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The role of "Environment" domain as a determinant of aboriginal community health of the Fond du Lac Denesuline First Nation in Northern Saskatchewan, Canada: A local perspective

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No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Soultana STYLIANIDOU

The growing need to measure and track aboriginal population health for better informed policies requires the development of socially and culturally sensitive frameworks and indicator sets. Researchers from the Saskatchewan Population Health and Evaluation Research Unit (SPHERU) in collaboration with nine communities of Northern Saskatchewan and their organizations developed a Toolkit, including a community health framework and associated indicators, for use in monitoring indigenous community health and wellness. Based on this project, the SPHERU researchers continued with the project "*Tools 2. Community health and wellness indicators reflecting daily life in Saskatchewan's isolated far North: Implications for Program planning and evaluation*". The current thesis research is part of phase two of the Tools 2 project, named "A Year in the Life". During this phase an ethnographic approach is taken to answer the question: "Why would we want to measure that?" or in other words, "Are we measuring the right things?" The aim of this research is to indentify the elements of the environment that are considered important by the community members of Fond du Lac Denesuline First Nation in Northern Saskatchewan, Canada for the health of their community. Two methods were used: photovoice and participant observation. The analysis of the photovoice outcomes (pictures and narratives), combined with the ethnographic data, revealed some key environmental issues of concern for the community (e.g. sanitation, weather and transportation safety, caribou). The identified themes were then compared to the Toolkit in order to identify strengths and deficiencies and propose changes and indicators that reflect the community perspectives.

Keywords: aboriginal health, environment, health indicators, indicator framework, photovoice, Fond du Lac, Saskatchewan, Canada.

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Abbreviations

AFN - Assembly of First Nations

AHA - Athabasca Health Authority

APS - Aboriginal Peoples Survey

CCHS - Canadian Community Health Survey

CIHI - Canadian Institution for Health Information

CIHR - Canadian Institutes for Health Research

FNHRF - First Nations Health Reporting Framework

FNIHB - First Nations and Inuit Health Branch

INAC - Indian and Northern Affairs Canada

ITK - Inuit Tapiriit Kanatami

MFN-CAHR - Manitoba First Nations Center for Aboriginal Health Research

NAHO - National Aboriginal Health Organization

OCAP - Ownership, control, access and possession

OECD - Organization for Economic Co-operation and Development

PAGC - Prince Albert Grand Council

PHAC - Public Health Agency of Canada

RHS - Regional Health Survey

SPHERU - Saskatchewan Population Health and Evaluation Research Unit

TEK - Traditional Ecological Knowledge

1 Introduction

Health and wellness -conceptualized diversely by different social and cultural groups- are affected by a combination of various factors including: income, employment, education, social status, biology and genetic predisposition, childhood development, gender, access to social safety networks, personal lifestyle choices and primary health care (Health Canada 2009a; Tikhonov and Berner 2009). Over the last decades, there has been an increasing interest to understand the complicated relations between the environment and human health. Reports on smog alerts, contaminated waters, shrinking ice caps and health issues such as asthma and waterborne illnesses bring attention to the changing environmental conditions and underline the linkages between the environment and human health. Health Canada (2008) identifies physical environment as one of the key determinants of population health, including psycho-social wellbeing and Environment Canada (2008) states that Canadian's health, wellbeing and economic security are highly dependent on the quality of the environment. Environmental health disparities, such as increased exposure of certain population groups (e.g. ethnic minorities) to contaminants and other environmental hazards (Gee and Payne-Sturges 2004) have also become an increasing concern to public health officials and scientists, especially in areas with large-scale resource development projects as Canada's North (Tikhonov and Berner 2009).

Despite a history of health reforms and policies, Canada has failed to eliminate health and other social disparities between Aboriginal[1] and non-Aboriginal people. Aboriginal statistics show notable improvements in life expectancy and decrease of infant mortality during the last decades. The Aboriginal population is fast growing and much younger on average compared to the rest of the Canadians. It is also important that registered[2] First Nations and Inuit people, apart from the universal health care services provided in provincial level, they are also entitled to health coverage from the federal government for certain medically necessary services (Anderson *et al.* 2006). However, the overall health status of Aboriginal people remains poorer compared to the general Canadian population. First Nation and Inuit people are facing increased rates of "western" diseases (e.g. diabetes, hypertension, and cardiovascular disease) and prevalence of

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1 "Aboriginal Peoples" is a collective name for the native inhabitants of North America and their descendants. The Canadian constitution recognizes three distinct groups of Aboriginal people: the Indians (commonly referred to as First Nations), the Métis and the Inuit (INAC 2010).

2 Recognition by the federal government of persons registered under the Indian Act is referred to as Registered Indian Status. Status Indians are entitled to a wide range of programs and services offered by federal agencies, provincial governments and the private sector. Non-status Indians commonly refers to people who identify themselves as Indians but who are not entitled to registration on the Indian Register pursuant to the Indian Act (INAC 2010).

other important health and social issues, such as obesity, tuberculosis, alcohol abuse and teen pregnancy (INAC 2008).

Gilman *et al.* (2009) claim that these problems are common in traditional indigenous societies worldwide that are experiencing rapid social change, including dietary transition, decreased physical activity, isolation, and increased exposure to environmental hazards. However, it is acknowledged that contemporary health issues in Canada's Aboriginal communities cannot be disconnected by the political, social, and economic impacts of colonization (Daniel *et al.* 1999) and the long-term health practices and policies that were derived from this colonial past (McDonald 2008).

Environmental health disparities have been also a major issue for some Aboriginal communities. Particularly the Athabascan region, where the research community is located, has been disproportionally impacted by resource extraction activities (e.g. mining) affecting the lands that support Aboriginal peoples' livelihoods for centuries (Simpson 1998). One additional factor of growing concern is the stresses faced by Indigenous[3] populations of Canada's North due to climate change (Ermine *et al.* 2005). The last two decades, the value of indigenous traditional ecological knowledge (TEK) has been recognized by the scientific community and there is a growing interest in using TEK for human health and environmental impact assessment of development projects (Noble and Bronson 2005) as well as to address various contemporary environmental problems (Johnson 1992; McGregor 2004).

Measuring population health has evolved from using traditional demographic and biomedical data (mortality, life expectancy and prevalence of disease) to the development of sophisticated indicator sets that attempt to measure social and other non-medical health determinants, as well (Etches *et al.* 2006). In Canada the health and wellness of Aboriginal peoples have been often measured in narrow biomedical terms (Parlee and O'Neil 2007) or framed from a western perspective, resulting in culturally irrelevant indicators, inappropriate to address Aboriginal peoples concerns and to meet community needs (Jeffery *et al.* 2006b). The non-participatory, top-down approaches that were often taken have also created frustration and suspicion among indigenous communities towards outside researchers (Daniels *et al.* 2009).

The growing need to measure and track Aboriginal population health for better informed policies and health promotion requires the development of socially and culturally sensitive frameworks and indicator sets (Jeffery *et al.* 2006b). This can be achieved by engaging the community in all phases of data collection, analysis and interpretation which is also a significant

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[3] The term Indigenous is used interchangably with Aboriginal in the current report.

step towards capacity building and empowerment (Hancock *et al.* 1999), particularly when the community has ownership of the produced knowledge (Jeffery *et al.* 2006b).

1.1   Research background

The Saskatchewan Population Health and Evaluation Research Unit (SPHERU) has been a leader towards the development of culturally appropriate, locally relevant frameworks and indicators, working with several Aboriginal and Northern communities (Johnson et al. 2008). When senior health managers of two northern organizations, the Prince Albert Grand Council (PAGC)4 and the Athabasca Health Authority (AHA), expressed interest in understanding how health and other services contributed to health and wellness and to determine the information that should be monitored to assess progress in community health and wellness, a collaborative project with SPHERU researchers originated in 2002. The research project named "The First Nations Health and Development: Tools for Program Planning and Evaluation" was developed to answer two main questions: "What is a healthy community?" and "How can we measure that?". Main partners of this projects were the SPHERU researchers, the PAGC with five First Nations communities and the AHA represented by two First Nations communities (Fond du Lac and Black Lake Denesuline Nations) and three northern provincial communities (Stony Rapids, Camsell Portage and Uranium City). The main outcomes of the projects were: the development of a conceptual framework that reflects the northern Saskatchewan Aboriginal views of a healthy community; and the development of a Community Health Indicators Toolkit for use by First Nations health organizations to track the effects of health and human service programs under their jurisdiction and to evaluate the progress towards the improvement of community health and wellness (Jeffery *et. al.* 2006a).

The Toolkit consists of six domains that were considered important determinants of community health and wellness: 1. economic viability; 2. healthy lifestyles; 3. services & infrastructure; 4. food security; 5. identity and culture; and 6. environment, each associated with a number of indicator categories. The individual indicators included in each category can be tracked over time to see if there have been changes in each domain (Jeffery *et. al.* 2006a).

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4 A Grand Council is the elected body that represents the collective interest of its member First Nationcommunities.
   The Prince Albert Grand Council was established in 1977 by 12 First Nations located in central anand
   northern Saskatchewan (including Fond du Lac Denesuline Nation)
   (http://www.pagc.sk.ca/pagc.asp?ID=19).

Based on the previous work, SPHERU researchers continued with the "*Tools 2. Community health and wellness indicators reflecting daily life in Saskatchewan's isolated far North: Implications for Program planning and evaluation*" project. During the first phase of this project, pilot studies are being carried out in five northern communities in order to answer the question "How healthy is our community?" and to produce community health profiles for each of the communities in focused in 4 of community-priority domain areas (food security, culture & identity, environment, services & infrastructure-housing) using the ToolKit indicators. The current thesis research is part of phase two of the Tools 2 project, named "A Year in the Life". During this phase an ethnographic approach is taken, including visual, oral, and ethnographic exploration of the life of community participants from a variety of social and familiar arrangements to answer the question: "Why would we want to measure that?" (SPHERU 2010) or in other words, "Are we measuring the right things?"

1.2   Aims and objectives

The aim of the present work is to explore and present the views of Fond du Lac Denesuline First Nation people on the environmental factors that affect the health of their community and to examine whether the issues raised by the community are addressed by the Community Health Indicators Toolkit. The key objectives to address the aim of the research are presented as follows:

- To investigate what the community members feel that supports or threatens their community health in the environment domain, by using photovoice and ethnographic data collection.

- To identify general issues or themes related to environment and the community's health, by analyzing the collected data on all four domains (environment, food, housing and culture).

- To compare the identified issues with the Community Health Indicators Toolkit and recommend changes in the Toolkit in order to provide more community-relevant information.

1.3   Overview of the methodology

In order to address the objectives of the present thesis two qualitative research methods were used: photovoice and ethnographic data collection. Photovoice is a community-based participatory research method that enables people to record and discuss meaningful images over

a particular issue (e.g. public health) using a specific photographic technique (Wang and Burris 1997). Participants from the community had already been recruited and provided with cameras by the "Tools 2" researchers. They were asked to take a maximum of 60 pictures in each season of the year: pictures of their everyday lives that they felt is important about keeping their community healthy or threaten their community health, in the four domain areas. Three female participants were interviewed during my field research: one on her winter photographs for all four domains, one on her winter photographs for all domains but housing and one on her spring photographs regarding only the environment domain. The results were then analyzed from the perspective of environment, codified into themes and compared to the Toolkit.

Ethnographic data collection including participant observation and photography were also conducted, focusing on the same questions to be considered by the photovoice process.

1.4   Scope and limitations

This study is part of the second phase of the Tools 2 project, named "A Year in the Life" and it studies the views of Fond du Lac Denesuline First Nation community members in Northern Saskatchewan, Canada.

One limitation of this research is that only three out of ten participants released their photographs and were interviewed, all women. However, during the ethnographic research, informal communication with other members of the community also took place and provided useful information. Furthermore the results are not representative of a full year "in life" of the community because they are based only on winter and a set of spring photos. It has to be understood that the current research is part of the Tools 2 project and is not intended to cover all the domain areas and seasons. A plethora of issues were raised by the community members during the research on other domains as well as other aspects of community life, such as recreation. The analysis of this data is outside the scope of this work as the main focus is on the environment as a health determinant, from a community perspective. Other challenges that occurred during the photovoice process were: uncertainties on behalf of the participants about the meaning of "environment" or under which domain they should place their photographs; overlaps and interconnection between different domains; and difficulties in identifying connection between certain environmental problems and health outcomes.

1.5   Outline of the thesis

Chapter 2 provides review of the literature that was considered important to understand the current work. The chapter begins with definitions of health and other related concepts, such

as: health determinants; health risk perception; population health; and community health and capacity building. The second session is an introduction to the Aboriginal people of Canada that highlights some important Aboriginal health and social statistics and describes Aboriginal health care systems in Canada. The third session of the chapter provides a review of health indicators and frameworks that have been developed to measure population heath worldwide and particularly in Canada. It also describes the process of measuring community health in Aboriginal context, identifying challenges, providing some of the main Aboriginal health data and indicator sets in Canada and reviewing several community-level research projects of Aboriginal health assessment. The next session introduces the concept of environment as a health determinant and describes some of the efforts to measure environmental health determinants at a global and Canadian level. It also focuses on Aboriginal environmental health and deals with two important issues that potentially affect Aboriginal health in Canada's North, resource development and climate change. The next session introduces the concept of ecological traditional knowledge (TEK) and describes recent efforts to integrate western science and TEK in Canada, including a co-management regime of barren-ground caribou in Northern Canada.

Chapter 3 outlines the background projects of this work. The first one, named Tools 1: "The First Nations Health and Development: Tools for Program Planning and Evaluation" project, lead to the development of the Community Health Indicators Framework and Indicators Toolkit, which are described in details and particularly the Environment domain; its continuation, the "Tools 2: Community health and wellness indicators reflecting daily life in Saskatchewan's isolated far North" project, is divided in three phases. This thesis is part of the second phase of the project, called "A year in life'.

Chapter 4 describes the broader study area (Athabasca region) providing information about the physical geography, the Dene people, industrial and commercial use, land use planning and resource management. It also includes a paragraph on the case study community of Fond du Lac Denesuline First Nation.

Chapter 5 describes the methodology that was followed, including: a community-based participatory research session that provides detailed description of the method of photovoice; ethnographic data collection methods; analysis of the results; and challenges and opportunities.

Chapter 6 presents the main findings of the photovoice process, including participant's photographs and narratives, grouped into main thematic areas.

Chapter 7 covers the discussion of the main results and provides the comparisons to the Toolkit and recommended changes.

Chapter 8 summarizes the main findings and proposals of the research and lists recommendations made by the community members.

2 Literature Review

The literature review is divided in five main sessions that include: definitions of key health concepts; introduction to the Aboriginal peoples of Canada; development and description of frameworks and indicator sets used to measure health, with focus on Aboriginal context; environment and health; and Traditional Ecological Knowledge.

2.1 Health: Key concepts and definitions

2.1.1 What is health?

There is no universal consensus on the definition of health. In the Constitution of the World Health Organization (1946), health is defined as "a state of complete physical, mental and social well-being, and not merely the absence of disease of infirmity". According to an updated definition that was developed by the European Regional office of WHO (1986a): "Health is the extent to which an individual or group is able on the one hand to realize aspirations and satisfy needs, and, on the other hand, to change and cope with the environment. Health is therefore seen as a resource for everyday life, not the objective of living; it is a positive concept emphasizing social and personal resources as well as physical capacities". The Public Health Agency of Canada (PHAC 2001) also refers to health as a resource of living and capacity of successful adaptation to life's challenges and changes rather than as a state.

The above definitions -going beyond the traditional biomedical perception of health as the absence of disease and emphasizing on the broader positive psychosocial aspects of health and wellbeing- have supporters as well as critics. Young (2004) supports that defining health as synonymous to wellbeing and quality of life is so broad that often makes it difficult to measure, thus not operational and confusing. There have been numerous other attempts for defining health such as Pampalon's (2005) broad concept of health as a complex and multidimensional resource of living that extends from people's characteristics, practices and coping skills and their immediate living environment and social network (family, work, school, community) to society as a whole (norms, values, ideology).

In the current work it is fully recognized that health is conceptualized and practiced differently among various national, social, cultural or other groups. Canada's Aboriginal people in particular traditionally hold a holistic view of health, represented by a medicine wheel that consists of four dimensions: mental, emotional, physical and spiritual; the balance between those four components is important for health and wellness (McDonald 2008). Aboriginal perceptions

of health and wellbeing also include the belief that good health is a combination of positive elements (e.g. spiritual strength) and the absence of negative elements. Wellbeing is often seen in connection to wellbeing of the community, society and the world (Dyck 2009).

2.1.2   Health Determinants

The knowledge that health is affected by multiple factors, or "determinants of health", such as individual choices, genetic endowment, environmental and socioeconomic conditions, early life conditions and health care is not new (Etches *et al.* 2006). In 1974, the federal government's document, *A New Perspective on the Health of Canadians* (Lalonde 1974), acknowledged that apart from medicine and health care, changes in lifestyles or social and physical environments would likely lead to more improvements in health. The documents *Ottawa Charter for Health Promotion* (WHO 1986b) and *Achieving Health for All: A Framework for Health Promotion* (Epp 1986) that were released during the First International Conference on Health Promotion held in Ottawa, recognized that health is determined by social, environmental and economic factors (including shelter, income, food, a stable ecosystem, sustainable resources, peace, social justice and equity.

Health Canada's (1998) framework outlines various key of determinants of health: biology and genetic endowment, personal health practices and coping skills, income and social status, education, childhood development, health services, social support networks, employment and working conditions, social environments, physical environment, healthy child development, culture, gender, health services. This framework has been criticized as atheoretical, failing to capture everyday experience of people's lives and lacking in policy relevance (Raphael 2004). More recently, Raphael (2004) proposed 11 key social determinants of health relevant to the Canadians, including Aboriginal status, food security, housing, social safety net, and social exclusion.

A set of broader health determinants in Aboriginal context was compiled by the National Aboriginal Health Organization (NAHO 2007), including colonization, globalization, migration, cultural continuity, territory, poverty and self-determination. NAHO also points out that First Nations, Inuit and Métis groups each require a specific lens with which to view their respective historical and contemporary realities.

At the community level, social capital, social cohesion, trust, security, the built environment and the services and institutions available, for example, may also be important factors that can help promote health and offer protection against physical or mental illness

(Pampalon 2005). The lists of determinants of health can be long and potentially overwhelming and the interactions between them particularly complex and incomprehensive.

2.1.3 Perception of health risk

Risk perception, generally defined as people's judgments of hazards or danger that might pose threats to their health and well-being (Adeola 2007), can be affected by many factors, from individual experiences and beliefs to culture (Adeola 2007; Byrd *et al.* 1997). At the individual level, perception of health risks can cause a number of negative health outcomes (including stress, increased blood pressure, reduced functioning of immune system) while at the community level, it can lead to social disorder and even violence (Health Canada 2004). Parlee and O'Neil (2007) claim that the impacts of large scale development (e.g., mining) are often imperfectly understood and create uncertainty and anxiety in the affected communities. "Lay" perception of health risk, often different from scientific outcomes and expert opinion has been recognized as valid and significant (O'Neil *et al.* 1998) and efforts have been made to incorporate public concerns into health assessments of various development projects (Noble and Bronson 2005).

2.1.4 Population health

Population health draws attention to health determinants that affect people as groups (i.e., communities, nations or people with common characteristics such as age, ethnicity) rather than individuals (Jeffery *et al.* 2006b). Hancock *et al.* (1999) argue that population health is much more than the aggregation of the health of individual members of the population; it also incorporates issues of health disparities among population groups. The authors explain how determinants of population health and wellbeing (as opposed to individual health) are closely related to meeting socio-economic equity, developing mutually supportive and respectful relationships and ensuring environmental viability and sustainability.

The population health approach that aims to improve the health of populations rather than individuals by addressing the entire range of health determinants became quite popular in 1990s, especially in Canada and UK (Young 2004). Today, the Public Health Agency of Canada (PHAC 2001) identifies population health as the key approach for policy development and resource allocation towards population health promotion, as essential for the country's economic prosperity, social stability and wellbeing.

2.1.5 Community health and capacity building

This thesis is studying the impacts of environment on health at a community level - particularly in a First Nation community- as it is perceived by its members. Health determinants at a community level include some elements that are absent from the population health literature and need to be identified.

A community can be identified spatially as a group of people living in a defined geographical area (municipality, neighborhood) or non-spatially as group of people sharing common values, cultures, norms (e.g. Aboriginal people) or characteristics (elders, users of a service) (Labonte 1998; Saskatchewan Health 2002). According to Reed *et al.* (2003) the community level domains of health include the same general health domains found for the individual level as well as other broader ones such as social interaction, public safety, governance and politics, culture and more. Racher and Annis (2008) define community health as "the ability of a community to generate and effectively use assets and resources to support the well-being and quality of life of the community as a whole in the face of challenges and barriers within the context of their environment". Reciprocal relationships, collective decision making and continuous interactions between people and their physical, economic, and social environments are considered essential for the promotion of community health (Racher and Annis 2008).

Public health in Canada refers to the organized efforts (programs, services and policies) in various levels of government towards the improvement of the health of citizens (Young 2004) by preventing illness, injury and premature death and promoting healthy lifestyles and environments (Health Canada 2008). Ridde (2007) suggests that both public and community health projects share the same aim, to improve the health of a population, albeit using a different approach: public health interventions are usually implemented in a technocratic way though community health approach is a participatory process.

Labonte (2002) makes a distinction between community-based health care and community development projects. The author describes the community-based health intervention as a "top-down" approach -similar to the public health care concept as described above by Ridde (2007)- where policies, programs or interventions are imposed on the community by health agencies and other authorities. Community health development/empowerment programs, on the other hand, count on the community itself to identify important issues and take action towards the improvement of health and health service delivery (Labonte 2002).

There is also an increasing focus on evaluating health and human services, especially in Aboriginal communities, by tracking changes in community capacities and exploring the

potential of services to further develop (build) these capacities (Jeffery *et al.* 2006b). The term community capacity building describes a wide range of health promotion strategies that enable community members to gain control over the determinants and decisions that affect their own health (Jeffery *et al.* 2006b; Johnson 2001). Labonte and Laverack (2001a) identify three different uses of capacity building in literature: health infrastructure and service development; program maintenance and sustainability; and problem-solving capability of organizations and communities.

2.2   Aboriginal Peoples in Canada

"Aboriginal Peoples" is a collective name for the native (Indigenous) inhabitants of North America and their descendants. The Canadian constitution recognizes three distinct groups of Aboriginal people, with unique histories, languages, cultural practices and spiritual beliefs: the Indians (commonly referred to as First Nations), the Métis and the Inuit (INAC 2010). According to the 2006 Census more than one million people in Canada identified themselves as an Aboriginal person, accounting for 3.8% of the country's total population (Statistics Canada 2010). Aboriginal communities are located in urban, rural and remote locations across the country. The First Nation people or Indian Bands are commonly located on tracts of land called reserves; there are also numerous First Nation and other Aboriginal communities in cities or towns which are not included on reserves or traditional territories (INAC 2010).

Particularly in the province of Saskatchewan, a total of 141,890 Aboriginal people were recorded in 2006 -representing 15% of the provincial population (Figure 2-1.) (Anderson 2010). The majority are First Nation people, mostly Treaty Indians (affiliated to a First Nation that has signed a treaty with the Crown) or Status Indians (registered under the Indian Act) (INAC 2010).

