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Managing Nutrition and Health in a Changing Climate:
A Yellowknives Dene First Nation Perspective

A dissertation submitted in partial satisfaction of the
requirements for the degree Doctor of Philosophy
in Public Health

by

Nelida Duran

2015

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ABSTRACT OF THE DISSERTATION

Managing Nutrition and Health in a Changing Climate:
A Yellowknives Dene First Nation Perspective

By

Nelida Duran

Doctor of Philosophy in Public Health
University of California, Los Angeles, 2015
Professor Charlot G. Neumann, Chair

Background and Significance: Arctic Indigenous peoples (IP) are vulnerable to climate change due to the influence of the Arctic's natural resources on economic and nutritional status, socio-cultural identity, and spiritual and physical health. Climate change is projected to affect global food systems and is presently disturbing traditional food systems, thus creating inequitable costs for IP who rely on both systems and resulting in unknown impacts on their nutrition and health. Comprehending IP's lived experience and resilience to climate and global environmental change is important to the development of programs that protect the welfare of IP and is essential to the local, national and international dialogue on nutrition and climate-related policy.

Methodology: A constructivist grounded theory method was utilized to systematically obtain and analyze data. In-depth interviews with 14 members of Yellowknives Dene First Nation (YKDFN) who harvest and use traditional foods in the Northwest Territories were conducted in 2010 and 2011. The interviews solicited data on the participants' lived experience that revealed

their views, feelings, intentions and actions. Theoretical sampling was used to explicate the theory being developed. Analytic codes, categories and themes were constructed from the data using a constant comparative method for analysis.

Results: The findings of this study provide insight on the complexity of the interdependence between food, nutrition, human health, and social-ecological factors. Climate change, contamination of the land and waters, changes in migration patterns and availability of species, and rapid social and cultural changes represent the global environmental change experienced by YKDFN. Nutrition and health are influenced by the perspective that “the land is what sustains us.” Social capital is strengthened by sharing practices and linkages with government, industry, and environmental institutions that share a commitment to sustainable use and development of natural resources.

Conclusion: The Global Environmental Change-YKDFN model and findings may enhance localized dialogue regarding nutrition and ecosystem services among decision-makers that include Indigenous, federal and territorial governments. This study also contributes to the body of knowledge that captures the human and cultural dimension of global environmental change, which is needed in the support and development of diverse and sustainable food systems in the context of climate change.

The dissertation of Nelida Duran is approved.

Gail Harrison

Susanna Hecht

Harriet Kuhnlein

Charlot G. Neumann, Committee Chair

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2015

To Mami Oly

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CHAPTER I

Introduction

This chapter introduces the impacts of climate change on human health and nutrition. It also presents the purpose and significance of this study related to the impacts of climate change on the food security, nutrition and health of Arctic Indigenous peoples. Key definitions are provided as a foundation for the subsequent chapters' exploration of the interconnectedness between food security, nutrition, health, and climate change, including the broader umbrella of global environmental change.

Impacts of Climate Change on Health and Food Security

The Intergovernmental Panel on Climate Change, Fourth Assessment Report (IPCC-FAR) states with medium confidence that regional climate change is affecting natural and human environments primarily through the effects of warming temperatures (Confalonieri et al., 2007). Of concern are the effects of climate-related change and variability on human health. Vulnerable populations to climate-related health impacts include: the elderly, children, the poor, chronically-ill people, rural residents, and those in climate vulnerable locations. Indigenous peoples residing in the Arctic Region are experiencing major economic and cultural impacts, and are particularly vulnerable to climate change due to the influence of the Arctic's natural resources on their economic and nutritional status, socio-cultural identity, and spiritual and physical health (ACIA, 2004). Climate change compounds the multiple stressors that interact and impact people and ecosystems, which raises the question of how Arctic Indigenous peoples manage their nutrition and health in a changing climate and environment.

Statement of the Problem

Since 1998 there has been a call for theory development to guide policy and action aimed at addressing food insecurity and its subsequent problems of hunger and malnutrition (Anderson & Cook, 1999). Malnutrition impairs the health of millions of children, and approximately 11% of total disease burden is due to maternal and child malnutrition, specifically under-nutrition (Black et al., 2000). Equally detrimental to human health is the global epidemic of obesity that is associated with other nutrition-related non-communicable diseases such as cardiovascular disease, cancer, and diabetes (Popkin, 2002). Most vulnerable populations are not benefiting from globalization, urbanization, genetic engineering, economic growth, technological advancement, food processing, and mass media growth. Instead, these modern activities have advanced and expanded agricultural production while simultaneously widening health disparities as a result of under and over-nutrition, environmental destruction, and social disintegration (Waltner-Toews & Lang, 2000).

Climate change exacerbates the perilous position of vulnerable populations and in particular, indigenous populations who still live with the land. Climate change-related exposures are projected to affect food yields and freshwater supplies, impair the functioning of ecosystems, displace vulnerable populations, and contribute to the loss of livelihoods (McMichael, Nyong, & Corvalan, 2008). The projected and present impacts of climate change and variability on global food systems (Toth, Villanyi, Balazs, & Kapusztá, 2008) combined with its present disruption of traditional food systems in the Arctic (Guyot, Dickson, Paci, Furgal, & Chan, 2006; Nuttall et al., 2005) creates inequitable costs for Indigenous peoples who rely on both systems. These impacts are likely to adversely affect food security, human nutrition, and health. Theory and policy framework development is particularly and uniquely hindered by our lack of knowledge about

the interdependence between food, nutrition, human health, and complex social and ecological factors, including climate and global environmental change.

The projected changes in climate reported in the Arctic Climate Impact Assessment were derived from global scale climate models (ACIA, 2004). The resulting assessments of the projected patterns of climate change and their impacts are useful in broad regional scale discourse. However, such assessments become less certain and less specific on smaller scales (ACIA, 2004), rendering them less useful in local adaptation planning and discourse. In addition, although the adverse environmental and social effects of climate change threaten human physical, nutritional, microbiological, and mental health, climate-change assessments continue to inadequately collect data that measure the risks and impacts on human health (McMichael, Neira, Bertollini, Campbell-Lendrum, & Hales, 2009).

Data collection on human nutrition and health that measures climate-related mortality and morbidity in Arctic Indigenous peoples is limited (Guyot et al., 2006; Parkinson & Berner, 2009). In Canada, the studies related to the determinants of Arctic Indigenous peoples' nutrition and health, as they relate to climate change and global environmental change, have primarily described the observed changes in the biophysical environment, potential impacts to traditional diets and health, and on occasion the coping strategies and adaptation planning related to harvesting activities. For example, Guyot (2006) and colleagues described the possible nutritional implications of observed changes in species, water, weather, and ice by identifying the traditional food that may be consumed (or not) and the subsequent nutrient that is affected (e.g. ↑ moose intake will ↑ protein and iron). And while Furgal and Seguin (2006) reported coping strategies related to harvesting activities, such as initiating a community hunt to provide meat for elders, the factors that determine food choices remain unknown. Similarly, the study did

not examine the day-to-day nutrition decisions and behavior adopted in the context of climate change and global environmental change.

Purpose and significance of the study

The Arctic Climate Impact Assessment (2004) recognizes that the impacts of climate change affect Indigenous peoples directly. Previous research has described Indigenous peoples' observed climate-related changes as affecting traditional food harvesting. However, the resulting impact on nutrition and health remains unknown. In particular, few studies have identified the processes and strategies that Indigenous people use to maintain their nutrition and health in a positive manner. The purpose of this study is to develop Midrange theory that describes the management of nutrition and health within the context of climate change and global environmental change for Yellowknives Dene First Nations in Yellowknife, Northwest Territories of Canada.

An inductive approach using qualitative methods were used to investigate the phenomenon of interest and to answer the research question “How do members of Yellowknives Dene First Nations, who harvest and use traditional foods, manage their nutrition and health in a changing climate and global environment?” Inductive qualitative research does not initiate a study with a priori conceptual framework or hypotheses; instead, the goal of inductive qualitative research is to develop theory (Morse & Field, 1995). An inductive approach using qualitative methods is appropriate for the proposed study because little is known about how Yellowknives Dene First Nations who harvest traditional foods manage their nutrition and health in a changing climate and global environment. To date, a conceptual model has not been developed to explain the relationship between global environmental change, climate change, and nutrition. Ford (2009b) developed a vulnerability-based conceptual model for assessing the potential

implications of climate change on Inuit food security in Canada, but did not address nutrition or health. Experts worldwide are encouraging negotiators involved in the United Nations Framework Convention on Climate Change (UNFCCC) to address the effects of climate change on food and nutrition security across local, national, and international agendas (UNSCN, 2010). Nutrition security, according to the UNFCCC, “exists when food security is combined with a sanitary environment...to ensure a healthy life for all household members” (UNSCN, 2010, p. 9).

More case studies on Arctic Indigenous peoples’ food and nutrition systems are needed to broaden our understanding of food and nutrition systems’ vulnerability¹ to climate change (Ford, 2009b) and its resulting impact on health. Subsequent comparative analyses of multiple case studies from diverse Arctic communities should follow to develop universal ideas about the relationships between food and nutrition systems and climate change (Ford, 2009b). Addressing the gaps in knowledge discussed will enrich our understanding of Arctic Indigenous peoples’ social-ecological system. Furthermore, reducing Arctic Indigenous peoples’ adaptation deficit² could likely enhance their resilience³, and reduce vulnerabilities associated with climate change (Ford, 2009a). Ultimately, a wider body of knowledge about Arctic Indigenous peoples’ food and nutrition systems may contribute to policy and action that strengthens ecosystem sustainability, nutrition, and health.

¹ Vulnerability: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard (www.unisdr.org)

² Adaptation deficit: Inadequate adjustment response in natural or human systems to actual or expected climatic stimuli

³ Resilience: The ability of system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner including through preservation and restoration of its essential basic structure and functions (www.unisdr.org)

Definitions

Climate change.

Climate change is defined as any significant change in the measures of climate that lasts for an extended period of time, usually decades or longer. Such measures might include temperature, precipitation, or wind (www.epa.gov). Climate change may result from natural factors, such as changes in the sun's intensity, or slow changes in the earth's orbit around the sun; natural processes within the climate system, such as changes in ocean circulation; and human-induced changes to the atmosphere's composition and land surface (www.epa.gov). The burning of fossil fuels for energy contributes to changes in the atmosphere's composition, while deforestation, reforestation, urbanization, and desertification alter the land surface. Desertification is the degradation of arid land that results from soil erosion, the conversion of forests to non-forests, and other human activities. Climate change is an influential element of the earth's ecosystem, which includes humans.

Food security.

The World Food Summit of 1996 defined food security as existing “when all people at all times have access to sufficient, safe, nutritious food to maintain a healthy and active life.” The World Health Organization later expanded its definition within the context of globalization, declaring that food security exists when:

“[A]ll people at all times have both physical and economic access to enough food for an active, healthy life; the ways in which food is produced and distributed are respectful of the natural processes of Earth and are thus sustainable; both the consumption and production of food are governed by social values that are just and equitable, as well as moral and ethical; the ability to acquire food is ensured; the food itself is nutritionally

adequate and personally and culturally acceptable; and the food is obtained in a manner that upholds human dignity.” (World Health Organization, 2006, ¶1.)

(www.who.int/trade/glossary/story028/en/)

Global Environmental Change.

Any ecosystem has natural systems and social systems. The natural systems are composed of physical elements such as air, water, land, etc., but social systems include human dimensions such as cultural, political, and economic elements. Such elements influence how humans interact with and use natural resources, and global environmental change pertains to this interaction. The *Journal of Global Environmental Change* defines global environmental change as “the outcome of processes that are manifest in localities, but with consequences at multiple spatial, temporal and socio-political scales” (<http://www.journals.elsevier.com/global-environmental-change/>). Global environmental change draws natural and social scientists to study the impairment of biophysical and ecological systems with particular attention to biodiversity and ecosystem services. Ecosystem services are defined as the benefits that people and communities obtain from the ecosystems (www.unisdr.org). Examples of global environmental change include climate change, freshwater shortages, loss of biodiversity, and the exhaustion of fisheries (McMichael et al., 2008).

Indigenous peoples.

Although the term *Indigenous peoples* lacks a universal definition, it is generally recognized to represent peoples originating and living in an area since time immemorial. Indigenous peoples are characterized by their cultural affinity, historical continuity, and for some nations, their stewardship of lands and waters. The United Nations Commission on Human Rights defines Indigenous peoples as:

Indigenous communities, peoples and nations are those which, having a historical continuity with pre-invasion and pre-colonial societies that developed on their territories, consider themselves distinct from other sectors of societies now prevailing in those territories, or parts of them. They form at present non-dominant sectors of society and are determined to preserve, develop, and transmit to future generations their ancestral territories, and their ethnic identity, as the basis of their continued existence as peoples, in accordance with their own cultural patterns, social institutions and legal systems.

(Martinez Cobo, 1984)

In Canada, Indigenous peoples are referred to as Aboriginal peoples and represent four percent of the total population. Part II of the Constitution Act of 1982 states that the designation Aboriginal peoples of Canada includes the North American Indian (hereafter referred to as First Nations), Inuit, and Métis peoples of Canada ("Constitution Act of 1982, Part II Rights of Aboriginal Peoples of Canada," 1982). For purposes of consistency, the term *Indigenous peoples* will be used throughout the dissertation to refer to Aboriginal peoples of Canada.

The next chapter will provide a review of the literature related to Arctic Indigenous peoples' nutrition and health in the context of climate change and global environmental change.

Chapter II

Review of Literature

With its significant variation in temperature, precipitation, and wind, climate change is deeply affecting vulnerable populations in the Arctic Region of Canada's Indigenous peoples. Canadian Indigenous peoples residing in the Arctic Region include: Yukon First Nations, Dene First Nations, Métis, Gwich'in and Inuit (Furgal & Seguin, 2006). A review of relevant geographic, social, economic, political, cultural, and health characteristics is necessary to provide context to the compounding effect climate change is likely to have on the existing stressors of Canada's Arctic Indigenous peoples.

Geographic

The Arctic region of Canada is comprised of the Yukon Territory, Northwest Territories, Nunavut, Nunavik in Quebec, and Nunatsiavut in Northern Labrador. The Arctic region includes both Arctic and Subarctic regions that are collectively referred to as the North, i.e. the area north of the latitude 60°0'N⁴ (Prowse, Furgal, Melling, & Smith, 2009). The Subarctic region, which is just below the Arctic circle, experiences long, cold winters and short, warm summers (Kuhnlein, McDonald, Spigelski, Vittrekwa, & Erasmus, 2009). The Northwest Territories (NWT) are located in northern Canada and border two territories (Yukon to the west and Nunavut to the east), and three provinces to the south (British Columbia, Alberta and Saskatchewan). The NWT have a diverse topography of mountains, forests and tundra that covers an area of 1.18 million square kilometers with 163,021 square kilometers of freshwater dispersed throughout the region

⁴ Circle of latitude that is 60 degrees north of the Earth's equatorial plan

(www.statsnwt.ca/environment, 2012). Protected areas⁵ account for 9.3% of the total 1.34 million square kilometers of land and freshwaters combined in the NWT. During January, the coldest winter month, Yellowknife in the Northwest Territories has the lowest average temperature at -30.0°C (-23.6°F) (www.statcan.gc.ca).

The Canadian Arctic is expected to experience higher averages of air temperature than the expected global mean air temperature rise of 1.5°C to 4.5°C in the future decades (Cohen, 1997). During the past fifty years, the Canadian Arctic has experienced substantial increases in both temperature and precipitation, and witnessed visible impacts on its physical environment. Furgal and Prowse (2008) reported that the climate-induced impacts on Northern Canada's ecological, economic and human systems are most evident in four key areas: the cryosphere, biodiversity of the Arctic ecosystem, navigability of Arctic marine waters, and Arctic Indigenous communities.

The cryosphere is composed of snow, glaciers, permafrost, and river, lake, and sea ice. The Arctic's infrastructure is dependent on the cryosphere to provide stable grounds for buildings and pipelines, containment of waste, consistent shorelines, and access to remote communities via ice-roads in the winter (Furgal & Prowse, 2008). Significant permafrost areas are expected to disappear, experience widespread thermokarsting and increased slope instability due to ecosystem shifts related to climate change (ACIA, 2004). Thermokarsting occurs when the ground collapses due to thawing of the permafrost. It can result in the creation of craters or lakes.

⁵ Clearly defined geographical space, recognized, dedicated, and managed through legal or other effective means, to achieve long term conservation of nature with associated ecosystem services and cultural values

These geological changes have profound consequences for plant and animal life in the area. The Canadian Arctic has more than 250 diverse species of fish, wildlife and plants that are consumed by Yukon First Nations, Dene First Nations, Métis and Inuit (NCP, 2003). Marine mammals harvested by Indigenous peoples include seals, walrus, narwhal, beluga, bowhead, fin and minke whales; land mammals include polar bear, caribou, musk ox, and moose; fish species include salmon, Arctic char and white fishes; and various birds such as king and common eider ducks (Anisimov et al., 2007; NCP, 2003). Climate change may compound the existing chemical contamination of the Arctic biota that is a natural and anthropogenic phenomenon (Muir, Shearer, Van Oostdam, Donaldson, & Furgal, 2005). Biodiversity shifts are occurring as consequences of the northward migration of species and the disruption from invading species, such as the cougar. The treeline is expected to move northward, and forests may replace significant portions of existing tundra. Tundra vegetation may move into the polar deserts (ACIA, 2004). These changes in wildlife, fisheries, and forests may economically and culturally adversely affect northern residents and regional economies (Furgal & Prowse, 2008). However, not all climate-induced changes are expected to be economically detrimental.

The diminishment of sea ice associated with warming will lengthen summertime shipping seasons and ease ships' passage, particularly in the Hudson Bay and Beaufort Sea. Furgal and Prowse (2008) project increased opportunities for economic growth in the Arctic communities due to increased access for trade and development of the region's natural resources. However, socioeconomic and cultural changes associated with the development of remote Arctic communities may challenge Indigenous peoples who practice traditional and subsistence-based ways of life (Furgal & Prowse, 2008). The increased land erosion due to permafrost thaw, the increased frequency and severity of forest fires, the migration of mid-latitude pests and diseases

into high latitudes, and the reduction of habitat suitable for cold climate species (e.g. polar bears, some fish) are climate change impacts that threaten Indigenous people, their communities and traditional lifestyles.

Natural resource use and development in the Northwest Territories

The land and waters of the Northwest Territories (NWT) have supported the subsistence lifestyle of Arctic Indigenous peoples since time immemorial. But climate change and the increased exploitation of natural resources threaten the biodiversity of the region, and subsequently endanger traditional life ways of Arctic Indigenous peoples. The following is a summary of the present-day use and development of natural resources and the contributions of Arctic Indigenous peoples in the decision-making process.

Arctic Indigenous peoples continue to use the natural resources of the environment for their health, well-being, and livelihood. The Department of Industry, Tourism, and Investment (ITI) of the Government of the Northwest Territories (GNWT) supports the traditional economy through two key programs: 1) Genuine Mackenzie Valley Furs (GMVF), and 2) Take a Kid Trapping (www.iti.gov.nt.ca), which educates youth about traditional trapping and pelt-preparing techniques. As for GMVF, the ITI provides financial assistance to NWT trappers in the form of startup, marketing, and sale costs, and also pays bonuses for the delivery of high-quality fur pelts. GMVF marten pelts are the most valuable, fetching prices as high as \$1300.00 (CAD) per pelt. Other NWT species that are trapped as part of the GMVF line of wild fur are mink, lynx, wolf, and arctic and red fox. ITI provides support for the sale of GMVF brand furs at the international fur auction market.

The Department of Industry, Tourism, and Investment also provides funding support to farmers, fisheries, wildlife harvesters, and producers of non-timber forest products (e.g. syrup).

Funding for small-scale foods program allows communities outside of Yellowknife to build self-sufficient community-based gardens and greenhouses. In 2013, the federal, provincial, and territorial governments invested \$3 billion dollars (CAD) to launch Growing Forward 2, a policy framework that guides the expansion of Canada's agriculture and agro-food sector (www.iti.gov.nt.ca). ITI also supports the Great Slave Lake Commercial Export by providing funding to the NWT Fishermen's Federation for the costs of equipment, packaging, and marketing services. In an effort to encourage and maintain traditional lifestyles, ITI also supports wildlife harvesting by providing financial assistance for community hunts and harvests. By funding a program similar to Take A Kid Trapping called Take a Kid Harvesting, ITI encourages and teaches youth traditional land-based harvesting skills. Recently, the most popular non-timber forest product harvested is the morel mushroom. In March 2015, the *Northern Journal* reported an estimated \$100 million dollars (CAD) in revenue from the sale of NWT morel mushrooms (norj.ca/2015/03/biggest-morel-harvest-in-world-history-expected-in-nwt/).

Harvesting of wildlife is shared with non-Aboriginal, non-residents of NWT. Hunters and anglers from outside the territory and Canada are welcomed, and they contribute millions of dollars to the economy. In NWT, there are three operating fishing lodges with access to species of northern pike, lake trout, arctic grayling, walleye, white fish, and pickerel. The Association of Mackenzie Mountains Outfitters began operations in 1965, and has 8 member outfitters licensed by the GNWT (www.huntnwt.com/nwt.html). Big game species hunted include the Dall ram, woodland caribou, moose, mountain goat, wolf, wolverine, and black bear (when not accompanied by cubs). The Environment and Natural Resources (ENR) department of the GNWT oversees the provision of licenses for fishing, hunting, timber cutting, and burn permits (www.enr.gov.nt.ca). As of January 1, 2010, hunting licenses for caribou have been suspended

in an effort to conserve the Bathurst and Bluenose caribou herds. Due to an agreement between the GNWT, Aboriginal governments, and wildlife management, the number of barren-ground caribou is managed. Aboriginal communities, including Yellowknives Dene First Nations, are permitted to harvest a limited number of caribou (news.exec.gov.nt.ca/news-release-political-leaders-support-management-actions-for-bathurst-and-bluenose-east-caribou-herds).

Fossil fuels, such as coal and petroleum, are natural resources that contribute to economic development. The ITI is responsible for oversight of onshore oil and gas interests, while offshore interests are managed by Aboriginal Affairs and Northern Development Canada. Onshore oil and gas responsibilities include petroleum resources policy, petroleum exploration and development, intra-territorial pipeline regulation, benefit plans, royalties, and securities. The demand for energy, especially by Asian countries, has driven the expansion of Canada's investment in oil sands, shale, and offshore gas resources (Mathewson & Asme, 2013). In 2013, oil and gas extraction contributed \$335.6 million of chained dollars⁶ (CAD) to the NWT's Gross Domestic Product (GDP) (www.statsnwt.ca/economy/gdp). Diamond mining is the largest contributor to the NWT's GDP at \$562.7 million of chained dollars (CAD). In 2013, Aboriginal business in the NWT received approximately \$250 million dollars (CAD) for goods and services contracted by the diamond mines.

Outside of Botswana and Russia, Canada is the third-largest diamond producer (based on value). There are currently three active diamond mines and a fourth soon to start. The ITI oversees mineral exploration and compliance with the Mackenzie Valley Resource Management Act (www.iti.gov.nt.ca). ITI is responsible for policy development and planning development of NWT mineral resources, administration of third party rights in form of mineral claims, and

⁶ GDP estimates only reflect changes in the quantities of goods and services produced, not their prices

administration of royalties. In addition to requiring environmental assessments to be completed, ITI also negotiates socio-economic agreements with the leadership of diamond mines. Socio-economic agreements are designed to ensure that all residents benefit from diamond mine activities. Such agreements also monitor the impact that mining activity may have on residents of Yellowknife and seven small local communities. The Yellowknives Dene First Nation communities of Dettah and Ndilo are two of the seven small local communities. Examples of services and benefits provided by socio-economic agreements include funding literacy programs, student scholarships, training for jobs in the mining sector, and professional development of mine employees. ITI publishes an annual report titled *Communities and Diamonds* that compiles socio-economic indicators used to determine how mining activities affect the health and well-being of the surrounding communities.

