Tuktu and Environmental Change:
INUIT CARIBOU HARVESTING ON SOUTHERN BAFFIN ISLAND

By:

Knut Tjensvoll Kitching

A Thesis Submitted in Partial Fulfillment of the
Requirements for the Degree of M.A. in Geography

Department of Geography
McGill University
Montreal (Quebec) Canada

Oct 2016

Abstract:

Up to this point there has been relatively little research that has examined human-caribou interactions in the context of multiple natural and human stresses. Previously the focus of management studies has been on the co-management structures and their function. By addressing community interactions with caribou on Southern Baffin Island in the context of changing access, climate-driven caribou population changes, and evolving management frameworks and institutions, this study aims to develop a baseline understanding of the sustainability of caribou harvesting in the Iqaluit region.

Drawing attention to caribou as a major source of country food, and a species that is sensitive to climate change impacts, the study will be a resource for land-use planners and policy-makers on the importance of preserving biodiversity and sustainable northern ecosystems from ecological, cultural and food security perspectives. The work helps to refocus attention on sustainable harvesting and co-management as a key adaptation and resiliency strategy in the face of a rapidly changing Arctic.

Working closely with community members, and building upon over 6-years of previous research in Iqaluit, the thesis examines how hunters are adapting their behaviors to changing access to harvest areas and variations in caribou populations. This is considered against the backdrop of adaptive changes within the territorial institutions and organizations that are engaged in wildlife management.

Resume:

Jusqu'à ce point, il ya eu relativement peu de recherches ont examiné les interactions homme-caribou dans le cadre de multiples contraintes. Auparavant l'objet d'études de gestion a été mis sur les structures de cogestion et de leur fonction. En abordant les interactions communautaires avec caribou sur Sud de l'île de Baffin, dans le contexte de l'évolution des accès, des changements des populations de caribous induits par le climat, et un certain nombre de cadres et d'institutions de gestion, cette étude vise à développer une compréhension de base de la durabilité de la chasse au caribou dans le Iqaluit région. Attirant l'attention sur le caribou comme une source importante de nourriture du pays, et l'une des espèces de l'Arctique qui, potentiellement, être profondément touchés par le changement climatique, l'étude sera une ressource pour les planificateurs et les décideurs politiques d'utilisation des terres sur l'importance de préserver la biodiversité et écosystèmes nordiques durables des perspectives de sécurité écologiques, culturelles et alimentaires. Cette étude aide à recentrer l'attention sur l'exploitation durable et de cogestion comme une adaptation du clavier et de la stratégie de résilience dans le visage d'un Arctique en mutation rapide.

Travaillant en étroite collaboration avec les membres de la communauté, et se fondant sur plus de 6 ans de recherches antérieures à Iqaluit, cette recherche examine comment les chasseurs adaptent leurs comportements à l'évolution de l'accès aux zones de récolte et des variations dans les populations de caribous. Cette question sera examinée dans le contexte des changements adaptatifs au sein des institutions et des organisations territoriales qui sont engagés dans la gestion de la faune.

Acknowledgements:

This work has been made possible through the guidance and support of my supervisor Dr. James Ford and my committee members Professor George Wenzel and Dr. Martha Dowsley. Their advice and comments have been instrumental in shaping all aspects of my research and writing process. Their patience with my struggles has helped fuel my enthusiasm for the research process, and they have nurtured my love for all things northern. In Iqaluit, Jamal Shirley, Mary Ellen Thomas, Levi and Udlu Pishuktie, and Annugakuloo Kelly have helped to make my research process a wonderful adventure. They have shared their time and encyclopedic knowledge of the Arctic to help make my visits to Iqaluit as productive and exciting as possible.

Table of Contents:

List of Figures

List of Tables

Glossary of Acronyms:

GN – Government of Nunavut
HTA – Hunters and Trappers Association
HTO – Hunters and Trappers Organization
IEK – Inuit Ecological Knowledge
IK – Inuit Knowledge
IQ – Inuit Qaujimajatuqangit
NTI – Nunavut Tunngavik Incorporated
TEK – Traditional Ecological Knowledge
TK – Traditional Knowledge
TAH – Total Allowable Harvest

CHAPTER 1: INTRODUCTION

1.1 Introduction

The findings of the Arctic Climate Impact Assessment (ACIA) and the Intergovernmental Panel on Climate Change clearly show that the impacts of global anthropogenic climate change will be felt most dramatically in the Polar Regions (ACIA, 2005; Larsen and Anisimov, 2014). These global trends and changes are already making themselves felt in communities around the circumpolar north where residents have long noted increased unpredictability in shoulder-season conditions, decreased ice cover and thickness, and warmer weather (Ford et al., 2015). Nowhere are these changes felt more keenly than in the indigenous communities of northern Canada, particularly the Inuit Nunangat (the homeland of the Inuit people) (Bourque and Willox, 2014; Cunsolo Willox et al., 2012; Ford, 2009a; Ford et al., 2012; Furgal et al., 2008; Furgal and Seguin, 2006; Gearheard et al., 2006; Gearheard et al., 2010; Nickels et al., 2006; Pearce et al., 2011a). In addition to climate change, the Arctic is also experiencing rapid social, cultural, economic, and environmental changes associated with globalization, resource development, generational transitions, and rapid population growth in some regions (Larsen and Fondahl, 2015; Hovelsrud et al., 2011). Together, these multiples stresses will have considerable impact on Arctic societies and the environment (Krupnik et al., 2010).

