spruce and black spruce forest communities, and undisturbed and disturbed environments such as bogs, seismic lines and other cleared areas.

Selection of Areas of Resource Redundancy

While most women have favourite areas for picking each of cranberries, blueberries and cloudberries, most have knowledge of or make regular use of other picking areas from time to time. This redundancy in resource areas is particularly important when ecological events or habitat changes such as a late frost, forest fires, cutbank erosion or flooding temporarily affect or even destroy a favourite location. When one blueberry patch is affected by road construction, for example, the harvester can easily shift picking areas; joining family or friends in other locations or identifying a new picking area of their own.

5.6 CONCLUSION

Perceptions of ecological variability have an important influence over where, when and with whom Gwich'in women harvest berries in their region. The indicators or signs and signals they use to describe these variabilities are found in Tables 8-2, 8-3 and 8-4. Although we have presented these indicators at different spatial scales, the way that women perceive and interact with the landscape is not fragmented in this way. In order

to make sense of their environment and make good resource harvesting decisions, women have had to be vigilant of change at multiple scales.

Harvesting strategies were also developed that reflect this knowledge of variability. By identifying specific microclimates in their harvesting areas, women are able to deal with variability, including extreme events, in temperature and precipitation as well as corresponding changes in the maturation and spoilage of berries. The habitats of cloudberries, blueberries and cranberries are relatively distinct from one another; by selecting species specific harvesting areas women have been able to maximize harvest yields of each species; this strategy may be characterized as a form of optimal foraging (Winterhalder 2001). Storing or sharing high yields in a good year can offset scarcity in other years. Harvesting in areas where all three berries and other valued resources can be found in close proximity to one another is the third approach developed by the Gwich'in for dealing variability. Even when one resource may be scarce, women can be sure to find others with very little effort or energy required. This approach to resource harvesting is well-documented in other regions and is considered a common approach to dealing with ecological uncertainty (Berkes et al. 2003). Extreme events such as forest fires, flooding, cut bank erosion as well human disturbance can permanently affect some harvesting areas; in such cases women will shift location, making use of other known areas or finding new ones. Developing harvesting areas of resource redundancy is therefore important for the Gwich'in and has been documented as an example of resilience in other regions (Berkes et al. 2003).

This investigation does not, of course, paint a complete picture of the process of berry harvesting in the Gwich'in region. There are many socio-cultural factors that affect where and when women harvest (See Chapter Three). Neither is the harvesting of berries an isolated activity; the spatial patterns associated with fishing, caribou hunting, or even cutting wood also affects where and when women harvest. When such activities are spatially compatible, or are in close proximity to one another (Fig. 5-3), it enables women, men and families to work together as an integrated whole, maximizing the returns of many different harvesting activities while minimizing energy expenditures. Given the emphasis on family in Gwich'in culture, it is perhaps not surprising that those areas of resource diversity are of tremendous value.

The paper suggests that the Gwich'in have a way of thinking about ecosystems and ecological variability that is drawn from their land-based way of life. Their region may, at first glance, appear infinitely vast, an endless source of resources for such a small population of people. However, it is clear from this study that even in the case of a relatively abundant resource – berries – and even in such a large region, there is ecological uncertainty. The resilience of the Gwich'in, or their ability to deal with variabilities in abundance and distribution of this valued resource, is dependent upon their knowledge and capacity to harvest in many areas of the region depending on ecological conditions. Although these results are specific to berries and berry harvesting activities in the Gwich'in region, it is likely that the Gwich'in, and other Dene of the sub-arctic, have developed similar strategies to deal with variabilities in the abundance and distribution of other valued -arctic resources.

Photo 4 – Wilson Fish Camp near Rat River, NWT
Photo Credit – Brenda Parlee (2003)

Photo 5 – Mary M. Firth harvesting berries near the community of Fort McPherson
Photo Credit – Brenda Parlee (2003)

CHAPTER SIX

USING TRADITIONAL KNOWLEDGE TO ADAPT TO ECOLOGICAL CHANGE: DENESOLINE MONITORING OF CARIBOU MOVEMENTS[1]

Summary:

The Chipewyan Dene or Denesoline have been dealing with variability in the movements of barren-ground caribou (*Rangifer tarandus*) for many generations. By observing caribou at key water crossings during the fall migration, Denesoline hunters were able to obtain critical information about caribou health, population and movement patterns. Systematic observation of these indicators by hunters strategically organized along the treeline, enabled the Denesoline to adapt their harvesting practices, including the *location* of family camps, to maximize harvest success. While this system was traditionally developed for subsistence harvesting, it may be usefully adapted to other natural resource management contexts; in particular it may be useful for understanding how new bifurcation points created by mineral resource development may be affecting the Bathurst caribou herd. As governments, communities and academics search for ways of including traditional knowledge in that resource management context, this paper recognizes that the Denesoline and other indigenous peoples have their own systems of watching, listening, learning, understanding and adapting to ecological change.

[1] Parlee, B., Manseau, M. and Lutsel K'e Dene First Nation. 2005. Using traditional knowledge to adapt to ecological change: Denesoline monitoring of caribou movements Arctic 58(1): 26-37.

6.1 INTRODUCTION

The traditional ecological knowledge and management practices of indigenous peoples can provide tremendous insight into how to deal with ecological uncertainty (Berkes, Colding, and Folke 2003). Monitoring is among those practices recognized as key to ensuring the long term sustainability of natural ecosystems and the communities that depend on them to survive (Parlee, Manseau, and Lutsel K'e Dene First Nation 2004; Berkes, Colding, and Folke 2000). This paper describes a system of monitoring based on traditional ecological knowledge that enabled the Chipewyan Dene or Denesoline to learn and adapt to variability in the fall movements of barren ground caribou (*Rangifer tarandus*).

During fall migration, the Bathurst, Beverly and Ahiak caribou herds travel from their calving grounds at Bathurst Inlet, Beverly Lake and the Queen Maud Gulf near the arctic coast to their fall and wintering grounds near the treeline (Fig. 6-1). Although, each herd occupies a defined range over time (Resources Wildlife and Economic Development 2004), their distribution within that range can vary significantly from year to year . In a given fall, large numbers of caribou may cluster around Artillery Lake (63° 13' N / 108° 04' W) or areas west of Yellowknife - a span of over 500 km (Fig. 6-1). In addition, the timing of migration or the presence of caribou at a given location on the landscape also varied between years. This spatial and temporal variability of caribou distribution on the landscape is well understood by the Dene communities that depend on caribou to survive (Dogrib Treaty 11 Council, 2001; Parlee et al., 2001).

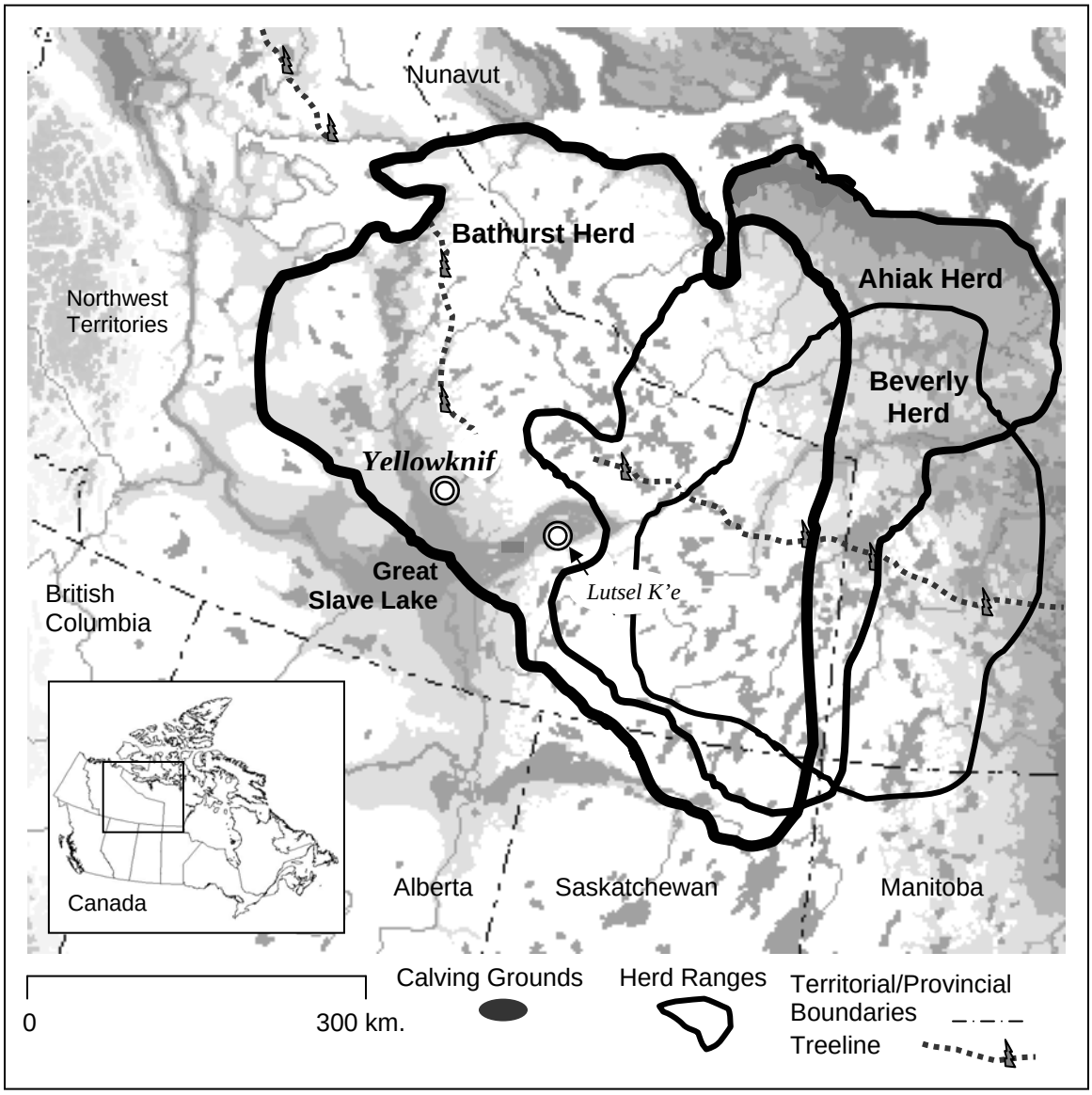

Fig. 6-1- Study Area:
Lutsel K'e within the Bathurst, Beverly and Ahiak Caribou Ranges
Map Adapted - Resources Wildlife and Economic Development, 2004)

Different hypotheses have been proposed to explain the inter-annual variability of caribou movements and range use including availability of food sources, weather, parasites and predators. (Dogrib Treaty 11 Council 2001; Gunn, Dragon, and Boulanger 2001; Fryxall and Sinclair 1998; Manseau, Huot, and Crete 1996; Messier et al. 1988).

There is, however, little capacity to predict seasonal movements and range use based on such factors (Gunn, Dragon, and Boulanger 2001). The capacity to predict movements becomes even more complicated in the face of human disturbances, particularly linear disturbances. Studies done around Prudhoe Bay, Alaska provide some evidence that roads and other linear developments are affecting caribou movements during spring migration (Wolfe et al. 2000; Camerson R. et al. 1995; Cameron et al. 1992); however, a direct cause and effect relationship has not been established.

This paper on the Denesoline monitoring of caribou movements builds on previous research on Dene harvesting and social organization (Jarvenpa and Brumbach 1998; Irimoto 1981); most specifically on Dene hunting strategies (Smith 1978). Smith (1978) argued that the social network of Dene groups around the treeline of the central Arctic provided for significant adaptation to caribou movements. "Hunting groups were strategically situated in a long narrow front near the treeline, from a point west of Hudson's Bay to Great Slave Lake" (Smith 1978: 78) (Fig. 6-2). This paper describes how the Denesoline, strategically organized along the treeline, learned and adapted to caribou movements through systematic observation and communication about movements at water crossings known to be bifurcation points.

6.2 STUDY AREA:

THE DENESOLINE AND THE BARREN GROUND CARIBOU

Lutsel K'e, formerly called Snowdrift, is a community of 350 Chipewyan Dene *(*Denesoline*)* located on the east arm of Great Slave Lake in the Northwest Territories (Fig. 6-1). Traditionally, the Denesoline of Lutsel K'e did not inhabit a single settlement; like many other Dene in the region they were organized in local and regional family groups (Bands) across a vast expanse of present day Northwest Territories and northern Saskatchewan (Smith 1978; Smith 1976). They are described as the most widely traveled and most numerous of the Northern Athapaskans (Smith 1981); "They occupied the forest-tundra ecozone (the 'edge of the forest') near Hudson's Bay, north of the Seal River, in a wide northwesterly arc to north of the Arctic Circle…" (Smith 1981: 271).

The area of the Denesoline traditional territory described in this paper stretches across the fall and winter range of the Bathurst, Beverly and Ahiak caribou herds (Figure 6-1). Traditional knowledge and archaeological evidence suggests that people have been using this area for caribou hunting for thousands of years (Lutsel K'e Dene First Nation et al. 2003; Noble 1981); stone lanceolates (arrowheads used for killing caribou) found in the Artillery Lake area have been dated back to 3000 B.C. (Noble 1981; Noble 1971; Macneish 1951). Early explorers estimated the number of Dene in this area at the time of European contact to be between 2500 and 5000 (Thompson 1966; Mooney 1928). Explorers such as Stewart (1715-1717) and Hearne (1958) reported encountering camps

of at least 700-1000 Dene in their travels. The communities of Dene and their caribou harvesting practices have changed over this time period with the most significant changes having occurred in the last one hundred years; technology including snowmobiles, radios and air transport now enable the Denesoline to travel across the landscape and communicate with other communities with minimal time and effort. Nonetheless, many aspects of traditional caribou harvesting practices are still in use today, including the practice of observing caribou movements.

6.3 METHODS

This paper draws from the results of two inter-related traditional ecological knowledge projects carried out between 1997 and 2000 with Lutsel K'e Dene First Nation (Parlee, Basil, and Drybones 2000; Marlowe and Parlee 1998); funding for the projects was received from a regional research funding agency (West Kitikmeot Slave Study Society 1995). A third project, focused on caribou movements around a proposed diamond mine, was carried out in 2001 (Lutsel K'e Dene First Nation et al., July 2001). Terms and conditions for data collection, analysis and reporting were set out in research agreements between Lutsel K'e Dene First Nation Chief and Council, the researcher and the funding agencies. The methodology was loosely based on the principles of participatory action research (PAR) (Friere 1973); consideration was also given to adaptations of PAR developed by the Dene Cultural Institute and others involved in documenting Dene traditional knowledge (Ryan 1995; Johnson 1992b; Johnson 1992a; Bielawski and Lutsel K'e Dene First Nation 1992; Friere 1973). Methods were developed to address specific

project objectives and to meet the needs of the community. For example, all projects were guided by the Wildlife, Lands and Environment Committee and an Elders' committee and included an on-the-land component during which elders and youth worked and learned together; local personnel (community researchers) were the primary information gatherers for all projects and were also trained in database management and GIS mapping technology.

The community-based research effort for these projects was involved and substantial. Data collection occurred through individual and small group semi-directed interviews with 27-50 Denesoline elders and harvesters. Interviews were audio and/or video recorded and verified by community researchers using translators during on-the-land workshops with elders and caribou harvesters. Data collection on 1:250 000 and 1:50 000 scale maps was also undertaken and integrated into the local geographic information system. Stories shared during small group interviews and elders meetings were also recorded. Results include a wide range and depth of local and traditional knowledge about the Dene way of life. Only information relating to caribou health, habitat and migration and harvesting strategies is presented in this paper. Evelyn Marlowe, Wally Desjarlais, Marcel Basil and Nancy Drybones were the primary community researchers and Bertha Catholique was the primary translator involved in the projects. Consent forms were also completed with individual interviewees whose knowledge, including direct quotations, formed the basis of this paper. The overall argument of the paper, as well as specific details about hunter organization and caribou health were discussed and verified

by the Lutsel K'e Dene First Nation, Wildlife, Lands and Environment Committee (WLEC) and the elders during meetings in 2003 and 2004.

6.4 RESULTS: DENESOLINE MONITORING OF CARIBOU MOVEMENTS

The Denesoline would begin to get ready for the fall harvest at family camps established along the north shore of Great Slave Lake (Fig 6-2). According to Denesoline elders, there were camps in all the small bays and inlets where the fishing was good and moose were likely to be sighted. It was in these camps that families would organize themselves into hunting parties. The hunters themselves would generally be male members of extended family groups; grandfathers, fathers and sons would work together. Denesoline women were also recognized as skilled hunters (Judith Catholique, 18 June 97). Wives, aunts, mothers and daughters were also involved in the hunt - sewing garments and hunting bags, preparing packets of dry-fish and berries for those traveling. Families that were unable to hunt would give what they could in anticipation of sharing in the harvest.

In the beginning, the elders say that the hunters would split up and go every direction on foot. Some of the hunting parties would move north or northwest to McKay Lake. Others would move in a north or northeasterly direction toward Aylmer Lake, the Lockhart River and Artillery Lake. Although there seem to be an infinite number of trails that extend into the barren lands, the elders say there were four main routes traditionally followed by the Denesoline; *Tath a Deze, Des Delgahi Deze* and *Des Tsel Che Deze* and

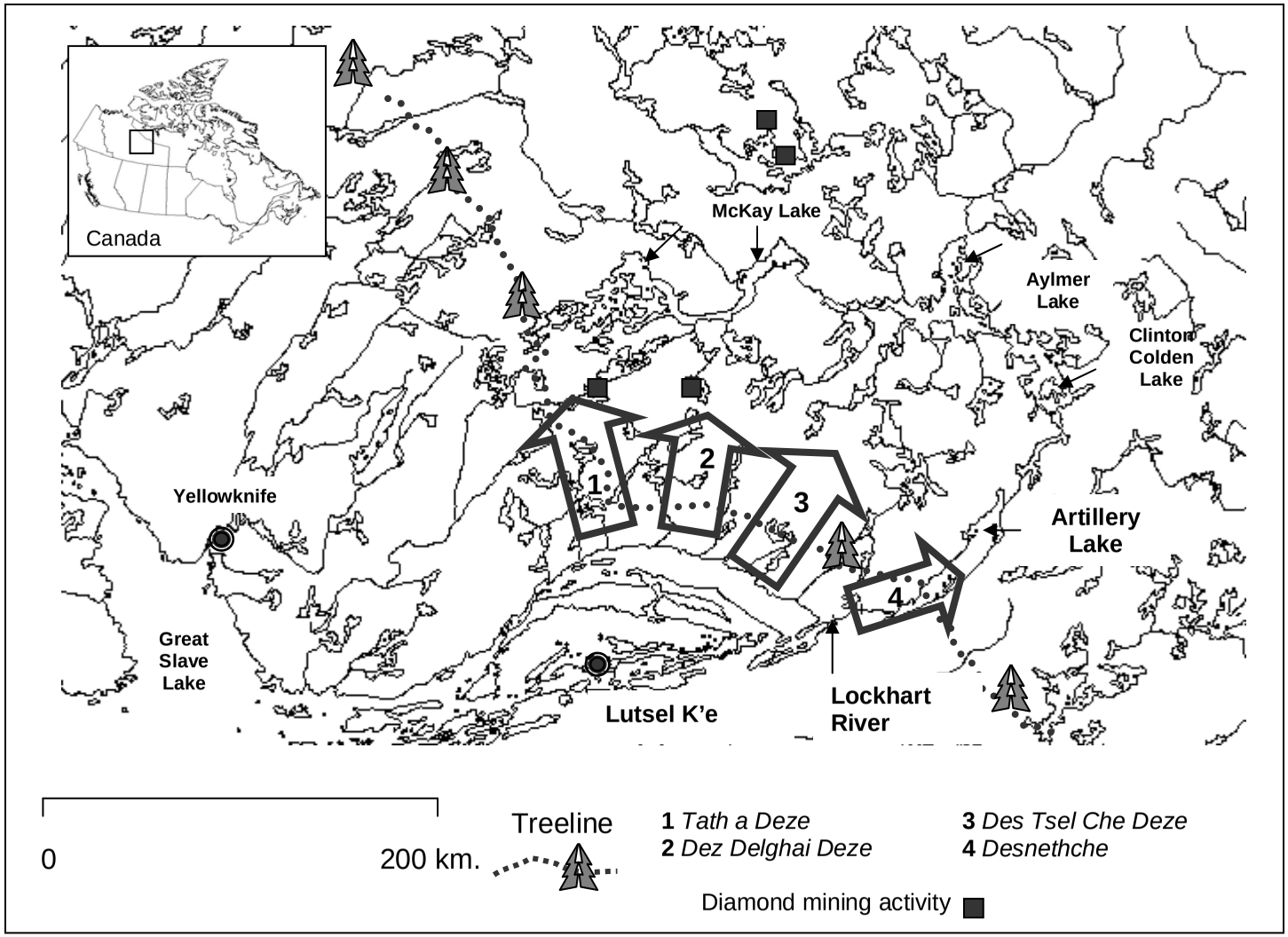

Fig 6-2 - Denesoline Travel Routes into the Barrenlands

Desnethche (Parlee, Basil, and Drybones 2000) (Fig. 6-2). These travel routes have been used by many generations of Denesoline. Evidence of this history is visible in the graveyards, trail markers, arrowheads and campsites dotted along the paths and portages. Denesoline place names and legends also indicate the long-lived relationship that the people have to the landscape. One prominent figure in legends and place names is *Hachoghe*; a larger than life character who followed mythical size beavers from Artillery Lake to Great Slave Lake. During the fall caribou hunt, these stories are told and retold by fathers and mothers to their children and grandchildren to guide them as they travel.

6.4.1 Hunter Organization, Observation and Communication across the Landscape

The organization of hunting parties was key to ensuring that hunters would be able to find caribou where ever they passed in fall and winter range (Fig. 6-3). Hunters traveling into the barrens would periodically reconnect at familiar camps close to areas where caribou were known to have passed in previous years. Of particular significance were the small pockets of black spruce (P*icea mariana*) and the thickets of willow (*Salix* ssp.*)* and birch (*Betula glandulosa, B. glandulifera*) found in the valleys and along rivers in the barren lands (*ts'u dzaii)* and near the treeline *(ts'u dza aze).* The best *ts'u dzaii and tsu dza aze* were those that were close to drinking water, offered both dry-wood for fuel and strong green trees for setting camps, were relatively sheltered from weather and were near some height of land that could be used as a lookout. As they traveled through the barren lands, hunters would use such *ts'u dzaii* as reference points or guides to find other hunting parties. These periodic meetings enabled hunters to share food as well as

information about caribou movements. Signs or indications of the caribou coming, such as footprint, fecal pellets and bushes thrashed by antlers, would be reported. If one or two caribou were taken, the group would share the harvest together and then travel even further into the barren lands. Distances traveled by the hunters would vary significantly depending on their capacity to move between hunting camps to communicate. Younger hunters might travel upwards of twenty kilometres per day by foot. Others might travel less than ten kilometres. Leadership

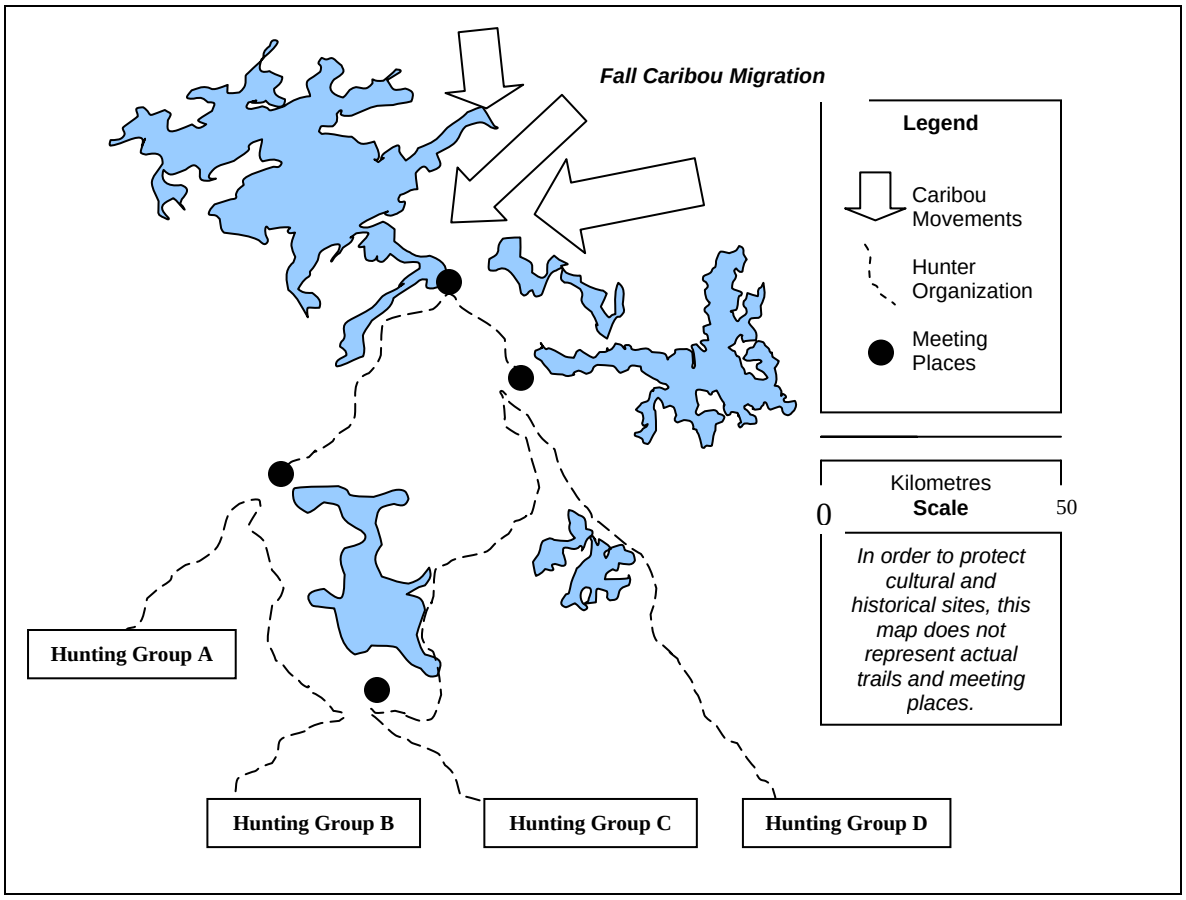

Fig. 6-3 - Hunter Organization Across the Landscape

was an important part of the organization and communication between the hunters. Leadership was generally visible among family groups. The eldest hunter from each extended family group would assume the responsibility of leading each hunting party and when the time came, for distributing meat. Sometimes, however, there was one individual who, because of age, past experience or reputation as a successful hunter, would provide direction for many hunters.

As hunters came within sight of the crossings, they would watch for signs of caribou coming, gathering together or re-grouping depending on indications of their direction. Sighting of a few caribou approaching from the east or west would be a key signal for was indication enough for parties to move in that direction.

Landscape features played an important role in the distribution of the hunters within the range. Like the caribou, hunters would travel along the eskers, lake shoreline and other heights of land. Use of these landscape features not only made travel in the barrens easier for hunters; it also increased the likelihood of their encountering caribou. The narrows of the big lakes or *eda*, were key areas where the Denesoline knew they could find caribou. Among the most significant caribou crossings were those on McKay Lake, Aylmer Lake and Artillery Lake. These lakes are known as the big water - *Tha K'ai Kue*, *Tla Kai Kue* and *Edacho Kue*. They stretch over 300 kilometers from west to east across the landscape (Fig. 6-1).

During the fall caribou migration however, McKay, Aylmer Lake and Artillery Lake are a barrier at their widest point. Although caribou are good swimmers, their dense coat providing them with buoyancy, they will travel along the shoreline until they can find a narrow point or crossing (*eda).* There the animals can easily cross in minutes or seconds (Fig. 6-4).

The most important crossings would be well marked by caribou trails from previous years; there the hunters would find strategic places to watch for the caribou. These "waiting places" or *k'a* were usually on the heights of land within good vision of the crossings. Large boulders or erratics on these hills were good waiting places (*k'a)* for hunters. They could stay for hours in these hiding places, watching and listening for sight of caribou on the horizon or observations from other hunters that the caribou were nearing.

Hunters would not always depend on natural erratics for caribou blinds. In some areas, hunters would devise their own caribou blinds from smaller rocks. At a distance these *k'a* appear similar to other boulders dotting the hills. Upon inspection however, it is easy to see the care taken in engineering and construction. From these locations they would be able to assess the health of the herd as well as make observations of their direction.

6.4.2 Observations of Caribou Movements and Condition: Anticipation of the Winter Range

Hunters would also observe many health related indicators including size and composition of the groups, rate and direction of movements, behaviour and body condition - to decide which groups to follow to their winter range and which animals to harvest. If the caribou crossed around McKay Lake, the caribou were more likely to winter in the western part of the winter range. If they used the eastern crossings, hunters knew they could be found closer to Artillery Lake and Lutsel K'e in the eastern part of the winter range.

