

“Walking in two worlds and not doing too well in either”

Investigating vulnerability and climate change in Nunavut,
Canada

Kate Whitfield

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LUCSUS

Lund University Centre for
Sustainability Studies



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Abstract

Arctic communities are currently experiencing the effects of climate change. This paper contributes to a growing body of vulnerability and adaptation research in the Arctic. This case study provides an assessment of current vulnerabilities and offers insight into how climate change is experienced in the hamlet of Cambridge Bay, Nunavut. The predominantly qualitative research method involved semi-structured interviews, a focus group, surveys, and community observations. Local residents reported that factors such as higher and less-predictable temperatures and changing sea-ice patterns affected the quality and availability of local country foods, exacerbated hunting risks, and caused emotional stress. Local adaptation strategies included modifying diets to store foods and altered hunting strategies. Adaptation strategies are not exclusively a result of climate-related changes, as they interconnect with the broader transition toward a less traditional lifestyle, including changes in family networks and a disconnection from traditional ways of hunting. Respondents reported their daily experiences with local environmental changes, including unpredictable characteristics of ice and weather, dwindling caribou populations, new non-native wildlife species and a changing landscape. However, with few subsistence hunters, livelihoods and food security were not significantly affected by climate change. This study provides a snapshot of one Arctic community, where assessing vulnerability encompassed local perspectives of living in times of great environmental and cultural change. Unlike traditional vulnerability studies that typically overlook cultural and social realities, this paper emphasizes them while providing insight into the vulnerability of one particular community in transition.

Key Words

Ethnography; Arctic climate impacts; Inuit communities; food security; hunting; Inuit traditional knowledge; adaptive capacity; vulnerability scoping diagram

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1. Introduction

Arctic Canada has experienced many changes over the past fifty years regarding environmental and cultural evolution (Bonesteel, 2006). Moreover, Arctic communities are considered to be vulnerable to both climate change and food insecurity (Beaumier & Ford, 2010; Ford & Furgal, 2009; Pearce et al., 2009). Research concerning the implications of climate change on people, the livelihoods of those people, and on the human capacity to cope with and adapt to changing climactic conditions is growing. Trends in research recognize what impact climate change will have on biophysical systems (IPCC, 2007), but require knowledge on how people experience and respond to such changes.

1.1. Climate change adaptation in the Arctic

The world's polar regions are recognized as: geopolitically and economically important, extremely vulnerable to current and projected climate change, and having the greatest potential to affect global climate and therefore affect human populations and biodiversity (Anisimov et al., 2007). People living in the world's Arctic regions are experiencing a warming climate that has caused dramatic changes in weather, vegetation, and animal distribution patterns over the last 50 years (Anisimov et al., 2007). Arctic communities, and populations worldwide, have adapted to weather or climate related events (Pachauri, Reisinger, & (Eds.), 2007). People living in the Arctic have always lived under harsh climatic extremes, suggesting that the capacity to adapt to extreme conditions is a part of Inuit culture (Langdon, 1995). However, due to less stable and predictable weather patterns, unpredictable and declining sea ice, changing snow quality, new non-native species, more storms and erosion and stronger sunlight, climate change is occurring faster than communities' ability to adapt, and in some cases it threatens cultural survival (Anisimov et al., 2007).

Responses to climate change can be categorized into either mitigation or adaptation; both recognized as equally important. Since issues of climate change have gained global attention, the predominant responses by parties of the United Nations Framework Convention on Climate Change (UNFCCC) and federal governments (such as the Kyoto protocol) have been mitigation. Mitigation refers to efforts to reduce or stabilize anthropogenic greenhouse gas emissions. As

climate trends and scientific evidence prove the climate has changed, need for adaptation methods are also increasingly important. Decision making bodies at micro to macro levels have recognized the need for partnership between mitigation and adaptation efforts. Regardless the scale of mitigation that has already occurred or that will occur over the next few decades, adaptation measures will be required to reduce the impacts of projected climate change and variability (Anisimov et al., 2007). Adaptation can be defined as "the ability of nations, sectors and communities to cope with climatic changes" (Ford & Smit, 2004: 390). Adaptation needs have been recognized beyond the UNFCCC, to the United Nations Development Programme (UNDP), the Intergovernmental Panel on Climate Change (IPCC), Canada's Climate Change Plan, the Canadian Climate Impacts and Adaptation Network (C-CIARN).

1.2. Vulnerability research program

In this context, vulnerability is a function of three dimensions: 1) exposure to specific social and/or environmental stresses, 2) sensitivities to these stresses, and 3) adaptive capacities to these stresses (Turner et al., 2003). Various vulnerability approaches are being utilized due to recent developments in inter-disciplinary fields (Eakin & Luers, 2006), like sustainability sciences. There is no definitive scale or scope in adaptation studies and small-scoped analysis are insightful contributions to the growing body of vulnerability research (Moser & Ekstrom, 2010). Research on reducing vulnerability addresses the complexities of the issue in relation to socio-environmental systems, which are critical for understanding the challenges facing human environmental systems (Eakin & Luers, 2006).

The broad overarching framework by Ford and Smit (2004) is used in this study. This framework is elaborated on in the paper: *A Framework for Assessing the Vulnerability of Communities in the Canadian Arctic to Risks Associated with Climate Change* (figure 1). This framework is meant to assist vulnerability and adaptability analysis in relation to climate change in the Canadian Arctic. Ford and Smit (2004) indicate that information gained through observations, experiences, and traditional local knowledge is a central component to current vulnerability assessment. Stage one of the process involves an assessment of current vulnerabilities by documenting climatic risks in the community (current exposures) and strategies used to address such risks (current adaptive capacity). Future work could include predicting the degree to which the community can deal with future exposures and vulnerability. This would involve "estimating directional

changes in exposure and predicting future adaptive capacity on the basis of past behaviour" (Ford & Smit, 2004: 395). However, this is beyond the scope of this paper.

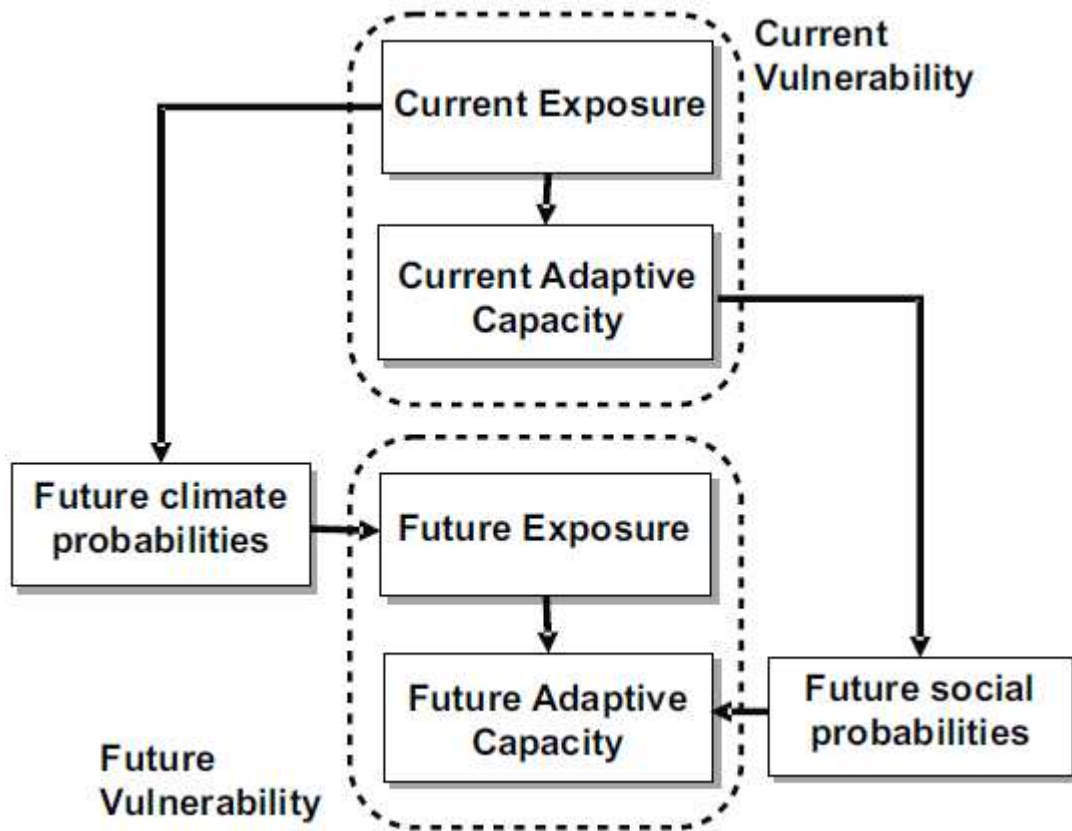


Figure 1: Framework from Ford & Smith (2004)

This study uses a vulnerability scoping diagram (VSD) as a tool to conceptualize and visualize the vulnerability of this case study. The exposure unit is the town of Cambridge Bay, Nunavut. The VSD was developed by Polsky et al. (2007) and used to scope vulnerability in winegrowing by Nicholas and Durham (2012). One purpose of the VSD is to make vulnerability analyses more comparable by providing a tool to categorize vulnerability in a standardized diagram. In this research, gathered data is plotted into the VSD (see discussion, section 4). The three dimensions of vulnerability are categorized as 1) exposure 2) sensitivity and 3) adaptive capacity (Turner et al., 2003). Procedures that evaluate vulnerability stresses have been identified as considering adaptation options, coping capacities, determinants of adaptive capacity (Yohe & Tol, 2002) and the limited capacity to adapt to stress (Nicholas & Durham, 2012).

1.3. Arctic food (in)security

Climate change can impact Arctic food security by affecting communities' hunting abilities and the local wildlife. The IPCC stated that hunters in Nunavut reported noticeable changes in the thinning of sea ice and reductions in ringed seal populations (Anisimov et al., 2007). Much of the work referencing the Canadian Arctic originates from the Climate Change Adaptation Research Group at McGill University, lead by Dr. James Ford. Due to the close relationship between traditional hunting practices and the land, climate change can impact traditional foods. Ford and Furgal (2009) identify a need to expand research on the implications of climate change on food security in food systems dependent on hunting and fishing. One study has shown that changing sea ice dynamics and weather variability in Ulukhaktok, North West Territories, has affected the health and availability of some wildlife species, and has exacerbated risks associated with hunting and travel (Pearce et al., 2009). Climate change does not cause insecurity in the Arctic but exacerbates it. Socio-economic forces such as poverty, difficulty transitioning into the Western monetary system, and rising gasoline prices drive food insecurity, affecting both traditional country foods and store bought foods (Beaumier & Ford, 2010).

Food security is a topic of concern in Canadian Indigenous communities, including Inuit communities in the Arctic. Canada's Food Security Action Plan (1998) acknowledges the importance of traditional hunting, fishing, gathering, bartering, and trading play in food security. The plan proposes actions to strengthen access to foods, related to the reduction of environmental contaminants, sustainable management of resources, and supplementing high quality commercial foods (Canada's Action Plan for Food Security, 1998). Key factors determining the level of food security include poverty, unemployment, food sharing, traditional knowledge, climate change, land access, environmental contaminants, access and availability to market foods and various social concerns (Power, 2008). Barriers to food security of traditional foods include low income levels, high harvesting costs and lifestyle and cultural changes (Chan et al., 2006). Food insecurity is a daily reality in many Nunavut communities. The role of traditional foods and related practices and climactic conditions are seen as contributing factors (Qaujigiartiit Arctic Health Research Network Nunavut, 2009).

1.4. Area of interest

The Arctic is a significant area of interest for studying human adaptation to climate change. Arctic sea ice continues to disappear, reaching its second-lowest seasonal minimum and the least volume on record in 2011 (Environment Canada, 2011). Various scientific sources have confirmed the reduction of sea ice (appendices 1 and 2), and the effects are recognized as threatening at the local-level. Climate change is expected to be felt earlier and more extremely in the polar regions, where large temperature increases and high variability of weather conditions are expected (Anisimov et al., 2007; Berkes & Jolly, 2001).

The Canadian territory of Nunavut covers approximately one-fifth of Canada's land mass, but makes up less than 1% of the total population (Nunavut Bureau of Statistics, 2012). Its total population of 33,322 (in 2011) is dispersed between 28 small and isolated communities ranging in size from 5 to 6,699 inhabitants. A high percentage (83%) of residents self-identified as Inuit in 2006. Communities are organized into three administrative regions: the Baffin (Qikiqtani) region, Keewatin (Kivalliq), and the Kitikmeot (figure 2). The territory's population growth rate is three times the national average, with 60% of the territory under the age of 25 (Hicks & White, 2000).

The Nunavut food system consists of traditional (*country*) foods and modern (*store*) foods (figure 2). Traditional country foods include all processes associated with hunting, harvesting, preparing, sharing and consuming foods obtained from local natural resources. Roughly 71% of Nunavut residents participate in the harvesting of country foods such as caribou, whales, seals, ducks, muskoxen (called muskox), and berries (Tait, 2008). Of those who participated in harvesting, 96% share country food with others amongst the community (Tait, 2008), although this percentage varies per community. Store foods are available at modern grocery stores and arrive by barge or jet. Food mail can be ordered from major cities and flown to communities, but require a credit card.

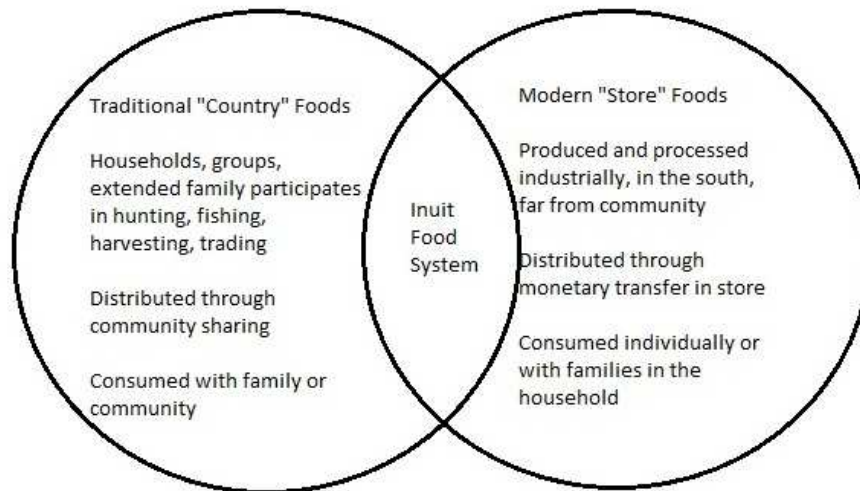


Figure 2: The Inuit Food System

The dwindling caribou populations in the Kitikmeot (central Arctic) region causes environmental and food security concerns (Miller & Gunn, 2003; N. L. Thorpe, 2000). Two recent research projects sparked interest on this issue. One project focuses on caribou health in the Gjoa Haven community by examining the connection between the caribou and the community's well-being by centering on the knowledge transfer between community elders and youth. Research by Thorpe (2000) at the University of Toronto provided further insight into methodology, where she used inductive, and adaptive semi-structured and participatory data collection methods to investigate contributions of Inuit ecological knowledge on understanding impacts of climate change on Bathurst caribou in the Kitikmeot. The Peary caribou, an endangered species, has shown roughly a 98% population decline in the Arctic's Queen Elizabeth Islands in Canada since 1961 (Miller & Gunn, 2003). Due to the vastness of the Arctic, few scientific projects and the Inuit connection with the land, there is significant value of incorporating Inuit traditional knowledge into studies on caribou in the Arctic (Ferguson & Messier, 1997; N. Thorpe, Hakongak, Eyegetok, & Elders, 2001; N. L. Thorpe, 2000).

1.5. Research questions

In this study, the following four research questions will be addressed. These questions will answer the main research objectives, which are; to understand local Arctic experiences with

climate change, to communicate how climate change impacts access and availability of food, how this community is vulnerable, and how this vulnerability could affect the capacity to adapt to climate change.

For the community of Cambridge Bay, Nunavut:

1. What cultural insights are valuable to understand adaptive capacity?
2. How are residents experiencing climate change?
3. How are residents adapting to climate change?
4. What are local food security concerns?

This paper will proceed by outlining the chosen methodological process for answering the above research questions. The findings section will be organized by these four questions, and according to uncovered themes. The findings will be plotted into a vulnerability scoping diagram (VSD) and many will be discussed according to components of vulnerability (adaptive capacity, sensitivity and exposure). Before concluding, reflections, community-level recommendations and implications for further research will be stated. As mentioned, Arctic regions are particularly vulnerable to climate change, and changes in the polar regions have the greatest potential to effect the global climate. Thus, documenting local observations of change, and communicating reported local experiences with change, this research contributes a local-level understanding of the reality that is climate change. It also contributes to a growing body of research on vulnerability and adaptation to climate change.

2. Methods

2.1. Case study

A case study approach was used to provide detailed and intensive analysis on a single case (Bryman, 2004). This case study aimed to examine climate change and associated vulnerabilities in the community of Cambridge Bay. Case studies weave together inquiry traditions and qualitative methods to reveal a story with depth and purpose (Patton, 2002). The primary advantage to using a case study is that it provides more detail than other methods (Neale, Thapa, & Boyce, 2006). Case studies allow researchers to present data collected from multiple methods to provide a more complete story (Neale et al., 2006).