Environmental change – encompassing climatic change and the effects of resource development on the environment – will affect Arctic Canada profoundly, as altered natural cycles and landscapes are already being felt in northern communities,

particularly those whose relationship to the environment revolves around a subsistence hunting tradition (Crowley, 2010; Orlove et al., 2014; Krupnik et al., 2010). Resource development and population growth are compounding stressors, affecting both wildlife populations and the ability of communities to adapt (Cameron, 2012; Ford et al., 2015). For Inuit, subsistence hunting is central to their culture and heritage and remains an important component of contemporary community life (Wenzel, 2009, 2013; Borre, 1990). The high cost of store purchased food in northern communities also means that many families supplement their diet with country food, the local term for the meat of animals acquired outside of the community in the local area (Egeland et al., 2011; Ford and Beaumier, 2011; Organ et al., 2014; Wesche and Hing Man, 2010; Gombay, 2005a). Amongst the Inuit of northern Canada there is a long and important tradition of sharing food that has been hunted or caught according to a variety of rules and ritual relationships and responsibilities (Collings et al., 1998; Harder and Wenzel, 2012; Kishigami, 2004; Wenzel, 1995, 2013; Wein et al., 1996). These sharing networks are both an important insulator during periods of hardship or stress as well as underpinning community cohesion (Wenzel, 1995).

Caribou (*Rangifer tarandus*) have traditionally been an important food source for many Arctic indigenous groups, and they are particularly important for the Inuit of Nunavut (Freeman et al., 1976; Wein et al., 1996). They are eaten throughout the Arctic on a semi-seasonal basis, as well as forming an essential part of Inuit material culture; caribou skins for instance, are used in clothing and their antlers and bones in a variety of tools, arts and crafts) (Oakes 1991). They are a core animal, an essential part of the landscape and the fabric of Inuit existence. The cultural keystone species concept

articulated by Garibaldi and Turner (2004) is an excellent descriptor for caribou, and alongside ringed seal they represent one of the most important country foods consumed for Nunavut Inuit. However, there remains relatively little research on the relationship between a community and a caribou herd in the context of environmental change, in particular the challenges facing hunters, noting that these are, of course, taking place against a backdrop of demographic change, resource development and other facets of community transition.

Since the early 1990s there has been a noted decline of the caribou herd of Baffin Island, Nunavut, by more than 90% (Jenkins et al., 2012). Communities on Baffin Island have observed this decline and there have been a number of attempts to enumerate the two sub-herds on the island (the north and south Baffin herds), which have all come to the same conclusion – there remain roughly 2000 animals left on the island from approximately 180,000 in the late 1990s (Ferguson and Messier, 1997). This decline has brought significant pressure to the territorial wildlife management institutions, with the decline of caribou reaching crisis levels. The response by the Government of Nunavut has been to impose a Moratorium on caribou harvesting on southern Baffin Island, beginning on 1st January 2015 and extending until 26 August 2015 when a Total Allowable Harvest (TAH) of 250 males was announced for the region. Given the importance of caribou for Baffin communities (Priest and Usher, 2004), the impacts of this ban and ongoing restrictions are expected to be significant.

The impact that environmental change will have on caribou remains debated: some scientists suggest that increasing temperatures and moister summers could lead to rapid regeneration of forage (Rattenbury et al., 2009; Vaisanen et al., 2014), while others

suggest that these same factors will trigger parasite blooms and the shoulder-season rain-on-snow events which have been noted as a major cause of starvation and calf mortality (Furberg et al., 2011). As such, there is limited understanding on how populations of caribou of southern Baffin Island might be affected by environmental changes.

This thesis is situated in the context of multiple stresses affecting caribou populations across the circumpolar north, and on Baffin Island in particular, many of which are expected to continue in the future. Specifically, the thesis asks: to what degree is contemporary caribou harvesting in Iqaluit influenced by these ecological, socio-cultural or socio-economic and political stresses, and how can available management options address these factors?

1.2 Aims and objectives

The overarching aim of the thesis is to characterize the changing nature of caribou harvesting on southern Baffin Island and to identify factors impacting the caribou harvesting of the community of Iqaluit related to environmental change, identified as change in ecological, socio-cultural and political spheres. This will be achieved through 4 objectives:

Objective 1: Document the changing patterns of caribou harvesting in Iqaluit drawing upon Inuit and scientific knowledge.

Objective 2: Identify and characterize factors affecting caribou harvesting and how they are changing.

Objective 3: Document community perspectives on changing caribou ecology.

Objective 4: Examine how hunters are experiencing and responding to changes in caribou.

1.3 Thesis Format

This thesis is made up of five chapters. The first chapter is the introduction. The second chapter reviews the relevant literature around the impacts of environmental change on caribou, the relationship between country food and food security in northern communities, various wildlife management regimes and their epistemological challenges and the use of community mapping as a tool for research with indigenous communities. In doing so, the chapter provides context for the remainder of the thesis. The third chapter then profiles the study design and the methods used to gather data. Chapter four documents the results. Chapter five examines the results and discusses implications for the co-management regimes of the territory and regional resource management and concludes the thesis.

CHAPTER 2: LITERATURE REVIEW

In this chapter key bodies of literature on caribou and environmental change, and Inuit subsistence hunting are reviewed and examined to provide context for the thesis. In particular, the literature around the projected and current impacts of climate change on caribou populations in the circumpolar north as well as the impacts of climate change on country food systems are of importance to this investigation. Scholarship around co-management, both as a site of epistemological conflict, as well as a management tool in-light of multiple social and environmental stresses, is considered.

2.1 Environmental Change in the Canadian Arctic

Ongoing environmental change in the Arctic is having a broad range of impacts on the natural and human environments (as seen in Table 1). These changes are occurring in the physical environment, notably through changes in temperature, and through the human environment, through increased development of resource industries and increasing exposure of remote communities to global economic forces.

Changing temperatures are having profound impacts on marine and terrestrial ecosystems (see Table 1). Warming air temperatures are causing shifts in seasonal weather patterns, causing earlier spring thawing of sea-ice and later freeze-up (Krupnik and Jolly, 2002). These impacts on the Arctic ecosystem have profound impacts for Inuit hunters who struggle to predict previously stable and predictable patterns of weather and ice movement. These ecosystem changes are making travel and hunting, necessary to the

conduct of traditional hunting activities and cultural continuance increasingly risky (Fox, 2002).