The water crossings were not the only landscape features the hunters recognized as important in understanding caribou movements; other features including the shape and condition of the land around the crossing also factored into their understanding of local caribou movements. Some hunters say that caribou were more likely to travel on *thai nene*, or flat land, *sheth* (hills), *thai t'ath* (eskers) and less likely to travel in very rocky areas (*na yaghe*), rough hummocky land (*ni horelghus nene*) or very wet areas (*elel*). Hunters were most confident, however, in finding caribou in areas where there was good "food" – or reindeer lichen (C*ladina spp.*) and avoid areas spoiled by fire. In some key areas, these features would function together much like a funnel, drawing the caribou together toward the narrows of the lakes. The first few caribou would cross tentatively; the others would follow more certainly, in one long stream until all they were safely on the other side.

The caribou would begin to return to the Denesoline at the end of the summer. The bulls would be the first to appear around McKay and Aylmer Lake; fattened from the summer feeding and ready for the rut *(ek'enalde)*. By early fall, the old bulls *(betsicho)* would stand out clearly with their fully developed set of antlers heavy at their brow and bright red from shedding velvet *(etthen erel ch'al)*. The antlers of the younger bulls (*yalaghus*), would be smaller and their behaviour more jittery – like teenagers. They would follow along side the older males. The sighting of these few bulls would be a sign to the hunters that the large herd of cows and younger caribou were not far behind. The cows would travel more slowly- staying near their calves and the other young caribou to show them the route to the winter range. They would have also developed a large set of antlers by this time and a thick coat for the winter season. The cows would be skinner than the bulls after a summer of nursing and protecting their calves. Some may have lost their calves early because of harsh winter or late spring. Other cows may have lost their calves to wolves or other predators; these cows would travel alone. Body condition was known to change health of the herd significantly from year to year. Some years were known to be bad for insects, which would irritate and stress the caribou, sometimes to the point where they would stop eating and consequently become skinny. In some years, hunters would notice fewer fat caribou coming from the west (Bathurst herd) and those coming from the east (Beverly herd). The Denesoline hunters, waiting at the crossings, would watch all these signs to decide which animals to harvest.

If there were many, they would choose from the fattest of the bulls, recognizing the fat animals by a number of indicators including a wide chest and tail hidden in the developed

hindquarter. A busy set of antlers and a well-developed coat were also indicators to the hunters that the animal was healthy. As described by J.B. Rabesca, ensuring the animal was fat was an important part of the harvest.

> Good looking caribou – their horns look nice and their fur is pretty white. By that you now the caribou is fat… during the [late] fall you don't shoot the male caribou because they are skinny. They don't eat at that time because [of the rut] - they are chasing the female caribou… When you shoot a caribou, the first thing you do is check if the caribou is fat by cutting in the middle of the stomach. If the caribou is fat the hunter is happy (JB Rabesca, 15 October 98).

As the caribou approached the crossings, the hunters would take advantage of the opportunity to harvest the early bulls. Once the rut began, the bulls would no longer be good for harvest. "They are skinny… they don't eat because they are skinny from chasing the female caribou" (JB Rabesca, 18 October 99). Also the bull caribou would have a strong smell and taste during the rut that is unpalatable (*etsen)*. The fresh meat and rich fat would be a welcome prize after weeks of dried fish and berries. The hunters would set a campfire or a temporary camp to share the "goodies" – tongue, liver, kidneys and back fat. The hunters would not rest long; they would be anxious to find enough meat to feed families through the winter. After eating and packing a bit of the meat, the hunters would cache the remainder underground or in a rock crevice and mark it clearly so that others behind them would also be able to take advantage of the early harvest.

6.4.3 Relocation of Family Camps

Once the hunting parties found the large migration, news of the direction of the herd as well as small stores of fresh meat would be delivered back to waiting families. The

capacity of families to learn and adapt to the movements of the caribou clearly depended on the hunters being successful in their organization, observation and communication of caribou movements. When the caribou were coming, it was a very exciting time as described by elder Noel Drybones.

> When the caribou were coming, you could see them on the lake – on the narrows. Guns would fire and everyone was happy. People would yell, "Yahoo!!" Even the old ladies would howl "Yahoo! Yahoo!" (Noel Drybones, 9 July 97).

Depending on what was reported to them, families would prepare themselves for the harvest in their existing camps or would relocate further east or west to join other

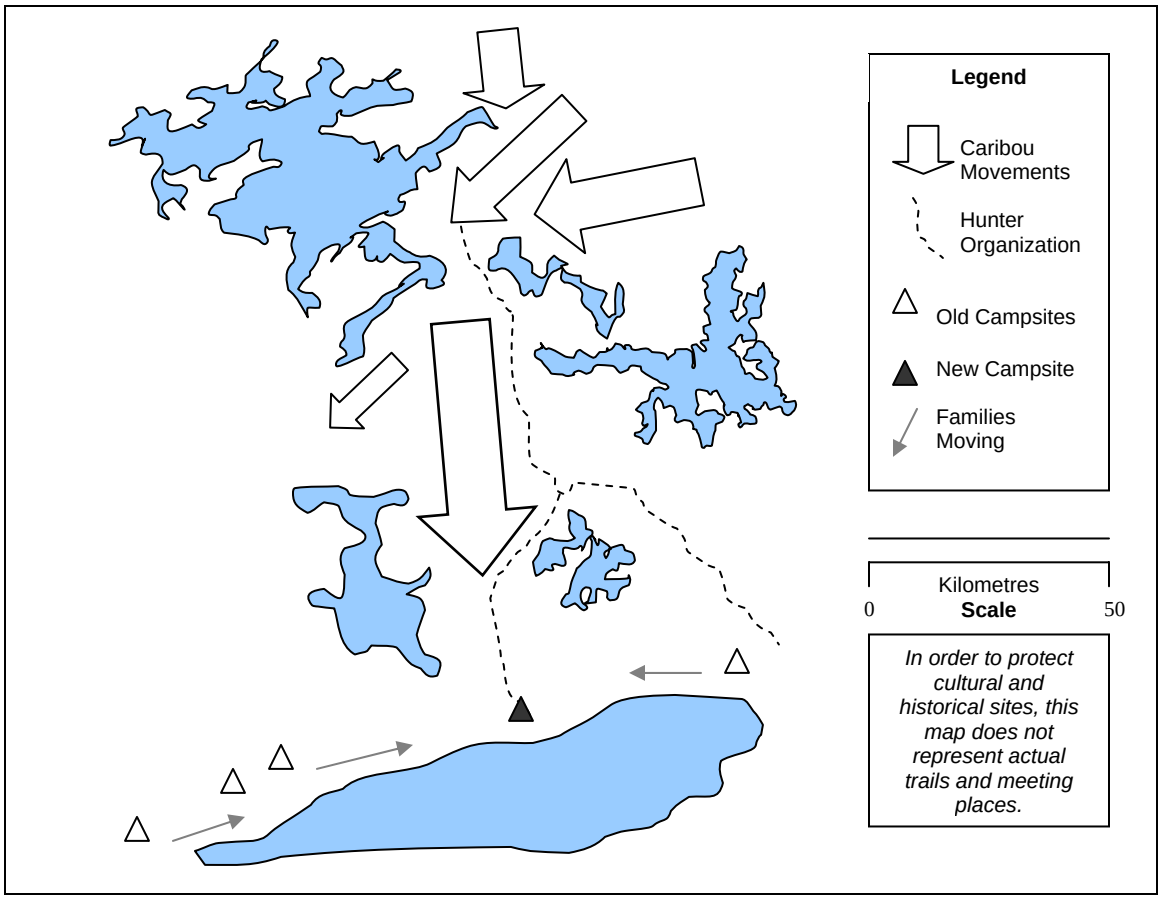

Fig. 6-4 - Relocation of Family Camps

families (Fig. 6-4). Some families might move camps upwards of one hundred kilometers or more. Eventually many families would be congregated together near the area where caribou were most likely to pass and over-winter. If they were successful in locating the winter range, families might not have to move again for many months.

Camps could not be located too far from the treeline (Fig. 6-2); as those areas provided the firewood necessary for preparing, drying and storing meat for the winter. Nor could the camps be located too far from areas where hunters predicted harvesting a large number of caribou. Caribou meat is heavy to haul over very long distances. If left for too long, there would also be the potential for it to spoil or be ransacked by wolverine, wolves or bears. The most effective harvesting strategy involved relocating camps along the treeline close to areas where large numbers of caribou were likely to over-winter.

Women played a key role in moving the family and ensuring that young children and elders were cared for. If meat or fish were in short supply, women would also have to hunt, sometimes taking caribou before the men arrived with the harvest. Hunters and their families developed systems and signals for how, when and where to move camps; women would watch for tree branches pointing in a particular direction, or erratics with fresh sets of caribou antlers.

As the meat was harvested, it would be hauled back to the camp. The most valued parts of the caribou were the fat and organ meats, as well as the brains, thighs, arms, brisket,

backbone, ribs, neck, backstrap and hide. The backstrap and thighs were particularly valuable as they were easiest to make into drymeat.

People traveled many tens and sometimes hundreds of kilometres to these gathering sites. These sites tended to occur in areas where the large migration had occurred in previous years. Camps near the crossings were traditionally large, according to the elders, sometimes numbering more than 1000 people. Tents could be seen everywhere. People would not camp right at the caribou crossing. Instead, tents and later cabins were set up some distance away at Timber Bay (*edachoghe).* The crossing itself was considered a sacred area to the Denesoline and as such was protected and watched carefully. Everyone would be careful not to show arrogance towards the area and would conscientiously offer prayers, tobacco, matches or other small items at the crossing. These gifts were signs of respect for the Creator, a sign of reciprocity for the gift of coming caribou.

The southern crossing of Artillery Lake was one such area where families commonly gathered. Aptly named *edacho tué* (the lake of the big caribou crossing) this was a place where people knew large numbers of caribou would pass each fall. Some families would only stay there in the fall for the caribou harvest and then would move on to trap in other areas of the barren lands or portage back to *Tue Nedhe*. For some, however, the security associated with the crossing was so great that they began to stay there all year round. In the early 1900s, many people built cabins on Artillery Lake at the place just north of Timber Bay and from time to time would stay there year round.

As the harvest continued, more families would arrive and gather together. Fresh meat would be shared amongst everyone in the camp. Meat would also be made into dry-meat and cached for the winter. If the harvest was very successful, enough meat could be cached until the following season. Caching meat was one way that the Denesoline could ensure that they would have food during times when hunters were unable to harvest due to poor weather. The late elder Zepp Casaway describes how caches were built in the barren lands.

> When the caribou were spotted they are killed then brought to where there are some small trees. Trees are put on it or they can also be put under the ground for use in late winter and nothing can be taken. The wolverine is a real thief and this is done to prevent him from taking anything…Some of the meat would be cached under the moss and it freezes there. Small trees would be cut down to mark the spot because of the severe winters with its blizzards and bad weather. Only when it was a nice day, the people would go hunting (Zepp Casaway, 27 September 99).

6.4.4 Dealing with Extreme Events: The Importance of Denesoline Spirituality

Denesoline understanding of caribou movements not only involved learning and adapting to physical signs; the Denesoline also recognized spiritual beliefs as key to harvesting and surviving on the land. Some of these beliefs begin with a perspective of the caribou as spiritual beings and their migration as a spiritual journey. Some elders say that the cracks and fissures on some caribou skulls tell the migration story of each caribou. *Tsankui Theda* (the old lady of the falls) or Parry Falls on the Lockhart River (Fig. 6-1) also provides spiritual guidance about caribou movements. As Maurice Lockhart explained, steam rising from the falls during colder months provided the hunters with guidance about where to hunt. "[The steam], it bends… whichever way it points, that is

where the caribou are. The people go that way to find the caribou" (Maurice Lockhart 08 August 2000).

Such spiritual beliefs were particularly important to the Denesoline during years when there were very few caribou. Many Denesoline elders attribute the absence of caribou in some years to a lack of respect shown for the land and animals; they believe that people must respect the caribou or they will not come back to them. That respect is demonstrated in many ways. Good hunting practices, proper harvesting and preservation of meat are some ways that this respect is demonstrated (JB Rabesca, 15 October 98). There were also certain codes of respect for men and others for women. Madelaine Drybones describes how the men show respect when hunting.

> The men would cut off the pointed part of the heart and throw it away right there and then. Also they cut off the tip of the caribou tongue to show respect for the caribou. They would work on cutting up the meat themselves and make sure no one stepped over the caribou leg. They would leave the pile of bones in one place and leave it there (Madelaine Drybones, 09 June1999).

Using all parts of the caribou and wasting nothing was also an important form of respect. "In the olden days they didn't even throw away caribou bones. They used the bones for fat. They would break up the bones into small pieces and then boil them in water. Everything was kept from the caribou" (Liza Enzoe and Mary Rose Enzoe, October 16 October 1998). Making dry-meat was a way of preserving the meat to ensure nothing was wasted and an important part of the work of the Denesoline women .

Chasing the caribou or hitting the caribou has always been a strong sign of disrespect which the Denesoline believe results in unexpected and unwanted changes in caribou migration. "Once someone [hits the caribou], the caribou will [migrate] further out and that is very bad for the people (Noel Michel, 4 October 1999). Within the context of caribou harvesting, these demonstrations of respect are also a means of further limiting the uncertainty associated with caribou movements by limiting the impact of small-scale human disturbance.

6.4.5 Effects of Development on Caribou Movements

Large-scale human disturbances, such as forest fires and mining projects have, in recent years, added a new dimension to the variability of caribou movements. Although small fires are recognized as a natural occurrence, the size and frequency of forest fires in recent years is of great concern to elders who worry about the impact on caribou and caribou migration in the area.

> Regarding the forest fires - some scientists say its 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 lightening. We look after the land and we respect the land and the animals (Pierre Marlowe, 6 November 2000).

> The reason why there is less caribou now is because of the forest fires in the area. Caribou vegetation is all burnt around Nanacho Lake (Nanula Tué). On the north side of McLeod Bay (Tue Nedhe) it is also burnt. The south side is not so burnt. Caribou come to the south side because of that. We can't do anything about what has happened with these fires. We cannot help what happened, nor could we have stopped it. The land has to grow back by itself. It's all a part of Mother Nature's life (Alice Michel, 18 October 2000).

The potential impacts of resource development have been a key concern for the Denesoline since the early 1900s when a gold mine was developed near Yellowknife. More recently, diamond mining exploration and projects, such as the BHPB Ekati Diamond Mine, Diavik Diamond Mine and the DeBeers Snap Lake Diamond Mine have raised community concern (Fig. 6-2). As described by the late elder Louis Abel, such development is likely to be the source of significant change in the size of the groups migrating and their routes.

> In a few years, the caribou will change their route again. They will go a different way; they will be disturbed by the winter road, planes and blasting. You will see [these changes] in 3-5 years from now (Louis Abel, 17 June 2001).

Roads are of particular concern to elders who perceive them as unnatural barriers to caribou movement. There is currently a 500 km winter road (seasonal road rebuilt every year) to link diamond mines at Lac de Gras to Yellowknife and points south. There are also a series of all-weather roads that have been constructed within the footprint of the mine. Some elders are particularly concerned about a stretch of all-weather road (Misery Road) running northwest and southeast, which connect a new diamond pit with the processing plant. This road stretches over 29 km across known caribou spring and summer migration paths. The elders' interpretation that the roads are blockages to caribou movements is based on their observations of how the all-weather roads are constructed. "The road is like a corral or wall blocking the caribou from moving west through the area" (Ernest Boucher, 17 June 2001). They are elevated 1 m or more above the ground level, with raised shoulders constructed of large rocks; in their view it would

be difficult for caribou to cross without injuring themselves. Although some pathways have been engineered ("ramps") so that the caribou can cross, elder J.B. Rabesca argues that these relatively small openings are insufficient for the large number of caribou that traditionally pass through the area.

> Regarding the winter road – if you make a road you cannot make it too high. It's too hard for the caribou to get over it. It should be lower. The caribou won't just pass through a little pathway you make, they go all over. The road needs to be fixed (JB Rabesca, 14 February 2001).

This perception of the roads as barriers for caribou movements is arguably based on the elders' past experiences and observations of caribou movements around natural landscape features. These new roads are not interpreted as good for the caribou; elders worry that the increasing number of mines and roads in the region may eventually stop the return of the caribou (*etthen niltla)*.

> No matter what you do, caribou will be affected by these mines and roads. The only way to not effect 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 (Pierre Catholique, 11 July 2001).

6.5 DISCUSSION AND CONCLUSION

The importance of the caribou to the Dene is well established (Jarvenpa and Brumbach 1998; Smith 1981; Smith 1978; Sharp 1977; Jarvenpa 1976; Gillespie 1976; Smith 1976; Jenness 1956; Irimoto 1981); caribou and harvesting has always been central to the social

and cultural well being of Dene communities, tying extended families together in traditional activities that date back many generations. Similar to other indigenous peoples with a strong relationship to the land, the Denesoline have developed different ways of learning and adapting to variability in the abundance and distribution of resources in their environment. The research presented here, describes how the Denesoline traditionally dealt with variability in the fall migration of the caribou by organizing, observing and communicating about movements at key water crossings in the vast fall and winter range. The approach can arguably be described as a sophisticated system of monitoring or as understood in Lutsel K'e – watching, listening, learning, understanding and adapting ecological change

Opportunities for involving Aboriginal people and traditional knowledge in the monitoring and management of barren ground caribou has grown in recent years, particularly in the face of concerns about climate change and non-renewable resource development. In designing and developing these new monitoring approaches, significant focus and energy has been placed on finding indicators that are based on traditional knowledge. Caribou body fat (back fat, stomach fat, marrow) is an indicator of health used by many northern hunters including the Gwich'in in the Yukon (Kofinas et al. 2002). There is evidence that a number of indigenous groups, from Labrador to Alaska, monitor the fat content of caribou in ways that make it possible to assess the status of the herd and to predict trends (Berkes 1999: 108). All of these indicators, while technically relevant, originated in a specific social, cultural and ecological context; once detached

from that context there is the potential for misuse and misinterpretation; the social and cultural values associated with the monitoring of such indicators may also be lost.

This research suggests that the inclusion of traditional knowledge in caribou monitoring need not be limited to indicators; Denesoline and other indigenous peoples have their own approaches to monitoring including ways of organizing as families and communities, methods of empirical observation, interpretation and communication. The value and reliability of this system, as well as its sustainability, has been tested and retested by hunters and their families for generations as evidenced by the continuance of caribou harvesting as part of the Denesoline way of life.

The Denesoline strategy of organizing and observing movements at key water crossing points in the caribou range provides opportunities to learn about a whole range of other ecological parameters or indicators of the land; the information captured at those crossing points goes beyond basic movement data; it carries multiple population indices based on the timing of the migration, composition of the groups, size of the groups, physical condition of the animals, direction and rate of travel. Together, these observations provide an integrative and holistic perspective on the parameters affecting population health; a perspective which could potentially complement information obtained from satellite telemetry and population surveys.

There is also much to be learned from the Denesoline about how to deal with complexity and uncertainty. Living with uncertainty is one of the key survival skills for societies in

an era of rapid change and unpredictability (Berkes et al. 2003). As initially identified by Smith (1978), the Denesoline have in fact developed a highly sophisticated and locally adapted monitoring system to deal with the variability in caribou movements. Traditional Denesoline monitoring has the elements of feedback learning and adaptive management (Berkes et al. 2003); it is highly resilient: as a hunting system, it is able to absorb year-to-year changes in caribou movements, shows capability for self-organization, and a capacity for learning and adaptation (Berkes and Folke 2002). While there are challenges in using traditional knowledge to address resource management challenges (Lyver and Gunn 2004; Ellis 2004), these systems can play a role in helping communities address their own uncertainties about rapid social, cultural and ecological change. Elders and leaders may feel significantly reassured by having members of their own community involved in monitoring caribou health. The benefits of doing so can increase exponentially when monitoring is based around traditional knowledge and practices that are fundamental to the way of life of the community.

Photo 6 - Barren Ground Caribou near Lutsel K'e, NWT
Photo Credit – Lutsel K'e Dene First Nation (2002)

Photo 7 - Caribou Trails on an Esker near Artillery Lake, NWT
Photo Credit – Lutsel K'e Dene First Nation (2002)

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CHAPTER SEVEN

INDIGENOUS KNOWLEDGE OF ECOLOGICAL VARIABILITY AND COMMONS MANAGEMENT: A CASE STUDY ON BERRY HARVESTING FROM NORTHERN CANADA[1]

Summary:

Common property arrangements govern the subsistence harvest of berries in the Gwich'in region of the Northwest Territories, Canada. Some of these arrangements, including rules for resource access, sharing information and harvest sharing, enable Gwich'in to deal with ecological variability. The rules are not applied uniformly over time and space. They change in response to year-to-year variations in the abundance and distribution of the resource across the region. This paper illustrates the interrelationships between ecosystem dynamics and local institutions, a neglected area of commons research.

7.1 INTRODUCTION

Resource abundance and distribution is a question most often dealt with by ecologists and ethnobiologists. How plants, animals and other biophysical elements manifest themselves, and behave across spatial and temporal scales has been the basis for much theoretical and empirical research. For many indigenous peoples, including the Dene of

[1] Parlee, B. Berkes, F. and Teetl'it Gwich'in Renewable Resources Council. Indigenous knowledge of ecological variability and commons management: A case study on berry harvesting from northern Canada. *Human Ecology* (In Press).

the Canadian sub-arctic, dealing with variability in the abundance and distribution of resources such as caribou is part of a way of life (Smith 1978; Parlee et al. 2005a).

Dealing with ecological change and variability is fundamental to commons management, however, the commons literature has not, however, dealt to any extent with the issue of adaptation to variability and the implications of variability for commons institutions. The issue is of theoretical and practical significance because the dynamic interactions between knowledge building on the one hand and decision-making on the other, provide communities with the capacity to deal with a range of complex systems problems (Johnson 1999; Berkes et al. 2000; Berkes et al. 2003). Among these problems is variability in the abundance and distribution of shared resources such as berries, about which a great deal of knowledge exists. How does that knowledge develop?

Knowledge generation has many faces. In the western academic tradition, it often involves hypothesis testing and peer review. In other societies, knowledge building is part of an intuitive or spiritual process that connects individuals with their families and the land around them (Ridington 1990; Smith 1998). At a basic level, knowledge building can be described as a process of empirical observation and individual and collective interpretation (Levi-Strauss 1962; Roots 1998). This process of knowledge building is not linear or one-dimensional process; it is dependent upon constant feedbacks between what is observed and what is interpreted in different places, by different people and over time (Davidson-Hunt and Berkes 2003). As such, the knowledge generation process is strongly interrelated with a particular social, cultural and ecological context.

In many indigenous societies, there are important interconnections between the knowledge generated about ecological conditions and the rules-in-use governing resource harvesting practices (i.e. commons institutions) (Ostrom 1990). Indeed this is the foundation of a significant body of research on the sustainability of commons (McCay and Acheson 1987; Gadgil et al. 1998; Eerkens 1999; Dolsak and Ostrom 2003). Within this body of work, however, relatively little consideration has been given to the question of ecological variability and its implications for commons institutions.

Hence, this paper focuses on two questions: (1) how is knowledge generated or created; and (2) how are common property rules modified by knowledge about variability in the abundance and distribution of a commons? We explore these questions in relation to the subsistence berry harvesting practices of Teetl'it Gwich'in women of the Northwest Territories, Canada.

7.2 THE GWICH'IN STUDY AREA AND PEOPLE

The Teetl'it Gwich'in (Dene), historically known as Loucheux, are one of ten Gwich'in groups who live in current day Alaska, Yukon and the Northwest Territories, Canada. Since the 1950s, the Teetl'it Gwich'in have lived in a permanent settlement at Fort McPherson; traditionally they were known as the 'people of upper Peel River watershed' (Heime et al. 2001).

The traditional lands of the Gwich'in were recognized by the Federal Government in 1992 under the *Gwich'in Comprehensive Land Claim Settlement Agreement (1992).* The area claimed under the Agreement encompasses 57,000 square kilometres of the Mackenzie Delta Region of the Northwest Territories, and part of the Yukon region (Fig.7-1). Fort McPherson, where the Teetl'it Gwich'in live, is one of four Gwich'in villages in the Gwich'in Settlement Area and has a population of 910 people.

Like other Dene groups in the Canadian sub-arctic, the traditional Teetl'it Gwich'in way of life was interconnected to the seasonal availability of natural resources, including caribou, moose, fish, as well as berries. The importance of berries and boreal forest plants to northern Dene groups has been well documented in the ethnobiology and ethnobotany literature (Turner and Davis 1993; Marles et al. 2000). Dene use of berries and medicinal plants was documented as early as the 1800s by Mackenzie (1801). However, little research had been done on the value of these resources to the Gwich'in until recently (Andre and Fehr 2001; Murray and Boxall 2002).

Several species of berries and medicinal plants continue to be harvested by the Teetl'it Gwich'in as part of their subsistence economy (Table 7-1). The species most commonly harvested are the cranberry *(Vaccinium vitis-idaea),* blueberry or bilberry (*Vaccinium uliginosum)* and cloudberry *(Rubus chamaemorus).* These species are recognized as having important medicinal and nutritional value however, there many other social and cultural values that Teetl'it Gwich'in women associate with berries and berry harvesting that were documented during the research (Parlee et al. 2005b).

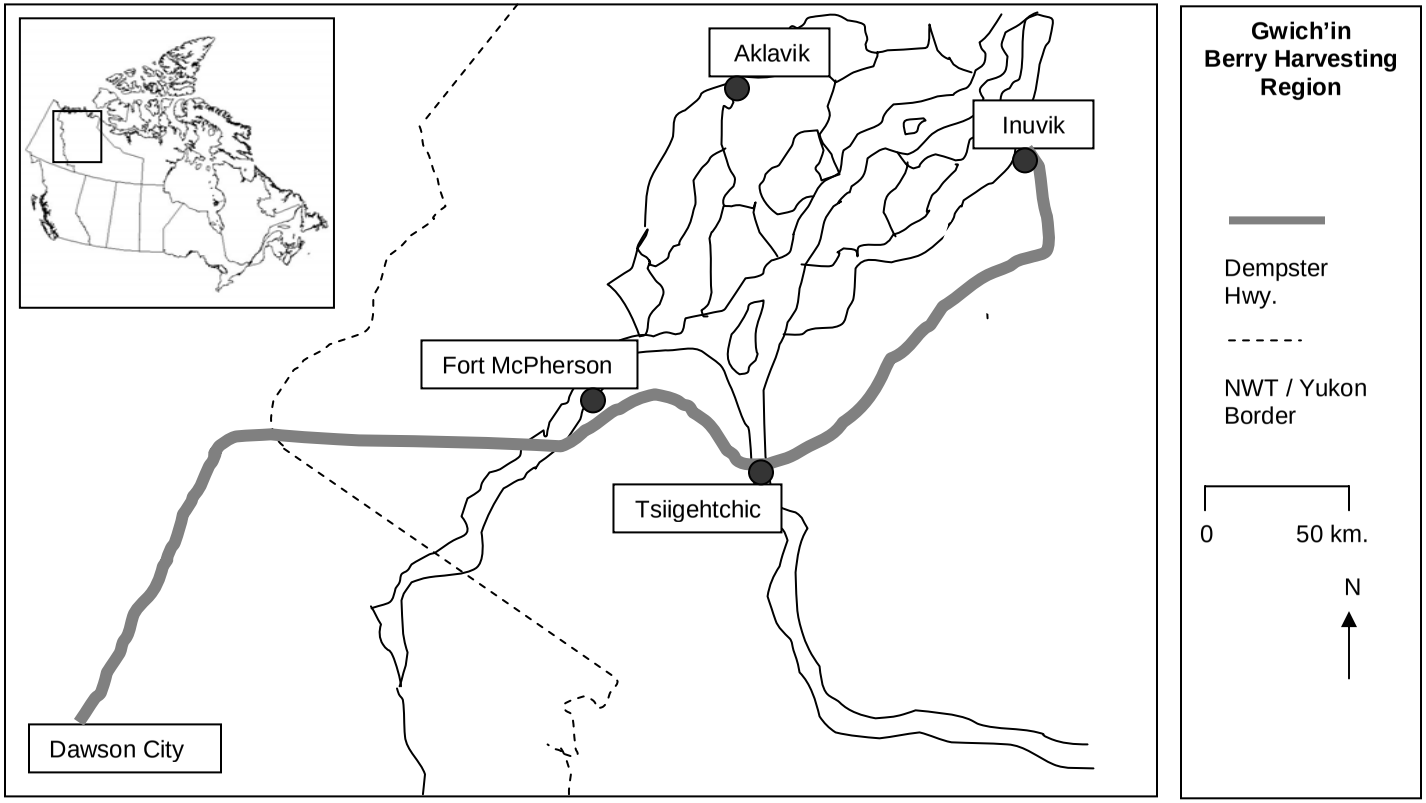

Figure 7-1. The study area showing the four Gwich'in communities in the Northwest Territories, Canada and Dawson City, Yukon. The village of Fort McPherson is where the Teetl'it Gwich'in people live.