Case studies are a valuable methodology for vulnerability research. This approach enables a comprehensive study of a particular area (e.g. community) to characterize vulnerability and determinants of vulnerability (Ford et al., 2010). This approach helps the researcher to better understand how determinants interact and may help him/her to identify opportunities to reduce vulnerability and enhance adaptive capacity to climate risks (Ford et al., 2010). Furthermore, Ford et al (2010) suggest temporal analogue methods that investigate past and present experiences and responses to provide insights for future vulnerability to climate change.

2.1.1. Description of field site

Cambridge Bay, Nunavut is located on Victoria Island in the Arctic archipelago in the central Arctic region of Kitikmeot (figure 2). Co-ordinates are a latitude of 69° 6.6' N, and longitude of 105° 8.4' W, which is 1790 km north of Edmonton, Alberta (Nunavut Planning Commission, 2011a). The hamlet's 2011 population was 1608 inhabitants (Nunavut Bureau of Statistics, 2012) and as of 2006, 78.9% of residents self-identified as Inuit (Nunavut Bureau of Statistics, 2012). Cambridge Bay has a dual economy (both wage-based and subsistence-based) and a dual food system (both traditional and contemporary). In this paper, "residents" and members of the "community" are terms used to describe people living in the hamlet of Cambridge Bay at the time of field work. The use of "community" is only used in reference of the settlement of Cambridge Bay.

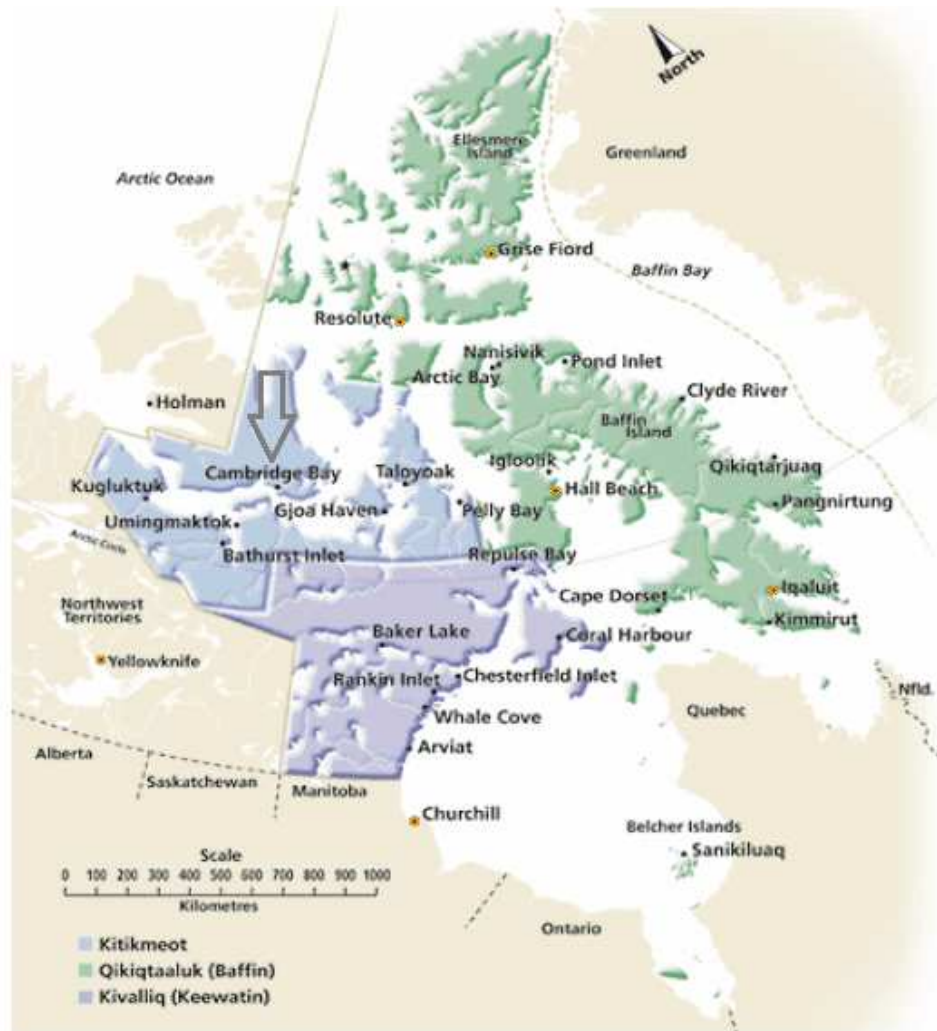


Figure 3: Map of 3 Nunavut administrative regions and 27 communities. *From Shirley, 2004. Arrow added by author, pointing to case study location.*

Cambridge Bay is one of two Nunavut communities where the Inuinnaqtun language is traditionally spoken. Inuinnaqtun is considered a dialect of Inuktitut, which is more widely spoken throughout the territory. As of 2010, only 12 percent, or 290 of the 2345 Inuit living in Cambridge Bay and Kugluktuk, cited Inuinnaqtun as their first language, suggesting a serious loss of the native language (NTI, 2011). According to the Nunavut Bureau of Statistics (2007), Inuinnaqtun is exclusively spoken by 140 inhabitants of Cambridge Bay, which is less than Inuktitut. The deterioration of the Inuinnaqtun language is an integral part of this study, and will be expanded upon.

The hamlet's Inuinnaqtun name is Iqaluktuuttiaq, meaning "good fishing place," as the surrounding lakes and rivers are known for excellent fishing (Nunavut Planning Commission, 2011a). Arctic char from this region is renowned and shipped across the Arctic and beyond (Nunavut Planning Commission, 2011a). Inuit of this region were unique due to their use of copper tools, and are known as Copper Inuit (Inuinait). Traditionally, Inuinait lived nomadically, following herds of caribou, muskoxen, and fishing, depending on the seasons.

Significant events for Copper Inuit after European contact included the establishment of the Hudson's Bay Company (HBC) who acted as early stewards of Inuit of the region, contact with the Canadian Arctic Expedition, the Residential School system, and the Cambridge Bay Distant Early Warning (DEW) Line (appendix 4). The majority of the change for the Copper Inuit has taken place within the past 60 years; illustrating the extremely short transition from traditional Inuit to modern Western ways. Today, most Kitikmeot Inuit live in houses and are employed by local government or businesses, and many hunt and participate in traditional activities to preserve their traditional way of life (Kitikmeot Inuit Association, n.d.).

Inuit Qaujimajatuqangit (IQ) is a common phrase in Nunavut, often translated as Inuit traditional knowledge (ITK) and is considered a guiding principle in Inuit life (Thorpe et al. 2001). Although IQ is typically understood as exclusively traditional knowledge, it is more accurately defined as, "the Inuit way of doing things: the past, present and future knowledge, experience and values of Inuit society" (Sivummut Economic Development Strategy Steering Committee, 2003). This presents a challenge due to the complex, varied and evolving meaning, depending on the individual, community or context (ITK & NRI, 2007). For a more comprehensive discussion, see Stevenson (1996). Due to distance from Western belief systems and ontology, there is a general lack of understanding in what ITK is, how it is constructed, and what role it can have in environmental assessments (Stevenson, 1996). Even the term "traditional" knowledge, how it is used in this study, implies that it is not contemporary, which could be interpreted as withdrawing some relevance to present day issues and events. In this paper, Inuit traditional knowledge (ITK) is used when referring to this overarching concept.

The hamlet of Cambridge Bay, Nunavut was chosen as a field site due to access. The initial connection to this location was made through the researchers brother who was previously

based out of the community as a pilot. Housing in the area is typically difficult to find and expensive. Without the previous contact, this would have been an extremely challenging study location for an independent researcher. There is a relatively high level of research interest in Nunavut and Arctic Canada. This is likely due to the unique Inuit populations and high levels of anthropological, environmental, and historical significance. Inuit health is a research area with high interest due to health-related discrepancies between Inuit populations and the general Canadian public. Inuit lung cancer rates are amongst the highest in the world, and communities have significantly lower contact with healthcare professionals than the rest of Canada (Tait, 2008). Food security is a federal-level concern, as the median income (\$16,970 CAD) is lower than the rest of the country (\$25, 615 CAD) and the cost of food is higher (Tait, 2008).

For the above reasons and more, an over-saturation of (non-Inuit) researchers can leave negative impressions on local residents. To minimize negative impact on local communities, the Nunavut Research Institute (NRI) grants research licenses for all research projects undertaken in the territory (appendix 5). The process requires the support of a community sponsor as well as an elected official. This ensures the community approval of the research design and the time-frame of the study, and that the project will benefit the community (ITK & NRI, 2007). This research was approved for a two-week period in March, 2012.

2.2. Conceptual foundations

This methodology was inspired and informed by aspects of an ethnographic research style. An ethnographic approach was deemed appropriate, since an understanding Inuit culture was essential when characterizing community vulnerability. The study of ethnography incorporates social sciences to better understand culture and way of life of groups of people (Patton, 2002). Modern ethnographic methods can be applied to the study of contemporary society and social problems, such as globalization or environmental degradation, and the approach can be used to understand culture in relation to change (Patton, 2002). The research style of sustainability sciences has broadened to incorporate other methodological styles such as ethnography (Khagram et al., 2010).

Considering the nature of this research project, identifying the researcher's conceptual foundations and philosophy of knowledge was deemed valuable, since external influences from

the researcher's personal position are inevitable in qualitative research (Denzin & Lincoln, 1994). The philosophy of knowledge follows interpretivism, which is commonly combined with ethnography "because it allows the lived experience of people in natural settings to be examined, deciphered and explicated" (Khagram et al., 2010). Interpretivist research seeks to understand the views of actors and communities of actors, and the "goal is not necessarily to generate objective truths, but to revisit and critique existing interpretations, often to conceptually emancipate people or ideas that are oppressed or manipulated" (Khagram et al., 2010).

2.3. Study design

Within the broader case study, inspired by an ethnographic approach, this study applied multiple data collection methods, identified as "mixed methods research" (Bryman, 2004). This process involved preliminary quantitative data collection from surveys, however, qualitative data collection provided the bulk of material for this study. Qualitative methodology offers a holistic approach where the researcher is the key instrument in the data collection process. Most often the analysis of data is inductive and focuses on participants' perspectives and their meanings (Ragin, 1987). For this study, the most relevant manner of communicating findings was through the stories of participants and in incorporating local voices and experiences. Triangulation was utilized to "check for internal consistency and improve reliability in data collection and interpretation" (Khagram et al., 2010), and was performed by connecting qualitative field observations and thematic content analysis with quantitative survey findings. Methods of content analysis are expanded upon in section 2.4.1.

2.4. Data collection and analysis

2.4.1. Interview

Ten interviews (interviewing twelve participants) were conducted lasting approximately 30 to 60 minutes each. Interviews provided the primary source of data. The interviews followed a semi-structured process because it "frees the interviewer to concentrate on the topic and the dynamics of the interview" (Brinkman & Kvale 2009: 130). Purposive (for elders and hunters), snowball (asked for recommendations), and convenience (who is available) sampling methods were used to obtain interviews. In-person interviews were conducted either at the

interviewee's homes or in a private spot at the community library. In-person interviews were conducted with respondents in pairs for two elderly married couples who required Inuinnaqtun-English translation. Interviews in pairs were suggested for the comfort levels of the interviewees and due to interpreter costs. The interviews were recorded using a Sony ICD-AX412B Digital Voice Recorder, and fully transcribed. Three informal interviews were conducted with individuals at the local library and were not recorded. All interviewees were made aware of the nature of the study and signed a statement of informed consent (appendix 7).

The purpose of the interviews was to gather qualitative data to enhance the richness of the study and go beyond what surveys and focus group findings can offer. Using in-depth interviews allows for the opportunity to capture local voices and tell stories as well as to develop inductive (unexpected) findings. The interviews were meant to contribute knowledge about adaptation strategies. Eight out of twelve interviewees had knowledge of the land, and/or practiced hunting, and were chosen in part for their knowledge which contributed to answering RQ's 1 and 4. Interviewees were selected on the basis of having lived a minimum of five years in Cambridge Bay and were over the age of 18. Pseudonyms are used in the text to respect participant confidentiality.

Table 1: Information on interviewees (N=12)

Name	Age	Heritage/ Birthplace	Interview Type/ Additional involvement	Occupation category	Details/ description of interviewees
Benjamin & Betsy	83 & 74	Inuit/ Nunavut	Couple interview/ focus group	Elders Hunter/ Seamstress	Married elder couple, lived at DEW line where Benjamin worked; Peggy was born on the mainland, Benjamin caches/ dries char (a delicacy); have a big family (biologically and adopted); one son is a full-time hunter
George & Peggy	79 & 73	Inuit/ Nunavut	Couple interview/ focus group	Elders Hunter/ Seamstress	Married elder couple; raised their children off the land, travelling nomadically, hunting and fishing; store food still does not keep Peggy full.
Phillip	57	European/ Ontario	Individual interview	Public Sector	Described as a non-Inuit Inuk; lives off the land during summertime; lifestyle is interconnected with the land; chips ice for drinking water; avid bird watcher; extensive knowledge of environment and wildlife; watched narwhal hunt from shore.
Tom	53	Inuit/ Yellowknife	Individual interview/ survey	Public Sector/ 	Modest hunter with extensive knowledge; grandfather; highly values tradition and country foods; drum dances as a hobby.
Jim	54	European/ British Colombia	Individual interview/ survey	Hunter/ Educator	Educator who has taught across the Arctic; extensive biology and wildlife knowledge; high interest in environmental changes; avid hunter; frequently on land.
Helen	45	Inuit/ Yellowknife	Individual interview	Educator/ Freelance	Inuinnaqtun language expert; daughter of a well-known local fur trader; helped establish local cultural initiatives.
Roberta	35	Inuit/ Yellowknife	Short interview	Student	Student at local college; from neighbouring community; mother of 4.
Anna	32	European/ Ontario	Individual telephone	Non-Profit Sector	Expert in Inuit culture; closely linked to elders, youth and cultural initiatives.
Samantha	32	Inuit/ Yellowknife	Short interview	Home maker	Mother of 3; survivor of hunting accident; no longer spends time on the land.
Joe	27	Inuit/ Yellowknife	Short interview	Hunter/ Public Sector	Young hunter; hunting is important to his culture and he loves doing it; modern Western interests.

This thematic analysis was modelled after qualitative or ethnographic content analysis (Bryman, 2004). This approach allowed categories to emerge out of data and recognized the importance of the context of the people and places being analyzed (Bryman, 2004). This analysis of text began with transcribing interviews. Once transcripts were printed, they were read once and initial themes were identified. A theme key guided the coding process (appendix 8). On subsequent readings of the transcripts, highlighters were used to visually identify themes and sub-themes that emerged. This was followed by cutting and sorting text according to themes (appendix 9), with the aim of coding or categorizing content in a replicable manner. The data analysis was iterative and allowed for both inductive and deductive themes to emerge from the text.

2.4.2. Focus group

One focus group with elders from ages 65-85 was conducted at the community library and cultural centre. The focus group was preceded by a community meeting discussing a local art project. The meeting was also an opportunity to introduce the project and researcher presence to the elders. Fourteen community elders, as well as a couple of library users attended and were served traditional bannock, coffee and tea. Many in attendance spoke very little to no English, wore traditional parkas and a few used canes and walkers. An Inuinnaqtun-English interpreter translated the meeting. Open-ended discussion questions were presented at the end of the meeting. The meeting was videotaped and from the recording, the discussion was fully transcribed. Prior to commencement, all elders signed a statement of informed consent in Inuinnaqtun (appendix 7) and the study was explained by the interpreter.

The focus group was intended to make first contact with the local residents, and give a first sense of local experiences. Photos of the Arctic tundra, store foods, and of locally hunted wildlife such as caribou and muskox were shown to initiate conversations on current exposures to environmental changes (specifically flora, fauna, weather and climate), as well as how the traditional food system is vulnerable to changing environmental conditions. Thus, this provided data for RQ 2 on experiences with climate change. "Climate change" was purposely not mentioned until the end of the discussion, but was brought up early on by elders. This contributed to data for RQ 1 on cultural values important for adaptive capacity. Topics like "what does climate change mean to you" and "what comes to mind when you hear 'climate

change' or 'global warming'?" were eventually discussed. This also exposed personal views on the environment and food security concerns.

Table 2: Information on elders focus group participants (N=14)

Name	Age	Traditional activities	Additional involvement in study
Johnny	85	Sews, Fishes, Hunts	
Benjamin	83	Sews, Fishes, Hunts	Couples interview
Ellen	82	Sews, Fishes,	
Emma	79	Sews, Fishes,	
George	79	Sews, Fishes, Hunts	Couples interview
Peter	78	Fishes, Hunts	
Betsy	74	Sews, Fishes,	Couples interview
Anne	74	Sews, Fishes,	
Peggy	73	Sews, Fishes, Hunts	Couples interview
Liz	73	Sews, Fishes,	
Lois	73	Sews, Fishes,	
Joyce	69	Sews, Fishes,	
Betty	65	Sews, Fishes, Hunts	
Joan	65	Sews, Fishes,	

2.4.3. Survey

A survey was administered to residents of the community, which was used to address three research questions, on experiences of climate change, adaptation to climate change and food security. The survey was initially in Likert ranking format, but was edited in the field to true and false questions about statements concerning environmental change and food security due to low reading and comprehension levels. Upon discovering barriers with survey research, oral surveys were administered with three participants. This was more qualitative approach, allowing for in-depth data. These oral surveys are considered part of the interviews and called "short interviews" (table 4).