Increasing temperatures are having important impacts on Arctic wildlife, leading to range shift as well as fluctuations of abundance (Krupnik and Jolly,2002). Northern species reliant on specific conditions are increasingly forced to shift their ranges further north, while southern species migrate north (Ford and Smit, 2004). These changes to wildlife are having important impacts on Inuit communities who rely on them for food and as central components of their culture (Ford and Smit, 2004; Krupnik and Jolly, 2002). As populations continue to grow and global economic forces continue to make themselves felt through expanding transport and extractive industry infrastructure the impacts on northern communities will only increase (Ford and Smit, 2004; Krupnik and Jolly, 2002; ACIA, 2005).

Environmental Stressors *(After Ford and Smit, 2004; Krupnik and Jolly, 2002; Berkes and Jolly, 2002)*	
Stressor	**Documented and Projected Impacts**
Economic	Increased shipping costs, increased food costs in communities. Increased pressure from extractive industries projects (gems, commodities, natural gas and oil)
Political	Sovereignty challenges will increasingly emerge as sea-ice deteriorates and shipping will increase with climate change
Food Security	As populations of communities increase demand for food will increase (both from regional wildlife populations, and store food)
Environmental/ Ecological	Changes to hydrological, permafrost, sea-ice systems which will in turn have serious implications for marine and terrestrial environments. Erosion of coastlines, increased risk of landslides and slumping.
Wildlife	Changes in temperature and precipitation will have significant impacts on wildlife populations and their ranges (which will have feedback impacts on food security of northern communities – mentioned above)
Social/Cultural	Stress and depression arising from increased cost of living, challenges of spending time out on the land (and increased risk

	associated with changes in environment)

Table 1: Environmental Stressors Impacting the Arctic Environment

2.1.1 *Rangifer Tarandus* and Environmental Change

Caribou declines on Baffin Island (Jenkins et al. 2012) and across large parts of the Canadian and Circumpolar North (Gunn et al. 2011, Vors and Boyce 2009) have been linked to a range of environmental factors, including climate change (Forbes, 2013; Furberg et al., 2011; Rattenbury et al., 2009; Vaisanen et al., 2014; Yannic et al., 2014). While scholars agree that caribou are being impacted by climate change, varying by region and population, the exact nature of these impacts is debated and will be influenced by interaction with non-climatic stress (Forbes et al., 2009). Changing temperature, moisture and wind regimes may have a range of impacts on caribou, their environment and other important species such as the warble flies (*Hypoderman tarandi*) and nose bots (*Cephenomyia trompe*) which are noted for stressing animals, and whose populations will likely increase with rising temperatures and more standing water after spring melt events (Pielou 2012).

While some scholars are noting links between environmental change and global declines of caribou and reindeer on broad regional and global scales (Vors and Boyce 2009), there have been few attempts to link population health to climate on a smaller, more local scale. Instead herd declines may often be locally attributed to causes such as habitat encroachment, disease or over-harvesting. In the case of the caribou herds of Baffin Island, environmental change may have a significant role – although what this role may be remains difficult to define clearly. Changes in temperature regimes will impact

snow cover change (Callaghan et al., 2011), increasing the likelihood of rain-on-snow events which make foraging difficult through the spring and fall (Forbes et al. 2008; Forbes and Kumpula, 2009; Rennert et al., 2009). Such events increase the standing water in the late spring and summer which causes blooms of the biting insects which pester caribou. Increases in insects mean that the pestered animals struggle to maintain body mass through the late summer and fall foraging season, resulting in underfed animals that may not survive the winter (Bergerud et al., 2007).

To contrast these climate-related stresses other scholars have suggested that increased temperatures will also lead to an extended growing season and potentially improved pasture in previously poor areas, as well as faster regeneration of browsed areas (Meltofte et al., 2008; Forchhammer et al., 2005). While greater access to forage is likely a potentially beneficial change for caribou, what that might mean in relation to the other dynamics discussed above remains unknown.

$$\Delta\ Caribou\ population$$

$$(Herd\ x) = natural\Delta\left(\frac{growth}{\begin{matrix}natural\ loss\ (calf\ death,\\ predation\ and\ natural\\ causes\ of\ mortality\end{matrix}}\right) - human\ take\left(\frac{\Delta population}{\begin{matrix}\Delta rate\ of\ consumption\\ by\ relevant\ communities\end{matrix}}\right)$$

Figure 1. Modelling herd population change in light of multiple stresses. Based on basic population change model from Hughes (1986) and adapted by the author.

Figure 1. represents the relationship between natural herd fluctuations and human influence on caribou herd size. The impact of natural changes is meant to encompass changes to the physical environment that caribou inhabit. It could be argued that the current changes being experienced through climate change are inherently 'unnatural',

although this is not the aim of this graphic. Rising temperatures and increased precipitation leading to 'rain on snow' events and increased/decreased forage (lichen) are inherently 'unnatural'. Human harvest of caribou could also be further subdivided into the 'takes' of different members of the southern Baffin Island communities. Because climate change acts to exacerbate other challenges, it may be a multiplying factor in human behavior as well as a direct cause of other environmental changes/conditions and certain caribou behaviours. While climate stresses may well influence human behavior and hunting landuse, the ability of caribou to adapt to changing weather and climate will likely be influenced by human disturbance, both that which is visibly intrusive like road and pipeline construction and less visible like increased air traffic and overflight noise (Forbes et al. 2009).

Two separate populations of caribou on Baffin Island (north and south) are documented, noting that both herds are made up of *Rangifer tarandus groenlandicus,* the barren ground caribou (Ferguson and Messier 1997, Pielou 2012). Reindeer (*Rangifer tarandus tarandus*) were introduced to the area close to Kimmirut in the early 1920's; however, while there remain local stories about certain of the traits of these reindeer being visible in local caribou, there is no genetic evidence on record to suggest a continuance of this herd stock.

2.2 Food Security, the Importance of Country Food, and the Impacts of Environmental Change on Subsistence Hunting

Country food is central to the lives and health of Inuit communities. Poppel and Kruse (2009) estimate that in four of ten households more than fifty percent of meat consumed is locally harvested. While such statistics may vary widely between

communities and are continually changing, they help to give a sense of the rate of consumption and the importance placed on country food. Studies of food security and the various pathways followed to access country-food are an important component of research on hunting. While these pathways are particularly complex in larger communities with large non-local Inuit populations, they are increasingly being investigated (Statham et al., 2015; Gombay 2005b; Dombrowski et al. 2013; Statham, 2012). For example Statham et al. (2015) in their work in Iqaluit show that country food is accessed in the traditional manner by sharing between immediate family members, but also through an increasingly fractured network of reciprocal relationships, as well as through an internet-facilitated inter, and intra-community trade.