Table 7-1. Berries and Other Plants harvested by the Tetlit Gwich'in

Tetlit Gwich'in	English	Latin
Natl'at	Cranberry / Lingonberry	*Vaccinium viti- idaea*
Jak na	Dwarf Blueberry / Bog Bilberry	*Vaccinium caespitosum* *Vaccinium uliginosum*
Nakàl	Cloudberry	*Rubus chamaemorus*
Nichìh	Rosehips	*Rosa acicularis*
Ts'ìivii ch'ok	Juniper Berries	*Juniperus communis*
Deetree jàk	Black Currant	*Ribes hudsonianum*
Nee'uu	Red Currant	Ribes triste
Shis jak	Red Bearberry	Arctostaphylos rubra
Dineech'uh	Crowberry	*Empetrum nigrum*

The harvest yield of cranberries, blueberries and cloudberries has been estimated at over 5000 litres per season, which is relatively consistent with other research in the region (Murray and Boxall, 2000). However, the yield of berries is not static; the actual yield varies from year-to-year in response to a host of social and ecological factors.

The Gwich'in region where berries are harvested is ecologically diverse. The region as a whole is generally characterized as sub-arctic boreal forest – barren ground transition (Marles et al., 2000). The continuous permafrost and short summer season associated with this high latitude region significantly affects where and when berries grow, as does the presence of the Richardson

Mountain range and the dynamics of the Peel River and Mackenzie River Delta. Cloudberries are largely harvested in the open alpine areas of the Richardson Mountains. Popular blueberry picking areas are located on the Dempster Highway between Tsiigehtchic and Fort McPherson as well as in around family camps up the Peel River,

between Fort McPherson south to Yukon border. Some people go cranberry picking around the community; many people also go picking cranberries around their camps on the Peel River north into the Mackenzie Delta. In 2003, the geographic span of the harvest area was some 40 000 km^2. Women picked berries along the Dempster highway as far south as Eagle Plains and as far north as Tsiigethchic. On the Peel River, people also picked berries as far north as Rat River and as far south as the Yukon border. In 2002 and 2001, poorer berry years than 2003, the harvest area was significantly larger at 100 000 km^2, as women travelled as far south on the Dempster Highway as Dawson City and as far north as Inuvik (Fig. 7-1).

7.3 METHODOLOGY

Our research on knowledge of ecological variability and Teetl'it Gwich'in berry harvesting practices was part of a larger study aimed at documenting Gwich'in local and traditional knowledge about non-timber forest resources. The research was conducted using a collaborative ethnographic framework (Friere 1973; Chambers 1994). All research activities were carried out under the guidance of three Gwich'in organizations - the Gwich'in Renewable Resources Board, the Gwich'in Social and Cultural Institute and the Teetl'it Gwich'in Renewable Resources Council.

Traditional ecological knowledge, more specifically Teetl'it Gwich'in knowledge about ecological variability, was documented through four interrelated methods. First, a series of open-ended semi-directed interviews were carried out with elder Teetl'it Gwich'in women in the community of Fort McPherson. This research approach provided an

understanding of life histories and experiences of individual women with respect to berry harvesting. Themes and issues related to harvesting practices and the ecological factors affecting the abundance and distribution of cranberries, cloudberries and blueberries were identified; these themes became the basis for a series of semi-directed interviews carried with 45 informants, mainly women, identified as berry harvesters including women and men from ages 16-85. An additional series of interviews related to access and information sharing rules related to berry harvesting were carried out to better understand this aspect of Gwich'in social organization.

A participatory mapping workshop was held and over 70 key harvesting areas were documented at both 1:50 000 and 1:250 000 scales by 35 community members. The mapping provided insight into the spatial distribution of berry patches relative to other landscape features and culturally significant sites such as cabins and historical sites including the best locations for picking cranberries, blueberries and cloudberries.

7.4 KNOWLEDGE OF ECOLOGICAL VARIABILITY

The Teetl'it Gwich'in have developed a body of knowledge about the abundance and distribution of berries that extends over a large area (Fig.7-1). As a foundation, harvesters hold knowledge about their environment that has been passed on from their mothers, grandmothers and great grandmothers. This traditional knowledge is not considered to be historical or fixed, but continues to develop each season through observation and interpretation. While some harvesters go out and check on their berry

patches in early spring and summer, the vast majority of observations and interpretations are made during the harvesting season (July – September) around the community of Fort McPherson - along the edges of the Peel River and Dempster Highway from the Yukon border to Tsiigehtchic (Fig. 7-1).

Observations and interpretations made by friends and relatives as far way as Aklavik and Inuvik and Dawson City, Whitehorse and Old Crow in the Yukon are also shared with the Teetl'it Gwich'in from time to time, consequently extending the geographical scope of their knowledge about seasonal abundance and distribution.

This paper discusses institutions as rules-in-use. However, the Teetl'it Gwich'in prefer not to use the term "rules" in this context; they simply say "ways we respect eachother and the berries". Specifically we focus on how this dynamic body of Gwich'in traditional ecological knowledge affects the sets of rules-in-use associated with Teetl'it Gwich'in berry picking; those associated with access, information sharing and harvest sharing (Table 7-2).

7.4.1 "It's my Grandmother's Berry Patch" - Rules related to Access

Teetl'it Gwich'in describe the resources from the land, including berries, as a gift from the Creator to be shared. In practice, however, "sharing" has many dimensions; different rules are in use for accessing cranberry, blueberry and cloudberry picking areas (Table 7-3).

Table 7-2. Flexibility of Rules-in-Use for Berry Harvesting

Rules	Description	Flexibility
Access Access to some berry patches is limited	• Rules for who can pick berries at a given location	• Rules become more flexible when berries are abundant
Sharing Information: Share observations about abundance and distribution	• Rules for how information is shared between families, within community and region	• Rules become more flexible when berries are abundant
Share Harvest Share harvest with others in the community	• Rules related to who benefits from harvests	• Sharing network expands when berries are abundant

Extended family ownership regimes appear to have developed around many cranberry patches particularly those near cabin sites along the Peel River and in the Mackenzie River Delta. As described by harvesters, "you can only go to those areas if you are invited". This may be due to the fact that cranberries are densely distributed and persist in the same local area for many generations. Many of the women interviewed said that they pick cranberries where their grandmothers or mothers used to pick. Some people have been picking in the same patches for more than three generations.

> My grandmother used to pick berries a way up the Peel. She always used this place because of her grandmother. The trail to that place is worn into the ground. These places, you really have to walk a long ways to get there but it is worth it. (Alice Vittrekwa February 20, 2003).

In the case of cloudberries, few access rules appear to be in use; this may be due to the fact that many of the good cloudberry picking areas are located along the Dempster highway, an area considered to be public or "open to anyone". The lack of property rights associated with cloudberry picking may also be attributed to the unpredictability of this species; their scattered distribution, cyclical productivity and sensitivity to drought and temperature extremes mean that harvesters cannot always find berries in the same

places from year-to-year; as described by one avid harvester "they [cloudberries] make us run around". Blueberry patches appear more predictable than cloudberries. However, given the susceptibility of patches to the succession of willow and other invasive species, they are considered to be somewhat unpredictable over time (Table 7-3).

Table 7-3. Rules related to Access

Species	Location	Access Rules	Flexibility
Cranberries (Lingonberry) *Vaccinium Vitis-idaea*	Near Family Camps	**Extended Family Access Rights** • Only extended family group should access cranberry patches, particularly near family camps; Access rights to patches are passed on within family group	• Others can pick when abundant; • Rule more strictly enforced / respected when berries are scarce
Cloudberry *Rubus Chamaemorus*	Anywhere; mostly near road	**Open Access** • anyone from the community can pick in cloudberry patches;	n/a
Blueberries *Vaccinium uliginosum*	Along the road and near family camps	**Mixed Access Rights** • Only extended family group should access blueberry patches, particularly near family camps; • access rights are passed on within family group • Some areas are open access (i.e. along public roads • Some stewardship rules related to access apply (e.g. cut down willows to prevent competition)	• Others can pick when abundant; • Rule more strictly enforced / respected when berries are scarce;

Most blueberry patches along the roads near the community are also considered to be public or open access. Access to those blueberry patches found near cabins along the Peel River, however, are limited to extended family groups, particularly where harvesters have made efforts to maintain the areas by cutting back competing species of willow.

In addition to differentiation by species, rules for access to berry patches also appear to be enforced to different degrees depending on year-to-year variability. In 2002, for example, very few berries of any kind were harvested around the community due to a late

frost and a cool summer. Those few harvesters whose cranberry patches did produce berries in 2002 were only seen to invite close family and friends. These same harvesters were less concerned about limiting access in the 2003 season when berries were clearly more abundant.

Access rules undoubtedly developed in different areas to limit the number of people who could harvest in one area, thereby increasing potential yields for each individual harvester or group. Access rules may also have developed to ensure good stewardship of the patches and the surrounding environment including cultural sites, such as cabins and "fishing eddies" [good fishing areas in the river characterized by circular flow]. When comparing these access rules to the nature of the resource, there appears to be significant correspondence between the ecological predictability and abundance of the species and property rights (Dyson-Hudson and Smith 1978). For example, there are better defined property rights associated with cranberries, which are abundant and predictable, than cloudberries, which are more scattered in distribution and sensitive to precipitation and temperature extremes.

7.4.2 "How are the Berries Growing?" - Rules related to Sharing Information

Each season, beginning in late winter and early spring and ending in late fall, Teetl'it Gwich'in women and other harvesters from across the Gwich'in region make observations about "how the berries are growing" (Parlee et al. 2005). This practice of observation or "checking the berries" provides women with insight into where and when they can find the best berries. The sharing of these observations among Teetl'it Gwich'in

harvesters and with other communities, is also fundamental to the success of the harvest in any given year.

Harvesters will first visit places where they know there have been berries before. If conditions are poor in their usual picking areas, harvesters will rely on information from other family members and friends in the community or in other parts of the region. Specific observations about conditions from year-to-year, and from patch to patch are generally communicated informally between family and friends. It is generally the younger women who are sent out to check where the berries are "good" before older, less mobile women venture out on the land.

> I find out from other people if the berries are good! I ask, Christine, "how's it growing"? When we women go for berries, they usually say, the "berries are good" or "there's lots". If they say, "there is not much", no one bothers to go out there (Elizabeth Colin, July 4, 2003)

Table 7-4. Information Sharing Rules

Rule / Harvest Success		Flexibility
Share observations about abundance and distribution	very poor year everywhere (2002)	Everyone makes efforts to share information across the region
	very poor locally; good elsewhere in region (2001)	Local community makes efforts to gather information from family and friends elsewhere in the region
	good everywhere (2003)	Little information sharing in region; opportunistic

Informal and opportunistic communication among and between family groups and friends is one of the main ways information is shared; it is also highly effective and efficient. Word of mouth communication about a "great" berry patch can turn a party of three women and two children into a party of over 20 women and children less than an hour

later, as experienced in one case. The urgent arrival of so many women in one harvesting location largely a phenomenon associated with blueberry patches; "you have to get there before the bears do!" In other cases, berries have to be picked quickly due to unpredictable weather, as in the poor year of 2002.

> Blueberries – I went a long way for nothing. I found lots of blueberries [it one spot where she was looking for cloudberries]. I found lots of blueberries but it was damp and it was getting late so I left it thinking that I was going to come back to it – to pick because to me it was too good… then the next day, it started raining. I think it rained for a couple of days; do you remember? After that I went back and all the berries were gone. They had dropped in the rain. Rain and a bit of snow made them drop early; the rain plus the heat that we had. So it [the blueberries] was only in certain places – shaded where I found cloudberries and blueberries but that's what happened (May Andre, April 7, 2003)

These information networks are key to ensuring that women are able to find berries, particularly in poor years.

> Rat River was the only place there were berries last year. I picked up there for a while. I wanted to go back but I did not have time. I knew I would not have time so I called my daughter (on the two-way radio) and told her – "Go check over there by Rat River for berries". I told her the exact place. So we went over there and she got so many berries – bags and bags of cranberries (Bertha Francis, June 2003).

Similar rules have developed around transportation. Although some people walk to picking areas near the community, most people rely on one member of their group to have a truck or boat to drive them to places further afield. Elder Elizabeth Colin explains some the history of transportation with respect to berry picking as well as her strategies for "getting rides" today.

> I like going for berries. But when you don't have a vehicle to go any place, it's very hard. Sometimes a bunch of us get together and we get gas money and we ask someone to take us for berries out on the highway but there are also some berry patches along the Peel River and up the Peel and down the Peel too. We don't go for berries much by boat anymore….when I was small, we didn't even have a kicker [a boat with outboard motor]. All I remember is that when we had to go somewhere we had to paddle… we paddled and we didn't think anything of it – to paddle to get berries. That was the way life was back then. (Elizabeth Colin, March 21, 2003)

Through these information sharing networks, Teetl'it Gwich'in harvesters are able to deal with seasonal variability in the abundance and distribution of berries through increasing or decreasing the geographic extent of their picking area. When berries are abundant around the community, the actual harvest area will be less than the full area available, as in 2003. In years of greater scarcity, women will seek out information and travel to visit friends and family in surrounding communities, thereby increasing the geographic extent of their harvesting area (Table 7-4).

7.4.3 "Giving Them Away": Rules for Sharing the Harvest

Rules for sharing berries are also based on a complex network of relationships both in the community and with friends and family in other parts of the Gwich'in Settlement Region, the Northwest Territories and the Yukon. "Giving away berries" is a very important tradition in the community, particularly to elders or others who are unable to get out on the land due to illness or other conditions. Sharing berries within the immediate family is also very important.

> I just give it away for nothing because it is important for me to do this… a long time ago people used to give berries away because it was a tradition, just like our culture (Dorothy Alexie, Oct. 15, 2003)

> I share with people who can't get out on the land and pick berries… I don't sell them because I have a lot of grandchildren, I make cranberry sauce for them and cranberry juice. (Rebecca Francis, Oct. 15, 2003)

Table 7-5. Rules for Sharing in the Harvest

Rule / Harvest Success		Flexibility
Share the harvest with others in the community	very poor year everywhere (2002)	Share only for special purposes (elderly / illness / celebration)
	very poor locally; good elsewhere in region (2001)	Share within family group or for special purposes (elderly / illness / celebration)
	good everywhere (2003)	Share within anyone / everyone in the community

Different rules apply under different harvest conditions (Table 7-5). In years such as 2002 when there were few berries, some families received berries from outside of the community from Dawson, Aklavik, Whitehorse or elsewhere. Elder Alice Blake, for example, received cranberries from her niece in Whitehorse in 2002. Elizabeth Colin (Oct. 16, 2003 said "she was lucky to get some berries from relatives in the Yukon". When berries are very abundant around Fort McPherson, women will in turn give them away to others who have none. Some women who are able to stock up on berries in very good picking years ration these out during years when the picking is not so good, however, sharing berries is still very important.

> Last year 2002, there were hardly any berries that year. I was lucky

> that I still have some berries from the year before that. I sure rationed my berries then. I also gave some out to people who were sick and needed the berries for their health (Elizabeth Colin, Oct. 16, 2003).

Shopping for imported commercial berries at the store is also common in years when there are few berries available, however, it is not the preferred option. As Dorothy Alexie (Oct. 16, 2003) said, “I had to buy cranberries from the store, but it doesn’t taste like cranberries”.

Trading of berries for other kinds of food from the land or basic good was a common traditional practice and still is for many elder women like Rebecca Francis.

> I trade berries for dry fish or dry meat [strips of fish or meat dried for preservation purposes]… I trade berries for rabbits or tea, sugar or something like that I need; it’s very important (Rebecca Francis, Oct. 15, 2003).

The most complex trading relationships are those between women who “cut fish” [prepare fish in fillets or strips to be dried or frozen] and women who pick berries. Roles and responsibilities associated with fishing and berry harvesting are strongly integrated. Pathways for resource sharing are crucial for social relationship and the well-being of families and communities (Fig.7-2). Women who are the primary berry pickers and fish cutters sometimes share their time between these two activities. More often the work is shared between women of the same family group, as Figure 7-2 indicates.

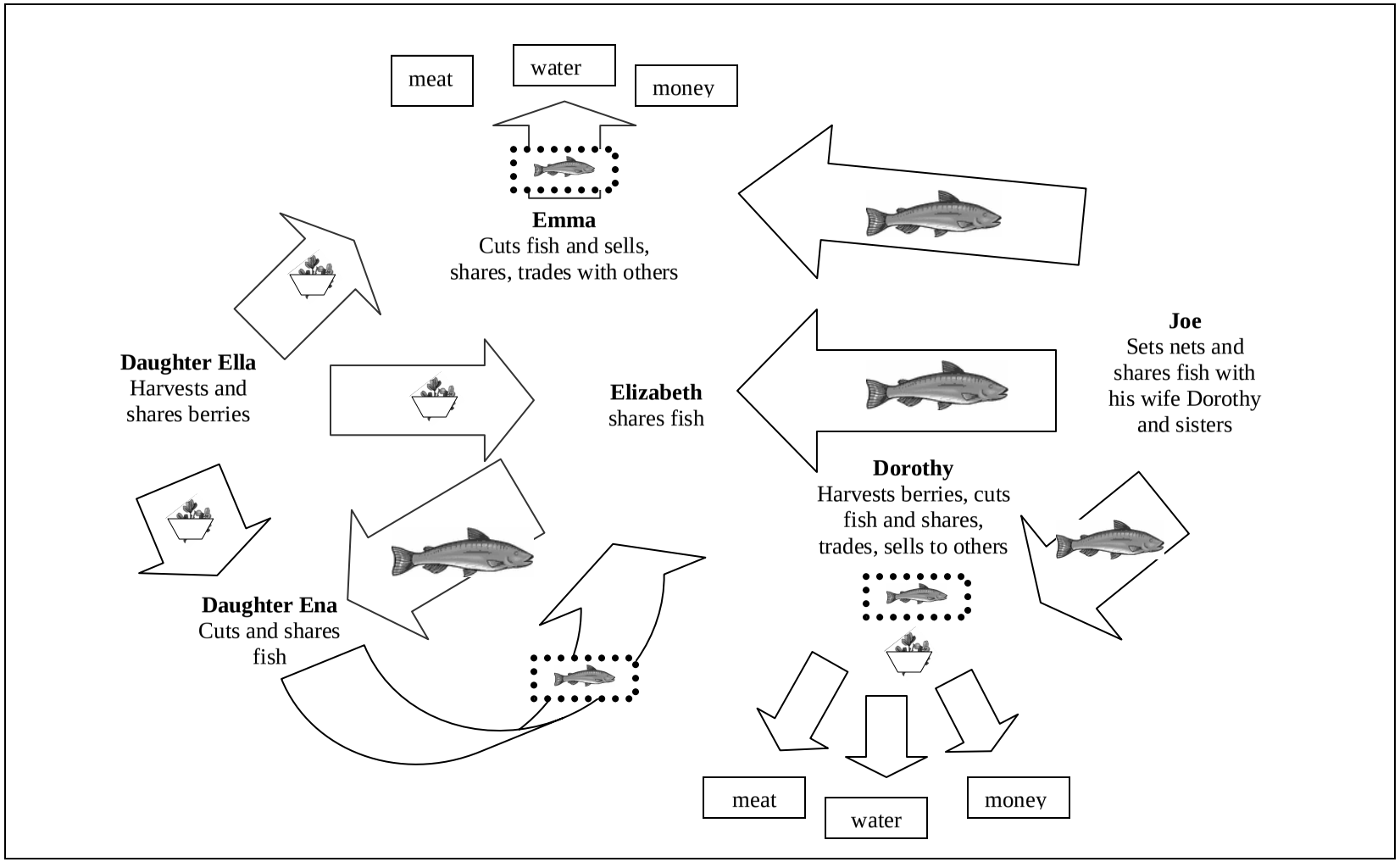

Figure 7-2. Pathways for resource sharing. The figure depicts an extended family group. Arrows with symbols denote trade, basket denotes berries and dotted box with fish denotes fish-cutting. The couple, Joe and Dorothy, harvest both fish and berries. Joe's sister Elizabeth receives fish from Joe and her daughter Ena processes that fish. Her other daughter Ella harvests and shares berries with her mother who, in turn, trades berries for more fish. Ella also shares berries with her Aunt Emma who is also receiving fish from her brother Joe. In turn, Emma and Dorothy will, from time to time, trade with other community members.

Rules for sharing the harvest of berries is the most direct way in which harvesters deal with variability in this valued natural resource. As with rules that limit access (Table 7-3), rules for sharing berries are more strictly enforced or become more specialized in times of scarcity (Table 7-5). When there are few berries to be found around the community, harvesters generally share with immediate family and those in particular need, such as the ill and elderly, and at special family or community events. By contrast, during times of abundance, harvesters are less concerned with how and with whom berries are shared.

7.5 DISCUSSION AND CONCLUSIONS

The institutions or rules-in-use governing commons resources have developed in many indigenous and other communities to prevent what has been called the tragedy of the commons (Hardin 1968; Feeny et al. 1990). Over the last thirty years, the study of common property institutions has provided many insights into how these institutions function (Ostrom 1990). For example, the Chisasibi Cree, of the Canadian eastern subarctic, have rules about how much fish is to be harvested in different seasons, the size of fish as well as what kinds of nets are used (Berkes 1977). Many Amerindian hunter-trapper societies, as well as indigenous and other rural groups in Asia, have maintained resource biodiversity in sacred groves through specific beliefs, rules and rituals (Gadgil et al. 1998). The rules and norms developed by indigenous peoples who have lived through resource scarcity provide a particularly useful perspective on how to deal with uncertainty (Berkes et al. 2003). For example, where resources are recognized as

important, limiting, predictable and depletable and are under the control of the resource harvesters, those who depend on the resource more often than not, develop ways of sustainably managing those resources (Dyson-Hudson and Smith 1978).

Access rights to natural resources in the Gwich'in region such as forests, fish and wildlife are defined in the *Gwich'in Comprehensive Land Claim Agreement* (1992). Formal institutions, created under this agreement, such as the Gwich'in Renewable Resources Board and other co-management boards largely serve to limit non-Gwich'in access to local resources. There are also a variety of informal institutions within Gwich'in communities that shape local resource use, as is the case of berries and fish.

The contribution of the current study to general common property theory may be limited in that berries such as cloudberries, blueberries and cranberries may not be susceptible to the same potential for over-harvesting and lack of regeneration as is the case with fisheries or forests (This is an area for further research). The research does, however, support previous arguments in the common property literature that open-access systems tend to be associated with resources that are relatively unpredictable; closed access systems, by contrast, are associated with resources that are more predictable (Fratkin 1986; Dyson-Hudson and Smith 1978).

The main contribution of the paper is in regards to the flexibility of commons institutions according to ecological variability. The three sets of rules in the Gwich'in region related to berry harvesting (rules for resource access, information sharing and sharing in the

harvest), likely developed to limit use of berry patches, thereby increasing potential yields to individual harvesters and ensuring good stewardship. The extent to which these rules are enforced depends on ecological conditions (Table 7-2), creating a local management system that is remarkably responsive to signals from the environment, a kind of adaptive management (Berkes et al. 2000).

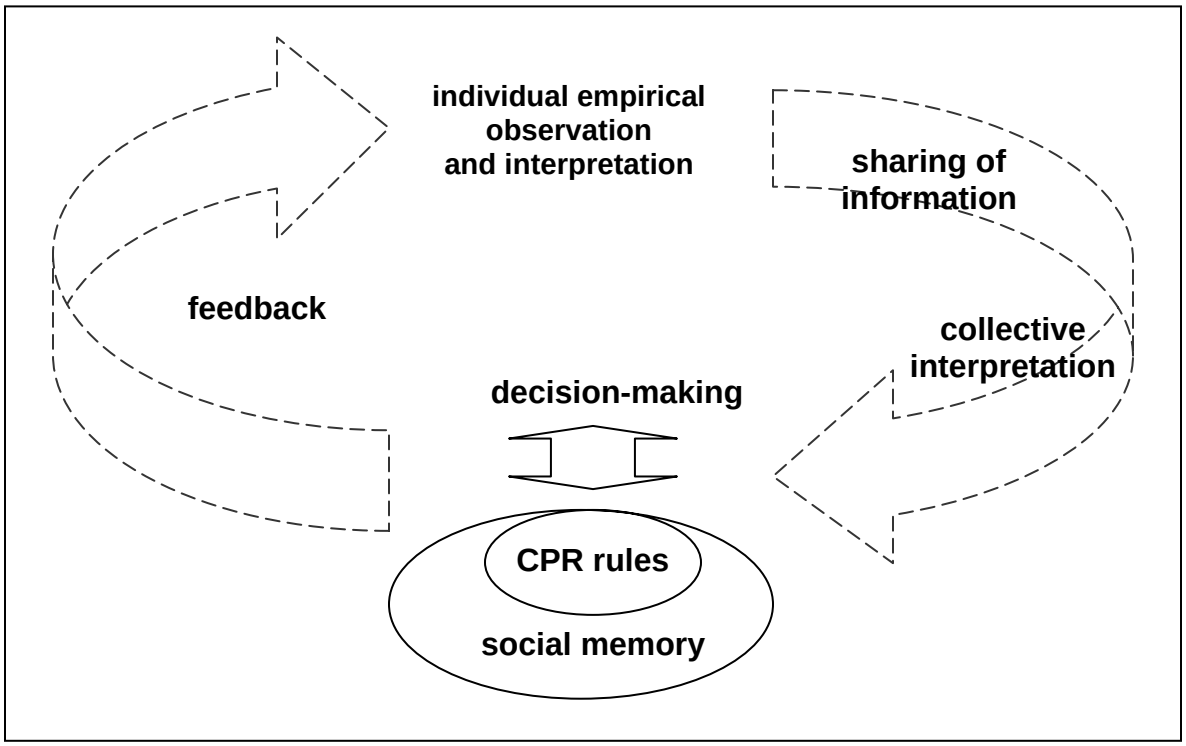

Figure 7-3 Knowledge generation and common property rules. Empirical observations are made in each berry harvesting season. These observations are shared and interpreted by harvesters, within family groups and in the larger community. The collective interpretations are then used by harvesters to make decisions about where, when and with whom to harvest berries. The decisions become part of the social memory of the community and are manifested in a set of respectful relationships ("rules") which are modified from year-to-year to reflect environmental changes. The social memory and rules, in turn, shape subsequent observations and interpretations.

At the basic level, property rights appear to mirror the relative predictability of the species. Cloudberries, which are scattered in distribution and sensitive to temperature and precipitations extremes, are associated with few property rights. The hardier and more densely distributed cranberry, by contrast, tends to be associated with extended family group property rights. When cranberries are scarce across the region, these rules become more strictly enforced by the family group. Rules related to information sharing also change depending on local and regional ecological conditions (Table 7-5), as do rules for sharing in the harvest (Table 7-6).

Ongoing knowledge generation about seasonal ecological conditions is therefore key to ensuring the relevance and legitimacy of rules-in-use. For Gwich'in harvesters, knowledge is generated by 'checking' the land or through empirical observations and interpretations of change at species and landscape scales, a process also documented elsewhere in the Canadian north (Parlee et al. 2005b). When shared over space and time, these observations and interpretations become embedded in social memory, providing a map for harvesters seeking guidance on where and when to harvest, as seen also in Dene caribou hunting systems (Parlee et al. 2005a). Dynamic interaction between knowledge generation and decision-making forms the foundation for further observations and interpretation. This system is illustrated in Figure 7-3 for the Gwich'in berry harvesting.

This system (Fig. 7-3) can be viewed as a sophisticated approach to understanding and dealing with ecological change – specifically variability in the abundance and distribution of a commons resource. Although the Gwich'in berry harvesting practices are unique to

their region of the boreal sub-arctic, this system is likely to share characteristics with social learning and adaptive management approaches developed by other groups in other regions of the world. In particular, it helps illustrate a responsiveness of local management institutions to year-to-year variation and environmental change (Berkes et al. 2003), that is far greater than that of government or other centralized resource management institutions.

Photo 6 - Alice Blake harvesting blueberries at the northern edge of the boreal forest near Fort McPherson
Photo Credit – Brenda Parlee (2003)

CHAPTER EIGHT

LEARNING AND ADAPTING TO ECOLOGICAL CHANGE: RESOURCE MANAGEMENT APPROACHES IN THE DENESOLINE AND GWICH'IN REGIONS

Summary:
There is a growing body of research on the value of traditional knowledge in resource management decision-making. Most of this research, however, has focused on local issues; few studies have investigated the use of traditional knowledge at larger scales. The Chapter addresses this gap by exploring the opportunities for including traditional knowledge in resource management decision-making in the Canadian north. Focusing on three issues of concern to the Denesoline and Gwich'in - forest fire activity, non-renewable resource development and climate change – the Chapter investigates how institutions at regional, territorial, national and international scales facilitate the use of traditional knowledge in resource management decision-making. Seven different kinds of institutional arrangements are highlighted; i) regional resource management legislation; ii) land claim agreements; iii) obligations created by Supreme Court decisions on Aboriginal rights; iv) ad hoc agreements / contracts between Aboriginal groupers and decision-makers; v) obligations created by policies, protocols or guidelines; vi) formal and informal national and international arrangements, and vii) informal knowledge sharing arrangements. Legal requirements to consult and include traditional knowledge in processes such as land use planning or environmental assessment are highlighted as powerful tools. However, even where there are no legislative requirements, informal guidelines, policies and protocols, such as those related to climate change, are useful in affirming the value of traditional knowledge.