Statements from the Arctic Climate Impact Assessment were taken to compare experiences in Cambridge Bay to the rest of the Arctic, significantly contributing to data for RQ 2 on experiences of climate change. The statements on food security were based on the FAO's Human Right to Food Standards, contributing valuable data to answering RQ 4 on food security concerns. Surveys were handed out at the community library during open hours and at "adult night" where possible respondents had to be over the age of 18. Convenience (available people)

and purposive (seeking knowledge of the land and long-term residents) sampling methods were used. A table was made that included all research questions and corresponding survey and interview questions (appendix 6).

Table 3: Information on survey participants (N=12)

Age	Gender	Heritage	Years in C.B.	Job Field	Hobbies
53	Male	Inuit	38	Carpentry	Drum dance, hunt, fish, travel
52	Male	European	5	Education	Fishing, hunting, on land
51	Male	Inuit	40	Unemployed	Cross-stitching, hunting, fishing, mechanics
47	Female	European	3	Education	Hiking, reading
47	Male	European	N/A	Research	Fishing, ATV
40	Female	Inuit	40	Traditional food	Sewing
34	Female	Inuit	34	Healthcare	Working
29	Female	Inuit	13	Education	Sewing, drum dancing, fishing
29	Female	Inuit	10	Education	Fishing, hunting
24	Female	Inuit	24	Caregiver	Time with friends
22	Female	Inuit	11	Caregiver	Time with friends
19	Male	Inuit	10	Labour person	Snowmobile, anything on the land

2.3.4. Observation

Observations began on flight from Ottawa to Iqaluit and continued for the duration of field work. This included personal observations during flight stopovers while crossing the Eastern Arctic. This allowed for some comparisons to be made to other Nunavut communities, including landscape, weather, clothing, homes, and language. In Cambridge Bay time spent at the community library, cultural centre and museum, visits with the elders' sewing group, visiting people's homes during interviews, the grocery store, observations while walking around town, and informal conversations all influenced views. Key observations were recorded in my field notes and are incorporated in this paper where possible. Casual conversations with experienced hunters, particularly one who was a former environmental researcher, influenced the study. Pamphlets on local invasive species, local newspapers and magazines, as well as posters on local initiatives influenced observations. See appendix 10 for the "March is Nutrition Month" advertisement that was observed in newspapers and in public spaces.

2.4. Qualitative thematic analysis

The chosen method of qualitative analysis follows the methods outlined by Ryan and Bernard (2003), who describe themes as uncovering 'what is this expression an example of?'. Themes are described as the conceptual linking of expressions that can range from broad and sweeping to more focussed and link specific kinds of expressions (Ryan & Bernard, 2003). The process of uncovering themes is iterative, and involves continually revisiting the data and revising the findings. Both "expected" content (deducted from the interview questions) as well as "a priori" (inducted from the stories and content) themes arose. The thematic analysis was deemed most appropriate to represent and organize both deductive and inductive themes. Deductive themes stem from characteristics of the phenomenon being studied; professional definitions, external constructs (e.g., on Inuit or climate change), and the values, experiences and beliefs of the researcher. In this study, all themes could not be anticipated prior to data analysis, despite the set open-ended questions (Ryan & Bernard, 2003).

Analysis began with transcribing interviews, which also improved reliability and validity of the study. However, it should be noted that informally, the identification of themes begins with the investigator's prior understanding of the phenomenon being studied (Ryan & Bernard, 2003). During transcription, and with field notes, preliminary themes were identified. Methods of searching for repetition, similarities and differences between transcripts and missing data were predominantly used. The transcripts were read multiple times during the data analysis process and themes and subthemes were uncovered. The iterative process continued while writing the findings section. The themes were finally presented and categorized according to research questions for clarity.

Table 4: Example of iterative process to uncover themes, answer research questions (RQ), and dimensions and components of vulnerability scoping diagram (VSD)

Raw Data	Phase 1	Phase 2	Phase 3	Phase 4	RQ's	VSD
<i>A) A lot of people do worry about the climate change.</i>	An expression of: Enviro. awareness	Perceptions of climate change	Enviro. perceptions (deductive)	Personal views on the environment Emotional stress and vulnerability	RQ 1 & RQ 3	Adaptive capacity/ Inuit way & Exposure/ climate change
<i>B) Like I said, it's different, like these days, I find the month of March is a lot colder than the months of January and February.</i>	An expression of: How the environment is changing	Climate change indicators (Recent unpredictability of weather and environment)	Enviro. indicators of change (deductive)	Vulnerability and exposure to climate change	RQ 2	Exposure/ climate change
<i>C) In January and February my wife and I talked about it... and even with the sun as high as it is now.</i>	An expression of: Enviro. concern & how the environment is changing (unrecognizable from the past)	Perceptions of climate change & climate change indicators (Contradicting Phillip's statement)	Enviro. perceptions and awareness (deductive) & Enviro. indicators of change (deductive)	Personal views on the environment Vulnerability and exposure to climate change	RQ 1 & RQ 2	Adaptive capacity/ Inuit way & Exposure/ climate change

Table 4 demonstrates the iterative process to uncover themes. Text was first categorized according to its interpreted expression. The above example is taken from Tom's transcript. Text from category A) began with an expression of environmental awareness, and was categorized under theme "pink" or environmental perceptions (appendix 8). Sub-themes were modified twice to include phase three, environmental perceptions, and phase four, identifying this as a deductive theme. Finally, this text was identified (coded) as both an expression of personal views on the environment, as well as an expression used to illustrate the emotional and stress-related vulnerabilities experienced by residents. Thus, this data was considered when answering research questions 1) what cultural insights are important to understand adaptive capacity? and 4) what cultural insights are valuable to understand adaptive capacity? Details on the scope and limitations of this research approach are provided in appendix 11.

3. Findings

3.1. What cultural insights are valuable to understand adaptive capacity?

With reference to the ethnographic component of this study, a sense of the Inuit way emerged as a key insight into understanding adaptive capacity. This included five sub-themes: 1) the family 2) distance from Western norms 3) blend of traditional and modern values 4) harshness of life and 5) spirituality and superstition. Personal views concerning the environment also emerged, and reflected respondents' beliefs and values in the community. This includes four sub-themes: 1) external and introduced concepts of climate change 2) oral history of climate change and 3) local environmental perceptions. In the following (and subsequent) themes, sub-themes are marked with bold text.

3.1.1. The "Inuit way"

The "**Inuit way**" theme emerged inductively during data collection in the field. The "Inuit way" is an important component of this analysis and is considered essential due to its interconnectivity with the research interests and it sets the background for upcoming themes. First, **the family** is a very important part of Inuit life. Traditionally, following the seasons, nomadic groups of families traveled around Victoria Island and beyond and eventually coming together as larger family units living at communal outpost camps¹ (using igloos and tents) and partaking in fishing and hunting. The history and language was exclusively oral. During interviews in elders' homes, immediate and extended family members dropped in, and the elders proudly showed off their collection of family photographs. Also, the tight bond within family networks were demonstrated by three funerals that took place while conducting fieldwork where families and large groups gathered and mourned together. In Cambridge Bay, the extended family network can extend to a large proportion of the town residents, making deaths very significant. The town bank closed due to the passing of an elder emphasizing the strong bonds that exist today.

A **distance from Western norms** was demonstrated through familial and matrimonial practices. Helen, the daughter of a local fur trader, reported: "my father had two wives before the

¹ "outpost camp" is a camp occupied by families or other groups of Inuit who occupy the particular location on a temporary, seasonal, intermittent, semi-permanent or a year round basis for the purposes of wildlife harvesting and the associated use and enjoyment of lands (Tunngavik Federation of Nunavut, 1993)

missionaries started coming around. It was normal for them. It was natural". Polygamy is no longer accepted, but informal adoptions remain a widespread practice, where children are raised by friends or extended family members. Recalling a story about a friend (now in her 50's), Jim stated: "Someone had put her outside of an igloo when she was a little girl. [...] So someone picked her up and kept her, and thought 'we'll raise her'... so they [did] practice infanticide. They couldn't afford a huge family..."

The common absence of family names also indicates the distance from Western norms. The naming of a baby is a very significant act in Inuit culture. Babies inherit namesakes and with that come an essence of that person's being. Anna, an expert in Copper Inuit Culture reported: "It's often a family member and the names are often associated with things that they're good at or known for. [...] A lot of children in town are named after people's fathers, brothers, or mothers, and it can be a boy's or a girl's name. [It's] unisex". Everyone has both an English name and an Inuinnaqtun name and shared Inuinnaqtun names can indicate that people are related. Observations indicated the common use of familial labels such as "sister" or "son" when speaking with family members, rather than using first names. This further demonstrated a resistance from Western names.

Field observations indicated a **blend of traditional and modern** aspects with some residents living relatively traditionally, and making traditional choices, but with modern amenities and interests. The youth observed at the community library were similar to "down south" in terms of language, slang, interests in computer networking, and references to pop culture. The hamlet had modern amenities such as a national bank branch, post office, two grocery stores, a recreation centre, pool hall, a state-of-the art high school and community library, as well as a combination Kentucky Fried Chicken and Pizza Hut restaurant. Trucks and Sport Utility Vehicles (SUV's) were a common sight in the hamlet, and reported as status symbols: "if you've got one, you've made it" (Phillip).

Observed traditional aspects included the widespread use of traditional *komatik* sleds for transporting people, supplies, and animals ready for harvest (typically pulled behind snowmobiles). Most residents used fur and skins for out-door clothing, notably wolverine parkas, mittens made from wolf and seal, and traditional hide and fur *gammack* boots. Use of

fur in outdoor clothing was also practical as it protected one from the frigid temperatures. Traditional *ulu* knives were used when serving frozen char and caribou at George and Peggy's home and also commonly used in the kitchens of Inuit and non-Inuit. Organized sewing groups were commonly held in public spaces and were frequented mostly by elders, however, were offered to residents of all ages and backgrounds. Traditional arts like drum dancing and throat singing are practiced and celebrated in the community (tables 2, 3 and 4 detail participants interests and hobbies). Anna, an expert in local culture, reported that celebrating one's Inuk has become trendy amongst youth, demonstrated by the changing of Facebook names to Inuit namesakes.

A physical distance or isolation from the rest of Canada was felt during time in the field. This was demonstrated when casually discussing a heat wave in the Toronto area, a resident compared talking about the weather in Ontario to talking about weather in Moscow. The Canada below Nunavut (or south of the Arctic circle) was often generalized and referred to as "down South" by residents. The Western or "white man's" way of doing things was called the *kablunak* way. *Kablunak* was used commonly in the community either derogatively or to emphasize the difference between the *kablunak* and Inuk (Inuit) way. The Western monetary system was considered foreign and it was learned that the Inuit way includes a focus on the present or living day-to-day. This was demonstrated through the financial struggles that Inuit residents have with banking; including saving, credit cards, loans and mortgages. This was a generalization made amongst the Inuit population, however, arose in numerous casual conversations

The sense of isolation was interconnected with expressions of **harshness**. This harshness was observed in the natural Arctic surroundings. Despite the harshness of life on the tundra and differing social challenges, the Inuit way demonstrated resilience. Elders communicated this through stories of surviving off the land before living in settlements, having survived long stretches without food. The word "harsh" was repeatedly used in interviews and was often accompanied by indications of strength: "and to see our elders having to live through it and they didn't complain. They never complained. And that is one of our Inuit culture and our tradition is to never complain" (Helen). Anna, an expert on Copper Inuit, described the Inuit way:

It is very, very stoic. Like you have to be if you want to get along. It's still kind of like that. This is a small community. It's kind of like igloo living, because if you do something, if you say something [...] it's all going to come back to you. It's not going to be peaceful. That is kind of the Inuit way. Like they don't dwell on things, they don't drudge things up.

Beliefs in **spirituality and superstition** were quickly observed in the field and were demonstrated by the Inuit legends told. According to local legend, the mountains, lakes and rivers surrounding Cambridge Bay were the remains of Inuit giants who perished in search of food. Elder Peggy repeatedly reported "praying" for food in the old days. Tom found that killer whales have excellent memories and "sense" certain people who have aggravated them in the past. This spirituality was also demonstrated in younger generations. Joe, a young hunter, reported feeling such a spiritual connection to a muskox he hunted, that he could no longer hunt or eat them. Phillip, a non-Inuit "Inuk", explained why the news was not commonly viewed on television: "They'd say that if you watch things like that, it'll come here. So the whole traditional belief was, you don't watch violent stuff or violent stuff is gonna happen."

3.1.2. Personal views on the environment

In an attempt to understand community members' environmental perceptions, it became difficult to separate self-generated awareness from an **external concept of climate change**. Non-Inuit interviewees agreed that the concept has been recently adopted from external, southern sources: "[We have] heard climate change so much that that a lot of it is introduced. A lot of it is in the media now, it's in the newspapers, on the radio, a lot of researchers coming up to talk about climate change, so that's influencing [people]... you get asked something over and over and it's almost like you have a set answer to it" (Phillip, non-Inuit "Inuk"). Jim, a wildlife expert agreed: "I don't see people talking about it when we're having tea [...] The only time I see them talking about it is when they are asked by somebody else". An opposite view was reported by Tom, a local Inuit hunter, who often discussed climate change at home.

According to many elders, **climate change was an introduced concept, which was told to them** by missionaries. Ellen, an elders' focus group participant, discussed learning about climate change in this way:

As a young girl, she was brought up and raised with her parents as well as the Anglican mission. And the missionary would often share the story that [...] the days are coming that [...] the weather will change, the food, the animals, will also change. That you know the weather will become hotter and it would also spoil the food. [...] That it will affect, you know, the people and the animals. *Interpreted by translator*

Anne, also a participant in the focus group, was also told by the missionaries and by other Inuit that this would happen. Roberta, a student, reported that she was told the weather would change over time and affect plants and animals, yet she believes pollution is the cause of climate change. A phenomenon similar to **climate change is part of the oral history** passed through generations. It is challenging to identify the source of these introduced concepts from oral history or external news and media.

Local environmental perceptions were uncovered in focus groups and interviews. Informants quickly associated recent environmental changes with "climate change." The majority (8/12) of survey respondents described their cultural heritage as very connected to the environment. Local mining projects were reported as detrimental to the environment. Helen mentioned her concern over lack of recycling in the hamlet: "Too much of wastage... even up here, too" and expressed relief due to the new aluminum pop can recycling program. Casual conversations, however, led to the conclusion that many residents were not concerned about recycling: "I wouldn't even know how to recycle here" (anonymous). At time of field-work, waste was brought to an open dump that reportedly resembles a shallow lake in the summer (appendix 11) and was susceptible to the harsh Arctic winds that blow garbage outside its borders. In addition, these conversations revealed safety concerns of waste management practices, particularly when burned on very windy days.

When asked, "What does climate change mean to you?" participants Samantha and Tom associated greenhouse gases, pollution, and other toxins to climate change. Climate change was described as a "luxury" concern by Anna, Phillip and Jim and was viewed as less important being prioritized behind social issues. It was reported that despite the acknowledgment of environmental issues, people's behaviours have yet to reflect the concerns. The town's necessary supplies (and luxury items) arrive from Southern cities by jet or barge, and residents are very happy to access these items. It was reported by Jim that middle and high-school youth

were un-phased by visiting climate change scientists who showed presentations of declining Arctic sea ice in 2008. Helen reported that climate change is an issue for the South. She attributed the people, activity, and pace as the cause: "Everything is so fast paced now. Too much use of oil and gas and all that affecting the environment. That is my concern,, too much activity, human activities that cause the global warming." (Helen, Inuinnaqtun language expert).

3.2. How are residents of Cambridge Bay experiencing climate change?

Three themes were identified in relation to the research question. The first was current exposures to environmental change. This encompassed the sub themes 1) changes in fauna, some of which will be communicated in a table 2) changes in weather and environmental conditions and 3) changes in flora. The second theme was current vulnerabilities to environmental change. Sub-themes included were 1) unpredictability of ice and weather 2) dwindling caribou population 3) compromised travel routes and 4) emotional stress. The final theme was named as contributing socio-cultural vulnerabilities, which included the sub-theme of cultural disconnect due to a) hospitalization of childbirth and b) the residential school system. Relevant survey findings will be presented first.

3.2.1. Survey findings

Table 5: Survey findings relevant to RQ 2 (N=12)

# THAT RESPONDED YES	SURVEY QUESTION
11	Does your ability to earn money depend on weather conditions?
9	Have you noticed new wildlife nearby, uncommon to the region?
8	Does the sun feel stronger than it did in the past?
8	Are there more plants in summertime?
6	Are summer water levels in lakes lower than usual?
5	Have any common animals disappeared from the region?
5	Have there been signs of permafrost melting?
4	Have recent weather conditions made it more difficult to hunt?