Much of the food security work that has been done in Inuit communities has concluded that sources of country food and the networks that have traditionally distributed it are changing (Chan et al., 2006; Ford, 2009b; Loring and Gerlach, 2015; Nancarrow and Chan, 2010; Statham et al., 2015; Wesche and Hing Man, 2010; Statham, 2012). In her examination of changing food networks in Puvirnituq, for example, Gombay (2005a and 2010) examines the ways in which the work of economist Karl Polanyi can be mobilized to explain the transition of Inuit economy from one based on kinship networks which are at the heart of food sharing, to one based on economic trade relationships between individuals. This transition, and the gradual replacement in many cases of traditional sharing networks, is a key part of any discussion of food security and subsequently of hunting (Ford and Beaumier, 2011; Wenzel, 2013). Inuit are for the most part not sport hunters, and with the collapse of the sealskin economy after the 1983 EU ban, Inuit hunting is done primarily for food (Wenzel et al. 2016). In-turn, the impacts of

environmental change will be felt throughout the sharing economy and the country-food based system (Hovelsrud and Smit 2010; Ford, 2009b).

Research on wildlife and the current status of wildlife management has direct relevance to Inuit access to country food. The nature of management regimes thus will have an impact on food sharing networks, as they will to a great extent determine the ease of access, for hunters seeking certain types of country foods.

Hunting often demands major cash investments, both in longer-term investments such as equipment (rifles, snowmachines etc.) but also in shorter-term trip-by-trip costs for fuel. As the cost of hunting increases and other factors such as wage jobs keep Inuit in the settlements, more and more Inuit are finding themselves only making short hunting trips after work or on weekends (Gombay, 2010; Ford, 2009b; Ford et al., 2013). In many cases, these shorter trips act to limit the types of prey that hunters can harvest, as well as focusing hunting pressure on a smaller and more defined area close to communities (Ford et al., 2013; Pearce et al., 2015; Pearce et al., 2010; Wenzel, 1991, 2009). This acts to increase the hunting pressure on those species that are to be found within a shorter distance of the settlement. In the case of Iqaluit, for example, the focus of this thesis, key sites for shorter hunting trips include certain areas close by on the bay where seal can often be found, as well as several local trails where caribou may be encountered and in several cases, where there are also rivers with good char runs.

The degree to which young hunters (and older ones in some cases) feel comfortable on the land also impacts both the species hunted and the distances travelled (or areas exploited) (Ford et al., 2006a and 2006b; Pearce et al., 2015; Pearce et al., 2011b). In the case of communities such as Iqaluit where the proportion of non-Inuit is high, and there is

a large proportion of the Inuit population from other communities, there is increased pressure on hunting territories close to town (Ford et al., 2013). Young hunters who do not have elders to travel on the land with or who are from different communities (and therefore are familiar with a different landscape) do not feel as comfortable travelling along certain trails or hunting in certain areas (Ford et al. 2013).

2.3 Incorporating Traditional Knowledge into Resource Management Paradigms

The challenge of integrating Indigenous Traditional Knowledge (ITK) into bureaucratic institutions has been examined from a number of different angles by a variety of anthropologists, geographers and First Nations Studies scholars. There has been excellent historical work on Inuit and game management done on the period from 1900-1970 by Kulchyski and Tester (2007), studies on the challenges of integrating translating and integrating traditional knowledge (Davis and Wagner 2003; Murray 2000; Nadasdy, 1999). Wenzel has also made a contribution to the consideration of Inuit Qaujimajatuqangit (IQ) as a separate but partially intersecting concept from ITK and Traditional Ecological Knowledge (TEK) (Wenzel 1999, 2004; Usher 2000), although there remains a dearth of research on the integration of IQ in Nunavut policy.

At the core of incorporating these two ways of knowing (science and ITK) into any effective management system must be recognition that they are just that, different 'ways of knowing' with complex organizations and histories behind them, an approach advocated by scholars like Martin (2012) in the integration of Indigenous and non-Indigenous ways of knowing (Cruikshank, 2005; Scott, 1996; Simpson, 2004). Nakashima's documentation of the ecological knowledge of eider ducks amongst Belcher

Island Inuit describes in detail the contribution that ecological knowledge can make to management and also the ways in which it is dismissed by managers (Nakashima 1991). There are seen to be profound differences between, as Nakashima puts it, the "anecdotal" and the "ordered" systems of thought represented in these two different epistemologies or ontologies.

In the world of wildlife management this conflict centres on the killing of animals – and whether or not this can be done in a careful manner without a discernible (western) conservation ethic. When he encountered the Danish explorer Knud Rasmussen, the Inuit elder and shaman Ava is recorded as having said, "All the creatures that we have to kill and eat, all those that we have to strike down and destroy to make clothes for ourselves, have souls, like we have, souls that do not perish with the body, and which must therefore be propitiated lest they should revenge themselves on us for taking away their bodies." (Gibson, 2009). Until contemporary wildlife management institutions can integrate this Inuit vision of animal souls there will be ongoing conflict (Nadasdy, 2007).