Figure 1 Percentage of Aboriginal people in the population, Canada, provinces and territories,

Figure 2-1 Percentage of Aboriginal people in the population, Canada, provinces and territories. Source: Statistics Canada 2006
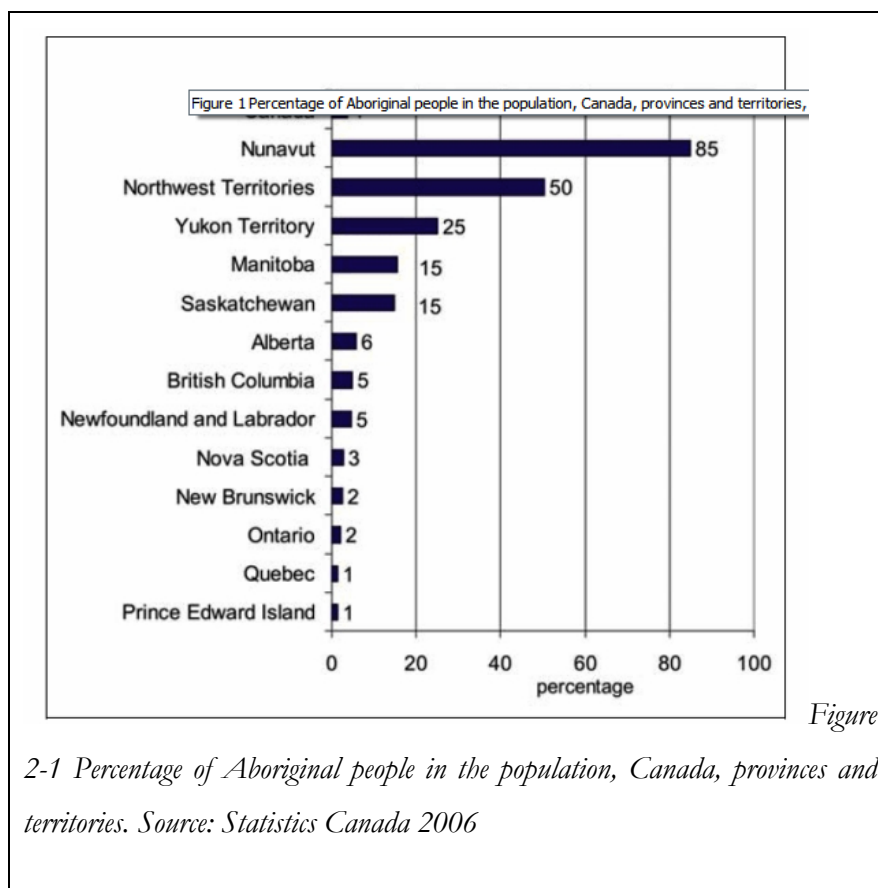
2.2.1 Aboriginal health and social profile

Political, social, and economic subjugation, repeated assaults on Aboriginal culture and collective identity, generations of discrimination and loss of livelihood make up the legacy of Aboriginal colonial history (Daniel *et al.* 1999). Despite a long history of health reforms and policies, Canada has failed to address resultant contemporary health and other social disparities. Despite the notable increase in life expectancy and decrease in infant mortality of First Nation and Inuit people during the last decades, their overall health status is poorer compared to the general Canadian population (INAC 2008). In monitoring the health of Aboriginal people and making comparisons to the general Canadian population, it is necessary to consider the differences in population composition. The Aboriginal population is on average considerably younger; more than half of First Nations people are below 25 years old (Figure 2-2) (Health Canada 2009b).
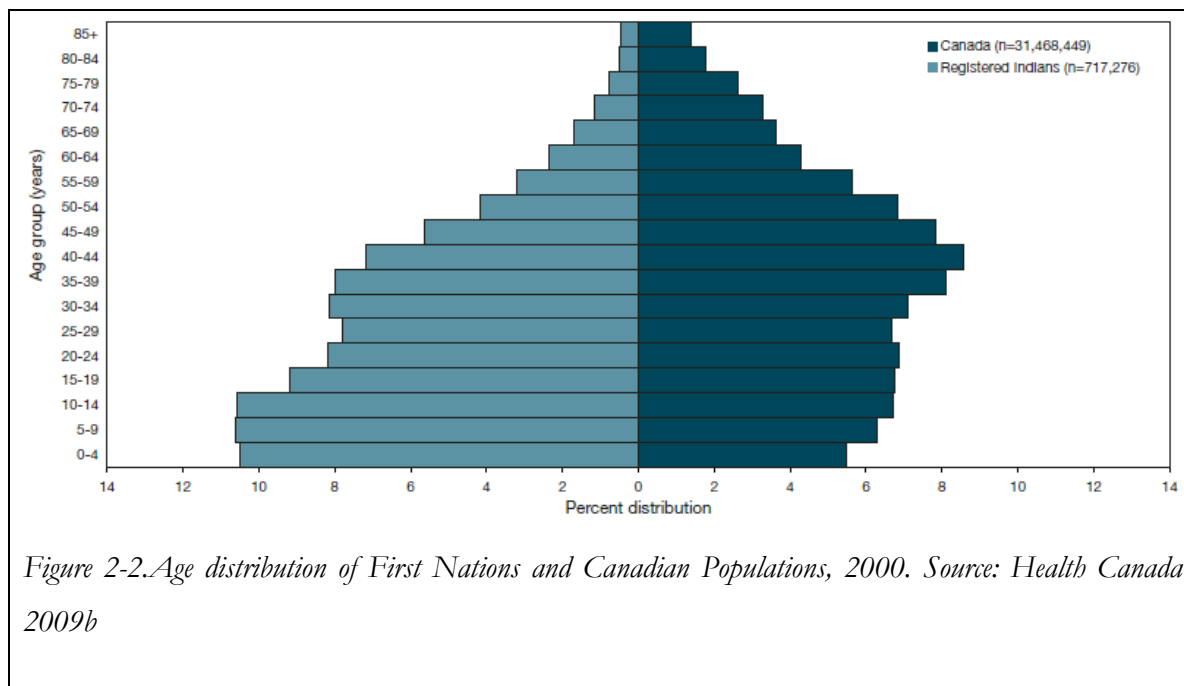
Figure 2-2.Age distribution of First Nations and Canadian Populations, 2000. Source: Health Canada 2009b

Life expectancy of Aboriginal people remains lower compared to the non-Aboriginal population. There is also an increase of type 2 diabetes and other chronic western diseases such as stroke, cardiovascular disorder and hypertension among Aboriginal people, as well as higher rates of unintentional injuries, mental stress and suicides. Overweight and obesity is also observed at higher levels in the First Nations population, with over one third considered obese. High prevalence of addictions such as smoking, alcoholism and solvent use has also been recorded (Health Canada 2009b).

Statistics for Registered Indians on-reserve show lower education levels, almost four times higher unemployment rates, lower income, and poorer housing standards compared to the rest of Canadians; almost one quarter of First Nations on-reserve households have inadequate water supply and almost one fifth have deficient sewage effluent systems (Figure 2-3.). Other major problems identified by Health Canada (2009b) are teen pregnancy, sexually transmitted diseases and family violence.

. Figure 2-3. Quantity and quality of water services, First Nations on-reserve housing units 2001-2002 (N=91,652 housing units). Source: Health Canada 2009bNote: Excludes dwellings in the Northwest Territories, Nunavut and Inuit communities of Northern Quebec, as well as dwellings of bands under the James Bay and Northern Quebec Agreement, self-government bands in the Yukon and the Sechelt Band.

2.2.2 Aboriginal health care system in Canada

It is acknowledged that contemporary health issues in Canada's Aboriginal communities are located in long-term practices and policies with roots in a colonial past. Prior to contact with European settlers, First Nation Peoples had their own traditional health systems, founded on their holistic approach to health (McDonald 2008). Medical practices were diverse, including the use of plants and animal parts as medicines, ceremonies and other activities (Anderson *et al.* 2006). After contact with European settlers many changes came. New epidemic diseases such as smallpox, influenza, measles and tuberculosis were transmitted from the colonizers with detrimental effects to the Aboriginal people of Canada (INAC 2008). Later efforts of assimilation, such as the Canadian Residential schools system, has also had detrimental effects on the mental health, social and family structures and cultural identity of Aboriginal people, being identified until today (Milloy 1999).

The federal Department of Indian Affairs was established only in 1880, but even then medical care continued to be provided by non-trained Indian agents. After the appointment of

the first federal office for indigenous health in 1904, a sequence of different departments responsible for the health care of Canada's Aboriginal peoples evolved, to the establishment of the First Nations and Inuit Health Branch (FNIHB) of Health Canada in 2000 (Health Canada 2007).

Registered First Nations and Inuit people are in a unique position in terms of health care in Canada. As with all Canadians, they are entitled to universal health care administered through the provincial health care systems. In addition, registered First Nation people also receive health coverage from the federal government for certain medically necessary services that are not normally covered by the universal health care system, such as drug coverage and transportation for medical purposes. *Non-status* First Nation and Métis people (almost 40% of Canada's Aboriginal population) do not have access to services provided by FNIHB and other federal health programs (Anderson *et al.* 2006).

Nonetheless, there are still many remote First Nation communities with limited access to health services, such as screening health tests (mammograms, Pap test), due to lack of services, transportation barriers (especially for isolated communities), economic barriers, and cultural appropriateness of such services (Health Canada 2009b; McDonald 2008). In many remote communities, primary care is provided chiefly by nurse practitioners, while patients with emergencies are transported to facilities in larger centers (Health Canada 2009b).

2.3   Measuring health

Measuring the health status of a population has a long history in public health and demography (Hansluwka 1985). The first official quantitative reporting of health is found in London *Bills of Mortality* published in the 1500s (Etches *et al.* 2006). For many centuries, mortality, life expectancy at birth and prevalence of certain diseases were traditionally used to measure population health. In the 19th century social scientists started collecting new data on populations including environmental and socioeconomic conditions as health determinants (Mootz 1986).

Regular censuses, national surveys, vital statistics, civil registrations, administrative data as well as international classification systems have improved the quality and comparability of data on morbidity and health services use, sometimes including social determinants of health. More recently, these traditional health databases are linked with datasets of social and other non-health determinants to produce comprehensive indicators of population health (Etches *et al.* 2006).

2.3.1 Health indicators

According to the Dictionary of Epidemiology (Last 2001), a health indicator is a "variable susceptible to direct measurement that reflects the state of health of persons in a community". First Nations Center (2007) refers to health indicators as a means to measure and track over time different aspects of health within a community or a group, such as health status (life expectancy, infant mortality) or health determinants (diet, smoking and drinking habits, pollution).

Population health indicators have several important uses: as basic tool in health surveillance, by providing a benchmark for tracking and monitoring population health; for identifying and prioritizing community needs (FNC 2007); to inform health planning, developing and monitoring programs (Hancock *et al.* 1999); as an important tool to evaluate the performance of health care systems, programs and policies; and as a means to advocate for funding for specific programs and services (Hancock *et al.* 1999). Labonte and Laverack (2001b) make a distinction between the typical population health indicators and the capacity building indicators that track change in capacity of communities.

A good indicator has to be valid, reliable (reproducible), sensitive to subtle differences, easily understood and acceptable to the intended users (e.g. First Nation people), feasible provided the given resources; it can also be universal, for use within different settings, or inclusive for specific users and context relevant (FNC 2007).

Since communities serve as the centers where social and political actions and interactions that affect health outcomes take place, the development of indicators at a community level is sensible and worthwhile (Hancock *et al.* 1999). Indeed, the collection of information at the local level where people live and interact are more meaningful for use by the citizens, community organizations and local authorities for the evaluation of community wellbeing and the effects of health policy implementation (Etches *et al.* 2006). To ensure the significance and relevance of indicators at a local level, community involvement in both development and selection of measures is recommended (Marks *et al.* 2007).

2.3.1.1 Brief overview of western[5] indicator sets

The first indicators of population health were merely clinical, such as child mortality rates. The concept of social indicators was first employed in 1962 by the American Academy of Arts and Sciences (Mootz 1986). As the quantitative analysis started transgressing into social

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5 OF EUROPEAN ORIGIN; AS OPPOSED TO ABORIGINAL KNOWLEDGE SYSTEMS.

sciences a proliferation of indicators for formulation and evaluation of social policies emerged. The development of health indicators as a constituent part of social indicators originated in Anglo-Saxon countries and became widespread during the 19th century (Hansluwka 1985). The indicator movement for measuring population health status was largely stimulated by the WHO's (1986a; 1986b) publications of health indicators for the evaluation of national, regional and global health strategies (Young 2004). As the demand for evidence-based policy making from various social movements rose during the 1990s, numerous population health indicators were developed worldwide (WHO, OECD, national and regional surveys) (Young 2004).

In Canada, Statistics Canada and the Canadian Institute of Health Information have collaborated since 1999 on the Health Indicators project to produce a regularly updated broad set of health indicators, grouped under health status, non-medical determinants of health, health system performance, and community and health system characteristics (CIHI 2009). The updated federal report Healthy Canadians (Health Canada 2006; Health Canada 2009a) is based on input from health partners, experts and the general population with the aim to evaluate and report to Canadians the performance of their health care system. The most recent report (Health Canada 2009a) presents data on 37 featured indicators grouped under three basic themes: health services; quality of health care services; and health status and wellness of Canadians. Apart from general population health data, these reports also provide limited data for First Nations living on-reserve and recognized Inuit.

Standard sets of core indicators based on health statistics that are gathered on a regular basis in national or international level are important for monitoring population health over time and space and for comparison purposes (Reed *et al.* 2003). Although regular reports of WHO, OECD and national surveys also present data on sub-population groups (by sex, age etc.), they usually lack sufficient information on socioeconomic status, ethnic group or other important categories that determine health and wellbeing (Etches *et al.* 2006).

Canada in particular has excellent data sources and infrastructure to record health status and inequalities within its population but there is limited work towards individual communities and their special needs (Johnson *et al.* 2008). According to CIHI (2006), most of the government and non-government efforts to develop appropriate and comprehensive community-level measures of health and well being are inadequate and mainly centered on the city level. Moreover, among the various indicator systems of Indigenous health in Canada, very few manage to incorporate the distinct cultural, social and historical contexts of Indigenous communities that are important for health (Daniel *et al.* 2009).

2.3.1.2 Western Health Frameworks

With growing research on a broad set of health indicators, several researchers (Etches *et al.* 2006; Hancock 1993; Hancock *et al.* 1999; Jeffery *et al.* 2006b; Friedman 2002) have proposed the development of theoretical frameworks that acknowledge the complexity of health determinants and allow a consistent, comparable, valid, comprehensive, transparent and standardized way of measuring and reporting population health (Etches *et al.* 2006).

The most common framework for population health that is currently used in Canadian health policy has been developed by Health Canada (1994). As shown in Figure 2-4, this model is illustrated by a pyramid which shows the causes below (as health determinants) and the effects (health status or outcomes) above; the concept of this framework is that health improvement can be achieved by acting at the forces below (Health Canada 1994). This model has received wide acceptance and influenced following work in Canada, but has also been criticized for deficiencies and weakness to understand the impact of global political regimes and social structures on health (Etches *et al.* 2006). The linear type of illustration that highlights cause and effect also fails to represent the holistic view of health of Canada's Indigenous people that emphasize the need of balance between health determinants.

Another popular western health framework in Canada has been proposed by Hancock (1993). This framework of community health and sustainability includes the three basic elements of community health and wellbeing (community, environment and economy) with focus on two key principles, sustainability and equity; education and governance were later added by Hancock *et al.* (1999) as important processes of community health change (Figure 2-5). Based on this framework, Hancock *et al.* (1999) developed a core set of indicators organized in three broad categories: health determinants (inputs), processes of change, and health outcomes (outputs). This western framework is closer to the Aboriginal holistic view of community health and has been used as basis for the development of culturally relevant health frameworks for Canada's North Aboriginal communities (Jeffery *et al.* 2006b).
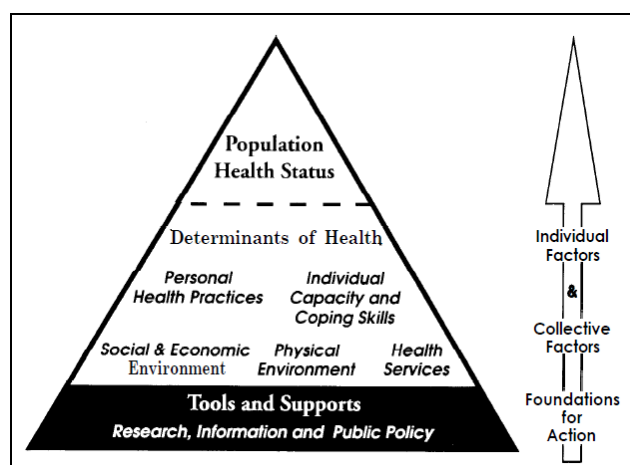
Figure 2-4. Health Canada's Framework for Population Health. Source: Health Canada 1994
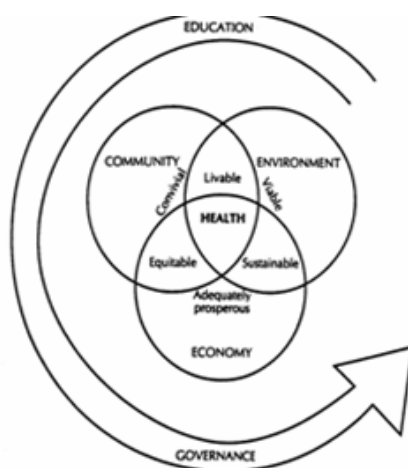
Figure 2-5Basic framework for indicators developed by Hancock et al. (1999).

2.3.2 Measuring community health in Aboriginal context

The development of health indicator systems and services in Canada have been proved quite inefficient in monitoring the health status of First Nations, Métis or Inuit Peoples and reducing health disparities (Marks *et al.* 2007). The non-participatory, top-down approaches that have been widely used in research and surveillance have resulted in the development of culturally inappropriate indicators, incongruent with the holistic approach of indigenous health and irrelevant to community concerns and goals (Daniel *et al.* 2009). Such imposition of expert knowledge over "lay" knowledge (Jeffery *et al.* 2006b) usually fails to actively engage stakeholders and creates frustration.

Another important research barrier is that Aboriginal groups are increasingly suspicious of research enterprises that involve the extraction of data from Aboriginal communities without any clear benefit accruing to the community and with the potential to result in any type of ranking. Former negative experiences with academic researchers and government organizations have created a climate of mistrust towards externally imposed recommendations (Daniel *et al.* 2009).

2.3.2.1   Challenges in measuring Aboriginal health

There are various challenges towards measuring Aboriginal health status and performance of health services in Aboriginal communities. Some of the most important limitations are listed below.

- At a national level there is difficulty in identifying all three groups of Canada's Aboriginal people in health care databases, records and vital statistics, especially non-registered individuals. Provincial and territorial health care systems, in particular, usually lack ethnicity specific data because non-registered First Nation and Inuit people that access provincial health care services do not have the opportunity for self-identification (Anderson *et al.* 2006).

- Multiple and often overlapping jurisdictional responsibilities for health care between federal, provincial/territorial and local governments and lack of communication between authorities (Smylie and Anderson 2006). For instance, status First Nation people accept both provincial and special federal health care services. The situation becomes more complicated considering that sometimes in the same family there are both status and non-status members (Anderson *et al.* 2006). Health Canada (2009b) considers a household Aboriginal if at least one parent in a family household, or 50% of the residents of a family or non-family household, identify as Aboriginal.

- Differences and tensions, especially concerning data ownership, between agencies that collect universal, comparable health indicators (e.g. Statistics Canada) and agencies that promote the development of Indigenous-centered information (e.g. Assembly of First Nations) often occur (Anderson *et al.* 2006).

- Lack of infrastructure and human resources at all levels of data collection, mobility of populations, limited participation in censuses etc. All the above result in poor quality Indigenous-specific data with little consistency (depending whether population estimates come from the Indian Register, the Census or the band lists). For instance Health Canada (2006) reports difficulties and limitations in collecting and reporting sufficient

information on Aboriginal health. In the 2006 Federal report, most data were derived from the First Nations Regional Longitudinal Health Survey (RHS) 2002-2003 though previous versions were using Aboriginal-specific health information through the Aboriginal Peoples Survey (APS).

- Historically, First Nations health planners and service providers did not have access to trustworthy health information based on the best available research. Most health information was housed within universities and governments, which were inaccessible to First Nation communities (Elias and O' Neil 2006).

- Traditionally, most indicators are collected to satisfy fiducially accountability requirements and justify resource allocation and not towards real improvements, and thus are of no local relevance and utility. Such centrally driven development processes, with limited or no regional and community level consultation of Aboriginal people, gave rise to policies that also lack local relevance and utility. Lack of feedback is another important limitation, since little information is returned to the communities to inform public health planning or service delivery (Anderson *et al.* 2006).

2.3.2.2   Aboriginal health data and indicator sets in Canada

Some of the agencies that own Aboriginal health data sets at a national level include government agencies such as: Statistics Canada with important data sets beginning with the Canadian Census and others such the Aboriginal Peoples Survey (APS) and the Canadian Community Health Survey (CCHS) (Statistics Canada 2007, 2008); the Canadian Institution for Health Information (CIHI); the Public Health Agency of Canada (PHAC); Health Canada and particularly the First Nations and Inuit Health Branch (FNIHB); Indian and Northern Affairs Canada (INAC); as well as non-governmental organizations such as the National Aboriginal Health Organization (NAHO).

Most national level Aboriginal health data is retained in the First Nations and Inuit Health Branch (FNIHB) of Health Canada. In 2004, Health Canada published for the first time "A Statistical Profile on the Health of First Nations in Canada", providing information about demographics, health status, and non-medical determinants of health (Health Canada 2009b), from a combination of multiple data sources, such as 2001 Census of Statistics Canada and the 2002-03 First Nations Regional Longitudinal Health Survey (RHS). The report includes information on registered First Nations people, mainly those living on-reserve. Various data and methodological limitations are recognized in this report, such as incomplete reporting for several

or all indicators in most regions, and lack of available Inuit-specific and off-reserve First Nation population data (Anderson *et al.* 2006).

Indian and Northern Affairs Canada (INAC) has generated health status indicators mostly for registered First Nation and Inuit people, maintains a large number of Aboriginal demographic data and has performed various surveys of First Nation people on reserves (INAC 2006, 2008). However, the accountability of those data sets are often questioned comparing to the quality Canadian Census data because they are mainly obtained from a sub-regional level, such as tribal council6 (Anderson *et al.* 2006).

The 2002-2003 First Nations Regional Longitudinal Health Survey (RHS), now hosted by the Assembly of First Nations, offers unique First Nations data, mostly for registered Indians on-reserve and is the only national survey under complete First Nations control (FNC 2007). The conceptual framework that was developed to guide the RHS is referred to as the Working Wheel (Figure 2-6).

Figure 2-6. The Working Wheel. Source: FNC 2007

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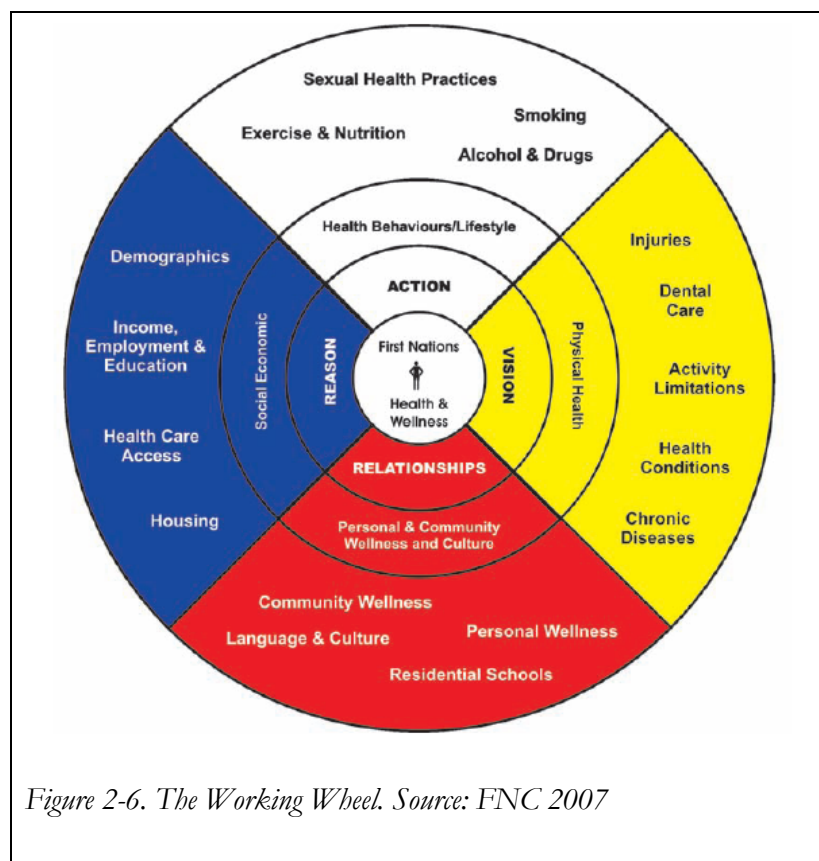
6 TRIBAL COUNCIL IS A REGIONAL GROUP OF FIRST NATIONS MEMBERS THAT DELIVERS COMMON SERVICES TO A GROUP OF FIRST NATIONS (INAC 2009).

In 2006 the Assembly of First Nations prepared the First Nations Health Reporting Framework (FNHRF) in order to evaluate First Nations health status and performance of health services. Another objective was to build First Nations owned health information systems that will enhance health program planning and administration capacity. The health determinants in this framework are organized into four overlapping areas (Figure 2-7.): individual health, environmental health, community health and social and cultural health (AFN 2006).