8.1 INTRODUCTION

Local and traditional knowledge systems can offer resource managers alternative perspectives on how to deal with ecological change. Land-based societies, particularly those that have developed over many generations, hold knowledge about the complexities and dynamics of ecosystems that, arguably, does not exist within conventional resource management institutions (Berkes, 1999).

Traditional knowledge is defined as a cumulative body of knowledge and beliefs evolving by adaptive processes and handed down through generations by cultural transmission (Berkes 1999:9). For many Aboriginal peoples, traditional knowledge holds the values and cultural teachings that guide them in their day-to-day lives. Some traditional knowledge is historical; oral histories about ecological events, such as an ice age, can date back many thousands of years (Cruikshank, 2001). Other knowledge has been generated more recently; observations of climate change for example have been documented in many northern communities including Sach's Harbour (Nichols et al. 2004; Krupnik and Jolly, 2002). Traditional knowledge is not just information; the concept also refers to those tools and practices, such as monitoring, that enable communities to live in complex and dynamic environments (See Chapters Six and Seven).

Traditional knowledge research in Canada and elsewhere has focused on the value of traditional knowledge and practices in many local-scale resource management contexts

including small scale fisheries management, agriculture and forest management. (Donovan and Puri, 2004; Berkes et al., 2003; Mishra, 1998; Morel and Belanger, 1998; Warren, 1997; Schulz et al. 1994). Relatively little research has focused on the opportunities that exist for including traditional knowledge in larger scale resource management contexts including multi-scale governance of ecological change (Berkes et al. 2005a).

The limited use of traditional knowledge at larger scales may be partially due to fact that most regional, territorial, national and international institutions are grounded in western scientific thinking (Nadasdy, 2004). There are also many historical, political, social and cultural barriers that make interaction and communication difficult. Even co-management boards deemed to be successful at incorporating traditional knowledge, such as the Beverley Qaminiurjuaq Caribou Management Board, are challenged by an absence of trust between traditional knowledge holders and scientists (Kendrick, 2003). This lack of trust is not unique to Aboriginal peoples; critics of traditional knowledge worry that the spiritual and cultural values that underlie this knowledge system will decrease the rigour and credibility of processes such as environmental assessment (Howard and Widdowson, 1996). Although there are many challenges, "models for incorporating culturally specific information are needed to provide [Aboriginal Peoples] and other indigenous peoples around the world with equitable roles in resource management decision-making (Flannigan and Laturi, 2004). This purpose of this paper is to identify and discuss the opportunities and challenges that exist for using traditional knowledge in resource management in the Canadian north.

The Canadian north is a useful setting for examining these opportunities and challenges. In addition to the rich body of traditional knowledge that is held by northern Aboriginal peoples, the north is also undergoing significant institutional change. The settlement of land claims in the Inuvialuit, Gwich'in, and Sahtu regions and the creation of Nunuvut, has led to the devolution of federal and territorial government authority over northern lands and resources. Supreme Court rulings such as *Delgamukw v. British Columbia [1997], Haida Nation v. British Columbia (Minister of Forests) [2004],* and *Taku River Tlingit First Nation v. British Columbia [2004],* have also created a range of obligations and requirements for consultation and the involvement of Aboriginal people in resource management decision-making. Governments who once operated in a top-down and centralized framework are now involved in more inclusive decision-making processes. New institutions including co-management boards and multi-stakeholder agencies have been created across the north. This paper focuses on those institutions dealing with three resource management issues of concern to the Gwich'in and Denesoline - forest fire, non-renewable resource development and climate change.

The paper begins with an overview of how forest fire, non-renewable resource development and climate change are affecting the ability of the Denesoline and Gwich'in to harvest caribou and forest resources including berries. The paper then describes the institutional arrangements in place for dealing with these issues. The analysis of these arrangements identifies common themes in the kinds of opportunities available and discusses some of the challenges that limit the use of traditional knowledge in resource

management decision-making. The paper closes with some key arguments about the role of land claim agreements in creating new opportunities for traditional knowledge and the value of traditional knowledge in multi-scale governance.

8.2 METHODS AND STUDY AREA

The paper is based on a review of secondary source material and interviews with local harvesters and resource people from community organizations, co-management boards, government departments and other institutions in the Gwich'in and Denesoline regions. My direct observations and experience with these institutions as an employee of the Lutsel K'e Dene First Nation Wildlife, Lands and Environment Committee (1998-2001) and during my research in the Gwich'in Settlement Area (2002-04) also informed the research.

The focus is on the Gwich'in and Denesoline regions of the Northwest Territories. The Gwich'in Settlement Area (GSA) is a 57 000 km^2 region of the Northwest Territories defined by the *Gwich'in Comprehensive Land Claim Agreement (1992).* A review of the *GCLCA* provides insight into the rights of the Gwich'in to the land and resources of the region; a study of the institutional arrangements that resulted from the

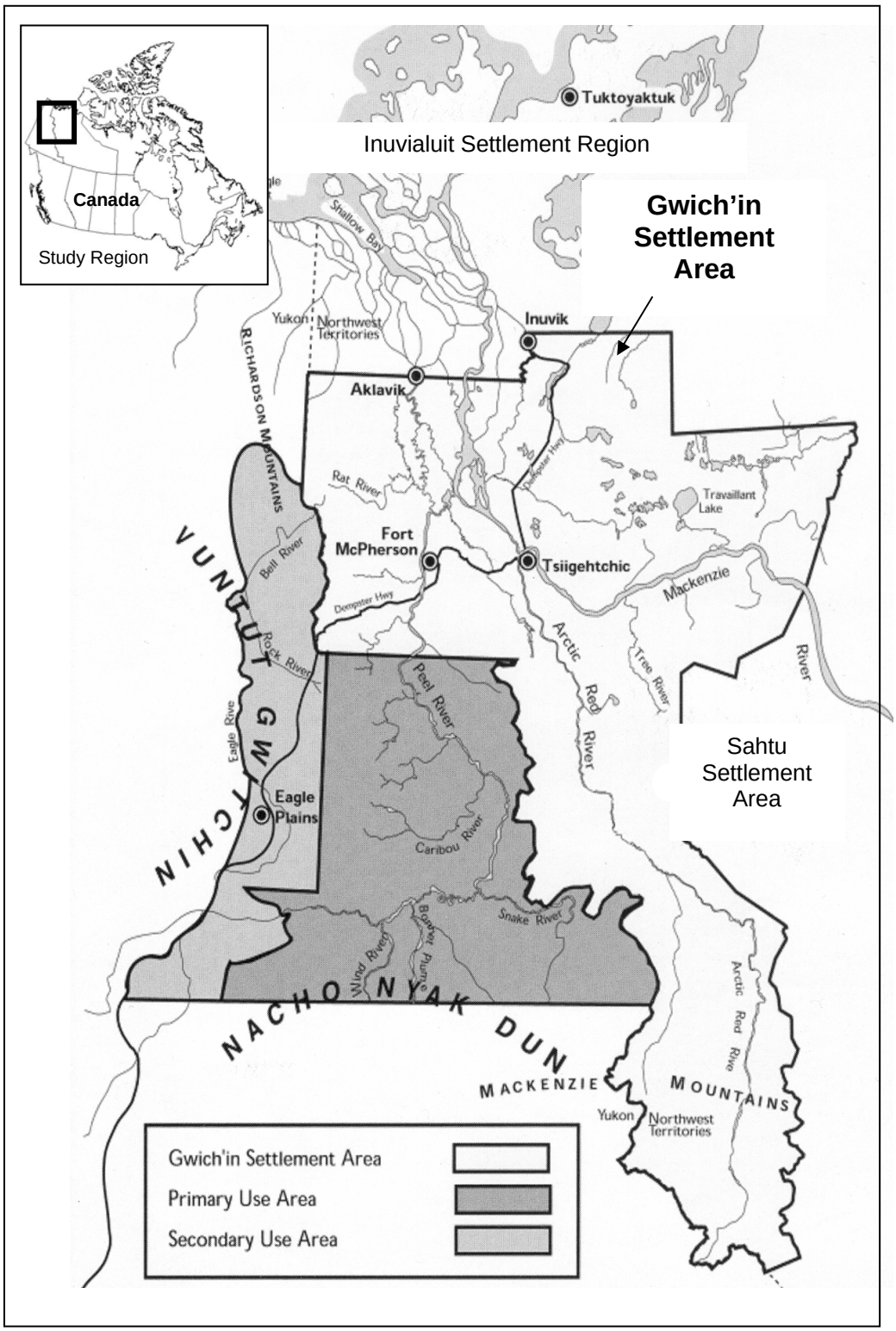

Fig. 8-1 - Gwich'in Settlement Area

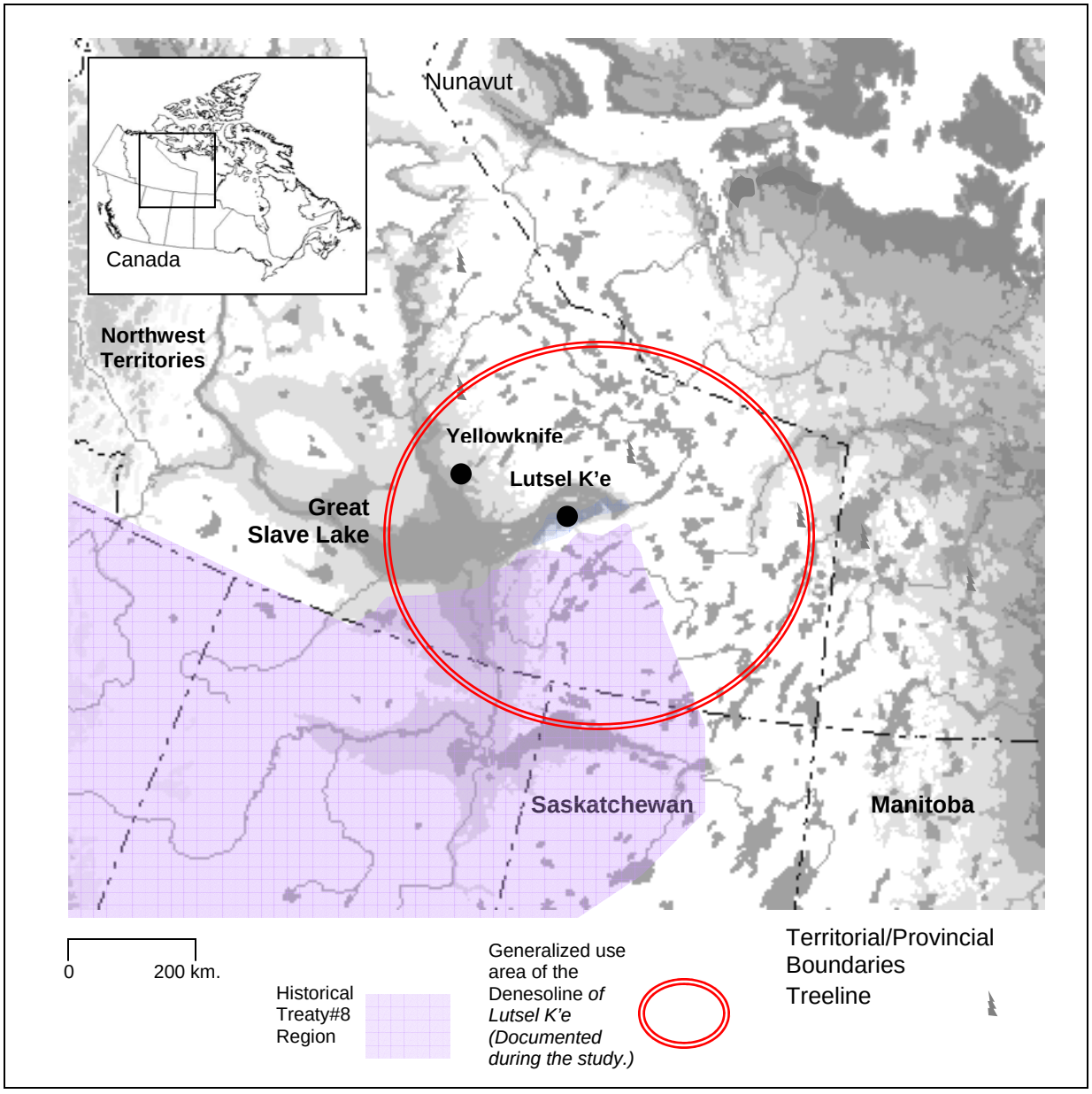

Fig. 8-2 – Treaty #8 and Traditional Use Area of the Lutsel K'e Denesoline

agreement provides additional perspective on how these lands and resources are being managed. Prior to the 1992 land claim agreement, authority for the management of natural resources, such as fish, forests and wildlife fell under the jurisdiction of the

Federal and Territorial governments; today the management of these valued resources is shared with the Gwich'in through a variety of co-management arrangements. The Gwich'in Renewable Resources Board (GRRB), the Gwich'in Land and Water Board (GLWB) and the Gwich'in Land Use Planning Board (GLUPB), for example, wield significant authority over resource management decision-making.

The GCLCA and the settlement of the *Sahtu Dene and Metis Comprehensive Land Claim Agreement (1993)* also resulted in the development of the *Mackenzie Valley Resource Management Act (1998).* This Act was created to facilitate more integrated planning and management up and down the Mackenzie Valley and led to the creation of a variety of other resource management institutions including the Mackenzie Valley Land and Water Board (MVLWB) and the Mackenzie Valley Environmental Impact Review Board (MVEIRB). The Territorial and Federal Government including the Department of Resources, Wildlife and Economic Development (GNWT - RWED) and Department of Indian and Northern Affairs (DIAND) continue to play major roles in the Gwich'in region.

Unlike the Gwich'in, the Denesoline of Lutsel K'e Dene First Nation have not settled a land claim agreement. Lutsel K'e Dene First Nation lands include both the lands defined as Treaty #8 as well as lands to the north (See Fig. 8-2). Caribou hunting and trapping activities, for example, regularly took the Denesoline west of Yellowknife, north to McKay and Aylmer Lakes and northeast into the present day Thelon Game Sanctuary (Parlee et al. 2005b). The lands of the Denesoline of Lutsel K'e and others in the Treaty

#8 region of the Northwest Territories also fall under the jurisdiction of the *MVRMA*. While the Act and its associated institutions are legislated, the Denesoline and other members of Treaty#8, have been disputing the legitimacy of the *MVRMA* since its inception in 1998. They argue that the Act disregards their Treaty and inherent rights and prejudices their own land claim negotiations that are still ongoing. While the communities of Treaty#8 have been able to establish some interim protection of their lands and resources through the *Akaticho Interim Measures Agreement (2001),* community members continue to be frustrated about their limited role in resource planning and management in the region.

8.3 TRADITIONAL KNOWLEDGE - FOREST FIRE, NON-RENEWABLE RESOURCE DEVELOPMENT AND CLIMATE CHANGE

The Denesoline and Gwich'in have lived a land-based way of life for many generations. Although they have undergone significant social and cultural change over the last half century, resources such as caribou and berries are still an important part of their livelihood. In recent years, however, increasing forest fire activity, non-renewable resource development and global warming have begun to impact on these resources in ways that affect the social, cultural and physical well-being of their communities.

Historically, the Gwich'in and Denesoline viewed fire as an important part of mother nature's cycle; fire cleaned the land and provided new life for all the animals and the people. In recent years, however, the Denesoline and Gwich'in have expressed concern that forest fires are getting worse. They are experiencing a greater number of large fires

in areas around their community. As described here by elder Pierre Marlowe from Lutsel K'e, this kind of frequent forest fire activity was not common in the past; among their concerns is the loss of caribou habitat.

> 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 the 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 lightening. We look after the land and we respect the land and the animals (Pierre Marlowe, November 6, 2000).

In the Gwich'in region, concerns about the increase in forest fires are various, however, the loss of valued berry patches is a key issue for many women. Unlike in the southern edge of the boreal forest where fire can be a useful tool in the regeneration of some berry species, in the Gwich'in region, the unique sub-arctic ecological conditions significantly limit regeneration (Janzen, 1989; Landhäusser et al., 1993). Elders say that, "once there has been a fire, we no longer go back there".

Scientific research suggests these kinds of forest fire are likely to increase (Janzen, 1989; Landhäusser et al., 1993). Some fire ecologists argue that fifty or more years of fire suppression in the north has fundamentally changed fire ecology in the region and created a homogenized forest landscape vulnerable to fire (Applejohn, 2004; Bergeron et al., 1998). Others argue that climate change is responsible for the increasing scale, frequency and intensity of forest fires (Weber et al. 1997; Lynch et al. 1995; Flannigan et al. 1998; Hassol and others, 2005). It is in this context that the Gwich'in and Denesoline are

seeking to share their observations and knowledge about fire and its effects with resource management decision-makers in the region.

Increased forest fire activity is not the only ecological change being experienced by northern communities. In the Denesoline region, the ecological effects of mining exploration and development are a major issue. There are currently three diamond mines in operation in the Bathurst range; fifty-three land use permits for further mineral exploration or development have been issued in the same region (MVLWB, 2004). Lutsel K'e elders are particularly concerned about the effects of this activity on caribou and subsistence caribou harvesting. Roads present one major problem; elders perceive the mining roads as barriers to caribou movements and believe they are affecting local movements as well as seasonal migration. (See Chapter Six). In addition to the impact of the roads themselves, there are additional concerns about the cumulative effects of mineral exploration in the Bathurst range and the overall effects of this activity on the health and movements of the herd.

In the Gwich'in region, oil and gas exploration and development is the major concern. This activity, which has been ongoing since the early 1950s, has also increased in recent years as a result of renewed interest in northern gas reserves and a Mackenzie Valley gas pipeline. Point source contamination from fuel spills and other similar activities associated with the oil and gas industry are a concern, as are contaminants associated with the recent failures of permafrost dumps or sumps that were created in the 1960-70s (Kokelj and GeoNorth 2003; NRTEE, 2001). In the Fort McPherson area, an old sump at

Caribou River, for example, is thought to have leaked a variety of PCBs, metals and other carcinogenic material into the Peel River and the surrounding area. Seismic lines have also been a major issue; while technology has changed in recent years, the clearing of vegetation that took place thirty to forty years ago has created permanent scars on the landscape, distinct from those that would be caused from natural forest fires or other clearing activities (Seccombe-Hett and Walker-Larsen, 2004). While some of these linear features are being used for subsistence harvesting activities, others think these areas may be contaminated as described here by Christine Firth.

> Seismic lines and developments like roads and fires [are a concern]. Back in the 1940s, 50s and 60s when people from down south brought technologies to the north they did a really sloppy job. Now today we see the damages [that] development has left behind within the Gwich'in lands. Now today we have better ways of protecting the land and working together for a clean and healthy environment (Christine Firth, July 3, 2003)

Of particular concern to the Teetl'it Gwich'in is the area around Caribou River where an old Shell site was found to be leaking (James Andre August 3, 2002). It is for these reasons that the Denesoline and Gwich'in are worried about increasing non-renewable resource development activity in their regions and seek to share their knowledge with decision-makers.

Climate change is also a growing concern for many northern communities including the Denesoline and Gwich'in communities of Lutsel K'e and Fort McPherson. Research has revealed that climate change is affecting northern communities three times faster than anywhere else in Canada (Hassol et al., 2004). The Denesoline, Gwich'in and other

northern peoples are already observing and experiencing many changes that scientists attribute to global warming; as described by one northern elders, “the earth is moving faster now” (Krupnik and Jolly, 1998; Jolly et al., 2002; Reidlinger and Berkes, 2001). Among these observation is the increase in forest fires, as described above. There are other related observations.

Gwich’in berry harvesters are also observing greater variability in temperature and precipitation that in turn affects the abundance and distribution of berries. While some years, such as 2003, have been extremely good years for picking berries; in other years, extreme weather events such as a late frost and extremely hot dry weather have all but ruined the seasonal harvest.

> I hardly got any cranberries this past fall (2002); nobody did in this area anyway. Out this way, I checked (toward Tsiigehtchic) and there was hardly anywhere it used to be. I think it was the weather conditions. First, it was too hot – in June. Then in July, it snowed! and I think that was the cause of no berries – extreme weather change (May Andre, April 17, 2003)… I notice a lot of these changes – extreme weather condition changes. Like this last summer – it was extremely hot. It wasn’t good for the health of the people. Lots of elders couldn’t stand it. It was pretty dangerous. It switched from one extreme of heat to cold rain… then for about five days it snowed. I was at 8 miles and it was very very cold. And that is crazy weather! (May Andre, April 17, 2003)

Many of the changes experienced by the Denesoline are also weather related. Although average temperature increases in summer and winter are of some concern, unexpected weather events cause many problems, particularly for harvesters who depend on

traditional knowledge about weather conditions and seasonal observations to guide them while hunting and trapping.

> The climate is changing. The wind blows harder than it did in the past. Its different - the wind picks up quickly and changes quickly; now I don't know what has happened… In the afternoon you can't even go out onto the lake (Noel Drybones 11 June 2000).

Changes in wildlife distribution are also apparent; "little yellow birds"[1] and other songbirds that have never been seen in the region before are suddenly appearing near the community each summer. Other animals, such as moose, that were rarely seen are now appearing in growing numbers around Great Slave Lake and the Thelon River. Other signs of climate concern to elders are the decreases in water levels. According to many elders and harvesters, the creeks and streams are drying up and the lake levels are decreasing. Although there has always been some variability in water levels, these recent changes are confusing to many elders - "some how we seem to be losing water" (Maurice Lockhart 15 September 1999). These changes in water levels also present problems for resource harvesters. The portage used by the community to cross Peithii Peninsula on Great Slave Lake for example, has increased over 40 feet in the last 10 years making it almost unusable to harvesters who have to physically push their fishing boats along the trail. Other rivers, such as the Snowdrift River are drying up as described here by elder Noel Drybones.

1 The "little yellow bird" is likely a warbler – possibly a Wilson's Warbler. Research north east of the community in the Thelon River area suggests that the range of this species has expanded in a north easterly direction(Norment 1999). Given that this is a species of bird that is new to the area, it is understandable that the elder would not have a Chipewyan name.

> At one place in Whitefish Lake I got stuck on an island because of this… Toward the Thelon River - things have changed also. A long time ago, my sister and me traveled on the Snowdrift River to Siltaza Lake. We never saw any rocks along that river but today you can see lots of rocks [the river is shallow.] (Noel Drybones, May 11, 2000).

For many elders, these changes are surprising - outside their memory of natural variability; unlike other natural changes in the environment – these are described in terms of *edo aja* – something has happened to it (Parlee et al. 2004). It is for these reasons that the Gwich'in and Denesoline wish to share their local and traditional knowledge with those institutions involved in dealing with the climate change issue.

8.4 INSTITUTIONAL ARRANGEMENTS - OPPORTUNITIES FOR TRADITIONAL KNOWELDGE

While the effects of forest fire, non-renewable resource development and climate change are felt acutely at the local level, there are many institutions at various regional, territorial, national and international scales that are involved in the management of these resource management problems. Each of these institutions offer different kinds of opportunities for incorporating traditional knowledge.

8.4.1 Forest Fire Management

Opportunities for including traditional knowledge in forest fire management decision-making have changed significantly over the last two decades. Beginning in the 1930s and to a greater extent in the post-war period, the federal government was actively

involved in forest fire management in present day Northwest Territories; their approach to fire protection, tied in with their interests in exercising authority over the region and its resources, was among the "best examples [of colonialism] whereby Ottawa officials directed matters of local concern" (Janzen, 1989:114). This centralized top-down approach significantly limited the role of local communities in forest fire management; Ottawa was little interested in the knowledge and experience of northerners, including the Denesoline and Gwich'in. In 1979, after a particularly treacherous fire season, a federal review panel, fashioned after the Berger Inquiry process, was struck to assess the effects of the federal fire management policy; greater involvement of the communities in forest protection policy-making process was among its key recommendations (Ministerial Fire Review Panel, 1980). The federal government made some efforts to gain local input, however, their reputation as a colonial force in the region, as well as the political unrest associated with self-government negotiations led to less than successful consultation. Responsibility for forest protection was consequently devolved to the territorial government in 1987. Forest protection policies of the territorial government were based on the events and realizations about forest fire activity from the 1970s; specifically those policies recognized the "impossibility of complete protection under certain conditions and implied that fire management should allow for and incorporate the role of fire in the northern environment" (Janzen, 1989:123).

Today, the government agency responsible for forest fire management in both the Denesoline and Gwich'in regions is the Department of Resources, Wildlife and Economic Development (RWED); forest fire operations are defined under the *Forest Protection Act (1988)* and the *Forest Fire Management Policy (1997).* In the Gwich'in

region, a land claim settlement has created a formal role for the Gwich'in in the management of forests and other natural resources through institutions such as the Gwich'in Tribal Council, the Gwich'in Renewable Resource Board and local Renewable Resource Councils.

Notwithstanding the fact that forest fire management was not part of the scope of the land claim negotiations, the Gwich'in do have the opportunity to exercise significant influence over the decisions of the territorial department. The Gwich'in Tribal Council for example, works closely with RWED to ensure community views are included in fire management (GTC, 2004).

Table 8-1: Opportunities for including traditional knowledge in the management of forest fires

Type of Local / Traditional Knowledge	Mechanism	Institution / Process	Required by:
Cultural and ecological values at risk	GNWT Forest Fire Management Policy	o GWNT-RWED carries out consultation (workshops) in local communities every five years;	Forest Fire Management Policy Section 2.(5)and 6.(3)
	*Gwich'in Forest Management Plan	o Research carried out by GRRB Staff o GRRB, GTC and RWED carry out consultation with communities including local Renewable Resource Councils every fiver years;	Gwich'in Forest Management Plan
	*Gwich'in Land Use Plan	o Five year review of values and land use designations	GCLCA/ GLUP
Historical knowledge of forest fire ecology	GWNT Forest Fire Management Policy	o GWNT-RWED carries out consultation (workshops) in local communities every five years;	Forest Fire Management Policy Section 2.(5)
Seasonal observations of forest fire activity	Opportunistic (e.g. reporting of fire sitings)	o Direct contact with local RWED- Renewable Resource Officer; o Telephone contact with regional RWED Fire Managers in Inuvik and Fort Smith	*Forest Protection Act* 6.(1) b

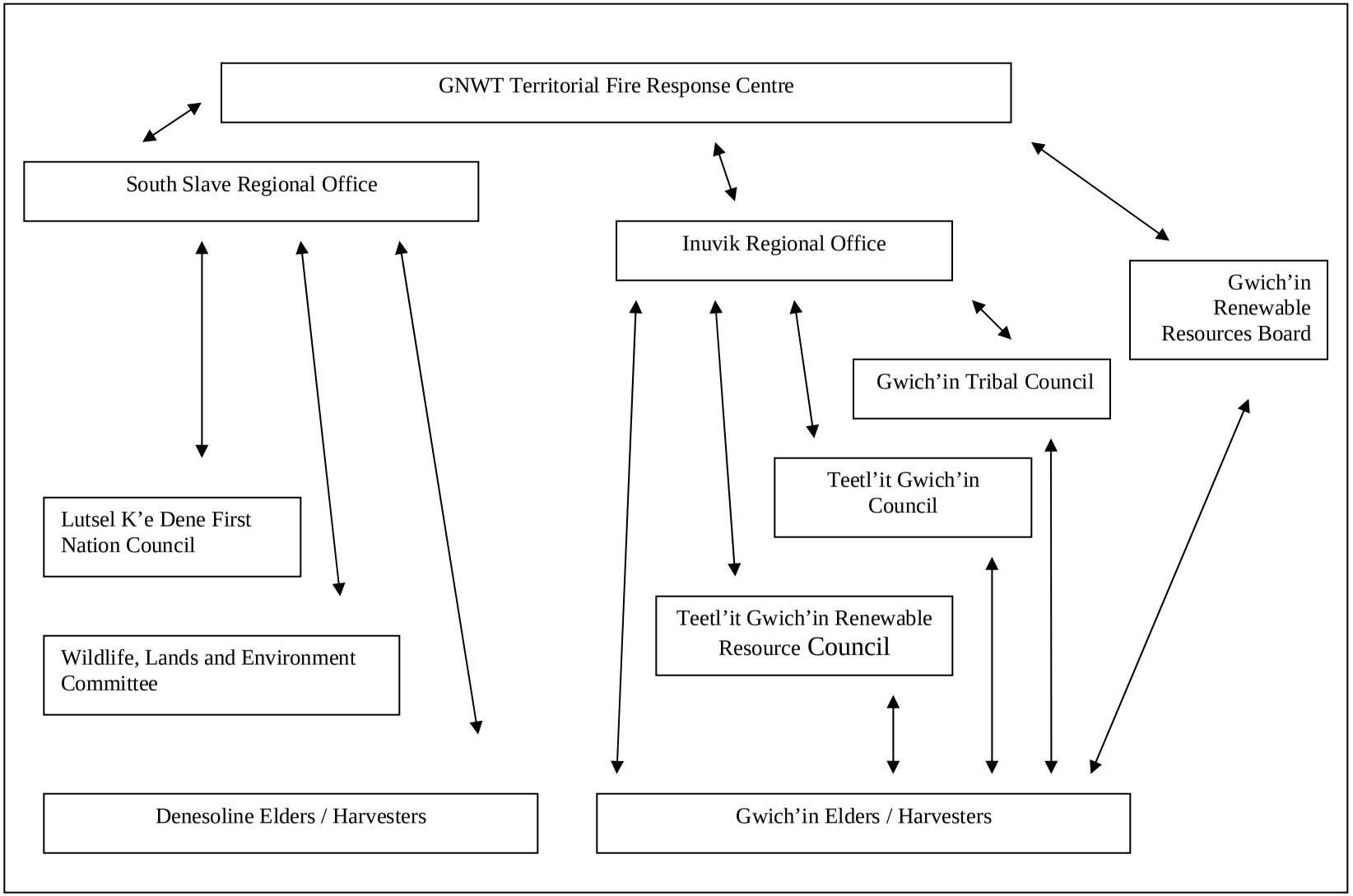

Fig. 8-3 – Institutional Arrangements for Forest Fire Management in the Gwich'in and Denesoline Regions

Similar opportunities to participate in forest fire management also exist in the Denesoline region. Although there is no settled land claim in the region, the Forest Fire Management Policy requirement to include local knowledge and consult about values at risk applies to peoples within settled land claim as well as non-settled land claim areas. In Lutsel K'e, it is the Wildlife, Lands and Environment Committee that deals with forest fire management issues

The *Forest Fire Management Policy* has a specific requirement to include local and traditional ecological knowledge in forest fire management decision-making; this requirement is manifested in a variety of ways. The main opportunity however, is in the identification of values at risk defined as "human life and the specific or collective set of natural or cultural resources and improvements/developments that have measurable or intrinsic worth and that could or may be destroyed or otherwise altered by fire in any given area" (GNWT, 1997: Sec. 4).