Water is a resource that is sensitive to the demands of economic development and its subsequent population growth. The NWT has an extensive system of lakes, rivers, and streams. The Mackenzie River, the longest river in Canada, flows northwest into the Mackenzie Bay and Beaufort Sea (www.worldatlas.com). The Mackenzie River is frozen solid from October to April. Canada's first and second largest lakes, Great Bear Lake and Great Slave Lake, are in the NWT. The construction of ice roads supports natural resource development activities and the transportation of goods throughout NWT. In northwestern Canada and northern Alaska, the construction of ice roads require the withdrawal of water, which strains water reserves and has a detrimental effect on the biodiversity of the aquatic biota (Cott, Sibley, Somers, Lilly, & Gordon, 2008; Samarasin, Minns, Shuter, Tonn, & Rennie, 2015). Remediation efforts using biotechnology continue after the closures of Con Mine and Giant Mine. Sequencing batch reactor (SBR) technology has been shown to effectively treat nitrogen compounds, such as the

thiocyanide (CNS) and ammonia (NH₄-N) found in gold mill effluents (Kapoor, Gould, Bedard, & Morin, 2004). The end products of CNS and NH₄-N after treatment with SBR were found to be non-toxic to rainbow trout. Con Mine and Giant Mine were learning experiences for the Environment and Natural Resources department of the GNWT. In March 2015, the NWT and Alberta signed a bilateral water management agreement to ensure the protection of aquatic ecosystems in the Mackenzie River Basin and the integrity of water flow from Alberta downstream to the NWT (news.exec.gov.nt.ca/alberta-and-the-northwest-territories-announce-bilateral-water-management-agreement). The Alberta-Northwest Territories Bilateral Water Management Agreement is the first to incorporate input from the Aboriginal governments of the NWT.

In Canada, the Government of the Northwest Territories was the first to adapt a formal policy related to the use of Traditional Knowledge. Under the policy, indigenous knowledge can inform policies and programs so that they reflect the values and priorities of northern residents (Abele, 1997). Although government employees have raised concerns regarding the appropriate application and interpretation of Traditional Knowledge, its inclusion in the formal policy creates an opportunity to introduce different ways of knowing to the decision-making process and practice around sustainable resource development (Turner & Clifton, 2009). Devolution became effective on April 1, 2014 and localized the oversight of resource use (<http://devolution.gov.nt.ca>).

Devolution is the transfer of administrative power and responsibilities over Crown lands, resources, and rights with respect of water from the Government of Canada to the Government of the Northwest Territories. Specifically, oversight of the NWT Oil and Gas Operations Act, NWT Petroleum Resource Act, NWT Mining Regulations, Dredging Regulations, and Coal

Regulations was transferred from Aboriginal Affairs and Northern Development Canada to the GNWT's Department of Industry, Tourism and Investment (<http://devolution.gov.nt.ca>). Fiscal benefits include keeping 50% of resource royalties in NWT to improve the quality of life for all NWT communities, and sharing up to 25% of the GNWT resource revenues with participating Aboriginal governments with the aim of supporting capacity-building initiatives within the communities. Current Devolution signatories and participating governments include: GNWT, Inuvialuit Regional Corporation, Gwich'in Tribal Council, Sahtu Secretariat Incorporated, Northwest Territory Métis Nation, Tlicho Government, Acho Dene Koe First Nation and the Fort Liard Métis Local #67, Salt River First Nation, and Deninu Kue First Nation. As of April 1, 2015, negotiations with Deh Cho First Nation and Akaitcho Territory Dene First Nation continue; Yellowknives Dene First Nation are represented by the Akaitcho Territory Dene First Nation. The governments of Deh Cho First Nation and Akaitcho Territory Dene First Nation represent half of all the indigenous communities in the NWT, which makes their negotiations with the federal and territorial governments significant to the effectiveness of Devolution.

According to the Environment and Natural Resource department, regulatory regime systems in the NWT include environmental assessments and regulation of approved projects that are largely based on conditions outlined in Aboriginal land claims (<http://devolution.gov.nt.ca>). This, however, does not negate Aboriginal governments' concern over the impact a devolution agreement might have on current and future land claims and self-government negotiations (Alcantara, 2013). Inuvialuit, Gwich'in, Sahtu, and Tlicho are the only four Aboriginal groups that have land claims agreements, and the process of formulating these agreements took over 20 years. The last land claim agreement is under ongoing negotiation between the Akaitcho Territory Dene First Nation and the Government of Canada.

Social

Indigenous peoples of Canada include First Nations, Inuit, and Métis peoples of Canada ("Constitution Act of 1982, Part II Rights of Aboriginal Peoples of Canada," 1982).

Internationally, Canada has the second largest population of Indigenous peoples at four percent, which comes second to New Zealand, where the Maori represent 15% of the population.

According to the 2006 Census of Population, a total of 1,172,790 people identified themselves as First Nation, Inuit, and Métis (Cloutier et al., 2008). Indigenous populations increased 45% between 1996 and 2006, which is six times faster than the non-Indigenous populations of Canada; First Nations increased the most, by 29% (Cloutier et al., 2008). Indigenous peoples are younger than non-Indigenous people. Forty-eight percent of Indigenous peoples are 24 years or younger. Indigenous peoples comprise 50% of the population in the Northwest Territories, of which 29% are Dene First Nations (NWT Bureau of Statistics, 2007).

There are slightly more female than male Indigenous peoples ("Electoral Insight," 2005) and female Indigenous peoples are more likely to attain a post-secondary university education than male Indigenous peoples (Mendelson, 2006). On average 43% of Indigenous peoples, ages 20 to 24 years, who live on-reserves have not graduated from high school, compared to only 16% of Canada's overall average. Two main barriers to school attendance are the intergenerational impacts associated with the trauma of residential schools, and the educational system's dismissal of Indigenous ways of learning that include elders, community, as well as the land and environment (Tait, 2008).

Siggner and Costa (2005) reported that in recent decades, Indigenous peoples who live in urban areas have increased school attendance, high school completion, and attainment of college or university credentials. Although an urban area (total population $\geq 100,000$) is non-existent in

the Arctic region, Indigenous peoples' completion of high school or more has increased from 40.6% in 1984 to 60.6% in 2004 in the Northwest Territories (Aboriginal employment patterns in larger NWT communities, 2005). More than four in ten First Nations women have earned a college degree (Tait, 2008).

However, crowding and poor housing conditions continue to affect Indigenous peoples. Indigenous peoples are four times as likely as non-Indigenous people to live in crowded dwellings – a crowded dwelling is defined as having more than one person to a room (Cloutier et al., 2008). And Indigenous peoples are three times more likely to live in homes in need of repair. Indigenous children are twice as likely as non-Indigenous children to live in households with multiple families (Tait, 2008). Poor housing conditions are more common among First Nations living on-reserve than the off-reserve. On-reserve connotes communities affiliated with First Nations or Indian Bands, Indian Reserve, Indian Settlement, Indian Government District, and other French terms for Indigenous peoples communities (Cloutier et al., 2008).

Indigenous peoples are overrepresented in the criminal justice system. In 2005, Indigenous peoples accounted for three percent of the Canadian population but 20% of the incarcerated population (Kong & Beattie, 2005). Rates of victimization, however, are higher for Indigenous peoples than for non-Indigenous people. Violent crimes such as murder, attempted murder, and sexual assault are more frequent in Nunavut than all of Canada, and are primarily perpetrated by adults (Morin, Edouard, & Duhaime, 2010).

Economic

Arctic Indigenous peoples rely on mixed economies. In other words, a combination of wage and traditional economies comprise their livelihoods. Wage economies include commercial harvesting of fish and other animals, oil and mineral extraction, forestry, public

administration, healthcare and tourism. Traditional economies include harvesting renewable resources from the land and sea (ACIA, 2004). In mixed economies, more than half of household incomes are derived from wage work and government transfers, while harvesting activities provide goods and services to the community (ACIA, 2004; Morin et al., 2010). Harvesting activities include hunting, fishing, trapping, and related activities that satisfy the social, cultural, and nutritional needs of households and the community. Harvesting activities may offset the household's needs; however, wage work and cash are essential for the purchase of harvesting equipment (e.g. fuel, cartridges, etc.) (Morin et al., 2010). Climate change and variability have contributed to the rising fuel and maintenance costs associated with travelling longer distances to access wildlife whose migration route is sensitive to climate change (ACIA, 2004).

In 2005, the earnings and income of Indigenous peoples residing in NWT were higher than the overall median for Indigenous peoples in Canada (www.statcan.gc.ca) ("NWT Community Statistics Report," 2007). Forty-eight percent of Indigenous people over the age of 15 years were employed, earning an annual average of C\$33,687.00 in NWT. Forty-two percent of the 10,265 Indigenous peoples employed worked fulltime and earned an average of C\$54,527.00 annually in NWT. The median income was C\$20,080.00, composed of 85.5% earnings, 11.7% government transfers, and 2.7% other income. The costs of living and market food in the North are about 50% higher than in southern areas of Canada (e.g. Alberta) (Kuhnlein et al., 2009). Although there is a higher dollar amount of federal transfers to the Arctic regions to compensate for the higher cost of living, the percent of government transfers contributing to median income is less for Indigenous peoples in NWT than for Indigenous peoples in Canada as

a whole. Economic resources influence Arctic Indigenous peoples' resilience and vulnerability to climate change.

Political

Indigenous peoples in Canada occupy a paradoxical position that yields near-constant political strife. On one hand, they hold dear the principle that they - as First Nations, Inuit, and Métis - are equal to all Canadians, and should therefore not be privileged to special rights under the constitution (Macklem, 2001). On the other hand, to accept this notion is to disregard the particular history of Indigenous peoples in Canada. They had to (and continue to) strive for sovereignty over their peoples and territories, and upon first colonial contact, had even negotiated treaties with European nations as equal counterparts (Macklem, 2001). The *Constitution Act of 1982, Part II Aboriginal Peoples Rights of Canada*, recognizes and affirms the Aboriginal and Treaty rights of First Nations, Inuit, and Métis. Existing Treaty rights are exercised through land claims, which is a treaty process Indigenous peoples continue to engage in with the Crown⁷. Land claims contribute to self-determination and support co-management institutions that create opportunities for increased resilience and adaptation capacity in response to climate change (ACIA, 2004).

Climate change policy is broadly categorized as environmental policy that is most frequently grounded in science. Policy outcomes are considerably constrained by socioeconomic and political structures that influence which issues are addressed and supported by the public, as evidenced by Canada's shift in 1997, from an activist climate change position to a cautious position, in response to economic globalization (Litfin, 2000). Historically, policy outcomes have been tangible and accomplished during a politician's tenure and or individual's lifetime.

⁷ Crown: represents the legal embodiment of Canada's system of government

Climate change policy is handicapped by two major difficulties: the translation of scientific data into socioeconomic concern and public policy, and the extended time period of the policy outcomes that may not be realized in either the politician's or constituent's lifetime. The increasing economic, social, and ecological interdependence that is occurring in today's globalization is understood and experienced differently among various peoples and states.

Arctic Indigenous peoples face a number of challenges as they attempt to influence national and international climate-related policy. The complex nature of global climate change policy is an impediment, and Indigenous peoples find it difficult to influence international law because they are not a state (Koivurova & Heinamaki, 2006). Nonetheless, soft law as defined by the International Development Research Centre as documents that are not legally binding such as declarations of principles, resolutions, or charters, but whose provisions will be respected and followed by the international community (www.idrc.ca), may provide Arctic Indigenous peoples the opportunity to influence the law-making process at the international level. Though these soft law documents are not enforceable in courts, they are expected to impact international relations and laws, such as the United Nations Declaration on the Rights of Indigenous peoples.

The United Nations Declaration on the Rights of Indigenous peoples contains language that grants Indigenous peoples the right to fully participate at all levels of decision-making that may affect their rights, lives or destinies. On November 15, 2010, the government of Canada adopted and endorsed the United Nations Declaration of the Rights of Indigenous peoples. The Declaration affirms Indigenous peoples' right to self-determination, which it defines as the right of Indigenous peoples to control their own political, social, economic and cultural development (Article 3), and to maintain and strengthen their distinct political, legal, economic, social, and cultural institutions (Article 5). The Declaration overall affirms respect and non-discrimination

for Indigenous peoples (www.un.org/esa/socdev/unpfii/en/drip.html). The Arctic Council provides an additional soft law method that can influence climate-related policy.

The Arctic Council is recognized as successfully using soft law approaches to address sustainable development⁸ and environmental protection in the Arctic (Koivurova & Heinamaki, 2006). The Arctic Council is an intergovernmental organization (IGO) with high visibility and political access among the Arctic states. The Ottawa Declaration of 1996 formally established the Arctic Council as a high-level intergovernmental forum with the responsibility of promoting cooperation, coordination, and interaction among the Arctic states (www.arctic-council.org). Canada, Denmark, Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States of America are the Arctic states that hold memberships in the Arctic Council. One of the primary functions of the Arctic Council is to undertake scientific work that protects the environment in the Arctic States.

Arctic Indigenous peoples are directly affected by the projects and policy-related activities embarked upon by the six expert working groups of the Arctic Council. The Arctic Council invited community-based organizations (CBOs) representing the interests of respective Arctic Indigenous peoples to become “permanent participants” of the Arctic Council. The “permanent participants” forum provides for active participation and full consultation with the Arctic Indigenous representatives (from their respective CBOs) within the Arctic Council. There is a total of six “permanent participants,” of which three represent Canada’s Arctic Indigenous peoples: the Arctic Athabaskan Council, the Gwich’in Council International, and the Inuit

⁸ Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their needs (www.unisdr.org)

Circumpolar Council. Dene First Nations are represented by the Arctic Athabaskan Council and Gwich'in Council International.

Though Arctic Indigenous peoples have advanced their agenda of self-determination through involvement in efforts such as the Arctic Council, painful legacies of colonialism continue to burden Indigenous peoples' progress. Chief among these difficult legacies is the shadow cast by residential schooling, which has contributed to significant health disparities and culture loss. Residential schools were a form of deculturation and enforced assimilation upon children of Indigenous peoples. Early documentation suggests that the first residential schools that separated Indigenous children from their families opened in 1894. The system continued until 1996, when the last school was closed (Quinn, 2007). On June 11, 2008, Canadian Prime Minister Stephen Harper offered a full apology on behalf of Canada to former students of Indian Residential Schools. Harper opened his apology with these words:

For more than a century, Indian Residential Schools separated over 150,000 Aboriginal children from their families and communities. In the 1870s, the federal government, partly in order to meet its obligation to educate Aboriginal children, began to play a role in the development and administration of these schools. Two primary objectives of the Residential Schools system were to remove and isolate children from the influence of their homes, families, traditions and cultures, and to assimilate them into the dominant culture. These objectives were based on the assumption Aboriginal cultures and spiritual beliefs were inferior and unequal. Indeed, some sought, as it was infamously said, "to kill the Indian in the child." Today, we recognize that this policy of assimilation was wrong, has caused great harm, and has no place in our country. (Statement of Apology, ¶1) (www.ainc-inac.gc.ca/ai/rqpi/apo/index-eng.asp)

While attending Indian Residential Schools, Indigenous children experienced sexual, physical, psychological, and spiritual abuse, and many died of preventable diseases (Quinn, 2007). Residential schools survivors describe their experience as a "de-feathering process" whereby their knowledge, spirituality, physical, and emotional health, and sense of community were stripped away (Locust, 2000 as cited by Quinn, 2007). The most damaging effect of Indian

Residential Schools is the intergenerational impact on survivors' children and grandchildren. For these individuals, feelings of disconnection and low self-esteem, disrespect for traditional beliefs and practices, and negative self-conceptions of themselves as Aboriginal peoples still linger. These are all challenges Indigenous peoples face as they attempt to rebuild their culture (Smith, Varcoe, & Edwards, 2005).

Culture

First Nations, Inuit, and Métis are peoples that possess their own distinctive heritage, language, and culture. Sixty diverse Aboriginal languages are spoken by First Nations. These sixty languages can be grouped into distinct language families: Algonquian, Athapaskan, Siouan, Salishan, Tsimshian, Wakashan, Iroquian, Haida, Kutenai, and Tlingit. The 2006 Census found that 29% of First Nations reported speaking an Aboriginal language well enough to have a conversation, while 25% reported having an Aboriginal Mother tongue (first language spoken) (Cloutier et al., 2008). This Census finding suggests that a number of First Nations are learning an Aboriginal language as a second language. The learning of an Aboriginal language as a second language has been described as a healing and reconnecting activity that rebuilds cultures and communities lost as a result of Indian Residential Schools (Smith et al., 2005).

Traditional food⁹ is defined as mammals, fish, plants, berries, and waterfowl or seabirds that are harvested from the local environment for consumption (Van Oostdam et al., 2005).

Traditional foods influence the social, cultural, spiritual, economic, and nutritional well-being of Indigenous peoples. The acts of hunting, sharing harvested food, and transferring Traditional Knowledge to younger generations exemplify collectively shared cultural and social values. In

⁹ Dene use the term Dene traditional food, while Inuit use the term country food. The literature also uses the term Arctic foods. For consistency, the author of this dissertation uses the term traditional food.

addition, traditional foods are viewed as essential for not only physical health but also for personal and community well-being among First Nations and Inuit (Egede, 1995 as cited by Van Oostdam, et al., 2005). Climate change may adversely affect Indigenous peoples' access to traditional foods (Furgal & Prowse, 2008). Decreases in consumption and harvesting of traditional foods may contribute to decreased physical activity and increased chronic disease (Van Oostdam, et al., 2005).

Health

Indigenous peoples in Canada generally experience a disproportionate burden of morbidity and mortality when compared to the general Canadian population (Smylie, 2001). The life expectancy of registered "Status Indians" is 7 to 8 years less than the overall Canadian average. "Status Indian" refers to a person who is registered as Indian under the Indian Act of 1876 (amended in 1985 with Bill C-31, Indian and Northern Affairs Canada). The infant mortality rate among Status Indians is two times higher than the Canadian average rate. Post-neonatal (between 28 days and 1 year of age) death rates are three times the national average (Smylie, 2001). The underlying causes of infant mortality are: sudden infant death syndrome (SIDS), congenital anomalies, respiratory infections, and injury. Indigenous children have higher rates of respiratory tract infections, bronchitis, pneumonia, croup and otitis media, which may result in hearing loss. The First Nations Regional Longitudinal Health Survey reported that the common chronic conditions in First Nations children include: asthma, allergies, chronic ear infection, and chronic bronchitis (RHS, 2005).

A higher rate of death due to injury and poisoning also afflicts Indigenous peoples (Smylie, 2001). Such deaths can result from motor vehicle accidents, drowning, and exposure to extreme climate, and poisoning. Among First Nations, most of the domestic violence,

alcoholism, and suicide behavior is seen as the result of Indian Residential Schools (Gagne, 1998 as cited by Quinn, 2007). Indigenous peoples have a suicide rate twice that of Canada's as a whole, and suicide is even more prevalent in youth (under 24 years of age). The psychological distress associated with rapid social, cultural, and environmental changes remains understudied in the Arctic (Lehti, Niemela, Hoven, Mandell, & Sourander, 2009).

Chronic diseases such as diabetes, heart disease, cancer, hypertension, and arthritis/rheumatism are also increasing among Indigenous peoples. Although diabetes is rising among Canadian First Nations, in the Arctic, Dene First Nations have the lowest reported rate of diabetes (Young, Reading, Elias, & O'Neil, 2000). However, the 26% obesity prevalence among Indigenous peoples exceeds the Canadian national average for adults (over 18 years) by 11% (Belanger-Ducharme & Tremblay, 2005). Infections such as tuberculosis, hepatitis, gastroenteritis, meningitis, gonorrhea, and chlamydia affect more Indigenous peoples than non-Indigenous people. The incidence of Human Immunodeficiency Virus (HIV) is increasing, but may be underestimated in the Arctic region due to smaller, close-knit communities that make testing for HIV more difficult (Smylie, 2001). The major causes of death among Indigenous peoples are lung and digestive cancers which may be linked to smoking and inadequate nutrient intake (Tait, 2008).

Access to healthcare is one of many contributing factors to the health disparities experienced by Indigenous peoples. Inuit adults are less likely to have contact with a medical doctor or primary care specialist than Canadians in general. When compared to the 79% of the total Canadian population in contact with a medical provider, only 56% of Inuit have annual contact with a medical doctor (Tait, 2008).

Nutrition Transition

Traditional foods are integral to Arctic Indigenous peoples' food security (Lambden, Receveur, & Kuhnlein, 2007). A survey of 44 Canadian Arctic communities highlighted the importance of traditional foods in Indigenous peoples' ability to sustain food security; and 10% to 38% of respondents reported changes in the quality and quantity of traditional foods (Lambden, Receveur, & Kuhnlein, 2007). Economic factors have an influence on Indigenous peoples' food security. High food costs and low incomes influence the purchase of adequate amounts of food among Indigenous peoples (Lambden, Receveur, Marshall, & Kuhnlein, 2006). Also, costs related to hunting and equipment for fishing and hunting limit access to traditional foods (Lambden et al., 2006; Simoneau & Receveur, 2000). Other factors limiting access to traditional foods among Dene and Métis Indigenous peoples include the necessity of traveling farther to obtain food and the unhealthy appearance of certain species. Some households lack individuals who could serve as hunters or fishermen, and thus lose their access to traditional foods (Simoneau & Receveur, 2000). Indigenous peoples' culture, including their practices and consumption of traditional foods, have been and continue to be threatened by non-Indigenous belief systems, philosophies, and lifestyles (Macklem, 2001).

Nutrition transitions are described as a westernization of Traditional diets as a result of industrialization, urbanization, economic development, and globalization (Damman, Eide, & Kuhnlein, 2008). Indigenous peoples of the Arctic are experiencing nutrition transitions as documented by the decreasing percentage of Indigenous peoples consuming Traditional diets (Kuhnlein, Receveur, Soueida, & Egeland, 2004). Changes in the accessibility and distribution of wildlife species as a result of climate change, along with social, cultural, economic, and

political changes in the Arctic, have contributed to these nutrition transitions (Anisimov et al., 2007). Other influences on nutrition transitions relate to contaminants.

In 2000, Health Canada lowered its mercury intake guidelines (0.2µg/kg of body weight/day) for women of reproductive age based on the no observable adverse effect level (NOAEL) measured from maternal hair (Chan & Receveur, 2000); the NOAEL was converted to an equivalent dietary intake level from food with a five-fold uncertainty factor to account for individual variation (Freeley & Loo, 1998 as cited by Chan & Receveur, 2000). This is an example of a health campaign that has good intentions but may contribute to decreases in traditional foods if not delivered appropriately and responsibly. For example, while Dene First Nations and Métis have a low risk for exceeding the Provisional Tolerable Daily Intake of Mercury, the perception of being at high risk is omnipresent (Chan & Receveur, 2000) and may reduce their intake of traditional foods unnecessarily. The 2013 Canadian Community Health Survey (CCHS) found that 58.8% of Indigenous respondents avoided foods for health or weight concerns (www.statsnwt.ca). The most contaminated traditional foods that are likely to be avoided are marine mammal fats that include narwhal and beluga muktuk (Donaldson et al., 2010).

A change from a traditional economy to a wage work economy has also contributed to the nutrition transitions (ACIA, 2004). The majority of wage work requires employees to work Monday through Friday, and limits the time that Indigenous peoples have to go on the land and harvest. Social changes, such as Indian Residential Schools, have also contributed to the loss of traditional skills and knowledge necessary to harvest traditional foods (Quinn, 2007).

Biophysical Environmental Changes: Contaminants, UV-Radiation, Climate Change

Arctic Indigenous peoples are particularly vulnerable to climate change due to their rural habitat and close relationship to the land. The Arctic Climate Impact Assessment (2004) recognizes that climate change and variability affect Indigenous peoples directly due to the centrality of the Arctic land and waters on their economic and nutritional status, socio-cultural identity, and spiritual/physical health. Contaminants, excess ultraviolet radiation, and climate change are three major changes to the biophysical environment that impact human health (ACIA, 2004).

Contaminants impact on nutrition and health. Private sector mining, oil, gas, and government military activities are sources for various contaminants found in traditional foods throughout Canada (Van Oostdam et al., 2005). Chemical contaminants such as heavy metals and organochlorines are found naturally in the Arctic and subarctic environment; however, heavy metals are also released by industrial activities and long-range atmospheric and oceanic transport (Berti, Receveur, Chan, & Kuhnlein, 1998). The primary concern with traditional food consumption is associated with the biomagnification and bio-accumulation of contaminants in the food chain. Biomagnifying refers to the increase in amount of contaminants in the food chain at each step from prey to predator. Bioaccumulation occurs when animals or humans store contaminants in their bone and muscle tissue. Indigenous peoples have greater contaminants exposure than non-Indigenous people due to their higher consumption of traditional foods (Van Oostdam, et al., 2005).