2.3.1 Inuit Ecological Knowledge, Inuit Qaujimajatuqangit and Traditional Knowledge

There are important distinctions that must be made before using any of these popular terms. The concept of Inuit Ecological Knowledge is perhaps the most precise of these terms, originating in the writings of Thorpe (1998), where she views the term to be centred on the knowledge held by Inuit that relates specifically to the function and structure of the natural world that surrounds them. *Inuit Qaujimajatuqangit* is a term that has been written about extensively by Wenzel and others (Wenzel 2004, Thorpe 1997). While it is often used by scholars and the Government of Nunavut to mean a variety of

different things, almost a sort of catch-all term, it was originally conceived to be a term which would represent a clearly articulated set of key values and core principles by which Inuit behavior and cultural practices were defined and organized (Henderson 2008, Arnakaq 1999). Traditional Knowledge (TK) is perhaps the most ambiguous of the terms as it is generally held to mean the sum total of knowledge held by Indigenous groups, accumulated over their experience (Berkes, 1999; Reidlinger and Berkes, 2001; Cruikshank, 2005). Often it is highly localized and of an environmental nature and thus other terms or phrases such as Local Knowledge, Inuit Ecological Knowledge (IEK) and perhaps the most broadly used and recognized Traditional Ecological Knowledge (TEK) have emerged (Cruikshank, 2005; Johnson, 1992).

By using a word like 'Traditional' to describe knowledge, what is being appended to the term is that the knowledge has accrued over time, that it represents a process of acquisition which has taken generations and thus that it references a past time but also that it has stood the test of time. This becomes a particular challenge when the climate and the environmental conditions under which this knowledge was generated or acquired are changing rapidly, often over the course of a single generation. Thus using a term like local knowledge is a way to better reference the accrual of highly focused and often very place-specific environmental knowledge, without laying claim to historic precedents. This recognizes local knowledge as adaptable and changeable.

This emphasis on time scales can be problematic. Many Inuit mobilize TEK and TK with the underlying assumption that because the knowledge described is 'traditional' it is more legitimate. By suggesting that 'traditional' knowledge does not change or changes very slowly, we run the risk of overlooking or forgetting that knowledge is a

dynamic and constantly evolving resource. Like the human cultures which create and acquire it, it is always morphing and growing to absorb new ideas and new social, cultural and environmental realities (Agrawal, 1995).

Current thinking around the integration of Traditional Knowledge and Inuit Ecological Knowledge often considers this process from the point of view of TK and IEK as adding to the knowledge produced by western science (Usher, 2000; Pearce et al., 2009). In the context of environmental science and most especially wildlife conservation, this confusion between knowledge and cultural values means that TK and IEK are viewed in a discrete manner rather than as part of a holistic and culturally informed vision of the environment (Berkes et al., 2000; Agrawal, 1995).

One of the great questions or challenges facing wildlife management in the Canadian Arctic is how best to integrate the knowledge held by Inuit communities and the principles of IQ into management frameworks and institutions (Dowsley and Wenzel, 2008; Ford et al., 2010). This is a challenge of practical integration but also of profound paradigm shift and will require a major epistemological regime change. The change has to come in the fundamental way that words such as environment and ecosystem are viewed (Menzies, 2006). The system of conservation ecology and wildlife management currently in place is predicated on management of wildlife for the purpose of preserving maximum biodiversity – this is a vision which has demanded the exclusion of human needs and desires and entirely excludes an Inuit vision of wildlife – especially in so far as the regeneration of souls demands that animals be hunted in order to maintain the population (Berkes, 1999; Wenzel, 1991; Suluk and Blakney, 2008; Nadasdy, 2007). Such a concept is anathema to western conservation science, and so it makes it very

difficult to integrate the understandings of hunters with the conservation and management ideals of institutions predicated on essentially preventing and limiting hunting and human 'interference' in an ecosystem (Suluk and Blakney, 2008; Nadasdy, 2007). Arctic biology needs to reach a stage where Inuit are recognized as a part of the ecosystem and where animals and the land are managed so as to maintain the balance of souls that Inuit have traditionally sought.

Nadasdy's (2005) work on the relationships between the Kluane people of the Southwest Yukon and the Canadian bureaucratic system is particularly revealing in the way he engages the work of both other anthropologists and philosopher Michel Foucault. The relationships between Kluane hunters and the bureaucracy of the Canadian government are unequal and Nadasdy argues that Foucault's 'power-knowledge' complex is a lens that can reveal the complex ways in which these inequalities of power are exercised and sustained. Many of the ongoing debates around wildlife management are centred on questions of knowledge. The way that knowledge (both traditional and scientific) is valued, legitimized or questioned is at the heart of the question of power. Power is about more than simply who is able to make decisions, but it is rooted in who controls knowledge or determines the lines along which knowledge systems will be evaluated.

2.3.2 Caribou Management in the Qikiqtaaluk Region

Within the field of research on caribou, this thesis is most concerned with the studies that were completed by scholars such as Michael Ferguson and Francois Messier, which have a noteworthy focus on the traditional knowledge of Inuit on the subject of caribou (Ferguson and Messier, 1997 and Ferguson, Williamson and Messier, 1998).

Natasha Thorpe with the Tuktu and Nogak Project has also contributed to this body of work (Thorpe, 1997). Ongoing studies by Debbie Jenkins and other biologists at the Department of the Environment in the Government of Nunavut and the Canadian Wildlife Service, have been largely exploratory and small-scale (Jenkins 2007, 2008, Redhead and Land 1979, Kraft 1984). The findings of these early surveys are as a result difficult to compare.

There have been significant bodies of scholarship written on some of the mainland barren-ground caribou herds, including the Beverly-Qamanirjuaq herd, both on population counts as well as more studies on movement, health, diet and co-management (Thomas and Schaefer 1991, Kendrick and Manseau 2008, Klein 1996, Kruse et. al. 1998, Brook et. al. 2009, Berkes 2009, Ferguson and Messier 2000, Curry 2007, Cronin et. al. 2003). There has also been work done on caribou populations in Greenland that are of interest regarding the long-term population cycles which are a part of the discussion around caribou on Baffin Island (Forchhammer et al. 2002, Vors and Boyce 2009).

Adaptive co-management is a term that has been used for some decades (Berkes 1999), and it is a principle that relies heavily on the involvement of all stakeholders (Mulrennan and Scott, 2005). Co-management and the complex relationships between communities and wildlife management institutions have been considered by several scholars in the context of Nunavut harvesting. The work of scholars such as Shari Gearheard (Gearheard et. al. 2011, Gearheard and Shirley, 2007) has considered in depth the challenges of research in small Arctic communities as well as considering the complexity of relationships between Nunavummiut and institutions. Suluk and Blakney (2008) have also done excellent work on the complexities of harvesting data and the ways

in which Inuit hunters have resisted what they see as a challenge to their control of their own resources. There has also been work completed on participatory research in the context of climate change adaptation (Ford et. al. 2007, Pearce et. al. 2009).