The Department holds community workshops at least every five years to identify or review any changes in community defined values at risk, evaluate the effectiveness of the forest fire management system, and to discuss any related issues of concern to community members. On a yearly basis, Department officials also monitor the status of values at risk, such as cabin sites, during a spring helicopter survey; depending on the level of concern, one or two community members are also included in the spring survey. During the fire season, ongoing and informal communication between community members and Department officials about the status and relative risks posed

by fires in the region also provides opportunities for knowledge sharing between community members and the government.

8.4.2 Non-renewable Resource Development

There is a diversity of institutions involved in the planning, assessment, management and monitoring of non-renewable resource development in the Gwich'in and Denesoline regions. Traditional knowledge is included in the decision-making processes of these institutions in a number of ways.

Landscape level planning, including decisions about what lands and resources can or cannot be developed for mineral or oil and gas resources, takes place through a land use planning process. The *Gwich'in Comprehensive Land Claim Agreement (1992)* resulted in a land use planning process. The purpose of the land use plan, as defined in the land claim agreement (Section 24.2.4a), was to "protect and promote the current and future well-being of residents and communities in the Gwich'in area and have regard to all citizens of Canada". During the land use planning process, significant local and traditional knowledge was gathered to identify heritage and conservation zones, special management zones, and general use zones (GLUPB, 2004). This zoning system allows for multiple uses of land, water and resources in certain areas and controls activities, include resource development in critical and sensitive environmental and heritage areas and aims to balance conservation values with those related to the use and development of the land, water and resources (GLUPB, 2004).

It is important to note however, that despite the identification of these zones, non-renewable resource development is still feasible in up to ninety percent of the Gwich'in Settlement Area (Fig. 8-1).

There is currently no land use planning process in place for the Denesoline region and much of the traditional territory of the Denesoline is open for mineral resource development. Rights to minerals on Crown lands in the Northwest Territories are issued under the *Canada Mining Regulations (1979)*; these rights are granted to licensed prospectors through a free-entry claim staking process. The free entry system essentially gives exploration companies the right of entry and access on virtually all lands, the right to locate and register a claim, without the intervention of the Crown, and the right to acquire a mineral lease. According to the free entry system, the only option open to government to limit or exclude mineral exploration is to withdraw lands from mineral entry for specific purposes. These would include lands proposed or defined as national parks, lands used as cemeteries or burial grounds, lands already under a mining claim, mining lease or grant and lands withdrawn under the *Territorial Lands Act*. There is currently no requirement under the free entry system to consult with Aboriginal peoples with an interest in the resources or lands being staked and consequently, there are no required opportunities for communities to share traditional knowledge with government and or resource developers.

Management of oil and gas resources in the Northwest Territories falls under the *Canada Petroleum Resources Act (1985),* which is administered by the Department of

Indian Affairs and Northern Development, and the *Canada Oil and Gas Operations Act (1985)* administered by the National Energy Board. Unlike the free entry system, rights to oil and gas resources are issued under a "rights issuance process" which includes a land parcel nomination and competitive bid process defined in the CPRA. The COGOA, focuses on operations associated with oil and gas exploration and development including production and conservation of resources, protection of the environment and safety of workers. COGOA also requires that companies develop a benefits plan that sets out how northern businesses and residents will be consulted and benefit from the resource exploration and development activities.

The free-entry system and rights issuance process do not, however, exist in a vacuum; the federal government does have a fiduciary obligation to consult about activities which may affect Aboriginal rights as a result of Section 35 of the *Canadian Constitution Act* and Supreme Court rulings such as *Delgamuukw, Haida* and *Taku River Tlingit,* Consultation is also required in many parts of the *Gwich'in Comprehensive Land Claim Agreement* and is defined as: "the provision of sufficient information to allow the Aboriginal party to prepare its views, the provision of sufficient time to allow an Aboriginal to prepare and present its views and full consideration of these views by the party required to consult" (GCLCA). These requirements to consult, create opportunities for the Denesoline and Gwich'in to include their traditional knowledge in decisions made about lands and resources proposed for development.

Resource rights are only one dimension of the non-renewable resource development picture; there are other opportunities for the Denesoline and Gwich'in to share their traditional knowledge through the land use permit, water license and environmental assessment processes. The *Mackenzie Valley Resource Management Act (1998)* requires that companies proposing to use lands and waters in the region apply for a land use permit and/or water license. Proponents apply for a land use permit and water license from the Gwich'in Land and Water Board , Sahtu Land and Water Board or in non-settled claim areas, and in the case of applications that are defined as transboundary or are likely to have transboundary effects, the Mackenzie Valley Land and Water Board. These Boards are responsible for carrying out Preliminary Screenings of land use permits and water license applications. Often the applications are approved under the Preliminary Screening process and the permit or licenses are issued directly. In some cases, however, where the screening has revealed significant public concern or significant adverse effects, the Board refers the application for an Environmental Assessment or Environment Impact Review.

The Mackenzie Valley Environmental Impact Review Board (MVEIRB), a co-management body made up of individuals from across the Mackenzie region, is the central institution involved in the Environment Assessment and Environment Impact Review process. The MVEIRB defines traditional knowledge in terms of i) knowledge of the environment, ii) knowledge about use and management of the environment and ii) values about the environment, must be considered, in all phases of the environmental assessment process (MVEIRB 2004a: 5). There are a variety of

opportunities for including traditional knowledge in these processes. Project proponents are encouraged to consult with Aboriginal communities potentially affected by a project prior to their application; methods of consultation and the extent of effort placed on gathering local and traditional knowledge can vary significantly depending on the proponent and the stage of project development. During the Preliminary Screening process, the land and water boards also seek input directly from local communities about the application and potential effects of proposed project activities.

Table 8-2: Opportunities for including traditional knowledge in dealing with non-renewable resource development

Process	Institution(s)	Mechanism	Required by:
Free Entry System	NA	o NA	No requirement under the Canadian Mining Regulations
Rights Issuance Process	DIAND	o Consultation	Required under terms and conditions of the land claim agreement GCLCA 12.4.13(b); 21.1.2; 21.1.3 and in accordance with Supreme Court rulings (e.g. *Delgamukw v. British Columbia [1997]*, *Haida Nation v. British Columbia (Minister of Forests) [2004]*, and *Taku River Tlingit First Nation v. British Columbia [2004]*,

Environmental Assessment	*GLWB MVLWB MVEIRB	o Boards consult with communities to identify issues that should be considered in screening or assessment; o Communities potentially affected by proposed activity have an opportunity to review applications and intervene in proceedings	-MVRMA -MVLWB Rules of Procedure (1)34 and (1)35. -MVEIRB – Traditional Knowledge Guidelines Discretion of the Board(s).
	Project Proponent	o Consultation with communities about applications; o Consultation/ Research for Development Assessment Report	
Protected Areas Strategy	Protected Areas Strategy Steering Committee (PAS SC)	o Communities carry out traditional knowledge research and other studies as part of their preparation of a Protected Area Proposal;	Protected Areas Strategy 3.2.1(a)
*Gwich'in Land Use Planning Process	*Gwich'in Land Use Planning Board (GLUPB)	o Board carries out consultation with communities every five years as part of their 5 year review of the GLUP.	*GCLCA GLUP- Section 6.6
Cumulative Effects Research and Monitoring in the Mackenzie Valley region	Cumulative Effects Assessment and Management Framework (CEAMF)	o Traditional knowledge has been documented through Community Involvement Projects;	CEAMF is the result of commitments made by the Federal Government during the Environmental Assessment of the Diavik Diamond Mine.
	Cumulative Impact Monitoring Program (CIMP)	o Traditional knowledge has been documented through Community Monitoring and Capacity Building Projects	MVRMA

	Non-Governmental Organizations and other Agencies (e.g. West Kitikmeot Slave Study Society WKSS)	o Traditional knowledge has been documented about valued ecosystem elements and processes such as caribou movements	Various (e.g. WKSS Terms of Reference)
Project Specific Monitoring	Independent Environmental Monitoring Agency (IEMA)	o Communities share local and traditional knowledge with Board Members on an opportunistic basis and during annual meetings in communities	Environmental Agreement between the Federal and Territorial Governments and BHPBilliton Inc. Condition of Approval under the CEAA Environmental Assessment http://www.monitoringagency.net/website/Key%20Documents/New 20Key%20dcouments%20 index.htm
	Environmental Monitoring Advisory Board (EMAB)	Communities share local and traditional knowledge with the Board through their community representative, during annual meetings and through specific projects.	Environmental Agreement between the Federal and Territorial Governments, Aboriginal Groups and Diavik Diamond Mines Inc. Condition of the Approval under the CEAA Comprehensive Study. http://www.ainc-inac.gc.ca/nr/prs/j-a2000/envagr_e.PDF
	Snap Lake Monitoring Agency (SLMA)	Communities share local and traditional knowledge with the Board through their community representative, during annual meetings and through specific projects.	Environmental Agreement between the Federal and Territorial Governments, Aboriginal Groups and DeBeers Canada Ltd. Condition of Approval under the MVEIRB Environmental Assessment:

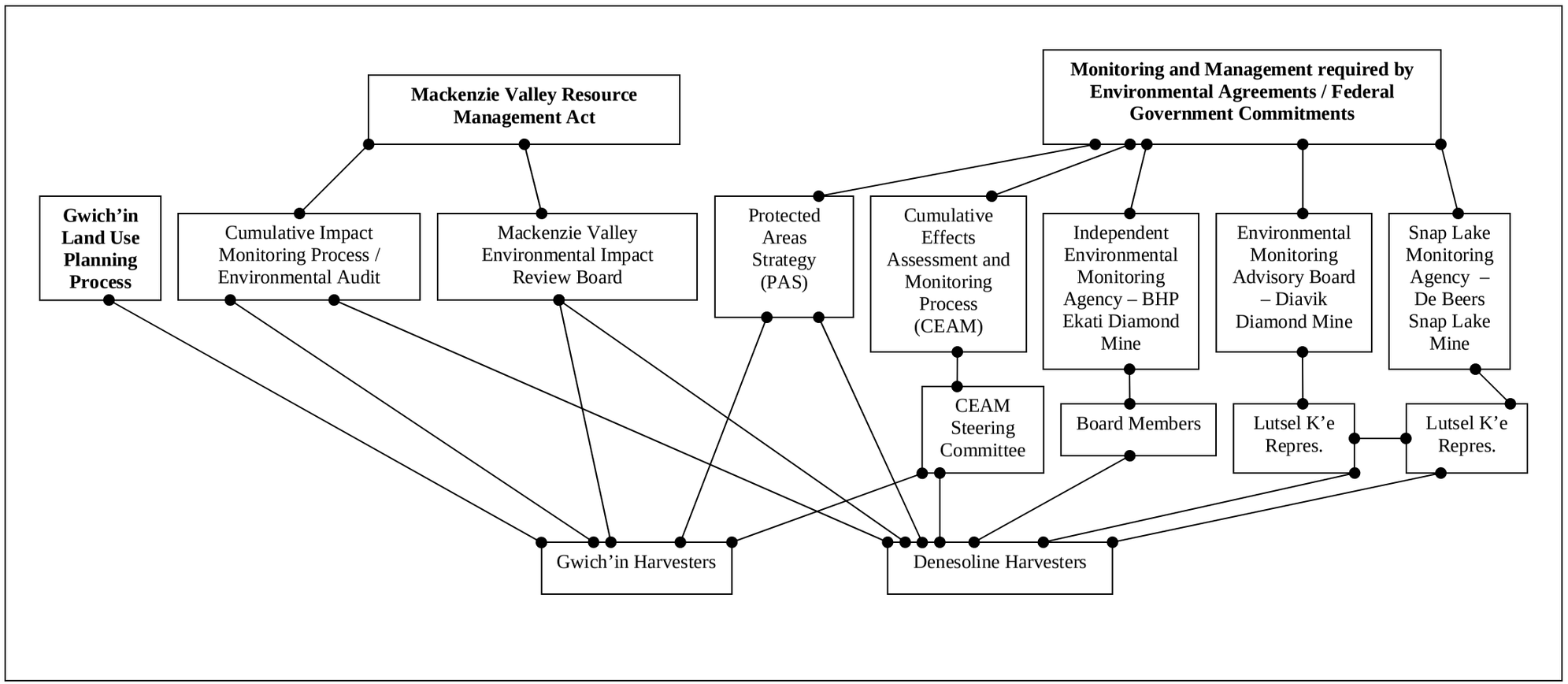

Figure 8-4: Arrangements associated with the planning, assessment, management and monitoring of non-renewable resource development

The MVEIRB generally requires more in depth consideration of local and traditional knowledge during environmental assessments. Proponents of larger projects, such as a mine or pipeline, are usually required to work with local communities to document relevant local and traditional knowledge and demonstrate how that knowledge has been used or will be used in the future to mitigate, monitor and/or manage adverse environmental effects.

The MVEIRB itself also solicits local and traditional knowledge to identify issues and develop terms of reference for assessment, and in the review of the environmental assessment report through formal technical hearings and/or community hearings. While there are many challenges associated with the use of traditional knowledge in the screening and assessment process, the MVEIRB perceives traditional knowledge as having a valuable role in increasing understanding of the environment in which a development is proposed, the potential effects of that development and the significance of those effects (MVEIRB 2004b:7).

To date the Board has reviewed eighteen applications; another five are still under review. All of these applications have been approved by the Board with the exception of the New Shosoni Ventures application to carry out diamond exploration at Drybones Bay (MVEIRB, 2004b). In that case, an approved water license would have allowed New Shosoni to carry out advanced diamond exploration activities at Drybones Bay, located within the traditional lands of the Denesoline, Yellowknives Dene and North Slave Metis Alliance. During the environmental assessment, the MVEIRB heard arguments from

the Yellowknives Dene, Lutsel K'e and others about the cultural value of the lands and resources proposed for development.

> [W]e don't want our cultural identity treated like points on a map that can be simply managed and mitigated or made less important. Those places, the cultural representations, the landscape and the information those places contain are not just archaeological sites. They're part of our social, spiritual and cultural identity. […] Those places out there are how we communicate who we are and […] pass on our culture to our children (Chief Darrell Beaulieu, Yellowknives Dene First Nation, November 26, 2003, MVEIRB Transcript PR #255).

In its final deliberations, the Board determined that New Shosoni Ventures had not made adequate efforts to understand the cultural value of the land and resources they proposed to develop. Drawing on the traditional knowledge shared by elders and leaders such as Darrell Beaulieau, the Board rejected the application stating that "the project was likely to cause an impact on the environment so significant that it could not be mitigated" (MVEIRB, 2004a: vi).

A variety of other opportunities for including traditional knowledge have been created in relation to planning, monitoring and management of mining activities in the Denesoline region. Companies such as the BHPBilliton, Diavik Diamonds and DeBeers have, from time to time, funded traditional knowledge studies to assist them in identifying ways to mitigate or manage the effects of their projects. BHPBilliton and other members of the Chamber of Mines have also funded traditional knowledge studies through a regional funding agency (WKSS, 1998). In the Gwich'in region, oil and gas companies have

started to take similar steps, however, the extent of traditional knowledge documented to date has been limited.

There are also several ad hoc monitoring agencies in the Denesoline region. The Independent Environmental Monitoring Agency, the Environmental Monitoring Advisory Board and the Snap Lake Monitoring Agency aim to include local and traditional knowledge in the monitoring of specific diamond mining projects; specifically the BHP Billiton Mine, Divaik Diamond Mine and DeBeers Canada Snap Lake Diamond Mine. It is anticipated that similar agencies will be developed for monitoring the construction and operations of the proposed Mackenzie gas pipeline and its ecological effects.

In addition to these project specific opportunities, local and traditional knowledge is also considered in cumulative effects monitoring and management through the Cumulative Impact Monitoring Program (CIMP) and the Cumulative Effects Assessment and Management Framework (CEAMF). To date this has largely been done through community research projects (LKDFN, 2001).

There are clearly many opportunities for including traditional knowledge in the planning, assessment, management and monitoring of non-renewable resource development in the Gwich'in and Denesoline regions. The environmental assessment and regulatory process offer a number of avenues, however, institutions created under the Mackenzie Valley Resource Management Act, the Gwich'in Comprehensive Land Claim Agreement and ad hoc agreements have also been important.

8.4.3 Climate Change

Traditional knowledge can also make useful contributions to our understanding of the integrated social and ecological effects of climate change (Nuttall et al., 2004). While the bulk of climate change research has been based on western science, there is growing recognition of traditional knowledge as a result of research with Sach's Harbour and other Arctic communities (Nichols et al., 2004; Reidlinger and Berkes, 2001; Krupnik and Jolly, 2002)

Community organizations such as the Teetl'it Gwich'in Renewable Resource Council and Lutsel K'e Wildlife Lands and Environment share their knowledge about climate change and its effects from time to time during regular council and committee meetings. Discussion is often precipitated by an event such as a late caribou migration, a late freeze-up or related human impact. In other cases, information presented to the councils or committee by representatives from regional organizations such as the Dene Nation or Gwich'in Tribal Council, a government department or other agency addressing the climate change issue leads to the sharing of knowledge by these local organizations and their constituents.

There are also a variety of regional institutions that have created opportunities for sharing traditional knowledge on climate change. In the Gwich'in region, one key agency is the Arctic Borderlands Knowledge Coop (Kofinas et al., 2002). The main activities of the Coop include interviewing local harvesters and communicating results through annual

workshops and over the internet. The Gwich'in Renewable Resources Board and the community of Fort McPherson are among the original participants of the Coop. In 2004, the Coop had expanded to include more than ten communities from the Yukon, Gwich'in Settlement Area and Inuvialuit Settlement Region of the Northwest Territories. Other organizations involved in studying or addressing the effects of climate change in the Gwich'in and Denesoline regions include the Environmental Monitoring and Assessment Network North (EMAN-N), Climate Change and Adaptation Research Network (C-CAIRN) and Northern Climate Exchange (NCE). The NCE, in particular has a mandate to "support the contributions of indigenous peoples to the climate change knowledge base by promoting the acceptance of traditional knowledge and aboriginal expertise" (NCE 2004). These agencies are, however, centred in Whitehorse Yukon and are largely funded and coordinated through the Yukon College. The extent to which they are able to draw on the traditional knowledge of northern peoples in the Gwich'in and Denesoline regions depends on the capacity of other regional and community level organizations in the NWT including the Aurora College and Aurora Research Institute in Inuvik.

Most federal government policies and strategies on climate change have focused on southern populations and on strategies for limiting greenhouse gas emissions. To date there has been little recognition of the effects of climate change on northern communities. The Government of the Northwest Territories has also done little to recognize or deal with the effects of climate change. While the territorial government has stated that it is committed to the Kyoto Accord, no targets to limit greenhouse gas emissions for the Northwest Territories have been set.

The best known institutions related to climate change are those created by United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol. These institutions have resulted in international recognition of the climate change issue and specific targets for limiting greenhouse gas emissions. Canada ratified the Kyoto Protocol in 2002. These agreements made use of existing institutions like the Intergovernmental Panel on Climate Change and created new bodies such as the Conference of the Parties which is the main body involved in the implementation of the UNFCCC. These institutions rely overwhelmingly on western science in their decision-making and there are few opportunities for including traditional knowledge.

The exception is the work of the Arctic Council and that carried out as part of the Arctic Climate Impact Assessment (ACIA). The Arctic Council may be among the most effective institutions at linking the traditional knowledge of northern communities to decision-makers at international levels. "The Arctic Council is a high-level intergovernmental forum that provides a mechanism to address the common concerns and challenges faced by the Arctic governments and the people of the Arctic" (www.arctic-council.org). This organization is made up of eight state members: Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States and a number of permanent members including the Gwich'in Council International and the Arctic

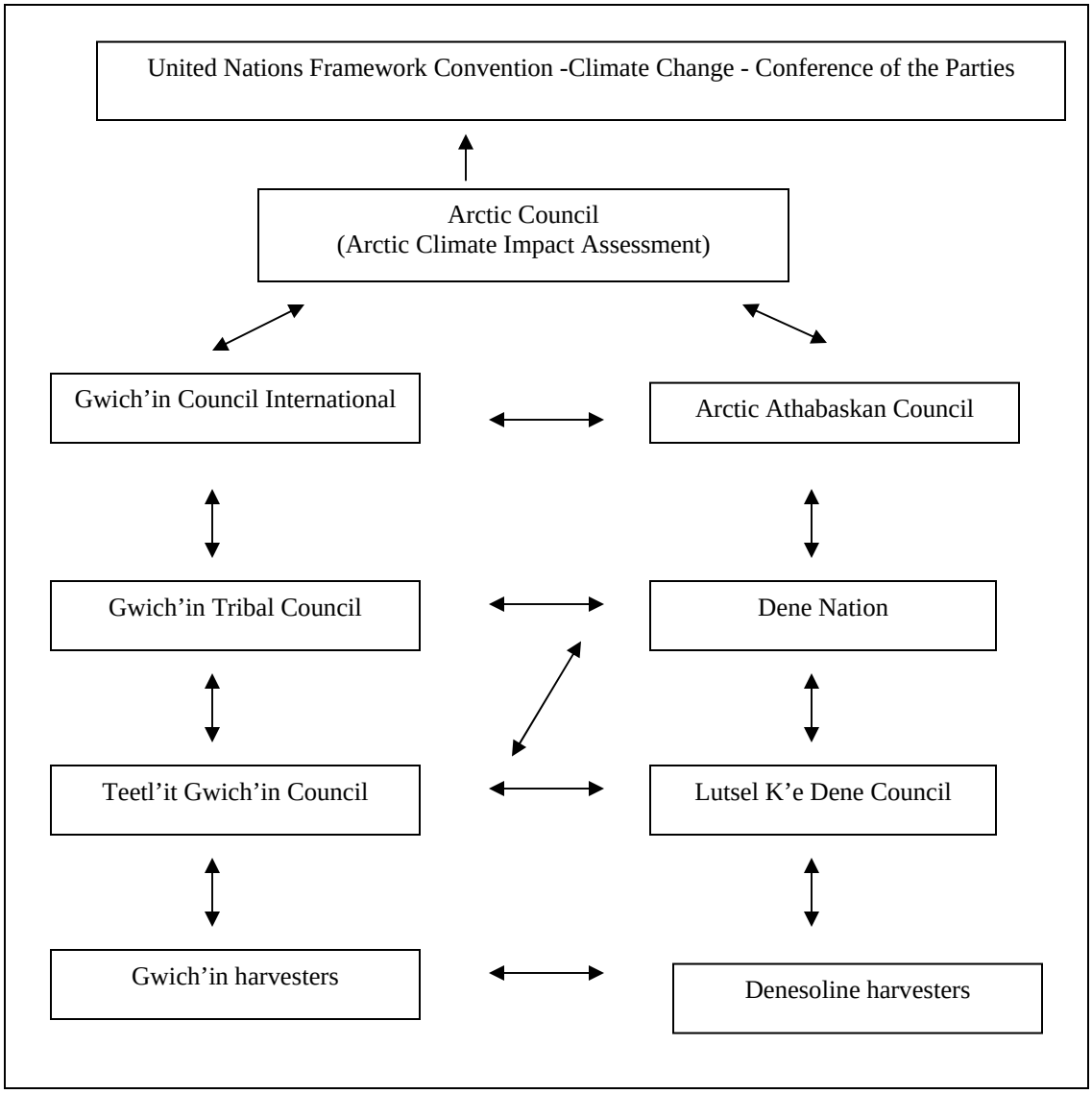

Figure 8-5: The institutional arrangements associated with Climate Change

Athabaskan Council (See Fig. 8-5). Nations represented on Arctic Council, including Canada, are able to bring forward knowledge generated to international circles through their representation at the Conference of the Parties.

The Report of the Arctic ClimateImpact Assessment highlights the current and potential effects of climate change on arctic ecosystems and peoples (Hassol et al. 2004). Although the arctic has been largely overlooked in previous international discussions on climate change, this report has the potential to reorient the debate to include the perspectives of northerners including traditional knowledge.

8.5 DISCUSSION

Models for incorporating traditional knowledge in resource management at different scales are needed if Aboriginal peoples are to play an equitable and meaningful role in the management of their lands and resources. Although there is a growing literature on the value of traditional knowledge in local scale resource management, little consideration has been given to its value at other spatial and organizational scales (Berkes, 2002). This paper attempted to address this gap by exploring the opportunities that exist for including traditional knowledge in dealing with three resource management issues of concern to the Denesoline and Gwich'in – forest fire, non-renewable resource development and climate change.

Table 8-3: Summary of Institutional Arrangements

Summary of Institutional Arrangements	
1	Regional Resource Management Legislation (e.g. MVRMA)
2	Land Claim Agreements (e.g. GCLCA)
3	Obligations created by Supreme Court decisions on Aboriginal rights (e.g. requirements to consult)
4	Adhoc agreements / contracts between Aboriginal groups, governments and industry (e.g. Environmental Agreement for the Diavik Diamond Mine.)
5	Obligations created by policies, protocols, guidelines (e.g. Fire Suppression Policy)
6	Formal and informal international arrangements (e.g. Kyoto Protocol / Arctic Council)
7	Informal knowledge sharing arrangements (e.g. Arctic Borderlands Knowledge Coop)

These opportunities are facilitated by different kinds of institutional arrangements (Tables 8-3). Arguably, the most powerful or legally binding opportunities are tied to legal requirements for consultation. Even where there is no legislation requiring governments to consult, as is the case with forest fire management and institutions involved in addressing climate change, there are opportunities. Policies, guidelines, protocols and other similar mechanisms effectively serve as soft-law, and result in increased awareness and recognition of the value of traditional knowledge and the role of Aboriginal peoples.

Ad hoc agreements such as those created for the management and monitoring of diamond mines in the Denesoline region create other key opportunities. Unlike some other arrangements rigidly defined in legislation or policy, these negotiated arrangements allow for innovation and creativity. For example, the Environmental Agreement for the Diavik Diamond Mine and DeBeers Snap Lake Mine have created unique mechanisms for including traditional knowledge in site-specific monitoring, cumulative effects monitoring as well as in industry and government decision-making about mine management and mitigations.

Co-management arrangements involving Aboriginal groups and governments have created many opportunities. Formal co-management agreements developed as a result of land claim agreements such as the Gwich'in Comprehensive Land Claim Agreement (GCLCA), create an obligation to include traditional knowledge in many decision-making processes. The Mackenzie Valley Environmental Impact Review Board, and the Land and Water Boards, are examples of co-management institutions in which representatives of the Aboriginal communities work together with government to make decisions about non-renewable resource development activities. The discussion on forest fire management describes a process of shared decision-making that is similar to many formal co-management arrangements. Arguably, the culture of co-management in many regions of the north has had a spill-over effect in other resource management areas. For example, even though no formal co-management arrangement is in place, the GNWT works with the Gwich'in and Denesoline to make decisions about many aspects of forest fire management. The absence of a settled land claim or formal co-management arrangement is, however, a continued concern for some communities in the Denesoline region. While they value the opportunities to share knowledge and participate in resource management decision-making, they fear that their traditional territory is being badly managed by institutions in which they have no formal role.