A total of eight survey questions were relevant to local experiences with climate change. It was most striking that the majority (11) of respondents' livelihoods did not depend on weather conditions, contradicting a previous assumption that livelihoods would be dependant on weather conditions. The finding could be due to various factors including: a) respondents work

indoors b) respondents live close to where they work c) respondents do not depend on hunting, fishing or "the land" for income or d) those that use local resources to supplement income hunt or fish regardless of weather. The finding also highlighted the difference between Cambridge Bay and other Arctic communities, where local resources play a larger role in livelihoods. Only 4 reported that recent weather conditions have negatively impacted their ability to hunt and fish, indicating that hunters adapted to inhospitable environmental conditions.

3.2.2. Current exposures to environmental change

Survey results demonstrated that 9 out of 12 participants are very aware of **changes in the local fauna** (table 7). Grizzly Bears, a non-native animal about the tree line (3 lateral degrees to the south) (Doupé et al., 2007), have been increasingly spotted on Victoria Island. Although grizzlies were occasionally observed as early as 1938 (earlier by Inuit) on the sea ice and islands north of the mainland (Doupé et al., 2007).

One extraordinary finding was the Grizzly and Polar Bear hybrid, called the Grolar. Confirmed by news reports (CBC News, 2010a; Roach, 2006), two Grolar Bears have been documented on Banks Island and the north-west part of Victoria Island. These hybrids were allegedly capable of producing viable offspring. Testing confirmed a second generation Grolar hybrid, which was killed April 8, 2010 in Ulukhaktok, on Victoria Island (CBC News, 2010a). The hybrids could be due to climate change driving evolutionary responses and altering selection pressures (Skelly & Freidenburg, 2010). Otherwise, changing environments have affected habitat and migration patterns causing unexpected species to come into contact. Phillip, a hunter and outdoorsman, explained:

The second hybrid that was killed by a fellow from Holman (Ulukhaktok) which is the other community on Victoria Island, they did the DNA on that one, and it was the hybrid of a hybrid, its mother was already a hybrid. And I think this all started from a Grizzly bear that was tagged north of Victoria Island in 1991. And it was a 9ft Grizzly. Which is just huge for a Barren Ground Grizzly. And this could be the offspring of that guy who was hanging around.

Crows (or ravens) are now a common sight in town, but an elder reported that this was not always the case: "I came to Cambridge Bay in 1957, we'd never seen crows. They were not here.

Nothing. And about 1989, they start coming. Now there's a lot of crows" (Lois, focus group participant).

Table 6: Reported non-native animals in the Cambridge Bay area (mentioned by at least 1 interview participant)

NON-NATIVE ANIMALS	DETAILS
Barren-Ground Grizzly bear (and Grizzly/Polar "Grolar" Bear hybrids)	Grizzly Bears seen above the tree line and producing hybrid offspring with Polar Bears. (Phillip, Jim, Helen)
Narwhal	Pods entered Cambridge Bay in August/September 2011. (Multiple respondents)
Red fox	Increased presence on Victoria Island. Either due to adaptation or warming temperatures. Threatening to the Arctic fox. (Jim)
Moose	Marginal, increasing presence and tracks seen (Phillip)
River Otter	Marginal, increasingly detected (Phillip)
Beaver	Marginal, seen increasingly in the Arctic. Beaver cuttings found just South of Cambridge Bay (Phillip)
Birds	Crows, Yellowmut, Kingfisher, Golden Eagle, Mountain Bluebird, Pine Grossbeak (Elders, Phillip, Jim, Helen)
Insects	Insects are increasing in summer (Joe, George, Phillip)

Focus group elders and 7 survey respondents reported **changes in the size and position of the sun**. This observation was also confirmed in reports such as Anisimov et al. 2007; Shirley 2004 and others, which prompted its inclusion to the survey. Furthermore, this was one of the first environmental changes reported in both interviews and casual conversations. Respondents reported the sun feeling hotter and stronger and it was observed to be higher in the sky, bigger, and closer, compared to when elders were young. Liz reported observing similar changes to the moon over her lifetime. Helen, daughter of local fur-trader, described the changes: "The position of the sun, it's more in the centre than it should be." Common speculation is that the earth's axis has shifted (also reported as observed by elders in Shirley, 2004). **Higher temperatures than usual** were observed in recent years. "We were out hunting in January and we seen -17 [degrees Celsius], in January, which is unheard of up here." (anonymous). Much higher temperatures were reported specifically during the summertime. The changing temperature is interconnected with expressions of **less predictable weather conditions**.

Regarding biodiversity in the region, there are many reported **changes in the characteristics of the flora**, and an unexpected number of new species were identified. Many references were made to the landscape looking more green: "[D]uring the summertime, too, it becomes really green, with really rich vegetation. That is really unusual" (Helen). More plants on the landscape were reported by 8 survey respondents. According to 5 survey respondents, changes in flora possibly indicated a deeper problem; the sign of **melting permafrost**. Yellow permafrost melt water was reported to be collecting puddles or pools above ground. This was seen in the autumn of 2011 and in previous years. Phillip, a hunter and outdoorsman, recalled seeing indicators of melting permafrost while working for a scientist at a camp nearby:

By the time they started their camp in the late 1980s until it closed up around early 2000s, they said the flowering plants were flowering ten days earlier than when they started the camp. And this means the permafrost is deeper into the ground, which means it's melting. Flowering plants [were] coming out earlier and mosquitoes were coming out earlier... These were systematic indicators.

3.2.3. Current vulnerabilities to environmental change

Interviewees of all age demographics commonly reported the **unpredictability of the ice melt**. It was conveyed that the sea ice was disappearing faster than ever has before. Informants reported drastic loss of ice in the North West Passage: "There has been no ice in the North West Passage in late August for the last two to three years" (Phillip). Loss of ice between Cambridge Bay and the mainland was also reported. Elders Betsy and Benjamin observed that both the sea and river ice had melted at an uncharacteristically fast pace.

Interviewees connected the unpredictable ice to warmer temperatures. George stated that "all of a sudden it would drop, you know, the temperature would change [...] It wasn't like that years ago... like 50 years ago" (translated). **Less predictable weather** was reported by hunters. One anonymous hunter spoke of drastic changes in the characteristics of winter storms in the past few decades compared to the 1990's when storms often lasted from four to ten days. Confirmed by Benjamin and Betsy since 2000, an estimated ten or fifteen storms a month have occurred.

Dwindling caribou populations were reported by focus group participants and by the majority of interviewees. This could have implications for food security; discussed in the following section. The observation of dwindling caribou was however not unanimous, as two younger participants saw more caribou than usual. The area surrounding Cambridge Bay is known for excellent caribou hunting, and has nearby caribou calving grounds. Tom, a modest hunter, familiar with the migration patterns, noted that "over the years, I think a lot of it has to do with climate change, because the herds, they are declining." The caribou were described as skinnier by interviewees. Outdoorsman Phillip attributed their lack of fat to an increase in insects during hot spells: "[I]nstead of putting on fat, they are just running like crazy because they don't want to be bothered by bugs."

Different migration patterns, dwindling numbers, and less visible caribou were reported. Jim, a hunter and educator, saw a steep decline in caribou last spring: "I've heard people say the patterns have changed and maybe that's all it is, but from my perspective, when you go from seeing hundreds and hundreds to seeing... four?" When caribou cross unstable ice a lot of the herd may be lost (Miller & Gunn, 2003). There are many bodies of water that caribou herds cross in the region (appendix 12: map of caribou calving grounds and ice crossings). Caribou become particularly vulnerable to *the imaaq* when crossing from Victoria Island to the mainland. *Imaa*q, meaning falling through the ice into the water, was explained by Jim:

Like most things when they migrate, it's based upon [sun]light [...]. And these caribou want to get off the island and onto the mainland to their wintering grounds and I looked and I could not see enough frozen water anywhere for these things to get across. [...] The old timers say that going to the mainland they'd be going across and a whole lot of caribou would be half way across, frozen, dead. They fell through and couldn't get back up. I wouldn't be surprised to see an awful lot of that this year. [...] But the animals want to get across and they risk it. 30 miles across, it's a long way to swim.

Compromised travel routes, less predictable weather conditions, and diminishing quality of country foods causes **emotional stresses** in the community. This was particularly evident while speaking with elders. Elder Betsy expressed concern over the safety of her grandsons while they are traveling by boat or snowmobile: "the ocean, you know people often rely on it to go across to the mainland and back for hunting purposes [...] when it warms up the ice would melt [...]"

and it's pretty difficult to travel across for hunters" (translated). During the same interview, elder George described the hazards of summer ice: "You have to really be careful... it can shatter your boat or when you're travelling it becomes very dangerous. Especially in the summertime because you can see there is no ice, so it's good for traveling on the boat. And the next day, there's ice burgs that day. It becomes very dangerous sometimes" (translated). According to hunters and elders, the difficulties with hunting and traveling were intensified due to declining ability in predicting weather conditions (or reading the land). Samantha, a participant in a short survey, reported crossing the ice with her uncle while hunting and both fell through. Her uncle did not survive the accident. For this reason she no longer hunted and the topic of hunting and unpredictable ice was emotionally difficult for her.

3.2.4. Contributing socio-cultural vulnerabilities

In Cambridge Bay, various social vulnerabilities were found, and exacerbated the overall community vulnerability. It was reported and observed that residents struggle to exist between traditional and modern worlds. This **cultural disconnect** from the traditional "Inuit way" was reported through the hospitalization for childbirth that came alongside Western medicine. Since approximately the 1970s, women have been flown to larger cities to give birth. Survey respondents were asked their birthplace and 75% of Inuit respondents were born in cities Yellowknife² or Edmonton. Only one survey respondent, (a 51-year old male) was born in a small nearby community. This was found to be an example of a disconnect from the family unit and from "the Inuit way." Jim, an educator who has taught across the Arctic explained his perspective on the affect of this Western medical standard on residents:

It's just really interesting, because people my age, born out there [in a tepee or an igloo]. Your age, born in Yellowknife. The moms are shipped out early and they come home with a baby... These women are used to being around family and friends when they have a newborn baby. Then you have your babies in a hospital, in a sterile, clinical room with nobody there, and then you come home... it's just disjointed or feels disconnected. It's got to.

² Yellowknife, North West Territories, is located approximately 850 km WSW of Cambridge Bay. It is considered the main hub for health care and air traffic for much of the Canadian Arctic.

Another contribution to this disconnect is the Residential School system³. This program was a joint effort of the government and the Anglican church resulting in the mass removal of Inuit children who were sent to live with non-Inuit families or live in boarding schools to learn Western values. In Cambridge Bay, Inuit children were sent to schools in Inuvik or other locations in the Northwest Territories beginning in the 1950's. Speaking Inuinnaqtun and practicing the Inuit faith was forbidden. Many children were away from their families for ten months of the year and some full-time students stayed for multiple years. Many participants born between 1950-1975 would have been likely to attend Residential school, but they were not specifically asked about this. Anna, an expert in local culture, described the residual effects of Residential Schools:

Not only had they lost so much of their culture, and their language, but also valuable connections with their parents and their grandparents... so when these people had their children [...] they couldn't pass on their language, because they didn't feel comfortable speaking it. Even the ones that still had it, it wasn't as natural. Like English was their more natural language. But it wasn't just that, that they couldn't pass on their language and culture... they didn't really know how to be parents. They didn't grow up with their mom and dad full time.

3.3. What are current adaptation strategies?

From initial observations upon landing in Iqaluit to in-depth interviews in Cambridge Bay, it was evident that in varying degrees the Inuit of Nunavut were adapting to Westernized lifestyles and standards. This was done to varying degrees at individual and community levels. In Cambridge Bay, the preference for a modern lifestyle was evident (through observations, conversations and interviews). Local Inuit were described as "walking in both worlds" by multiple interviewees, although predominantly by non-Inuit participants. Identifying current adaptation strategies included two themes: 1) adaptation of the food system and 2) adaptation of hunting practices. Indications of a transitioning food system will be presented, followed by relevant survey findings. The adaptation from traditional to modern hunting practices was demonstrated, and will be mainly based upon a frequently referenced incident when Narwhal entered in Cambridge Bay.

³ In the Kitikmeot region, the Anglican church was an actor in the Residential School system. Similar removals extended to other Aboriginal groups across Canada, with involvement from other Christian churches.

3.3.1. Adaptation of the food system

Despite shifting lifestyles and values, the local food system retained many traditional aspects despite shifting lifestyles and values. Caribou, muskox, Arctic char and other fish are defined as staple foods. Phillip, a non-Inuit Inuk estimated a families' intake of country foods: "If you have a hunter in the family that's eating caribou, you're probably eating caribou 3-4 times a week. Some people like fish a lot, it could be fish 3-4 times a week... some people just buy store food because they don't have a hunter in the family or people are getting used to buying store-bought meats." Food preference could reflect the greater interest in modernizing: "But today, everyone wants to follow the more modernized ways of living. More so than the traditional" (Helen, daughter of local fur trader).

3.3.2. Survey findings

Table 7: Survey findings relevant to RQ 3 (N=12)

# THAT RESPONDED YES	SURVEY QUESTION
9 ⁴	Do you eat more store foods than country foods?
9	Would you rather eat more country foods than store foods?
6	Does over half your meat intake come from country foods?

Survey data suggested that people want to be eating more country foods. 50% of survey respondents currently get half of their meat from country foods. Since country food in Cambridge Bay is almost exclusively wild game and fish, many respondents complemented traditional country foods with store foods. Reported advantages to country foods include health and freshness and lower cost than store foods. They were also suggested to be more satisfying than store foods and keep you full for longer. Helen, Inuinnaqtun expert, reported why she preferred eating country foods: "They're healthier than the store bought food. And they maintain in you for a long time." The taste of drinking water from melted freshwater sources was also preferred over tap water, although observations indicated that it was regularly consumed out of necessity at cabins without tap water. Country and store foods were combined in the modern diet: "last weekend we had caribou heads and we had some Alaskan king crab legs, and Sheppard's pie, so, we balance our food out all the time. We don't eat country food seven days a week" (Tom, modest Inuit hunter).

⁴ 2 survey respondents report eating equal amounts of store and country foods.

Hunters reported storing **country foods ahead of time** and **supplemented store foods for country foods** during the off-season or when country foods were unavailable. For example, canned tuna replaces Arctic char (Helen), and chicken replaces muscox (Phillip). Participants expressed concern over the shift in preferences, particularly in local youth's lack of knowledge in preparing and storing country foods: "I am trying to teach my grandchildren and even my children the importance of keeping country food in their diet. They've got to want to stay with it" (Tom). The transition from country foods can be viewed as a simultaneous shift from local culture since all aspects (production, preparation, and consumption) are inherently fused with culture.

3.3.3. Adaptation of hunting

The **role of hunting** changed considerably alongside the shift toward Western lifestyles in Cambridge Bay. All hunters interviewed had separate wage-earning employment. For many, hunting was an important element of life, however, hunting habits were **flexible** and done in leisure time and external from work, "whenever I need to" (Phillip). Full-time hunters were typically guides for sports hunters and/or sell the meat or pelts externally. **Subsistence hunting** was observed to be something of the past and those who depend on the income have additional external government support⁵. Tom hunts: "On the weekends and holidays when I can get away from work. I usually work Mondays to Fridays. I like to get out on the weekends, depending on the weather," and uses modern vehicles to travel. "In the winter times, it's a snowmobile. In the spring, summer, fall time, it's either by 4-wheeler or boat" (Tom). When weather or ice conditions were less predictable, routes were modified, trips delayed, or **extra precautions were made**, such as informing others of your route.

⁵ External support in reference to land claims beneficiary payments, made to eligible Inuit, and federal compensation funds (Kitikmeot Inuit Association, n.d.).

Table 1: Climate-related vulnerabilities affecting community adaptation

CURRENT VULNERABILITY	CHANGE IN CLIMATE	ADAPTATION/COPING STRATEGY
Compromised access to hunting and safety	<ul style="list-style-type: none"> •Conditions of the past no longer apply to the present •Less predictable ice conditions and later freeze-up •Increase of shorter storms •Less predictable temperatures 	<ul style="list-style-type: none"> •Informing others of your whereabouts on land •Increase in technologies like GPS
Species availability	<ul style="list-style-type: none"> •Changing weather and ice conditions affecting local wildlife •Dwindling caribou herds; caribou lost while crossing unstable ice 	<ul style="list-style-type: none"> •Transitioning food system toward more store foods; less dependant on country foods •Flexible hunting; whatever species are available
Emotional stress	<ul style="list-style-type: none"> •Less predictable conditions leads to a changed relationship with nature •Hunters and elders having difficulty with predicting weather or reading the land •Worried about kin fishing or snowmobiling in unpredictable conditions 	None identified

3.3.4. Narwhal Example

Many residents referenced one rare event about Narwhal in Cambridge Bay during interviews and casual conversations about this research. This event was connected to many reported changes with local wildlife, and was brought up alongside current hunting practices. This incident demonstrated community opinions and perceptions on many aspects of this research, but is categorized under hunting adaptation, as many residents reported problems with how the hunting of Narwhal was handled on this occasion. Four sub-themes were found regarding the adaptation of hunting practices: 1) hunting of Narwhal was a learning experience 2) the event brought the community together 3) the need for training was demonstrated and 4) tensions between traditional and modern hunting practices were revealed.