Figure 2-7. First Nations Determinants of Health. Source: AFN 2006
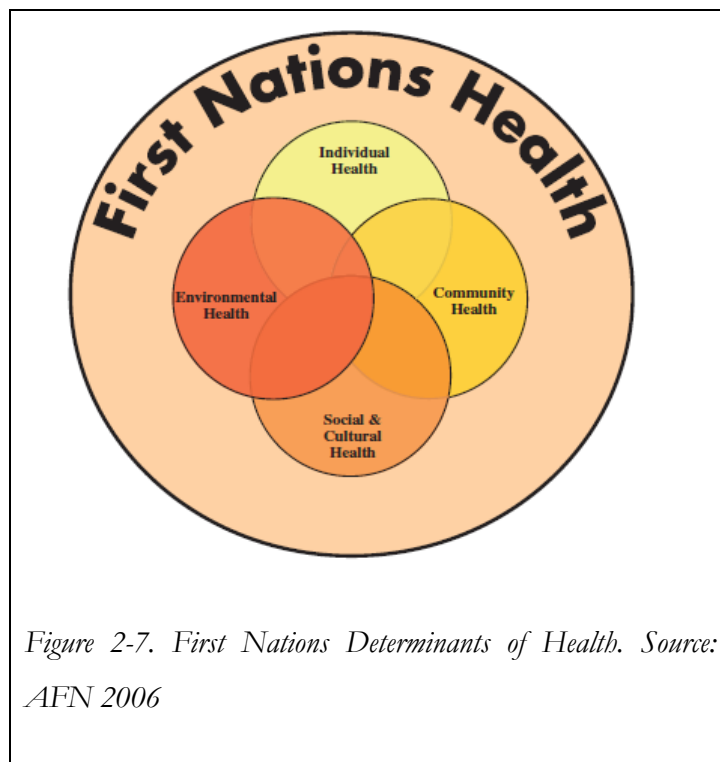
In provincial and territorial level there is an effort to link provincial health data with First Nations population data through various ethnic identifiers (such as health card flags). However, non-status First Nation, Métis and Inuit people are still excluded. Indigenous operated health authorities may publish health indicator reports but are usually limited to specific issues, such as immunization programs and diseases as required by FNIHB. Other non-health indicators such as housing, education and environmental determinants are scattered and of doubtful reliability (Anderson *et al.* 2006).

Regional level health indicator sets usually lack Aboriginal-specific data. Another issue is that the provincial health regions do not coincide geographically with First Nations regional health authorities. An exception is the Northern Saskatchewan's Health Indicators Report 2004 (Irvine *et al.* 2004) that despite the lack of Aboriginal-specific data, can serve as proxy measure of these populations because of their large representation in the region (most of the population is of

Aboriginal origin). A detailed report on Indigenous health in Saskatchewan was published in 2006 by the Indigenous Peoples' Health Research Centre, a joint initiative of the University of Saskatchewan, the University of Regina and the First Nations University of Canada (Sinclair *et al.* 2006).

2.3.2.3 Community-level assessment of Aboriginal health

Most of the available Aboriginal health data and indicator sets are have limited utility at a community level as they are "one size fits all", they usually focus on national priorities and fail to conceptualize health from an Aboriginal perspective (Anderson *et al.* 2006). For this reason it is important to develop community-specific, culturally appropriate health frameworks. Nevertheless, a core set of indicators that allow tracking over time and comparisons between communities is necessary, given that it allows variations and changes according to special needs of a community (Jeffery *et al.* 2006b).

The development of indicators and frameworks that pay attention to the important processes of self-determination and cultural revitalization and hold the balance between scientific rigor and cultural and social relevance (Daniel *et al.* 2009), enhances cultural validity and reduces reporting bias (Cargo and Mercer 2008). The produced information can be further transformed into useful knowledge and be utilized in a beneficial way provided that the identification, collection, analysis and interpretation of data have been done by the community itself (Hancock *et al.* 1999). The whole process of participation to define public health problems and goals is essential for capacity building by: stimulating discussion within the community; raising awareness of the most important health issues; helping to identify community's strengths and weaknesses to address problems; empowering the community and stimulating public action towards a healthy future (Hancock *et al.* 1999; Jeffery *et al.* 2006b).

Furthermore, in order to cope with suspiciousness and mistrust towards researchers and secure the utility of the outcomes it is important to ensure that the communities not only will participate in the research but will also have access, ownership and control of the research data and information (Lalonde 2005). For this reason First Nations in Canada have established a set of principles known as OCAP (ownership, control, access and possession of research data) that they expect to govern the relationship between researchers and First Nations communities and authorities. The RHS is in full accordance with the principles of OCAP. An explicit ethical guideline has been also developed for conducting Indigenous research in Canada (Ermine *et al.* 2004). Health researchers funded by the Canadian Institutes for Health Research (CIHR), and

who conduct research specific to Aboriginal populations, are required to follow the CIHR guidelines document (CIHR 2007).

Following are some of the best examples of initiatives (organizations or Indigenous communities) in Canada that have tried to rectify the gaps in the local Aboriginal health information system by developing their own measuring models/indicator frameworks.

- The Inuksiutiin Health Information Framework that was released in 2002 by the national Inuit governing organization Inuit Tapiriit Kanatami (ITK) with the aim to secure important Inuit-specific data based on the Inuit understanding of health and to empower Inuit communities in their health planning (Boyd & Associates 2002).

- The EAGLE project (1990-2000) was a collaboration between the Assembly of First Nations, the Chiefs of Ontario and Health Canada in an effort to examine the effects of environmental contaminants on the health of First Nation people living in the Great Lakes basin, by combining traditional environmental knowledge and scientific information (AFN, COO & HC 2001). The project is considered landmark for First Nation community-based research and the outcome was a culturally sensitive framework for the assessment of Aboriginal health (FNC 2007). The produced indicators were organized in the so-called "community life indicators wheel", which is divided vertically and horizontally into corporal, spiritual, intellectual and visceral parts (Figure 2-8.). Each indicator provides a partial measure of community health with the health of the community being the balance point at the center (Jeffery *et al.* 2006b).
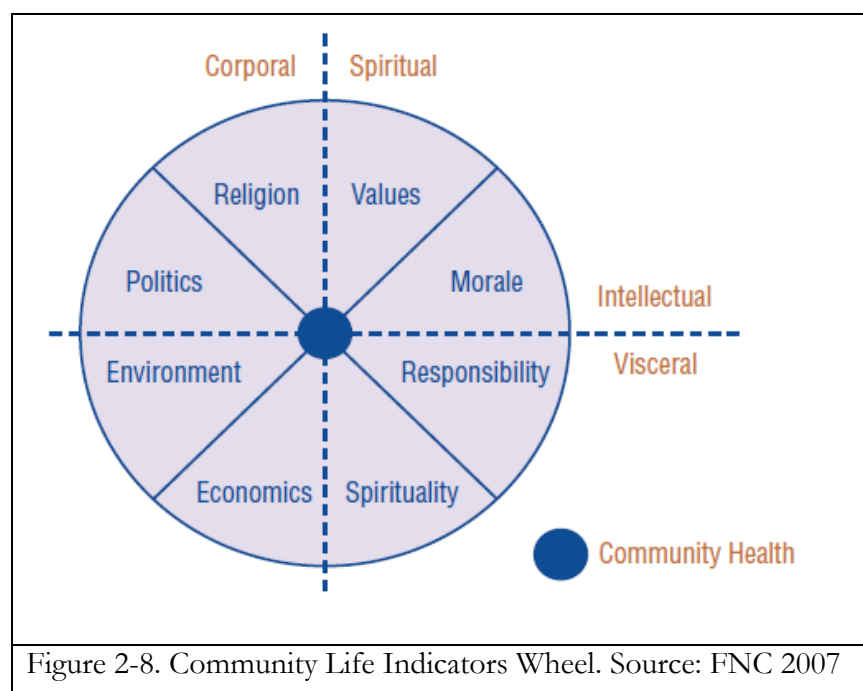
Figure 2-8. Community Life Indicators Wheel. Source: FNC 2007

- The Manitoba First Nations Center for Aboriginal Health Research (MFN-CAHR) has taken several population health research initiatives in full partnership with Canadian Indigenous peoples. A regional health survey was carried out to introduce population health research approaches to First Nations health care directors and providers to build capacity for further health planning. Indigenous people were also encouraged to participate in the development of questions of importance for the communities as well as to various health studies (Elias and O'Neil 2006).

- In 2000, the Mohawk Council of Akwesasne, Little Red River Cree Nation, Miawpukek First Nation and the Institute of the Environment at the University of Ottawa started working together on "The Community Health Indicators Project". The main purpose was the development of community health indicators based on the knowledge and requirements of Aboriginal communities (FNC 2007).

- The Saskatchewan Population Health and Evaluation Research Unit (SPHERU) has been involved in various Aboriginal community health projects (Johnson *et al.* 2008). Among other achievements, SPHERU developed an Evaluative Framework for use by First Nations Health Organizations. The current work is part of the second phase of this project which will be described in details in chapter seven.

2.4 Health and environment

The influence of environment on human health is very old knowledge. Hippocrates (500 BC) identified environmental variables such as climate, soil and water as causes of endemic diseases (Etches *et al.* 2006). The first English Sanitary Act was passed in 1388 to deal with "Corrupting" of the environment/air from practices at slaughterhouses (NAC, SARS & PH 2003). Pioneers of public health in the 18th and 19th centuries investigated and advocated action against the causes of environmental diseases such as poisoning from heavy metals, and introduced measures to limit inequalities in health (NAC, SARS & PH 2003). Nowadays it is widely recognized that physical and mental health are intricately connected to the environment. Health Canada (2008) identifies physical environment as one of the key determinants of population health, including psycho-social wellbeing.

2.4.1 Environment as a health determinant

In a broad medical sense environment is all the external (non genetic) factors that can affect a human host, including physical, biological, social and cultural (Last 2001). WHO (2006) proposes a more practical definition for the purposes of environmental health: "the environment

is all the physical, chemical and biological factors external to a person, and all the related behaviours. This definition excludes behaviour not related to environment, as well as behaviour related to the social and cultural environment, and genetics".

The WHO (2006) estimates that environmental factors account for approximately one-quarter of the burden of disease globally. However, much of this environmental disease burden is considered to be preventable by cost-effective measures and interventions like improved access to safe drinking water and sanitation (WHO 2006). The assessment and control of environmental factors that can potentially affect health, in order to prevent disease and create health-supportive environments is referred to as environmental health (WHO 2006).

2.4.1.1   Environmental health in Canada

Although the environmental disease burden is much higher in developing countries, the per capita impact of certain non-communicable diseases such as cardiovascular disease and cancers seem to be higher in developed countries, including Canada (WHO 2006). In 1998 the federal and provincial governments of Canada collaborated to publish *The Health and Environment Handbook for Health Professionals* in an effort to introduce basic environmental health concepts and serve as a quick reference for health professionals to help communicate complex and important health issues to the community (Health Canada 1998). However, environmental health is still considered as a neglected public health issue in Canada (Abelsohn *et al.* 2009).

According to Health Canada's report on the Health of First Nations (Health Canada 2009b) physical environment consists of various elements such as housing quality, clean air and water, sanitation services and security of community infrastructure such as fire services. The last Healthy Canadian's report (Health Canada 2009a) identifies two types of environmental health determinants: physical environment and built environment. The physical environment encompasses various variables such as air, noise, soil and water pollution, climate change, environmental contaminants, occupational health and safety, pest control, and radiation. The built environment includes housing as well as every type of built structure that provide the setting for many health determinants; built environment could have major impacts on physical and mental health through factors such as community design, adequate housing, access to safe water, good sanitation and a variety of services (Health Canada 2009a).

For the current project the term environment included the physical environment (e.g. land, air, water, plants and animals). Housing, as a critical component of environment with major effects on health and overall wellness, has been studied as a separate domain. However, during

the research process and analysis local perspectives of the concept of environment were brought in and taken into consideration in the discussion of the results.

2.4.1.2   Efforts to measure environmental health determinants

The field of environmental health is broad and complex (Abelsohn *et al.* 2009). A variety of health problems such as cancers, birth defects, respiratory problems and other illnesses can be linked to contaminants in food, air, water or soil (Health Canada 2009a). However, it is often difficult to establish causality between environmental hazards and health outcomes. In some areas (air pollution and health) scientific evidence can be strong while in others (pesticides, climate) there is controversy and uncertainty. Other important factors such as time of exposure, multiple exposures and genetic-environment interactions makes the linkage between environmental hazards and health outcomes an even more complicated and difficult task. In most cases environmental health tracking combines datasets from many different disciplines, such as epidemiology, toxicology, engineering and others (Abelsohn *et al.* 2009).

Eyles and Furgal (2002) describe the measurement of all the relationships between health and environment as an endless task. The authors propose the selection of an indicator set based on what is important to measure based on the concerns of a population group or a community. As for all the indicator sets, environmental health indicators should also be based on a conceptual framework that puts the indicator set at the heart of the selection process.

In the previous chapter a number of various efforts to develop population health indicators and frameworks were reviewed. Most of them, for instance the CIHI Health indicator set, seem to have a gap as far as it concerns environmental determinants of health. Recently there has been a growing interest in the development of indicators that focus on the intersection of the two domains, health and environment that comprise the so-called environmental health (Abelsohn *et al.* 2009).

These efforts include work at the European and international level. The World Health Organization has developed a core set of environmental health indicators for Europe (WHO Europe 2004) while the United States, through the Centers for Disease Control and Prevention and partners established a National Environmental Tracking Program (CDC 2006). In the Canadian context various research efforts culminated in the October 2000 Conference on Environmental Health Surveillance held in Quebec City. The result was a common environmental health surveillance system for tracking environmental health, occupational health and infectious diseases which consists of 41 environmental health indicators based on expert consensus (Abelsohn *et al.* 2009).

Other efforts to explore the potential for developing environmental health indicators have been made at various levels. The Canadian environmental sustainability indicators aim to track three major environmental issues of concern for Canadian health/wellness and economy: air quality, water quality and greenhouse gas emissions (Environment Canada 2008). However, the current reports provide nationwide results comparable to other countries and regions but fail to reveal issues of environmental injustice such as disparities and inequitable share of the environmental burdens within the population, such as Aboriginal communities. According to the Canadian Institution for Health Information (2004) most commonly measured environmental elements of community health in related literature are air/water quality, waste management and housing while other aspects of environment such as renewable resources, local production, soil or food contamination, and noise pollution, are less developed.

Abelsohn *et al.* (2009) claim that despite the growing concern on environmental issues such as climate change and air pollution in Canada, there is still a lack of public health infrastructure and programs to effectively deal with environment as a health determinant. The authors propose the development of a coherent national system of surveillance indicators of environmental health that will include hazard, exposure and outcome surveillance as well as assessment of policy interventions.

2.4.2   Aboriginal environmental health

From a traditional Indigenous perspective, the term "environment" does not distinguish between humans and everything else in nature, like wildlife, fish, trees, air, land and the spirits (Kwiatkowski 2010). Aboriginal people in Canada have long recognized the link between environment and human health. In many cases Aboriginal communities have been subject to environmental damage that has affected their health and wellbeing disproportionally compared to the rest of the Canadian population. Many of the environmental burdens faced by Aboriginal people have been the result of the action of others, like contamination by persistent organic pollutants or impacts of climate change (Hassol 2004).

Indigenous cultures, interactions and systems are tied to the lands and many of the Aboriginal people continue to practice traditional lifestyles and diets, being exposed to various health risks (e.g. through the food pathway) (AFN 2005). The role of environmental contaminants in the multi-factorial causes of disease is usually complicated and there is a need to consider interactions between exposure and other health conditions. For instance, obesity is associated with an increased risk of diabetes. Persistent organic pollutants (POPs), even at low concentrations, are also related to increased risk of diabetes (AMAP 2009). The etiologic role of

certain contaminants (e.g. POPs, arsenic) in diabetes and other disease needs are currently under study (Longnecker and Daniels 2001). Information about the impacts of POPs and other contaminants to human health, with focus in the Aboriginal people in the Arctic, is provided by the Arctic Monitoring and Assessment Programme (AMAP 2009).

2.4.2.1 Resource development and Aboriginal community health

The impact of resource extraction such as uranium ore mining and other development projects on human health is a major issue in Canada's North. Inadequately addressed in the past, there has been an effort to include human health issues in Environmental Impact Assessment reports that are currently focusing mainly on impacts of development on the physical environment (Noble and Bronson 2005). The *Canadian Handbook on Health Impact Assessment* (Health Canada 2004) provides health indicators for use in the Environmental Impact Assessment (EIA) of development projects combining physical health and socio-cultural wellbeing. It also highlights the importance of combining scientific information, public concerns as well as traditional knowledge -including indigenous knowledge- for an informed, integrated health assessment.

Many efforts are also made to explore the impacts and responses of resource development projects in Canada at a community level. The National Aboriginal Health Organization (NAHO 2008) summarized the annotated bibliography and discovered that although there are many documents about resource extraction impacts on the environment that can subsequently affect health and wellness, there is little literature on other impacts such as social, cultural, gender and political.

Some of the most successful community attempts identified have been inter alia the Yellowknife Dene First Nation assessment of health and socio-economic impacts of diamond mining on their communities (Tsetta *et al.* 2005) as well as the Lutsel K'e Dene First Nation community-based monitoring project of changes on health due to mining (Parlee and O'Neil 2007). Nonetheless impact analysis of resource extraction is a relatively new phenomenon for Aboriginal communities and there is a growing need to develop their own methods of assessment and mitigation of associated environmental and human impacts of resource development (NAHO 2008).

2.4.2.2   Climate change in Canada's North

There is strong evidence that Canada's North7 experiences significant changes in its climate with pronounced impacts on Aboriginal and Northern communities (CCME 2003; Furgal and Seguin 2006). Scientific research, monitoring, as well as observations and knowledge acquired from Aboriginal people show that these changes seem to happen faster compared with the other parts of the country. Some of the unique challenges faced by these communities are changes in ice and terrain conditions, changes in the formation and break-up of ice on water systems, changes in species ranges and numbers and in fresh water supply (CCME 2003). The assessment of these changes on people's lives in order to develop appropriate response strategies requires an interdisciplinary approach and diverse methodology.

Increased accidents due to ice thinning and break up, increased morbidity due to extreme weather events, elevated ultraviolet radiation levels and other stresses related to climate change are some of the potential problems for human health and wellbeing that were identified in the Arctic Climate Impact Assessment (Hassol 2004). However, the research on climate change and health impacts in northern Canadian Aboriginal communities is relatively new and still lacks regional scale assessments. Given the increasing pressure and the new challenges there is a growing need for community participation in filling information gaps (Turner and Clifton 2009). Indigenous knowledge and local observations of environmental change combined with scientific assessments and monitoring can provide a better understanding of factors that enhance or inhibit adaptive capabilities in changing environments (Ermine *et al.* 2008).

The AFN Environmental Stewardship Unit, in collaboration with Health Canada, have been working on the "Climate Change and Health Adaptation in Northern First Nation and Inuit communities" program that funds First Nation community centered research on adaptations to the health impacts of climate change (AFN 2010). Other community-based research examples in this field have been: the recent work of Ford *et al.* (2010) on climate change policy responses for Inuit people in Canada in close collaboration with 15 Inuit communities and

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7 A common definition of Canada's North includes the regions north of 60 latitude (Furgal and Seguin 2006); the community under study is located on the 59 degree, right on the border between Saskatchewan and Northwest Territories, and will be considered as such.

policy makers; and the Climate Change and Health Project in Nunavik and Labrador regions (Furgal and Seguin 2006).

Most of the climate change research has been focused on the Arctic as one of the most vulnerable and impacted regions on Earth (Hassol 2004; Krupnik and Jolly 2002). Northern Saskatchewan in particular is found on the transitional subarctic zone where there are few historical weather monitoring stations compared to the southern regions of the province. This information gap needs to be filled partly by proxy environmental measures as well as by using Indigenous oral knowledge (Ermine *et al.* 2005). One of the major efforts towards understanding the climate change impacts on Aboriginal community health in Saskatchewan has been the Prairie Adaptation Research Collaboration Project Isi Askiwan, with the participation of the Prince Albert Grand Council Elders Forum on Climate Change in February 2004. The traditional ecological knowledge (TEK) held by the Elders and other members of Aboriginal communities provided valuable information about changing climate in the region (Ermine *et al.* 2005). More efforts towards this direction are important to raise awareness at the community level around issues of climate change and promote action.

2.5 Traditional ecological knowledge (TEK)

For thousands of years, Aboriginal peoples worldwide have been using the knowledge of their lands and local natural resources to sustain themselves and maintain their cultural identity (Johnson 1992). During the last two decades the western scientific community and academia have shown growing interest in this knowledge, interest that has emerged from the recognition that indigenous knowledge is a valuable source of ecological information (Ermine et al 2005) and can be used to address contemporary environmental problems (McGregor 2004). A growing body of literature refers to the value and potential application of traditional ecological knowledge (TEK) and various research projects have attempted to document the knowledge of Aboriginal groups worldwide (Johnson and Ruttan 1992). TEK is typically ascribed to Aboriginal people (Usher 2000), however, similar knowledge can be found among non-indigenous groups, such as local harvesters or farmers (Johnson 1992). The word traditional reflects the cultural continuity of knowledge and does not necessarily mean that TEK is static, or stuck in the past (Witt and Hookimaw-Witt 2003). On the contrary, it is considered dynamic knowledge, adaptable to new challenges and evolving through new experiences and observations (Usher 2000).

2.5.1 What is TEK?

Researchers have used different terms to describe TEK -which is also labeled as traditional environmental knowledge, indigenous ecological knowledge (Johnson 1992) or just traditional knowledge (Usher 2000). The most commonly used definition is by Johnson (1992), former executive director of the Dene Cultural Institute in the Northwestern Territories, who describes TEK as: "a body of knowledge built up by a group of people through generations of living in close contact with nature. It includes a system of classification, a set of empirical observations about the local environment, and a system of self-management that governs resource use". Witt and Hookimaw-Witt (2003) suggest that TEK is still applied to "keep the balance in the relationship to the environment" and that "the application of traditional knowledge is directed towards sustainability of life as a whole and it is defined within the concept of self-determination".

Johnson (1992) explains the general differences between TEK and western science, describing the first as: oral-based; experiential, based on empirical observation; holistic; intuitive and qualitative; rooted in the social context; diachronic; often spiritual. However, the author recognizes that there are exceptions in these generalizations and that TEK can also be quantitative and based on experiments. McGregor (2004) claims that the Aboriginal view of TEK is different from the existing Eurocentric definitions and that it includes the concepts of the Creation and the relationships between people, their local environment, the other living beings and the spirits. From an Aboriginal perspective indigenous knowledge has been characterized as a "way of living" (McGregor 2004) or as "the way we do things" (Witt and Hookimaw-Witt 2003) rather than just knowledge and cannot be separated from the people and their lands, the environment and Creation (McGregor 2004).

2.5.2 Integrating TEK into scientific research and decision making

The importance of indigenous knowledge and local people's expertise for achieving sustainable development gained international recognition with documents such as the Brudtland report (WCED 1987) and the Convention on Biological Diversity (McGregor 2004). In Canada a growing effort has been made to consider and incorporate TEK in resource management, conservation strategies, development planning, environmental assessment, environmental monitoring and decision making (McGregor 2004; Usher 2000); particularly in the North the integration has become part of public policy (Usher 2000).

The Canadian Environmental Assessment Act (CEAA) recommends the use of TEK as part of the EIA (Witt and Hookimaw-Witt 2003). Usher (2000) presents some of the Canadian

bodies that have adopted related policies, such as the Inuvialuit Final Agreement (IFA), the Government of Northwest Territories and the Committee on the Status of Endangered Wildlife in Canada (COSEWC). The Environmental Health Research Division (EHRD) of the FNIHB conducts scientific-based research in collaboration with numerous Canadian Indigenous communities in areas such as biomonitoring, health impact assessment, climate change adaptation and food security with the purpose to inform Health Canada's and Indigenous community's decision makers (Kwiatkowski 2010).

Sherry and Myers (2002) describe the growing efforts to establish co-management regimes of natural resources by signing institutional agreements between state management agencies and Aboriginal people in Canada; the authors argue that the effectiveness of such collaboration depends heavily on the successful integration between TEK and western scientific approaches. Some of these co-management regimes in Canada include: the James Bay and northern Quebec environmental regime (Peters 1999); the Inuvialuit wildlife harvesting and management regime (INAC 1997) and various research initiatives of documenting Aboriginal caribou hunting communities' traditional knowledge of barren-ground caribou populations to establish co-management regimes (Kendrick and Manseau 2008).