Multi-stakeholder processes facilitate sharing of traditional knowledge among communities, regional organizations and governments at many different scales. The Arctic Borderlands Knowledge Coop is a useful example of the horizontal linkages that

exist between communities across the Gwich'in, Inuvialuit and Yukon areas and how a regional perspective on climate change can be built based on local observations and experiences. The Arctic Council is another example of a multi-stakeholder body that draws together northern organizations and nations; linkages created by the Council are both horizontal and vertical. The Council facilitates horizontal dialogue and interaction between representatives of its member nations and organizations, such as the Gwich'in Council International, through annual meetings and ongoing project activities. There are multiple vertical linkages associated with the work of the Arctic Council as well. The Council provides a forum in which Arctic nations can discuss ideas of common concern and develop research strategies, such as the Arctic Climate Impact Assessment, to address those concerns. Each of the member nations as well as indigenous organizations also, engages with their constituents creating further vertical interaction. For example, the Inuit Circumpolar Conference engages with its members in Canada through elected leaders of the four land-claims settlement regions: Inuvialuit, Labrador, Nunavik, and Nunavut who also, in turn, communicate with beneficiaries from each of these regions. These vertical interactions facilitate and are facilitated by the horizontal interactions of smaller scale institutions such as those shown in Figure 8-5. The Gwich'in Tribal Council for example, regularly communicates with the Dene Nation about issues in the Northwest Territories about issues such as contaminants. In recent years, climate change has also been a key issue of discussion (Dene Nation 2005)

Although to date, these organizations appear to have had little impact on policies related to climate change, the kind of long-term knowledge collection that has taken place

through the Coop and the detailed research undertaken by the Arctic Council, may have some influence over future policy. This kind of influence is not without precedent. An investigation into the institutions involved in dealing with Persistent Organic Pollutants (POPs) suggests that knowledge sharing between communities, regions and circumpolar nations can raise critical awareness and action at national and international levels (Berkes et al. 2005a).

Multi-stakeholder agencies, such as the Diavik Diamond Mine Environmental Monitoring Advisory Board highlight how traditional knowledge can influence the planning, management and monitoring of non-renewable resource development. Environmental Agreements such as that developed for the Diavik Diamond Mine create a legal obligation for government and industry to consider and respond to recommendations made by Aboriginal groups. These Environmental Agreements and the legal obligations defined within them, seem to provide communities such as Lustel K'e with powerful tools to influence the management of their lands and resources.

Some institutions offer very limited opportunities for using traditional knowledge. The Canada Mining Regulations, enabled under the *Territorial Lands Act (1985)* for example, are based on an 'open-door policy' that does not allow for input from local communities. In effect "miners can enter onto the traditional lands of Aboriginal peoples, stake claims, go to lease, and produce and export minerals, all without the consent of the Aboriginal peoples concerned and without compensation to those peoples" (Bankes and Sharvit, 1999:1). This system however, has been criticized as unconstitutional and contrary to

Supreme Court decisions such as *Delgamukw v. British Columbia [1997], Haida Nation v. British Columbia (Minister of Forests) [2004],* and *Taku River Tlingit First Nation v. British Columbia [2004]* (Bankes and Sharvit, 1999). It is likely that in future, government as well as industry will face increasing obligations to consult with Aboriginal communities whose lands and resources may be affected by mineral development.

8.6 CONCLUSION

There is a growing body of evidence that the use of traditional knowledge in resource management leads to better management (Schulz et al. 2004; Berkes et al., 2003; Mishra, 1998; Warren, 1997). Most research however, has focused on local scale issues; there has been little consideration of how traditional knowledge is incorporated into the decision-making processes of institutions at other scales.

Land claim settlements have played a particularly important role in creating these new opportunities. However, even where land claims have not been settled, the culture of co-management that has been created by agreements in other regions of the north and Supreme Court rulings such as *Delgamukw, Haida,* and *Taku River Tlingit*, have led to new kinds of relationships between government and Aboriginal peoples.

Many of these new relationships can be characterized as multi-scale governance arrangements (Berkes et al. 2005a; Berkes 2002). This paper builds on previous research on multi-scale governance by suggesting how local, regional, territorial, national as well

as international institutions can function together to address such issues as forest fire activity, non-renewable resource development, and climate change. These kinds of multi-scale governance arrangements are not unique to the Gwich'in; other Aboriginal groups across the north are observing and experiencing similar kinds of changes in their regions and are working with institutions beyond the local level (Natcher, 2004; Nichols et al. 2004; Krupnik and Jolly, 2002; Innu Nation, 1999). As such this paper and its discussion on opportunities for including traditional knowledge in resource management decision-making has implications for other Aboriginal communities in Canada and elsewhere.

There are still many questions about the potential use of traditional knowledge in resource management; there is arguably a long way to go before traditional knowledge and western science are considered on equal ground in decision-making processes in the Northwest Territories and elsewhere. However, the opportunities highlighted in this paper are useful starting points for Aboriginal peoples, governments and other institutions seeking to learn and work together to address resource management issues of common concern.

CHAPTER NINE

CONCLUSIONS AND OPPORTUNITIES FOR FURTHER RESEARCH

9.1 INTRODUCTION

Many land-based societies, including northern Aboriginal peoples, have developed sophisticated knowledge and management practices for living in complex and dynamic environments (Moller et al. 2005; Berkes et al. 2003; Trosper 2003; Berkes et al. 2001; Alcorn and Toledo 1998; Berkes et al., 1998; Niamir-Fuller 1998; Mwesigye 1996). This Thesis has attempted to contribute to this literature through research on indicators and monitoring practices of the Denesoline and Teetl'it Gwich'in and by identifying opportunities for using traditional knowledge in resource management decision-making.

This Chapter provides a brief overview of Thesis content related to the three Thesis objectives. I discuss some of what I have learned through the research about social-ecological systems and adaptive management. This is followed by a section on the limitations of the Thesis, as well as areas for further research.

9.2 SYNTHESIS OF RESULTS BY THESIS OBJECTIVES

9.2.1 Objective One

The first objective of the Thesis was to identify and discuss indicators based on the traditional knowledge of the Denesoline and Teetl'it Gwich'in. More specifically, the Thesis provides examples of indicators of: (a) community health and well-being, (b)

social-ecological health, (c) ecosystem health, and (d) ecological variability. The research in these four areas is presented in Chapters Two, Three, Four and Five.

Chapter Two presents indicators of community health and well-being based on the local and traditional knowledge of Lutsel K'e Dene First Nation. "Health" in Chapter Two was defined, not in terms of illness or disease, but as a "way of life". This way of life was further defined in terms of self-government, healing and cultural preservation and thirteen indicator themes (See Figure 2-2).

In Chapter Three, I explored the idea of healthy social-ecological relationships by studying the berry harvesting activities of Teetl'it Gwich'in women. The Chapter summarizes findings about why berry picking is healthy, a question defined in collaboration with the case study community. The results suggest that individual preference and well-being, family well-being, social connectivity, cultural continuity, land and resource use, stewardship, self-government and spirituality are all important aspects of how Gwich'in women relate to the land.

The indicators presented in Chapter Four are based on the observations and experiences of elders and harvesters from Lutsel K'e and knowledge passed down to them from previous generations about the health of their environment. These indicators are categorized in the Chapter according to the following themes: body condition, wildlife abundance, distribution and diversity, water quality and Denesoline cultural landscapes and land features. In Chapter Five, the research focused specifically on indicators used

by Teetl'it Gwich'in women for understanding and communicating about variability in the abundance and distribution of valued berry patches. These indicators reflect change in blueberry, cloudberry and cranberry plants as well as regional, local and site specific conditions affecting these species. Some strategies for dealing with these variabilities are also presented in this Chapter including use of micro-climates, species-specific picking areas and selection of areas of resource diversity and resource redundancy.

9.2.2 Objective Two:

Harvesters from northern communities such as Fort McPherson and Lutsel K'e have spent many years living on the land observing changes in the resources and environments that are important to them. In some cases these practices of "watching the land", "tracking movements" or "checking the berries" are so systematic, they can be described as monitoring. Results of the research on monitoring practices are presented in Chapters Six and Seven.

A process of monitoring the movements of barren ground caribou developed by the Denesoline is described in Chapter Six. The Denesoline, strategically organized along the treeline, made systematic observations about movements at water crossings known to be bifurcation points. This practice not only provided perspective on caribou movements but also provided opportunities to learn about a whole range of other ecological parameters. The information captured at those crossing points goes beyond basic movement data; it carries multiple population indices based on the timing of the migration, composition of the groups, size of the groups, physical condition of the

animals, direction and rate of travel. In the Gwich'in case study, (Chapter Seven), systematic observations of variability in the abundance and distribution of valued berry patches are made by Teetl'it Gwich'in women in order to guide decisions about where, when and with whom to harvest berries. Knowledge generated from this practice of monitoring is interconnected with institutions or "rules in use" guiding decisions about access, information sharing and harvest sharing.

9.2.3 Objective Three:

The indicators and practices of monitoring described in the Thesis are embedded in the traditional harvesting practices of the Denesoline and Gwich'in. What kinds of opportunities exist for using these elsewhere? Chapter Eight attempts to answer this research question by focusing on the opportunities for including "traditional knowledge" in resource management decision-making related to forest fire management, non-renewable resource development and climate change – three issues of concern to the Denesoline and Gwich'in.

The Chapter suggests that there are many different kinds of opportunities being created through: i) regional resource management legislation; ii) land claim agreements; iii) obligations created by Supreme Court decisions on Aboriginal rights; iv) ad hoc agreements / contracts between Aboriginal groupers and decision-makers; v) obligations created by policies, protocols or guidelines; vi) formal and informal national and international arrangements; and vii) informal knowledge sharing arrangements.

It was not within the scope of this research to identify or discuss challenges for integrating Denesoline and Gwich'in traditional knowledge in resource management decision-making. Further research on these challenges would be helpful however, in pointing out how opportunities discussed in this Chapter can be realized.

The Chapters are diverse, cutting across a range of disciplinary categories and resource management themes. Given the complexity of issues facing northern communities, this multi-disciplinary approach is, arguably, appropriate; "environmental change does not lend itself to analysis by conventional approaches" (Ludwig et al. 1993).

9.3 DISCUSSION

Denesoline elder Alice Michel once told me - "The land is alive. Everything is alive... not only the plants and the animals, even the rocks and the ground". It was part of her way of explaining that ecosystems are dynamic; even the most static of resources can change in unforeseen ways. We were camping near Artillery Lake at the time, watching for signs of Bathurst caribou and studying the effects of frost boils on the landscape – large boulders perched in perfect balance atop smaller stones indeed suggested that the land was alive.

When I began my Doctoral studies, I was looking for a way of interpreting these stories and experiences. I wanted to make sense of the relationships that the Dene have to each other and the land in a way that was both meaningful to them and to my studies on

traditional knowledge and social-ecological systems. I started out with some very simple questions about the way in which people perceive their communities, their environment and their relationship to it. What is community health? What is ecosystem health? But once immersed in the Denesoline and Gwich'in communities, engaged in activities such as caribou hunting and berry picking, other kinds of research questions developed and new learnings emerged.

9.3.1 Indicators and Traditional Knowledge

This Thesis focused on a number of interrelated research questions around how the Denesoline and Gwich'in understand communicate about and deal with variability and change in their communities and the environment. One set of research questions focused on indicators of community health, ecosystem health, social-ecological health and ecological variability. One of my observations during the interview process was that interviewees in both communities tended to talk about the "health" of their communities, their environment or the "land" and their relationship to it, not in abstract categories, but by using their own experiences as points of reference. As demonstrated in Chapter Two, community members spoke about community health using stories about themselves, their family and the local community. In Chapter Four, ecosystem health was defined by the Denesoline in terms of the species and landscapes used in their subsistence resource harvesting activities. In the case of the research on social-ecological health (Chapter Three), women consistently relayed personal anecdotes or information about their own experiences berry harvesting when asked the question, "why is berry picking healthy?"

Even the indicators associated with variability in the abundance and distribution of good berry patches reflect the experiences of individual harvesters.

Interviewees also shared knowledge from previous generations. This knowledge was relayed either in story form, as in the Denesoline legend of the "old lady of the falls", as principles or rules about how to relate to other people and the land or as a descriptions of historical events. In most cases, however, I did not perceive an explicit division between knowledge about the present and knowledge about the past. Rather, there appeared to be fluidity in how people talked about historical and contemporary experience that belied these categories. This may be due in part to the fact that most stories about the past were made personal in some way through references to family members such as mothers or grandfathers. It may also be due to the fact that there is significant continuity in the beliefs, practices as well as the geography of the Denesoline and Gwich'in people. For example, the Denesoline have been caribou hunting in the same areas around Artillery Lake for hundreds, if not thousands, of years. Berry picking is also being carried out in areas that have been used by many generations. As such, the Denesoline and Gwich'in may have a sense of time and space that is relatively integrated or holistic in nature when compared to other societies who lack such continuity [1]. These observations have contributed to my understanding of traditional knowledge, not as historical knowledge, but as a living system that evolves over time.

[1] Trosper (2003) notes that societies that exhibit "cultural continuity" should not be interpreted as static. There is an important tension between cultural continuity and change in Aboriginal societies such as those of the Pacific Northwest Coast.

9.3.2 Learnings related to Social-Ecological Systems and Adaptive Management

The social-ecological systems literature and that on adaptive management formed an important foundation of my Doctoral studies. Through research with the Denesoline and Gwich'in, I came to a deeper appreciation of the dynamics of social-ecological systems and a greater understanding of the mechanics of adaptive management.

One of my observations from early in the research process is that there are, seemingly, a number of parallels in how systems ecologists and the Denesoline and Gwich'in perceive the behaviour of biophysical resources. Systems ecologists argue that variability is essential to the maintenance of ecological systems (Gunderson and Holling 2002: 9). The Denesoline and the Gwich'in also appear to recognize the importance of variability. For example, it is forbidden in Denesoline communities to "chase caribou with sticks" or camp too close to major caribou crossings. Teetl'it Gwich'in women also refer to the natural ups and downs in the productivity of berry picking areas as something to be expected. As described by Mary Ruth Wilson, "Sometimes there are a lot of changes. One year, there would be a lot of blueberries and no cloudberries; then the next year there would be a lot of cloudberries and no blueberries. It has always been like this…" (Mary Ruth Wilson February 20, 2003).

In this research, I also learned more about how ecological variability has influenced the structure and behaviour of northern societies who have depended on these resources for generations. Some of this was learned through the review of existing literature about hunter-gatherer societies but I also learned from the Denesoline and Gwich'in

themselves. The influence of the barren ground caribou on the social organization and way of life of the Dene is well documented (Smith 1978; Smith 1976). Anthropologists have also documented how the social organization of the Teetl'it Gwich'in people was traditionally driven by the seasonal activities of fishing and caribou hunting (Heime et al. 2000; Slobodin 1962). During the research, Teetl'it Gwich'in elders also talked about how berry picking played a part in where and when the Gwich'in, particularly women, traditionally gathered together in summer and early fall.

Although the structure and function of northern ecosystems may have influenced the development of northern societies, there is certainly more to the story. Part of the story deals with the resilience of the Denesoline and Gwich'in or their capacity to develop creative strategies for coping, buffering or adapting to perturbations or "surprises" in their environment. What does resilience look like at a local level? In a review of numerous case studies from a range of cultural and ecological contexts, Berkes and Folke (1998) emphasize the importance of knowledge generation about ecological dynamics, flexible and adaptive institutions, social memory or mechanism for internalizing culture, and cultural norms and values such as reciprocity. Trosper (2003) provides examples from Northwest Coast of specific kinds of resilient behaviour including (1) cooperative decision-making, (2) social learning, (3) environmental ethics, (4) contingent proprietorship, (5) balanced reciprocity, and (6) public accountability. As the research by Berkes et al. (1998) and Trosper (2003) suggests, social structures, processes and institutions such as reciprocity are key to understanding resilience. The themes and indicators identified as important to "health" in Chapter Two may provide additional

ideas about the kind of social mechanisms important for resilience. For example, I have argued elsewhere that the capacity of Lutsel K'e to deal with the effects of diamond mining is dependent, not only upon external forces such as government policies, but upon the capacity of the community to self-govern, heal and preserve the culture of their community (Parlee 1998).

The Thesis provides specific evidence about the adaptive capacity of the Denesoline and Gwich'in. One strategy developed by the Denesoline for ensuring the success of fall caribou hunting, for example, involved relocating family camps each season to areas along the treeline where caribou were expected to migrate. The research on Teetl'it Gwich'in berry harvesting revealed a range of strategies for dealing with different kinds of changes in the abundance and distribution of berries including: (a) use of microclimates, (b) selection of species-specific harvesting areas, (c) selection of harvesting areas with diverse resources and (d) selection of harvesting areas with redundant resources. The Gwich'in also appear to have developed a number of informal institutions or "rules in use" related to berry harvesting as a means of coping with natural variability including: rules around access, information sharing, and sharing in the harvesting. These adaptive strategies such as those identified in the Thesis are not developed or implemented within a vacuum. Given that ecosystems are constantly changing, ongoing knowledge generation about ecological conditions is essential. This Thesis has focused on indicators and processes of monitoring as tools of knowledge generation.

Indicators can be useful tools for sorting through the complex elements and interactions associated with social-ecological systems. "Ecosystems are complex, but not infinitely complex" (Holling 1978). Holling suggests there are key elements or aspects of the system that drive ecosystem dynamics. The key elements and processes central to the "health" of Lutsel K'e Dene First Nation were presented in Chapter Two. Some key variables underlying the relationship of Teetl'it Gwich'in women to the land were presented in Chapter Three. Other indicators related to ecosystem health and variability were also discussed (Chapter Four). Chapter Six focused on key water crossings or bifurcation points affecting caribou movements. In Chapter Five, I highlight some of key parameters that Teetl'it Gwich'in women perceive as affecting the abundance and distribution of good berry patches. Temperature and precipitation were identified as the most important variables, however, women also watch for signs and signals related to "how the berries are growing" at finer scales.

Knowledge about dynamic ecological conditions can be generated through monitoring or ongoing and systematic observation of these indicators. In the Denesoline case study, hunters strategically organized along the treeline, made systematic observations about movements at water crossings known to be bifurcation points as well as a variety of other parameters related to caribou and ecosystem health. In the case of the Gwich'in, knowledge is generated by 'checking' the land or through empirical observations and interpretations of change in individual species as well as at a regional, local and site specific scale. In both cases, this knowledge is shared and interpreted with other harvesters and in some cases becomes embedded in social memory, providing a mental

map for future harvesters seeking guidance on where and when to harvest. In the previous section I described some of the adaptive strategies developed by the Denesoline for dealing with variability and change. I then described how knowledge is generated about ecological variability though the use of indicators and monitoring. How does this process of knowledge generation help build adaptive capacity? The case study from Chapter Seven provides one example of how this works. Knowledge generated about variability in the abundance and distribution of good berry patches appears to affect the institutions or rules in use governing berry harvesting. More specifically, it appears that access to berry patches located near family camps becomes more strictly enforced during times of scarcity. Rules related to information sharing also seem to change depending on local and regional ecological conditions, as do rules for sharing in the harvest. As illustrated in Chapter Seven, dynamic interaction between knowledge generation, on the one hand, and decision-making on the other, forms the foundation for further observations and interpretation (Fig. 7-3).

In summary, there is a kind of dynamic interconnectedness in how northern communities are affected by, and in turn respond to, variability and change in their environment. Further research on these dynamic interconnections can lead to greater learnings about social-ecological systems and adaptive management.

9.3.3 Challenges to Using Traditional Knowledge in Resource Management

During my research in the north, I interacted with numerous government departments, co-management boards, industries as well as community leaders. My communication and

experience with these agencies and individuals suggests that there is interest in the kind of traditional knowledge and management practices documented as part of this Thesis. An examination of institutions engaged in the management of forest fire, non-renewable resource development and those involved in addressing issues of climate change led to a number of learnings about the potential role of traditional knowledge in resource management decision-making in the north (Chapter Eight).

Legal requirements to consult and include traditional knowledge in processes such as land use planning or environmental assessment appear to be powerful tools. Even where there are no legislative requirements, there are opportunities. Some principles and processes associated with formal co-management arrangements have, seemingly, spilled over into other areas of resource management in the Gwich'in region. A good example of this spill-over effect occurs with forest fire management. Although forest fire management was not within the scope of the Gwich'in Land Claim Settlement, government departments and communities in the region appear to operate in ways that resemble more formal co-management arrangements. Communities, such as Lutsel K'e, who live in unsettled land claim areas also seem to benefit from land claim settlements made elsewhere through this spill-over effect. In some cases, however, the lack of formal recognition and certainty about their rights to lands and resources in the region blocks the realization of these opportunities. For example, the Mackenzie Valley Resource Management Act (MVRMA) created as a result of the Gwich'in and Sahtu agreements, also applies to areas of the Denesoline traditional territory. The Act provides a variety of new requirements for including traditional knowledge in monitoring and management,

however, Lutsel K'e Dene First Nation and others have opposed the application of the Act in the Treaty#8 region on the basis that the MVRMA prejudices their own self-government negotiations.

In addition to these opportunities for integrating traditional knowledge, there are also challenges. It was not part of the scope of this Thesis research to deal with challenges, however, many have been identified and discussed in the traditional knowledge literature. An overarching theme in much of the literature relates to the divide between traditional knowledge and western science. Specifically, traditional knowledge is generally described as more qualitative, holistic, intuitive and eco-centric than western science (Berkes 1993; Johnson 1992). Given that most resource management institutions in the north, such as environment assessment and land use planning, are based on western scientific thinking (Nadasdy 2004), it would follow that opportunities for including traditional knowledge would be limited. In recent years, however, the divide between traditional knowledge and western science has been questioned. Traditional knowledge advocates, as well as policy experts, suggest that discussion of these differences creates artificial boundaries between systems of knowledge which, in practical terms, may not be so different (Berkes 2000; Roots 1998; Agrawal 1993). Other related barriers to including traditional knowledge in resource management decision-making discussed in the literature include: lack of definition and understanding of traditional knowledge (Usher 2000; Agrawal 1995), limited frameworks and methods for cross-cultural communication and poor trust (Kendrick 2004) and inequitable power relations between Aboriginal and non-Aboriginal peoples (Nadasdy 2003).

Another challenge not so commonly discussed in the literature but of obvious concern in both case study regions relates to the lack of community capacity. Neither the community of Fort McPherson nor Lutsel K'e appear to have time, personnel or financial resources to ensure that their knowledge is included in decision-making at regional, national or international scales. Limited resources available through the implementation of the Mackenzie Valley Resource Management Act (*MVRMA),* for example, has greatly limited the capacity of communities to understand the technical aspects of proposed land use permits, water licenses or environmental assessment reports. The current pace and scale of resource development activity and pressure from industry leaders also seems to have restricted the timeline available for communities and other stakeholders to engage in meaningful dialogue about specific projects or about the long-term social and environmental effects of development in the region. As a result, communities such as Lutsel K'e have become frustrated with resource management processes such as environmental assessment and their limited capacity to participate (Krieger 2003). Further research related to the challenges of including traditional knowledge in resource management decision-making in the north would increase understanding of how the opportunities identified in Chapter Eight can be realized.

9.3.4 Understanding the Traditional Knowledge of the Denesoline and Teetl'it Gwich'in

The research has also provided me with an applied understanding of some of the characteristics and assumptions about traditional knowledge that are found in the literature. One key assumption is that traditional knowledge is integrated and holistic in

nature; disciplinary divisions between social and ecological often don't make sense at the community level (Berkes 1993).

This integrated perspective does appear to be important in understanding the knowledge of the Denesoline and Gwich'in. Elders and harvesters provided knowledge about their natural environment during the interview process. Interwoven with information about biophysical conditions, however, was information about individuals, families, and communities, social and cultural events and experiences on the land. For example, many of the stories about the movements of caribou or about the effects of weather on berry patches were associated with family harvesting activities. The arrival of the caribou at Artillery Lake in the fall was, and continues to be, a key event in the lives of individual harvesters and the community as a whole. When many cloudberry, blueberry and cranberry patches around Fort McPherson were damaged by a late frost in 2002, it had an effect on the relationship that women have to the land and to each other.

Another key assumption is that traditional knowledge is diachronic and local in nature. It has been argued that the historical continuity or longevity associated with many harvesting practices coupled with the proximity of harvesters to the resource enables them to observe and interpret changes not necessarily visible at larger scales (Moller et al. 2005; Berkes 1999). The Denesoline and Gwich'in knowledge and management practices documented in this Thesis also appear to be diachronic and local in nature [2].

[2] A review of the academic literature was carried out in relation to barren ground caribou movements in the Denesoline region and forest ecosystems in the Gwich'in Settlement Area (See Chapter Five and Six). It was not, however, an objective of the Thesis to identify and compare other kinds of knowledge about caribou and berries with that documented in the case studies.

Oral history from the Denesoline elders and archaeological evidence suggests that the big caribou crossings at Artillery Lake for example, have been used for hunting for many many generations (Noble 1981; Noble 1971; Macneish 1951). Teetl'it Gwich'in women also draw on their elders' knowledge about where and when to find the best cranberries, blueberries and cloudberries.

Denesoline and Gwich'in knowledge is not, however, exclusively local in nature. The research shows how harvesters are able to expand the geographic scale of their knowledge by interacting with other harvesters in other locales. In the Denesoline case study, hunters gain knowledge about caribou movements across a distance of several hundred kilometres by communicating with other hunters spread out along the treeline. Likewise, Gwich'in women learn more about "how the berries are growing" across the region by communicating with other berry harvesters from Fort McPherson and neighbouring communities.

Another characteristic often attributed to management practices based on traditional knowledge is that they are more "human" in nature than those used in conventional resource management. This claim has been made about a variety of management practices including monitoring (Moller et al. 2005). This research also suggests that monitoring need not be a highly technical process that is separated from the every day lives of communities. The process of observing, interpreting and reporting of data in the Denesoline and Gwich'in case studies is embedded within the harvesting practices of those communities. Unlike many technical data collection processes, this kind of

monitoring may be considered more “human” in its affirmation of social and cultural practices, beliefs and values important to the Denesoline and Gwich’in way of life.

Another characteristic or assumption about traditional knowledge is that it is intuitive in nature (Berkes 1993). The Anishanabe of Shoal Lake for example, argue that knowledge is generated not only through the study of the biophysical landscape but through the “experience” of the being on the land (Davidson Hunt and Berkes 2003). Anthropologist Smith (1978) in his work on Chipewyan ontology suggested that some Denesoline seem to have a capacity to sense what is happening in their environment, without seeing any kind of physical signs or signals. Others have taken a phenomenological approach, describing the relationship that hunter-gather peoples have to the land in terms of the “poetics of dwelling” (Ingold 2000). While out on the land with elders and harvesters, I also came to appreciate Denesoline and Gwich’in knowledge as more than an accumulation of tactile observations. I had a strong sense at times that the land had its own voice and spirit and was telling its own story; “the land is alive” after all. The ability that the Denesoline and Gwich’in have to hear this voice consistently over time, may come from the love they have for the “land”. As described by Denesoline elder Maurice Lockhart, “Some people who don't care so much won't notice the changes” (Maurice Lockhart, May 11, 2000).

9.4 LIMITATIONS OF THE RESEARCH

The Thesis is a collection of individual papers about indicators and monitoring practices and as such does not contain a single literature review or methods chapter. Instead, each of Chapters Two through to Eight contain their own specific literature review and discussion of methods relevant to the content. This format enabled me to develop my research findings in individual papers suitable for publication. Although there are obvious benefits to this approach, there are several limitations. First, some of the papers are shorter and do not contain the same level of detail about methods that might be found in a conventional dissertation. To address this problem, I have added a summary of methods as an Appendix (Appendix A) to the Thesis. Given that the Chapters were developed for different kinds of publications from several different disciplines, the Thesis may not read as a unified document. To help address this problem, I developed the Thesis Introduction and Conclusion around objectives and themes from the literature that are common to all of the Chapters.

There were also some differences in how the research was defined and carried out in the two case study communities and how the results are presented in this Thesis. Although indicators and monitoring were the constant theme in both cases, there was no single research question. Instead, a series of interrelated research questions were developed or evolved over time (See Chapter One). As such the Thesis is a living document, reflecting

my own learning process about the knowledge and management practices of the Denesoline and Teetl'it Gwich'in.

The research questions also reflect the specific research interests of the case study communities. In the case of Lutsel K'e, for example, the community was interested in documenting the knowledge of older elders before they passed on. During these interviews, elders tended to relate experiences about the recent or distant past and stories told to them by previous generations. Consequently the case study on caribou monitoring is written in the past tense.

In the case of Fort McPherson, the research was guided by a group of active berry harvesters. As a result, the monitoring practice described in Chapter Seven is a contemporary one and is therefore framed in the present tense. Despite these different timeframes, the knowledge documented in both case studies can be described as traditional knowledge in the sense that there is some historical continuity to the knowledge and practices in use today with those in use by previous generations. In other words, caribou hunters and berry harvesters do not carry out their activities in a temporal vacuum; why, when, where, how and with whom they harvest is guided by the knowledge of previous generations. The knowledge of current harvesters will likely inform the activities of future harvesters.

The loss of elders and a land-based way of life is a concern to many northern communities. It was not, however, a goal of the research to document or explore this

decline. Rather I, in collaboration with research partners, chose to focus on knowledge and practices of value to local community members with the aspiration that the research might serve to help the Denesoline and the Gwich'in preserve their knowledge and resource management practices for future generations. Further research is needed at the local level however, to help identify in specific ways in which traditional knowledge can be meaningfully and appropriately transmitted, stored, interpreted and used in the future.

The previous discussion points out some of my key learnings related to social-ecological systems, adaptive management as well as traditional knowledge. Further research in other case study regions is needed to better understand how indicators and monitoring practices based on traditional knowledge can increase our understanding of social-ecological systems.