Pods of Narwhal that uncharacteristically entered the bay on August 25, 2011 and was confirmed by local news reports (George, 2011a). Elders reported that this has happened very rarely in this region, and the number of Narwhal passing through made it particularly remarkable. Skilled hunters caught a Narwhal the first evening and shared it traditionally amongst spectators. Unfortunately, a baby Narwhal was killed by an amateur hunter later that night. This impacted community elders: "One female elder said to me that she cried and she

thought it was really sad. And it's not something that traditionally would have happened. I mean you wouldn't kill a baby" (Anna). From early on perspectives of the event were divided. Phillip, a hunter who watched what happened from shore near his home, reported:

The first hour was just glorious because nobody had seen whales before. So it was like three hundred people running down to the shore, driving down, biking down, and everyone watching these groups of whales. But pretty soon they were just getting shot at. A pretty grizzly sight for the next two weeks. So the hunting skills, not what it used to be. [...] The pilots were the ones who would say they saw all kinds of bleeding ones in the group and dead ones in the water.

Some saw the Narwhal hunt as a positive experience as hunters were given the chance to practice hunting whales and learn new techniques. Joe learned that seal harpoons are not strong enough to catch Narwhal. Tom, a modest hunter, considered it a learning experience: "There was only a handful of people who knew how to hunt. But that's a learning experience and a lot of people learned from that. I know I did." Respondents were grateful to see younger generations interested and active in hunting. The event was even described as empowering: "And it was beautiful, everyone was coming together. It was awesome. I'd never seen people work together in such a great way. It was fantastic" (Anna).

Poor hunting skills demonstrated the need for training: "Hopefully someone runs a workshop. They probably will have a workshop about how to properly hunt the whales. Because last year, for the first time, it was just crazy" (Tom). Yet no respondents indicated mobilization following the event. "I think people talked about it, families and friends talked about it after, in reflecting and maybe thought we should have done this differently, but no collective decision. It was not organized by that" (Anna, Copper Inuit expert).

Residents were not hunting out of necessity: "The people I saw harvesting for the most part have employment [...] and they have the big powerboats, no need to do a traditional harvest. I did not see any spiritual ceremonies" (Jim, hunter and educator). Traditional values such as respecting the animal, utilizing every part, and sharing with the community were reportedly not followed. Many Narwhal were killed and sunk to the bottom of the bay, therefore wasting the meat. Hunting these Narwhal is understood as the right of the local Inuit residents, and whales

are part of local traditional food system in other Arctic locations. Tags were distributed through the Hunters and Trappers Organization, as hunting a controlled amount is legal. Muktuk (frozen whale skin and blubber) is a delicacy Cambridge Bay residents do not typically have the chance to enjoy. Overall, stories about the event reflected a mix of emotions ranging from excitement to sadness. This event demonstrated the extent of tensions between traditional and modern, as stated by Anna:

A lot of people weren't really following the traditional values so that you hunt so that you can have enough. So you can share so you can have enough. Not so that you can say that you did this, not for your ego, not so you can take pictures and put on Facebook. That wasn't the reason you killed an animal. It was because you had to. Because you were respectful and grateful to the animal. That's where, you know, it went off track, and a lot of people didn't feel good about that. A lot of the elders, a lot of the people in town didn't feel good about that. It was very divided.

3.4. What are local food security concerns?

Findings concerning food security are first communicated through the relevant survey findings. First, food security concerns of store foods are presented, with cost and nutritional awareness identified as sub-themes. Findings pertaining to country foods are subsequently presented, where change in quality and change in abundance of wildlife are main sub-themes. Due to interconnectivity with RQ 2 sub-themes of changes in fauna, vulnerabilities of wildlife and caribou population and changes in flora have been presented in a table to avoid repetition.

3.4.1. Survey findings

Table 9: Survey findings relevant to RQ 4 (N=12)

# THAT RESPONDED YES	SURVEY QUESTIONS
11	Are you generally able to get all the foods you want (store and country)?
9	Are you able to access all the foods needed for a healthy diet?
<i>STORE FOODS</i>	
11	Are store foods expensive?
8	Does the weather stop you from getting the store foods you need (e.g. blizzards, visibility)
<i>COUNTRY FOODS</i>	
6	Are there less caribou available to eat than there used to be?

5	Lately, has the caribou meat been good quality?
4	Are there health risks associated with eating country foods?

3.4.2. Store foods

Very few food security concerns were reported in the hamlet, and access and availability to store foods has reportedly improved. The **cost** of some main food staples are approximately twice the cost as in Southern Canada (table 11). Participant Roberta reported difficulty in obtaining fresh fruits and vegetables from the supermarket. Some country foods, such as Arctic char, are now available at the supermarket at a considerable mark up. Half an Arctic char, which are abundant in local rivers was available for \$40 CAD.

Table 10: Price Comparisons of food staples in Ontario vs. Nunavut

COMPARISONS OF STORE FOOD PRICES⁶		
Food item	Price in Cambridge Bay	Price in Ontario
Whole wheat bread (value brand)	2.79	1.97
2 L. 2% milk	5.19	3.83
12 eggs	4.95	2.65
Package Catelli spaghetti	4.19	1.69
Value brand 700 ml. pasta sauce	7.39	2.99
1 kg. Apples	5.97	2.84
340 g. box Golden Grahams Cereal	7.99	3.97

Nutrition was not viewed as a consideration when making dietary choices: "instead of people buying healthy fruits and vegetables, I could see them buying some chips and a pop instead. So I don't see people buying that food, not because they can't but because they don't choose to" (Phillip). The territorial and federal government released a Nunavut Food Guide that was picked up during fieldwork at the local library. This guide promoted the consumption of traditional foods and healthy store bought foods over processed "junk foods" (appendix 14). The Nutrition North initiative was reported in interviews and conversations as well as observed in the community. This initiative was advertized in pamphlets and newspapers and subsidized healthy foods in northern communities. This was done by providing the highest subsidies to the most nutritious perishable foods flown from Southern Canada, as well as commercially processed country foods registered with the program.

⁶ Food prices in Canadian dollars as of April, 2012. Nunavut prices obtained from the Co-Op and the Northern Store in Cambridge Bay, NU. Ontario prices obtained from the Metro and No-Frills in London, ON.

3.4.3. Country foods

Table 11: Observed negative changes in the traditional food system
Identified in interviews and surveys

SPECIES	OBSERVED CHANGE	Description
Caribou	Decrease in abundance	•Population rapidly decreasing, moving further away from town
	Decrease in quality	•White puss balls/spots found when harvesting meat •Summer caribou are thinner
Trout and Whitefish	Decrease in quality	•Trout are poorer quality •More fish found with red spots and fins missing (less pleasant taste)
Muscox	Decrease in abundance	•Herds moving further away from town

The reported changes in caribou herds and other country foods indicate **vulnerability in the traditional food system** (table 12). Caribou is a staple country food in Cambridge Bay and hunters Jim, Tom and Phillip all reported a decrease in the abundance of local caribou. Elder Betsy found small white spots, or balls while harvesting the animal for caribou jerky. A decrease in the quality of caribou (particularly these white balls) was also reported by Helen, and Benjamin and Betsy. Ellen, a participant in the elders' focus group, stated that "more and more and more every year" it became increasingly difficult to harvest meat. Liz, also a focus group participant, felt that summer caribou appear skinnier than usual.

Ellen, Roberta, and other participants reported Whitefish and Trout as skinnier than usual and of poor quality. One anonymous survey participant spoke of catching an increasing number of fish with missing fins. Helen reported difficulty in locating muscox herds. Jim described the last muscox hunt as unsuccessful: "[hunters are] allowed up to 400 animals. Horrible hunt this year, really bad weather. Only got 120, 30, 40 animals. Also said the herds were 40 miles away."

Table 12: Observed positive changes in the traditional food system
Identified in interviews and surveys

SPECIES	Observed change	Description
Arctic char	Increase in abundance	More than there used to be
	Increase in quality	Bigger, wider, more round, fatter
Blueberries	Increase in abundance	Warmer temperatures are more hospitable for blueberries
Narwhal	Increase in abundance (non-native species)	Pods uncharacteristically entered Bay (expected to happen more in future)

Findings in table 13 indicate that recent environmental changes could positively impact food security. Elders Ellen and Betty (focus group participants) and Samantha (hunting accident survivor) all reported positive changes in the quality and abundance of Arctic char populations. This included more abundance and larger, fatter and rounder fish. No participants or contacted residents of the community reported a decrease in the char populations. Changes in summer temperatures have reportedly increased both the vegetation on the tundra and availability of local native fruit. Elders, new and old town residents alike cited the new ability to go blueberry picking; "I have never berry picked in my life in Cambridge Bay, but a couple summers ago, I did" (Helen). Due to very little understanding of the migration patterns on Narwhal, some reports suggested that this could become a more common occurrence (Geddes, 2011; George, 2011b) and that Narwhal may become a more regular addition to the traditional diet.

4. Discussion

This vulnerability assessment developed a vulnerability scoping diagram (see Polsky et al. 2007; Nicholas & Durham 2012) for this case study of Cambridge Bay (figure 3). The three dimensions of vulnerability are 1) exposure 2) sensitivity and 3) adaptive capacity (Turner et al., 2003). The "exposure unit" in this diagram is the Arctic community of Cambridge Bay and the stress being evaluated is climate change. In this study, the components of dimensions of vulnerability were identified as 1) climate change exposure 2) natural (biophysical) and socio-cultural sensitivities and 3) adaptation of the food system, adaptation of hunting practices and the "Inuit way" and ITK as components of adaptive capacity. Each of these three dimensions is described below.

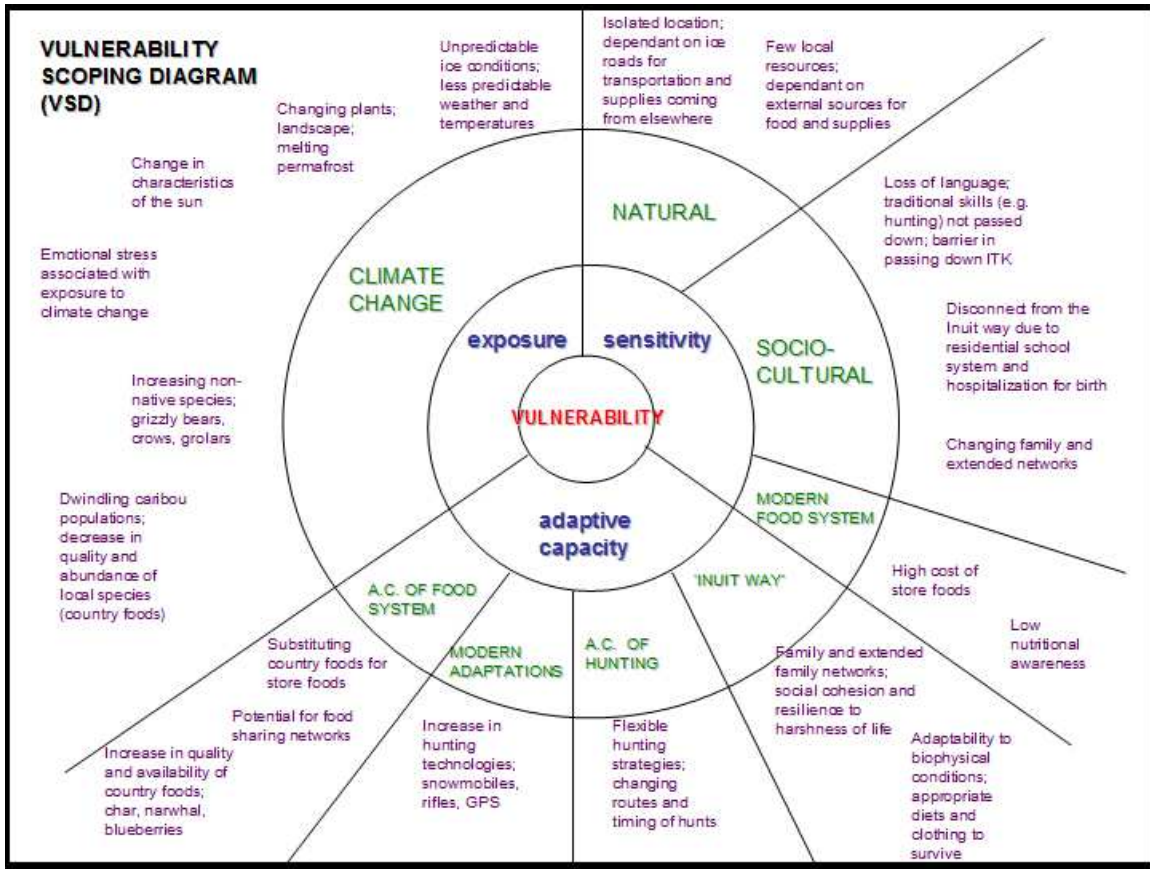


Figure 4: Vulnerability scoping diagram

Themes and sub-themes were categorized into the dimensions, measures and components of the VSD (appendix 15)

LEGEND

Exposure unit: Arctic community of Cambridge Bay and climate change
Blue: Dimensions of vulnerability
Green: Components of dimensions
Purple: Measures of components

4.1. Exposure

Exposure is a dimension of vulnerability. This study identified components of dimensions as 1) the community of Cambridge Bay (as the exposure unit) and 2) climate change (as the component of vulnerability) (figure 3). Measures of climate change were identified as: unpredictable ice, unpredictable weather, vulnerability in traditional food system (e.g. dwindling caribou populations) emotional stresses, changes in vegetation, indicators of melting permafrost, change in position and intensity of the sun, and numerous reported non-native species.

Alongside the many reported measures of climate change, the particular finding that stood out was the unexpected phenomenon similar to climate change was part of the local oral history. Elders were told by missionaries that the land, climate and animals would change in a manner similar to current climate change, a belief that was passed down through generations. This demonstrates the importance of ethnography, field-work, and qualitative research when researching the human dimensions of climate change in indigenous communities and, furthermore, the extent in which unexpected external influences can saturate philosophies and worldviews. This belief could have affected interpretations of current changes. Local residents taught the climate change prophecy could be less worried about environmental changes or less inclined to act on their concerns because the changes were expected or inevitable.

Overall, residents appeared proud of both personal and historical resilience as people. Although climate change was obvious, it was not perceived as an immediate threat. It was challenging to separate sources of introduced concepts of climate change between oral history (prophecy taught by missionaries) or external news and media. As participants referred to climate change as "that climate change thing" it became increasingly obvious that there existed a predominant lack of local concern and overall view that climate change was a problem of the "south" and out of the control of local populations. Climate change emerged as a daily reality (evident through environmental changes) that was an accepted truth rather than something that collective or individual actions could change.

4.2. Sensitivity

4.2.1. Natural

Natural components of vulnerability were included in the scoping diagram due to biophysical attributes of the case study location. Measures of this included the latitude and location of the Arctic that may cause climate changes to be more extreme and variable than elsewhere on the planet (IPCC, 2007). Other natural measures of sensitivity included: the physical location on Victoria Island in the Arctic Archipelago, the isolated location (the closest community, Kugluktuk NU., is almost 450 km away, or 45 minutes by airplane), the dependence on sea ice for both human traveling (ice roads and snowmobile tracks) and animal migrations. These physical measures made residents more vulnerable to climate change as the isolation and physical

distance could have lead to low accountability for environmental actions (e.g. burning garbage at the open pit dump, or leaving snowmobiles on ice floats rather than disposing of them). These natural components could make it more challenging to adapt since transportation is so dependant on ice conditions, and the changing physical surroundings could not be ignored or avoided.

4.2.2. Socio-cultural

In Arctic communities, social vulnerabilities are found to exacerbate climate and environmental sensitivities (Anisimov et al., 2007; Beaumier & Ford, 2010; Ford et al., 2010; Ford & Furgal, 2009). Identifying the socio-cultural components of sensitivity to climate change were important findings in this study. Measures of this component included the historical colonization and assimilation of Inuit people. These contributed to a disconnect with traditional Inuit culture. The Residential School system and the transition to town life led to the past and present issues related to cultural loss. Identified present-day issues included depression, suicide and addiction. Measures of socio-cultural sensitivity included lost hunting skills, a shifted relationship with the land/nature, lost language, and skewed family and extended family networks. The Residential School system and the medicalization of the birth process both included the (sometimes forced) removal of family members at pivotal points of life (childbirth), and for long periods of time (childhood). These were found to negatively impact the family unit and loss of traditional norms and values that historically kept the Inuit social fabric strong against harsh and difficult lifestyles.

The Truth and Reconciliation Commission of Canada was established in 1998 as a response to the Residential School legacy. This was both an acknowledgement of and an effort to rectify mistakes associated with the program, which was in many cases a tragic element of colonization. Support networks and holistic approaches to rectify the past and reconcile toward a future were all part of the mandate (Truth and Reconciliation Commission of Canada, 1999). There have also been efforts to return birth to Inuit communities. The medicalization of birth was a practice also associated with colonization that remains in Inuit communities. There have been recent studies on the return of midwives, and on the best practices to return birth to remote and rural communities (Couchie & Sanderson, 2007), which could strengthen traditional Inuit bonds, return autonomy, and build adaptive capacity.