2.5.3 Co-management of barren-ground caribou in Northern Canada

Canada's first co-management board for a major game species, the Beverly and Quamanirjuaq Caribou Management Board (BQCMB), is an Aboriginal-led co-management group that was created in 1982 for the conservation of two distinct barren-ground caribou herds in Northern Canada; the Beverly and the Quamamirjuaq herds are of major economic, social and cultural value for Dene, Inuit, Métis and Cree people that live within their vast range. The migratory routes of the herds traverse Saskatchewan, Manitoba, the Northwest Territories and Nunavut (Appendix 10.1) (BQCMB 2002).

Several times in the past, federal and territorial governments have introduced regulations and hunting restrictions to address decline in caribou, ignoring indigenous knowledge and presenting local hunting as a threat (IASC and Saundry 2010). During the late 1970s, a recorded decline in Beverly and Quamamirjuaq barren-ground caribou herds became a controversial issue between biologists and Aboriginal people of Northern Canada. The majority of researchers and government managers were claiming that the caribous were decreasing because of over-harvesting by local people. Dene hunters attributed the decline to the lack of habitat protection, especially to the fires on the herds' winter range rather than excessive hunting. Inuit hunters were skeptical towards the scientific conclusions about population decline, supporting that not all

caribous had been recorded. They were also claiming that mining and other exploration activities had impacts on caribou distribution. Subsequently, more accurate surveys showed that the number of caribou was indeed underestimated and the need for multi-cultural co-operation was recognized by both sides (BQCMB 2002).

Johnson (1992) argues that Aboriginal harvesters are more concerned with increase or decrease trends of a population, than with actual numbers. The harvesters are usually in ongoing intimate contact with wildlife which allows them to make population predictions and detailed qualitative observations and harvest in accordance with individual and community needs. Johnson and Ruttan (1991) claim that sometimes the spiritual explanations of Aboriginal people conceal functional ecological concerns and can enhance the harvester's ability to manage the resource in a wise and sustainable way. Western scientists usually gather quantitative information to build mathematical models of population dynamics and make recommendations to decision makers for resource management. Both approaches can be seen as different sets of values and cultural norms that present reality from a different perspective (Johnson and Ruttan 1991).

The Beverly and Quamamirjuaq caribou herd co-management regime that was established in 1982 brought together government managers and Aboriginal people for co-operative research and action. The board consists of eight community representatives and five representatives of the governments of Canada, Nunavut, Manitoba, Saskatchewan and the Northwest Territories. Biologists, government officials and Aboriginal people have been working together on various monitoring programs of the caribou herds and their habitats; the local hunters share their knowledge and observations on distribution, movements and health of the herds (BQCMB 2002).

2.5.4 Challenges and limitations to integration

Integration of western science and TEK is usually a difficult task, subject to many challenges and limitations such as: the profound cultural barriers between the two different paradigms and subsequent misunderstandings; the rapid disappearance of TEK with the passing of elders (Johnson 1992); Aboriginal people are not always happy to see their TEK codified and written down, integrated into western frameworks and thus removed from its cultural context, thus they refuse cooperation (Simpson 2001; Usher 2000); on the other side, western science often devalues TEK as subjective, invalid (Witt 2007), superstitious or fatalistic (Johnson 2000). Usher (2000) claims that although the general policy requirements are usually in place in Northern Canada, there is usually lack of guidance and clarity on how to implement the integration of TEK and Western science (Usher 2000).

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Such integration has been also subject to criticism. Simpson (2001) characterizes the documentation of TEK as a product constructed outside the Aboriginal context for western-Canadian consumption. Nadasy (1999) also takes a critical look in integrating TEK and science because it is based on the conceptualization of TEK by the western scientific world which takes for granted the existing power relations between Aboriginal people and the state. According to the author, Aboriginal people are often forced to conform to the state's management bureaucracies and practices. For this reason, documenting, understanding and applying TEK has to comply with certain methodological and ethical mandates, including long-term community based and participatory research; attention to local protocols and research ethics; recognition of intellectual property rights (Butler 2004); respect towards Aboriginal culture; willingness on behalf of the scientists to put outside their research agendas and learn from the people and not about them (Simpson 2001); and focus on capacity-building and empowerment of the communities.

On the one hand, traditional knowledge has been criticized for having been eroded from assimilation to the western culture and for failure of transmission to new generations. On the other hand, some researchers tend to be very romantic and uncritical towards traditional systems of knowledge (Johnson 1992). It is important to understand that both approaches have strengths and limitations thus the best ways to integrate both sides towards effective management of natural sources and sustainable development need to be explored.

This thesis has been based on the contribution of Aboriginal knowledge, both traditional and contemporary, in assessing the impacts of the environment on community health. Aboriginal people's perspectives and experiences were captured in the form of visual images and narratives coming from the members of the research community.

3 Background of the current work

This thesis is based on the *First Nations Health Development* project conducted in collaboration between researchers of SPHERU and two organizations in northern Saskatchewan, the Prince Albert Grand Council (PAGC) and the Athabasca Health Authority (AHA). The AHA was represented by two First Nations communities (Fond du Lac and Black Lake Denesuline Nations) and three northern provincial communities (Stony Rapids, Camsell Portage and Uranium City) and PAGC participated with four of their First Nation Communities (Cumberland House Cree Nation, Wahpeton Dakota Nation, Red Earth Cree Nation and Hatchet Lake Cree Nation).

The project originated with senior health managers at the PAGC and the AHA. These organizations wanted to better understand how health and other human services contributed to health (or wellness from a holistic indigenous perspective) and to determine, from the community viewpoint, the information that should be monitored to assess progress in community health and wellness (Jeffery *et al.* 2006a).

3.1 Tools for Program Planning and Evaluation

In 2002, SPHERU researchers made a contract with PAGC to evaluate their transferred health services[8]. In the process of conducting the evaluation, the PAGC managers expressed a desire to expand the evaluation process, by including the issue of the health effects of various non medical factors (such as environmental degradation, nutrition, culture) on community health and wellness. The PAGC managers were also interested in determining what information communities could collect to track and monitor their progress in the area of community health outcomes. The newly-formed AHA also expressed interest in participating in the research (Jeffrey *et. al.* 2006a).

The project named "The First Nations Health and Development: Tools for Program Planning and Evaluation", built upon the 2002 evaluation, had two primary objectives: to develop indicators for use by First Nations health organizations to assess changes in community health in order to track the effects of health and human service programs under their jurisdiction; and to develop an evaluation framework that provides context to the range of indicators proposed (Jeffrey *et. al.* 2006a). The main research questions were: "What is a healthy

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[8] Transfer of health programs from Health Canada to First Nations and Inuit control. Community-based health services under transfer, including environmental health and treatment services, undergo evaluation at 5-year intervals (http://www.hc-sc.gc.ca/fniah-spnia/pubs/finance/_agree-accord/10_years_ans_trans/2_intro-eng.php#introduction).

community?" and "How would we measure that?" The outcome of this project was the development of a conceptual framework that reflected northern Saskatchewan Aboriginal views of a healthy community and the creation of a Community Health Indicators Toolkit (Jeffery *et al.* 2006a).

3.1.1 The development of the Toolkit

The research process was community-based and participatory, focused on building capacity between research and community partners (Jeffery *et al.* 2006a). The methods included: a literature review of indicators and frameworks in Aboriginal context and relevant documentation for each community; review of resources from the health and social service programs in each of the participating communities; community interviews and focus groups to ask community members and program managers about what makes a community healthy and how they could tell whether their community was healthy. Community relevant indicators were often suggested by the participants in the focus groups as part of the discussion (Jeffery *et al.* 2006a). The main outcomes of the project were: the production of logic models[9] that describe the health and other social programs offered in the First Nation participating communities (the basic structure of a logic model is contained in Appendix 10.2); the Community Health Indicators Framework and the Indicators Toolkit.

After reviewing and making necessary revisions to ensure that the framework and the indicator categories reflected the participant's views, the next step was to search for existing data sources that could be available at the community level. For this reason a pilot testing of the framework and the indicators was conducted in one of the communities to identify the availability of data at regional and national level for some of the indicators, suggest survey type questions for local level data collection and identify possible gaps in the indicator sets. After the pilot study the toolkit was revised again into the final version (Jeffery *et al.* 2006a).

3.1.2 Community Health Indicators Framework

The purpose of the framework is to organize the concepts of community health described by community members into key areas (domains) with proposed indicator categories. The developed framework consists of six domains that are considered to influence community health and wellness and need to be measured: 1. economic viability; 2. healthy lifestyles; 3. services & infrastructure; 4. food

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[9] A logic model is a summarized graphical representation of the goals, objectives, resources, activities and anticipated outcomes of a program. It is normally displayed on one page and it is used to assist with both the understanding and evaluation of programs (Jeffery *et al.* 2006a).

security; 5. identity and culture; and 6. environment. Each domain is associated with a number of specific areas (indicator categories) that were indentified as important for community health and wellness. Outside the circle of domains key illness and addictions issues that affect the health and wellness of the community members are identified (Jeffery *et al.* 2006a) (Figure 3-1.). These are not located within the conceptual framework since it is intentionally structured to capture health and wellness rather than disease. Illnesses and addictions simply serve as the entry to the discussion about what makes a community healthy, a tangible issue to through which to explore how the determinants play out.
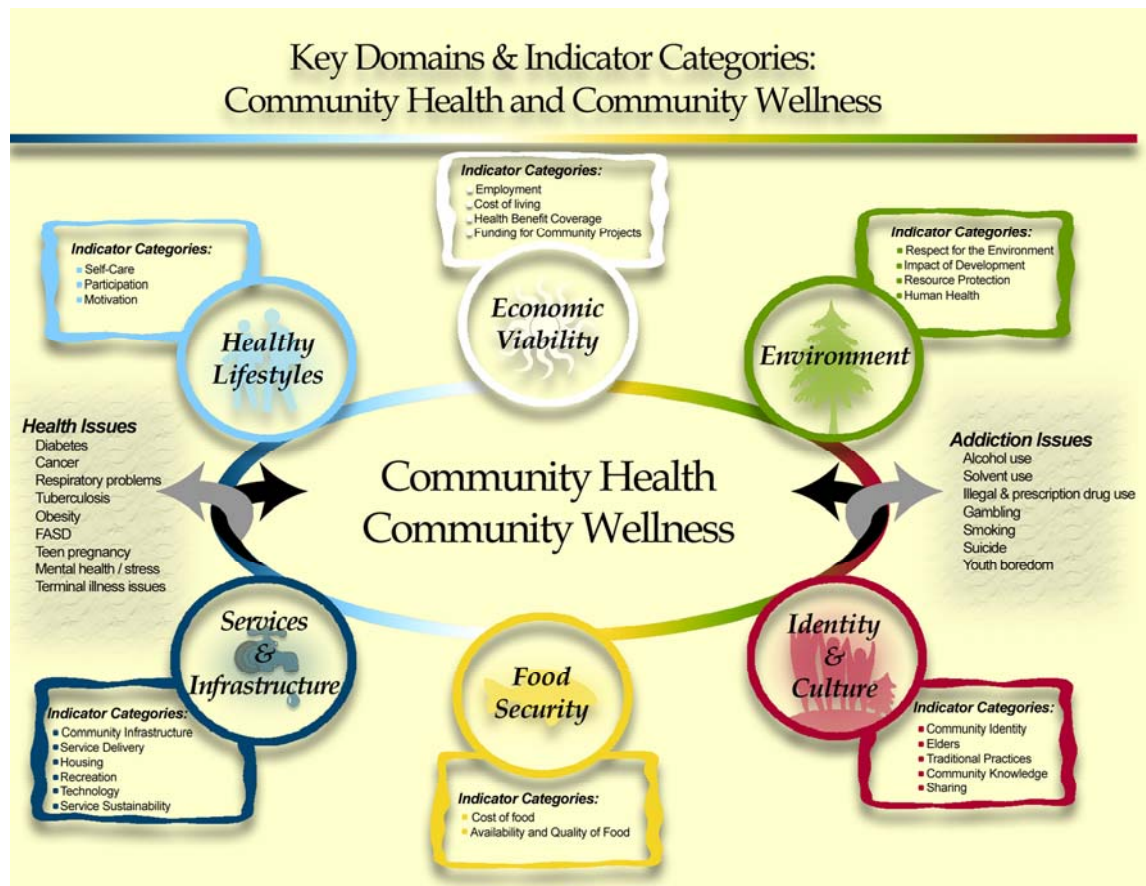
Figure 3-1. The Community Health Indicators Toolkit. Source: Jeffery et al. 2006a.

3.1.3   Community Health Indicators Toolkit

The Community Health Indicators Toolkit was designed to assist with the identification and collection of data, based on the 6 framework domains with their respective indicator categories. The individual indicators included in each category can be tracked over time to see if there have been changes in each domain. The Toolkit consists of a diagram of the evaluation framework; a section on each of the

domains with their associated indicators; and a methods section with information for the research process (Jeffery *et al.* 2006a; see also http://www.spheru.ca/research-projects/first-nation2019s-health-development-tools-for-assessment-of-health-and-social-service-program-impacts-on-community-wellness-and-capacity).

Each domain section of the Toolkit manual includes:

- A description of the domain and a list of the indicator categories
- Specific issue areas under each indicator category with their respective numbered list of community proposed indicators
- A set of data sheets, which organizes the indicators within each category into an indicator table and provides a list of data sources for each one of them.
- A tool sheet, which provides an example on how data can be collected and how a value for a specific indicator can be calculated (Jeffery *et al.* 2006a).
- An example of the Environment domain with the list of indicator categories, as it appears on the toolkit, is shown in Figure 3-2.

Figure 3-2. Example of the Domain description and Indicator list of the initially developed Environment domain of the Community Health Indicators Toolkit. Source: Jeffery et al. 2006a.
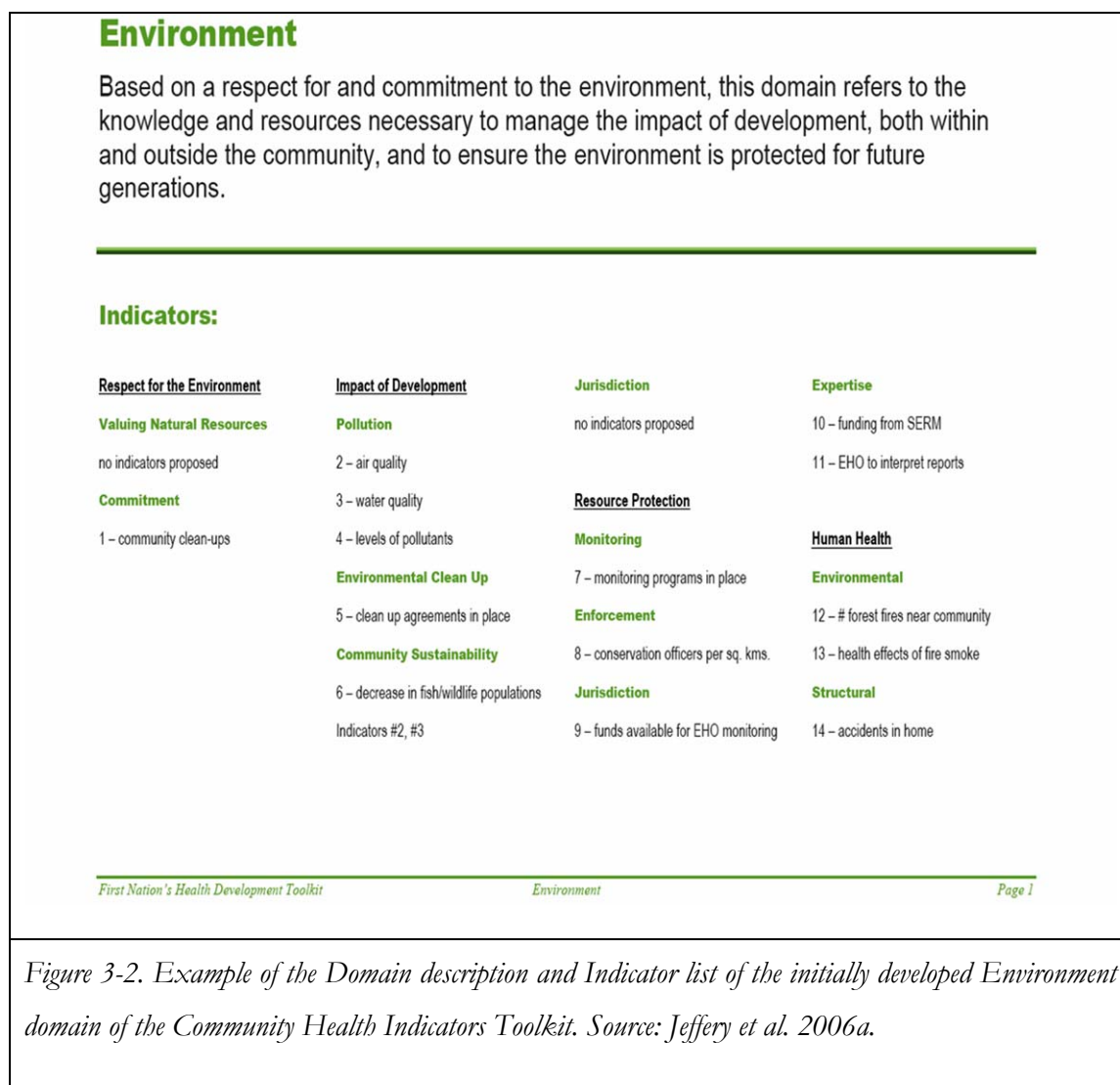
3.1.4 The environment domain

The Environment domain is described as following: "Based on a respect for and commitment to the environment, this domain refers to the knowledge and resources necessary to manage the impact of development, both within and outside the community, and to ensure the environment is protected for future generations" (Jeffery *et al.* 2006a). It consists of 4 indicator categories: respect for the environment; impact of development; resource protection; and human health. An example of the domain datasheet is shown in figure 3-3.

The environment domain of the toolkit has been reviewed and revised by Anthony (2009) who developed avenues for further exploration of the concepts related to the environment domain; proposed additional indicators for identified issue areas; updated the community and regional level data resources; identified relevant indicators developed and used elsewhere; and proposed more questions for research and dialogue. The Environment domain indicator list of the Toolkit before and after the changes made by Anthony (2009) are shown in Appendices 10.3 and 10.4.

Figure 3-3. Datasheet of the environment domain. Source: Jeffery et al. 2006a

3.2 Tools 2: Community health and wellness indicators reflecting daily life in Saskatchewan's isolated far North.

Based on the previous work of Tools 1, SPHERU (2010) continued with the project Tools 2: "Community health and wellness indicators reflecting daily life in Saskatchewan's isolated far North: Implications for Program planning and evaluation". The purpose of this project is to work with the 5 northern communities of Athabasca Health Authority on a detailed study of their community health framework in order to answer the questions "How healthy is our community" and "Why would we want to measure that?" (Abonyi *et al.* 2007).

3.2.1 Phase 1: The community health indicators database

To answer the first question, the pilot study from the earlier work has been expanded to include four more northern communities. As with the earlier research the approach is collaborative, grounded on community-identified priorities and aiming in capacity building and data ownership by the community. During this first phase, indicator information is being compiled in community-specific data bases. These data can be used by Athabasca Health Authority for evaluating community-based and controlled program, for resource allocation and for facilitation of policy initiatives. Moreover, as the data quality allows, quantitative analysis of this data by applying the Toolkit is conducted to produce health profiles for each of the communities, focusing on four domain areas (food security, services & infrastructure, housing, culture & identity and environment) (SPHERU 2010).

3.2.2 Phase 2: A year in the Life

This second phase of research is answering the question: "Why would we want to measure that?" meaning: Are we measuring the right things?; What are the elements of community health that are important to community members, and how do these members understand the linkages between them? According to the project's description during this phase an ethnographic approach is being taken, including visual, oral, and ethnographic exploration of the life of community participants from a variety of social and familiar arrangements in the areas of environment, food, housing and culture (Abonyi *et al.* 2007). This thesis is part of this phase of Tools 2, with a focus on understanding local perspectives on the role of the environment in the health of the community.

3.2.3   Phase 3: Dissemination and feedback

The third phase will include dissemination and feedback with community members in the form of a community photo exhibit and dinner. There will also be a focused discussion with a sub-group of exhibit attendees (Abonyi *et al.* 2007).

4 The study area: Athabasca region

The Athabasca region is located in the northern part of the province of Saskatchewan. The total population is over 5,000 people most of whom are of Aboriginal origin (Métis, Cree or Dene). The region includes seven communities: Fond du Lac, Black Lake, Hatchet Lake, Stony Rapids, Uranium City, Camsell Portage and Wollaston Lake. The first three are First Nation communities, governed by the Chief and the Council while the rest are provincial communities. Road access to the region is via Highway 905, which extends from La Ronge to Wollaston Lake. The Athabasca seasonal road links Highway 905 with Stony Rapids and Black Lake and an ice seasonal road connects Stony Rapids and Fond du Lac (ALUPIAP 2003). A map of the region is provided in Appendix 10.5.

4.1 Physical geography

The vast Athabasca region has subarctic to arctic climate with long, cold winters and short, cool summers and relatively low precipitation. Almost one third of the area is covered by lakes, with major drainage systems being the Athabasca and Churchill Rivers (ALUPIAP 2003). From the southwest towards the northeast the boreal forest is gradually depleting towards a sparse and underdeveloped transitional forest, accompanied by a change in composition and abundance of animal species across the region as well as a change in socio-cultural expressions (Hay 2006).

Wildlife density is low to moderate due to the harsh environment created by the transitional climate, the shallow and often sandy soils and the high fire frequency. Especially the habitats of the dry uplands are poor for most animals, while the lush riparian vegetation attracts mammal and bird populations as well as several amphibian species. Mammal populations in the region include large game such as barren-ground caribou (*Rangifer tarandus groenlandicus*), moose (*Alces alces*) and woodland caribou (*Rangifer tarandus caribou*), predators such as grey wolf (*Canis lupus*), black bear (*Ursus americanus*), lynx (*Lynx canadensis*), wolverine (*Gulo gulo*) and marten (*Martes americana*) and many other smaller mammal species. Bird fauna includes resident species such as the common raven (*Corvus corax*), spruce grouse (*Falcipennis canadensis*) and ruffed grouse (*Bonasa umbellus*), grey jay (*Perisoreus canadensis*) and other species. There are also migratory breeding populations of bald eagle (*Haliaeetus leucocephalus*), red-tailed hawk (*Buteo jamaicensis*) and other bird species. Waterfowl include the mallard (*Anas platyrhynchos*), common merganser (*Mergus merganser*), lesser scaup (*Aythya affinis*), common loon (*Gavia immer*) and other bird species (ALUPIAP 2003).

4.2 The Dene people

The Dene (meaning "the people") are First Nation people that live in the northern boreal and arctic regions of Canada and their homeland is referred to as Denendeh (Young 2008). One of the main Dene groups is the Denesuline (pronounced Dene-su-lee-neh) of the Athabascan region, also known historically as Chipewyan (Hay 2006). Denesuline language belongs to the Athabaskan linguistic group, with many variations across the province. Before the European contact, the Denesuline were the most numerous of the northern Athabaskan groups, occupying the wide boreal-tundra area for an estimated period of 8,000 years; their distribution was changing historically following changes in the tree line and temperatures (Elias 2003).

Traditionally Denesuline people lived on the land, mostly hunting, trapping and fishing. For this reason they were traveling great distances, often extending their winter range of hunting camps northward into the Northwest Territories (ALUPIAP 2003). While moose is considered to be an important source of meat and wood bison has also played a significant role for the regional Indian bands, the most important large-game animal for the Denesuline is the barren-ground caribou (Hay 2006). The distribution of the Denesuline bands and hunting groups has been closely linked to the dispersal and movements of barren ground caribou, mostly those of Qamanirjuaq and Beverly herds, which are available with some regularity in the Athabasca Basin (Wakelyn 1999).

Apart from its economic importance as source of meat and other products, hunting of barren ground caribou is an essential element of the Athabasca Denesuline cultural identity. The migration of barren-ground caribou is an essential part of community activity and involves outdoor travel and bush skills, knowledge of the land and animals, and respect for the sustainability of the herds (ALUPIAP 2003). The meat preparation within the community by the women is also an important part of the Denesuline community life.

Trapping is also an important traditional subsistence activity of the Denesuline people. Fur-bearing animals that are often trapped for food and hides are beaver (*Castor canadensis*), muskrat (*Ondatra zibethicus*), marten (*Martes Americana*), mink (*Mustela vison*), weasel (*Mustela erminea*), fox (*Vulpes fulva*) and otter (*Lutra canadensis*). Although beaver was once very important to trappers during the early Fur Trade, it has declined in importance over the years (Hay 2006). Fishing is also a vital part of life in the Athabasca region. One of the most preferred species is the lake whitefish, but other species are harvested as well such as lake trout, northern pike, arctic grayling and others. Other activities, such as gathering of wood, berries and plants usually take place around the communities (ALUPIAP 2003).