CHAPTER 3: CONCEPTUAL FRAMEWORK AND METHODOLOGY

This chapter outlines the conceptual framework and methods that underlie the research carried out as part of the thesis. At the heart of the work is an attempt to examine complex community interactions and behaviors drawing upon a body of literature that has been termed 'vulnerability science.' A mixed methods approach was developed to engage community members in the research process and allow for better understanding and recording of local ecological knowledge, with fieldwork spent in Iqaluit at different times of the year.

3.1 Vulnerability Science

Conceptually, this study draws upon scholarship in what has been termed 'vulnerability science' (Cutter, 2003) to identify and characterize the socio-ecological interactions that are affecting caribou populations on south Baffin and document associated implications for hunters, communities and food systems. Vulnerability science approaches seek to understand how social and biophysical stresses interact to affect communities, combining assessment of both exposure, sensitivity, and adaptive capacity (Turner et al., 2003; Ford and Smit 2004; McDowell et al., 2016; Smit and Wandel, 2006). At a community level, vulnerability focuses attention on local factors affecting human-environment interactions along with broader scale drivers of change (Smit and Wandel, 2006). Grounding the study using a vulnerability-based approach to examine interactions on a human and community level, builds off the development of systems thinking in the natural sciences regarding ecological interactions (Berkes, 1999).

It should be noted that the vulnerability approach provides the conceptual grounding for the thesis and directs at a broad level how the work was conducted and interpreted: it directs attention to human-environment interactions, emphasizes the importance of scale, and directs attention to underlying socio-economic and political factors affecting caribou populations and shaping management decisions. The vulnerability approach, however, is not explicitly used to frame the results, as it is in some other studies in the environmental change field (Ford et al., 2006a).

3.2 The Study Area and Research Methods

Grounded in ethnographic principles this research employed a range of techniques over the course of several trips into the field (Stern and Stevenson, 2006). An ethnographic approach was used because it was conducive to developing a deep understanding of the local contexts informing hunter decision-making as well as the socio-economic and political realities impacting the relationship between the community of Iqaluit and local caribou herds (Wenzel, 1995; Harder and Wenzel, 2012). Ethics approval (REB #490-0513) was granted by McGill Research Ethics Board 1. Semi-structured interviews and participant observation formed the central basis of data collection. Over the course of three trips to Iqaluit (August 2012, May 2013 and January-February 2014), I spent time getting to know the community and especially the hunters who were most commonly engaged in pursuing a variety of species in the area. On a final trip to Iqaluit in June of 2014, I shared results with institutions and partners, and discussed with participants my findings and results in order to test whether their interpretations agreed with mine.

3.2.1 The Qikiqtaaluk Region

Iqaluit is the largest community in the territory of Nunavut and one of the southernmost communities on Baffin Island. With a population of roughly 7500, the community serves an important role within the territory as it is home to both the territorial government as well as the offices of most corporations and many of the Inuit associations, organizations and institutions. Ethnicities are also more varied than in most of the other Nunavut communities, with approximately 40% of the population non-Inuit and close to 60% Inuit. Most non-Inuit are employed in the various corporations, institutions and government offices which are based in Iqaluit. The diversity of ethnicities represented in the community is of great importance to understanding social networks and the behavior of community members, particularly around aspects of life such as hunting or the sharing of food. According to the 2006 Census, the population of Iqaluit increased 17.6% from 2001 to 2006, a significant increase compared to the rate of increase for the rest of the territory which was 9.2% for the same period. Despite being one of the fastest growing regions of Canada, Nunavut struggles with high rates of unemployment, income insecurity, housing insecurity and health outcomes for this vulnerable population are consequently poor.

The landscape around Iqaluit is a mix of low rolling hills and steeper coastal hills and ravines. There are significant hills and valleys on the two peninsulas (Hall and Meta Incognita) that border Frobisher Bay. Inland of the end of the bay, the landscape is primarily low rolling hills and river valleys until the area around Amadjuak Lake where the hills flatten out into a large alluvial plain which extends around the lake and towards

the western coast of Baffin Island and the area around the mouth of the Koukdjuak River. There are few obvious natural limits to hunter mobility – the land is relatively open in all directions, making the major determining factor in hunter mobility the trail conditions (snow or ice depth and coverage).

Figure 2. Map of Nunavut and Inset of Baffin Island

3.2.2 Mixed Methods Ethnographic Approach

3.2.2.1 Interviews with Hunters and Key Informants

Interviews and conversations with hunters and community members were conducted using a semi-structured approach. This is a method widely used in

ethnographic studies, particularly in northern and remote community settings (Huntingdon, 1998; Fienup-Riordan, 1999; Bernard, 1995). By conducting conversations more flexibly around themes using open-ended guiding questions, but without the use of standardized interview-guide, associations and thoughts can be followed and tangents explored as they emerge (Ford et al. 2006). This can allow the scope of conversations to expand and new connections and relationships to be explored. Semi-structured interviews are a preferred method in this context as they provide rigour but also allow the flexibility necessary to accommodate individual's schedules and needs (Ford et a., 2012; Collings, 2014). Interviews (n=37) were carried out in Iqaluit, 28 with hunters and community members (five with young hunters (under ~30 years of age), 21 with mature hunters, and two with elders) and nine with institutional representatives. This study was carried out using both purposive and snowball sampling to enroll participants that represented a range of perspectives within the community. Certain key informants, in several cases with experience researching in the community, were identified at the start of fieldwork. This key group included persons in territorial institutions dealing with questions of wildlife management as well as experienced and active hunters within the community. During initial interviews, participants were asked for suggestions of other knowledgeable community members.