For Inuit in the Arctic, connections between land and culture are fostered by inter-generational and place-based learning based on experiences. Only three to four generations ago, the Inuit lived nomadically, following the seasonal rhythms of the land, oceans, and animals, and some community elders living today began their lives in this lifestyle. Thus, Inuit culture and language are tied to place and stories of journeys and of the past are interwoven into social and cultural fabric of life. The majority of Cambridge Bay youth were found to speak only English and understand very little Inuinnaqtun. Elders over 65 generally spoke Inuinnaqtun, with many understanding little English and very few people of any age could read and write Inuinnaqtun. With this range of language abilities, the inter-generational communication gap could be vast. A grade seven teacher reported that only 4 or 5 out of his 20 students understood some or most of what an elder says, and no students spoke Inuinnaqtun. This assessment of adaptive capacity emphasized the barriers associated with inter-generational communication in general and the passing of traditional skills.

As with other Inuit communities, social challenges and health issues came with the rapid transition of lifestyle and livelihoods in Cambridge Bay. Particular problems with Inuit health as a result of social, cultural and economic changes appear to have occurred after coming in contact with Europeans (Bjerregaard, Young, Dewailly, & Ebbesson, 2004). Interviewees reported community-level problems with addiction, alcohol abuse (leading to Foetal Alcohol Syndrome), violence, depression and suicide. Many of these issues did not exist before Western contact (particularly alcohol abuse) and are not unique to Inuit populations; rather extend to colonized aboriginals all over the world. Tension between traditional heritage and modern interests were obvious in the community. Technologies like Facebook brought electronic access, but the physical distance from the rest of the world remained. Issues such as struggling with identity and physical isolation (among other problems) have reportedly contributed to high numbers of suicide and alcohol problems in Inuit communities (Patrick, 2003). Addressing issues like suicide, violence, accidents, and substance abuse are high priorities in Inuit communities, and changes in lifestyle and society are found to be major determinants of health (Bjerregaard et al., 2004).

Some of these socio-cultural sensitivities were also identified as set-backs to adaptation. In this study, the Inuit way and ITK was found to contribute to adaptive capacity, thus actions that lead to the destruction of these elements were considered to be dimensions of vulnerability. This assessment did not perceive all impacts of colonization as exclusively negative. These components were included to highlight the complicated, historical nature of contributing sensitivities. This historical consideration was emphasized as it was seen as profoundly important in assessing climate change vulnerability and adaptation in Inuit communities. Eventual contact with outside cultures was inevitable; however the manner in which Europeans made contact still impacts the social-cultural fabric of Inuit communities and remains an important issue today, as Inuit struggle between traditional and modern worlds.

4.3. Adaptive capacity

4.3.1. The Inuit way and ITK

The theme of the Inuit way and Inuit traditional knowledge (ITK) were identified as components of adaptive capacity (figure 3). In addition, the unique local traditional knowledge was deemed important in assessing adaptive capacity. This "code of conduct" constantly evolves along with the people who perpetuate it and was found to be meaningful and omnipresent in the case study location. Measures of components of the Inuit way and ITK encompassed the historical adaptability of Inuit. This included the following measures identified from the data: family, norms and values, resilience against the harshness of life, and spirituality and superstition. For millennia, Inuit adapted to the harsh biophysical conditions of the Arctic. Use of furs and skins protected Inuit from the physical harshness. Social adaptive capacity was demonstrated through the strength of individual family groups and extended family networks. During field-work, networks and social bonds were identified as coping strategies and were observed through the ceremonies that occurred after the passing of a community member.

The distance from Western norms (and values) was a measure of the "Inuit way." Four documented differences between traditional aboriginal and Western values (figure 4) were chosen and applied to findings in Cambridge Bay. These traditional aboriginal values were: 1) focus on the present 2) practical, intuitive thinking 3) sharing and wealth distribution and 4) holistic view of nature. Participants indicated that an element of the "Inuit way" is living day-to-

day and was demonstrated when Philip described hunters as simply hunting whenever they need to. The focus on the present made it challenging to uncover adaptation strategies because people simply did what was required at the given time, rather than plan ahead, using practical, intuitive thinking to make decisions (figure 4).

Socioeconomically, individuals appeared to struggle when adapting to the monetary system, which could reflect the focus on the present. As previously indicated, Jim reported that while many residents function well within the Westernized system, many exist within the margins of society. There are still those who struggle to acclimate to the monetary structure. This demonstrated the contrasting worldviews of sharing and wealth distribution vs. saving and wealth accumulation and focus on the present vs. focus on the future (figure 4).

Traditional Aboriginal Values and Orientations	Western Values and Orientations
individual, extended family, and group concern	individual and immediate family concern
small group size	large group size
cooperation	competition
holistic view of nature	homocentric view of nature
partnership with nature	exploitation of nature
renewable resource economy	nonrenewable resource economy
sharing by all of land and resources	private ownership of land and resources
sharing and wealth distribution	saving and wealth accumulation
focus on the present	focus on the future
nonmaterialistic orientation	materialistic orientation
time measurement in natural cycles, e.g., seasons	time measurement in small, arbitrary units
practical, intuitive thinking	theoretical thinking, prone to abstraction
face-to-face government and politics	representative democracy
egalitarian organization	hierarchical organization
age and wisdom valued	youth and beauty valued
high group esteem, lower self-esteem	high self-esteem, lower group esteem
modesty and reserve	confidence and noisiness
patience: problems will be resolved in time	impatience: problems resolved quickly

Figure 5: Table comparing Inuit (Aboriginal) and Western worldviews

Source: Stevenson, 1996

Furthermore, a strong focus on the present could also be a driver of the overall lack of future environmental concern. A shift from a holistic to a homocentric view of nature (figure 4) was evident in the findings. Traditionally, animals were hunted so people had enough food to eat. Anna reported that with transitioning values, there is never "enough" and therefore changes the way that younger generations view nature and hunting. This finding was also confirmed when respondents described how the Narwhal were hunted.

Local projects promoting traditional skills can be considered as contributing to adaptive capacity. The Inuit Qaujumajatuqangit of the Bathurst caribou project (introduced in section 1.4) and programs and cultural preservation initiatives (such as sewing groups) at the Kitikmeot Heritage Society were identified in this particular case. Efforts to build community adaptive capacity through maintaining and recording traditional (often oral) knowledge can empower community.

4.3.2. Adaptive capacity of hunting

Adaptive capacity encompassed the adaptation of hunting. Measures included flexible hunting strategies, with reference to changing routes and timing of hunts (figure 3). Knowledge of the land, of hunting, and related practical skills were demonstrated by many participants, particularly hunters and elders. The harshness of life and lack of predictable available resources promoted incentives for individuals to learn hunting and fishing skills and a knowledge of the land from a young age. This diversification of skills demonstrated resilience and is a documented strategy used to avoid risks (Kelly & Adger, 2000). Furthermore, this knowledge of the land is considered highly valuable, and allows individuals to exercise a high level of autonomy (Freeman, 1996).

Measures of adaptive capacity of hunting included modern adaptations, such as an increase in technology (figure 3). When modern mentality was combined with modern technology, concerns over the wildlife were reported by participants. Tom described feeling concern regarding improperly harvested (wasted) caribou that was found on the land. It is clear that problems exist associated with unskilled hunters, tensions between traditional (holistic) and Western (homocentric) views of nature (figure 4), and alarm over youth disregarding traditional hunting rules.

4.3.3. Adaptive capacity of the food system

The substitution of store foods for country foods was identified as a measure of the food system's adaptive capacity (figure 3). The importance of country foods was reported in interviews and in surveys (75% of survey respondents reported wanting to eat more country foods). In addition, the importance of food related practices to culture was emphasized in

interviews, and concern was expressed over the loss of food-related traditions, particularly within the youth population.

4.3.4. Future options for increasing adaptive capacity at the community-level

Re-introduction of food sharing could both strengthen community ties and contribute to a small food security buffer. The traditional Inuit practice of food sharing, where country foods were traditionally harvested and shared amongst community members, is no longer practiced in Cambridge Bay. This was potentially due to reduced availability of country foods (Beaumier & Ford, 2010). A participant who has lived in more traditional Inuit settings discussed the use of communal refrigerators to store country foods; a practice that common elsewhere in the Arctic. If a hunter had a surplus of caribou, it could be stored in the community fridge and shared with community members who needed it. A more modern application of a food-sharing network, including community fridges, could contribute to adaptive capacity. These fridges may also encourage a relationship with nature and the land, reconnecting individuals with their heritage while benefitting food security by providing relief for residents who cannot afford store foods.

Skills workshops that properly train hunters in both traditional and modern methods (perhaps lead by the Hunters and Trappers Organization) is another potential solution to increase adaptive capacity. The ideal workshop would incorporate both new (rifles and GPS) and old hunting technologies (harpoons and reading the land). As hunters and elders reported concern over the disconnect with nature and culture, incorporating traditional techniques could build cultural bonds, and benefit adaptive capacity. Workshops including skill building, encouraging familiarity with the land (including the effects of recent environmental changes) could potentially prevent hunting accidents, as young hunters would be made more aware of the dangers of unstable ice.

4.4. Future vulnerabilities

Cues toward future vulnerabilities emerged, although out of the scope for this project. Cambridge Bay is expected to see profound developmental changes in near future. The location of the new Canadian High Arctic Research Station (CHARS) was announced as Cambridge Bay in 2009. The project has a budget of \$18 million CAD over five years, starting from pre-

construction and set to be built in 2017 (Aboriginal Affairs and Northern Development Canada, 2010). The location was chosen in part due to the more attractive size of the hamlet (as compared to smaller, more northern communities) that will make it more attractive to researchers (CBC News, 2010b). The project aims are resource development, exercising sovereignty and monitoring the Arctic, strengthening environmental research efforts, and building strong and resilient communities (Aboriginal Affairs and Northern Development Canada, 2010). The massive undertaking will undoubtedly re-shape the community and increase non-Inuit presence substantially; the concern over cultural loss was expressed by many participants.

More sea transport in the Northwest Passage was discussed while in the field. According to Environment Canada, the ice in the passage is commonly variable, but has been staggeringly low since 2006/2007. The southern route, through the straits of the Canadian Arctic Archipelago, opened for the sixth year in a row. The area around the magnetic North Pole would have 75 per cent ice coverage in a typical year, however, ice covered just 40 per cent of the area in August 2011 (Environment Canada, 2011). This has extremely negative environmental implications but increases the accessibility of sea traffic (positively impacting food security). Ships, freighters and leisure craft have been reportedly seen in the bay from Australia and Germany, as well as Canadian cities like Montreal and Vancouver.

5. Conclusion

The research provides a snapshot into the nature of vulnerability in Cambridge Bay, Nunavut. This community-level vulnerability assessment contributes to a growing body of research on one of the great sustainability challenges of our time - climate change. This study contributes to an understanding of how people in Arctic communities experience, are affected by, and how they respond to changes in climate. The answered research questions add to a local-level understanding of how one community is vulnerable to climate change and provides specific insight into the components and dimensions of exposure, sensitivity and adaptive capacity. Furthermore, the study provides options for strengthening adaptation capacity at the local level

offering an understanding of the dimensions and components of vulnerability that may help facilitate future adaptation opportunities and strategies.

The main contribution of this study is the included socio-cultural sensitivities, a factor discounted from similar case studies. Findings demonstrate that climate change vulnerabilities are interconnected with many social and cultural factors. One emergent theme is that while many residents continue to adapt from traditional to modern lifestyles, many still struggle with "walking in two worlds". Many communities around the globe experience a disconnect between elders and youth, but in this case, the transition from nomadic lifestyles to contemporary modern culture occurred in under sixty years. This disconnect can be identified as a barrier in passing down Inuit traditional knowledge. Findings demonstrate that teaching, respecting and following these traditional principles can contribute to resilience and increase adaptive capacity in the community. This generational gap in worldviews and values also contributes to a disconnect between nature (or "the land") and humans.

Evidence from interviews, surveys, and observations suggest that food security is not as significant an issue as anticipated when beginning the research. Vulnerability of the traditional food system was not demonstrated as expected (e.g. hunting barriers directly resulting from climate change, and significant reduction in the availability of local wildlife). With reference to the locally reported reductions of available country foods, residents did not perceive these changes as particularly threatening, as the dwindling availability and quality of country foods accompanied the evolution from more traditional to more modern preferences. Strengths in the traditional food system was also discovered. For participants, store foods provide adequate substitutes for country foods, and although expensive, they are overall accessible.

Participants did not identify food security as a concern; however, research exclusively on food security would provide more conclusive results. This study did not focus on socio-economic barriers (e.g. high gasoline prices, poverty and unemployment, access to modern hunting equipment, etc.), which a food security study could include. The logical next step for research would be a study on future vulnerabilities in the community, including projected trends for climate variability, sea ice, and associated affects on humans and wildlife.

This research communicates the complicated and sometimes sensitive aspects of conducting research in Inuit communities in the Arctic. Representing less than one percent of the Canadian population and extremely high levels of environmental, historical and social research interest, Nunavummiut remain sensitive from the residual effects of colonization, and continue to struggle with fitting between Inuit and Western ways. These factors must be considered when conducting research in the territory.

"There is thus a grave mismatch between the knowledge that is needed to act locally and what is currently being done globally to generate knowledge about climate change, its impacts, and responses to concerns..."

(Wilbanks & Kates, 1999)

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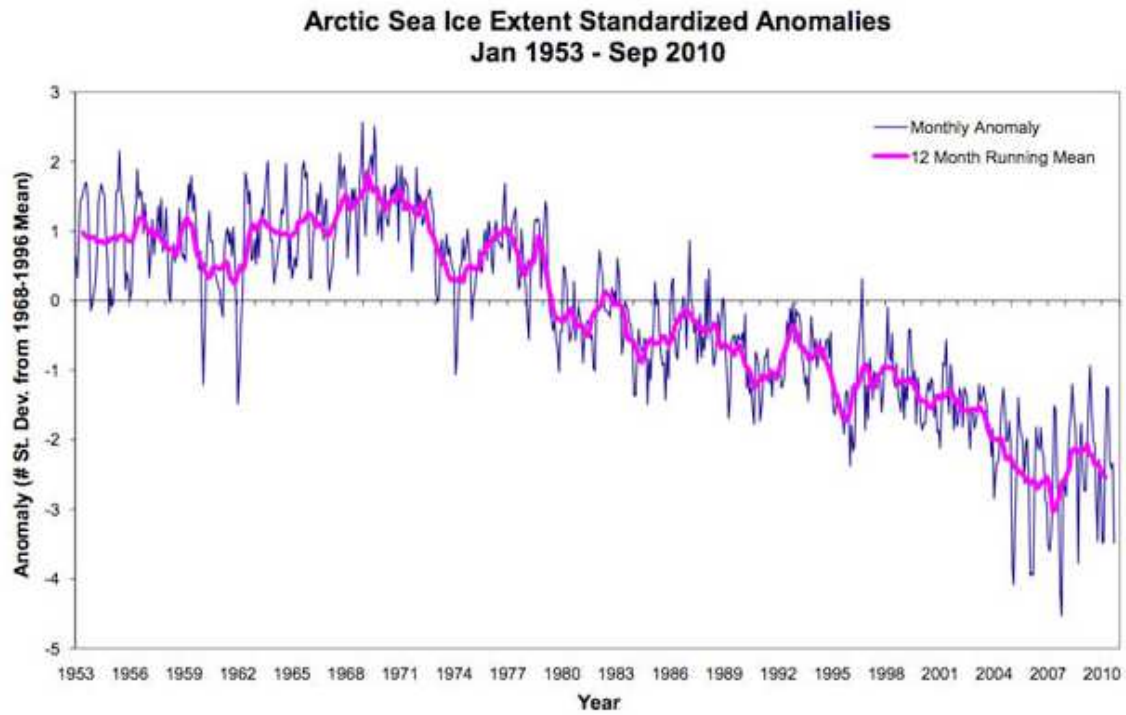
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7. Appendices

Appendix 1 Trends in declining Arctic sea ice



Trends in the Arctic Ocean, mean sea ice anomalies, 1953-2010: Sea ice extent departures from monthly means for the Northern Hemisphere.

Source: NWT Environment and Natural Resources n.d.