9.5 AREAS OF FURTHER RESEARCH

An important area of further research relates to the complementarity of traditional monitoring systems with those already developed in the case study regions. Governments, industry and non-governmental organizations are increasingly interested in monitoring in relation to such issues as climate change, oil and gas exploration, mining and hydro-electric development. Monitoring programs can, however, be costly and methods and technologies not always socially and culturally accepted by northern communities. Caribou collaring of the Beverly Caribou herd, for example has received a mixed reception by the Dene and Inuit communities who depend on this herd. While

some harvesters welcome the new knowledge that this kind of monitoring would bring to their communities, others maintain that radio-collaring of wildlife is disrespectful (Wakelyn 2001). Where efforts are made to build on local values, knowledge and practices, monitoring can potentially offer social and cultural enrichments to local community members. Further research in this area is needed to identify these potential benefits.

The research results presented in Chapter Four deal with a broad range of indicators used by the Denesoline for understanding and communicating about ecological change. These indicators relate to species body condition, wildlife abundance, distribution and diversity, water quality and Denesoline cultural landscapes and land features. Through the process of identifying these indicators, elders and harvesters shared their observations and experiences related to a range of ecological issues including forest fire activity, climate change, hydroelectric development, the effects of uranium mining at Stark Lake and diamond mining in the Bathurst Caribou range. Some of these issues have been explored in depth in other research projects (Bielawski 1993). Other issues, such as those related to diamond mining, are newly emerging. Further research into the latter would be of value to the community and would add depth to the discussion about the indicators presented in Chapter Four.

Further understanding of the value of the Thesis results could also be developed through research and comparative analysis of the Denesoline and Gwich'in indicators and monitoring practices with other indicators and monitoring initiatives currently in place in

the region. A significant number of monitoring programs have been developed in relation to both caribou and vegetation. For example, there are seven different kinds of caribou research and monitoring programs that have been carried out or are currently ongoing with respect to the Bathurst and Beverly Caribou herds (NWT CIMP 2005). Plantwatch, being coordinated by Ecological Monitoring and Assessment Network – North, focuses on changes in vegetation as does the Arctic Borderlands Knowledge Coop (Morin 2005; ABKC 2005). Traditional knowledge has been used in some of these initiatives, however, there is, arguably, a great deal more that can be learned. Are the ecological indicators presented in Chapter Three, Four and Five distinct from those currently used by government in the Gwich'in and Denesoline regions? Can the Denesoline approach to monitoring offer new insights into caribou movements and the effects of diamond mining in the region? What can resource management institutions such as the Gwich'in Renewable Resources Board learn from the process of knowledge generation and institutions developed by Gwich'in women? To fully answer these questions, additional research and analysis into the characteristics of other kinds of monitoring is needed.

Another key area of research relates to forest fire activity. In both the Denesoline and Gwich'in region, elders provided observations about forest fire. Some elders in the Gwich'in region said that forest fire is an important part of Mother Nature's cycle. Other elders, such as Pierre Marlowe, expressed concern that fire was destroying caribou habitat near the community of Lutsel K'e. Further research is needed to better understand elders' knowledge of forest fire. A study specifically on forest fire history

could help determine the natural cycle of fire in the region and how this cycle has been altered by fire suppression activities and climate change.

Land and resource use practices of Aboriginal women have received only minimal consideration in the academic literature relative to male dominated harvesting practices, namely hunting and trapping. I have aspired to address this gap with research on the berry harvesting practices of Teetl'it Gwich'in women from Fort McPherson. Only some aspects of this practice and its importance to the case study community were dealt with in the Thesis. Further research in this area is needed to more fully understand the social, cultural, economic and spiritual importance of this practice.

Many of interviewees in both the Denesoline and Gwich'in regions communicated their observations about change in the weather conditions including temperature and precipitation. Elders Noel Drybone and Maurice Lockhart for example, talked about water levels dropping in certain rivers and lakes near Lutsel K'e. Elder Pierre Marlowe and Alice Michel spoke about increases in the incidence of forest fire. In the Gwich'in region, many women talked about warming temperatures, decreases in precipitation in summer and winter and increases in extreme weather events. Further research and analysis related to these observations would contribute to the growing body of local and traditional knowledge emerging from the north about climate change and its effects on northern communities and traditional livelihoods (Nuttall et al., 2004; Krupnik and Jolly 2002; Berkes and Jolly, 2001). More specifically, further research on indicators of climate change effects on the subsistence lifestyle of northern communities is needed.

9.6 CONCLUDING COMMENTS

Northern Aboriginal communities have always had to deal with variability and change in their communities and the environment. In recent years, however, the pace and scale of change has, seemingly, increased in the north as a result of mining, oil and gas exploration and development, forest fire activity and the effects of climate change. As described by one northern elder, "the earth is faster now" (Krupnik and Jolly 2002). How will communities cope with these changes? What kinds of tools are available to help them learn and adapt to their changing environment? These are questions of growing interest to government, industry as well as community leaders. Through this Thesis research, I aimed to demonstrate that northern Aboriginal communities have knowledge and capacity for understanding, communicating about and dealing with ecological variability and change and as such can make a valuable contribution to the management of northern ecosystems.

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APPENDIX A

RESEARCH AGREEMENTS, CONSENT FORMS, AND SUMMARY OF METHODS

Research Agreement
"Understanding Changes in the Land: Gwich'in Harvesting of Berries"

The Research Agreement hereinafter known as **"GRRB / *GSCI*/ *Teetl'it* Gwich'in RRC Research Agreement**" made this day of November 30, 2002.

BETWEEN

The Gwich'in Renewable Resources Board, Gwich'in Social and Cultural Institute and *Teetl'it Gwich'in* Renewable Resource *Council* who are directing the Research, hereinafter referred to as the:

GRRB / GSCI / *Teetl'it* Gwich'in RRC
OF THE FIRST PART

AND

Brenda Parlee
OF THE SECOND PART
hereinafter referred to as the "Researcher."

Whereas the Researcher (Brenda Parlee) is carrying out this research project as part of the requirements of a Doctoral degree from the Natural Resources Institute, University of Manitoba. And as part of these requirements, and subject to the terms set out in part 1-8 of this Agreement, the results will be included in the following public documents:

a) A Doctoral Thesis;
b) Academic and other publications and presentations or any other product resulting from this research in any media form and;

Whereas the **GRRB / GSCI / Teetl'it Gwich'in RRC** and the **Researcher** agree to undertake a Research Project concerning Gwich'in harvesting practices of berries and other plants as defined by the research proposal to the Sustainable Forest Management Network entitled, "Social-Ecological Indicators for Community-Based Monitoring and Forest Resource Management" (Appendix A). This research project is hereinafter described as the "Research Project".

THIS AGREEMENT NOW WITNESSES, THEREFORE, that the parties agree to the following:

2. The purpose of this Research Project, as discussed and understood by the **GRRB / GSCI / Teetl'it Gwich'in RRC** and the **Researcher** is to gather traditional ecological knowledge from the Teetl'it Gwich'in related to berries and berry harvesting for the purposes of developing social-ecological indicators for community-based monitoring and forest management.

3. The scope of the Research Project, as discussed with and understood by the **GRRB / GSCI / Teetl'it Gwich'in RRC** relates to berry and berry harvesting practices, however, may include knowledge related to other non-timber forest products including medicinal plants, driftwood and related resources and resource harvesting activities.

4. Methods to be used, as agreed by the **GRRB / GSCI / Teetl'it Gwich'in RRC** and the **Researcher** include:

a) Interviews, discussion groups, and workshops to gather traditional ecological knowledge from the community of Fort McPherson; and
b) Meetings with the GRRB, *GSCI*, RRC and community members who participated in the project AND if there is a community steering committee to guide the research, then the community steering committee AND/ OR a committee composed of a person representing each of the organizations plus an academic supervisor to verify and communicate results.

5. Capacity building and community participation, as agreed, is to include:

a) Hiring and training of a local community member from Fort McPherson;
b) Community participation (8-12 elders and harvesters) through interviews and workshops;
c) Communication and knowledge sharing with GRRB and staff in Inuvik;
d) *Communication and knowledge sharing with GSCI staff in Tsiigehtchic and/or Yellowknife* and
e) Communication and knowledge sharing with the RRC and staff in Fort McPherson.

6. Ethics:

- This Research Project and Agreement has been submitted to, and approved by, the University of Manitoba Ethics Committee and the Aurora Research Institute. The Researcher will adhere to the recommendations contained in "Ethical Principles for the Conduct of Research in the North" as well as the "Tri-Council Policy Statement of Ethical Conduct for Research Involving Humans."

7. Interviews and Informed Consent:

a) Interview

- The interview process will be relaxed and open-ended
- Questions/guiding statements will be used to facilitate the interview. (Appendix B) These questions/guiding statements may be adapted by the GRRB/ GSCI/ Teetl'it Gwich'in RRC or the Researcher in order to focus the interview on information that is needed to meet the goals and objects of the study.
- The person being interviewed will be encouraged to speak in the language in which they feel most comfortable, either in their indigenous language or English;
- Should they choose their indigenous language, a translator the participant is comfortable with will be required
- The interview will be scheduled at a time convenient to the person being interviewed, and at the location of their choosing
- If possible, interviews could be conducted on the land to facilitate memory

b) Consent to Conduct Interview:

- Prior to interviews being conducted interviewees will be asked if they wish to take part in the project
- A Research Summary and Consent Form (Appendix B) will be presented to the interviewee(s) to ensure that they are aware of the nature of the Research Project;
- If the interviewee does not want to participate in the Research Project and Interview Process, the interview will not take place.

c) Consent to use Results of Interview in Thesis and other Publications:

- Verbal or written consent to use the interview results in a publication will also be obtained from the interviewee;
- Where verbal or written consent to use the interview results in publication is given, the **Researcher** will ensure that the interviews are acknowledged by name in all material or public statements generated from the information collected. Where written consent to use the research results in publication is NOT given, the **Researcher** will ensure that any material or public statements generated from the information collected from the participant does NOT contain statements or quotes which are attributable to the interviewee and that names of interviewee does not appear in the material.

d) The **Researcher** will verify interview results (present the results back to the interviewee) within 6 weeks of the interview to ensure that the information is accurate.

8. Information collected is to be shared, distributed and stored in the agreed ways:
   a) Raw data (results interviews and workshops, audio and video tape) gathered for the purposes of the Research Project will be made available through the GRRB, RRC office. Copies of all raw data including but not being limited to audio and video tape and written notes will be deposited with the Gwich'in Social and Cultural Institute;
   b) Should any of the research material from this project be used or made available for use in future for the purposes of and production of any publications or videos or any media format, then the **GRRB / GSCI / Teetl'it Gwich'in RRC** will be contacted prior to any project beginning to enlist their involvement in same;
   c) Activity reports and summaries of results of the Research Project will be presented to the **GRRB / GSCI / Teetl'it Gwich'in RRC** twice yearly beginning April 1, 2003 until March 31, 2004.
   d) A final project report will be developed for the **GRRB / GSCI / Teetl'it Gwich'in RRC** on December 31, 2004.

9. Communication regarding the project with all other parties (including the Sustainable Forestry Management Network - SFMN) will be handled in these agreed ways:
   a) All reports of the Research Project (including publications and presentations) will be *reviewed* by the **GRRB / GSCI / Teetl'it Gwich'in RRC** or their representatives before being distributed to other parties;
   b) The Researcher will fully acknowledge the **GRRB / GSCI / Teetl'it Gwich'in RRC** and interviewees involved in the Research Project (depending on consent as discussed in part 5).
   c) A poster for each community will be prepared summarizing the goals and findings of the study. A one-page summary of the goals and results of the project will be provided to all participants.

10. In the event that the **GRRB / GSCI / Teetl'it Gwich'in RRC** has reason to believe that the terms and conditions of this Agreement are not being met by the Researcher, they may terminate this agreement and the Research Project upon giving such period of notice as the **GRRB / GSCI / Teetl'it Gwich'in RRC** deems appropriate.

11. In the event that this Agreement is terminated, in accordance with part 8 or part 15, the Researcher shall return all originals and copies of raw data, including video, audio and written materials collected or prepared for the purposes of the Research Project to **GRRB / GSCI / Teet'lit Gwich'in RRC**.

12. The Researcher has acquired funding and other forms of support for this Research Project from the Sustainable Forest Management Network who has imposed the following criteria and reporting responsibilities on the Researcher:
    a) March 31, 2003 – Report – Preliminary Indicators of Social-Ecological Health
    b) March 31, 2004 – Report – Comparison of Indicators with other SFMN Projects
    c) March 31, 2005 – Report - Indicators in Forest Resource Management

13. The **GRRB / GSCI / Teetl'it Gwich'in RRC** agrees to:
    a) Participate in and support the project (workshop discussions, feedback on project and information gathered) and;
    b) Review for approval/disproval any reports and materials intended for public communication and distribution;
    c) Support the Researcher in gathering information as set out in parts 1-6.

14. The Researcher undertakes to:
    a) Proceed with Research Project according to the goals and objectives set out in the proposal (See Appendix A) and according to the terms and conditions set of in this Agreement;
    b) Work under the direction of the **GRRB / GSCI / Teetl'it Gwich'in RRC** and Steering Committee if one is formed;
    c) Act as a resource person with respect to the Research Project and its topic.

15. The Researcher agrees to stop the Research Project under the following conditions:
    a) By consensus decision of the **GRRB / GSCI / Teetl'it Gwich'in RRC**;
    b) If the Researcher is not able to adhere to the terms and conditions of this agreement;
    c) If the **GRRB / GSCI / Teetl'it Gwich'in RRC** terminates the Researcher pursuant to part 9.

_____Date: _____
Teetl'it Gwich'in Renewable Resources Council
James Andre

_____Date: _____
Gwich'in Renewable Resources Board
Robert Charlie

_____Date: _____
Gwich'in Social and Cultural Institute
Leslie McCartney

_____Date: _____
Researcher
Brenda Parlee

Project Summary and Consent Form for Interviews in Fort McPherson
"WATCHING OVER THE BERRIES SO THAT WE CAN BE HEALTHY"

Researcher:	**Brenda Parlee, University of Manitoba**
Research Assistant:	**Christine Firth, Fort McPherson**
Partner:	Gwich'in Renewable Resources Board, Teetl'it Gwich'in Renewable Resources Council, Gwich'in Social and Cultural Institute
Study Funding:	Sustainable Forest Management Network2002-2004

Project Description:
I am working on a research project with the Teetl'it Gwich'in Renewable Resources Council, the Gwich'in Renewable Resources Board and the Gwich'in Social and Cultural Institute. This project is part of my Doctoral Thesis at the University of Manitoba. I am interested in talking to you about berries and berry harvesting:

- What are the signs and symbols (indicators) traditionally you use to recognize changes in berries and other plants?
- How do you watch, listen, learn, understand and adapt to these changes?

Some of the questions I would like to ask you include:

- What kinds of berries do you harvest?
- Where do you go for berries? Are some areas better than others?
- How do people harvest the berries? (Do people mostly go in family groups?)
- What do people do if some good berry picking areas close to the community are affected by late frost, a dry summer or an early winter? How do they know where to go instead?

Research Protocols: Results of the interview with you will become public.

- This study has been approved by the University of Manitoba, Joint-Faculty Research Ethics Board (Protocol #J2002:121)
- I will acknowledge you by name in all research documents and materials, or if you prefer the results of your interview can be coded to Person A or 001 etc. so that the public does not know who shared the information;
- If there is any information that you would not like to share publicly, please let me know.

I understand and agree to participate in this research project as outlined above. I understand that I can choose not to answer questions that are asked and can stop the interviews or withdraw (quit) the project at any time without prejudice or consequence.
I DO ___ want my name to be shared in public documents/ presentations.
I DO NOT ___ want my name to be shared in public documents/ presentations.

Interviewee _____ Date: _____

Witness _____ Date: _____

If you require additional information, please contact
Brenda Parlee (403) 561-8443 or Dr. Fikret Berkes at (403) 474-6731.
If you have any concerns or complaints about the ethics of this project, please contact the
University of Manitoba, Human Ethics Secretariat at (204) 474-7122

RESEARCH AGREEMENT

Social-Ecological Health:
"The connection between the health of the people and the land"

The Research Agreement hereinafter known as Research Agreement made this day of November 25, 2002.

BETWEEN

Lutsel K'e Dene First Nation who are directing the Research, hereinafter referred to as:

Lutsel K'e Dene First Nation
OF THE FIRST PART

AND

Brenda Parlee
OF THE SECOND PART

hereinafter referred to as the "Researcher."

Where as the Lutsel K'e Dene First Nation and the Researcher agree that the Project focuses on the relationship between health of the community and the health of the "land" (ecosystem) and discusses how i) monitoring and indicators are important tools for understanding this relationship, and ii) how these tools can be useful in self-government (under the self-government agreement currently being negotiated by Treaty#8).

THIS AGREEMENT NOW WITNESSES, THEREFORE, that the parties agree to the following:

1. The purpose of this Research Project, as discussed and understood by Lutsel K'e Dene First Nation and the Researcher is to analyze the results of research projects carried out under the West Kitikmeot Slave Study Society in the community of Lutsel K'e including:

    - Community-Based Monitoring Project
    - Traditional Knowledge Study on Community Health
    - Traditional Knowledge Research in the Kache Kue Study Region

2. The scope of the Research Project, as discussed with and understood by the Lutsel K'e Dene First Nation is defined by the scope of the projects (above) funded by the West Kitikmeot Slave Study Society.

16. Methods to be used, as agreed by the Lutsel K'e Dene First Nation and the Researcher include:

    c) Analysis of existing local and traditional ecological knowledge previously gathered as part of the West Kitikmeot Slave Study Society studies;
    d) Verification interviews with elders, harvesters and others involved in those studies;
    e) Meetings with Lutsel K'e Dene First Nation (Elders Committee, Wildlife, Lands and Environment Committee) to verify and communicate results;
    f) Preparation of a thesis, written reports for the community as well as academic papers and presentations.

17. Informed consent of individuals who participated in the previous studies will be obtained in these ways:

    a) A consent form outlining any direct or indirect quotations used in the preparation of the thesis, written reports and/or publications will be presented to the individual (or in the case of a deceased elder to his/her closet family member);
        - Where consent is given these quotes will be included in any written or oral presentations;
        - Where consent is not given, these quotes will not be included in any written material or oral presentations;
    b) As part of this process the Researcher will also consult with the community researchers who participated in the studies.
    c) The final papers and reports will be presented to Lutsel K'e Dene First Nation.

18. Information collected is to be shared, distributed and stored in the agreed ways:
    e) Activity reports and summaries of results of the Research Project will be presented to Lutsel K'e Dene First Nation twice yearly beginning April 1, 2003 until March 31, 2004.
    f) A final project report will be developed for the Lutsel K'e Dene First Nation on December 31, 2004.

19. Communication regarding the project with all other parties (including the Sustainable Forestry Management Network - SFMN) will be handled in these agreed ways:

    d) All reports of the Research Project (including publications and presentations) will be approved by the Lutsel K'e Dene First Nation or their representatives before being distributed to other parties;
    e) The Researcher will fully acknowledge Lutsel K'e Dene First Nation and interviewees involved in the Research Project (depending on consent as discussed in part X).
        - In academic publications, the Researcher will appear as first author where the written product is based on academic analysis of the material. Lutsel K'e

Dene First Nation shall appear as first author where the publication is a summary or a report of results.

20. In the event that Lutsel K'e Dene First Nation has reason to believe that the terms and conditions of this Agreement are not being met by the Researcher, they may terminate this agreement and the Research Project upon giving such period of notice as the Lutsel K'e Dene First Nation deems appropriate.

21. In the event that this Agreement is terminated, in accordance with part 7 or part 14, the Researcher shall return any copies of raw data, including video, audio and written materials being used as part of the Research Project to Lutsel K'e Dene First Nation.

22. The Researcher has acquired funding and other forms of support for this Research Project from:
    a) Northern Scientific Training Grant;

23. The Researcher shall also adhere to the terms and conditions set out by the West Kitikmeot Slave Study Society for the use and analysis of material as part of this Research Project and will acknowledge their support in any academic publications or presentations.

24. The Research Project is being carried out as part of the requirements of a Doctoral degree from the Natural Resources Institute, University of Manitoba. The members of the Doctoral Committee are Fikret Berkes, John O'Neil, Nigel Bankes and Micheline Manseau of Winnipeg and Calgary. As part of these requirements, and subject to the terms set out in this agreement, the results will be included in the following public documents:
    c) A Doctoral Thesis;
    d) Academic publications and presentations.

25. Lutsel K'e Dene First Nation agrees to:
    d) Participate in and support the project (workshop discussions, feedback on project and information gathered) and;
    e) Review for approval/disproval any reports and materials intended for public communication and distribution;
    f) Support the Researcher in gathering information as set out in parts 1-6.

26. The Researcher undertakes to:
    a) proceed with Research Project according to the goals and objectives set out in the proposal (See Appendix A) and according to the terms and conditions set of in this Agreement;
    b) work under the direction of Lutsel K'e Dene First Nation;
    c) act as a resource person with respect to the Research Project and its topic.

27. The Researcher agrees to stop the Research Project under the following conditions:

d) By consensus decision of the Lutsel K'e Dene First Nation;
e) If the Researcher is not able to adhere to the terms and conditions of this agreement;
f) If Lutsel K'e Dene First Nation terminates the Researcher pursuant to part 8.

Chief Archie Catholique
Lutsel K'e Dene First Nation

_____Date: _____

Charlie Catholique – Chair
Lutsel K'e Wildlife, Lands and Environment Committee

_____Date: _____

Brenda Parlee - Researcher

_____Date: _____

SUMMARY OF RESEARCH METHODS

SUMMARY OF RESEARCH METHODS - CHAPTER TWO

Chapter Two draws on the results of interviews carried out between 1995-1996 in Lutsel K'e, NT as part of my Master's Degree at the University of Waterloo. The interpretation and analysis of these results using medical anthropology, cultural epidemiology and related community health literature was carried out as part of my Doctoral research activities in 2002-2004 under the guidance of Dr. John O'Neil.

Four primary research activities were involved in the research on community health indicators in Lutsel K'e:

Scoping with research community (Lutsel K'e)

The focus of the research was developed in collaboration with the Lutsel K'e Dene Band and Wildlife, Lands and Environment Committee in December 1995. Ongoing communication about project rationale and issues occurred between the Band and myself occurred between December 1995 and June 1996. Once I arrived in the community in June 1996, these organizations provided guidance about research design and methods and recommended:

- Hiring of a local person as a research assistant who could learn more about research and issues of community health;
- Chipewyan terminology documentation and development around terms of "community health"
- Semi-directed interviews with each household in the community
- Small group meetings and workshops
- Plain language reporting / verification

Community Research Assistant:

A community research assistant (Angie Lantz) was hired by the Band with funds from the research project to assist with the implementation of the research on community health and to ensure knowledge and skills were being transferred to the community as part of the research process. Knowledge and skills were transferred to the research assistant through:

- ongoing discussions about the research focus;
- provision of reading material on research methodologies;
- on-the job training in interviewing methods and data organization;
- providing opportunities to learn about the big picture of research by attending workshops / conferences;

Knowledge was transferred to me through ongoing communication about community issues, translation of elders' knowledge from Chipewyan to English and through introductions to community members being interviewed.

Terminology Documentation and Development

I worked with two language instructors in the community (Alizette Abel and Archie Catholique) and an elders committee to help define the meaning of health in the Chipewyan language. To help me understand more about the terminology and to help communicate with members of the community during interviews, I attended Chipewyan language lessons during June, July and August of 1996.

Semi-directed interviews

The primary method of data collection was semi-directed interviews. Over one hundred (105) interviews were carried out with each household in the community between June and September of 1996. Before we actually began visitation, a consent form was developed to ensure those people participating in our study that their information was confidential.
The guiding questions included:

- "What is a healthy community?"
- "What do you think about (like or dislike) your community?"
- "What is it about the Dene chan'ie (Dene way of life) that is important?".

Although we planned only to spend ½ hour to1 hour with each person, often the interview would last over 2 hours. The results of the interviews were documented in short hand or were audio-recorded. The transcripts of these interviews were digitally transcribed (typed up in MSWord) and are currently held by the Wildlife, Lands and Environment Committee.

Small Group Meetings and Workshops

Several small group meetings were held with members of the community who were not involved in individual interviews. These included:

- School visit (June 1996)
- Elders workshop (June 1996)
- Youth on-the-land workshop at Wildbread Bay (July 1996)
- Participatory Mapping workshop with Children ("mapping favourite places in the community")

Analysis

Once the interviews were completed, we did an initial review of data to interpret key themes and sub themes. (Figure 3) These themes and sub-themes were confirmed during a Lands and Environment Committee meeting. Poster displays of themes were made for the Band Office to facilitate discussion around the project and generate further ideas.

The data was then coded by the researchers according to the sub themes in order to facilitate analysis for indicators. For example anything in the data related to leadership was coded A. Anything related to economic issues was labeled C. As the

analysis continued the coding evolved. Some categories were collapsed into others and eventually more specific codes were developed A1, A2, A3 as shown in Appendix B. There was no cross-referencing analysis done between the coded categories to determine relationships between community concerns.

The coding system was developed to facilitate the researchers finding commonly mentioned indicators in the interview data. The research trainee was involved in the coding of the data, however, was not able to participate in the analysis of indicators. Each coded category (i.e. A1, M2 etc.) was reviewed by the project director with the question in mind "what are signs of change?" Indicators were limited to 3 per category. Given the expanse of data that was collected in the interviews, finding 3 indicators per coded category was not difficult.

Indicators came in the form of what people saw, heard or felt in the context of the issues they were discussing. For example one the theme of good leadership, many people talked about leaders from the past who used to communicate well by doing a lot of homevisits. Homevisits as a sign of good leadership was mentioned frequently by people in the community. On the theme of togetherness in the community, gossip was often mentioned as a sign of bad social relationships. Because of what people saw, heard, or felt as a result of gossip in the community, they determined it was a negative sign of community togetherness. Numerous people focused on a decrease in gossip as an indicator of community togetherness.

An indicator was selected during analysis if it was referred to by more than 10 people during homevisits or in other words, had a 10% weighting. The majority of indicators fell around the 35-60 % weighting while some of the more significant indicators fell into the 80-90% weight area. Approx. 60 *quantitative and qualitative indicators* were developed during homevisits.

Plain Language Reporting / Verification

The results of interviews and the analysis were verified as relevant indicators of community health with the Wildlife, Lands and Environment Committee during a public meeting in August 1996 and again in September 1996. Additional verification about the relevance of the indicators also came with the development of a follow-up project on community-based monitoring carried out between 1998-2001.

Review and Verification of Chapters Two

I developed a draft of Chapter Two and presented it to the Wildlife Lands and Environment Committee and the Elders Committee for review in 2004. Members of the Committee were given copies of the paper for review. There were no concerns recorded from the Committee about the Chapter.

Review and Consent to Use Quotations in Chapter Two

I carried out a series of verification interviews with the individuals quoted in the Chapter to:

- ensure the accuracy of the quotes;

- gather feedback from them about the key arguments of the Chapter and the context of their quotation;
- Acquire consent for the use of the quotation in the Chapter and in a publication.

A Chipewyan translator was hired to assist in this process to ensure that elders fully understood what was being told and asked of them. There were only two individuals who did not want their names used in the Chapter. Their names were therefore removed.

Additional details about the research process can be found at: http://www.wkss.nt.ca/HTML/08_ProjectsReports/PDF/ComBasedMonSlaveGeol.pdf

SUMMARY OF RESEARCH METHODS - CHAPTERS THREE, FIVE, SEVEN

Chapters Three, Five and Seven are based on research carried out between 2002-04 in Fort McPherson, NT as part of my Doctoral research.

The research was carried out in collaboration with the Teetl'it Gwich'in Renewable Resource Council, the Gwich'in Renewable Resource Board and the Gwich'in Social and Cultural Institute. The Project Team includes an Advisory Team of Teetl'it Gwich'in berry harvesters, a community researcher (Christine Firth) and myself. Together we carried out research about berries and berry harvesting.

Development of the Funding Proposal

A funding proposal was developed with the Gwich'in Renewable Resources Board and submitted to the Sustainable Forest Management Network in the fall of 2001. I was named as the Project Director with Dr. Fikret Berkes named as the Principal Investigator. The case study community was defined as Fort McPherson. The goals and objectives of the proposal were focused around harvesting of non-timber forest products, specifically berry harvesting. These goals and objectives were defined under the guidance of the Executive Director the Gwich'in Renewable Resources Council and using my own knowledge of the community and their interest in berry harvesting. The Sustainable Forest Management Network funded the proposal for a three year period (2002-2004).

Secondary Source Information Review

A preliminary review of existing information about non-timber forest products and related issues in the Gwich'in region took place in June-July, 2002. This included meetings with the partner organization and staff; a review of existing reports and the Gwich'in Ecological Knowledge Program (GEKP) database system. A total of thirty-one (31) records from the data base were reviewed however, no references to berry harvesting were found.

Additional resource people were also identified and contacted. An important aspect of the secondary information review involved the review of Teetl'it Gwich'in terminology, particularly that related to berries, plants and landscape features. The Gwich'in Social and Cultural Insittute also carried out a review of placenames to identify those related to Teetl'it Gwich'in berry harvesting. No specific references to berries or berry harvesting sites were found in their review of the place names.