Interviews were conducted in the homes and offices of participants, occasionally in an office space in the Nunavut Research Institute and during trips on the land. The interview guide consisted of a set of key themes, combined with some specific questions on chosen topics, modelled partly on Thorpe's (1997) work on Inuit Ecological Knowledge of caribou in the Kitikmeot Region (see Table 2). The guide first focused on

documenting the personal information on interview participants, including life histories. This was followed by documenting participants perspectives on caribou biology, individual hunting practices and the community's hunting behaviour during the past and present. There were also questions asked about the rules and regulations governing hunting and opinions were solicited about the process of consultations and decision-making. These questions are listed in the following table (Table 2), grouped around their corresponding themes.

Theme	**Questions**
Life History	• What is your age? • How long have you lived in the community? If you have lived here less than 10 years where did you live before? • What is your primary occupation? What do you spend the most time doing? • How many days per week do you spend hunting? • How and where did you learn to hunt? Who did you learn from? • Whom do you travel with and go hunting with most often? How did you meet them? Do you have a relationship outside of hunting together?
Travelling and Environmental Changes	• What sort of conditions make travelling on the land challenging? How do you cope? • What are the best/ worst times to go out hunting? • Have the above times changed? • Do you think it is becoming easier or more difficult to travel on the land? Do you notice environmental changes impacting this? Or do you think other factors like gas costs or available time play a bigger role? • Do people in Iqaluit have traditional hunting territories? Places that they have a particular connection to? Do you behave differently in certain places? • What kind of safety gear do you carry? • Do you ever make decisions (whether or not to go hunting) based on cost? Risk? Do you ever discuss these decisions with other hunting

	partners? • Where have you travelled recently? Whats the biggest trip you've completed in the last season? Year?
Caribou	• Have you observed changes in the caribou in region? Do you see less/more/the same number? Are they in similar condition to what you remember in the past? (Changes in size? Changes in parasites? Flies?) • How many caribou do you take per year? Has this number changed in the past few years? • How many caribou do you think the community catches per year? Has this changed? • Where do you go most commonly to hunt caribou? Where do you think most of the community goes? • Do you think caribou populations go in cycles? How long do you think those cycles last? Where do you think the population is now within the cycle? • Do you recognize a difference between caribou from northern or southern Baffin Island? • Where are the best spots to hunt caribou? Where do you usually find them? • How many caribou would you usually expect to see grouped together? Has this changed in the past years?
Wildlife Management	• Do you think the community needs to limit how much it is hunting? • Are you concerned about the caribou decline? Why/why not? • Should hunting limits be imposed by the community (HTO) or by the government? • Do you feel limited at all by rules and legislation around hunting? Do bylaws and rules change what you do on the land? • Do you think there will be a moratorium? Should there be a moratorium? What will happen if there is or isn't one? • Are there alternatives to a moratorium that you think should be discussed? • Do you think there are more or less hunters in Iqaluit than in the past? • Do you think people are hunting more or less caribou? Are tastes changing?

	• Have you participated in any community consultations around caribou? Do you feel that hunters voices are adequately heard?
Country-food	• How many days a week do you eat country food? • How many times a week/month do you eat caribou? • What sorts of country food do you eat the most of? (ranking exercise often used here, including common foods like caribou, ringed seal, char, ptarmigan, berries etc.) • What do you think people eat the most in the community? • How does the season change what you eat?

Table 2: Interview Guide – Thematic Nodes

In conversations with hunters and community members, these questions formed a guide in beginning the dialogue. However, if the conversation took an interesting turn or if it was apparent that an informant wanted to speak at length or was especially interested in one particular area, then I would shift questioning to that or simply allow the conversation to flow in that direction. This is consistent with techniques known to work well in northern contexts (Bryman, 2004; Lloyd-Evans, 2006; Collings, 2014; Briggs, 1986; Huntingdon, 1998).

A deliberate choice was made not to record the interviews, reflecting the complex and contentious issues being discussed as well as the discomfort that people obviously felt and expressed around recording. Instead, I made notes myself, as well as having maps and pens available so that participants could mark down anything they liked. After the conclusion of an interview, I would tape-record my impressions of the exchange, including nonverbal cues. Finally I would re-record my impressions, essentially talking the interview back to myself, thus building an extensive multi-source set of field notes (Patton 2003, Emerson et al. 2011). This procedure was followed as soon as possible

after each data-gathering interview or experience and, along with the notes made during the interview, served to ensure that I recorded as much as I could without the interruption and intrusion of using an audio-recorder at the interview.

I found the system of note-taking to work well. In addition to helping me to retain more it would often lead to new questions and repeat interviews where I could follow up on issues I did not remember well enough or felt required further investigation. It was apparent upon abandoning audio recording that people were far more comfortable and the awkwardness that would originally be there when I mentioned the recording was gone (Collings 2014). An added benefit of not recording was that I think many people felt the conversation was more informal, and alluded to the fact that they felt more comfortable allowing the conversation to flow beyond the boundaries of the set questions (Briggs 1986).

Follow-up meetings served a vital function as they allowed key facts that had emerged during the interview to be verified in order to make sure they were captured correctly, and to ensure all themes of interest had been covered. These secondary meetings, conducted on 11 occasions, were also important in building confidence amongst the community/project participants. Too often researcher presence in communities is fleeting and interactions are usually brief (Castleden et al., 2012a; Castleden et al., 2012b). While I was never able to remain in Iqaluit for more than a month at a time, having multiple meetings at different times of the year helped me to communicate my interest and commitment to what Iqalummiut had to say, and helped people to understand that I was concerned with accurately recording and understanding what they had to say.

It was difficult estimating community harvesting levels or the number of animals believed to be in an area. When discussing numbers and data in other contexts, for example distance between camps or harvesting sites, interviewees were exact and forthright in their responses. Such specific questions are challenging in northern contexts as they are perceived as having right and wrong answers, and so people were possibly concerned that they would prove themselves ignorant and so they would refuse to respond or would shrug the question off. Briggs (1986), Collings (2009, 2014) and Huntingdon (1998) have noted similar struggles around making sure that questions are phrased in such a way as to allow people freedom to respond how they want, as well as focusing on personal experience. One important technique which I used extensively, combines this freedom with personal experience by offering the interviewee a statement to accept or refute. Phased assertion was particularly important as a technique for gathering personal anecdotes, for checking statements made previously and for encouraging people to speak (Collings 2009).