Today the Denesuline occupy the territory in northern Saskatchewan from Lake Athabasca in the west to Wollaston Lake in the east. The primary communities of the Athabascan First Nations Denesuline are Fond-du-Lac, Black Lake and Hatchet Lake. There are also bands in Alberta, Manitoba and in the Northwest Territories (ALUPIAP 2003). Most people are bilingual with English but Denesuline is predominately spoken in everyday life of the communities (PAGC 2010).

Since Dene historically depended on caribou for much of their food, clothing, and shelter (ALUPIAP 2003), their lives revolved around the migration of these animals, resulting in frequent moves and temporary settlements, almost until the middle of the 20th century (Elias 2003). Nowadays many communities have become more permanent and have transitioned to a mixed economy of traditional or land-based activities and wage employment. Hunting of caribou still takes place during the autumn and spring migration of the herds between their winter range and calving grounds (BQCMB 2002). Many of the wage employment opportunities are associated with large-scale development of nonrenewable natural resources (e.g., mining) in the region. These increases in development and cash income have resulted in changes in local economies and increased accessibility to many market items typically available in urban centers to the south (AIAP 2006). On the other hand the shift from nomadic to a sedentary lifestyle and salary based subsistence is criticized to have social and other implications such as: dependency on government social assistance to cover their basic needs when unemployed, increase of birth rates, cultural disruption and various health problems because of processed food consumption (UoS 2000).

Compared with southern Saskatchewan the people living in the Athabasca region face higher unemployment (almost 4 times higher than the provincial total) low income level, housing shortages and overcrowding and a range of health challenges such as higher rates of lung cancer, increasing diabetes problems and higher rate of tuberculosis (ALUPIAP 2003).

4.3   Industrial and commercial land use

Mining is the most important industrial activity and the biggest employer in the Athabasca region (UoS 2000). The Athabasca basin has the world's largest uranium resource generating almost one third of global production. There are also numerous sand and gravel quarries and other mining operations. Most of the Crown-owned mineral and petroleum commodities are managed by Saskatchewan Energy and Mines (SEM). Saskatchewan Environment and Resource Management is responsible for the monitoring of environmental regulations of mining operations. Given the less vigorous environmental regulations of the past,

there are numerous abandoned mine sites north of the Lake Athabasca and the Fond-du-Lac River which create major concerns about environmental impacts and public safety (AIAP 2006). Only in the Uranium City region there are around 45 abandoned mine sites. The Uranium City is a settlement on the northern shore of the Lake Athabasca that was established in 1952 to serve the thriving uranium mining in the Beaverlodge area by Eldorado and Refining Mining Ltd (Graham and Barsi 2001). After the sudden termination of mining and milling operations in 1982, the community has experienced economic collapse and its population fell from almost 5,000 to about 60 people (in the winter months) while in the summer there are approximately 200 people (AHA 2006).

Other important land use and economic activities that take place in the region are road and trail construction, commercial fishing, outfitting and other touristic activities, hydroelectric power development (AIAP 2006).

4.4   Land use planning and resource management

In March 2000 the Athabasca leadership -represented by the Athabasca Denesuline Nations Chiefs and Prince Albert Grand Council (PAGC)- and the Saskatchewan government signed the Agreement Respecting the Land and Renewable Resource Use Planning and Management in Northern Saskatchewan - Lake Athabasca Region. The purpose was to design a process and structure for integrated land use planning and renewable resource management within the Athabasca Basin. The main goal of the agreement is the sustainable development of the region in order to minimize the negative impacts of development and at the same time optimize social, cultural, economic and other benefits to present and future generations while conserving the integrity of the region's ecosystems (ALUPIAP 2003).

The agreement recognizes the need for participation of all interests (local and provincial); promotion of meaningful local decision making processes and public involvement; co-operation and balancing between local and provincial interests; recognition and promotion of needs of the people and communities in the planning area which will bear the greatest development impacts; openness and provision of adequate information to all impacted interests; and respect for indigenous traditions and incorporation of traditional knowledge (environmental, land use and resource management) into the land use plan; and respect for First Nation treaty rights to hunt, trap and fish on lands they have right to access (ALUPIAP 2003).

The Stage 1 land use plan has been prepared by an Interim Advisory Panel (IAP) with the majority of representatives coming from Athabasca communities; other partners include the Saskatchewan Mining Association and Saskatchewan Environment. The planning area is a 50 km

wide road corridor in the far North of Saskatchewan that includes the northern portion of highway 905 and runs along the seasonal road from Points North to Stony Rapids and the winter road between Stony Rapids and Fond du Lac. One of the major concerns of the Panel is the impact of development on the Athabasca communities' traditional land use activities and the need of compensation. Especially the environmental impacts of mining exploration activities were identified as one of the major resource management issues to be addressed. The land use planning process also includes a detailed management plan, the Athabasca Land Use Vision (Appendix 10.6) for conservation of natural and cultural resources as well as recommendations for the protection of barren-ground caribou habitats (AIAP 2006).

4.5   Community under study: Fond du Lac Denesuline First Nation

Fond du Lac is a Denesuline First Nation community (Indian reserve) located on the northeast shore of Lake Athabasca, with a total area of 138.26 km². According to the 2006 Canadian Census, the population of Fond du Lac is 801 registered Indians on-reserve (Statistics Canada 2010). The Fond du Lac Denesuline First Nation is one of the twelve affiliated First Nations members of the PAGC. The community has a Primary Health Center, community hall, one retail grocery store, elementary school, high school, catholic church, RCMP detachment office, a lodge, day care center, and Northlands college office. The Fond du Lac Health Center is operating with three primary care nurses, a home care nurse and support staff. Mandatory programs, regular clinic hours and 24 emergency services are provided, as well as physician services one day per week (AHA 2006). The community also manages and administers their own programs for education, health and social services (e.g. daycare, wellness program, family violence, social development) (PAGC 2010).

There is a winter road to Stony Rapids and also an airstrip that accommodates two flights per day except for Saturdays. Water and sewer treatment services are available and expanded sewage system works are currently being undertaken. Gas and electricity networks are provided from hydro-electric stations on the Charlot river system as for the rest of Athabascan communities (ALUPIAP 2003).

5 Methodology

The current thesis is part of the second phase of the Tools 2 project conducted by the researchers of SPHERU and three communities in the Athabasca Health Authority, as described in the previous chapter. To answer the question "Why would we want to measure that?" an ethnographic approach is taken to explore a year in life of the community participants in the areas of environment, food, housing and culture using photographs and words. For this reason, two qualitative research methods were used: photovoice and ethnographic data collection in the community of Fond du Lac.

5.1   Community-based participatory research

Historically, scientific research involving Indigenous people in Canada has been linked to colonialism (Castleden *et al.* 2008; Daniel *et al.* 2009). Many Aboriginal community health research efforts in Canada and elsewhere have been criticized for not providing adequate opportunities for community stakeholders to contribute to the research process. The result of non-participatory approaches to Indigenous health research has lead to outcomes that are not socially or culturally relevant and fail to provide tangible benefits to the communities (Daniel *et al.* 2009). As a consequence, skepticism, suspicion and even resentment towards academic researchers is a common case among Indigenous people (Castleden *et al.* 2008), especially towards research efforts that involve the extraction of data from their communities without any clear benefit accruing to the community and with the potential to result in any type of ranking (Daniel *et al.* 2009).

The current study uses a community-based participatory research (CBPR) approach that equitably involves community members in the research process and recognizes the strengths that such participation brings (Minkler and Wallerstein 2008). The main goals of this community driven and action oriented approach is to produce culturally and socially relevant knowledge owned by the community, to foster community capacity building, to cultivate trust, cooperation, dialogue and commitment to action towards social change and improvement of community health. Participatory research methods have demonstrated benefits to research range from enhanced participant recruitment and retention rates, to enhanced cultural validity of measures, reduced reporting bias, enriched interpretation of research findings and increased translation of findings into action (Cargo and Mercer 2008; Minkler and Wallerstein 2003). Some of the traditional methods to assess the health needs of a community are context evaluation, diagnostics evaluation, focus-groups, surveys, interviews and others (Wang and Burris 1997). The method that is used in the current research is known as photovoice.

5.1.1 Photovoice

Photovoice is a community-based participatory research method defined as "a process by which people can identify, represent, and enhance their community through a specific photographic technique" (Wang and Burris 1997). The main concept is to provide individuals with cameras and ask them to photograph their everyday health, work or living realities and then discuss their photographs. The purpose is to enable people to record and reflect their personal and community concerns and strengths over a particular public health or other social issue and to promote critical dialogue and knowledge. The final goal is to communicate the indentified issues with policy makers, health providers and other influential advocates than can catalyze positive change. Photovoice is flexible and can be adapted to different communities and groups of people for a variety of public health and other issues (Wang and Burris 1994, 1997). It is also user-friendly, because virtually everyone can use cameras, even those that don't know how to write and read in the dominant language (Wang 1999; Wang and Burris 1997).

Photovoice is based on three theoretical concepts: Paulo Freier's (1970) approach to education for critical consciousness; feminist theory, that participatory research has been traditionally influenced by male bias (Wang and Burris 1997); and community participatory based approach to documentary photography (Wang and Burris 1994). The method has been described as a participatory needs assessment tool (Pies and Parthasarathy 2008; Wang and Burris 1997) but also as a participatory research action method that can lead to community empowerment and action (Baker and Wang 2006; Catalani and Minkler 2009).

Catalani and Minkler (2009) have published a review of the use of photovoice in public health and related disciplines, reporting that more than half of the case studies have lead to community action towards health improvement. Hergenrather *et al.* (2009) explored the value of photovoice as a research tool in community health and despite the identified limitations of the reviewed studies the authors support further application of the method to facilitate community change. Some of the main advantages of photovoice reported by Wang and other authors (Baker and Wang 2006; Catalani and Minkler 2009; Hergenrather *et al.* 2009; Palibroda *et al.* 2009; Wang 1999; Wang and Burris 1994; Wang and Burris 1997; Wang *et al.* 1994) are summarized as following:

- It entrusts cameras on the hands of people that typically lack access to those that make decisions over their lives.
- It focuses on what is important for the community and not what is important for the researchers.
- It uses a powerful means to describe peoples needs, the visual image.

- It identifies every day realities, defines community goals and objectives and recognizes the legitimacy of popular knowledge as a contributor to scientific expertise.

- Photovoice can reach the most vulnerable or marginalized community members, such as uneducated people, poor village women, children, immigrant workers, old people, and homeless people. It is accessible to anyone that can learn how to use a camera and does not require literacy or special skills.

- It allows sampling of different social and behavioural settings. People can record moments, ideas, needs and settings of their everyday lives that health professionals and researchers might not have access to.

- Cameras seem to be an appealing and motivating tool for participation in the programs. Participation in photovoice projects can become a source of pride and ownership for the community and give an opportunity to people to express not only their concerns, but also their creativity and imagination.

- Photovoice can help to follow-up research goals and stimulate dialogue between the community members. For instance when participants are asked why they are taking pictures of the other community members there is an opportunity for them to explain the goals of the project, their concerns as well as to receive feedback.

- It enables participants to bring stories and ideas of other community members into the assessment process.

- It provides tangible benefits to people and their network; giving, for instance, photographs back to friends or neighbours.

- The participant can not only depict the community needs and but also its assets and capabilities that can't be captured with conventional surveys. In this way it uncovers positive and negative aspects of the community life.

- It is an adaptable and culturally flexible method, appropriate for many different objectives, different groups and communities (village women, students, Aboriginal communities) and diverse public health and other issues.

5.1.1.1 Previous work

One of the oldest efforts to enable Indigenous people to produce their own visual images was made in early 1970's by Worth and Adair (1972) who trained Navajo citizens to film their social world. However, their work, presented in the book "Through Navajo eyes", has been criticized by Feitosa (1991) for representing the researchers' instead of the Navajo people's interests. On the contrary, the Mekaron Opoi Djoi documentary project with the Kayapo

Indians of Brazil gave them the opportunity to produce videos that are representative of their needs and interests (Feitosa 1991).

Photovoice was developed in 1990's as an innovative research methodology, initially referred to as photo novella (Wang and Burris 1994), by the work of Caroline Wang and her colleagues with rural women in China's Yunnan province (Wang and Burris 1994; Wang *et al.* 1994). The following decades the practice of photovoice started growing rapidly to address numerous public health and social justice issues; a diversity of different groups and communities all over the world have been trained to use photovoice in portraying various aspects of their lives (Catalani and Minkler 2009; Hergenrather *et al.* 2009; Palibroda *et al.* 2009; Wang and Burris 1997). Many of the newer photovoice efforts altered Wang's methodology to suit the needs and constraints of researchers' unique projects (Hergenrather *et al.* 2009).

Photovoice research within Canada's Indigenous communities is an emerging field. Castleden *et al.* (2008) tried to modify photovoice for use in Indigenous context, in a research partnership with a First Nation in Western Canada. The participants provided their own perspectives of the photovoice process as part of a larger study on health and environmental issues. The analysis showed that the method succeeded in building capacity, fostering trust and sense of ownership and matching the cultural preferences of the people (Castleden *et al.* 2008). Poudrier and Mac-Lean (2009) employed photovoice to explore and make visible Aboriginal women's experiences with breast cancer in Saskatchewan. Since 2002, the Prairie Women's Health Centre of Excellence (PWHCE), an organization funded by Health Canada, has led five photovoice research projects in communities across the prairie region of Canada, to enable low income women to express ideas about poverty and public policy. Based on their experience and acquired knowledge the researchers have published a photovoice manual (Palibroda *et al.* 2009).

5.1.1.2 Ethics of research

The importance of community engagement and ownership of research data is reflected in ethical guidelines and codes of ethics for conducting Indigenous health research in Canada initiated by the Indigenous People's Health Research Center (Ermine *et al.* 2004). The Ethics Office of the CIHR in conjunction with its Institute of Aboriginal People's Health (IAPH) have published the CIHR Guidelines for Health Research Involving Aboriginal People, in order to assist researchers and institutions in carrying out ethical and culturally competent research involving Aboriginal people (CIHR 2007). The Tools 2 project complies with the CIHR Guidelines for Research Involving Aboriginal peoples as well as the standard Tri-Council Policy Statement on the Ethical Conduct for Research Involving Humans (TCPS 2009). The latter is a

requirement for all nationally funded research in Canada. Ethical procedures for individual research projects are reviewed by institutional ethics boards to ensure their consideration of the TCPS, and more recently of the CIHR Guidelines as well. This project was approved by the University of Saskatchewan Behavioural Research Ethics Board. The project requires that written informed consents are obtained from all the participants and follows explicit rules of ethical conduct during the photovoice and participant observation research (Abonyi 2007).

Since photovoice involves the use of photography there is an additional challenge to the ethical conduct of the community-based research, such as invasion of personal privacy (Wang and Redwood-Jones 2001). For this reason two levels of consent are required: the first level of consent covers the role of participants in the study, where they are asked to take photographs and participate in an interview to discuss their photographs; the second level of consent is for third party participants whose identifiable images may be captured as part of the photography activities (Abonyi 2007). The consent forms include: the Photovoice participant information and consent), the Photovoice participant photo release), the Interview Consent and the Interview Transcript Release). Photographs taken by any members of the research team that include identifiable individuals also require a signed release (Third Party Photo Release).

5.1.1.3   Methodology of photovoice

Phase 2 of the Tools project in the community of Fond du Lac is currently being undertaken by the community co-investigator, who is also the Health Director of the community and has been involved in this project since its inception in 2001. She hired and supervises a Community Research Assistant (RA) who is responsible for data collection activities and management. The RA is working directly with the participants on the photovoice project and also conducts ethnographic data collection, under the supervision of the community co-researcher. A Participant Guide has been created to assist research assistants with providing information and conducting the orientation with those interested in participating (Abonyi *et al.* 2007).

According to the project's guideline participants should include men and women who are young adults, older adults and in old age and represent different socioecomic and family arrangements (e.g. reliant on social assistance, traditional subsistence economy, paid work - possibly seasonal; living with other family members in multi-general households, or in nuclear family arrangements). Participants must meet the following criteria: (1) 18 years of age or older, (2) be able to provide informed consent, and (3) reside for the duration of the study period in one of the study communities. Their recruitment has been accomplished via a public poster

campaign and word of mouth. The participants are expected to participate in one-on-one orientations to the project with the community research assistant, which includes review of consent forms and discussion about their rights, options and opportunities; take digital photographs for a two week period, and participate in an interview that will explore a sample of the photographs taken. This cycle of photography and interview will take place 4 times throughout a full year, representative of a seasonal cycle of life (Abonyi *et al.* 2007).

In particular, participants were asked to take a maximum of 60 pictures in each season of the year: pictures of any places, objects, events, that are related to their current experiences and that remind them of their past experiences with a healthy community in the areas of 1) food, 2) housing, 3) culture and 4) environment; pictures of their every day life that reflect what they feel is important about keeping their community healthy in a particular season, or that show what they feel threaten or supports a healthy community in the four domain areas. A break of 4-6 weeks follows each season until all four seasons have been completed (Abonyi *et al.* 2007).

The main ideas that participants are to consider while taking their photos in each area as described in the Participant Guide are:

Environment: What do you feel are the usual and unusual conditions in the air, land, water, and animals that influence the health of your community?

Food: We are interested in understanding your experiences of access to safe, nutritionally adequate and personally acceptable foods in a manner which maintains human dignity. Housing: We are interested in knowing more about where you live and what is important about your housing to keep you and your family healthy.

Culture: What are the things that you do, places that you go, people that you hang with, that are important to being a healthy Dene person from Fond du Lac?

After each cycle of photography the participants meet the RA who downloads the pictures onto the laptop and then delete them from the camera. The participant goes through the pictures with the RA who organizes them into the four domain areas, and works with the participant to select the three most significant ones in each domain for discussion. The selected pictures, 12 in total, are discussed during an interview guided by the following questions:

- Why did you take this photo?
- What is important in that picture for a healthy community in the area of environment/food/housing/culture?
- What would threaten/facilitate what is shown here?
- If the photo is of something that is threatening to health in any of these areas, what could be done to change this?

- Is this photo related to any of the other three domains?

- Are there any photos that you would have liked to take but were not able to?

The previous questions are only meant to guide the interview as many other questions come up during the process. During the interview various issues and themes can be identified, such as food availability, pollution, etc. The interviewer can also probe for specific details in the photos relevant to the four areas (like smells, noises, etc.). Also, in order to contextualize, that is to understand what the photographs mean in a broader set of circumstances (Palibroda *et al.* 2009), the interviewer can encourage the participant to provide more information about the general setting of the pictures. For example, a photo of the winter ice road can lead to a story or a discussion of a larger context which includes the impact of late freezing or early spring melt on community transport and safety, the high expenses of traveling by other means, the lack or high prices of basic goods that have to be brought in from other cities, the general problems of isolation and other environmental and social issues.

During my visit to the community three photovoice participants were interviewed regarding their photos, all women. Two (referred to as P1 and P2) were interviewed on their winter photos for all four domains and the third (referred to as P3) on her spring photos and only for the area of environment. Before each interview, the first two participants had to separate their pictures into the four domains, e.g. housing, food, culture and environment (which were saved in different folders). Since there were less than 60 photos per person, the selection procedure was not strict and the participants were free to distribute their pictures as they wished to each domain, as far as they were at least 3 in each area. All interviews were recorded with the consent of the participants and then transcribed; audio-recording facilitated the access to all information in details and captured the occurring narratives and stories. The first interview was mainly conducted by a project (my co-supervisor) in the presence of myself and the RA. I performed the transcription for all three interviews, which were conducted in English. The participant (P1) asked for a copy of her transcript and returned it to me revised. The second interview with P2 was conducted by me but due to external factors we had to end the interview before discussing the area of housing. With the third participant (P3) we followed a slightly different procedure. The pictures were taken in my presence while driving and walking around the community. During this session I was also taking pictures and had the opportunity to discuss with the P3 about many environmental and other issues that affect the health and wellbeing of the community.

5.2   Ethnographic data collection

Ethnography refers to a broad field of studies that involve an immersing participation in the lives of groups of people (Bloor 2002). Such research involves two main activities: participant observation and writing down the observations in a regular, systematic way (Emerson *et al.* 1995). Participant observation or ethnographic fieldwork is described by Bernard (1995) as "getting close to people and making them feel comfortable enough with your presence so that you can observe and record information about their lives". Emerson *et al.* (1995) describe how the participant observation starts as the ethnographer enters into a social setting, gets to know the people, participates in their daily routines, develops relationships and observes what is going on. Establishing a place in the natural setting enables the ethnographer to investigate and represent social processes, relationships, values and various other aspects of social life in the form of written accounts and descriptions, the so called field notes (Emerson *et al.* 1995). Bernard (1995) argues that participant observation can include various data collection methods apart from observation such as natural conversations, various types of interviews, questionnaires and others.

Along with the photovoice project and capacity-building with the RA, I also conducted ethnographic data collection including participant observation and photography. Natural conversations with members of the community (of different age groups and both sexes) as well as outsiders largely took place opportunistically in public settings in the community or in private. A semi-structured interview with an elder member of the community was also arranged by the RA. The discussions were focused on the same questions to be considered by the photovoice participants around the role of food, housing, culture and environment in community health as well as other environmental and social issues. These observations, anonymized where necessary, became project data to be analyzed in conjunction with the photovoice findings because they provide different perspectives (community or outsider) on the factors influencing community health.

The fact that the participants and most of the community members are fully bilingual (Dene-English) made interaction and communication easier. However in their interactions with each other people often switch to Dene. The observations also provided a better understanding of the social and cultural context, as well as of the issues that were already encountered during the literature review. The whole experience was also helpful to formulate more sensible questions during the interviews and conversations.

5.3   Analysis of the results

The main data collected from the photovoice project were the photographs, taken by community members, and their own words describing and explaining the photographs. The photovoice data, in conjugation with the data and photos obtained by myself during the participant observation, were analyzed in order to: identify general issues or themes, a process known as codifying (Palibroda *et al.* 2009); discuss how individual opinions about health and environment were related or contradicting to each other and their connection to other domains.

The identified themes and issues were then compared to the Community Health Indicators Toolkit in order to: identify and discuss similarities and differences to indicators under the environment domain; identify possible common areas with other domains, such as food and culture; make necessary recommendations for improvements of the toolkit so that it reflects the communities' needs and concerns.

5.4   Challenges and opportunities

The most challenging part of the photovoice project was to reach the participants for the interviews. Despite the efforts of the RA, objective difficulties such as participants being away from the community during my visit and other personal reasons limited the photograph release and interviews to 3 out of 10 participants. Here comes the question posed by Bernard (1995) whether few informants are able to provide adequate information about an issue. The author claims that this is possible when the research relies on key informants rather than a representative sample. Furthermore all three participants were young women which could be considered as a form of gender bias. According to Wand and Burris (1997) most of the photovoice projects reported engagement of majority-female groups perhaps reflecting in part its roots in feminist research. Nevertheless, the casual conversations during participant observation included men of all ages, providing some gender balance.

Other general challenges and limitations of the photovoice method, as identified by Wang and Burris (1997) were considered. For instance, the authors support that recording the reality of a community and asking for change can sometimes lead in self-censorship for sensitive, inappropriate and politically incorrect topics, such as negative aspects of governance (Wand and Burris 1997). This issue could be partially addressed by providing confidentiality for the interview data, insofar as none of the researchers associated with the project will directly link a participant's name with his/her comments without consent, and interview files (digital and paper) will be coded. However, it is made explicit that since the community is small and the

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photography is a public activity it is possible that participants can be identified by their photographs or anecdotes shared in interviews, so anonymity is not guaranteed.

Photographs are easy to gather, but the information is so abundant and complex that it makes it difficult to analyze (Wand and Burris 1997). That was not a serious issue since we analyzed a limited set of photos but the most prominent challenge was to distinguish issues and themes between different domains, since all four areas are closely related to each other. A general observation during the photovoice process was that the participants were not certain under which domain they should place some of their photographs. This did not seem to have significantly affected the results because of the open-ended structure of the interview questions.

Before the beginning of the project, certain doubts were expressed by the RA about how clear the concept of the environment domain was for the participants. As she mentioned the first thing that the word environment brings in mind is "something out there", like climate change. The RA also asked for some clarifications, for instance whether garbage pictures could be included under the area of environment. The difficulty of conceptualizing the environment domain as well as other procedural issues regarding the photovoice process was clarified through discussion with the RA. Furthermore, the fact that I was also present when the P3 was taking her spring pictures had some benefits: I had a better idea of the setting in which the pictures were taken; this fact, combined with the discussions with the P3 during the process made it easier for me to formulate the questions during the interview that followed and facilitated identification of issues and contextualization. However, it can be claimed that the researcher's participation in the photo taking process could be considered as an important intervention on selection of pictures by the participant.