Development of a Research Agreement and Research Permits

A research agreement between myself, the Teetl'it Gwich'in Renewable Resources Council, the Gwich'in Renewable Resources Board, the Gwich'in Social and Cultural Institute and the Gwich'in Tribal Council was developed and completed in early 2002. The agreement focused on such questions as:

- How will knowledge be gathered in the community? Who will be involved?
- How will harvesters / elders be recognized and compensated for sharing their traditional knowledge?

- How will elders / harvesters give consent / or not for interviews and/or the use of results of interviews?
- How will the results of the study be verified and reported?
- How will the results of the study be shared outside of the community?

This research agreement became the basis of my research permit applications to the Aurora Research Institute in 2002 and renewals in 2003 and 2004. A plain language summary and consent form was developed to communicate the purpose of the project with the community. A copy of the Research Agreement and the Consent Form can be found in Appendix A.

Scoping Interviews with Berry Harvesters

I carried out some initial scoping interviews in the community of Fort McPherson related to berries and other non-timber forest resources in August 2002. Scoping was carried out with a local research assistant - Denise Firth. The scoping specifically involved interviews with eleven (11) elder women and other berry harvesters in the community. Another three (3) scoping interviews were carried about with staff of the Gwich'in Renewable Resources Board and the Gwich'in Tribal Council (Peter Clarkson, Ingrid Kritsch, Alestine Andre) (See "Scoping" in Table A-4).

The principal aim of the scoping interviews was to determine the level of community interest in the project. However, during the process, women shared some narratives about their experiences berry harvesting. Some sites valued for berry harvesting were also identified as part of the scoping in Fort McPherson.

Key members of the scoping activites were Rosie Firth, Dorothy Koe, Alice Blake, Caroline Snowshoe, Elizaeth Mitchell, Elizabeth Colin, Margaret Vittrekwa and Alice Vittrkwa. A more permanent community research (Christine Firth), was also identified as a potential community researcher for the project.

Scoping Workshop with Berry Harvesters and Community Members

A workshop was held on February 20, 2003 with twelve (12) berry harvesters from Fort McPherson as well as two (2) members of the Teetl'it Gwich'in Renewable Resource Council (RRC) and two (2) resource people from the Gwich'in Social and Cultural Institute (Alestine Andre and Melanie Fefard). Women recognized by the RRC and the community researcher (Christine Firth) as being knowledgeable about berries and berry harvesting were invited.

The objectives of the workshop were the following:

- Formally introduce myself to the community;
- Determine level of interest of the berry harvesters and the local RRC members in the project;
- Refine project goal, objectives and work-plan for 2003;
- Seek guidance and agreement about the content and use of the Consent Form .

In addition the following information was gathered:

- Plain language name for the project (Watching over the berries so we can be Healthy);
- stories about why berries and berry harvesting are important to the community;
- geographic scope and activities related to berry harvesting;
- social and ecological issues related to the "berries being good".

Participatory Mapping Workshop (2003)

A participatory mapping workshop was held in June, 2003 at the community hall in Fort McPherson. The purpose of the workshop was to document berry picking areas identified during the open-ended interview process and to solicit interest from other community members in the project. Harvesters were asked to mark their own berry picking areas with coloured pencils on paper maps of 1:250 000 and 1:50 000 scales. More than forty (**40**) people participated in the mapping and over seventy five (75) sites were documented. Individuals (e.g. elderly or ill) interested in the mapping but who were not able to attend were visited at their homes by the researchers. The results of the workshop were digitally recorded using ArcView 3.0 with 1:50 000 base maps of the Gwich'in Settlement Area aquired from the Gwich'in Tribal Council. Due to concerns about access to the berry harvesting sites, these maps are not included in the Thesis.

Open-Ended Interviews / Documentation of Life Histories (2002-2003)

A series of twenty (**20**) open-ended were then carried out with women in the community of Fort McPherson to document life histories associated with berry harvesting – specifically to learn more about why the Teetl'it Gwich'in view berry picking as healthy? Women were selected by the community researcher on the basis of their interest and knowledge of berry picking. During this process, general statements such as "I like berry picking" and "it's good for my family's health" were discussed in terms of their specific meaning to the interviewee; on that basis researchers identified key themes and questions related to the social and ecological dimensions of berry harvesting for follow-up interviews.

Semi-directed Interviews (2003-04)

Semi-directed interviews were carried out with (45) harvesters to document the specific social and ecological aspects of berry harvesting. Thirty (30) interviews were carried out in town and detailed written notes were taken and memory maps developed. Another (15) interviews were carried out on the land during harvesting activities; some written notes, photos and video recordings were made during these interviews (See Semi-Direct 1 in Table A-4). .

I used twenty (20) guiding questions to carry out the interviews (See Table A-1). These questions were developed around themes that emerged from interviews carried out in 2002-03. Three different kinds of questions were asked to ensure that the experiences of the berry harvesters were meaningfully documented. These included, closed responses questions (i.e. yes or no), short answer questions, and questions involving drawing or mapping.

Table A-1 - Guiding Questions for Semi-Directed Interviews (Summer 2003)

1	Why is berry picking healthy? (Why is berry picking important to you? / Why is berry picking not important?)
2	Where do you usually pick (please map) Cloudberries Blueberries Cranberries Other plants
3	How many years have you been picking in these areas?
4	How did you learn that these places were good for berry picking? Who was picking in those areas before you?
5	When do you go picking in these areas?
6	Do you "check" the areas before the berries are ready? When? What do you check for?
7	How often do you visit these places? How many berries will you get? (ziplock bags) Would you like to pick more?
8	How will you get there? Who will go with you?
9	What will you do with the berries?
10	Do other people pick in these same areas? Why? Why not?
11	Do you think that your family and friends will continue picking there in the future?
12	Are you concerned about any changes in the land or community that will affect these berry picking areas? Should any of these areas be protected - for example by the Gwich'in Renewable Resources Board?
13	What is the berry patch like where you go picking berries? (Can you draw a map of what is in that area and how you get there) Is it wet, dry, hilly, hummocks, mossy, sandy? Is it near a like, river, bog, creek? Are there tall spruce trees, small spruce trees, willows, birch or alders there? What other plants are there?
14	How is the area affected by the weather?
15	Has this berry patch (or another you know) ever been affected by: River erosion Flooding Fire Seismic lines / Cut lines Roads Wildlife (bears) What happened? When did this happen?
	Do you ever check this area in the spring, summer, fall or winter to find out what is happening?
17	What kinds of signs do you watch for to tell you the berries will be good?
18	Do you share the information with other people? How? With whom?
19	What will you do if there are no berries this year? What did you do last year?
20	Do you have other information you would like to share?

In the fall and winter of 2003, another series of twelve (12) semi-directed interviews were carried out to verify and gather more detailed information about the themes and arguments made in Chapters Three, Five and Seven (See Semi-Direct 2 in Table A-4). The following guiding questions were used.

Table A-2 - Guiding Questions for Semi-Directed Interviews (Fall and Winter 2003)

1	Do you remember berry picking when you were growing up?
2	Were there times you remember surviving only on berries? When?
3	Do you remember years when there were few or no berries around?
4	How was it picking berries this year?
5	How was the berry picking last year?
6	How was the berry picking the year before last year?
7	Do you remember berry picking in 1999?
8	When there are no berries, does someone share with you?
9	How much berries have you saved or used in the last year?
10	How much did you share with others in your family?
11	Did you share with others in the community?
12	Did you sell or trade any of your berries?
13	Is sharing or trading berries important in the community?
14	What did you do last year when there were no berries? Did you get berries from someone else or somewhere else? Did other family members give you berries
15	Did you end up going further up the road or the river for berries last year?
16	How many days did you go for berries or cut fish this year?
17	Did someone else in your family go for berries or share it with you?
18	How many days did you pick cloudberries, blueberries, cranberries?
19	Is there anything else you would like to share with me?

In the spring of 2004, another set of interviews were carried out with eleven (11) members of the Gwich'in Renewable Resources Board and Staff the Teetl'it Gwich'in Renewable Resources Council, the Gwich'in Tribal Council and the Government of the Northwest Territories, Resources Wildlife and Economic Development office (See "Other" in Table A-4). These interviews focused on issues and challenges associated with resource management in the Gwich'in region. The guiding questions for those interviews are found in Table A-3.

Table A-3 - Guiding Questions related to use Communication / Use of Traditional Knowledge (Fall and Winter 2003)

1	What was the original goal of the GRRB with respect to a) including traditional knowledge; b) involving the local communities in resource management decision-making? Has that changed since the GRRB was established?
2	Has the GRRB accomplished that goal? How? Why? Why Not?
3	What have been the major successes? What are the indicators of success?
4	What have been the major challenges?
5	What do you think has been learned from the inclusion of traditional knowledge?
6	Are there recommendations for doing it differently in other regions?
7	What are the opportunities for the future?
8	What are some major challenges for the future?

9	What is the GRRB mandate /objectives with respect to communication and information sharing?
10	What kind of communication strategy has been developed? How well is it working?
11	What are the signs or indicators that it is working?
12	What kind of information is shared by GRRB? How? How often?
13	What kind of information is shared by the communities? How? How often?

14	Is there any kind of information that is not being shared?
15	How does that information sharing happen? Who is involved? What kind of format?
16	What are some examples of successful information sharing?

17	What is the relationship between GRRB, GTC, GSCI and the Gwich'in communities?
18	What is the relationship between GRRB and the Territorial Government?
19	What kind of relationship building has taken place over the last 10 years; more recently?
20	What aspects of the relationship(s) are not working well? Why?
21	What can be done to address the problems?
22	What aspects of the relationship(s) are working the best? Why?
23	What are some success stories?
24	What can be done to build on these successes?

A further fifteen (15) follow-up interviews with community members from Fort McPherson were also carried out about in 2004 on issues of concern to the project (e.g. forest fire activity / communication within the community about resource management issues) (See "Other" in Table A-4).

Participant Observation

I also used participant observation as a method. Specifically I participated in all aspects of berry harvesting activities. In addition, I did assessments of over seventy-five (75) harvest sites and related locations (e.g. cabins / spiritual sites) in the Gwich'in region to identify and verify ecological conditions including those identified in Questions 13 to 15 (See Table A-1). These sites were recorded using a geographic positioning system (Etrex GPS Unit). Due to concerns about access to these areas, the specific way-points were not included in the Thesis or in publications. A regional map was created however, using these GPS points and can be found in Fig. 5-2 in Chapter Five.

Analysis

Analysis of research results was carried out according to the objective of the individual chapters. In the case of Chapter Three, the objective was to understand "why berry picking is healthy". Analysis of the results from the open-ended interviews and semi-directed interviews (See Questions 1-12 in Table A-1) was carried out to identify key themes and indicators.

For Chapter Five, the purpose was to understand how berry harvesters perceive variability in the abundance and distribution of berries and how they deal with this variability. The results of interviews, the participatory mapping workshop and participant observation were all used to develop the arguments found in Chapter Five.

Chapter Seven focuses on knowledge of variability and how this knowledge affects local institutions or "rules in use" related to access, sharing information, sharing berries. The content of Chapter Seven is also based on the results of interviews, the participatory mapping workshop and participant observation.

Verification

The community research carried out verification of interview results with the interviewees in the spring of 2004. Specifically, they were asked if the quotations used in Chapters Three, Five and Seven were accurate. No inaccuracies were recorded.

A workshop was held with the berry harvesters and community members interviewed throughout the project on May 26/2004. The purpose of the workshop was to review and verify the results of interviews and the arguments presented in Chapters Three, Five and Seven. Some concerns and inaccuracies were recorded. Specifically these included:

- The number of community members who berry pick calculated was considered too low. I explained how the calculation was made. The workshop participants still felt that this number was too low. The fact that the community members disagreed with the calculation was pointed out in Chapter Five (p. 116) and in Chapter Seven (p. 172).
- Fireweed was identified as a food source or famine food by one of the elders interviewed during the study. Horsetail was also identified as a medicine. Some of the workshop participants did not agree. The elder and some older elders at the workshop who shared this information restated their use of this species. We therefore agreed to keep fireweed in our list of species harvested by the Teetl'it Gwich'in however, detailed horsetail from the list. (See Table 5-2 in Chapter Five). (Note – These species are also listed in the publication by Andre and Fehr 2001).
- Participants also expressed concern with the commons term "rules" used in Chapter Seven. I added a paragraph to Chapter Seven to point out that women from the community of Fort McPherson prefer to talk about "ways we respect each other and the land" instead of "rules" (See p.175).

As a final step of verification, drafts of Chapters Three, Five and Seven were submitted to the Gwich'in Social and Cultural Institute, Gwich'in Renewable Resources Board and Teetl'it Gwich'in Renewable Resource Council prior to their submission for publication. No comments or changes to the manuscripts were suggested.

Table A-4 Interviews with Berry Harvesters and Other Resource People in Fort McPherson / Gwich'in Study Area

Participant	Scoping Interview	Scoping Workshop	Mapping Workshop	Open-Ended Interview	Semi-Direct 1 Interview	Semi-Direct 2 Interview	Verification Workshop	Other Interviews
Abe Stewart			June 19/03		June 19/03			Oct.26/04
								Oct.27/04
Abe Wilson			June 19/03					
Abraham Koe			June 19/03					
Agnes Neyando								
Agnes Snowshoe								Nov.30/04
* Alestine Andre	Aug. 2/02	Feb 20/03						
Alice Blake	Aug 30/02	Feb 20/03	June 19/03	March 11/03	July 3/03	Oct. 3/03	May 26/04	Nov.11/04
					(July 28/03)			
Alice Snowshoe								Nov.30/04
Alice Vittrekwa	Aug 30/02	Feb 20/03	June 19/03		July 4/03	Oct.15/03	May 26/04	
					Aug.19/03			
* Andrew Applejohn								May 27/04
Andrew Neyando								Nov.30/04
Annie Kay			June 19/03					
Shirley Kyikavechik					July 4/03			
Amos Francis			June 19/03	July 3/03	July 3/03		May 26/04	Sept. 15/04
								Oct.27/04
Barb Kaye			June 19/03				May 26/04	
Beatrice Blake					(July 30/03)			
Bernice Francis						May 18/04		Nov.12/04
Beatrice Jerome				May 14/03			May 26/04	Sept.15/04
Bella Greenland					Aug.19/03			
Bertha Francis	Aug 30/02	Feb 20/03	June 19/03	May 16/03	July 9/03	May26/04	May 26/04	
Betty Anne Vittrekwa					(June 18/03)			
Blake Family			June 19/03					
* Charlie Snowshoe								Aug./03

Caroline Kay			June 19/03	April 23/03			May 26/04	
Caroline Snowshoe		Feb 20/03			(July 28/03)			Nov.30/04
Christine Firth		Feb.20/03	June 19/03		July 3/03	May 25/04		
Debbie Jerome								Nov.9/04
* Denise Auriat								Jan.22/04
Donna Koe			June 19/03		July 3/03			
Dorothy Alexie	Aug 30/02	Feb 20/03	June 19/03	May 1/03	July 9/03	Oct. 16/03	May 26/04	
Dorothy Koe	Sept 2/02		June 19/03		June19/03			
					July3/03			
Edna Nerysoo			June 19/03					
Edna Robert					(July 29/03)			
Effie Bella Snowshoe					(Aug.6/03)			
Effie Jane Snowshoe	Aug 30/02	Feb 20/03	June 19/03		June 11/03		May 26/04	
					(July 24/03)			
Effie Francis				Feb 25/03				
Eileen Koe							May 26/04	
Eliza Robert				May 25/03				
Elizabeth Colin	Aug 30/02	Feb 20/03		March 21/03	July 4/03	Sept. 15/03	May 26/04	Sept.15/04
Elizabeth Mitchell							May 26/04	
Elizabeth Vittrekwa							May 26/04	Nov.10/04
Eleanor Mitchell Firth					(June 18/03)			
Ellen Vittrekwa		Feb 20/03		April 7/03				Sept 16/04
Emma Kay	Aug 30/02	Feb 20/03	June 19/03	April 29/03	July 3/03		May 26/04	Oct. 12/04
Ernest Vittrekwa					Aug.19/03			
Eunice Mitchell								Sept. 16/04
Fred William Koe			June 19/03	July 16/03	June19/03		May 26/04	Nov.10/04
Georgina (Gina) Firth								
George Vittrekwa			June 19/03					
Gladys Alexie					June 29/03			

Hanna Alexie					(July 30/03)			
Herbert Firth			June 19/03					
Ida Stewart						Jan. 17/04		
* Ingrid Kritsch	Aug.2/02							
Jaida Andre					July 9/03			
*Janet Winbourne								Jan.23/04
James Andre					July 4/03	Aug.03/03		
Joe Vittrekwa					July 3/03			
Johnny Kay			June 19/03					
* Joseph K.								Jan.21/04
Joseph Kay			June 19/03					
John A. Snowshoe			June 19/03		June 19/03			
* John Nagy								May 27/04
Johnny Charlie			June 19/03					
Judy Colin					July 3/03			
Kayla Firth			June 19/03		July 10/03			
Margaret Thompson								Oct. 29/04
Margaret Vittrekwa	Aug 30/02	Feb 20/03		July3/03	July10/03			
* Marie-Anick Elie	July 2/02							Jan.23/04
Mary-Anne Robert					July 3/03			Nov.10/04
					(July 23/03)			
Mary Effie Snowshoe					(Aug14/03)			
Mary Kendi				Feb 25/03				Nov.12/04
Mary Konnizzie				Feb 25/03				
Mary Rose Vittrekwa			June 19/03					
Mary Ruth Wilson		Feb 20/03			July 6/03			May 26/04
May Andre	Aug 30/02		June 19/03	April 7/03	July 3/03			Nov.30/04
					(July 22/03)			
Mary M. Firth			June 19/03	Feb 20/03			May 26/04	Nov.10/04

Neil Snowshoe			June 19/03					
Neil Colin		Feb.20/03						
* Norman Snowshoe								Jan.23/04
* Peter Clarkson	Jul 2/02							
Peter Francis					July 17/03			Oct.12/04
* Pippa Seccombe-Hett								Jan.21/04
Rachael Stewart				Feb 27/03		Oct.9/03		Sept.16/04
Rebecca Francis			June 19/03	June 12/03	June 12/03	Sept.15/03	May 26/04	Sept. 15/04
Robert Alexie								May 26/04
* Robert Charlie								May 24/04
Rosemary Koe			June 19/03					
Rosie Firth	Aug. 30/02			Aug 30/02				
Selwin Kay			June 19/03					
Shirley Alexie					July 17/03			
Shirley Stewart					Aug 6./03			
* Sue Mackenzie								Jan 23/04
Tabitha Nerysoo			June 19/03		(July28/03)		May 26/04	
Troy Alexie					July 9/03			
Victor Koe			June 19/03					
Walter Alexie								Nov.30/04
William Robert						May 19/04		Dec.1/04
Woody Elias		Feb 20/03	June 19/03		June 19/03			
Wilson Family #1					(Aug.20/03)			
Unknown Youth			June 19/03					
Unknown Youth			June 19/03					
Unknown Youth			June 19/03					
Unknown Youth			June 19/03					
Total	**14**	**15**	**40**	**20**	**49**	**12**	**17**	**26**

The asterisk (*) refers to Board Members / Staff of Gwich'in Organizations Brackets around the date (date) refers to interviews on the land

SUMMARY OF RESEARCH METHODS - CHAPTER FOUR AND SIX

The research carried out for Chapters Four and Six was carried out between 1998-2001 in Lutsel K'e, NT. The methods and results that contributed to Chapter Four and Chapter Six can be found in detail at:
http://www.wkss.nt.ca/HTML/08_ProjectsReports/PDF/TradEcoKacheTueFinal.pdf
Follow-up research activities were carried out in 2002-2004 (See Below).

Review of Research Objectives / Development of a Research Agreement
A meeting was held with the Wildlife, Lands and Environment Committee in the late fall of 2002. I developed a plain language written summary of my research objectives for the committee to review in advance of the meeting. I was granted approval by the committee and a Research Agreement was then developed (See Appendix A).

Preliminary Review of Chapters Four and Six
I developed drafts of the Chapters and presented them to the Wildlife Lands and Environment Committee and the Elders Committee for review in 2003. Members of the Committee and resource people were given copies of the Chapters prior to the meeting for detailed review. The Committee had some concerns about the Chapters including:

- Need to verify Chipewyan Terminology used in Chapters Four;
- Need to verify Chipewyan Place Names cited in Chapter Six;
- Use of the concept "uncertainty" in the title of Chapter Six;
- Additional small edits to text of Chapter Four and Six;
- Need to emphasize the importance of spirituality in caribou monitoring.

I addressed these comments by making changes to the text as required. Revised versions of the Chapters were then resubmitted to the Committee and the Lutsel K'e Dene Council for review in 2004.

Verification of Chipewyan Terminology
To address concerns about terminology, I worked with Chipewyan language translators Angie Lantz and James Marlowe and elder JB Rabesca to verify the accuracy, including spelling, of all Chipewyan terminology used in Chapters Four and Six. Some revisions were made.

Review and Consent to Use Quotations in Chapter Two
I carried out a series of verification interviews with the individuals quoted in the Chapters so as to:

- ensure the accuracy of the quotes;
- gather feedback from them about the key arguments of the Chapters and the context of their quotation;
- acquire consent for the use of the quotation in the Chapters and in publications;

A Chipewyan translator was hired to assist in this process to ensure that elders fully understood what was being told and asked of them. All individuals agreed to have their quotes used in these Chapters.

In 2004, permission and agreement about the use of "Lutsel K'e Dene First Nation" as a co-author was granted after consultation with Chief Archie Catholique, the Chair of the Wildlife Lands and Environment Committee. I also had discussions with the Treaty Entitlement Lawyer for Lutsel K'e Dene First Nation (Sharon Venn) about citing "Lutsel K'e Dene First Nation" as an author.

Table A-5 Research Activities associated with Interviews in Lutsel K'e

Research Activity	**Date**	**Participants**
Project Scoping	April 16, 1999	Wildlife Lands and Environment Committee / Elders Committee Meeting / Dr. Fikret Berkes
Identification of Personnel and Elders to be Interviewed	April 27, 1999	Wildlife Lands and Environment Committee / Elders Committee Meeting
Review of Background Material	May 1-14, 1999	Community Researchers
Preliminary Interviews about Migratory Birds	May 11-21, 1999	Elders
On-the-land Workshop about Migratory Birds	June 3-6, 1999	Elders and Youth
Follow-up Interviews about Migratory Birds	June 5-July 1, 1999	Elders
Verification/ Reporting about Interview Data on Migratory Birds	July 2-15, 1999	Researchers / Elders
Research Team Meeting	July 7, 1999	Dr. Fikret Berkes
Elders Meeting about Fish and Caribou) (Scope Questions and Elders to be Interviewed)	July 14, 1999	Elders Committee
Preliminary Interviews about Fish	Aug.12-16, 1999	Elders
Chipewyan Terminology Training – Fish and Caribou	Aug 17-20, 1999	Researchers and Chipewyan Language Instructor (Florence Catholique)
Verification/Reporting about Interview Data on Fish	Aug 23-27, 1999	Researchers / Elders
#1. Elders / Harvester Meeting about Caribou / Caribou Harvesting	Aug 20, 1999	Wildlife Lands and Environment Committee / Elders / Caribou Harvesters
#2. Elders / Harvester Meeting about Caribou / Caribou Harvesting	Aug. 23, 1999	Wildlife Lands and Environment Committee / Elders / Caribou Harvesters
#3. Elders / Harvester Meeting about Caribou / Caribou Harvesting	Aug 26, 1999	Wildlife Lands and Environment Committee / Elders / Caribou Harvesters

Meeting to Scope On-the-Land Research Activities related to Caribou / Caribou Harvesting	Aug 31, 1999	Elders Committee
On-the Land Interviews about Caribou	September 1-19, 1999	Elders / Caribou Harvesters
Follow-up Interviews about Caribou	September 19-Oct.1, 1999	Elders / Caribou Harvesters
Verification/Reporting about Interview Data on Caribou	October 4-8, 1999	Researchers / Elders / Caribou Harvesters
Verification of Interview Data on Birds, Fish and Caribou	November 1999	Researchers / Elders / Caribou Harvesters
Interviews on Fur-bearing Animals	January, 1999	Elders / Caribou Harvesters
Verification of Interview Data on Birds, Fish and Caribou and Fur-bearing animals	February, 1999	Wildlife Lands and Environment Committee

Key themes and guiding questions for interviews were established by the Wildlife, Lands and Environment Committee and the Elders Committee. The four main themes were Migratory Birds, Fish, Caribou and Fur-Bearing Animals. The interviews that took place in 1999, largely focused on identifying species known to the elders and the Chipewyan terminology for each and species descriptions. In addition questions focused around:

Can you share any legends or stories related to the environment?
What kind of changes in the environment, including the health of birds, fish, caribou or furbearing animals have you noticed in their lifetime? What changes do you know about from you

The elders that were identified by the Wildlife, Lands and Environment Committee and the Elders Committee as being most knowledgeable about the study area were:
Noel Drybones, Madelaine Drybones, Alice Michel, Joe Michel, Madelaine Catholique, Joans Catholique, Pierre Catholique and Maurice Lockhart. Many other elders and harvesters were also identified as having some knowledge that could be useful to the study. The interviews that were relevant to the material presented in this Thesis (Chapter Four and Six) are found in Table A-6.

Table A-6 Interviewees from Lutsel K'e

Albert Boucher	Oct. 26, 2000	Environment / Mining Issues
Albert Boucher	Oct. 30, 2000	Environment
Alice Michel	April 20, 2000	Migratory Birds
Alice Michel	Oct.8, 2000	Environment
August Catholique	July 18, 1999	Caribou
Ernest Boucher	May 19, 1999	Migratory Birds
Eddy Catholique	June 29, 1999	Fish
Henry Catholique	May 1999	Migratory Birds
Henry Catholique	Feb. 2, 2000	Caribou

JB Rabesca	July 11, 1997	Caribou
JB Rabesca	Sept.15, 1999	Caribou
JB Rabesca	August 28, 2000	Caribou
JB Rabesca	Oct. 26, 2000	Fur-Bearing Animals
JB Rabeseca	Nov. 30. 2000	Environment / Mining Issues
JB Rabesca	Feb. 14, 2001	Environment / Mining Issues
Joe Boucher	April 23, 1997	Caribou
Joe Desjarlais	Dec. 18, 2000	Environment / Mining Issues
Joe Michel	April 25, 1997	Caribou
Joe Michel	July 11, 1997	Caribou
Joe Michel	Sept. 16, 1999	Caribou
Joe Michel	Jan. 15, 2001	Caribou/ Fur Bearing Animals
Jonas Catholique	May 1999	Migratory Birds
Jonas Catholique	Jan. 15, 2001	Caribou
Jonas Catholique	Jan. 28, 2001	Fur-Bearing Animals
Judith Catholique	June 18, 1997	Caribou
Liza Casaway	July 12, 1997	Caribou
Liza Enzoe	Oct. 26, 2000	Environment / Mining Issues
Liza Enzoe	Nov. 6, 2000	Enviroment
Madelaine Catholique	July 3, 1997	Caribou
Madelaine Catholique	Aug. 12, 1999	Caribou
Madeline Drybones	June 9, 1997	Caribou
Madelaine Drybones	May 1999	Migratory Birds
Madelaine Drybones	Nov. 12, 2000	Lockhart River
Madelaine Marlowe	July 17, 1999	Caribou
MN	April 23, 1997	Caribou
Mary Louise Nitah	April 15, 1997	Caribou
Maurice Lockhart	April 21, 1997	Caribou / Environment General
Maurice Lockhart	Sept. 1, 1999	Caribou
Maurice Lockhart	Sept. 15, 1999	Caribou
Maurice Lockhart	May, 11, 2000	Environment - General
Maurice Lockhart	August 28, 2000	Caribou
Maurice Lockhart	August 31, 2000	Old Lady of the Falls
Noel Abel	January 15, 2001	Artillery Lake / Fur-bearing Animals
Noel Drybones	July 9, 1997	Caribou /
Noel Drybones	August 29, 1999	Fish / Caribou
Noel Drybones	Sept. 18, 1999	Caribou
Noel Drybones	Jan. 15, 2001	Caribou / Fur Bearing Animals
Noel Drybones	May 11, 2000	Environment
Noel Michel	October 4, 1999	Caribou
Pierre Catholique	August 13, 1997	Caribou
Pierre Catholique	Sept. 15, 1999	Caribou
Pierre Catholique	Nov. 30, 2000	Caribou / Fur Bearing Animals
Pierre Catholique	Jan. 15, 2001	Moose / Caribou
Pierre Caholique	Jan. 29, 2001	Fur-Bearing Animals

Pierre Marlowe	April 9, 1997	Caribou
Pierre Marlowe	June 3, 1999	Fish
Pierre Marlowe	April 20, 2000	Fish
Pierre Marlowe	Nov. 6, 2000	Environment
Pierre Marlowe	Nov. 30, 2000	Enviroment
Stan Desjarlais	October 4, 1999	Caribou
Zep Casaway	July 8, 1997	Caribou
Zepp Casaway	Sep. 27, 1999	Caribou
Zepp Casaway	June 28, 2000	Environment – General
Zepp Casaway	November, 2000	Legend – "How the Sun was Stolen by a Bear"