Rising temperatures threaten the safety of some traditional foods (e.g. marine mammal fats) because global warming affects environmental contaminants (Anisimov et al., 2007). The warmer temperature of the North Atlantic waters has been found to increase the rate of mercury

methylation in fish and marine mammals. Increased levels of mercury in beluga from the Beaufort Sea and Hudson Bay have been reported and linked to climate change (Van Oostdam et al., 2005; Walker et al., 2006). Excess consumption of toxic metals, such as mercury from contaminated fish and marine mammals, may adversely impact health. Methyl-mercury may cause neurodevelopment effects, and it is toxic to the kidneys, liver, nervous system, reproductive system, and cardiovascular system in adults (Fontaine et al., 2008; Van Oostdam et al., 2005). Lead exposure from bird consumption with lead shot fragments has neurological effects in children and adults, and cadmium exposure primarily from cigarette smoking may damage kidneys and bone health (Donaldson et al., 2010; Fontaine et al., 2008).

Studies measuring the methyl-mercury, cadmium and lead levels in the maternal blood of Dene, Métis, Inuit and Caucasian women have found Inuit women to have significant higher blood levels of methyl-mercury than other ethnic and Caucasian women. Dene, Métis, and Inuit women have higher blood levels of lead than Caucasians women do (Walker et al., 2006). More than half of the Inuit population from Baffin Island has dietary mercury exposure levels that exceed the Provisional Tolerable Daily Intake (PTDI), while less than one percent of Dene First Nations and Métis usual dietary intake exceeds the PTDI (Chan & Receveur, 2000). This is primarily because Inuit eat more marine mammals than Dene and Métis.

Studies of Inuit from northern Quebec reveal higher blood levels of hydroxylated polychlorinated biphenyls (OH-PCBs) than in non-Indigenous southern Quebec residents (Sandau, Ayotte, Dewailly, Duffe, & Norstrom, 2000). Inuit mothers have oxychlordan and *trans*-nonachlor levels that are 6 to 10 times higher than other groups such as Caucasians, First Nations (Dene), and Métis, or Other (African, East Asian) (Walker, et al., 2003, 2005; and Muckle, et al., 2001 as cited by Van Oostdam, et al., 2005). Oxychlordan and *trans*-nonachlor

are metabolites of chlordane, an older generation of insecticide no longer utilized in developed countries. Chlordane affects the nervous system of humans and wildlife, and causes liver damage and cancer (NCP, 2003). Inuit mothers also have significant higher blood levels of other organochlorine pesticides such as hexachlorobenzene (HCB), toxaphene, and polychlorinated biphenyls (PCBs).

Epidemiological studies in the Canadian Arctic have found decreases in infant birth size to be associated with increases in PCB concentrations in the Inuit population of Nunavik (Van Oostdam, et al., 2005). Additional studies with this birth cohort have also shown a link between contaminants and immune deficiencies in Inuit infants. However, Van Oostdam and colleagues (2005) argue that determining the adverse human health effects of contaminants in country foods is challenging due to the variety of factors that influence health. These factors include lifestyle such as alcohol consumption, smoking, and substance abuse, diet, socioeconomic status and genetic predisposition (Muir et al., 2005).

The Northern Contaminants Program (NCP) established in 1991 to address human exposure to contaminants in wildlife species that are important to the traditional diets of Northern Indigenous peoples has demonstrated to be an effective adaptation strategy to global environmental change. NCP has and continues to communicate the potential risks of contaminant exposure, as well as the significant benefits of traditional food consumption, to Arctic Indigenous communities (NCP, 2003). The research agenda and education programs undertaken by NCP have been developed in partnership with Arctic Indigenous peoples, and have incorporated local and Traditional Knowledge.

The Northern Contaminants Program has also been instrumental in raising global awareness of environmental contaminants in the Arctic, and in influencing key international

agreements to reduce the emission of key persistent organic pollutants (POPs). These agreements include the 1998 POPs Protocol under the United Nations Economic Commission for the Europe Convention on Long-range Transboundary Air Pollution, and the 2001 United Nations Environment Program global convention on POPs signed in Stockholm (Muir et al., 2005). In addition, NCP research findings contribute to the Arctic Monitoring and Assessment Programme of the Arctic Council (NCP, 2003).

Studies that have monitored contaminants in wildlife and humans in the Canadian Arctic have reported decreases in tissue and blood concentrations. In the Arctic Bay, decreases in PCBs, DDT, and OC pesticides have been found in ringed seals (Muir et al., 2005). In Nunavik in Northern Quebec, mean blood concentrations of mercury, lead, and cadmium (in non-smokers) have decreased in Inuit between 1992 and 2004 (Fontaine et al., 2008). It remains unclear if the decrease in mercury blood concentrations resulted from decreased traditional food intake or decreased tissue concentrations in fish. Nonetheless, the mercury blood concentration remains disproportionately high among the Inuit (Fontaine et al., 2008).

Since 1998, the risk of exposure to chemical contaminants in the Northwest Territories is considered to be generally low, posing minimal health risks (Berti et al., 1998). The NCP's phase III assessment reports the continued trend of decreasing levels of contaminants in maternal blood (Donaldson et al., 2010). Inuit communities have the highest levels of POPs and metals. Recent data highlights the beneficial effects of omega-3 fatty acid consumption on the brain development of Inuit infants and children (Donaldson et al., 2010). The bans on PCB and OC pesticides in North America and Europe, along with the ban of leaded gasoline and lead cartridges for hunting, have contributed to decreased health risks associated with environmental contaminants (Fontaine et al., 2008; Muir et al., 2005). Donaldson and colleagues (2010) also

posit that communication about health risks associated with marine mammal fat may have contributed to the reduced amount of marine mammal fat consumed and the resulting decreased levels of contaminants in maternal blood.

Excess Ultraviolet Radiation impact on nutrition and health. In the Arctic, increasing ultraviolet radiation¹⁰ (UV) is reaching the earth's surface. This increase is the result of stratospheric ozone depletion, which occurs due to emissions of chlorofluorocarbon (CFS) and other anthropogenic chemicals introduced over 50 years ago (ACIA, 2004). Although most ozone-destroying chemicals have been banned or phased out, they remain in the earth's surface and continue to destroy the ozone (ACIA, 2004). Climate change is projected to significantly increase ozone depletion due to ozone's sensitivity to temperature. The uncertainty in future ozone projections is high, but remains a concern for human, plant, and wildlife health (ACIA, 2004).

The Arctic Climate Impact Assessment (2004) projects that the present generation of young people in the Arctic will receive a 30% greater lifetime UV dose compared to prior generations. In humans, excess UV exposure has been established as a cause of skin cancer, sunburn, cataracts, cornea damage, and immune system suppression (ACIA, 2004). Skin cancer rates in the Arctic are low and rare among Inuit. Epidemiological studies have shown an association between non-Hodgkin's lymphoma and UV-exposure (Noonan & De Fabo, 1999). In addition, the risks of having an immune system suppressed by UV exposure include decreased immunity to infectious agents that are expected to increase with climate change. A suppressed immune system, too, is a potential co-factor in certain autoimmune diseases such as dermatomyositis in women (ACIA, 2004; Love et al., 2009; Noonan & De Fabo, 1999).

¹⁰ Ultraviolet radiation is the emission of energy measured on the electromagnetic spectrum (www.fda.gov)

UV exposure may also decrease the productivity of the base of the food chain by affecting plant growth, forest health, and marine life (ACIA, 2004). Excess UV has been shown to decimate northern anchovy and Pacific mackerel embryos (ACIA, 2004). Many of these foods are important parts of Arctic Indigenous peoples' traditional diets. Thus, excess UV may reduce the availability of traditional foods; however, studies have not yet been undertaken to research these interactions. Indeed, in the Canadian Arctic, published research on the impacts of excess UV on human nutrition, and related health outcomes among Indigenous peoples, have not been done. Nonetheless, as the ACIA recommends, humans can reduce their exposure to excess UV by using sunscreen, sunglasses, protective clothing, and other preventive measures (ACIA, 2004).

Climate change impact on nutrition and health. Research predicts that warmer winter temperatures will reduce the Arctic's winter-related mortality because fewer people will die from cardiovascular and respiratory ailments (Confalonieri et al., 2007). However, grave threats to Indigenous peoples' nutrition and health remain. The warming temperature in the Arctic is expected to increase the number of land-based accidents and injuries caused by unpredictable environmental conditions. Unpredictable environmental conditions include delayed formation, thinning and early break-up of freshwater ice used to form ice roads and skidoo trails on the surface of bays, rivers, and lakes that both humans and land animals use.

According to F. Paulette, former Chief of Smith Landing, unpredictable conditions such as the slow freezing of rivers and lakes and increases in overflow (water under snow) make travel difficult and unsafe for animals and humans (personal communication, July 09, 2008). These unpredictable environmental conditions are likely to negatively affect the traditional diets of Indigenous peoples due to changes in animal migration and humans' ability to safely navigate

the land and ice roads. The decrease in sea-ice cover and thawing of permafrost have created unsafe conditions for travel and resulted in reduced harvesting activities among Inuit residing in Sachs Harbor, NWT (Berkes & Jolly, 2001).

The unpredictability of the weather, snow and ice conditions and the inconsistent timing of wildlife migration have also reduced harvesting activities among Inuit because of the *perceived* inability to safely travel and the difficulty of synchronizing harvesting activities with wildlife migration (Berkes & Jolly, 2001). Inuit have reported increased food insecurity as a result of reduced harvesting activities, however, the actual impact to their nutritional status and health remains undocumented and unreported (Berkes & Jolly, 2001). Coping strategies to respond to shortages in traditional food include the sharing of food among Inuit community members, and increasing the purchase of market foods (Berkes & Jolly, 2001).

The northwestern North American Arctic region is also expected to have longer periods of diseases transmitted by wildlife and insects (Confalonieri et al., 2007). Increased burdens of disease in animal species such as marine mammals, birds, fish and shellfish mean that Indigenous people, for whom these animals are an integral part of their diet, face an increased incidence of disease transmission. Dene First Nations from the Gwich'in and Akaitcho regions of the Northwest Territories have observed changes in the temperature and cleanliness of the waters around their lands. In their perception, this environment contributes to fish migration and health (L. Casaway, personal communication, July 16, 2008). Reported changes in the fish include: discoloration, a diminishment of size, and changed flesh texture. These observers find the fish visibly unhealthy, and also report that there are fewer fish available to harvest (Guyot et al., 2006). Furthermore, smaller and remote Arctic communities in Canada are likely to experience adverse climate-related impacts on the quality, quantity, and access to safe drinking

water. Among First Nations and Métis, the actual impacts of climate change on nutritional status and health also remain undocumented and unreported.

When Arctic Indigenous peoples lose access to traditional foods, their nutrient intakes and subsequent health outcomes experience a variety of impacts. Traditional diets are low in fat, high in protein, and high in nutrients. Additionally, harvesting traditional foods contributes to physical fitness (Damman et al., 2008). The reduced intake of traditional foods among Indigenous peoples may result in reduced dietary intake of protein, iron, zinc, vitamin C, and fiber (Guyot et al., 2006). For example, the reduced intake of berries may result in reduced Vitamin C intake. But the greater concern with the reduced intake of traditional food is the transition to a Westernized diet, which is more likely to result in an increase in obesity (Damman et al., 2008). Traditional foods may be replaced with high-fat, high-calorie, and nutrient-empty market food (Kuhnlein et al., 2004). A reliance on market food may be a coping strategy in response to the changes associated with climate change, but it has serious consequences for Indigenous peoples.

While physical health outcomes are undoubtedly influenced by a loss of access to traditional foods, climate change also introduces feelings of loss and distress among Indigenous peoples. Inuit have reported feeling “lonely for the ice” in the 1990s, as the ice was depleted (ACIA, 2004). After European settlement and the introduction of foreign infectious diseases, Indigenous peoples experienced great pain associated with the loss of their land and people, and with their subsequent cultural dislocation (McCormick, 2000). These legacies remain with Indigenous peoples today. Although not formally documented in the context of climate change, the risk of substance use disorder is important to consider. Alcohol has been used to cope with

the painful experiences of Indian Residential Schools (Quinn, 2007), and may be used to cope with climate change and global environmental change.

Migration is another possible adaptation process to cope with climate change, though it has not been adopted in the Canadian Arctic. Communities at risk of coastal erosion and sea level rise include: Tuktoyakuk, Sachs Harbor, and Ulukhaktok in the Northwest Territories, and Cambridge Bay, Hall Beach, Iqqluit, Pond Inlet and Arctic Bay in Nunavut (Prowse et al., 2009). Although Inuit were once very mobile and were willing to relocate for their livelihood, the possibility of migration has become limited because of the vast resources invested in the Arctic's infrastructure (ACIA, 2004). However, Environment Canada officials are placing careful attention on Tuktoyakuk, which is at greatest risk of flooding (ACIA, 2004).

The next chapter will discuss the research methodology used for this study.

CHAPTER III

Methods

This chapter describes the grounded theory approach used in this study. First, it will provide an introduction and explain the research purpose, study design and role of the researcher. Then, it will illustrate the parameters of data collection. Finally, it will describe the data collection and analysis procedures.

Introduction to Methods

Criticism associated with projections drawn from global scale climate models relates to the complexity of the ecosystem and the inability to measure the global and local economy, political realities, regional culture, and population health impacts (Cohen, 1997). Thus, projections reported in the *Arctic Climate Impact Assessment* only superficially address the impacts of climate change on the economic and sub-regional levels (ACIA, 2004). Lastly, the impacts of climate change in combination with other stressors were preliminarily studied, but proved inadequate to assess the cumulative vulnerability of communities (ACIA, 2004).

The ACIA (2004) is a resource for local, national, and international policymakers that raises awareness of the impacts of climate change on the Arctic biota and its inhabitants. It has won praise for its comprehensive nature and engagement with Arctic Indigenous peoples' leadership and advocacy organizations. However, the models used for the projected changes limit the inclusion of Traditional Environmental Knowledge and local experiences, so researchers have used qualitative methods to fill these gaps (Berkes, Mathias, Kislalioglu, & Fast, 2001).

Focus group use. Observed data from Indigenous communities has primarily been collected using focus groups (Berkes & Jolly, 2001; Furgal & Seguin, 2006; Guyot et al., 2006). Some advantages associated with using focus groups to collect this information include: data can be collected from a large number of people in a quick and more naturalistic way, and discussion within the groups helps identify similarities and differences among participants (Morgan, 1997 as cited by Guyot, et al., 2006). The use of focus groups also allows for increased use of participatory research (Berkes et al., 2001). However, the extensive use of focus groups limits researchers' ability to move the data to more abstract levels, impeding the research community's ability to build conceptual models that can better inform quantitative data collection and model development.

Qualitative methods have contributed to different ways of knowing and understanding climate change as experienced by Indigenous peoples, which is an area of knowledge that the *Arctic Climate Impact Assessment* only addresses in a limited fashion. Future qualitative studies, including those that use grounded theory, can provide deeper understanding of the impacts of climate and global environmental change on the nutrition and health of Indigenous peoples. Such studies can also contribute to the development of conceptual models and frameworks.

Researcher's Past Experiences

In 2008, the researcher was introduced to Dene National Chief Bill Erasmus by Dr. Harriet Kuhnlein, Professor Emerita at McGill University, to explore the opportunities for a summer research internship on the topic of climate change and nutrition. With support from Drs. Gail Harrison and Charlotte Neumann, and the Drabkin Family International Fellowship, the researcher interned at the Dene National Office under the supervision of Dene National Chief Bill Erasmus during the summer of 2008. The researcher lived in the Yellowknives Dene First

Nation community of Ndilo with an YKDFN family where she participated and volunteered in YKDFN sponsored events and activities. The researcher gained valuable familiarity with the setting and informants during her three months in Yellowknife.

The researcher was engaged in two projects during her internship. The first involved preparing a literature review and PowerPoint presentation on the factors contributing to the decline of caribou for the Chiefs Caribou Committee. A resolution accompanied the PowerPoint presentation and was presented at the 38th Dene National Assembly held in Fort McPherson, Northwest Territories. The Dene National Assembly convenes Dene First Nations from the five regions of Dene Nation [NWT]: Akaitcho, Dehcho, Gwich'in, Sahtu, and Tlicho. While in attendance at the Dene National Assembly, the researcher embarked on her second project.

The researcher assisted Dr. Kuhnlein in the collection of data to evaluate a nutrition program and had the opportunity to explore the impacts of climate change on Dene harvesting traditional foods. Guided by Dr. Kuhnlein and a community member, the researcher developed an interview guide with fifteen open-and closed-ended questions. The interview explored whether Dene First Nations have enough traditional food and whether they purchase healthy foods. It also investigated the Dene's perception of how climate change and variability affects their health and their use of traditional foods.

Under the IRB approval from McGill University and supervision of Dr. Kuhnlein, the researcher recruited, consented, and interviewed 22 adults from all five regions of Dene Nation [NWT]. In 2008, the data were analyzed and summarized in a report submitted to Dene National Chief Bill Erasmus and to Dr. Kuhnlein. The project provided the researcher with invaluable research experience and insight into the topic of climate change and nutrition in the Arctic. The results of the exploratory questions influenced the current study and its interview guide.

Research Purpose

The purpose of this study is to understand the processes and strategies used by members of Yellowknives Dene First Nation, who harvest and use traditional foods to maintain their nutrition and health, in response to climate and global environmental change. The interconnectedness between social, cultural and ecological systems will be explored. The main research question is: How do members of Yellowknives Dene First Nation, who harvest and use traditional food, manage their nutrition and health in a changing climate and environment?

Study Design

This study uses a grounded theory method. Grounded theory is a qualitative method that involves the use of systematic yet flexible guidelines for collecting and analyzing qualitative data in order to construct theories grounded in the data (Charmaz, 2006). A constructivist worldview focuses on making sense of the meanings that participants have about the world and allows the study design to account for the context in which processes occur (Creswell, 2007). Inductive qualitative research defines process as the ongoing action, interaction, and/or emotion in response to stimuli, such as situations or problems, with the purpose of achieving a goal or resolving a problem. “Context” identifies the conditions in which situations and/or problems arise and processes occur (Corbin & Strauss, 2008). A grounded theory approach recognizes that the researcher is a research instrument and part of the world being studied as well as part of the data being collected (Charmaz, 2006; Labonte & Robertson, 1996). Constructivist grounded theory as defined by Charmaz (2006) was utilized to study the processes and guide the analytic thinking involved in interpreting the data collected and co-constructing its meaning.

Important characteristics of grounded theory. Important characteristics and features of grounded theory relate to the constructivist nature of the study design and the importance of

flexibility. The defining components of grounded theory as proposed by Glaser and Strauss (1967; Glaser, 1978; Strauss, 1987 as cited in Charmaz, 2006) highlight the researcher's simultaneous involvement in data collection and analysis. The researcher constructs analytic codes and categories from the data and not from preconceived, logically deduced hypotheses, allowing the researcher to make sense of the informant's lived experience (Charmaz, 2006). Grounded Theory uses a constant comparative method to analyze the data and involves making comparisons during each stage of the analysis. Each step of data collection and analysis, therefore, advances theory development.

At each step of data collection and analysis, the researcher engages in memo-writing to elaborate and explore categories, specify their properties, define relationships between categories, and identify gaps in information that direct theoretical sampling (Charmaz, 2006). Theoretical sampling allows the researcher flexibility to recruit informants that can provide insight and clarity about the processes being studied and those that emerge throughout the investigation. Sampling informants is purposive and aimed toward constructing theory and not towards obtaining a representative sample of the population.

The final defining component of grounded theory is that the researcher conducts a literature review *after* completing an independent analysis. Charmaz (2006, p. 10) states that "we construct our grounded theories through our past and present interactions with people, perspectives, and research practices." Thus, while the review of literature helped shape the initial interview guide by providing sensitizing concepts (Blumer, 1969 as cited by Charmaz, 2006), the researcher's knowledge of existing frameworks will be bracketed until the data collection and analysis is complete. Bracketing involves setting aside one's experiences to the maximum extent possible, to allow a fresh perspective to be taken of the phenomenon of interest (Creswell, 2007).

Assumptions About grounded theory. Pertinent assumptions by the researcher about the research process associated with grounded theory are ontological, epistemological, axiological, rhetorical, and methodological in nature (Creswell, 2007). Constructivist researchers are relativists whose ontological assumption is characterized by embracing subjective and multiple realities that are socially constructed by the participants and ungoverned by universal laws (Creswell, 2007; Lincoln & Guba, 1985 as cited by Labonte & Robertson, 1996). Epistemology is concerned with the theory of knowledge. Constructivists' epistemological assumption recognizes that the researcher is part of the reality being researched (Labonte & Robertson, 1996; Swift & Tischler, 2010) and the researcher aims to lessen the distance between herself and those being researched (Creswell, 2007).

Because the researcher is part of the reality that she is researching, it is important to be aware of her values, as they may introduce bias into the study. The axiological assumption is characterized by admitting that the study is value-laden and requires the researcher to make explicit her values and biases, including its influence on the information gathered from the field (Creswell, 2007). The rhetorical assumption relates to the language used in qualitative research such as credibility, transferability, dependability, and conformability (Creswell, 2007). Rhetorical assumptions embrace writing and language that is personal and literary based on definitions and meanings that evolve from the study (Charmaz, 2006; Creswell, 2007).

Meanings that evolve from the study are co-constructed from a grounded theory methodology that favors inductive reasoning (Swift & Tischler, 2010). Methodological assumptions are characterized by interpretative and dialectic analyses involving a constant comparison of different interpretations (Labonte & Robertson, 1996). The art of investigating the truth of participants' lived experience involves the iteration, analysis, critique, reflexivity,

reiteration, reanalysis, and synthesis until the best informed and most sophisticated truth is understood (Guba, 1990 as cited by Labonte & Robertson, 1996). Table 3.1 summarizes the philosophical assumptions and implications for practice associated with the Grounded Theory study design.

Table 3.1 Philosophical Assumptions and Implications for Practice in the Study

Assumption	Question	Implications for Practice
Ontological	What is the nature of reality?	Quotes and themes in the participants' own words provided evidence of different perspectives. Differing perspectives among YKDFN could be due to include gender difference, age difference, employment status (full-time wage workers vs. full-time hunters, residential school survivors vs. non-residential school adults, hunters raised on the land vs. hunters not raised on the land.
Epistemological	What is the relationship between the researcher and that being researched?	The researcher was a volunteer for YKDFN and lived in the YKDFN communities of Dettah and Ndilo surrounding Yellowknife, NWT. The researcher interned at the Dene Nation National office and lived with two YKDFN families in Dettah and Ndilo. During the researcher's stay in Yellowknife (in 2008, 2010, 2011, and 2012), the researcher participated and volunteered in YKDFN events and social activities, and engaged in the day-to-day activities related to the harvesting and use of traditional foods.
Axiological	What is the role of values?	The researcher openly discusses the values that shape the narrative and includes the researcher's own interpretation in conjunction with the interpretations of the participants. The researcher is of Mexican descent and from a family of active ranchers and farmers in Mexico. The researcher is sensitive to the Indigenous past that is woven into the researcher's heritage. Throughout the study's processes the researcher documented the researcher's reflections. She openly explored how personal values and worldview were shaping her interpretations, even as she stayed rigorously grounded in the data.
Rhetorical	What is the language of research?	The researcher used an engaging style of narrative and employed the language of qualitative research, using credibility, transferability, dependability, and conformability to describe the study's validity.
Methodological	What is the process of research?	The researcher worked with particulars before generalizations, noting in detail the context of the study. The researcher continually revised the study's questions based on experiences in the field. The logic was inductive and grounded in the data.

Role of Grounded Theory in Ecosystem Sustainability and Health

Grounded theory is qualitative methodology that is useful in addressing gaps in knowledge by drawing from the population experiencing the phenomenon of interest. Grounded theory helps prevent developing and implementing a survey that asks the wrong questions (Marshall & Rossman, 2006) and/or dismisses Indigenous ways of knowing and living. Indigenous peoples have historically been marginalized across multiple institutions. Grounded theory is an appropriate and culturally sensitive methodology that allows for the discovery and creation of knowledge that benefits individuals who have historically been marginalized and whose “meaning making” has been overlooked in previous policy and research (Marshall & Rossman, 2006).

Understanding different ways of knowing and living through Indigenous peoples and their stories will contribute to the field of ecosystem sustainability and health research (Waltner-Toews & Kay, 2005).

The Brundtland Report (1987, p. 43) defines sustainable development as “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.” (Development, 1987). The concept of sustainability is aligned with Dene First Nation’s commitment to protect the land and waters for future generations. Sustainability research is relevant to Indigenous peoples’ connection with the land and is essential to the development of mitigation strategies that minimize health risks associated with climate change.