Appendix 2 Changes in all ice and multi-year ice of Arctic archipelago

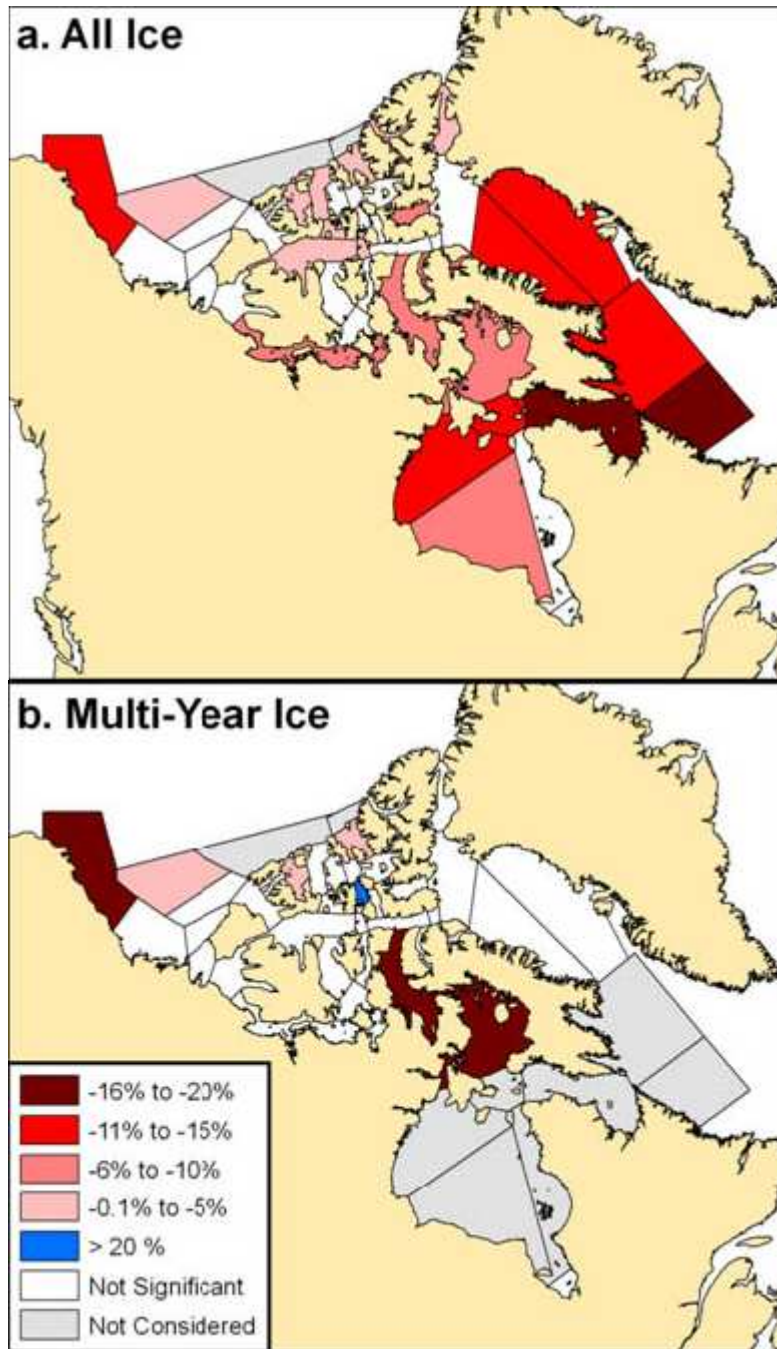


Figure A: Trends in summer total accumulated coverage for all ice types combined, 1966-2010.
Figure B: Trends in summer total accumulation coverage for old ice only, 1966-2010. Trends are expressed a percent of change per decade.

Source: NWT Environment and Natural Resources n.d.

Appendix 4 Selected significant events for Copper Inuit (post-European contact)

Source: Bonesteel 2006; Lackenbauer et al. 2005

YEARS	EVENT	DESCRIPTION
1000-1400	Thule migration	Ancestors of modern Inuit (Thule) migrated from coastal Alaska to Greenland. By the 15th century, they had replaced the Dorset people who previously inhabited the region. Copper Inuit were hunter-gatherer nomads.
1913-1916	Diamond Jenness (anthropologist and ethnologist) and the Canadian Arctic Expedition	First non-Inuit to immerse amongst the Copper Inuit of the Coronation Gulf area. He began documenting the Inuinnaqtun language with roman orthography. He counted 700-800 Copper Inuit during his research.
Up until the 1920's	Hudson's Bay Company (HBC) fur trading outposts	Unofficial administrators of Inuit services. The HBC was given authority from the British Government, and then from the Canadian Government, to record census information and to make reports about the welfare conditions of Inuit. In 1906, HBC declared Victoria Island "uninhibited", believing that Inuit had migrated to Hudson's Bay for trading opportunities. In the early 1920's, Inuit trader Stephen Angulialik worked at HBC post at Perry River. Angulialik was renowned across Canada for being an independent Inuit trader part of earliest business contact between the Kitikmeot and the outside world. He operated his post until 1956, gained notoriety in the north and awarded the Coronation Medal from Queen Elizabeth II.
1820-1969	Residential School System (Predominantly Anglican Missionaries in the Kitikmeot region)	The Government of Canada funded missionary societies to establish and operate boarding and residential schools for Inuit, First Nations and Métis children. At its peak involvement in the late 1920s, the Anglican Church operated 24 schools situated mostly in the central and western Arctic. The last residential school in Canada closed in 1996.
1956	Construction of the Cambridge Bay DEW Line (joint effort of Canadian and American Governments)	During the cold war, an integrated chain of radar and communication stations were built across the Arctic coast of North America. The purpose was to provide the US and Canada with warning of attack from the north. It extends east and west at roughly the 69th parallel. It is approximately 200 miles north of the Arctic Circle and 1400 miles from the

		North Pole. Construction occurred between 1954 and 1957.
1950's - 1960's	Canadian Government	Forced Inuit in the Kitikmeot to settle, abandoning nomadic tradition (some Inuit were forced to relocate to remote locations in the high Arctic). "Matchstick" housing units were shipped into Kitikmeot communities and replaced traditional dwellings.
1999	Establishment of Nunavut	The establishment of Nunavut as a distinct territory under Inuit self-government, from a section of the North West Territories, This provides a government responsive to the Inuit majority. It includes an elected legislative assembly of 19 members with no political affiliation, a cabinet, a territorial court and a premiere.

Appendix 5 Research License from Nunavut Research Institute (NRI)

Nunavummi Qaujisaqtulirijikkut / Nunavut Research Institute
Box 1720, Iqaluit, NU X0A 0H0 phone: (867) 979-7279 fax: (867) 979-7109 e-mail:
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SCIENTIFIC RESEARCH LICENSE

LICENSE # 04 052 12N-A

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TEAM MEMBERS: K. Whitfield, K. Nicholas, A. Anderberg, R. Krucas

AFFILIATION: Lund University

TITLE: Investigating the relationship between traditional foods, culture, and climate change:
A qualitative case-study in Cambridge Bay, Nunavut

OBJECTIVES OF RESEARCH:
The Canadian Arctic is understood as being one of the most affected by changing climactic conditions. Literature demonstrates that Northern communities profoundly feel the effects of climate change. Nevertheless, this is manifested very differently within various communities. This is why case studies are required, examining the effects felt by local residents. Food security is a commonly researched issue, as Aboriginal and Inuit groups have significantly lower food security than the rest of the Canadian population, as is food sovereignty as populations rely heavily on imports from the south (store foods). Overall, Canadian Arctic communities are considered to be extremely vulnerable to both climate change and food insecurity, which is why case study research is a valuable contribution to various disciplines, including the field of environmental studies and sustainability sciences.

TERMS & CONDITIONS:

DATA COLLECTION IN NU:
DATES: March 08, 2012-March 22, 2012
LOCATION: Cambridge Bay

Scientific Research License 04 052 12N-A expires on December 31, 2012
Issued at Iqaluit, NU on March 05, 2012


Mary Ellen Thomas
Science Advisor



Appendix 6 Table aligning research questions with survey and interview questions

<i>Survey question</i>	Relevance to RQ			
	1	2	3	4
Have you noticed new wildlife nearby, uncommon to the region?		x		
Have any common animals disappeared from the region?		x		
Does the sun feel stronger than it did in the past?		x		
Are there more plants in summertime?		x		
Have there been signs of permafrost melting?		x		
Are summer water levels in lakes lower than usual?		x		
Does your ability to earn money depend on weather conditions?		x		
Have recent weather conditions made it more difficult to hunt?		x		
Do you eat more store foods than country foods?			x	
Would you rather eat more country foods than store foods?			x	
Does over half your meat intake come from country foods?			x	
Are you able to access all the foods needed for a healthy diet?				x
Are you generally able to get all the foods you want (store and country)?				x
Are store foods expensive?				x
Does the weather stop you from getting the store foods you need (e.g. blizzards, visibility)?				x
Are there health risks associated with eating country foods?				x
Are there less caribou available to eat than there used to be?				x
Lately, has the caribou meat been good quality?				x

Note: Interview questions followed a less structured format. This was the planned structure before fieldwork, but loosened in the field to allow for more inductive findings. Each interview was tailored according to the participant(s), and covered topics relevant to each research question, such as those below.

<i>Interview question</i>	Relevance to RQ			
	1	2	3	4
<i>Weather & Climate</i>				
How is your personal life affected by the weather?	x	x		x
How is your professional life affected by the weather?	x	x		x
If you use traditional methods to read the weather, have you noticed differences in your ability to do so?	x	x	x	
Have you noticed any changes in sea ice in the region?		x	x	
Do you find the temperature is getting warmer?		x		
Have the seasonal weather patterns changed?		x	x	

Have any changes in the weather been good or bad for your community?			x	x
Have you changed the way you live in order to cope with changes in the weather?	x		x	
When you hear the term "climate change", what does it mean to you?	x	x	x	x
Food				
How do you use or define the terms country and store foods?	x			x
Does most of your meat intake (over 50%) come from country foods?	x		x	x
Tell me about the foods that you eat (store and country foods)	x		x	x
Depending on the answer above, why do you choose them?				
What store foods are most important to your diet?	x		x	x
Are these foods easy or difficult to get?			x	x
What makes these foods easy or difficult to get?			x	x
If it is difficult to get these foods, how do you deal or cope with this?	x		x	x
What country foods are most important to your diet?	x		x	x
Are these foods easy or difficult to get?				x
What makes these foods easy or difficult to get?				
If it is difficult, how do you cope with this?			x	
Does the weather make it easier or more difficult to get the foods most important to you?				x
If answered "easier", how does the weather make it more difficult?				x
If answered "difficult", how does this affect you?		x	x	
Is there anything you do to cope or deal with this?			x	
Overall, to what extent are you satisfied with the store and country foods available in your community?				x
Tradition & Food				
What are your hobbies?	x			
Do you participate in traditional activities (e.g. sewing, hunting, fishing)	x			
Are traditional activities (mentioned above) important to you?	x			
Why are they important to you?	x			
Do you enjoy doing them?	x			
Is it easy or difficult to participate in traditional activities?			x	
Why is it easy or difficult?		x	x	x
How often do you participate in traditional activities (hunt, sew, fish)?	x		x	
Is there anything else you would like to tell me about traditional practices and local food?				

Appendix 7 Consent forms for participation in surveys, focus group and interviews

7.1. Consent form in English

Consent Form

Please consider this information carefully before deciding whether to participate in this research.

What you will do in this research: You will be asked to participate in one interview (and if agreed, follow-up). You will be asked several questions on the following topics:

- weather and climate
- foods
- tradition and culture

Time required: The interview will take approximately 60 minutes. The survey will take under 15 minutes.

Benefits: This is a chance to tell your story and share your thoughts on environmental issues and changes in Cambridge Bay. It is also an opportunity to share experiences with traditional foods and communicate knowledge about your culture.

Confidentiality: Your responses to interview questions will be kept confidential. At no time will your actual identity be revealed. With your permission, I will tape record the interview. You will not be asked to state your name on the recording. You will be assigned a random number. I won't use your name or information that would identify you in any publications or presentations.

Participation and withdrawal: Your participation is voluntary, and you may withdraw at any time. You may skip any question during the interview, but continue to participate in the rest of the study.

To Contact the Researcher: If you have questions or concerns about this research, please contact: Kate Whitfield. Phone: (519) 701-5954, 12 Ardaven Place, London, ON. N6C 1H5. Email: kate.whitfield@gmail.com. You may also contact the faculty member supervising this work: Kim Nicholas, Professor of Sustainability Science, Lund University Centre for Sustainability Studies, P.O. Box 170, SE-221 00, Lund, Sweden. Email: kimberly.nicholas.academic@gmail.com

Statement of informant rights: "I have been fully informed of the objectives of the project being conducted. I understand these objectives and consent to being interviewed for the project. I understand that steps will be undertaken to ensure that this interview will remain confidential unless I consent to being identified. I also understand that, if I wish to withdraw from the study, I may do so without any repercussions."

Signature: _____ Date: _____

Name (print): _____

I agree to have this interview audio-recorded: YES _____ NO _____

7.2. Consent Form in Inuinnaqtun

Apikhoktoayagani Agigun Titigak

Ihomagineakan una hivonikhiyotikhak ihomaleogeaktinatin ilaoneaguvin uvani ilitokhaonmi.

Kanogileoguhikhan uvani ilitokhaomi: Apikhoktoaneakotin ilaoyakni ataohimi apikhoktaolotin (agikalo, kigoagutaok). Apigiyaoneakotin malguknik ukoniga okaotaoyonik:

- Hilam aalagukniganik
- Nikaenaknik
- Ilagekniginik nikin ilitkuheoyuvlo

Pivikhakakniga: Apikhoeneaktun ataohikmi ikaknikmi.

Ikayutikhan: Una pivikhakateaknik okaohigiyagani unipkagiyan okaohigilogilo ihomagiyatin kaoyimayatilo hilam aalagukpaleanigagun Ikaloktuteami. Okakveolaktoklo kaoyimayutigiyaviknik nikaenaknik okaohigilogilo kaoyimayatin Inoenaknik Nunavumeotalunen Iitkohenik.

Angeagiyaoniga: Kaoyutigiyatin apikutoayonun angeagiyaoneaktun. Kinaonigiyalunen kaoyimayaolimagitok. Agiguvin, nipileokneaktatka okakatigegutaoyun. Apigiyaolimaetotin okaohigiyagani atigiyan nipileogunmi. Toniyaoneaktotin napamik. Atulimaetaga atigiyan hivonikhiyotilunen naonaegutaoneakata kinaonigiyaknik kitulika takuyakhaeni okaohigiyenilunen.

Ilaonigiyani atokoeginiguvilo: Ilaonigiyani ihomaknegutigiyani, ilaohoelaktotilo ihomaknik. Keoyageakagitotin ilaginin apikotaoyonik okakvigiyaoiliguvini, kiheani ilaohimaklotin ilagani ilitokhaotimi.

Okakatigiyagani Ilitokhaeyi: Apikotikhakakniguvini ihomalotikaguvilunen ilitokhaonmik, okakatigiyavan: Kate Whitfield. Hivayaota: (519) 701-5954, togaaktakvealunen 12 Ardaven Place, London, ON. N6C 1H5. Kagitaoyakun: kate.whitfield@gmail.com. Okakvigenagealiklunen sikuktonik monagiyeoyok umiga havaamik: Kim Nicholas, Professor of Sustainability Science, Lund University Centre for Sustainability Studies, P.O. Box 170, SE-221 00, Lund, Sweden. Kagitaoyakun: kimberly.nicholas.academic@gmail.com

Okaohik hivonikhiyutikhanik ihomakhutaoyonik: "Kaoyipkagaoyoga piyotaoyonik havaamik. Kaoyimayoga ukoa piyotaoyun agigutigalo apikhoktaoyamni havaami. Kaoyimayoga kanogileokneakun una okakatigegun angeagiyaoneakok kiheani agiguma talvatoak. Kaoyimayogalo, taemagumanigupko ilitokhaotin, pilaktoga kanogileoktaogiloga."