6 Results

The way that environment was perceived by the participants as reflected in their photovoice photographs included a variety of external factors that can affect community health and safety including sanitation services, transportation, pollution, weather conditions and climate, community infrastructure and more. The gathered information was codified to distinct general themes and issues presented below.

6.1 Sanitation

One major theme that emerged during the photovoice interviews and discussions with participants was sanitation, particularly solid waste management and wastewater treatment. The most apparent problem according to my personal observations and the interviews was the litter widespread over the town and the surrounding forest area, including larger items like electric appliances and car components. During personal observations around a small pond in the middle of the town many types of garbage were found as well as signs of burnt garbage (Figures 6-1 and 6-2). The pond was also surrounded by fenced sewage pumping stations. Photovoice participant 1 (P1) mentioned during a casual conversation that the particular pond that used to be clean is now polluted by garbage disposed by the surrounding houses but no water analysis has ever been conducted.

Figure 6-1. Solid waste discarded next to the pond. Photograph by Soultana

Figure 6-2 Signs of burnt garbage next to the pond. Photograph by Soultana

6.1.1 Solid waste management

Two participants and other community members identified the lack of enough community garbage collectors and the subsequent infrequency between collections as the main reason for the excess garbage during the winter time. According to P1 and photovoice participant 3 (P3) there is only one person that picks up the garbage every two weeks or sometimes less often. According to P3 the garbage bins have limited capacity so they get overloaded quickly, especially in larger households. As garbage accumulates people usually choose to discard it elsewhere close by or burn it. While burning garbage is discouraged, it takes gas (which is very expensive in Fond du Lac) and time to drive garbage away, as participant P3 pointed out. P3 also mentioned that the new type of garbage bins allow dogs, birds and other animals to dig in the garbage and spread it around, making the situation worse.

During the spring and summer the situation is improved because of community clean-ups that start in late spring after the snow has melted. During a casual conversation P3 talked about community members hired for the spring clean ups. She expressed concern about hiring school students to start the clean-up because she believes it is hazardous for them to get in contact with all this garbage. An older person also mentioned that the end of spring is the worst time of the year after a whole winter of disposal, combined with snow melt, but stated that in the summer the town looks much cleaner.

The collected garbage is hauled to a dumpsite, located in the forest area, a few kilometers outside the town. The place was characterized as 'big giant dump pile' by photovoice participant 2 (P2) where the wind blows the garbage "all over" the surrounding area. It seems that burning of garbage is taking place regularly in the dumpsite, which interviewees mentioned is not permitted. Indeed, according to Saskatchewan Ministry of Environment the burning of mixed waste at waste disposal sites is prohibited because of the chemicals and toxic smoked released, including chlorinated dioxins (SME 2010). Another problem identified by P2 was the lack of repair shops for domestic appliances and electronic devices so once they break down they are thrown away, unless someone can afford to fix them in another city. Stoves, television appliances, fridges and other large items are not disposed separately but are just discarded (Figures 6-3 and 6-4) to finally just end up in the dump pile with the rest of the garbage.

Figure 6-3.Water heater discarded next to the pond.
Photograph by Soultana Stylianidou

Figure 6-4. Television discarded next to the pond.
Photograph by Soultana Stylianidou

P2 talked about the previous dumpsite that was located in the middle of the town and is now buried and closed. Although she would not prefer the old dump, she characterized the current one as messier because it is not properly taken care of and the garbage ends up in the bushes. Answering the question of how she thinks that this situation affects community health, P2 mentioned impacts on the ozone. P2 and P3 also expressed annoyance for all the white plastic bags and rubbish that are spread 'everywhere', especially in the forest area and bush around the dumpsite. The wind is spreading the garbage further north (as P3 said, 'it just makes it look ugly').

Of particular concern was the issue of wild animals attracted to the dumpsite area shown in figure 6-5., especially wolves and bears. Asked about why she thinks it as a danger, P2 raised two issues: first, wild animals being a threat to the safety of the community members; second, eating garbage is dangerous for the animals themselves. P2 said that she is not walking around the dump site because of a wolf den located next to it and she also expressed worries about the possibility of wolves getting hungrier and even entering the town, since the site is not that far from the community. She also mentioned bears showing up around the site, and shared a story about a bear walking in the middle of town looking for food in the garbage, some years ago. Asked if she thinks this is the case because the bears cannot find enough food in the wild, the participant answered that it is mostly because the garbage is easily accessible by the animals. Participants also shared their concerns about the condition of the bears. P3 said that the bears looked pitiful, scraggy and starving even though they were feeding in the garbage and their fur looked different. P3 said that it is sad to see bears and cubs feeding on garbage instead of catching fish in the lake and that it seems that they have lost their survival skills.

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Figure 6-5 The solid waste dumpsite. "And we took this picture because as you see they're not taking care of the garbage, it's how it looks all the time ... and almost every day they're burning it. And I don't think they they're supposed to be doing that. They're supposed to be burying it. And I wanted to go around and look for that [wolf] den but I was too scared. There is a wolf den around there somewhere and they said there is about 8 or 10 wolves". Photograph by P2.

P2 mentioned that there is a plan to move the dumpsite further north, but she considered this as a bigger problem than a good solution. She feels the result will be to just spread the garbage even more, into an area that is still clean; P3 said that this would look like hiding the garbage in the bush. Both participants P2 and P3 proposed that hiring more waste management staff and providing better maintenance and monitoring of the landfill is required to improve the situation and make something beneficial for the community. One recent positive change for community mentioned by P3 was the replacement of plastic bags by green recyclable bags from the local store. P3 expressed hope that the following year the community will look cleaner, saying "*So now that they got rid of the plastic bags and they're going green I hope it's going to be greener in the forest*". She also mentioned that it takes some time for people to get used to it, so some still forget to bring their bags with them so they have to buy new ones or use cardboard boxes.

Community members also expressed frustration because of the old abandoned vehicles found around the town, in house yards or on the side of the road. Furthermore, participant P2

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brought me to an open space in the forest between the community and the dump site where numerous old trucks and other abandoned vehicles can be seen piling up not far off the road. One of main the reasons for this situation that was brought forward by P3 was the absence of car repair services in the town. Another issue she identified was the purchase of bad quality vehicles from the south, because of their low cost. These vehicles break down within a couple of years and since it is not worth the cost to repair them or transport them away, they are simply abandoned. Most of these vehicles looked already rusty and useless and according to P3 there is no way to deal with them. The participant said that she does not consider this situation as a threat to community health, especially comparing to the garbage dump site because it is no more than a big pile of bulk material that cannot be moved away and does not attract wild animals. However, the pile of old vehicles in the middle of the forest makes a really bad sight; it is a waste of steel and other material and creates concerns for the next generations, as expressed by P3 talking about picture 6-6.

Figure 6-6. Discarded vehicles in the forest area out of the town. "That's sad I think in a way because how is it gonna be for the next generation? You know, just like my kids' generation so, if you look at that, in that perspective, like next generation are we gonna have five times as what we saw in that (…) It's more like an industrial waste area .. no? Like how big is it gonna grow into? Like within the next generation if nothing is being done about it? Do they want to see garbage and

stuff like that? ". Photograph by P3.

During the interviews and conversations with local people there was significant talk of the importance of recycling. P2 referred to a substantial waste of material such as steel and plastic and talked about thousands of dollars worth of cans thrown away. Some of the main difficulties towards recycling that were identified were: lack of space to store the garbage and absence of a store that would collect the material (P2 and P3); the school used to collect recyclable material but not any more (P1and P2). Further, the freight costs are simply too high to fly recyclable material south to where it can be recycled (P3). However, some people collect the metal cans and drive them south when the winter road is open, exchanging them for cash to pay for their gas (P2). It was also mentioned by P3 that in the past an airline company that no longer flies to Fond du Lac had agreed to send out the recyclable waste without charging extra fee (P3).

6.1.2 Wastewater treatment

The second key sanitation issue raised was waste water treatment. The community is served by a sewage lagoon located close by but a new, larger capacity lagoon is currently being constructed because the existing one has reached its capacity. Before the existing lagoon, there was a smaller lagoon located in the middle of the town and very close to the lake (Figure 6-7). Participant P2 characterized it as smelly and dirty, a waste of space and water that no one wants to be around. A visit to the site showed that there is no fencing or signage to indicate that this used to be a sewage lagoon area. P2 also observed that the particular plants growing around this lagoon seem 'weird' to her because she has not seen them anywhere else around[10].

The water that flows from the existing lagoon (Figure 6-8) towards the lake was characterized as "*smelly, yellow water*" and "*rusty, looking grass, brown sort of thing*" by P3. Participants P2 and P3 also talked about the community activities that were taking place in this area before the lagoon was built. People used to camp in the forest and pick berries, along with other cultural activities such as making drying meat. Both the participants said that after the construction of the lagoon no one is willing to pick berries there any more and now people have to go across the lake or drive to other places.

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[10] The plants are identified as cattails, species of genus *Typha*, commonly found in wetlands.

Figure 6-7. The old sewage lagoon of Fond du Lac. Photograph by P3

The construction of a new sewage lagoon, outside the town and close to the dump site area, seems to be a big development investment for the community. According to the Government of Canada (2009), the project is funded through Canada's Economic Action Plan and lead by INAC, as part of a large investment in completion of water and wastewater infrastructure facilities to address health and safety priorities in 12 First Nations communities across Canada, including Fond du Lac and Black Lake. Approximately 9 million dollars have been invested for the design and construction of Fond du Lac's new sewage lagoon and decommissioning of the existing one. The project is scheduled to be completed in August 2010. The Chief of Fond du Lac referred to the project as important for the sustainability and the health of the community for the long term, with both economic and environmental benefits (Government of Canada 2009).

Two participants (P2 and P3) took pictures of the new lagoon construction area for the environment domain (Figure 6-9). While taking the pictures P3 expressed negative feelings about the cutting of trees and clearing such a large forest area to construct the lagoon. The bad example of the existing lagoon, that it is less than ten years old and yet needs to be already replaced, has also created doubts about the effectiveness of such projects. However, during the interview the participant made clear that if properly monitored the project can actually be

positive for the community. P3 also expressed hope that since this lagoon is larger and better designed by professionals it would "probably not leak like the existing one".

Figure 6-8. The currently used sewage lagoon has reached its capacity and is leaking towards the lake. Photograph by P3.

During the visit period many workers arrived in Fond du Lac for the construction of the new wastewater facilities, including the sewage lagoon and a pumping station. According to the workers the lagoon is large enough to cover the increasing capacity needs of the community for many decades. The old lagoon area is going to be reclaimed and the sludge will be pumped into the new facility. The new lagoon will be constantly monitored by computers while liners have already been installed to prevent leakage.

The issue of safe drinking water did not appear to be a major concern for the participants. As mentioned by P2 and P3, the entire community has access to tap water since the early 1990s and is served by a community water treatment plant. According to P2, before the installation of the water system people had to carry water from the lake and store it in tanks and they used to drink it without treatment (e.g. boiling it). P2 also mentioned that there are few people that still use water from the lake.

Figure 6-9. Construction works of the new sewage lagoon, funded by Canada's Economic Action Plan. Photograph by P2

6.2   Caribou importance and availability

Participant photographs taken in the areas of food and culture, as well as casual conversations with community members, stressed the importance of caribou hunting and availability for the community. This theme is closely connected to the area of the environment as well, since caribou is a valuable natural resource for Fond du Lac Denesuline First Nation that, according to P2 is currently less available. Details about methods of preparation of caribou meat, cultural beliefs and other stories shared during the interviews will not be covered extensively. Instead, focus will be given to the community's concerns over the availability of caribou and possible existing threats.

The importance of caribou for the community was related to food security, health as well as cultural identity and continuity. P1 stressed that caribou meat has been a very important part of their culture for years and that it is also cheaper than meat from the store. Describing her caribou meat photos –that were placed under the food and culture domains- she mentioned that this meat belonged to the Health center and was destined for the old people of the Home Care

program[11] (Figure 6-11). P2 characterized caribou meat as lean and less fatty; talking about dry caribou meat (Figure 6-10) she called it a 'delicacy' for the people in Fond du Lac that is also easy to store. A healthy diet, according to P2, includes traditional food such as berries, bannock[12], and wild meat. Another important issue that emerged during the interviews is that the price of basic goods (e.g. milk) that contribute to a healthy diet, are extremely high in the local store. Talking about her picture of caribou meat (Figure 6-12) P3 said it is as a free source of food, since people only have to pay for gas and bullets to get it.

Figure 6-10. Dried caribou meat, a "delicacy" for people in Fond du Lac. Photograph by P2

Figure 6-11. Caribou meat cut into pieces and ready to be frozen. This meat will be provided free to the Home Care clients by the Health Center. Photograph by P1

However, community members expressed worries about availability of caribou around Fond du Lac during recent years. P1 said that it depends on who you ask since some people claim that it is hard to get caribou meat, whereas others do not find it that difficult. P2 talked about scarcity of caribou in the last two or three years. The result is that now many hunters from Fond du Lac have to travel southeast, towards Wollaston Lake and pay people from other

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[11] Health service provided to people (usually seniors) who can no longer live independently, or need assistance.

[12] Home made type of bread very popular among First Nations people.

communities to go hunting for them. This raises the cost and also results in smaller supplies of caribou meat, since people cannot go hunting more that once a year as they used to. P3 claimed that although there was some financial support provided from the band for hunting, there was no use because there were no caribou. A teenage boy mentioned during a casual conversation that they did bring back caribou this year, but had to move further north than where they usually went hunting. P2 expressed fear that families will starve this year, especially those with low income or unemployment problems. People of Fond du Lac also rely on fish for food supply and fortunately no worries were expressed about the availability of fish stocks in the lake. They also hunt birds, such as ducks and ptarmigans, moose whenever they have the opportunity, or trap martens and other animals.

Figure 6-12. Caribou stock for the winter P2 talked about scarcity of caribou the last years: "*It's hard to get now, not as easy as before. And I think there's gonna be a lot of hungry families this year*". When asked what she thinks that can be done to address the problem the participant answered "*I have no clue. I just like, I don't know they [the caribou] have their own [way] like you can't force them to go where they go like you know they have their own way. And like I said they lost their way, like they usually go around our area but I guess they don't any more*". Photograph by P2.

People's beliefs about the pressures on caribou varied. P2 talked about pollution, and particularly about oil fields that affect the animal's feeding grounds as well as the impacts of

uranium mining. An older man, who also mentioned that the herds have now moved towards Wollaston Lake, supported that the reason for caribou scarcity is not the pressure from local hunters but mostly pollution due to mining activities as well as the low flights that disturb the animals. P3 and the teenage boy also referred to an anecdote about a person that burnt a whole sleigh of caribous up north some years ago, so the animals "are not coming around here", "like a curse or something"(P2). Transportation

A key theme of the pictures taken and the interviews was the importance of the means of transportation that connect Fond du Lac to neighbouring communities and to the south, such as the winter road (Figure 6-13.), and the barge. During the winter, when the lake is frozen, there are only two means of transportation: airplane, which is the most expensive solution for people in the community; and driving the winter ice road to Stony Rapids and then south to other larger communities. During the summer, once the ice has melted, there is a barge that transports people and vehicles across the lake, to Stony Rapids and back (Figure 6-14). The cost of the barge is also considered relatively high but it is still cheaper than the airplane fees.

Figure 6-13. Aerial view of the ice road on Lake Athabasca. Photograph by Soultana Stylianidou.

P1 took pictures of the winter road for the environment and food domains, explaining how important this road is for the transportation of food and other supplies to stock up for the summer. It is also the best way to transport lumber and housing material that would be very expensive as air freight. The road is also important for people from other communities to drive to Fond du Lac to visit friends and relatives or to participate in cultural events such as the Winter Carnival which is a significant event for the community. P1 mentioned that the winter road was shut down early this year, consequently people from Black Lake and other communities did not make it for the carnival.

Figure 6-14. The barge is an important means of transport for the people of Fond du Lac during the summer. Photograph by P3.

The presence of many vehicles in the town was raised as an environmental health issue by P3, for two reasons: as a source of air pollution as well as with regards to lifestyle and physical activity since people mostly use their vehicles for transportation in town rather than walking. Other modes of land transport include snowmobiles and ATVs[13], also known as quads. P1 mentioned that a snowmobile is a cheaper and easier mode of transport during the winter compared to larger vehicles. People use them to drive over the frozen lake towards Stony Rapids,

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[13] All-terrain vehicles

where they have their vehicles to go shopping; they also use them to go hunting and collect fuel wood. Quads are also very popular, especially among young people.

Talking about picture 6-15, P1 mentioned that there are traffic signs along the ice road that she has not noticed before. During the interview it was revealed that some of these signs, like the third one from left shown in the picture, created a slight confusion on what drivers are supposed to do. The increased signage provides more information but can also create more concern and insecurity about what is the safest way to drive on the winter road. According to P1 driving over the ice road feels insecure while P2 said it is scary, particularly over the ice part. It is also time consuming and as the ice starts melting it can take many hours to cross the winter road as it gets in a very bad shape.

Figure 6-15. Signs along the side of the winter road, moving from the land part to the ice road (i.e. over lake).Photograph by P1.

According to P2 the winter road is well maintained. P1 expressed particular concern about big trucks wrecking the land part of the road and creating overflows[14]: increased traffic of semis[15] and bigger loads during the last years causes damage and increases travel time and sense of insecurity. The positive side of this increase also pointed out was that more housing and other

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[14] The presence of water on the top of the frozen surface of the lake

[15] A semi-trailer truck

supplies can now be transferred to the community. Given the high cost of flights, P3 also highlighted the importance of the health benefits program that covers the medical transportation for registered First Nation people in a conversation.

6.3   Weather and climate change

The duration of the winter road depends heavily on the weather conditions. This year (2009/2010) the road only remained open for a couple of months because it froze up late and started melting early because of high temperatures, and was closed around mid March. After the winter road is closed, people drive 'at their own risk' (P1 and P2). Participant P1 mentioned that in previous years the road was open even in mid-April. The period between the closure of the winter road and the opening of the lake for the barge, seems to be the hardest in terms of transportation and food supply. According to P1 the duration of this period also considerably affects food prices in the store. P2 considered global warming as the most important threat to the photograph of the frozen lake that she took for the environment domain (Figure 6.18), and expressed worries for the winter roads: if the weather stays warm all year then no more winter roads so people would get stuck and unable to get their supplies.

Two elder members of the community shared their perspectives on the weather conditions in the region. One mentioned that this was the warmest April he has ever experienced and that this time of the year snow is usually two feet (~60 cm) deep. The second person said that according to his personal observations and a weather diary he has kept for many years, he has noticed an overall rise in temperature. He also mentioned that freeze up seems to happen later and spring melt earlier compared to the past and that nowadays snow 'looks different'. They also start their garden earlier than before, which according to him is an indicator of warmer springs. He concluded that in the future the place might become "like a jungle".

6.4   Resource extraction

Of particular concern between the members of the community were the environmental and health impacts of uranium mining. P2 took pictures of a site on the other side of the lake where people have been surveying for uranium, since a large deposit of uranium ore is believed to extend under the lake (Figure 6-16). P2 also mentioned that there was also a proposal on behalf of mining companies to build a nuclear power plant in the area towards Uranium City which outraged the people in the community. The participant pointed out that no project can start without consent from the community. When she was asked whether she thinks uranium mining can be positive for the community as an employment opportunity, her response made

clear that the people do not care about that since they are worried about the environment. Mining was presented as harmful for the water and the environment, as well as a cause for caribou scarcity.

Figure 6-16. The site across the lake were surveying for uranium takes place according to P2 Asked about how she perceives uranium mining effects on community health, she responded: "I think it's really bad. Because of the water and ... and it's not good for the environment. I guess ... I didn't .. I think that's why there's hardly any caribou around here too. Because of all the pollution". Photograph by P2.

There is also important concern about the link between disease and uranium mining. P3 said that she would like to have taken a picture of the cemetery to show that many old people passed away from cancer during the past decade, possibly because of uranium contamination in the area of Uranium city. The presence of abandoned uranium mines in the Uranium City area creates major concerns to the community. A male community member that works for a mining company said that they are not surveying for uranium, but for other minerals. He also said that the company takes all the safety precaution measures for the workers.

6.5 Community infrastructure safety

Interviewees shared their concerns on safety issues like: inadequate fire safety of buildings such as the band hall that is used for social events (P1) and also gas tanks close to inhabited areas. The large gasoline tank (Figure 6-17) that is located right behind the local clinic and among houses was identified by P3 as an environmental issue that threatens the safety of the community. The fact that it is self service also raises concerns about potential accidents.

Figure 6-17. Gas tank in a residential area. "Ah there is a big gas tank, fill tank, and it is located in between the local clinic (…) as well a couple of residences. So it's overcrowded with buildings and sits right behind the clinic. I feel that it would be an environmental issue because it is so close … it is so close in between residences and there is a lot of big buildings around it. In case something should happen like half of maybe downtown would be gone. And you know hopefully it doesn't happen but I can see it as environmental issue". Photograph by P3.

6.6 Air quality

House air quality emerged as an issue during personal communication with an individual outside the community, involved in an ongoing air quality monitoring project. As P1 confirmed, a particular area of the community was contaminated by oil spillages by used oil tanks and during the operation of an old diesel power generator -before electrification of the community. The houses that stand on this area have been monitored for toxic volatile organic compounds since 2006. The basements of those houses have already been inspected and the problematic cases are supplied with air exchangers to pump the air out. Currently there is an effort to measure the

volatile compounds in the actual living spaces of the houses. In case the pollutant levels exceed the national standards the government is supposed to invest money for housing improvements or moving people out. Previous plans to remediate the polluted areas were not followed through. Asked if the people express concern about this issue, the respondent said that they are more worried about the uranium contamination as a cause of illness. Inappropriate housing and lack of maintenance of community buildings, such as the sports arena that fell apart (the roof collapsed under weight of snow), was also raised as an issue by the participants.

6.7   Wood supply

Another common topic found among the photographs of participants P1 and P2, in the areas of housing and environment, was cutting of firewood (Figure 6-18). Wood is an indispensable natural resource for heating in Fond du Lac, considering the long and harsh winters. Wood is also used for dry meat preparation. Apart from wood stoves there are also households that use electric heaters. Asked if there is any concern about wood supply P1 replied that that there has always been enough timber around the lake but seems that people now have to travel further to get it. According to P1 wood harvesting is more of a part time job and the supply for the following winter starts already in spring.

Figure 6-18. Pile of firewood. Photograph by P1.

6.8   The Lake

Lake Athabasca was the main theme in all environment pictures (Figure 6-19). The lake is considered as a valuable natural feature for the community in many aspects, such as a source of fish, water, important for transportation, a place for recreation, and its aesthetic value. Responding to the question concerning the lake's importance for a healthy community, P1 mentioned that many people still use the lake for ice fishing and other activities. P2 also presented ice fishing as an important winter activity for the members of the community. Both participants mentioned that there are still people drinking the water. Recreation activities such as fishing derbies and snowmobile races were also mentioned (P1 and P2). The role of the lake for transportation was re-emphasized. Some of the identified threats to the lake were: global warming, particularly as a threat to the winter road; uranium mining; leakage of wastewater into the lake from the sewage lagoon; P1 also referred to a possible connection of the seemingly polluted pond in the middle of the town to the lake.

Figure 6-19. The winter scenery of the lake was characterized as "peaceful and relaxing by P2. Photograph by P2.

7 Discussion of the main findings

7.1 General comments and identified challenges

Most of the images shown in the photographs, e.g., the lake and the ice road, the barge, the forest area, the dumpsite and the sewage lagoons, are located within or in the proximate vicinity of the town. There is a possibility that photographs taken by individuals that use to go for hunting, trapping animals or ice-fishing would have revealed a more diverse Aboriginal perspective of the environment domain. Indeed, the RA mentioned that at least one of the participants (that was not interviewed) had already taken spring pictures of hunting activities outside the community. However, some photographs taken by the participants regarding the other domains -such as the caribou meat pictures under food and culture domains or the uranium ore survey site- revealed environmental issues that affect the broader area, apart from the immediate environment of Fond du Lac, and provided significant information about winter traditional land-use activities such as hunting and ice-fishing. It can be assumed that by the end of the Tools 2 project, after the release of the photographs from all the photovoice participants and for all four seasons, new themes will emerge, to provide a more complete picture of the community's perspective on health and environment. Also after the completion of all the interviews the software package Atlas.pi could be used in order to identify broader themes and connections between them.