Quantitative methods alone cannot adequately address these complexities of the relationship between Canada’s Arctic Indigenous peoples and their relationship to the Arctic

biota. This social-ecological system is complex and nonlinear, and in the context of climate change, there are long time delays in resulting impacts (Berkes & Jolly, 2001). A mixed methods approach that builds on lessons learned and knowledge generated from local people (Berkes & Jolly, 2001) is recommended to study the complexity of social-ecological systems (Waltner-Toews & Kay, 2005).

Indeed, sustainable development researchers have emphasized behavior, culture, and values as research priorities. Current research recognizes the importance of incorporating different perspectives into sustainable development initiatives (ICSU, 2005). Behavior, culture, and values are underlying factors across all aspects of sustainable development and human health (ICSU, 2005). Culture is defined as “a shared ecologic schema or framework that is internalized and act as a refracted lens through which group members see reality and, in which both the individual and collective group experiences the world” (Kagawa-Singer, Dressler, George, & Elwood). Social understanding of the diverse realities embedded in different cultural contexts are essential to the success of sustainable development (Berkes & Jolly, 2001; ICSU, 2005) to the creation of programs that protect the welfare of IP, and to the local, national and international dialogue on nutrition and climate-related policy.

Role of the Researcher

Gaining access and securing permission. Gaining access and permission to study how YKDFN manage their nutrition and health in a changing climate and global environment was initiated in 2008. At the conclusion of the researcher’s summer internship, the Dene National Chief Bill Erasmus and the Yellowknives Dene First Nations Chief Fred Sangris of Ndilo encouraged the researcher to pursue the topic for her dissertation and invited her to return the following summer.

Institutional Review Board (IRB) approval was granted from the University of California, Los Angeles Office for Protection of Research Subjects in May 2010. The researcher returned to Yellowknife in May 2010. Guided by Chief Erasmus and an YKDFN Chief and Council Member, she prepared a research agreement with the YKDFN leadership. This research agreement was prepared in accordance with the World Health Organization's document titled "*Indigenous peoples and Participatory Health Research: Planning & Management, Preparing Research Agreements*" (www.who.int/./index1.html).

The researcher presented the research agreement to the YKDFN Council in June 2010. At this time, the YKDFN Council members and the researcher were able to discuss, explore, and clarify all aspects of the proposed study. This discussion served as an additional measure for the protection of the rights and welfare of the participants. YKDFN Council approval of the research agreement and permission to conduct the study was granted at the conclusion of the Council meeting. The researcher also submitted an application for a Scientific Research License as required by the Northwest Territories Scientists Act. The researcher received her Scientific Research License in August 2010 from the Aurora Research Institute of Aurora College, NWT.

As she gained these permissions, the researcher maintained regular contact with Dene National Chief Bill Erasmus and YKDFN Chiefs and Council member, whom she met in 2008. As part of "getting in," which "involves gaining, building, and maintaining trust with the participants you wish to study" (Morse & Field, 1995, p.70), the researcher shared progress reports with all of her correspondents. Thus, she kept the YKDFN leadership abreast of the study's progress and funding, her travel to Yellowknife, and her educational progress. Once in Yellowknife, the researcher participated and volunteered in YKDFN community activities and interned at the Dene National Office. These activities helped the researcher establish credibility

within the setting by “being present” and “being trusted,” while still “keeping one’s distance” (Morse & Field, 1995, p. 71).

Ethical issues. Individual in-depth interviews were used to collect data. The use of open-ended questions may introduce moral and ethical problems related to the intimate nature of the interview and sharing of sensitive information (Morse & Field, 1995). During interviews it was possible for informants to experience psychological discomfort associated with telling stories about changes in their environment. These changes may have affected their livelihoods, harvesting of traditional foods, cultures, and/or diminished their stewardship over traditional lands.

The steps taken to minimize the risks and discomforts to informants included designing a culturally-sensitive interview guide and offering referrals to counseling services at the Healing Circle in Yellowknife when appropriate. Informants in this study had the opportunity to tell their stories in a familiar and private environment at a pace that was comfortable and not pressured. Informants were also informed of their right to terminate the interview at any time, or to choose not to answer any questions. In this study, there were no dilemmas in data collection related to hearing or observing acts that may adversely affect the quality of life of the informants (Morse & Field, 1995) . However, informants who expressed distress also shared their healing practices and did not require a referral to counseling services.

The researcher embarked on the study with an understanding of her responsibility to prioritize the welfare of the informants over the research project. The process of being in the field and observing exposed the researcher to all aspects of the environment. The researcher had a protocol to consult with Dene National Chief Bill Erasmus and report unlawful behavior that the researcher witnessed and might harm the welfare of the informants. The Canadian Institutes

of Health Research (CIHR) guidelines for health research involving aboriginal peoples was employed to ensure the research was ethical and culturally competent

(www.cihr.ca/e/29134.html).

In addition to minimizing the risk to informants and prioritizing their welfare, the researcher maintained the confidentiality of sensitive information shared in the interview. After obtaining informed consent from an individual, the researcher accessed data from the informant directly via individual in-depth interviews. The informed consent included a request for permission to contact the informant in the future to clarify information and/or to seek comment on the interpretation of the data. The researcher maintained privacy in the research setting by interviewing informants in a private room in the Dene National Office, the YKDFN community centers, or in the informant's home. The consequences to the informant resulting from a loss of privacy may include feelings of disappointment or lack of trust. However, a risk to reputation or other social risks were not anticipated in this study due to the neutrality of the research topic, as it is not a stigmatized topic. Additionally, the advanced consent obtained from the YKDFN Council in June 2010 helped neutralize social risk.

Digital audio-recordings of the interviews were transcribed verbatim by the researcher. The confidentiality of the data, which was used solely for the intended purposes outlined in the research proposal, was maintained in two ways. First, all personal identifying information from the interview transcript was removed. Second, each digital audio-recording was deleted after the researcher had completed the transcription and reviewed it for accuracy. Informants were assigned an identification number that matched the transcript to the corresponding informant's name and telephone number; only the researcher had access to the key to the code. The informants' personal identifying information will not be disseminated or released. All data is

stored in the researcher's computer that is firewall and password-protected. After the study is completed, all data files will be stripped of the informants' personal identifiers and the key to the code will continue to be securely stored.

Parameters for the data collection

Study settings. Yellowknife is located in the Northwest Territories (NWT) of the Canadian Arctic. Yellowknife provides access to a relatively homogenous group of Yellowknives Dene First Nations (YKDFN). YKDFN share the experience of managing their nutrition and lives in ways that secure a positive health outcome despite the changing climate and global environment. Yellowknife and its surrounding Dene First Nations communities of Dettah and Ndilo was selected for this study because there is documented evidence of climate change and global environmental change in this area. The temperature of and precipitation in the Canadian Arctic has increased substantially (Cohen, 1997), and global environmental change has contributed to the nutrition transition experienced by Indigenous peoples of the Canadian Arctic (Kuhnlein et al., 2004).

Sampling. The inclusion criteria for participation in this study was limited to adult YKDFN who were nineteen years of age or older, residing in Yellowknife, or its surrounding communities of Dettah or Ndilo. Subjects were required to have had over ten years of residency in NWT, and a history of harvesting traditional foods within the prior twelve months. In addition, the researcher selected informants who self-identified as YKDFN and are registered as Dene First Nations, also referred to as Status Indians. Registration as Status Indians is important because those who are registered have First Nations rights to access their land and waters. Additionally, a registered individual may find the harvesting of traditional foods more accessible. For example, though the Environment and Conservation Department of the Government of the

NWT instituted a ban on hunting caribou in 2010, an appeal on this sanction permits members of YKDFN access to a limited number of hunting licenses and recognizes their rights as First Nations. The described criteria were used for the initial purposeful sampling of informants necessary to start this grounded theory study (Charmaz, 2006). Such criteria helped identify a homogenous group of individuals who have experienced the phenomenon of interest necessary for the success of this grounded theory study (Creswell, 2007).

Theoretical sampling. In grounded theory studies, data collection and analysis occur jointly. Thus, the process of data collection shows the influence of the emerging analysis (Morse & Field, 1995). Theoretical sampling is the process of selecting pertinent informants to develop the emerging theory. More specifically, these pertinent informants elaborate the categories that support the emerging theory (Charmaz, 2006). Theoretical sampling helped explicate the categories until saturation was achieved and whereby no new information that informs the emerging conceptual model was uncovered in subsequent interviews and all the allied categories have been identified and delineated (Morse, 2004). Saturation is achieved when categories reflect the properties and qualities of the informants' experiences and contribute to conceptual and theoretical development (Charmaz, 2006) that is no longer hypothetical (Morse, 2004). The informants for this were selected based on their willingness to be interviewed and their ownership of special knowledge regarding the phenomenon of interest (Morse & Field, 1995).

In this study, a type of data analysis called memo writing was used to direct theoretical sampling. Memos were written using questions outlined by Charmaz (2006) to evaluate the quality of the data and ensure that the emerging theory was based on rich, substantial, and relevant data. Memo writing related to theoretical sampling was guided by the following questions:

- 1) Have I collected enough background data about persons, processes, and settings to have ready recall and to understand and portray the full range of contexts of the study?
- 2) Have I gained detailed descriptions of a range of participants' views and actions?
- 3) Do the data reveal what lies beneath the surface?
- 4) Are the data sufficient to reveal changes over time?
- 5) Have I gained multiple views of the participants' range of actions?
- 6) Have I gathered data that enable me to develop analytic categories?
- 7) What kinds of comparisons can I make between data? How do these comparisons generate and inform my ideas? (Charmaz, 2006).

Saturation was achieved by conducting sixteen one-on-one interviews with fourteen adult members of YKDFN who harvest and use traditional foods. Most participants were middle-age adult males between the ages of thirty and sixty. Three of the participants were Elders. The community defines Elders as members who hold extensive Traditional Knowledge about their culture, history, and language and are most often advanced in age. However, the title of Elder is not bounded by specific age parameters. Two of the three Elders in the study were female, and there were a total of three females in the study total. There was one male youth participant, but because climate change has occurred over decades or longer, the researcher chose not to recruit additional youth interviewees. Their limited experience in harvesting and using traditional foods did not contribute to the conceptual and theory development of this study.

Recruitment. The primary modes of recruitment were snowball sampling and direct contact. The researcher posted and distributed flyers that advertised the study at the Dene National Office and the YKDFN Regional Offices and community centers in Dettah and Ndilo. Flyers were also distributed to the researcher's acquaintances, friends and colleagues for

snowball sampling. Informants interested in participating in the study contacted the researcher. The researcher then provided information about the study, answered questions, and determined eligibility using the inclusion criteria listed on the recruitment flyer.

YKDFN Chiefs (present and past), friends of the researcher, and informants suggested other members of YKDFN who met the inclusion criteria. The researcher made direct contact by introducing herself and the study to recommended informants via phone or face-to-face. The researcher participated in community events and attended community meetings and hearings where the chiefs and informants introduced the researcher to members of YKDFN. Residence with members of YKDFN in both Dettah and Ndilo allowed the researcher to more easily recruit potential informants.

Data Collection Procedures

Qualitative research interviews contribute to conceptual and theoretical knowledge. Such knowledge is based on the participant's life experiences, which yield meaning that researchers co-create with informants (DiCicco-Bloom & Crabtree, 2006). In this study, data were collected from individual in-depth interviews that were digitally audio recorded and then transcribed verbatim. Participants were asked open-ended questions that aimed to elicit rich stories based on their lived experience (See Appendix A). In this way, the study tried to identify interviewees' views, feelings, intentions, and actions (Charmaz, 2006). Data were also collected from the researcher's observations, which were documented in field notes. These field notes contained the researcher's observations of the setting, taken prior to the interview, as well as her impression of the interview and first impressions of the data, written at the conclusion of each interview after the participant had exited.

Observations are useful in grounded theory studies because observations provide the researcher opportunities to seek the tacit understandings of the interactions that may not be articulated in an interview (Charmaz, 2006). Observations helped identify the conditions under which specific actions, intentions, and processes emerged or were silenced. The researcher reflected on what she saw and heard while in the setting, and attended to the actions and processes, and accompanying words (Charmaz, 2006). Observations assisted the researcher in explaining the phenomenon by exploring the “what” and “where” of social behaviors that occurred in their natural setting (Morse & Field, 1995).

Data were collected in the spring, summer and fall in one to three-month fieldwork rotations over a period of four years (2008-2012). The researcher consciously decided not to collect data in the winter, when harvesting is limited to checking traps. Harvesting resumes in late winter and early spring. During the frigid and dark winters, residents remain indoors and use protective gear when outdoors, thus potentially limiting the researcher’s visibility and subsequent opportunities to establish rapport with the community. Furthermore, given the limited funds available, the researcher scheduled her travel to Yellowknife during periods that allowed her to observe diverse harvesting practices. Travel was also scheduled to maximize the opportunities for one-on-one interviews, and so that the researcher might participate in day-to-day activities related to harvesting, nutrition, and health.

The researcher observed the day-to-day activities through sustained participation. These activities included taking YKDFN children to camp to learn traditional skills such as preparing and smoking caribou meat, helping to clean and singe ducks, gathering fish and resetting fishnets, cleaning and fileting fish to dry, and picking berries. The researcher also participated and volunteered at community events such as picnics, feasts, youth conferences, drum dances

and hearings related to development and environmental impact assessments. In the fall of 2012 the researcher travelled to the Arctic Tundra with community hunters and youth to harvest caribou for the community.

The researcher had the privilege of attending the Dene Nation National Assemblies held in Fort McPherson, Fort Good Hope, and Whati in 2008, 2010, and 2012 respectively. Dene National Assemblies are convened annually and hosted by one of the thirty Dene communities within the five regions of Denendeh (NWT) that include: Gwich'in, Sahtu Deh Cho, Tli Cho and Akaitcho. Dene Nation organizes the National Assemblies to provide Dene leaders and members with a forum to have discussions, consultations and make resolutions that prioritize their sovereignty and present concerns (<http://www.denenation.ca/dene-national-assembly/>).

Nutrition related concerns included the decline in caribou, protection of the environment, rising cost of living, and harvesting rights that are based on Aboriginal and Treaty rights. The researcher listened to and documented the concerns of and discussions contributed by the members of YKDFN.

Recording data. Data were recorded using a digital audio recorder. This study used an interview protocol to guide individual in-depth semi-structured interviews that asked how YKDFN manage their nutrition and health in a changing climate and global environment. Informed consent (approved by the Office of Human Research Protection Program at the University of California, Los Angeles) and permission to start recording was obtained from the informant prior to initiating the interview. Each participant received a copy of the informed consent.

Interviews were conducted in the Dene Nation national office in Yellowknife, in the homes of participants living in Ndilo and Dettah, in the YKDFN band office in Dettah, and in

other locations convenient for the participant. Interviews were held in locations that were private and comfortable for the participant. Interviews were conducted in English. Two participants requested that their community interpreter be present to assist in interpreting words or ideas that they preferred to express in their native language and on occasion to clarify the researcher's questions.

Observations and analytical insights were documented in field notes. However, the field notes were not purely descriptive – they also recorded the setting and initial impressions of the interview. Corbin (2008) argues that purely descriptive writing in the field is impossible due to the fact that we must choose language to describe what we are seeing and hearing. In addition, theoretical ideas are likely to arise from the data noted while in the field (Corbin & Strauss, 2008). The researcher made notes of the language used to describe concepts or rephrase questions, incorporating this language into later interviews. Additionally, the researcher documented theoretical ideas and analytic insights in the field notes.

Protocol for collecting information. Establishing rapport early in an in-depth interview is essential. Doing so necessitates that the researcher build trust, show respect, and provide a safe and comfortable environment (DiCicco-Bloom & Crabtree, 2006). In order to establish rapport, the interview protocol began with a broad and non-threatening question, one that aimed to reflect the nature of the research. The question (Appendix A) was deliberately open-ended: *“Could you tell me about your experiences in harvesting traditional foods?”* The researcher carefully listened, and when appropriate probed for additional information using prompts such as: *“Tell me as much as you remember about when you first began harvesting traditional foods; who did you learn from?”* or *“How has harvesting traditional foods changed over time?”*

As the interview progressed and the subject's level of comfort increased, the questions grew more specific. This phase of the interview permitted the researcher to explore sensitive topics, such as the confiscation of caribou meat, and ask clarifying questions while remaining cognizant of the participant's comfort level. This was part of the study's ongoing prioritization of the participant's comfort over the data collected (Charmaz, 2006; DiCicco-Bloom & Crabtree, 2006). An example of an intermediate question is: "*Some people talk about eating less traditional foods and more 'Western Food' [that is, processed food, store food, restaurant food]. Others do not. What do you think influences these decisions?*" In order to elicit additional information, the researcher followed this question with prompts like these: "*What influences the foods you have in your house? What factors influence what foods you eat? How do you balance the traditional foods you eat with the store-bought foods? How did you learn to balance your traditional foods with store foods? How do the foods you eat today differ from when you were a child (or young adult)?*"

Throughout the interview, the researcher listened attentively and moved the conversation towards a deeper understanding of the participant's assumptions, implicit meanings, and tacit rules, especially around the topics of sharing. However, to avoid having a superficial conversation, or worse, staging an interrogation, the researcher actively tried to empathize with participants and validate the significance of what was shared. To close the interview, as recommended by Charmaz (2006), the researcher ended each encounter with questions designed to elicit a positive response. For example, the ending question of the interview protocol was: "*What to do you think would help Dene adjust and be healthy in a changing climate?*"

Data Analysis Procedures

The initial analysis of the data began with transcribing each interview, and continued with a reflective memo about the completed interview. As recommended by Charmaz, initial coding and line-by-line coding employing speed and spontaneity were used to analyze the transcripts (Charmaz, 2006). Line-by-line coding was performed using gerunds, which are also known as action verbs. Initial coding was performed individually with an eye to establishing a symbolic understanding of the social interactions and meaning. Questions asked of the data while coding included “What is happening here?” and “What does it mean?”

After rereading the transcripts, field notes, and codes, the researcher wrote memos that recorded her analysis. Some memos focused on the assumptions I was forming of the data and aimed to make me aware of personal biases that may have influenced my interpretation of the data. Other memos explored confusing and/or conflicting elements of the data that were emerging. Additionally, situational analyses were conducted to explore the human and non-human elements of the context that made a difference in a given situation, a method of analysis outlined by (Clark, 2005). A situational map describing the phenomenon that emerged was developed to understand the nature of the relationship between the elements.

These memos provided feedback to the researcher and informed changes to the interview protocol. For example, when the descriptor of novice hunter emerged, it prompted the researcher to develop additional questions that explored the subjects’ motivations, actions, sources of knowledge, and processes of learning. The novice hunter described the participants who learned how to harvest as adults and through their choice to learn.

Focused codes were created from initial codes (which had used gerunds to signal the symbolic import of an interaction) by asking “what are the most significant and/or most frequent

initial codes?” (Charmaz, 2006). These frequently used focused codes were compared with reflective post-interview memos to look for clumps or clusters that could constitute a category. Clustering is the process of visually diagramming how codes relate to a central idea, category, or process (Charmaz, 2006). Focused codes that were active, succinct, and reflected what interviewees were doing or what was happening in their stories helped develop categories that were conceptual and had abstract power (Charmaz, 2006).

Subsequent memos written on the focused codes served to build and clarify the categories. These memos also ensured that the categories explained the ideas, events, or processes in the data (Charmaz, 2006). As categories were formed, their interconnectedness emerged and evolved into patterns and themes (Morse & Field, 1995). Additional analytical memos summarized the theoretical relationship between categories and identified areas where additional data were needed, prompting theoretical sampling. The iterative method of collecting and analyzing data continued until saturation was achieved. At the point of saturation, no new categories were emerging, or only a few new properties were added to each category (DiCicco-Bloom & Crabtree, 2006; Morse & Field, 1995).

Once saturation was reached the researcher engaged in theoretical sorting, diagramming, and integrating the analytic memos written about the categories. The interconnectedness of the categories allowed the researcher to sort through the categories, comparing them at an abstract level (Charmaz, 2006). The aim of sorting, comparing, and integrating categories was to create the best possible representation of the studied experience, categories, and theoretical statements written about the categories (Charmaz, 2006). This exercise contributed to the first draft of the narrative.

Diagramming and mapping also made possible a visual representation of the theoretical relationships between categories. Clark's *situational mapping* (2005) was used to map the structural elements that shape and condition the situation being studied. Situational mapping allowed the researcher to move the analysis from a micro to macro level and generate midrange theory that may inform a policy framework. Once a midrange theory was developed, the researcher reviewed the literature on theories and frameworks related to climate change and nutrition, and compared the literature with the generated midrange theory.

Methods for Verification. The validity of the conclusions rests on the usefulness and originality of the findings and generated theory (Charmaz, 2006). *Rigor* was implemented and documented throughout the research process to establish credibility, and contribute to research that resonates with professionals' and participants' life experiences (Charmaz, 2006). Credibility was established by the researcher's findings, prolonged engagement in the field (in this case, Yellowknife, NWT) and triangulation of the data (Lincoln & Guba, 1985 as cited by Creswell, 2007) using archives, reports, and attendance at community meetings and hearing related to the environment. The findings were further corroborated by existing theories and literature related to the topic, and with feedback from the community about the accuracy and acceptability of the findings.

Transferability refers to the readers' ability to transfer the midrange theory developed to other settings or to determine if the findings can be transferred based on shared characteristics (Creswell, 2007). The researcher wrote rich, thick descriptions that are necessary for transferability. These descriptions capture the participants and settings in the study in great detail.

Dependability is characterized by results that will be subject to change, while conformity refers to consistency within the data analysis (Lincoln & Guba, 1985 as cited by Creswell, 2007). In this study, dependability and conformity were established through an audit of the research process. In addition to field notes and analytic memos, the researcher maintained rigorous methodological notes that document research decisions and their rationales – for example, these memos describe the thought process behind the decision not to recruit youth interviewees.

The final method this study used for *verification* was member checking. Member checking involves sharing the study's findings and interpretations with participants in order to obtain their views of and feedback on the material presented (Creswell, 2007). The researcher met with YKDFN leaders and members of the community of both genders, sharing drafts of her work that included preliminary data analyses, interpretations, and conclusions. Informants were asked to judge the accuracy of the material shared and provide guidance on possible improvements.

Generalizability of the proposed study The effects of a changed climate and global environment on Yellowknives Dene First Nation's nutrition and health is understood from the lived experience of those YKDFN who harvest traditional food. Although the explanatory framework may be transferrable among Arctic Indigenous peoples, the applicability of the study's generated theory is initially limited to populations with similar experiences and situations.

The study is unique in that the findings highlight the social and cultural capital attributes of YKDFN's resilience to climate change and global environmental change. The findings also provide direction to adapt policies and programs that build on the assets of YKDFN in response to climate change. The study's findings also offer a unique perspective on the impacts of climate

change by accounting for the existing and complex stressors, such as the transition from a traditional economy to a wage economy, as well as other rapid social changes that may be compounded by climate change among Indigenous peoples.

CHAPTER IV

Results

This chapter reports the results of the processes and strategies utilized by members of Yellowknives Dene First Nation (YDKFN) who harvest and use traditional foods to maintain their nutrition and health in a positive manner. The chapter provides a description of the participants' profiles, and then explores the participants' experienced biophysical environment to provide context for the findings at the intrapersonal, interpersonal, and socio-cultural levels (Table 4.1).

Table 4.1: Themes and Categories Organized Using a Social-Ecological Systems Approach

Level	Theme	Categories
Biophysical	Experiencing changes in the biophysical environment	<ul style="list-style-type: none"> • Change is happening • Industry is “changing our land and waters” • Implications for our food environment
Intrapersonal	Managing nutrition and health in a changing climate and environment	<ul style="list-style-type: none"> • Defining health and being healthy: “The land is what sustains us” • A closer look at nutrition and dietary behaviors • Holding on to cultural food preferences • Our sources of well-being
Interpersonal	Building relationships – our successes and challenges	<ul style="list-style-type: none"> • Overcoming the legacy of residential schools • The wage economy • Working with the government • We have treaty rights
Socio-cultural	Sharing is our way	<ul style="list-style-type: none"> • Sharing traditional food • Abundance versus scarcity • Knowledge is a gift to be shared • “I learned a lot from my Elders” • Teaching youth their traditional way

Participants' Profiles

A purposive sample was composed of 14 members of YKDFN who harvested or used traditional foods in the prior twelve months. Harvesting activities included hunting, setting traps and fishnets, and picking berries, as well as cleaning and scraping hides and preparing traditional foods for consumption. Ten participants were raised on the land where learning to harvest traditional foods was part of their upbringing. The remaining 4 participants, who varied in age and gender, learned as adults to harvest and use traditional foods, most notably caribou. The youngest participant was still in the process of learning to harvest.