Saeneotin: _____ Uploa: _____

Atugiyan (titigateaklogo): _____

Kungeaktologo una: _____ Uploa: _____

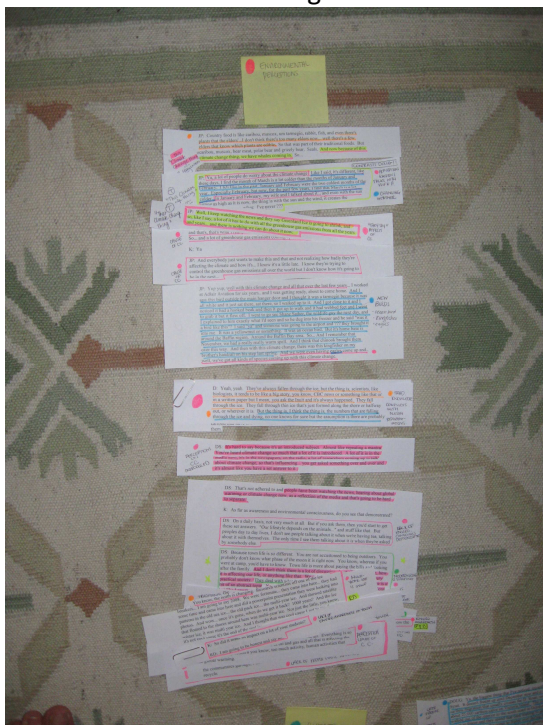
Appendix 8 Qualitative theme key (used to code themes from text)

Colour code	Theme	Sub-theme	Example from transcript text
Orange	The Inuit way	Traditional way of life Knowledge of the land Values, spirituality, family, norms Strength and resilience Harshness of life Oral history and language	Yes and that's how our elders taught us. Is no matter what happens in life, you know, just keep going. Just keep on going. You know, situations become hard or you know rocky down the road but you know, you just have to keep on going. (Helen)
Green	Adaptability to modernized life	Adapting work and monetary system Adapting to town life Less time on land Loss of language "Walking in both worlds" Transition of food system Adaptation of hunting Fast pace of transition	Yes [the food] is very important to my tradition. Because it's what our ancestors lived off for many generations. And here, it's still important and it should still be important today for our youth. To see the types... they don't have to like it...try it if they haven't but to understand and to know that the traditional food are just as important as their KFC today. (Helen)
Pink	Environmental perceptions	Environmental awareness/ concern External perceptions of climate change (media and missionaries) Loss of environmental stewardship	And everybody just wants to make this and that not realizing how badly they're affecting the climate and how it's... I know it's a little too late. I know they're trying to control the greenhouse gas emissions all over the world but I don't know how it's going to be... (Tom)
Blue	Observed environmental changes	Unpredictability of weather (storms and snow) Unpredictability of ice conditions Changing flora and fauna New species Changing sun	...the sun is right in the centre. It's right in the centre compared to where it used to be situated. (Betsy and Benjamin)
Purple	Human vulnerabilities	Difficulties hunting and travelling Emotional and stress-related vulnerabilities	Like when Brent mentioned, the ocean... you know people often rely on to go across to the mainland and back for hunting

		Vulnerability of traditional food system	purposes... when it warms up the ice would melt and that would happen and it's pretty difficult to travel across for the hunters. (Betsy and Benjamin)
Red	Food security	Nutrition High prices of store foods	Mangoes, you name it. You pay a lot of money for them. But, the availability is amazing. Compared to what it used to be, it's a non-issue. (Phillip)

Appendix 9 Photographs demonstrating the highlighting, cutting and sorting data into themes and sub-themes

9.1. Transcripts have been read, highlighted according to themes and sub themes, cut and sorted into thematic categories



9.2. Cut and sorted data is sorted with paper clips and Ziploc bags before writing. This organization made it easy to go back to the data and revise themes and revisit written sections.



Appendix 11 Scope and Limitations

11.1. Scope and limitations of the research approach

Entering research, it was acknowledged that adaptation alone is not expected to cope with all the expected effects of climate change. This is especially true not over the long term, as most impacts increase in magnitude (Pachauri et al., 2007). This study did not aim to capture all stresses associated with climate change. Nor did it aim to reflect the entire community or generalize the Inuit experience. The goal was to report on the main vulnerabilities found in this community, providing a broad snapshot, incorporating traditional knowledge where possible. This study included the views of very few residents in the community (N=29). The variation of perspectives, opinions, and experiences between groups in the community (e.g. elders and youth) or within groups were not addressed. Quite evident was the lack of representation of the Inuit youth (under 25), who represent 43% of the population of Cambridge Bay (Nunavut Bureau of Statistics, 2012).

The methodology and methods of data collection utilized in this study do not claim to be representative of the entire community. Rather the purpose was to gather rich and detailed information about current vulnerabilities, to gain a deeper understanding of local experiences, to make a better assessment of vulnerability. The second stage of the vulnerability framework, which was beyond the scope of this project, would have required collaboration with the greater climate sciences community; estimating directional changes in exposure to climate change, predicting future adaptive capacity on the basis of past behaviour, estimating the likelihood of climatic changes in the community as well as estimating future socio-economic conditions in the community (Ford & Smit, 2004). This particular application of the framework primarily focuses on current vulnerabilities and current adaptive capacity, and disregards most implications for future vulnerability.

Within ethnographic research, the researcher is meant to engage in a long-term sustained interaction with an intact cultural group of participants in a natural (not controlled) context, in order to gain an insider's understanding to gain an in-depth look at life (Khagram et al., 2010). Due to time and funding limitations, only two weeks in the field were possible. This weakened the ethnographic approach. The lack of external funding for this project presented financial barriers in many ways; from transportation to the Arctic (for follow-up visits or to communicate findings), food and housing costs, and a lack of funds to compensate participants (which many expected). Many Inuit participants in research find that they are not appropriately credited in published works, nor are they financially compensated in a fair manner (ITK & NRI, 2007).

Within the guidelines *Negotiating Research Relationships with Inuit Communities*, it was made clear that researchers should have a level of local input and involvement with communities at all stages of the research process, which enhances the research value to the community (ITK & NRI, 2007). In this study, a higher level of local input would have strengthened the utility in the community. An understanding of local socio-economic and environmental conditions was recommended before going into the field (ITK & NRI, 2007), which was challenging due to remoteness of the location, lack of studies on the region, and working individually, rather than with a research team. Greater knowledge on the demographics, social and economic situation in this locations would have made it easier to narrow down the scope of this project, with focus

tailored on a) climate impacts or b) socio-cultural vulnerabilities or c) food security, and not a surface level understanding of the three.

11.2. Research limitations encountered in the field

An aim in this research is to incorporate an element of local, traditional Inuit knowledge or Inuit Qaujumajatuqangit. In this paper, a community-level sense of the multi-faceted and highly evolving traditional knowledge is attempted through the theme the "Inuit way". As a non-Inuit researcher, the distance from Inuit Qaujumajatuqangit is a barrier in adequately incorporating traditional knowledge. Knowledge of Inuinnaqtun would have also enhanced the research. Analyzing data that first went through an interpreter decreased the validity and reliability of the findings from the focus group and from the elders interviews.

Literacy and comprehension levels of participants were identified as a major barrier for the survey research. An informant reported that levels average at a grade three and four level. Despite multiple modifications of the survey, it became evident that survey research is not an appropriate methodology for research of this kind, as the questions were deemed confusing, and many residents were intimidated by paper surveys. Nineteen surveys had already completed before this barrier was realized, of which only twelve were viable. Oral surveys provided higher quality data. This enabled participants to open up, and give more detailed answers and stories. Participants were much more amiable and willing to participate when approached about oral surveys. Overall, the oral nature of history and knowledge in this community made it much more conducive to qualitative interview-based research.

Regarding duration in the field, the timing of late winter/early spring field work had both negative and positive elements. A benefit was that summer often brings many researchers. In such a small community, researchers are noticeable and residents can become weary of their presence. However, the summer season would have allowed for more time on the land and participation in hunting or harvesting activities.

The short field work period became problematic when unexpected events arose. Three funerals occurred during time in the field. Funerals are very significant in the community, closing banks and offices in some cases. On the day of a funeral, it is inappropriate to conduct interviews or make arrangements for interviews. The short time in the field also lead to missed opportunities with some excellent hunters who were on duty travel.

Being a single, foreign (non-Inuit) female researcher was a observed as a barrier. In some cases, I was not treated as an equal capable of understanding hunting, or handling the harshness of Arctic life. This was observed with some participants in the study, but mainly observed through informal conversations with locals. More opportunities to participate in traditionally male activities (such as hunting and harvesting) may have arisen with a male researcher. This could also be attributed to visiting in winter.

Lastly, these findings were very interconnected with aspects of Inuit culture. This was not the intent of the researcher, but with a background in sociology and cultural studies, interests lay in the social and cultural arena. During semi-structured interviews, topics inevitably leaned toward socio-cultural aspects. Furthermore, the key research contact was through the Kitikmeot Heritage Society, which influenced interests in the field. Two participants in this study were

affiliated with cultural restoration efforts, which may have created a slight bias toward socio-cultural aspects.

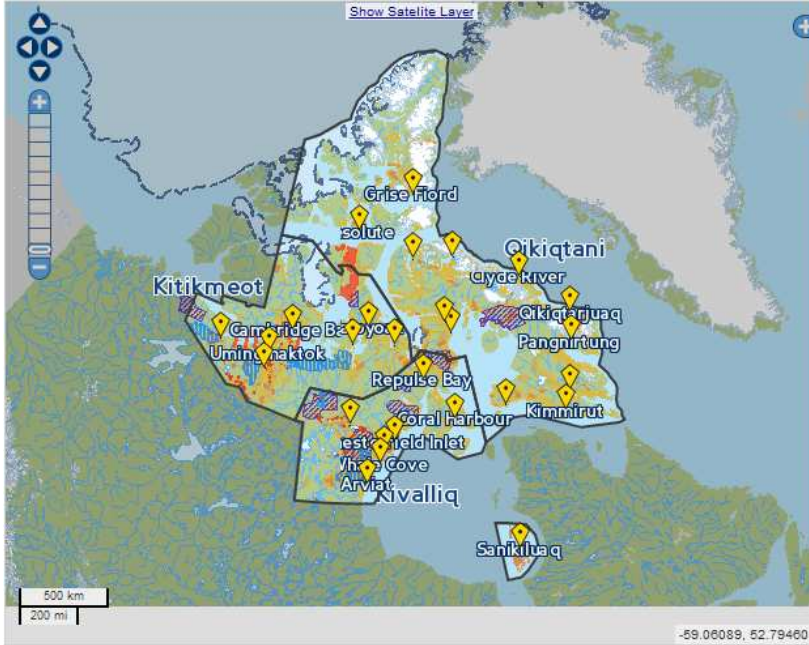
Appendix 12 Photo of Cambridge Bay dump in summertime



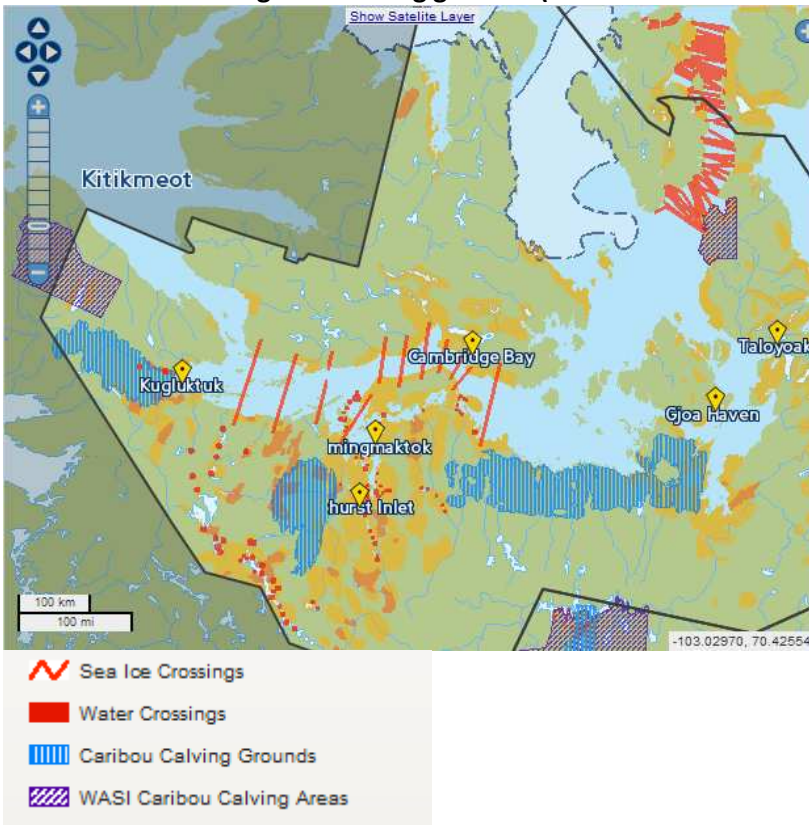
Photo credit: Monica Bourque
Photo taken June, 2011

Appendix 13 Map of caribou calving grounds and ice crossings

13.1. Caribou crossings and calving grounds (zoomed out)

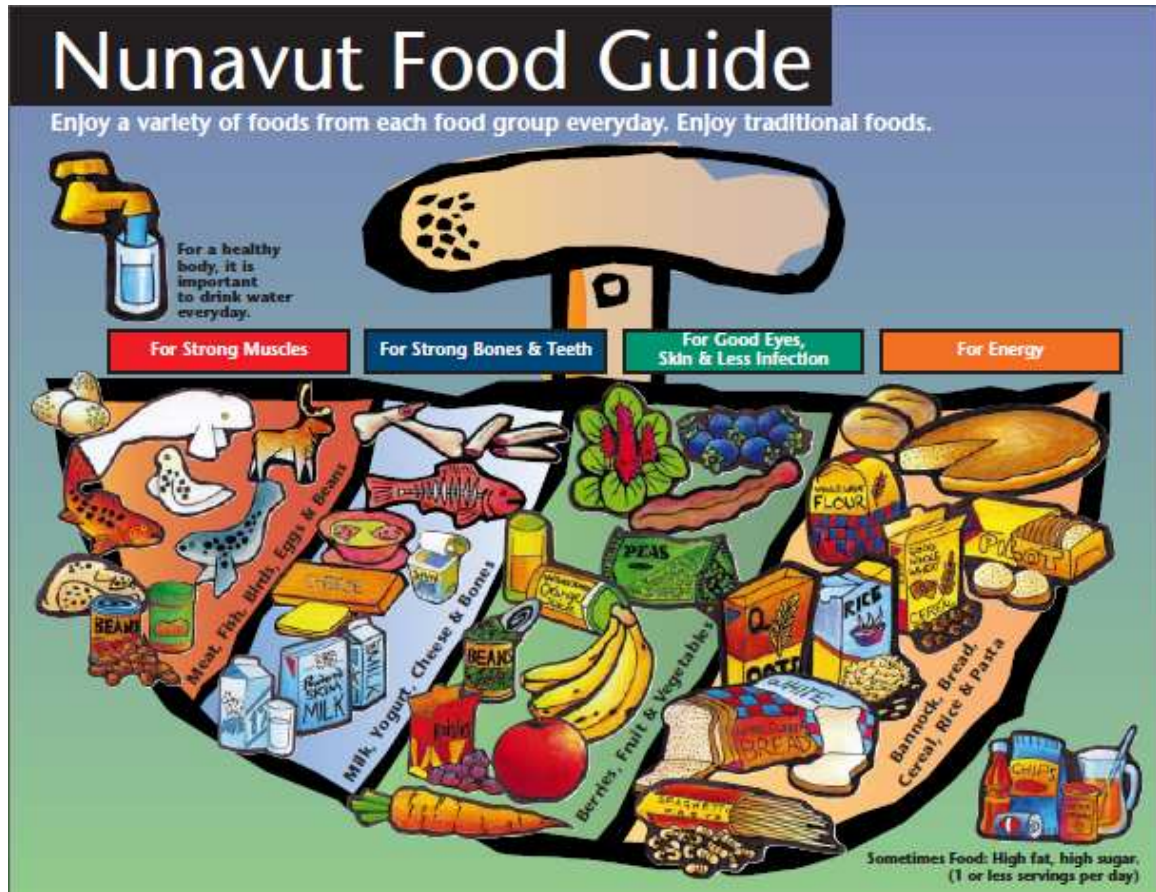


13.2. Caribou crossings and calving grounds (zoomed into area of interest)



Source: Nunavut Planning Commission n.d.

Appendix 14 Nunavut Food Guide



Source: Nunavut Department of Health and Social Services n.d.

Appendix 15 VSD Categories

Sections in the text	Components of VSD
<i>RQ 1: What cultural insights are valuable to understand adaptive capacity?</i>	
Theme 1:	Dimension: Adaptive capacity Component: The Inuit way
The Inuit way	
Sub-themes:	
Family Distance from western norms Mix of traditional and modern Harshness of life Spirituality and superstition	Measures of components
Theme 2:	Dimension: Adaptive capacity Component: Inuit way
Personal views on environment	
Sub-themes:	
External and introduced concepts of climate change Oral history Local environmental perceptions	Measures of components
<i>RQ 2: How are residents experiencing climate change?</i>	
Theme 1:	Dimension: Exposure Component: Climate change
Current exposure to change	
Sub-themes:	
Changes in local fauna Changes in characteristics of the sun Higher temperatures Changing plants and permafrost	Measures of components
Theme 2:	Dimension: Exposure Component: Climate change
Current vulnerabilities to environmental change	
Sub-themes:	
Unpredictable ice melt Less predictable weather Dwindling caribou populations Emotional stress	Measures of components
Theme 3:	Dimension: Sensitivity Component: Socio-cultural
Social vulnerabilities	
Sub-themes:	

Disconnect from Inuit way Medicalization of birth Residential School system	Measures of components
RQ 3: How are residents adapting to climate change?	
Theme 1:	Dimension: Adaptive capacity
Adaptation of food system	Component: Adaptation of food system
Sub-themes:	
Substituting store for country food Storing country food Shift in preferences (esp. youth)	Measures of components
Theme 2:	Dimension: Adaptive capacity
Adaptation of hunting	Component: Adaptation of hunting
Sub-themes:	
Non-subsistence hunting Extra precautions taken while hunting	Measures of components
Theme 3:	Dimension: Adaptive capacity
Narwhal event	Component: Adaptation of hunting
Sub-themes:	
Learning experience Brought community together Need for training Tensions between traditional and modern hunting	Measures of components
RQ 4: What are local food security concerns?	
Theme 1:	Dimension: Sensitivity
Store foods	Component: Store food (modern food system)
Sub-themes:	
High cost Low nutritional awareness	Measures of components
Theme 2:	Dimension: Exposure
Country food	Component: Climate change
Sub-themes:	
Vulnerability of traditional food system (caribou, muscox, fish) Positive changes in food system (char, berries, narwhal)	Measures of components