The main idea that the participants were to consider while taking their photos for the environment domain was "any usual or unusual conditions in their natural environment (land, air, water and animals) that influence the health of their community". However, various other issues of concern for the community members were expressed, outside our predetermined categories. For instance, one of the participant's (P3) photographs for the environment domain showed a discarded bottle of alcohol. This image brought about a discussion about alcohol use in the community despite the prohibitions[16], bad influences for young people, community norms and addiction issues in general. In that case, the social environment was also included under the umbrella of the environment domain. Another major issue about community health and wellbeing that was raised by all the participants during the interviews was the lack of recreation infrastructure and opportunities as well as the negative impacts of such deficit, like alcohol use and addictions.

CEU eTD Collection

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[16] Fond du Lac is a dry reserve

Various positive aspects of community life were also described by the participants, such as the celebration the Winter Carnival and the winter sports that take place in the lake (e.g. fishing derbies). I also had the opportunity to participate in a two-day Youth conference that was organized in the community highschool, with workshops about various social and health issues (e.g. bullying, HIV-AIDS, self esteem development, addiction prevention) and many activities (film projections, games, jerky making, dance, show with magicians). However, all these topics and observations are outside the scope of the current work therefore were not presented in the results.

The overlap and interconnection between different domains became apparent during the photovoice process (see Table 7-1). The issue of caribou scarcity was discussed under the environment, food and culture domains, the winter road fell mainly under the food area and the barge appeared in both food and environment photographs. Transportation was not clearly placed under a certain domain but was discussed with regards to the winter road and the barge photographs under the environment domain, as well as under the food domain in general. Also pictures of snowmobiles were placed under culture by P1 as important modes of winter transportation for the people of Fond du Lac. Housing pictures also raised environment issues such as wood harvest and availability, while photographs of cutting wood were also placed under the environment domain by P2. Weather and climate change issues were brought up as important issues for all four domain areas. The picture of the installations for uranium surveyors was discussed under the culture domain by P2 because it also included a building of cultural importance according to the participant, the old Hudson Bay store where people used to trade fur for dry goods around the end of 19th and beginning of 20th century (P2).

7.2 Exploring the Community Health Indicators Toolkit

The revised Environment domain by Anthony (2009) incorporated several environmental issues that were not covered by the initial version, like climate change or endangered animal and plant species, and included many new indicators, such as "sustainability of harvesting rates", "Environment Canada's indicators of change", "waste generation and disposal" and more. Both the initial (Jeffery *et al.* 2006a) and revised (Anthony 2009) versions of the Environment domain indicator list are shown in Appendices 10.3 and 10.4.

The photovoice and participant observation outcomes of the current research were compared to the Issue areas and indicators of the improved Environment domain. Furthermore, since some of the environmental issues that were identified by the community members are found under other domains, the whole Toolkit was reviewed for relevant indicators. Some

indicators that are found under other domains but are closely related to the environment could be also included under the Environment domain with reference to the other domains. Some additions or changes will be also proposed for adjustment to the context of the community. Furthermore, during the design process of the evaluation framework and the Toolkit of Tools 1 project, a number of logic models were developed by looking at the existing health and human service programs in the communities (Appendix 10.2). Some of these logic models include environmental health indicators that provide useful information for the assessment of environmental health services and programs, and could be possibly added to the Toolkit. The relevant datasets for measurement of these indicators are already available at the community level (Jeffery *et al.* 2006a).

Table 7.1. Some of the identified themes appear in more than one domains of the Toolkit (shown in blue colour).

Theme \ Domain	Environment	Food	Housing	Culture
Waste disposal	X			
Sewage water treatment	X			
Transportation	X	X		X
Climate and weather	X	X	X	X
Lake	X	X	X	X
Caribou meat	X	X		X
Uranium mining	X			X
Infrastructure safety	X			X
Wood cutting	X		X	

7.2.1 Transportation safety and climate

Only one relevant indicator, named "accidents on roads", exists under the Services and Infrastructure domain of the Toolkit. However, the enforcement of transport and safety regulations is also an important issue for the community. A recent accident that happened on the winter ice road, about 1.5 km from the community of Wollaston Lake, when a vehicle fell through a pressure ridge on the ice, brought about the general problem of transportation and safety in northern communities of Saskatchewan. According to the media release on behalf of the Hatchet Lake Desuline First Nation (HLDFN 2010), every year the communities in Northern Saskatchewan are affected by accidents due to dangerous winter ice road conditions. According to the article, the period that the road is open is reduced every year as a result of climate change so people choose to drive on the ice road at their own risk in order to get supplies and fuel at reasonable cost. The community representatives were asking from the government to fulfill their commitment for the construction of an all-season weather road which would improve transportation of goods, emergency response and other aspects of community lift. Similar concerns about safety in the winter road were shared by the interviewees.

Increase of accidents due to ice break ups or extreme weather conditions are significant issues found in the literature regarding the impacts of climate change on northern Aboriginal communities (CCME 2003; Hassol 2004). The total absence of climate related issues in the Toolkit was addressed by Anthony (2009), who added a detailed set of various climate change indicators (developed by the Canadian Council of the Ministers of the Environment) under the category Impact of Development (issue area Jurisdiction). Some indicators related to transportation safety could be also added, e.g. "number of accidents due to extreme or unpredictable weather events" or "number of accidents because of the conditions of the winter road" or "duration of the period that the winter road is open" which could also indicate changes in climate patterns. New indicators to evaluate compliance and enforcement of transportation regulations would be also useful to protect the drivers in the community. Another important transportation topic, food transportation, is covered separately under Food Security domain.

7.2.2 Wildlife

One of the main concerns during the interviews and personal conversations was that when caribou winter far from the community there is problem of supply and people have to travel over longer distances to hunt. The use of snowmobiles by Aboriginal hunters is believed to have increased accessibility to caribou compared to the past (BQCMB 2002) but it is not always a feasible solution, for instance when the weather does not allow their use or if the travel

distance is too long. The main identified reason for the limited availability of caribou in the surrounding area during the last two years was contamination and other disturbances because of mining.

The BQCMB's report (2002) presents construction of roads (that can increase human access to the herds and act as barriers to caribou movements) and mineral exploration as the major threats for the barren-ground caribou herds. The main concern for the communities of Northern Saskatchewan according to the same report has been uranium mining and all the related activities (e.g. frequent low-level aircraft flights, road construction, contamination of land and water) that could have potential negative effects on the animals. The possible negatives impacts of mining are difficult to predict because of the variability of other factors (e.g. weather, caribou movement patterns) and the lack of short-term measurable effects. Forest fires over the foraging areas and various impacts of global warming were also considered as possible threats (BQCMB 2002).

Some of the indicators proposed by Anthony (2009) that could provide information on caribou status, threats and monitoring efforts were: "sustainability of harvesting rates", "levels of pollutants on wildlife", "number or species in risk" and the pre-existing indicators "decrease in wildlife populations", "monitoring programs in place" and "number of conservation officers". Furthermore, indicators regarding hunting activities (% of people who hunt and fish; access to hunting and fishing; methods of hunting and fishing) are found in the Identity and Culture domain under the category Traditional Practices (issue area Traditional Ways). The indicator "number of informal (e.g., fishing and hunting) Elder/youth activities" is also found twice in the same domain. The Identity and Culture domain includes various indicators regarding the practice of traditional ways of living and transmission of knowledge from the Elders to the youth, which in turn are important for wise and sustainable use of natural resources by the young members of the community. The Food Security domain includes the issue area Traditional Foods with the indicators "levels of hunting and fishing" and "traditional food availability" which can also provide information about the availability of caribou as well as other important food resources, e.g. fish and plants.

7.2.3 Sanitation and waste management

Sanitation, one of the major environmental concerns expressed by the participants, is found in the Services and Infrastructure domain of the Toolkit, under the category Community Infrastructure (issue area Sewer and Water). According to the Toolkit's description: "Communities require adequate sewer and water treatment systems that use proper technology,

meet current standards and are operated and maintained by trained staff". The proposed indicators for this area are: "houses with/without water and sewer"; "water borne illnesses"; and 'houses relying on bottled/purchase water'. The issue of maintenance of the sewage facilities, that was also raised during the interviews, is placed under the same category (issue area Locally Staffed) and is described as: "Operation and maintenance of critical infrastructure (sewer and water) should be carried out by trained community members to avoid gaps in service that occur due to stuff turn over and scheduling of outside stuff" (Jeffery *et al.* 2006a). The proposed indicators under this issue area are: "number of instances where treatment facilities are without stuff members"; "number of community members that are employed in water/sewer facilities" and "percentage of community staff that are properly trained". Another relative indicator "water and sewer technologies is use", is found under the category Technology of the same domain.

However, the issue of solid waste management has not been totally covered by the Toolkit. The only relevant indicator that was found was "community clean-ups" under the category Respect for Environment of the Environment domain. Anthony (2009) has also added the indicator "waste generation and disposal (total and per capita)" in the Environment domain, under the category Impact of Development (issue area Pollution). The community clean-ups in Fond du Lac take place during the spring according to the members of the community. Solid waste collection in regular basis is considered as an important indication of how clean the community is during the whole year. Under the "waste generation and disposal" indicator we could add indicators such as "frequency of community solid waste collection", or "number of employees in solid waste collection and disposal".

One of the Environmental Health programs that were presented as logic models during the Tools 1 project was about Water, sewage and solid waste. The particular program has been designed to inspect and monitor private and community water supply as well as sewage and solid waste disposal systems of the studied communities. Various indicators were proposed to measure the activities, the short- and long term outcomes of the program some of which could be incorporated in the Toolkit. One of the program goals was to ensure that disposal systems meet safe design and operational standards. With regards to the dump site of Fond du Lac it is important to ensure compliance with legislation in order to avoid malfunction and incidents such as burning of mixed waste which can be harmful to community health (SME 2010). Some of the indicators to measure progress towards this effort could be: "percentage of landfill operation (federal/provincial) regulations complied with" or "number of trained waste disposal operators".

7.2.4 Human health, environment and traditional activities

The issue area Environmental Health in the revised version of the Environment domain includes three indicators that are all related to forest fires and their potential effects on human health and natural resources (Anthony 2009). Forest fires were not indicated by the participants or other community members as determinants of human health or causes of environmental degradation; one possible explanation could be that the photographs were taken for the winter and spring seasons, while forest fires are mostly a summer problem in the region; or that the issue was not one of the major concerns of the participants as a determinant of community health.

One challenge that occurred during the interviews was the linkage between a certain environmental burden and community health. Some health risks were indentified by the participants, e.g., burning of the garbage or attraction of wild animals to the dump site. Furthermore, uranium mining was presented as a cause of community sickness by participant P3. In general, the effect of the physical environment on individual and population health can be almost impossible to quantify, including a plethora of factors that affect health in various different and complex ways (Health Canada 2009a). For that reason indicators in this area could include anything, from air and water pollution to inadequate sanitation and food security. For instance scarcity of caribou could be indirectly related to the health of the community: caribou meat and traditional food in general is considered to be healthy (P2), lack of caribou means that people have to buy more food from the store, which in the end leads to cheaper but unhealthier options (P3).

Perception of risk is also an important determinant of public health and needs to be taken into account in decision making (Adeola 2007). For instance the uncertainty about contamination and radiation levels in a community can often exacerbate people's health concerns (Parlee and O'Neil 2007). In the case of Fond du Lac, uranium mining activities and particularly the presence of abandoned mines and tailings in the area of Uranium City has caused anxiety about the potential health and environmental risks. In 2000 the Athabasca Working Group (AWG) introduced an environmental monitoring program to test seven communities in Athabasca (including Fond du Lac) for contaminants related to uranium mining and milling operation. Samples of water, air, plants and wildlife (including caribou and fish) were taken with the participation of local hunters and other community members and were tested in independent laboratories in Saskatchewan and the US. According to the AWG reports for the period 2000-2005 and for 2007, there are not major environmental concerns near the community of Fond du Lac related to the operational uranium mining and milling projects (CanNorth 2005; CanNorth

2007). However, apart from the need for more monitoring programs and clean-ups of abandoned mines, the effective communication of the results to the local people is of major importance to address community concerns and risk perception.

Although it was not clarified during the interviews, we could assume that environmental problems such as waste generation and disposal could influence the wellbeing of the some members of the community. Perception of wellness and life satisfaction often differs from biomedical indicators and particularly in Aboriginal community it incorporates mental, emotional and spiritual wellbeing. It is also argued that the "health" of the land is of great importance for Aboriginal people's health and wellness (Parlee and O'Neil 2007). The pile of dumped vehicles was not characterized as hazardous for health (as it was the garbage dump site), but it was found an unpleasant sight by P3 and evoked concern for the future generations. Frustration was also expressed regarding the plastic bags and litter in the forest area around the dump (P2 and P3). The disruption of traditional land use activities (e.g., hunting) has also been considered important determinant of Aboriginal health. Kwiatkowski (2010) argues that Indigenous peoples' fear (real or perceived) of their food sources being contaminated has resulted in changes or even cessation of traditional hunting and gathering activities. During the interview was mentioned that the people of Fond du Lac stopped picking berries (and other related cultural activities) around the sewage lagoon because they considered them contaminated (P2 and P3). P3 also mentioned that people that used to hunt caribou, this year they had to hire hunters from other communities because the herds had moved far from Fond du Lac. Socio-cultural wellbeing of Aboriginal people could be impacted by loss of cultural identity associated with traditional life styles, resulting on increased stress, anxiety, and feelings of alienation (Parlee and O'Neil 2007). Connection to the land and environment that ensures cultural continuity is considered by Indigenous people as a basic prerequisite for sustaining healthy individuals and communities (Ermine *et al.* 2005). The Toolkit includes a variety of indicators under the Identity and Culture domain for the evaluation of cultural and traditional practices by the members of the community and their transmission to the younger generations.

7.2.5 Structural environment

The Environment domain includes the issue area of Structure (category Human Health), described as "Effects of housing (and other structural) quality on human health, including accidents due to houses in disrepair and health hazards such as black mould" (Jeffery *et al.* 2006a). However, the only proposed indicator is "number of accidents at home". The same indicator can be found in the Services and Infrastructure domain (under Housing Quality)

among various other indicators (e.g. presence of mould). I would suggest the removal of the indicator from the Environment domain with reference to Housing Quality, to avoid repetition. The indicator "accidents at home" could also be changed to "accidents at home and other structures", to include schools and other public buildings; the indicator "number of inspections of public buildings for public hazards" could be another addition. Another relevant indicator under Housing Quality would be "indoor air quality", since it was found to be a significant issue for some of the houses in the community. The measurement of such indicator could be based in the air quality inspection that is currently being undertaken by INAC after the publication of the results.

7.2.6 Environmental health education and other issues

Two of the logic models (Figure 11.1.) that are included in the Toolkit (Jeffery *et al.* 2006a) highlight the importance of environmental education in order to secure safe and healthy environments and communities. Formal or informal environmental health education or training of community members on proper waste disposal practices, general sanitation, and identification of environmental contaminants could contribute to improvements in community health outcomes. The category Environmental health education/training could be added under the Environment domain, including some of the indicators proposed by the logic models, such as: "percentage of people who are educated and informed regarding environmental health"; "number of environmental education programs/workshops" and others. An addition could be also made in the Culture and Identity domain, to include TEK education programs/activities along with the other traditional education programs. Volunteerism could also be an important measure for commitment to the environment which is also related to environmental awareness. A potential indicator could be: "number of volunteers for environmental events, such cleaning of the community". During a personal conversation P3 mentioned that "if there were people volunteering in community clean-ups then the town would look cleaner".

Figure 7-1. Logic models that were constructed during the Tools 1 project based on existing health programs in the participating communities. Adapted from Jeffery et al. 2006a.
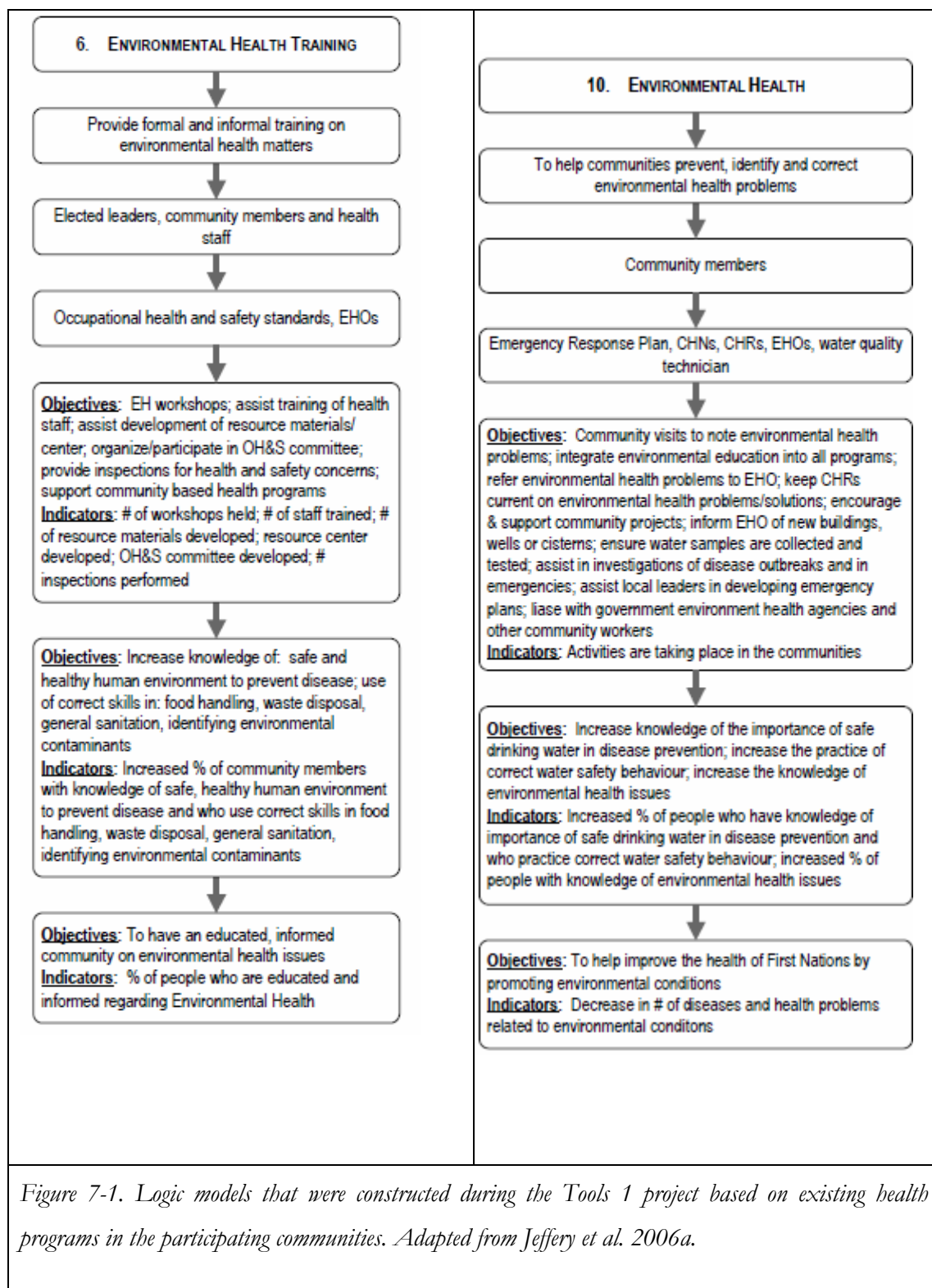
The Healthy Lifestyles domain includes an issue area entitled Environmental Concerns (under the category Motivation) which refers to: "Environmental conditions such as weather, black flies and bears can reduce motivation of community members to participate in outdoor activities" (Jeffery *et al.* 2006a). The proposed indicator is "number of walking groups and

number of outings" with the justification that participating in groups feels safer for the members in the community. This indicator could also inform us about perception of environmental risks by the members of the community -for instance P2 expressed fear to walk around the dumpsite area because of the presence of a wolf den- and could be also placed under the Environment domain with cross reference.

7.2.7 Community owned information

One major objective of the Tools 1 and Tools 2 community-driven projects has been community capacity-building and local control of information. The Toolkit itself provides numerous data sources to the communities. The indicator table contains statistical data on northern Saskatchewan (when available) and/or suggested questions or measures that could be used to perform a community based survey regarding each suggested indicator. The sources of these data/questions/measures are listed under each issue area. The web addresses of the existing data sources were identified and referenced in the Toolkit but since web addresses can change, some of them were referenced at source level (Jeffery *et al.* 2006a), i.e. Saskatchewan Game report 2007-2008. Anthony (2009) has updated the community and regional level data sources in the Environment domain and also suggested a list of currently used national level environmental indicators for the Toolkit developers. The regular update of the existing data sources is important for the measurement of the proposed indicators based on valid and more recent information and could be performed by the communities themselves as part of the capacity building process. The Toolkit guidelines also encourage the users to develop new indicators that reflect the uniqueness of their own communities.

One of difficulties in collecting data about First Nation communities is that there are numerous data sources under different jurisdictions, e.g. national and regional surveys, provincial statistics, community administrative records, etc. It is worth mentioning that, starting with participation at the Tools 1 project, the Athabasca Health Authority is now developing a database on community health indicators that will help to: evaluate community-based and controlled programs; determine allocation of program resources and facilitate policy initiatives (Jeffery *et al.* 2006a).

8 Conclusion and recommendations

The aim of this work –part of phase two of the Tools 2 project, named "A Year in the Life"– was to indentify the elements/aspects of environment that were considered important by community members of Fond du Lac Denesuline First Nation for the health of their community. Two qualitative research methods where used to document people's perspectives of the effects of environment on their community health: photovoice and participant observation. During photovoice the participants took photographs of their everyday lives that they felt was important for keeping their community healthy or threaten their community health in four domain areas (environment, food, housing and culture) and then were interviewed about their photographs. Three sets of photographs were analyzed, two for the winter season and one for the spring.

The outcomes of photovoice (pictures and narratives) and data from personal observations and casual discussions with various members of the community were analyzed to identify key environmental health themes/issues. Environmental issues appeared under all four domains, and interconnections and overlaps between the domains were . The challenges and strengths of the research process and outcomes were also recognized. The results were compared to the Community Health Indicators Toolkit that was produced during the "Tools 1" project.

8.1   Summary of identified issues

The main themes that were identified during the research and the analysis processes were: sanitation, particularly solid waste management and sewage water treatment; transportation; weather/climate conditions; caribou importance and availability; potential impacts of resource development and particularly uranium mining; community infrastructure safety; and the Athabasca Lake.

The lake appeared as a main element of the participants' photographs, given it provides a variety of services to the community, as: an important route of transportation (provided the ice road over the frozen lake in the winter and as waterway for transporting goods and people in the summer); a source of food (e.g. fish); a place of recreation (fishing and other activities); and as a place of aesthetic value. Contamination from solid waste and wastewater were some of the main concerns for the future of the lake; climate change as a threat for the ice road was also mentioned.

The interviewees explained how weather conditions can affect mobility in a remote northern community like Fond du Lac, and consequently various other aspects of community life, such as food supply, housing and social activities. This theme was also connected to climate change since the overall duration of ice in the lake determines the transportation opportunities

for the community –abnormal high spring temperatures can cause early closure of the ice road which is the only means of land transportation during winter.

Solid waste disposal appeared as one of the main concerns for the community. Among the various issues that were raised, were: the importance of spring community clean-ups; concerns about burning garbage in the town and the dumpsite area; improper maintenance of the existing dumpsite; and the need for more regular collection of garbage. Disposal of broken vehicles in the forest area and recycling challenges were also discussed.

The existing sewage lagoon raised concerns as being overloaded and leaking towards the lake. However, a new larger lagoon is currently under construction to serve the increasing needs of Fond du Lac. In some cases, both positive and negative sides of development were revealed. The construction of the new lagoon, for instance, was regarded as a positive development for community health, but also raised issues of negative impacts on the natural environment –like cutting down trees in the forest and as a potential contaminant of places were traditional activities (e.g. berry picking) used to take place. Another trade-off that was identified during the interviews regarded travelling on the winter road; from the one hand it was described as time consuming and risky for the community members, but on the other hand it was recognized as the cheapest way to acquire food and other supplies during the winter time. Uranium mining in the surrounding area was generally presented like a negative development for community health and the environment.

The importance of caribou meat as an inexpensive and healthy food source but also as an integral part of the Dene culture was highlighted during the interviews and casual conversations. Concerns about the decreased availability of caribou the last two years were expressed; according to the participants and other community members the herds have moved further so local hunters need to travel longer distances or hire other hunters to bring back caribou. The main identified reason (P2 and other community members) was the contamination of the land. Fire wood also appeared in the participant's photographs as an indispensable natural resource for the community that is usually found in abundance to cover their heating needs.