Eleven of the 14 participants were male and the remaining 3 were female. There was one male youth participant, and three participants who were Elders, two of whom were female. The remaining 10 participants were middle aged adults. Seven participants lived in Dettah, 6 lived in Ndilo, and 1 participant lived in the city of Yellowknife.

Experiencing changes in the biophysical environment

This section presents the participants' biophysical environment characterized by their lived experiences in a changing climate and environment. It also provides the participants' explanations for the changes observed, and the resulting implications for their food environment.

Change is happening.

There was uniform agreement among participants that climate change is occurring. All participants have observed changes in the climate, land, water, fish, wildlife, and plants. Among the changes in climate that participants noted were more severe weather storms and changes in the amount of water and ice present in the environment. Changes in the ice relate to the receding shoreline:

Like years ago when you go muskrat hunting you come back about June 15, June 10 you can come back, about that time there will be a shore eh like six, seven feet deep. Really deep ice eh, that's in those days. I think now you are lucky if you get four feet of ice.

The change in the timing of ice forming and melting also contributed to a sense that time was passing more quickly. An Elder described this altered sense of time in this way:

I lost one month somewhere. Where is it? And fall, we used to have fall very, very late in October. I remember my dad used to take off into the snow the first week of October on the ice. We don't have ice until November. And we see March. March is like April. We have 11 months a year instead of 12. For me we lost one month, it's been like that for me for the last 8 – 9 years.

The change in seasons experienced has implications for the accessibility to and availability of traditional food. The severe weather storms and stronger winds create travel difficulty on land, water, and air alike. The difficulty travelling by land was described as:

No, it's hard to go out in winter time. The weather is not cooperating as before. It's always wind, wind, wind.

Participants were more likely to experience discomforts such as snow blindness when travelling in the winter, and also spoke of an increased risk of frostbite.

Elders and participants observe greater risk when travelling on the water and are aware of the hardship the climate creates for members who harvest fish or travel by boat to access berries, moose, and other species:

But in olden days, when we were younger, we noticed the weather, especially during the summer, very warm, days like this, the whole lake used to stop, used to be very good days without any storms, or waves on the lake, used to be like that for days, 10 days at a time the water is not moving but now temperatures are changing, we noticed there's more severe weather down on the lake. As soon as the weather stops and it's calm within minutes it's picking up again. And it's having some severe problems for people traveling the lake, for their safety. In olden days, when the weather was calm, for up to ten days at a time or even beyond that, the older people used to go to a trading post... They'd be able to get there with their boats. They do their trading and come back in fine weather, no storms at all. They would make it back home here to their communities and everything would be fine, and days after that the weather would still be nice on the lake, there wasn't a lot of wind, it was unheard of in the past, but now we notice the weather is playing a big

role in these changes. As the climate is changing, we're noticing more severe winds, and more people on the lake here because of that changes and severe weather, more people are losing their life on the lake, whether it's drowning, or capsizing in boats, there seems to be more of that happening today. In the past it was unheard of. Capsize or any incidents like that. But now it seems the weather has its own spirit and is doing things unnaturally that it never done before. The more severe weather we're having today is having an impact on community life, people who rely on the waters, who rely on the lakes for getting their food from the water. Now we have to pay attention to the waters now, we have to pay attention to the severe weathers. When we decide to go out, we have to study the lake now. Before we could come and go, before we could travel the lake without having to worry because the lake was calm for a very long time. And now the weather is playing a big role, and there's things happening and globally the Earth is changing and we notice that there's changes happening and it's taking place.

Industry is “changing our land and waters.”

Participants are aware that climate change only partially explains the changes to their environment. Contamination and changes in the migration patterns of caribou are also attributed to economic development projects in the region. Participants were concerned about the environmental impacts of nearby mining efforts for gold and diamonds, as well as the effect the tourism and outfitters industries had on the environment. Additionally, the contamination of the land and water, including snow, concerned participants:

I find that even the snow too (has changed), before it used to be three or four feet of snow but every time we set up a tent out on the land you only see maybe 12 to 18 inches of snow. We still melt the snow that is still out there. We are lucky to have that. It's all polluted through [by] the mine or through all this mining, oil and different companies coming in and cutting timbers and all that.

Participants also shared their observations related to caribou:

It's not like before. Remember the first time I went there [Barren Land]? Before the mines came there were lots of caribou tracks, now you don't even see any. Mines are right on the migration paths, stops the caribou from coming down.

Industry's impact on the caribou migration routes ultimately affects participants' access to caribou:

So the animals, it's they the animals for as long as they live they go to the same route, same places, back and forth, go north have their young, come back [to North] in November December, come back in March so people could use it, they come back, but in

their way are developers. Developers are in their way, so they [animals] go and change routes.

The mining industry continues to grow and cause participant concern over the future of the species harvested:

The way you look at it now, all the mines started it. All the animals we traditionally hunted are all gone now. Just all mines now. All the animals are making different routes now. Before I was used to having lots of caribou before all that mine stuff. Caribou not as much now... There's another mine they want to open and in our hunting area. The moose are there. When that mine starts there's going to be nothing because all the animals will move, will migrate again with all the blasting.

The growth of the mining industry and the need for labor comes with an expansion of the city, both in terms of its infrastructure and its population growth. Northern residents also had access to hunting tags. Participants recognize that these factors combined are impacting the health and size of the caribou herd:

One year there was so much caribou, people were just shooting caribou all around here. Since then caribou numbers come down. It's hard to control people. I see lots when I was out on the land trapping. It's not all us. It's some people [non-Aboriginal] in town eat wild meat too, they shoot caribou.

An Elder succinctly described the sentiment, shared among participants, of longing for a simpler time on their land. This nostalgia was paired with a keen awareness that the remediation of the land and waters takes time:

I'd rather, I'd rather um you know I wish I could turn the clock back. I wish. What I see today I wish I could turn the clock back of [on] all the mining that you know that oil spill, the oil, and all over our country you know. I don't know if things are ever going to change back. It'll take a long time.

Implications for our food environment.

All participants access food from the global food system and traditional food system in varying degrees. The global food system provides grocery stores, convenience stores, fast food, and a variety of ethnic food restaurants and diners. Vietnamese, Italian, French and Middle

Eastern cuisines are examples of the ethnic food restaurants available. The traditional food system, by contrast, encompasses the species harvested from the land and waters, and ingredients from the store that are used to prepare traditional foods. For example, ingredients such as flour and oil are used to make bannock, and oats have traditionally been consumed in caribou stew. Both food systems are important to the participants' food security, and both were, according to participants, subject to climate and environmental change.

The combined effects of contaminated land and waters near Yellowknife, and the change in availability of caribou, contribute to a greater cost of harvesting. Participants described the burden of additional costs as:

One, I think uh the economy, uh unfortunately you can't just set your net outside your house like we used to do when we were kids. Well the lake is all polluted now so you have to go out a ways [to set your net], so you need a motor. I used to just paddle when I was kid, people drive by and stop by the bridge there and buy fresh fish from the net. I made one-hundred dollars so I was just doing that. But now if I want to setup a net I have to buy a boat with a motor and I have to buy gas, plus I have to pay for a permit to get a commercial license if I want to sell it to people and make some money back. Uh so there's that, there's the cost of going out there.

All kinds of harvesting-related travel and shelter incur additional costs now, according to participants:

You have to have a cabin in the bush which you really do to effectively hunt because you want to be able to live out there when you go out on the land and you know it has to be reliable. You have to uh so you have to build this cabin and that's going to cost you some bucks. In the old days it was the lifestyle, and everybody did it, lived off the traditional routes...So you know to go hunting now everybody buys a skidoo, a big powerful gun costs you one-thousand dollars, a skidoo is going to cost you ten-thousand dollars now, so that's eleven-thousand right there just for your gun and skidoo. Then you're going to need a sled so that's another thousand or a toboggan to attach to your skidoo, so to have it all you are going to need your cabin in the bush it's going to cost like twenty-thousand dollars now. Uh, lumber and roofing and all of that, nowadays they sell cabins in the bush for hundred-thousand dollars. So now you have this house that you are taking care of in the bush and a house in town. So when you go to the bush or want to go to the bush you

are still paying for your other house expenses, like your car, and everything else in town. So it's kind of, it could get kind of expensive when you have both.

Another participant described a situation in which the additional costs associated with travelling greater distances to harvest may put people's health at risk:

So now it affects us, because what that means to me is now we have to go further away because there's contaminated food and good food and to get the good food you have to go further out. And that's why my cousins and I, we have to go get on our boats and go further that's how we get our foods. It may be costly to go that distance and back, it's probably \$150 for one trip and that's what it will take to get our food. And other people who are unfortunate, don't have that equipment or boats, they have to get their food right in back bay here, they have no choice. If they want fish they have to get it. But there are still a few people who still believe the fish is ok here. But cancer is still around. People get it rarely now, not like in the 70s and 80s was very high.

Participants describe avoiding species from the Yellowknife area because of such contamination concerns:

People are cautious now. About the food intake and where they should get it. At one time we would get all of our traditional food from Yellowknife Bay and from around our communities. We used to put a net out in front of the communities, we used to get the birds and the fish. But now we can't do that no more. We really believe that our food is contaminated because of the city growth and mining growth, tailing ponds, sediments and so on.

However, concern over contaminated species is not limited to the Yellowknife area. Participants described the detrimental impact acid rain has on lichen, the primary source of energy for caribou:

I know one day in the future we may not be hunting caribou, because of the changing lifestyle. Climate change is happening. As we know, what I'm very worried about is we have acid rain in the north. Acid rain comes from the south, and goes it to the north. It drops in the arctic tundra on the lichen. Lichen is food that the caribou eats. So I always try to stay on top of the government's study, we want to know how much acid rain, how much pollution is dropping on the Barren Land. We need to know because the reindeer, the caribou is very important to us, we depend on it. Many indigenous people here depend on it. But if we don't know what's in the food intake, it could be harmful to us, we don't know.

Participants report seeing fewer caribou, and sometimes seeing none at all – even while travelling great distances. Concerns about and associated with the decline in caribou emerged as a pattern throughout all levels of the participants’ ecosystem.

Managing Nutrition and Health in a Changing Climate and Environment

This section presents the participants’ knowledge, attitudes, beliefs, and behaviors surrounding nutrition and health. It will also address participants’ experiences in managing the influence that a changing climate and environment has on their present nutrition and health status, as well as their observations about the nutrition and health status of future generations within the context of harvesting.

Defining health and being healthy: “The land is what sustains us.”

The degree to which the land contributes to being healthy varies among participants, but all participants view it as important. For them, the land provides varied sources of well-being. Participants reported that the land helped them remain physically active, and that consuming traditional foods that had been harvested from the land was another behavior participants viewed as essential to health. An Elder shared her view on health and food as:

Well I hardly ever drank, I never smoke in my life, I never want to see any damage in my life because I’m getting older and I want to live a healthy life. And living a healthy life is eating your country food, you know I don’t want all that greasy and fatty food, you know hidden in steak, and all that fat in steak and all that. I just love making a caribou stew for my children, but I don’t have any more caribou. But I’ll tell you something about beef stew and caribou stew are different taste, different flavor, no matter how you cook it, it’s a different flavor. I’m a pretty good cook too you know.

Traditional foods are not only a source of nourishment but also provide medicinal properties. A participant simply stated:

Eat traditional food and use traditional medicine that’s what I do, keeps me going. Have lots of fish and also fresh caribou meat and fresh trout.

Harvesting meat and fish provides nutritional and medicinal benefits, and participants also saw the process as a source of physical activity. Female participants describe the muscular effort needed to clean, scrape, and prepare caribou and moose hides, as well as the subsequent sewing projects undertaken once the hide is prepared. For example, hide might be used to line the knees of snowboarding pants. Physical activity at home related to harvesting might also include making dry fish, smoking meat and tending to the smokehouse. Male participants also tend to the smokehouse and on occasion help build smokehouses:

During the summer, this time of year, we do a little bit of gardening [on raised beds], building our camp fires and building firewood, smokehouses. Almost every aboriginal person I know in Northwest Territories either has a teepee...or a little something we call a smokehouse. In the smokehouse is where all the family gathers and you prepare and cook traditional foods, caribou or duck or fish but this is where they cook their traditional foods, and many people in the north I know, do a lot of work to prepare it and build it. Sometimes they have to come in twice a day to take care of their food because if you don't take care of it your food will get spoiled. You have to take care of it. You have to keep drying it and moving it around. Sometimes it takes the whole family or individual person to do that.

All participants recognize the significant amount of physical energy that is involved in harvesting, and they all express a preference for land-based activity. However, not all participants have the time to go on the land to harvest regularly to remain physically active. Participants who are unable to go on the land or who do not have harvested species to prepare obtain their exercise through participation in organized sports, running, walking, and going to the gym. Among participants who go on the land regularly, checking nets, cleaning fish, and carrying fish in large bins in and out of a boat are day-to-day physical activities. Walking on land or snow, and hauling one or two heavy animal carcasses are additional activities that

provide aerobic and anaerobic physical activity. A participant described the physical demands of harvesting on the land:

So some places we're not able to follow the caribou into the hills. So we would abandon our skidoos and put on our snow shoes. The snow shoes is how we get through the hills, through the country to track down moose or to track down caribou and that's how we bring our food back. And it's a lot of physical work. The snow condition here can be anywhere from two feet to five feet any given winter. And the conditions are very rough and sometimes it takes a group of people working together to get the food in and out. If you do it on your own, individual, it's probably about two days of work, it's very hard work. But at the end, if you're successful you have the caribou.

And another participant described the dual benefit of physical activity and nourishment while on the land:

[I] still go out on the land because I like it. I enjoy it, going on the land than to just stay home and do nothing. What am I going to do at home? Watch TV, that's it. Lots of things to do on the land. Cut wood. Keep busy. You see an animal you shoot it, skin it, cook it, whatever you want to do.

Participants raised on the land continue to feel the benefits of the physical work required of them, the prolonged consumption of traditional food, and the discipline and responsibilities learned from this work:

From the moment she [mother] gets up she tells us what is right and wrong about the land, the people around you. At one time, I thought she didn't care for us, because she's always preaching at us. But I'm grateful today for what she did for us. A little bit of discipline. That was a good way. She taught us right and wrong. So I'm real happy she did. She didn't talk for nothing I tell you that. So it was good.

Adequate sleep, especially in the tranquility of the land along with not engaging in substance abuse are viewed as additional factors contributing to being healthy. The tranquility of the land is described as a space without noise pollution, and where the pace of life is slower.

A closer look at nutrition and dietary behaviors.

Participants shared the belief that eating the right foods by balancing healthy store foods with traditional foods is an important part of health. Healthy store foods were described as fruit,

vegetables, and foods with the least amount of processing, in addition to the basic ingredients that support store products that have been incorporated into a traditional diet. Such ingredients include oats, lard, butter, flour, jam (for participants who do not can their own berries), and sugar, and can be used to make stew with oats and bannock (bread). A participant describes balancing traditional foods with store foods as:

I try to stay away from the processed foods or foods from cans. Even foods, I'm very careful with cabbages and other things that I buy. I have to wash it. Because I'm not sure how it's grown. I've heard of pesticides and spraying and all that stuff, so I'm really careful with what I eat. I try to keep my diet mostly on traditional food. Because I know that the animals that are harvested are very healthy because we check the bone marrow of the animals and make sure the meat is kind of reddish and not too pale. Also we check for the liver and the kidneys of the animals I harvest, to make sure it's nice and red. I check the liver, that it's healthy. So when it's healthy, that's how I know the food is good. And that's how we look after ourselves. But we balance our traditional foods today I believe in many communities. We try to live on the western food and traditional food. It's kind of half and half. But personally myself, I'm mostly on the traditional side.

Other participants shared this speaker's food safety concerns, not only in terms of possible contamination to traditional foods and water, but also in regards to the chemicals used in agriculture and food processing. Store foods, primarily processed foods, were described as being "all chemical," and thus less nourishing. Participants expressed health concerns related to diabetes, cancer, and hyperactivity (in children) that may result from the consumption of store foods with high fat and sugar content. Store produce with chemical (pesticide) residue was another area of concern. For some participants, it was difficult to square the desire to eat more fruits and vegetables with uncertainty about the purity of store-bought produce.

Participants expressed concern about food consumption and cancer risk when discussing traditional foods, not just store foods. One participant shared his cancer risk concerns related to the consumption of contaminated traditional foods:

So both of my parents died of cancer. And I truly believe that it has something to do with the mussels and the fish in the bay here that they ate. Over 20 years, I stopped eating the fish from the bay area. I had to go about 25 or 10 kilometers out to get my fish. But even the mussels there I don't eat them anymore. I stopped eating them up to 5, 6 year ago. They're very good, nutritious, very good for you, but I don't know health wise so I don't eat them. I think a lot of Yellowknives Dene don't eat the mussels anymore... So I really watch myself, because members of my family died of cancer.

But factors other than the relationship between food and disease risk influenced the participants' decision to purchase or harvest particular foods. Participants described reading food labels, and considering taste preferences and prices when purchasing store food. Some participants were influenced by other factors: they described being aware of the health benefits associated with eating vegetables, but said they choose not to consume vegetables because they were not part of the traditional diet. Participants that do purchase and consume fruits and vegetables, on the other hand, noted the higher cost of eating such whole foods. Having fish, ducks, caribou, and moose meat, and other traditional species harvested reduces the cost of being food secure. Throughout the study, participants referred to the high cost of living in the North. Some did so more explicitly than others:

So they put it in that perspective...if you're hungry or thirsty you go out [on the land]...that's the importance of the land and water to the people, because if you look at even look at the cost of living in the Northwest Territories...can you imagine in Norman Wells they're paying fifty dollars for a pound of ham, 200 dollars for a turkey in Artic Bay, four liters of milk is 18 dollars or 20 dollars and yet they're advertising that you should have a nutritional balanced meal, how can you do that when there's no jobs in the communities? There's no marketplace? If you're gonna sell something for a dollar in Lutselk'e, with 350 people, you're going to make 350 dollars, you sell that same thing for a dollar in Los Angeles, you're going to make 20 million dollars, so it's the environment that you live in, those factors play a huge role in people's lives and what they eat, if you can get a bag of chips for a dollar and a pop for a dollar fifty, hey for \$3.50, then why do I want to pay \$18 for a jug of milk, it's not tasty, could be nutritional, but then even milk, people grew up without milk in the Northwest Territories, or at least in Dene, for the majority of them, milk is a relatively a new thing, from cows.

An Elder shared:

Well today I got no choice [laughs]. I buy what I need. I don't just, sometimes I have a lot of people staying in my house. So I try to get what they need and what they're going to be needing. Always try to budget because I have a lot of people living in my house. High cost of living they call it. So I always like to have traditional food inside my freezer. Especially meats because meat costs so much.

Holding on to cultural food preferences.

For food security to be achieved, the community's food preference also needs to be taken into account. All participants shared a preference for traditional foods, which they understood as superior in quality, as well as healthier and better-tasting than store foods. These participants also shared strategies for consuming traditional foods as often as possible. Strategies for maintaining a traditional diet include harvesting moose when caribou is scarce, and consuming fish, ptarmigans, and ducks when meat is not available. One participant shared:

I was out on the land, out on Gordon Lake hunting for caribou. I saw so much meat, what a difference, you cook on the fire, you fry it, you hang your meat, ah it just tastes so good and you make soup out of it ah (sighs) is that ever good, yea that's what we did.

Participants also described their preference for cooking traditional foods using traditional methods. These methods include cooking meat over fire, and smoking meats or fish to dry:

Mostly when I'm out on the land, I just take the wild meat, cook and eat it, I don't bring anything from the store. Sometimes I do but mostly I just cook what I harvest; it's more nutritious that way. Sometimes I take my net. I set nets and cook fish, sometimes I cook fish right on fire, everything is on the fire eh, I like that.

Traditional cooking methods also contribute to the social aspect of community by bringing neighbors and family together. One participant suggested that elderly community members choose to stay in Ndilo and Dettah to ensure continued access to traditional cooking methods:

Like the old folks home like we have two or three [elderly members] in the community, that's all, the rest are gone. A lot of people who live in the community don't want to live in the old folks home in downtown, because they are so used to going to their neighbors to cook on the fire, but uptown you need a permit. I can make fire ten times a day, and I don't need a permit down here [in Ndilo,] that's one good thing about it, like today we are going to have traditional food, fresh fish on the fire, someone gave it to me.

Participants' preference for traditional foods is also influenced by their motivation to remain connected to their culture, to their land, and especially to caribou. A participant shared:

... I'm not that great of a moose hunter [chuckle] and I'm not that big of a fisherman and fish are relatively easy to get but mostly the tie is to caribou through this region. Moose are important as well rabbits, geese, muskrats, ducks and other game, wildlife and there's buffalo now or bison that are close by that I guess people can harvest, uh but I guess they don't hold the same cultural link as caribou does for us.

Our sources of well-being.

Well-being is defined as the state of being healthy, happy or prosperous, and for YDKFN this state is associated with having a relationship with the land. Going on the land to harvest traditional foods provides a connection to the land that contributes to the participants' well-being:

My family used to harvest here in traditional areas. Even though the city has grown up, because it's not, there's no factories or pollution here, other than the mines, we still have a close connection to the land.

For some participants, a connection to the land allows them to feel self-reliant and self-sufficient. Their successes in hunting, living off the land, surviving a storm or day without food, choosing trails, and ultimately providing food for their family and community are described as sources of well-being.

Another important part of participants' connection to the land is their respect for all living and non-living objects. Because participants view themselves as part of nature, they can demonstrate respect for their biophysical environment by practicing patience, and harvesting

slowly. Both male and female participants actively teach others to respect the land by interacting with it mindfully:

When picking berries. You can just sit there. I remember one time my daughter, she was sitting way out there, they were picking cranberries and she sees her little sister picking cranberries, and I told her that before, I said the elder ladies pick cranberries, they just don't walk around or jump around picking cranberries, they would sit patiently. My daughter told me about her sister, says she "see my little sister picking berries patiently, just like an Elder, picking berries patiently." Everything we did with patience and caring. Caring for the land not just jump all over the berries and squash them. So they did things with caring and respect for the land.

Participants describe experiencing an inner peace and positive energy when on the land. Walking on and seeing the land as their ancestors did gave participants a sense of homecoming. They expressed an appreciation for the beauty of the barren land and all that it encompasses and offers:

Well uh there's, well there's different things, people have different spiritual beliefs and things like that, but personally I think that there's an energy, yea, from the land and from what's out there. So when you go out, you know when you have trouble in town and what not, and you go on the land, peace comes onto you, the energy from the land comes to you. You know if you find a nice and quiet area especially where nature has not been spoiled, uh there's something to be said for that, about being on the lake, land or river, getting fresh water, a spring water. You have no industry going bang, bang, bang or whatever or the noise in town from cars or the smell of the exhaust. So there's that connection there, where you know you are comforted by the land that can actually provide for you.

There was a wide variety of spiritual expression and experience among participants, but in general participants believe in a higher being often referred to as God or Creator and ascribed spiritual significance to the land. Some participants describe being spiritual in the context of going to church, a pilgrimage, or participating in sweat lodges, prayer, or reading the Bible. Other participants find partaking in traditional ceremonies on the land, harvesting on the land, and being stewards of the land spiritual. One participant described the relationship between spirituality and the land:

You see something that's alive and you kill it and people know the purpose of that, what's the purpose of that and they know the process, and there's some spirituality involved also because you're killing another life form. The Elders always talk about that, when you're taking something, you gotta give something back.

There are, as participants state, a diverse number of ways to give back. While sharing traditional foods harvested is the most recognized act of giving back, other participants may offer a coin, or some tobacco. Others still will make less tangible offerings: a song, a prayer, an expression of gratitude to the Creator. Among these expressions are actions that help others or the self: taking care of, respecting, and healing oneself, and being good to others. A few participants who had struggled with substance abuse stated that being on the land contributed to their recovery and sobriety.

Building relationships – our successes and challenges

The government and employment institutions have contributed to significant changes in the lives of many aboriginal peoples, including members of Yellowknives Dene First Nation. The changes have had both positive and negative impacts on the participants' nutrition, health, and well-being. In particular, participants report that their relationship with the government deeply affected their ability to live their cultural lifestyle. Participants shared stories of both hardship and progress in managing the influences of a changing climate and environment.

Overcoming the legacy of residential schools.

Participants faulted residential schooling for the loss of Dene values and cultural way of life among some members of YKDFN. Partly because of this loss, there has been a break in the transfer of Traditional Knowledge and skills from parent to child. Participants shared their efforts, and the efforts of the leadership of YKDFN, in working with the education system and government of the Northwest Territories to promote and support programs that mitigate the loss of Traditional Knowledge and skills. These programs teach and expose youth to Dene language

and traditional skills. Their goal is to restore the practice and teachings of Dene values, language and cultural way of life:

I think everybody made some comment at one time or another about it [integration of Dene language and traditional skills]... I know years ago we wanted to have the Dene language taught in the schools and the governments wouldn't do it and we asked why and they said well the Dene Elders don't have an education degree, you have to have a degree to teach in the schools and teach and we said, well that doesn't make sense. Because you know the universities don't teach the language, they don't give a degree for that...

Yellowknife Education District Number 1 heeded the community's call to include aboriginal education and programming. Although the integration of aboriginal education and programming took time, today the Yellowknife Education District's Aboriginal Education objectives highlight the progress made in creating curriculums that value Indigenous ways of learning (Table 4.2). Elders have been integrated into the Yellowknife Education District's Aboriginal Education programs. Elder Mary Jane Francois recently celebrated ten years as a language and culture instructor at K'alemi Dene School in Ndilo.

Table 4.2: Aboriginal Education Objectives

To ensure all students and staff are engaged in, and value, Aboriginal language and culture-based education
To support staff to integrate culturally-relevant learning into instructional programming
To increase the number of skilled instructors of Aboriginal language and culture-based programs
To promote positive personal and cultural identity for Aboriginal students
To engage all students in Aboriginal language and cultural experiences
To strengthen relationships with the Aboriginal community

Source: <http://www.yk1.nt.ca/Aboriginal%20Education%20Facts.php>

One example of a successful collaboration between the Education District and YKDFN is the Take a Kid Trapping Program, which is supported by the Department of Industry, Tourism and Investment of the Government of the Northwest Territories (GNWT)

(<http://www.iti.gov.nt.ca/programs-services/take-kid-trapping-program>). The program

complements the Yellowknife Education District's Aboriginal Education program by teaching youth traditional harvesting practices, as well as conservation. It also teaches youth to properly prepare fur pelts for its sale. Mastering the proper preparation of fur pelts creates income opportunities for youth, opportunities that allow them to build a relationship with the land and to use traditional skills. A participant described his role in launching the program:

So there's a lot of stuff going on and I think we need a hunting education program. That's what we have to do is teaching because that's missing because everyone is in school now. They don't learn how to hunt, they don't know how to skin a caribou or moose, they don't learn that in school, but we are trying to bring that in with Take a Kid Trapping Program. So it's happening that way, it's a model to grow.

It did start from one program here in Ndilo within school. And then we realized how important it was for the kids to take off, because people really wanted to do this stuff. It just means a little bit of finances and a little bit of steering and a little bit of encouragement...

The Take a Kid Trapping program continues to be supported by the GNWT.

The wage economy.

Participants' reflections and lived experiences relating to the relationships YKDFN have forged with industry leaders, which has grown the wage economy and wealth, has created concerns regarding the land and waters. The transition from a traditional economy to a wage economy has also influenced participants' availability to harvest, introducing changes to their diets and lifestyles:

I always want to go on the land, but when I was working, I always try to go and ask my boss. If the boss said no, go back to work. Otherwise I'd spend most of my time on the land, to hunt for my family.

While the transition to a wage economy has limited participants' available time for harvesting, the transition to a wage economy based on industry raises other concerns. The increase in mining in the Northwest Territories influences where and what participants harvest.

Participants are concerned about the contamination of species that inhabit the land and waters. They explained that their opposition and precautionary approach to economic development projects, most of which focus on the extraction of natural resources, is driven by a desire to protect their cultural way of life, as well as their land and waters. A participant shared an Elder's explanation of the dilemma:

Yeah I grew up on some of those foods, there was a lot of fish, we ate a lot of fish, caribou, moose meat, whatever the land provided, one of the Elders said that when mining and development wanted to come in, they see that as destroying the land, had an effect on the caribou, had an effect on the water, had an effect on the fish, and they kind of describe it like the land is our bank, you know. I mean, how do you say? Contemporary lifestyles, we go to the bank, go to the store, food store, clothing store, hardware store. Well to the Dene the land is that, it's like our bank, you get hungry, you go out and it will feed you, caribou, fish, vegetables, etcetera, those caribou and various animals clothe you, you make clothes with it, with the trees and everything, it's building material, it's shelter, the water is so important because all the animals live by the water, and we live by the water, try living without water for a while, even one day without coffee or tea or juice or pop, people don't realize that's water based. So they put it in that perspective, it's like our bank, if you're hungry or thirsty you go out [on the land], it's there but if developments or if there is any destruction of that, then that hinders our life, not only for this generation, but for generations ahead.

Yellowknives Dene First Nation and the mining industry have established a working relationship through the use of Impact Benefit Agreements (IBAs). An IBA is a legally binding agreement between the miner (and the mining company) and Chief and Council of the band. It outlines the impact of the project, the commitment and responsibilities of both the mining company and Aboriginal community, and the anticipated shared benefits to the Aboriginal community ([http://www.miningfacts.org/Communities/What-are-Impact-and-Benefit-Agreements-\(IBAs\)/](http://www.miningfacts.org/Communities/What-are-Impact-and-Benefit-Agreements-(IBAs)/)). The IBAs have provided YKDFN job opportunities, training in mining-related skills and trades, and business opportunities for entrepreneurial individuals and the

Det'on Cho Corporation¹¹. Not all members of YKDFN work or will choose to work in the mining industry, participants shared the importance of education in shaping the future of YKDFN, especially youth. There's an acknowledgement that the decisions youth and members make regarding their educational and career goals will influence their lifestyle, and in particular going on the land to harvest:

Yeah, they're [leadership] always against it [mining development], they're trying to protect it [land] for future generations.

Yeah, they [youth] know [about leadership's opposition to mining development], but the way some are they worry more about the money, not about what's happening with the land. Maybe some of them don't want to be on the land once they grow they have different things to work for. My friend's daughter she says she's going to go to university, and go out on the land in the spare time. My friend go to school and start his own business. He thinks about going on the land but most of the time he's working at his own business. So that's what happens. He takes what he learned from the university to start his business, that's pretty good too.

Both the wage economy and legacy of residential schools influence the participants' access to traditional foods. YKDFN organize and support a community hunt to provide caribou meat to members who are unable to hunt because of a lack of time, resources or skills:

...you felt more appreciative because the community always goes out and does it, goes out on the hunt for those who can't go out, but for those of us that could go, I felt more appreciative of the hunters because I know it's a lot of work in the harvest.

Working with the government.

Participants' experiences working with the Government of the Northwest Territories (GNWT) and the Government of Canada are varied and not free of contention. Some

¹¹ Det'on Cho Corporation is a multifaceted company owned by members of Yellowknives Dene First Nation; its aim is to create prosperity for YKDFN and has annual gross revenues of over 30 million (\$CAD). <http://www.detoncho.com/joomla/>

participants have been employed by the GNWT, and others have served as expert consultants. Such consultants have participated in projects related to Dene culture, as well as land-based activities such as caribou surveys, contamination monitoring, and environmental remediation. For participants, contention with the GNWT can be partly attributed to its history of not always including members of YKDFN in projects related to conservation, remediation, and sustainability, all of which have environmental consequences. Participants expressed their desire to see the GNWT and the leadership of YKDFN work together more closely to address the conservation of caribou and other environmental concerns:

And I think that's something the leadership needs to do...to be part of the solution and to be at the table with the government and the other professional groups in order to find a solution.

The absence of a collaborative relationship between the YKDFN and the GNWT has led to culturally insensitive policies with detrimental results for members of YKDFN. For example, participants said the GNWT's 2010 policy banning caribou hunting was well-intentioned, but did not take into consideration YKDFN's Treaty Rights and subsistence harvesting practices. While some participants were unaware of the ban, others who were aware of the ban chose to practice their Treaty Rights to hunt anyway. Participants in both groups had their meat confiscated. The policy was intended to protect the Bathurst caribou herd from further decline, but participants reported that the messages they received were contradictory:

First they [Government] said we will help you for hunting. That's like fifty, forty years ago. Now they want to manage us. Now they want to control us, have jurisdiction. It's like they want to be your friend one and the next day be the boss of your house, that's what they are doing.

In 2010 the leadership of YKDFN and the GNWT entered into an Interim Agreement to support the recovery of the Bathurst caribou herd. YKDFN agreed to limit their harvesting for a period of two years

(http://www.enr.gov.nt.ca/sites/default/files/yellowknives_dene_and_gnwt_sign_agreement.pdf).

Participants shared ideas about how YKDFN can contribute to the conservation of Bathurst caribou. Greater education about conservation and a merging of Traditional Environmental Knowledge and science in conservation efforts and environmental activities are two approaches participants believe will create a more collaborative relationship and develop a language of communicating conservation that is relevant and reliable to YKDFN. A male participant shared:

I think what will help is being involved in natural studies of what's going on. I don't think we see enough signs of us relying on science. I think there has to be a bigger merge of science and Traditional Knowledge. The government has a whole bunch of biologists and mining companies have their professionals but we don't have enough professionals. We don't have enough biologists; we don't have enough advisors in that area... We need two, three, four long term positions to work hand in hand with the members who have Traditional Knowledge to say this is why this is happening and to understand each other. Because there's doubt, you know a lot of Elders doubt science. Science is good but it's not to say science should walk over Traditional Knowledge either. They're both good, there just has to be a better marriage to work together so that our people can want to work with the scientists in the bush and the scientists can come to the hunts and whatever they're doing right here. They need a baseline study of everything, document everything and all the trends would show up and people will hear about it. You can bring this up at meetings and say look here's what we found, here's what happening, here is the data and we should be on top of all this stuff going on.

We have Treaty Rights.

The lack of acknowledgement of Dene peoples' Treaty Rights is a primary source of contention for members of YKDFN as they evaluate their relationship with the Government of Canada and GNWT. A participant characterized the federal and territorial government's lack of

acknowledgement of Treaty Rights as a means of “making us like white people.” An Elder summarized the difficulty in working with the federal and territorial government:

The territorial government, I really don't trust them because they treat everybody equally and the federal government it depends who the prime minister is. The prime minister right now doesn't support us, who we are. Indian Affairs is forever changing, every six months they change. They [Indian Affairs] change their government, so Indian Affairs is from federal government.

Participants frequently questioned the trustworthiness and truthfulness of the federal and territorial government's dealings with YKDFN. At the time of the interviews, participants were concerned over Devolution discussions. Devolution is the term used to describe the transfer of authorities and responsibilities for land and resource management from the federal government to the territorial government (<http://devolution.gov.nt.ca/>). According to the GNWT, Devolution will not impact YKDFN treaty rights. Participants spoke of a history of distrusting the federal and territorial government's genuine interest in and commitment to the rights of YKDFN. They also called into question whether the federal and territorial government could be trusted to protect the land and waters for future generations:

You know when there were small communities and no mines, there was no impact. But as Yellowknife grew, you had two gold mines, well the impact was huge, you have all that arsenic oxide you're dealing with, they dumped tailings into the lake, it's interesting because even some of the scientists and government employees, went and got water from the lake, put it in little jars and said to First Nations 'the water is good, you can drink it,' so at that time one of the chiefs said 'well if it's so good, why don't you drink it,' and guess what happened, they wouldn't drink it. The scientists that said it's good, it's drinkable, wouldn't drink it. That was really strange.

Participants involved in the Devolution discussions expressed their concern over losing their voice in the decisions and dialogue around natural resource management and ultimately the impact that development will have on the health and wellbeing of YKDFN.

For example, participants describe an urgent need to finalize the Akaitcho Treaty 8 Land, Resource, and Self-Government Negotiations, commonly referred to as land claim negotiations

with the federal and territorial government. Land claim agreements are viewed as an opportunity for the YKDFN to have the same decision-making power about natural resource management as the Government of Canada and GNWT. Furthermore, land claim agreements are seen as the basis for the Treaty Rights of future YKDFN generations:

There's Yellowknives Dene First Nations, Ndilo, Dettah, there's Lutsel K'e, Fort Res [Resolution], that's four communities, they work together under one umbrella, they are called Akaitcho. And they are working on the Akaitcho agreement, trying to settle one hundred years of unfinished business. They call it land business, reconciliation, so that First Nations their children can go on with their lives and their future will be set. Right now future not set. We are constantly fighting all the time, fight with the mine companies, fight with the governments, a lot of things we don't agree on because of jurisdictional and territorial problems. It's been like that for one hundred years, we are still going. I think they are pushing for it for joint management under the land claims negotiations. Once land claims are settled First Nations will have more role in co-management.

Participants express that protecting their treaty rights is a way for present and future generations to maintain access to the land and waters. With climate change altering these environments, some participants state that a finalized land agreement would be an important basis for the development of adaptation strategies.

Sharing is our way

Sharing is one such strategy that can help members of YKDFN adapt to environmental change. Participants describe the importance of sharing in the historical context of Dene peoples' survival, and in the continued cultural practice of the present. Today, participants share their knowledge, resources, efforts in harvesting, and sense of responsibility for vulnerable members of the community, such as youth.

Sharing traditional food.

They mutually benefit from sharing a harvest of traditional species, most notably ducks, fish and caribou. One party receives a good, whether it is intangible or tangible, and the other party can take pride in practicing Dene's legacy of sharing. An Elder describes sharing as "lifting up the sprit" and described his experience:

When we traveled on the land we shared everything and we traveled together as a group. And sometimes we shared what we had. We went on the land in probably the worst conditions and we know it [storm] will come up. We would cook caribou tongue and put it in our pockets and vests because we don't know what's going to happen with the storms. Sometimes the weather can go for days at a time. We get hungry so we have to rely on food that we carry like caribou. Don't eat the whole thing... Share with other people not because you have to but to keep the spirit, to not give up hope. Give you extra determination to carry on. Will to survive to share the little food you have lifts your spirits.

That's how it was done. Everyone takes turns breaking trails and we keep doing that till we find [our] way back to our camp. Altogether, looking out for each other making sure there's enough food for everyone. Helps lift up the spirits.

A desire to preserve culture and community, as opposed to a concern about physical survival, motivates participants' sharing practices:

Well, we feel good about it [sharing], because it's been our practice for generations. Generations and generations. If we didn't do that, help each other and care for each other, help one another through bringing up families and children in the community. You know what they say, it takes a whole community to raise a child, which is true because we do that. And if we didn't practice this community sharing, there might not be any Yellowknife Dene. They might have perished in a cold, extreme cold. They might have had a starvation experience, and there might not be any. So the Yellowknives Dene are very strong and proud people, and they look after each other where their neighbors probably don't get along or other people who are not helping out but it doesn't make any difference, doesn't matter, people still share their food even to this day. We cook food or fish or meat or whatever we cook and everybody gets a share of it, and that's how we do it.

There is an emotional benefit of sharing as well:

Yea well I guess there's a sense of pride and happiness I guess, I don't know exactly what the emotions would be at the time but it's something that feels pretty cool to be able

to provide that [caribou] for your family but not only that, it's something that our peoples have been doing for generations and for 1000s of years right, so it's pretty neat to be able to be a part of that and to be able to hopefully continue that if there's caribou in the future.

Sharing traditional food, such as ducks, fish, caribou, and moose meat, is done throughout the year. Male youth at the average age of 16 (\pm 2 years) are encouraged to share their first caribou harvested. By sharing their caribou meat, young men learn the importance of sharing within the community. There is also a larger lesson about reciprocity here. A young hunter will learn that by giving meat to others, as the caribou gave itself to him, he will make it possible for the caribou to again give itself over during his next hunt.

Participants share the traditional food they harvest with their families and with other members of the community. Some participants prioritized sharing with households that include children and/or Elders. Households with children may be headed by single women, or by women whose husbands or partners do not harvest, either because they do not know how or because their work schedules make it impossible. There is also special attention that members who harvest give to families and Elders that maintain a more traditional diet and rely on traditional foods for their food security and nutrition. Although all participants expressed a preference for traditional food harvested, not all participants' food security was as sensitive to changes in the availability of traditional foods:

As you know, native people who depend on meat need to have those nutrition, need to have the bone marrow, need to have the fat, need to have the caribou or the moose. And we don't really select people but we identify people who are at most need, who are most cultural, and that can help with the harvest but at the same time share the food with other people as well. And that's how we kind of identify the needy ones first. When we come back and we look at widows who have a lot of children but don't have men or people around to help them out, we will take care of those people first. Second we would take care of our Elders, Elders who are very traditional. They can't live on hamburgers or Kentucky Fried Chicken. A lot of that stuff is not good for them, they know that. So we would look after the Elders as well. Because the Elders need the intestine of the caribou,

the soft meaty parts and this is where we would harvest for them, and as well when they need fish, they need oil as you now when they get older they get a bit of arthritis, so the elderly people eat a lot of fish so a lot of fish that we harvest, we give it away to the Elders and after the Elders then we look after everybody else in the community, that's who we share with.

Sharing traditional food also offsets the conditions that inhibit members of Yellowknives Dene First Nation from harvesting and going on the land. Sharing traditional food allows YKDFN to pool limited resources, including skills, equipment, and time for the benefit of all, especially the vulnerable. An Elder describes her experience:

At that time I didn't have. I never did have nothing to go out on the land, no skidoo, no dog team, nothing whatsoever. Today I'm just starting to get those things. I want to go out. I was raised over there and I just want to travel and just take my time and travel where I want. I didn't had equipment or tools to go out with. Whenever I get a chance now I like to go out.

And another participant summarized the effort in helping members as:

Dene people share a lot of their food, because not everyone is as equal in the community. Some are well off because they have traditional skills and they have the tools to go and get it. By tools I mean you got to have your sled dogs, you got to have your boat. You got to have your skidoos, to get your traditional foods. Sometime it's within in 10 kilometers, sometimes it's 100 kilometers and it's a long distance to do that and sometimes your neighbors or people in the community don't have it and so sometimes you do it together as a shared hunt and share the experience. And this is how we harvest a lot of our food as a community.

Abundance versus scarcity.

Participants describe sharing without limits at times when caribou and other species are abundant. However, in recent years caribou have become scarce. Where once participants would have shared openly with other members of the community, now sharing is measured in amount and members:

But in my family, my extended family, my brothers and sisters, we depend heavily on mostly caribou, moose, and fish. We still do that. My brothers, the other day, they were hunting ducks he brought back like five mallards and that's to prepare as food for his

family. His children eat the mallard, and I don't like that because they don't share it with me. [laugh] I wish they'd share it.

The scarcity in caribou also influences decisions about how much an individual should consume, bringing up issues of food security:

February, March and we still got caribou meat in the deep freeze [freezer]. I don't want to be stingy but only when I crave it [will I eat it] but if my sister ask for some caribou meat I give them some if they don't have anything to eat.

Another participant shared:

[O]ver a year and a half, we have not had caribou meat. We just have moose and it's gone in no time because everyone wants the moose meat...God there was a lot of meat and it was gone in no time.

Participants reported a change in the dynamics of sharing spurred by two distinct conditions. First, the scarcity in caribou has created opportunities to sell caribou meat, and second, the cost of living and hunting is rising. The selling of caribou meat was common knowledge among participants, and while many acknowledged that they were aware caribou meat was being sold, only one participant shared his personal experience:

I dropped the caribou meat and one guy wanted to buy one and the other guys were just fighting over it [for the caribou meat shared]. I don't call that sharing, they were just grabbing it. There was no caribou around that's why. Everybody wanted some. And somebody even offered to pay?

No caribou calls for desperate times...I never felt like that. First time I felt like that with no caribou, we had just three caribou.

After we were leaving and everyone helped themselves to a little caribou meat, instead of just grabbing, I just said you have whatever you want but just take one so they [everyone] can help themselves.

The second condition that has changed the dynamics of sharing relates to the rising cost in living, hunting, and travelling on the land and water. Although fish are abundant, avoiding contaminated fish requires that the harvester expend more fuel to travel farther out, and for some this creates the unspoken expectation that the harvester should be compensated. The expectation

is not applied to everyone – for example, Elders would not be expected to monetarily compensate the harvester, nor would families with limited resources. Some participants expressed their disapproval of compensating the harvester for fuel, while other participants view the monetary exchange as a gesture of appreciation of and support for the hunter.

Though these parameters for sharing have changed over time, participants describe a reason for sharing that is unchanged: sharing meat or fish prevents waste, because a resource divided up among many individuals stands less of a chance of spoiling. Before freezers, meat or fish were either shared or dried. Even with freezers, participants choose to share in order to avoid spoilage caused by freezer burn:

Yeah we grew up, there is no expectation, you're not creating an expectation, it's a value that's been given to you, you share what you have, in terms of meat from your hunts, stuff like that, I mean it makes sense practically, because you don't have fridges, you don't have freezers, unless you make dry meat of everything, you watch the old timers, they killed what they needed when they needed it, they didn't go crazy and just massacre animals thinking that you're going to freeze it forever, because if you put meat in the freezer, it's gonna freezer burn in six months so that's why on community hunts, you put it in the freezer, you give them out as much as possible and individuals do that too.

The adoption of technology, modern equipment and improved travel are viewed by a minority of participants as contributing factors to the declining numbers in caribou. These participants contemplate the influence that better scopes, more powerful firearms, greater access roads, vehicles, skidoos, and freezers have on Dene harvesting behaviors and the overall harvesting efficiency that these items introduce. Knowledge and education, especially around conservation, is viewed as important for all members of YKDFN to learn, even experienced hunters.

Knowledge is a gift to be shared.

Knowledge about Dene history, culture, traditional skills, and language has been transferred through generations. Today, newly acquired knowledge and skills are also

transferred from old to young, and young to old. For an Elder, Dene culture and knowledge is viewed as an important gift to be shared:

Today I'm an expert. Because I wanted to learn, I wanted that gift that my mother has, and my mother was patient to teach me for so many years of her life. And now she is gone, so I want to carry that gift that she gave me, and I'm going to write a book about what it is to be a Dene woman.

Yes we used to go out on the land all the time, my husband and I and our children because I promised my dad that I'd teach our children our cultural way of living. He was a very proud Dene, very proud, he doesn't want our children to lose that gift that he's got.

Participants who were raised on the land were exposed on a day-to-day basis to knowledge related to Dene cultural ways of living. They learned traditional skills, customs, values, and knowledge from listening, observing and then helping their family members with various tasks. Participants learned to harvest and use traditional foods from their mothers, fathers, uncles, grandparents, and other extended family members. One participant spoke of how a mother could transmit not only traditional skills, but also values that characterize Dene's survival:

In the past people have traveled the land and had difficult times and my mom she gave me lots of good advice. No matter where you go when you go on the land do not give up on hope because instinct is there to continue to survive. If there's hard work my mom said not to say anything is impossible because you can lift up your bag and try your best. So I should try my best and not try to be, some people are lazy and don't want to put effort.

Mom said to do everything right and do my best and not give up hope. Because what seems impossible is possible. You can walk with heavy bag then it will become simple and lighter. It's about discipline and doing your best and not give up hope.

That's what I've done because you have to discipline yourself to do your best because without it it's hard to survive.

Hands-on learning on the land was particularly important for the participants who attended residential schools. These participants describe the way their parents took advantage of school vacations to bring their children on the land. For these participants, being back on the land

was a chance to continue learning their cultural way of living. It was also an important chance to reconnect with their identities:

I was shy of my teacher. Shy of everyone and I felt ashamed but when I came back from residential school my mother and my father took us back to the bush right away. And oh I felt, I gained, I gained the knowledge of who I was, before I didn't know and my mother was so kind, such a kind voice never scold us, we made thousands of mistakes because we didn't know how to work as a Dene woman, scraping caribou hide, cooking, making dry meat, dry fish and all that, oh I didn't know.

Another participant shared her parents' resolve in teaching their children and grandchildren their cultural way of living:

Sometime we go out, every summer we did that. I think my dad kind of knew how it would be to be in residential school. He was trying to be out there as long as he can with his kids and his grandkids to take them to Smith and wherever they have to go. He tried to stay with us until the fall. And one time in fall time we were way out in [inaudible], and it was snowing, and only now we're coming back to Dettah. I think he knew how it was to be in residential school, so he tried to be with us on the land as long as possible. Until it's really cold, snowing and we're coming back to Dettah.