Concerns about infrastructure safety issues, including the presence of a gasoline tank in a residential area (P3), the collapse of the previous sports arena (P2) and fire safety issues (P1) were also expressed by the participants. Air quality was another identified problem in certain houses, because of past contamination by oil spillages.

Other issues, including the need for more recreation activities and infrastructures as well as various positive aspects of community life (e.g. the Winter Carnival) were also discussed, but they were not presented in details as being outside the scope of the current work.

8.2 Summary of recommended changes to the Toolkit

Several indicators under the Environment domain -the improved version by Anthony (2009)- as well as under the other domains were found useful for addressing more of the issues raised by the communities. However, some amendments and additions in the Toolkit were recommended, in order to better reflect the community's needs and concerns expressed during the research. The proposed changes are summarized as follows:

- Indicators that are found under other domains but are closely related to the environment could be also included under the Environment domain with reference to the other domains. For instance, several indicators under the Identity and Culture domain regarding hunting activities could be also included in the Environment domain. Indicators of the Community Infrastructure domain regarding sewer and water treatment could be placed under the Environment as well.

- The removal of the indicator "effects of housing" from the Environment domain with reference to the same indicator found under Services and Infrastructure domain. More indicators under this area (e.g. "indoor air quality") were also proposed.

- Addition of more indicators related to solid waste disposal and management, given its importance for the community of Fond du Lac. Some of the recommended indicators were derived from the logic models that were developed during the Tools 1 project.

- A set of indicators regarding transportation safety issues, particularly in relation to the changing climate conditions, were proposed for the Environment domain.

- The importance of environmental health education was highlighted during the discussion and the category Environmental health education/training was proposed under the Environment domain. The proposed indicators were mostly derived from the related logic models. TEK education programs/activities were also considered important addition to the Culture and Identity domain.

- Regular update of the resources listed in the indicator tables, is considered essential for the effective use of the Toolkit.

8.3 Recommendations by the participants

During the interviews and casual conversations, the participants came up with some recommendations to address the practical environmental problems of the community:

- Participants P1 and P3 suggested that the community should hire more staff for scheduled collection of garbage on a regular basis and proper solid waste disposal. Both participants P2 and P3 mentioned that hiring more waste management staff and providing better maintenance and monitoring of the dumpsite is required to improve the situation and make something beneficial for the community.

- Maintenance and proper monitoring of the new sewage lagoon was also identified as key issue for the improvement of sanitation conditions in Fond du Lac (P2 and P3).

- Discussing different solutions to create more opportunities for recycling, P1 suggested that the community could contact the private airline company that serves Fond du Lac and discuss the possibility of reducing or stop charging extra freight cost for recycling waste material (e.g. bags with cans). This change in the company's policy could enhance the recycling efforts of the community and promote an environmental friendly company profile.

The Fond du Lac Denesuline First Nation has made important steps towards improvement of provided health and social services to its members, including Day Care, Baby wellness, Post Secondary Students Support, Family violence, Social assistance and other programs (PAGC 2010). The participation of the community in this project could be one further step towards capacity building, control over decision making and action. Despite the everyday difficulties faced within the small community (e.g. remoteness and lack of capacity) and disregarding the legacy of their colonial past (including efforts to deprive them from their lands, eradicate their cultures, language and traditions), people of Fond du Lac keep their hope for a better tomorrow and make serious efforts for the improvement of their collective, current and future health and wellbeing. I would like to close this thesis using the words of one of the participant (P3): "I have faith in our people".

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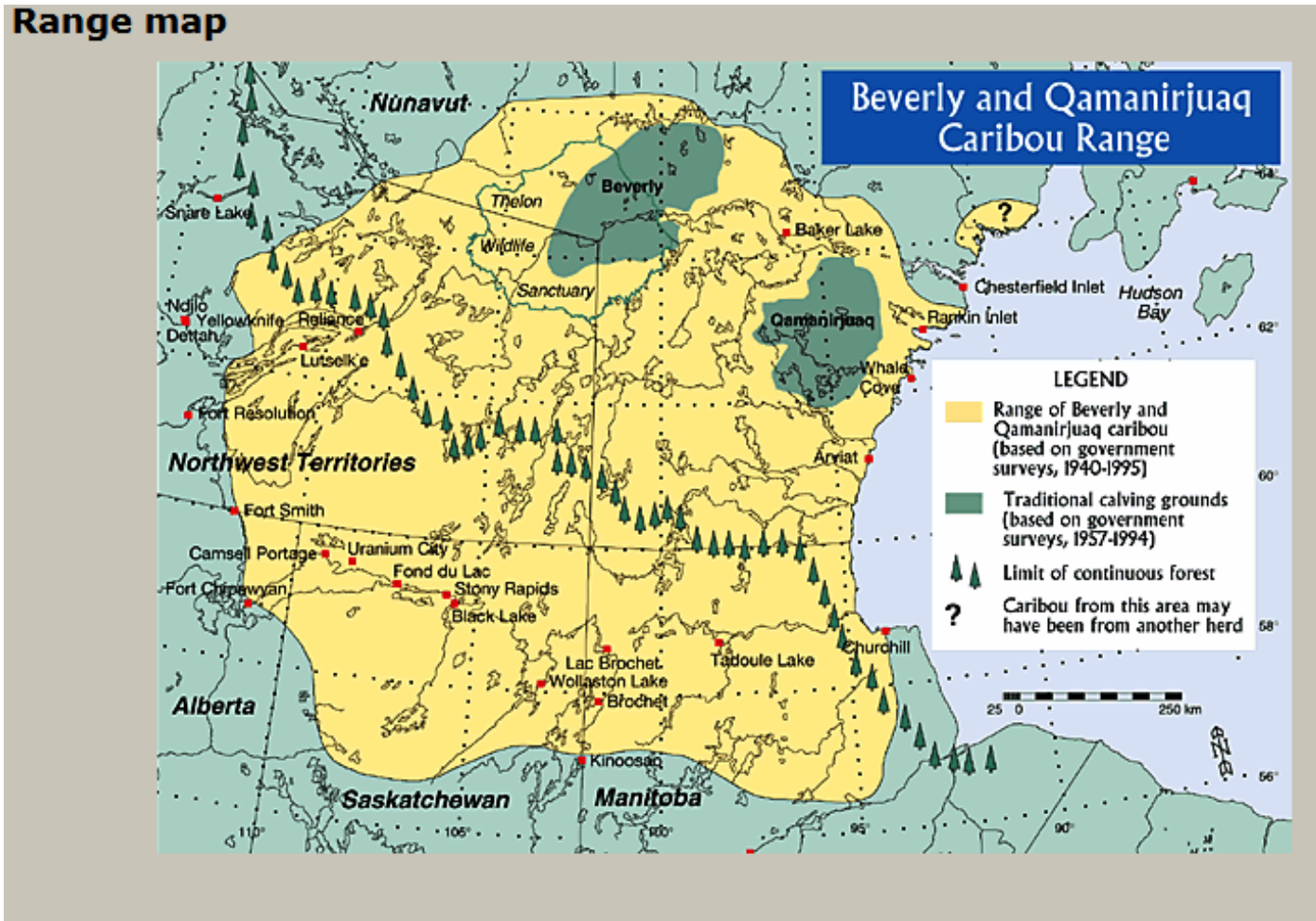
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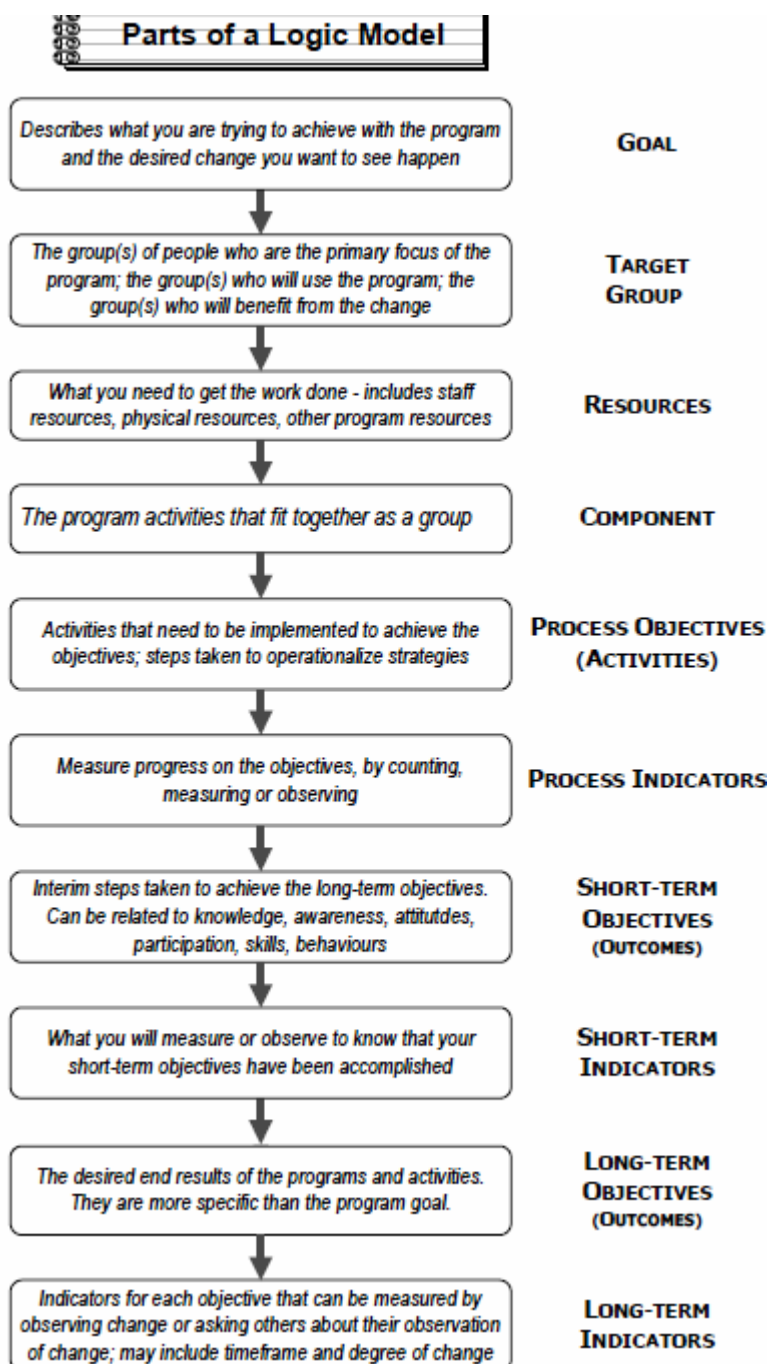
10 Appendices

Contents

10.1 Appendix: Beverly and Quamanirjuaq Caribou Range

Source: BQCMP 2002

10.2 Appendix. Parts of a logic model

Parts of a Logic Model

Description	Part
Describes what you are trying to achieve with the program and the desired change you want to see happen	GOAL
The group(s) of people who are the primary focus of the program; the group(s) who will use the program; the group(s) who will benefit from the change	TARGET GROUP
What you need to get the work done - includes staff resources, physical resources, other program resources	RESOURCES
The program activities that fit together as a group	COMPONENT
Activities that need to be implemented to achieve the objectives; steps taken to operationalize strategies	PROCESS OBJECTIVES (ACTIVITIES)
Measure progress on the objectives, by counting, measuring or observing	PROCESS INDICATORS
Interim steps taken to achieve the long-term objectives. Can be related to knowledge, awareness, attitutdes, participation, skills, behaviours	SHORT-TERM OBJECTIVES (OUTCOMES)
What you will measure or observe to know that your short-term objectives have been accomplished	SHORT-TERM INDICATORS
The desired end results of the programs and activities. They are more specific than the program goal.	LONG-TERM OBJECTIVES (OUTCOMES)
Indicators for each objective that can be measured by observing change or asking others about their observation of change; may include timeframe and degree of change	LONG-TERM INDICATORS

Source: Jeffery *et al.* 2006a.

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10.3 Appendix. The Environment domain of the Toolkit (old version).

Domain	Indicator categories	Identified issues	Community-proposed indicators
Environment	**Respect for environment**	Valuing natural resources	no indicators proposed
		Commitment	1-Community clean-ups
	Impact of development	Pollution	2- Air quality
			3-Water quality
			4- Levels of pollutants
		Environmental Clean Up	5- Clean-up agreements in place
		Community Sustainability	6- Decrease in fish/wildlife populations
			indicators #2,#3
		Jurisdiction	no indicators proposed
	Resource protection	Monitoring	7- monitoring programs in place
		Enforcement	8- conservation officers per sq. kms.
		Jurisdiction	9- funds available for EHO monitoring
		Expertise	10- funding from SERM
			11- EHO to interpret reports
	Human Health	Environmental	12- # of forest fires near community

Domain	Indicator categories	Identified issues	Community-proposed indicators
			13- health effects of fire smoke
		Structural	14- accidents in home

Data source: Jeffery *et al.* 2006a.

## 10.4 Appendix. The Environment domain of the Toolkit (Anthony 2009).

Domain	Indicator categories	Identified issues	Community-proposed indicators
Environment	**Respect for environment**	Valuing natural resources	1.1. knowledge of name/use of fauna/flora for community livelihoods
		Commitment	2.1. Community clean-ups
			2.2. Sustainability of harvesting rates
			2.3. Attitudes towards nature
	Impact of development	Pollution	3.1. Air quality
			3.2. Water quality (safe to drink the lake water)
			3.3. Levels of pollutants in sediments, plants, fish and wildlife
			3.4. Community population
			3.5. # of tourists per annum
			3.6. Waste generation and disposal (total and per capita)
		Environmental Clean Up	4.1. Clean-up agreements in place
		Community Sustainability	5.1. Decrease in fish and wildlife populations
			5.2. Decrease in important plant populations (medicinal, food, etc.)

			5.3. Number of species at risk (COSEWIC)
			5.4. Air quality
			5.4. Water quality
		Jurisdiction	6.1. EC Indicators of Change: • Forest Fires • Insects • Mercury • Nonnative Species • Mammals and Birds • Plants and Lichens • Drought and Blowdown Leopard Frog
			6.2. CCME Indicators of Climate Change • temperature • highs and lows • precipitation • snow & rain • river & lake ice • plant development • drought frost-free season
	Resource protection	Monitoring	7.1. Monitoring programs in place
		Enforcement	8.1. # of conservation officers (per km2)
		Jurisdiction	9.1. Funds available for an EHO to monitor area regardless of jurisdiction
		Expertise	10.1. Funding from SE
			10.2. Availability of EHO to help community members interpret reports
			10.3. Number of environment-related research projects within community
	Human Health	Environmental	12.1. # of forest fires near the community
			12.2. Effects of forest fire

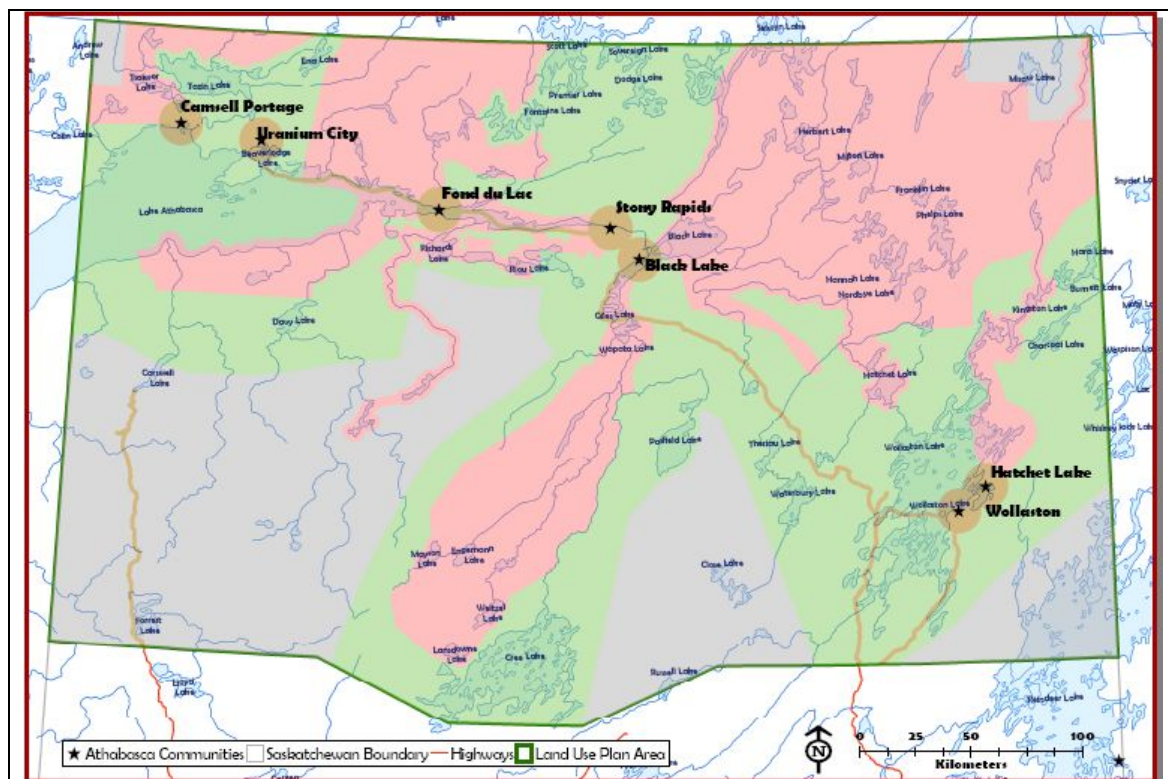|			smoke on community health
			12.3. Effects of forest fires on local resource base (medicinal plants, foodstuffs, fuelwood, etc.)
		Structural	13.1. # of accidents in the home

Data source: Anthony 2009

10.5 Appendix: The Athabasca region
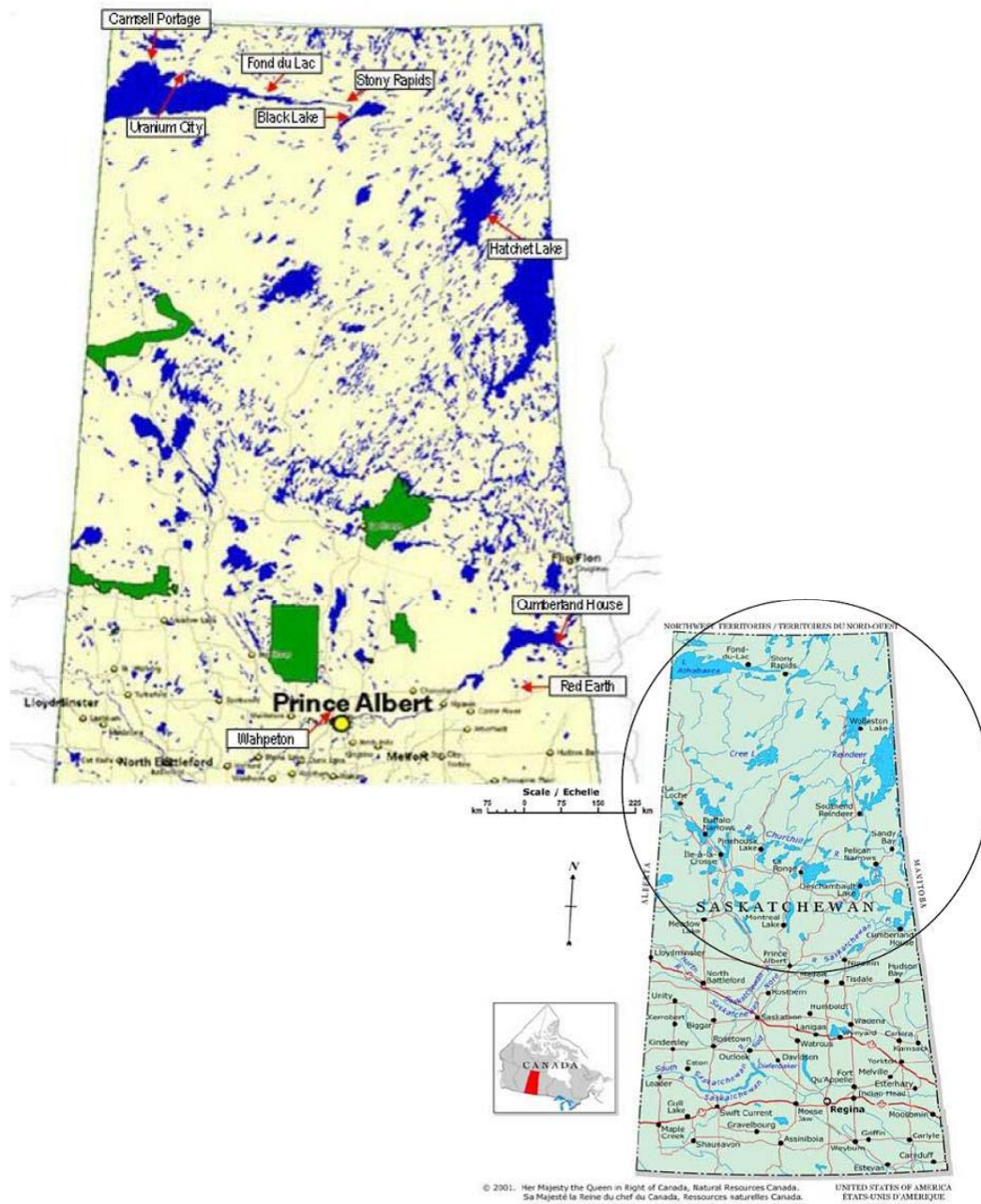
Source: Jeffery *et al*. 2006a.

10.6 Appendix: Athabasca Land Use Vision

What is allowed in each zone?

Land use activities & development	Nih bëk'ësóredli	Special Management	Multiple Use	Infrastructure
Land Use and Occupancy *	P	P	P	P
Low impact tourism**	P	P	P	P
Outfitting***	C	C	P	P
Commercial fishing	C	C	P	P
Mineral exploration	N†	C	P	P
Mineral extraction / mining	N†	C	P	P
Sand gravel extraction	N†	C	P	P
Roads & trails construction	N†	C	C	P
Lodge & infrastructure establishment	N	C	P	P
Waste disposal	N	C	P	P
Hydro development	N	C	P	P
Timber harvesting ††	N	C	P	P

N = Not Permitted	C = Potentially Permitted with Special Conditions and Consultation	P = Potentially Permitted with Conditions and Consultation

*   Land Use and occupancy includes hunting, fishing, trapping, gathering plants, gathering eggs, gathering soils.
**   In low impact tourism there is minimal environmental site disturbance. Activities include canoeing, skiing, hiking, tent trips, ecotourism.
***   Outfitting includes guided fishing and hunting, tent trips within allocation, snowmobile rides, ATV rides.
†   Existing dispositions, licences, leases authorizations will be valid for the life of their tenure; but they will not be renewed.
††   Includes fuelwood, sawlog and timber harvesting for subsistence and local commercial purposes.

Land Use Zone Policies

Overarching Policies

- Consultation with Aboriginal communities, including arrangements of socio-economic benefits, is necessary.
- Reporting and avoiding cultural places, archaeological sites, and caribou encountered during development is mandatory.
- Licences, permits or other government authorizations and their environmental protection terms are required. However, such authorizations may only be issued when consistent with the Athabasca land use vision and plan.

Nih bÿk'ÿsórÿdåí (Conservation) 30%

- The conservation zone was created to protect the ecological and cultural integrity of the landscape, with special attention to wildlife (especially barren ground caribou habitat), water, land use and occupancy, and important cultural sites. Nih bÿk'ÿsórÿdåí means "to respect and keep in their natural state."

- The Athabasca Sand Dunes Provincial Park is included in this zone.

- In this zone, new development is restricted to protect high concentrations of sensitive cultural sites and wildlife habitat. Existing authorizations will be valid for the life of their tenure; but they will not be renewed.

Special Management 40%

- In this zone, protection of cultural places and wildlife habitat are paramount. New development may be permitted providing that the impact on cultural and wildlife resources is minimal.

- New developments are subject to more rigorous up-front scoping and consultation to identify and protect significant natural and cultural values. The required consultation and investigations may be best accomplished through a social and environmental impact assessment of any proposed development.

Multiple Use 27%

- The multiple use zone is an area where commercial and industrial development are likely potentially compatible with or will probably have little direct impact on land use and occupancy.

- New development is potentially permitted under existing, approval, regulatory and environmental protection processes, and subject to the Athabasca land use planning guidelines.

Infrastructure 3%

- The infrastructure zone was created in anticipation of future community and infrastructure expansion, and also to protect land use and occupancy immediately surrounding the communities.

- New developments are directed towards community and public infrastructure, however, other forms of development are potentially permitted subject to the Athabasca land use planning guidelines.

Adapted from: ALUIP .2008.

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