While some participants learned how to harvest and use traditional foods at a young age by being raised on the land, other participants chose as adults to dedicate themselves to learning these skills. Younger participants attended schools in Yellowknife and were not raised on the land. For these adult learners, the connection to the land and their cultural way of living was important to them:

But the one thing that was always there [at community meetings] was the emphasis on language and culture, right. And learning about the land and knowing about the land and one of the things about the people that I would say is, 'how can you, how can you be a leader in the community if you don't know about the land and those types of things?' So that was always something that stuck with me and I always thought it was important to learn about that, it's part of my culture and I wanted to know what that was about.

These adult learners chose, later in life, to pick up a body of knowledge, but among YKDFN learning and sharing knowledge also occurs in more casual ways. Hunters share with each other

knowledge about safety conditions and precautions, location of trails and spots where caribou might be, as well as information about the health and safe consumption of the species harvested.

“I learned a lot from my Elders.”

In the olden days, participants often learned from Elders by listening to their stories.

Both male and female participants describe pleasant memories of their childhood in the company of Elders:

Uh hum, yea and mostly there were Elders around too. Make you feel good when we all get together and they tell stories about what they did out in the barren lands, how they survived and everything. Just by listening to their stories that’s how you learn.

Assisting elders was a way to learn about the land and waters, along with the discipline of work.

As one participant stated:

That time I remember I was being with an Elder lady just for maybe an orange or apple that they would give me. Those oranges they were so juicy. I liked those oranges back then. A big ship came from Hay River with fresh oranges and big huge apples. I used to love those apples back then too. They [Elders] give oranges and apples to kids. So I used to work with Elders. We go on canoes and picking berries. Just work with them [Elders]. Doing dishes for with them, whatever. Chop up wood, put them together, nice together. I used to do little things.

Elders were also a source of learning that could be transmitted through their leadership within the community. Community meetings, also referred to as Indian meetings, shape the trajectory of the community:

Once our Elders go that’s our knowledge, our consultant. They [Elders] speak the powerful words. They speak, some words are so powerful. You know they remember a long time ago that because people, whatever time, you stop, there was not such a thing as TV, those crazy things, in those days even young kids would go to the meetings and invite themselves and sit in the back of the meeting and listen. And that’s how they learned and grow up. They listen to the wise words and they carry that all their life, that’s how they have a good life.

Many participants learned about Dene history, values, and community priorities by attending local and regional meetings. The meetings, which continue today, focus on leadership, the

environment, health and wellness, and treaty rights. In addition, participants have attended and continue to attend hearings on economic development projects, environmental impact assessments, and other issues that impact their community, land, and waters.

But several participants express the concern that as Elders pass away, their knowledge and language will be lost to the community:

The Elders are professors in their own way, they know the language, they grew up with it, the language is tied to the land... But slowly they started to take the kids out on the land for one day, two days, a week, two weeks on trapping programs. So it's little things like that they started doing but they never fully get like the French language, there's no immersion or anything at all, so yeah, it's something, it may get there but I don't know, maybe with the timing and the language being lost so fast, and the Elders going, dying off, they're taking all that knowledge with them and skills.

While the physical loss of elders raises concern for participants, they also raise a second issue related to the sharing of knowledge. Some participants say that the transfer of knowledge and language from Elders to youth no longer occurs informally during childhood:

Yea, yea because it's our Elders that have the knowledge, and where are the Elders today? Where are the kids today? Kids are in school and the Elders... they're in the bush, or they're at home, and often times all that knowledge is just sitting there and not being utilized. You know it's just not being utilized.

Teaching youth their traditional way.

Participants share a concern that younger community members may not acquire the Dene language and connection to the land, waters, and environment. It is a priority, then, to teach this cultural way of living – also referred to as the “traditional way” – to youth. Maintaining their cultural and Traditional Knowledge and way of living is essential to preserving Dene culture and protecting Dene rights for future generations. But participants view a Western education as equally important for youth, saying that such an education prepares youth to have financially secure and healthy futures, and leadership roles in the community.

Participants have supported, contributed, and led efforts to integrate Dene traditional skills, language, and knowledge into the formal education system. Aboriginal education and programming is available in the schools of Yellowknife Education District No.1 (www.yk1.nt.ca). Participants speak of the pride they have in their native schools of K'àlemi Dene Ndilo Community School (K-12) and Kaw Tay Whee Dettah Community School (K-7). The effort of integrating Dene cultural and language skills into formal education can be summarized as:

So the program kinda brings that [Dene cultural and language skills] to the lower grades, brings that right to the schools, bringing the Elders right into the school. I sort of have my own philosophy that school, education given to us [apart from Elders], I guess the way western education work, of going to school, uh takes our traditions and culture from us because you take away the kids from the Elders, so they are not learning and there's a gap there. So if you get all that into school, into our education system, is one of the keys to uh keeping it and keep that connection [to the land, culture] so to get the Elders in the schools, get the schools to start participating in our land activities with these Elders and to keep it alive.

One Elder described her sharing of knowledge as:

It's been carried on to me now it's my turn to give back what has been taught to me. Teach what I know to the kids today. I go out to the kids' school, with the cultural instructors in town, with the school board. I go out with them. I tell them what I know, what I think I know. I try to pass that on. What I've been taught. I'm not going to just keep it to myself. That's like being stingy [laugh]. It's sharing.

For Elders, teaching youth Dene cultural skills and language is not only an opportunity to share knowledge, but is also a chance for older family members to learn from younger ones.

Such learning can, for some family members, reconcile the tragedy of residential schooling:

They bring the children to cultural camp and teach children how to prepare fish and dry fish. So they can teach their own parents how to prepare fish. Because most of the parents, I shouldn't say most, but some of those parents were from residential school and were impacted, it's where they lost their values, and their cultural way of life. They were not taught that in the residential school. So it was people like myself who are working with young children who are trying to bring those skills back to the parents. And the way we do it is we take the children on the land, we teach the children how to cook, how to

prepare food and we tell the children well when you go home please teach your parents how to cook dry fish or dry caribou and prepare other foods. And this is what they're doing which is good. The parents get a chance to learn. They get back some of their traditional foods that they lost. And this is how it comes back to the community.

Cultural camp is held on an island, and is only accessible by boat, so participants speak of the journey to camp as an important chance to experience the land and the waters. This is only one of the many opportunities that participants seek to take the youth in their families and community on the land. Participants use every opportunity to encourage youth to experience the serenity, sounds, smells, temperatures, textures, and tastes of the land and waters. A participant who grew up on the land shared how he transfers his knowledge and skills:

Their mom says teach them different things as they get older because they pick up things fast. Like the language. Sometimes I teach them our language they understand but they don't speak it. None of them do when they're out in town or the community. But at home they do, their mom use their language a lot. That's why I say when it's time for them to speak they'll speak but for now [the youth] keep it to themselves. Sometimes with the homework, you show them an animal and they write it down. I always teach them what kind of animal is that and what does it eat, it's part of environment and science. I like to teach my nephew all the time about the land. Every time he shows me a report card, I see 100%. I teach him [nephew] everything on the land. I like to teach my nephew and other kids about the land.

Another participant expressed:

I like bringing kids everywhere I go. They're not going to learn being left at home alone. They need to come out and see what's happening on the land. They need to experience things. So when I travel I like to bring kids with me. So they can learn. When they were young I used to try to take them everywhere I could, you know? Only way they're going to learn. They're not going to learn by staying at home.

The adult participants are committed to sharing their knowledge with all youth, male and female, family members and non-family members, and youth with or without a juvenile record. Young female members of the community are taught trails so that they may set traps. They are also taught locations for setting fishnets, and are shown how to handle rifles so they might hunt. At the time of this study, participants spoke highly of a particular female hunter, who they said

was also well-respected by other members of the community. Even youth with juvenile records (primarily related to underage drinking) are proactively encouraged to participate in land-based activities and opportunities to learn traditional harvesting skills. Engaging in such activities gives these youth with records a deeper awareness of Dene values, and gives them the chance to hear from Elders who can share their knowledge of living healthily:

I said don't abuse your body. Don't abuse your life. Go for healing. Anything that you think if you can't do it by yourself, if you don't have the strength you know because generation habit that you carry. If you can't heal yourself, go for treatment, go out [get help], be a better person. If a lot of our young people have criminal record...I said don't give up hope, go for treatment. I keep encouraging him in a positive way. If you can't help yourself go for treatment and that way it will be on your record and there's a good chance that you start living a healthy life and then you get pardoned from your criminal record. I said, if you don't do anything about it then it's going to stay. So that's what I see, start healing yourself and listen to Elders and people that are positive, doesn't have to be Elders but if there's a voice [someone] trying to say something good to you even though it hurts you, be silent, don't criticize.

Emergent Midrange Theory

Participants described processes that protect their rights, land, and waters for future generations within the context of their lived environment. Processes that focus on the present generation are aimed at giving youth the knowledge and skills to continue using and protecting the land and waters. The participants' strategy for promoting their nutrition and health aimed to maintain access to traditional foods, which they saw as the basis of their food security and the source of their health and well-being. Figure 4.1 provides a visual representation of the theoretical relationships between the emergent categories and themes of this study.

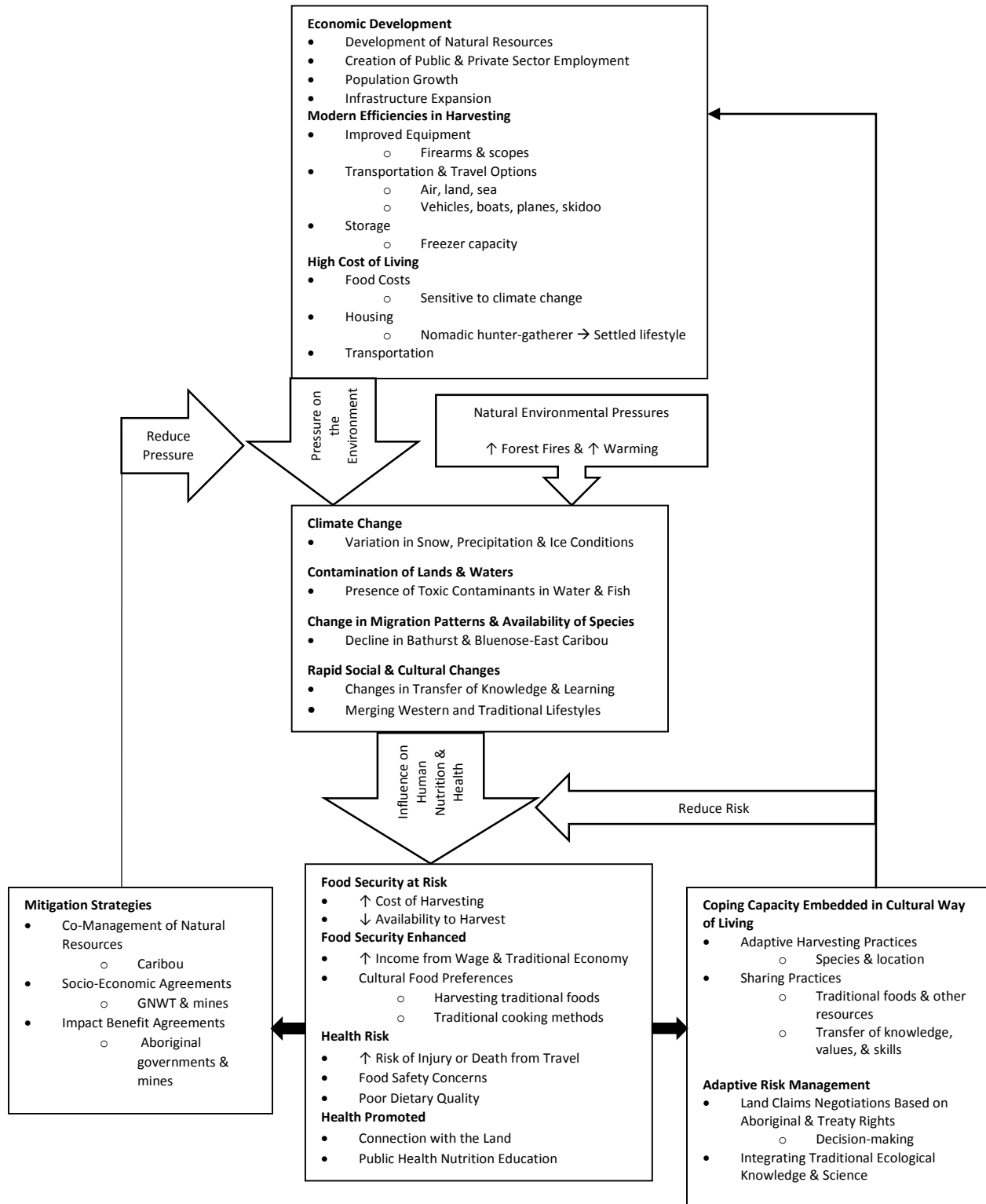


Figure 4.1 Conceptual Model of Nutrition and Health in the Context of Climate Change and Global Environmental Change as Experienced by Yellowknives Dene First Nation (adapted from McMichael et al, 2008)

The next and final chapter will discuss the meaning of the results and the midrange theory presented. It will also compare and contrast the existing literature with the results, assessing the results' contribution to knowledge. Finally, this last chapter will address the study's implications for public health nutrition, and offer suggestions for future research.

CHAPTER V

Discussion and Conclusion

This chapter interprets the importance, meaning, and significance of the findings presented in Chapter IV. First, it will summarize the key findings that answered the study's central question: How do members of Yellowknives Dene First Nation (YKDFN), who harvest and use traditional foods, manage their nutrition and health in a changing climate and environment? Second, the chapter will discuss the theoretical implications of the Emergent Midrange Theory developed here, and will consider its role in enriching our understanding of Yellowknives Dene First Nation's food and nutrition systems. Specifically, I will address the YKDFN vulnerability to climate change and global environmental change, and the resulting impacts of these environmental changes on human health. Finally, the chapter will provide implications for policy and program development and for the practice of public health nutrition before addressing study limitations and suggestions for future research.

Summary of Findings

Participants' lived experience and accounts of climate change and global environmental change are consistent with the existing literature (ACIA, 2004; Furgal & Prowse, 2008; Turner & Clifton, 2009). Climate change, which comes with the pressures of economic development on the environment, is creating vulnerabilities in YKDFN's traditional food systems. This phenomenon is also present in the global food system where soil degradation, freshwater availability, and other ecosystem uncertainties create vulnerabilities (Ericksen, 2008). The most significant vulnerability in YKDFN's traditional food system is the decline in Bathurst and Bluenose-East caribou. However, the decline in caribou is not the only vulnerability to the YKDFN food system. The following provides insight on how YKDFN's food security, nutrition, and health are interconnected with culture, politics, society, economics, and ecosystems.

Managing nutrition and health.

Indigenous peoples' conceptualization of health links human health and well-being to the health of their social, cultural and ecological environment (King & Furgal, 2014; Turner & Clifton, 2009). The Dene language, Chipewyan, defines health as the Dene way of life (Parlee, O'Neil, & Lutsel K'e Dene First, 2007). Embedded in the Dene way of life is the idea that the Earth, including both its biotic and abiotic components, is a living organism that exists in harmony for the benefit and survival of all life (Johnson, 1998). Similar to other Indigenous peoples, Dene believe that nature gives itself to them so that they may live (Turner & Clifton, 2009) and for YKDFN "the land is what sustains us."

YKDFN's connection to the land promotes their health and well-being in multiple ways. Among those most cited by participants were the physical benefits of consuming traditional foods, and the way harvesting served a form of physical activity. Traditional foods are valued as superior to foods procured from the global food system and are seen as important to the participants' household food security. The nutritional benefits of traditional food among Arctic Indigenous peoples is well established in the NWT (Fediuk, Hidioglou, Madere, & Kuhnlein, 2002; Kuhnlein, Chan, Leggee, & Barthet, 2002; Lambden et al., 2007). However, participants remain concerned about environmental contaminants in the traditional species they harvest. A valid concern as measured in the decline of organochlorine concentrations in trout but not burbot in Great Slave Lake (Evans et al., 2005). Participants spoke of trying to minimize their exposure to contaminants by assessing the health of the species harvested, or by moving harvesting activities to locations where the species are deemed safe for consumption. But even so, contaminant exposure remained a concern – and not just for traditional foods, but for market foods as well. This level of concern suggests that health promotion campaigns and interventions

related to dietary intake should also address contamination in market food. YKDFN' connection to the land also promotes spiritual health.

A connection to the land is particularly important for members of the community whose health is impaired by substance use. Spiritual health was experienced and practiced in diverse ways among participants. As with other Indigenous peoples, YKDFN spirituality remains situated in nature and in the totality of the environment (Johnson, 1998; King & Furgal, 2014; Turner & Clifton, 2009). Related to spiritual health is healing, as all healing is recognized as spiritual healing among Indigenous Elders in Canada and the United States (Mehl-Madrona, 2009). Participants saw avoiding substance use or healing from substance use disorder¹² as ways to foster health and well-being. In relation to nutrition, these factors are important not only because of the influence substance use has on nutrient utilization, but also because of the influence substance use has on accessing the land and waters to harvest. Participants explained that substance use disorder inhibits members from participating in harvesting activities for reasons related to availability, safety, and respect for one's self, the community and nature. Spiritual practices related to spending an extended period of time on the land alone being self-reliant and self-sufficient, coupled with reflections on Dene teachings contributed to a participant's sobriety. This finding is congruent with the belief, taught to the Dene by Indigenous Elders, that humans are self-healing because they are a part of nature and nature heals itself (Mehl-Madrona, 2009).

¹² Substance use disorder: The recurrent use of alcohol and/or drug that causes significant clinical and functional impairment; replaces the term substance abuse (www.samhsa.gov)

Building relationships.

Transfer of knowledge among members of YKDFN about Dene cultural way of living includes topics related to history, values, language, traditional ecological knowledge, and harvesting skills. Similar to their Inuvialuit neighbors in the north, participants have traditional ways of transferring this knowledge. They observe behaviors, listen to stories, and assist adults and Elders before practicing, thereby gaining hands-on experience (Salokangas & Parlee, 2009). But both this study and the literature find that it is difficult for youth to learn traditional skills, mostly because of the time commitment required. For youth, who spend most of their time in a classroom, it is difficult to find the time to learn Traditional Knowledge and skills while on the land and waters (King & Furgal, 2014; Salokangas, & Parlee, 2009). The NWT's regional educational districts' curricular integration of Aboriginal education may alleviate the time limitation concern and correct the historical dismissal of Indigenous ways of learning (Tait, 2008). Aboriginal attainment of a high school diploma among youth ages 15 to 24 years in the NWT has seen an average rate of increase of 5.1% every five years, between 1999 and 2009 (www.statsnwt.ca, 2009).

Because Aboriginal youth are now more likely to hold high school diplomas and to have had exposure to Aboriginal education, they have more kinds of opportunities. Among the possibilities are pursuing post-secondary education, training certificates, industry employment, and/or advancing their Traditional Knowledge and harvesting skills. These youths' social, cultural, and economic environments are likely to influence their choices (Salokangas & Parlee, 2009). Indeed, the participants of this study demonstrate that attainment of these pursuits are not exclusive of each other, and acquisition of Traditional Knowledge and harvesting skills can occur at various stages of an individual's life. The commitment of participants to share their

knowledge and maximize access to their Elders' knowledge creates an open learning environment. Social capital becomes increasingly important as members of YKDFN who harvest and use traditional foods enter the labor force.

Although the introduction of firearms replaced the necessity for group effort hunting of large game, there remains a need for collaborative hunts. Climate change and modern means of transportation, such as the skidoo, present safety concerns that can be minimized by hunting in pairs or larger groups, and utilizing satellite radios and phones. Collaborative hunts, such as the community hunts, also support members of YKDFN who may not be able to hunt but still prefer to use traditional foods. Similar to other reports of unconditional distribution of meat from community freezers (King & Furgal, 2014), meat from YKDFN's community freezer is accessible to all its members. Sharing of traditional foods among members of YKDFN complements the community hunts' efforts by making traditional foods available to the community. However, as in other Arctic communities, YKDFN members have found that freely sharing traditional foods is hampered by the declining caribou population and rising costs associated with harvesting activities (King & Furgal, 2014).

YKDFN and other Arctic Indigenous peoples recognize that resource development and climate change threaten their traditional food system (Cott et al., 2008; Wesche & Armitage, 2014). A partnership between YKDFN and the GNWT could make possible the co-management of natural resources, as well as the development of mitigation¹³ and adaptation¹⁴ strategies responsive to climate change and global environmental change.

¹³ Mitigation: The lessening or limiting of the adverse impacts of hazards and related disasters (www.unisdr.org)

¹⁴ Adaptation: The adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects which moderates harm or exploits beneficial opportunities (www.unisdr.org)

Participants view finalizing Akaitcho Treaty 8 Land, Resource, and Self-Government Negotiations as an important means to three particular ends: 1) securing their role in the decision-making process related to natural resource use and development, 2) adapting to climate change, and 3) protecting their traditional subsistence lifestyle. YKDFN's effort to protect their treaty rights for present and future generations is shared among other Arctic Indigenous peoples (Alcantara, 2013). Developing effective mitigation and adaptation strategies for climate change and global environmental change in the NWT will require participation from a diverse group of governing bodies and organizations.

Theory Contribution to Understanding the Complexity of the Interrelationship between Climate Change, Nutrition and Health

Systems theory. Public health has used a social-ecological approach to address the determinants of health and nutrition (Raine, 2005; Rayner, 2009). Originating from the philosophy of systems theory (Von Bertalanffy, 1972), the social-ecological approach is defined by two major principles: one, that human behavior is determined by multiple levels of influence that include both intrapersonal and environmental determinants; and two, that health is the result of the interdependence between the individual and subsystems of the ecosystem (Reynolds, Klepp, & Yaroch, 2004). The subsystems of the ecosystem have been defined by the social-ecological approach as the intrapersonal (e.g. individual knowledge), interpersonal (e.g. family), institutional (e.g. worksites), community (e.g. village) and physical environment (e.g. supermarket), social environment (e.g. culture, income), society (e.g. public policy), and supranational (e.g. United Nations) (Kok, Gottlieb, Commers, & Smerecnik, 2008; Raine, 2005; Reynolds et al., 2004).

Although there has been an increase in multilevel health promotion activities, few interventions have focused on the supranational level. Often such interventions fail to take into account natural ecology (e.g. biophysical environment) (Kok et al., 2008; Rayner, 2009). But addressing climate change and nutrition security in the context of climate and global environmental change requires greater effort at the supranational level. Though nations are collectively required to exert political power and influence policy change, and while health is influenced by both nutrition and socio-cultural determinants, food directly coalesces the biophysical environment, health, and culture (Waltner-Toews & Lang, 2000). The limited use of supranational level interventions and omission of the biophysical environment may have resulted from the greater feasibility of influencing policy at the national level compared to the supranational level, or even more problematically, lack of knowledge about the relationship between nutrition security and climate change (Kok et al., 2008; Raine, 2005).

More recently a return to systems theory is emerging. The natural ecology and human ecology are being accounted for in the study and development of conceptual frameworks that facilitate our understanding of the relationship between the environment and human health (DePlaen & Kilelu, 2004). Systems theory originated with Aristotle's idea that the whole is more than the sum of its parts, (Von Bertalanffy, 1972) and has evolved into a holistic perspective that provides insight into system boundaries, relationships between systems and subsystems, the maintenance of system homeostasis, and the concept of equifinality (Sobal, Kettel Khan, & Bisogni, 1998). Systems and subsystems have boundaries with varying permeability that allow the exchange of materials, energy and information between parts of a system and its subsystems, and between the system and its environment. System homeostasis aims to maintain stability in response to changes in parts of the system and/or its subsystems, or

in response to pressures from external forces. The concept of equifinality is used in complex systems, and refers to the principle that a given end-state (e.g. health outcome) can be achieved by many different paths and potential means (Sobal et al., 1998; Von Bertalanffy, 1972).

In the context of global environmental change, and in an effort to address the health risks associated with climate change, public health needs an understanding of the ecological relations and the necessity of environmental sustainability (McMichael et al., 2009). EcoHealth is an ecosystem approach to human health framework based on systems theory (DePlaen & Kilelu, 2004). EcoHealth is focused on understanding the interactions between social and ecological systems (e.g. cultural, socioeconomic, biophysical environment, etc.) to delineate key determinants of human health in particular settings; and examine the anthropogenic influence on the sustainability of the ecosystem processes (Lebel, 2003 as cited by DePlaen & Kilelu, 2004).

Two key features of EcoHealth that address sustainability are system homeostasis and holarchy. System homeostasis is understood in terms of feedback, which can be positive (e.g. reinforcing) or negative (e.g. degradation) and result from the interaction between systems and subsystems (Waltner-Toews & Lang, 2000). The concept of holarchy is related to the social and ecological system complexities that are nested in hierarchies (Waltner-Toews & Lang, 2000), for example an individual is seen as whole but also part of something larger, such as a family or community.

EcoHealth, and its underlying systems theory, provides a holistic approach to addressing human health and nutrition determinants in the context of climate and global environmental change. The EcoHealth approach also responds to calls for new methods and ways of understanding public health priorities (McMichael et al., 2009; Rayner, 2009). The strengths of the EcoHealth approach are balanced with its limitations. The EcoHealth approach is challenged

by the complexity of systems, such as the nutrition and environment system, that have limited methods and data to assess the systems' processes (Waltner-Toews & Lang, 2000). The EcoHealth approach is also limited by the existence of high uncertainty, mathematical obtuseness, and numerous variables required to study all the interrelationships (Von Bertalanffy, 1972; Waltner-Toews & Lang, 2000). However, the acknowledgement that uncertainty exists in dynamic systems (e.g. climate, and culture) in general makes the EcoHealth approach viable for the study sustainable ecosystem services (Waltner-Toews & Lang, 2000). The conceptual model introduced in chapter 4 was adapted using an EcoHealth perspective.

Conceptual model. In 2008, McMichael and colleagues introduced a conceptual model to delineate the relationship between human-induced global environmental changes and the health and social policy responses related to mitigation and adaptation. The model proposes that human society, through culture, institutions, economic activity, and demography shifts, places pressure on the biophysical environment (air, water, land, etc.). Per the model, global environmental changes result from the combined pressures of human society and natural factors on the biophysical environment. Global environmental changes include climate change, freshwater shortages, loss of biodiversity, and impaired functioning of ecosystems. Global environmental changes impact ecological systems that ultimately affect human society. The model offers two pathways: the first reduces human-induced pressures on the biophysical environment (e.g. mitigation) and the second reduces human society's risk of the adverse effects from global environmental changes (e.g. adaptation risk management).

The model proposed by McMichael and colleagues provides a broad understanding of the relationship between human society and global environmental changes that allows thoughtful conjectures to be made about the relationship between climate change, food and nutrition, and

health. The model maintains global environment changes as the focal point. The Conceptual Model of Nutrition and Health in the Context of Climate Change and Global Environmental Change as Experienced by Yellowknives Dene First Nation (GEC-YKDFN) (Figure 4.1) was adapted from the Global Environmental Change (GEC) model McMichael and colleagues (2008) developed to illustrate the relationship between global environmental changes and health and policy responses. In analyzing the relationships between the themes and categories of this study, it became apparent that the McMichael model could be adapted to illustrate the experience of YKDFN without compromise.

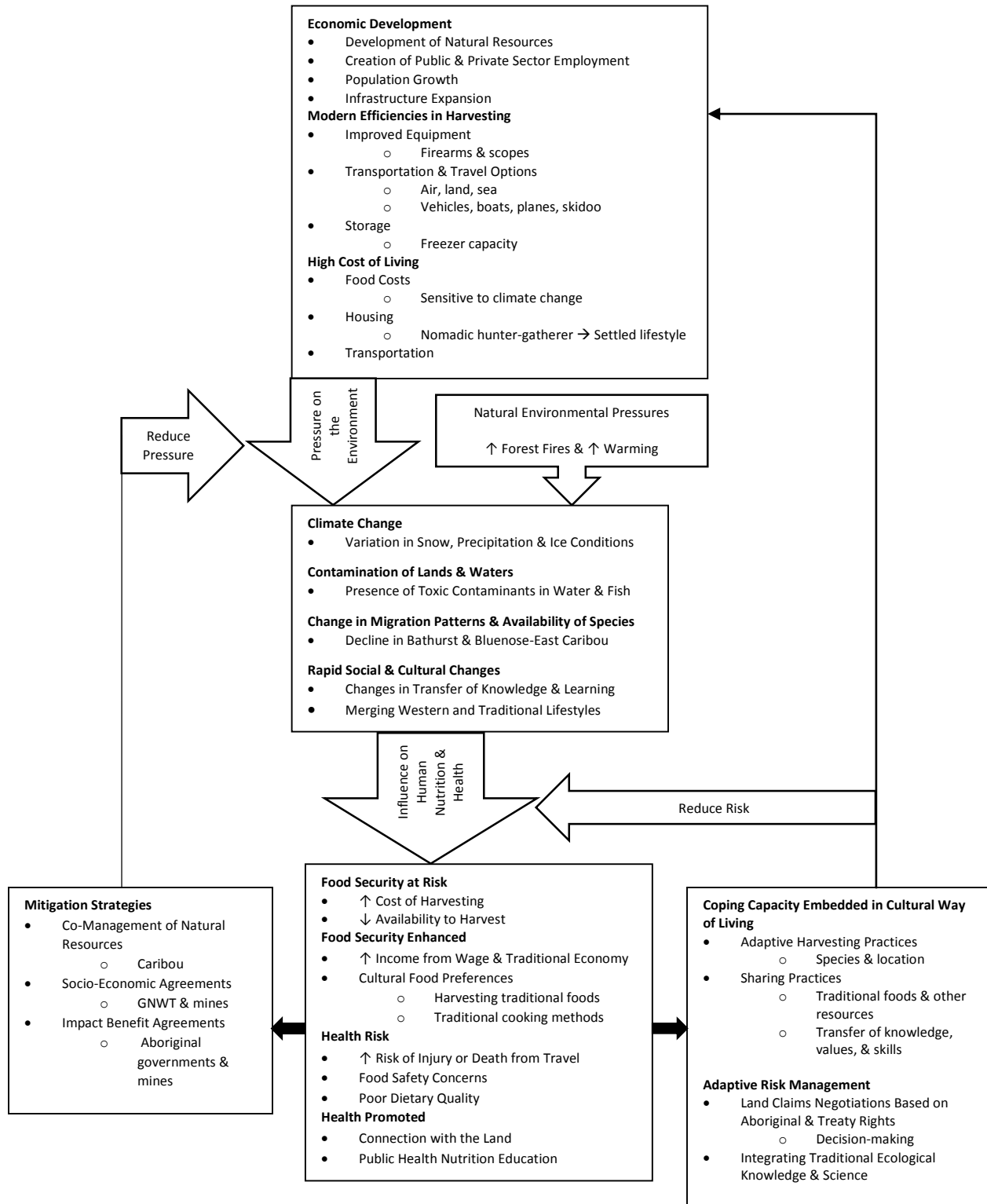


Figure 4.1 Conceptual Model of Nutrition and Health in the Context of Climate Change and Global Environmental Change as Experienced by Yellowknives Dene First Nation (adapted from McMichael et al, 2008)

The GEC-YKDFN model was conceptualized using a systems theory approach. In doing so, the model delineates the feedback loops that contribute to the homeostasis of the systems which is important to sustainable development (Waltner-Toews & Lang, 2000) and consistent with EcoHealth (DePlaen & Kilelu, 2004). Another dimension of EcoHealth that is imperative to sustainable development is the holarchy nature of ecosystems (Waltner-Toews & Lang, 2000). This is demonstrated by the central position of global environmental change and by recognizing the natural environmental pressures that exist within the biophysical environment system (McMichael et al., 2008).

Climate change, contamination of the land and waters, changes in migration patterns and availability of species, and rapid social and cultural changes represent the global environmental change experienced by YKDFN. Culture is understood to adapt and evolve in response to the individual and collective group's physical, social and political environments (Kagawa-Singer et al.). Natural environmental pressures include the extreme weather conditions in the Arctic that have affected biodiversity. In 1972, freezing rain in autumn replaced snow and led to ice coverage over vegetation, thus inhibiting caribou's access to food. For nearly six years after, caribou seemed to have all but disappeared (ACIA, 2004). Caribou is regarded as one of the most significant traditional foods that is essential to cultural expression and keeps peoples connected with nature (Lambden et al., 2007). The relationship between caribou and climate variation also impacts Arctic Indigenous peoples' food system, as well as their cultural and spiritual health.

The GEC-YKDFN model provides specific examples of the interconnectedness between human nutrition and health, and global environmental change. These systems are important to consider because climate change is projected to reduce food yields and biofuel production is

projected to increase water shortages which ultimately may affect global food and nutrition security (Tirado, Cohen, Aberman, Meerman, & Thompson, 2010). Under these conditions, and with the decline of caribou and presence of environmental contaminants, YKDFN will continue to face the inequitable burdens of climate and global environmental change referred to as double exposure (O'Brien & Leichenko, 2000).

In addition to food and water safety, the GEC-YKDFN model also conceptualizes physical environmental safety as it related to travel risks. Climate change and variability have increased the unpredictability of weather patterns and ice conditions, making travel on the land and water unsafe (ACIA, 2004). In 2010, a resident of Dettah drowned in Great Slave Lake after his boat overturned; there were two survivors (www.cbc.ca).

Health is promoted through YKDFN's connection to the land. Indigenous peoples believe good health is achieved when physical, mental, emotional, and spiritual elements are balanced and thus good health is described by a balanced relationship with the Earth and natural world (Malloch, 1989 as cited by Smylie, 2001). Spiritual health has been described as *getting beyond the self* and connecting with creation, where creation is conceptualized to include family, community, culture, the natural world, and the spiritual world (McCormick, 2000).

The inclusion of the biophysical environment and its interaction with human health is essential to Indigenous peoples' view that good health requires a balance between humans and the natural environment (Tait, 2008). The idea of balance between the environment and human health also speaks to the homeostasis of systems that underlies the GEC-YKDFN model. All elements of the earth's ecosystem are interconnected (e.g. humans, water, climate, etc.) and thus aligned with Indigenous peoples' holistic worldview (Smylie, Williams, & Cooper, 2006).

The interconnectedness between the systems in the GEC-YKDFN model also support Indigenous peoples' sense of belonging whereby harmony between the person and the environment contributes to health and well-being (Hill, 2006).

The inclusion of cultural, social, economic, and political factors in the GEC-YKDFN model is critical because each of these factors contributes to Indigenous peoples' resilience and vulnerability to climate change (ACIA, 2004). The GEC-YKDFN model recognizes the human induced pressures on the environment that contribute to global environmental change. YKDFN identified economic development, modern efficiencies in harvesting and the high cost of living in the NWT as the drivers that exert pressure on the environment. The recognition of human induced pressures on the environment may facilitate mitigation and adaptation-related policy dialogue between Aboriginal governments and the federal and territorial governments of Canada.

The inclusion the influence that policy and institutions have on global environmental change, through mitigation strategies, coping capacity and adaptive risk management, are also key elements that support YKDFN and other Indigenous peoples' ancestral responsibility to act as stewards of their land, waters, and nature for future generations (Dwyer, 2002). YKDFN's priority is the co-management of natural resources. The YKDFN leadership is presently working with the GNWT on efforts to protect and promote the health of the Bathurst and Bluenose-East caribou herds.

Historical mitigation strategies at the supranational level include the Montreal Protocol on Substances that Deplete the Ozone Layer. Commonly referred to as the Montreal Protocol, it is regarded as one of the most successful international agreements aimed at phasing out ozone depleting substances. Currently the United Nations Development Programme manages over US\$500 million to assist countries in phasing out ozone depleting substances

(www.undp.org/chemicals/montrealprotocol.htm). In the Arctic, reductions in ozone depleting substances are essential to reducing the levels of ultraviolet radiation (UV) that reach the earth's surface and threaten human, plant and wildlife health (ACIA, 2004). The adverse impacts of UV on plant and wildlife may reduce the availability of Arctic Indigenous peoples' traditional foods.

Coping capacity is the ability of people, organizations, and systems, using available skills and resources, to manage conditions, emergencies or disasters (www.unisdr.org). Sharing practices among YKDFN significantly contributes to coping capacity. The act of eating and sharing traditional foods contributes to a sense of belonging that strengthens Arctic Indigenous peoples' social and mental well-being (Hill, 2006; Raine, 2005). Sharing practices also extend to transferring knowledge. Indian Residential Schools contributed to a loss of Traditional Knowledge, including skills related to harvesting traditional foods (Quinn, 2007). In the Canadian Arctic, efforts to rebuild Indigenous peoples' cultural identity include the incorporation of traditional language and harvesting skills into the educational system (Smith et al., 2005; Tait, 2008); these efforts may nurture a positive cultural identity and increase access to traditional foods.

Activities that permit individuals and societies to adjust to new conditions are referred to as adaptation risk management. Land claims negotiations are viewed as essential in creating a space where YKDFN have equal power in the decision-making process related to policies and development initiatives that will have an impact on the environment and YKDFN.

Implications for Policy and Program Development

On a broad scale or supranational level, the findings of this study may inform dialogue and knowledge about the complexity of the interdependence between foods, nutrition, human health, and social-ecological factors. The findings of this study are timely, because although

Canada formally withdrew from the Kyoto Accord in 2011, assessing vulnerabilities of social-ecological systems remain important in developing mitigation and adaptation strategies to climate change and global environmental change. In addition, YKDFN can use these findings to persuade the Government of Canada to actively address climate change using a human rights approach that acknowledges a nation's human rights, including the right to food, "cannot be effectively exercised if the environment is not healthy and safe"(Gruskin & Madhury, 2014). Important to food system related policy is understanding both the human and ecological dimensions of vulnerabilities and drivers of climate change and global environmental change (Ericksen, Ingram, & Liverman, 2009). At the local level, these findings may help inform policy and program development that protects and promotes the health and well-being of YKDFN.

Food security and accessing traditional foods harvested is becoming increasingly more difficult with rising costs among YKDFN and other Dene communities (Simoneau & Receveur, 2000). YKDFN's close proximity to several market food outlets in Yellowknife does not translate into households that are food secure or access healthy foods regularly. The high cost of food and lack of familiarity with healthy-market foods hinder food security and consumption of healthy-market foods. Survey respondents from 2008 to 2010, representing 16 communities of the Dene Nation of the NWT, indicated that in the prior 12 months, they or a member of their household either reduced the size of their meals or skipped meals, were hungry but did not eat, or ate less than they felt they should, due to a lack of money for food (Dene Nation, 2012 as cited by, Council of Canadian Academies, 2014). The findings of this study may help design food assistance programs that are culturally relevant to YKDFN. In 2008, households where traditional foods contributed to 50% or more of the foods consumed, included 70% of households in Dettah and 45% in Ndilo (www.statsnwt.ca). Thus food assistance programs

should consider developing creative ways of supporting harvesting activities beyond the community hunts.

Study Limitations

Limitations in the study design. Limitations are the conditions that restrict the scope of the study, may influence the outcomes, and are not controlled by the researcher. Limitations of this study are related to the research design and its final product: midrange theory. Midrange theory is limited by its use of more specific constructs and its lower power of explanation when compared to grand theory (Morse & Field, 1995). Grand theory has the ability to explain a broad generalized phenomenon and thus has greater power of explanation whereas the midrange theory developed in this study is descriptive and focuses on the experiences of members of Yellowknives Dene First Nation.

The research design for this study was a constructivist approach to grounded theory methodology. As a constructivist researcher, I considered reality to be socially constructed, and thus my bias might have been a limitation (Swift & Tischler, 2010). Bias is inevitable because humans are incapable of being completely objective (Swift & Tischler, 2010). In qualitative research, humans serve as the research instrument and choose the research questions, interpret and analyze data, and decide the direction of the study. The author of this study addressed bias by making explicit her role and values, and their impact on the research (Creswell, 2007; Swift & Tischler, 2010) most notably the decision to use an EcoHealth approach in interpreting and analyzing the data. The author also addressed the bias she may introduce to the analysis by sharing her interpretations and findings with male and female members of YKDFN throughout the process of data collection and analysis while in Yellowknife. The members of YKDFN

provided feedback that clarified findings by providing historical context and helped identify members that could fill in unanswered questions in the data.

Limitations in the sampling technique. A purposive sample may introduce bias. Participants were primarily recruited with the help of prior participants' word of mouth and through direct contact with the researcher. It is possible that the findings may be biased in reflecting the experiences of a particular network of participants with similar socioeconomic status. In addition, although purposive sample is not meant to be representative of the population, the disproportionate number of male participants may bias the results. Female members of YKDFN contribute to the use of harvested foods. Challenges encountered in recruiting female participants related to their availability. Female members expressed an interest in participating but frequently cancelled our meetings due to family and community responsibilities. Although female representation was limited, the three female participants of this study contributed significantly to the findings.

Suggestions for Future Research

Food and nutrition. Quantitative research should be undertaken utilizing the conceptual model introduced to study the impacts of global environmental change on the food security and nutritional status of Yellowknives Dene First Nations. The availability of dietary reference intakes on Arctic foods (Kuhnlein, Receveur, Soueida, & Berti, 2008) and data on the environmental contaminant levels in Arctic foods (Donaldson et al., 2010) provide the opportunity to capture a holistic assessment of YKDFN's nutritional status. Studies attribute the lower levels of contaminants found in Dene women to the absence of marine mammal consumption (Donaldson et al., 2010; Tsuji et al., 2005). However, findings from this study reveal YKDFN remain concerned about contaminant exposure thus studies measuring

contaminant exposure in members of YKDFN are also needed to determine actual exposure and health risk. Food security should also be assessed capturing the nuances of sharing practices and rising costs of harvesting.

Youth. Youth-centered studies exploring attitudes, beliefs, values and behaviors related to harvesting activities, traditional foods, land stewardship and leadership within the community are needed. Dene, Métis and Yukon children receive 4.3% - 4.7% of their total calories from traditional foods (Nakano, Fediuk, Kassi, & Kuhnlein, 2005). Although nutrient intake was improved even with small amounts of traditional food consumed, there were observed health risks that included excessive overweight and inadequate intake of some nutrients (Nakano, Fediuk, Kassi, Egeland, & Kuhnlein, 2005). Understanding YKDFN youth's attitudes, beliefs, values and behaviors will help tailor programs that promote healthy behaviors that are relevant to youth and contextualized to their reality. It also provides an opportunity to understand how youth conceptualize their environment, nature and health.

Youth centered studies utilizing mixed methods may also prepare YKDFN for its future leadership. Questions of interest may include: What is their interest level in harvesting traditional foods? What do they know about their community's current state of land business? What role do they envision having in their community? What do they envision for the future? What are their goals? Elders and middle-aged participants often referenced their attendance at community meetings as a source of learning about Dene's priorities and what it means to be Dene. However, advancements in technology and the introduction of organized sports have replaced many traditional activities. Youth centered studies may also help inform communication strategies that leverage the technologies and social media space preferred by youth to keep them engaged in the priorities of YKDFN.

Conclusion

On a broad scale, a paradigm shift is needed in public health nutrition to adopt an ecological model that addresses the health challenges of today's anthropogenic age (Rayner, 2009) while supporting the sustainability of ecosystem services. The current anthropogenic era is characterized by the growth in human population and economic activity that threatens the existing ecological balance (Rayner, 2009). Thus, conceptual models related to climate and global environmental change, food and nutrition security, and health are needed to provide guidance to decision-makers and stakeholders worldwide. The findings from this study provide insight for localized decision-makers that include Aboriginal governments and the Government of Canada and of the Northwest Territories. Furthermore, these findings also lay groundwork for a much-needed supranational understanding of how we can better support diverse and sustainable food systems that account for climate and global environmental change.

APPENDIX A: INTERVIEW GUIDE

Nutrition and health in a changing climate and environment

Instructions for investigator:

Greet and introduce self to participant

Explain the purpose of the study and describe what will happen during the interview

Ask if he/she has any questions

Provide a copy of the informed consent and review it with the participant

Allow the participant time to read the informed consent and ask if he/she has any questions

Perform the comprehension assessment and obtain signature [from participants who demonstrate comprehension of the informed consent]

Inform the participant that you are starting the recording and turn on the digital audio-recorder

Begin interview

I am interested in hearing your story about how you manage your nutrition and life in a changing climate and environment. I will ask you broad questions and mostly be listening, if I have any further questions or something is not clear I will ask you. Let's begin.

1. I am interested in knowing more about the experiences of Dene First Nations who harvest traditional foods in a changing climate and environment. Could you tell me about your experiences in harvesting traditional foods?

Prompts: Tell me as much as you remember about when you first began harvesting and using traditional foods; who did you learn from; how has harvesting traditional foods changed over time; how do you feel about these changes; what past events have occurred that contribute to the changes that stand out in your mind; what current events are presently occurring that are contributing to the changes (Government? Immigrants? City?).

Parents: How do you teach your kids about traditional foods? Harvesting? What future would you like for your kids?

2. For some people harvesting traditional foods is a shared experience. For others it is not. Could you tell me about the people who share the experience of harvesting traditional foods with you?

Prompts: Who goes with you to harvest traditional foods; have you taken people who want to learn from you how to harvest traditional foods – if so, who are they; tell me about the last time you taught someone how to harvest traditional foods; how often does this [teaching] occur; who helps you skin, clean and prepare [cook, smoke, dry] traditional foods; how did you choose this person; could you tell me about a time when you shared the [traditional foods] with other people outside your home; how often does this [sharing] occur; how do these activities mean to you, your family, your community; how do these activities affect you, your family, your community.

3. Have there been times when you didn't have traditional foods (wild meat? Fish? Berries?) Please think of a time when you were unable to harvest traditional foods. Could you tell about that time?

Prompts: What was happening; how did you feel; what did being unable to harvest (Not Having) traditional foods mean to you.

4. Some people talk about having a spiritual experience (feeling better after being on the land) when harvesting traditional foods. Others do not. Could you tell me about your spiritual experience when harvesting traditional foods?

Prompts: How do you feel when you are harvesting traditional foods; what does it mean to you to have a spiritual experience when harvesting traditional foods; how would you describe your relationship with the land; has your spiritual experience in harvesting traditional foods changed-how; how do you feel about those changes [in spirituality experience in harvesting traditional foods.]

5. Some people talk about eating less traditional foods and more "Western foods" [processed.] Others do not. Could you tell me about what foods you eat?

Prompts: What factors influence what foods you have in your house; what factors influence what foods you eat; how do you balance your consumption of traditional foods with store [processed] foods; how did you learn to balance traditional foods with store foods; how do the foods you eat today differ from when you were a child (or young adult).

6. What are the healthy foods you like to eat? Have there been times when you didn't have (or couldn't get) these healthy foods? Could you tell me about those times?

Prompts: Have you experienced trouble in getting nutritious/healthy foods – if so, please describe; have you experience confusion about what foods are healthy; confusion about how to balance traditional foods and store foods; difficulty in knowing how to prepare/cook; how did you do (to resolve dilemma); are there people who helped you – how; how do these dilemmas affect how you look; how you feel about yourself; your health; any medical conditions according to you or your physician.

7. Looking back, how do you feel about the changes in Dene First Nations' diet that is the everyday foods that are usually consumed?

Prompts: How would you describe the changes in Dene's diets; in what ways have your decisions influenced these changes; what other things influenced these changes; what could make these changes better/worse.

For women: How would you describe the changes in Dene's diets during pregnancy? Breastfeeding?

8. I'd now like to talk about physical activity. What kind of physical activity do you do?

Prompts: How often; what type of physical activity is required when you harvest traditional foods; how does all (e.g. exercise, walking, house maintenance, harvesting TF) of the physical activity you currently do compare to when you were a younger adult, teenager, child; how have the changes in the amount of physical activity you do affect how you look (how your clothes fit); how you feel; your health; your medical condition according to your physician.

9. What are the sources of well being for you?

Prompts: Are there people who help you, who are they, how do they help you; what kind of things do you do to feel well and be healthy; what does it mean to be healthy to you.

10. I'd like to also talk about some of your beliefs. What does it mean to be Dene?

Prompts: What kinds of things do you do that makes you feel Dene; what do you talk about or not talk about; from whom did you learn how to be Dene; how have these learning experiences changed; what is the role of harvesting traditional foods.

11. If you had your community leaders right here in front of you, what would you say to them about the changes in Dene's diet and access to traditional foods?

Prompts: What kinds of things can they do to help you harvest and use traditional foods and eat healthy foods; what has been done in the past that was helpful; how did you feel; what has been done that was not helpful; how did you feel.

12. Is there anything else you would like to tell me so I could better understand what it is like to harvest traditional foods and eat healthy in a changing climate and environment?

13. What do you think would help Dene adjust and be healthy in a changing climate?

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