3.2.2.2 Participatory Mapping

There is a long history of using formal maps and of participatory map-making in social science, especially in the context of research amongst indigenous peoples (Eades 2015, Gearheard et al. 2011, Chapin et al. 2005, Aporta 2009, Freeman et al. 1976). In this study, maps were an important feature of the interview process, acting as a key prompt and eventual data source. Large-scale aeronautical charts (1967) were used which depicted at a scale of 1:1,000,000 the southern end of Baffin Island from about the Dewar Lakes (68° 37' 30" N, 71° 7' 37" W) southwards. These maps were printed and laminated

and brought to Iqaluit for the interviews. Possibly due to their relative age, and because the charts were perceived as being very rare and high quality maps, they elicited great excitement from interview participants. Being aeronautical charts they depicted with great accuracy the topography of the island without being too detailed, making them excellent for the interviews. The maps were laid out at the start of the interview and acted as a tool and prompt for interviewer and interviewee to illustrate where they were discussing, and also acted to allow a greater degree of visualization of the terrain features begin discussed, for example drainages and valleys (Ford 2009). Given that much of the interview focused on spatial relationships (e.g. where caribou were in relation to the community or major trails etc.) this visualization aid was invaluable.

While these maps were being discussed and the interview was ongoing, pens were used by all participants to highlight, draw on, circle or otherwise write on the laminated surface of the maps. This data formed a key memory aid as it was photographed at the end of the interview when the map was cleaned. Participants were pleased at being able to make their own inscriptions on the map, particularly as it allowed them to draw very precisely their own routes themselves, thus expressing their own experiences out on the land without having to rely on the interviewer's non-local knowledge of the area (Gearheard et al. 2011, Aporta 2009).

Eades (2015; 177) notes that maps are tools for "transmitting hybrid place-based knowledge", that is to say understandings of the landscapes that involve both southern and traditional ways of knowing, as well as both practical and observational styles of knowledge gathering. These layers of meaning have been noted in the context of other mapping related work completed among Inuit communities on Baffin Island. In

particular, it has been noted that mapping activities can be used to assess the rate and scale of change on a systematic basis, with relevance to both human and ecological systems (Gearheard et al. 2011). When we make a map, we express our value of certain attributes. Giving research participants free rein to make their own marks and map their own movements and experiences can act to bring a measure of their values, priorities and feelings to the surface of a process like an interview which is otherwise prescriptive in its interrogation (Harris and Hazen, 2005).

At the end of the interview process copies of these laminated maps were left with the Nunavut Research Institute as well as several key informants who expressed an interest in owning and using them.

3.2.3 Participant Observation

Participant observation is a technique widely used in studies of communities and particularly common amongst ethnographers as through participating in activities and the day-to-day functioning of a community, scholars can gain insights into local lifeways, traditions, knowledge and contexts which might otherwise prove elusive (Berkes and Jolly 2002; Krupnik and Jolly 2002; Collings, 2009; Jorgensen, 1989). Participant observation was an important technique in the methods toolkit as it meant travelling out on the land with hunting expeditions from the community, enabling conversations to occur in their proper place, out on the land (Fox, 2002; Collings, 2009). By providing a location for these conversations where hunters felt free of the strictures of the community and able to draw from examples around them, conversations were enhanced as it was easier to point out the details of the socio-ecological and socio-economic systems under

discussion. Knowledge-sharing on hunting trips was an important tool for helping build relationships with knowledgeable hunters, and helped to provide background into their individual life histories. Various Arctic scholars have noted the importance of spending time out on the land with hunters (Collings, 2009 and 2014; Huntingdon, 1998; Ford, 2009; Krupnik and Jolly, 2002), as it creates important bonds, and can act to help the building of good research relationships. Whenever possible I would travel with hunters and join in their conversations about animals, weather, trail conditions or traditions. Over the course of four trips to Iqaluit I participated in one mid-winter day-long floe edge hunt for seals and polar bear, several fishing trips both for cod on the ice and up the Sylvia Grinnell River for char in the spring and late summer, and a spring trip on the Meta Incognita Peninsula for geese. These trips were all single-day events, lasting between 5 and 14 hours. Participant observation also included time spent in the community engaged in everyday tasks such as food preparation and equipment maintenance as well as traditional activities like skin preparation and sewing. Often no questions would be asked relating to caribou, and time was spent focusing more on the routines of hunters and their families which helped me to learn about the local context of this study.

I also participated in the caribou management process, attending the community consultation in Iqaluit run by the Government of Nunavut and joining in the conversations that were had as a part of that meeting. The meeting included both a period of explanation of the survey process as well as opportunities to ask questions and discuss community knowledge around a set of maps.

3.2.4 Qualitative Analysis

Qualitative analysis of maps and interview data took place upon my return from the field. Fieldwork notes were read and re-read in order check for accuracy and notes made as themes emerged. Responses and participant-made maps were parsed apart, and the theories described in this manuscript were built up. Although systematic coding was impossible without recording, analysis was still focused on thematic nodes (Hay, 2000). Analysis was systematic in the sense that I passed carefully back through the notations I had made during each interview and used them to build rough profiles of each participant which I used to help myself recall the trends that I describe in the Results Chapter. Over the course of the Jan-Feb 2014 and June 2014 trips to Iqaluit, discussions included data verification and discussion of my emergent themes in order validate my findings in the eyes of knowledgeable hunters.

Analysis of secondary sources was also used to establish the regional context of caribou hunting. Records of past wildlife surveys and reports covering hunting and caribou-related activities by communities were studied to establish a background understanding of local harvesting behaviours and conditions (Kraft, 1984; Thomas and Schaefer, 1991). Studies like the Tuktu and Nogak Project conducted by Thorpe (1997) were also consulted and used as comparison points both for research method design as well as for comparisons in hunting technique and community land use. Previous land use studies which have included a vulnerability dimension were also consulted to lend depth and context to the study of risk factors and the exposures that hunters might take into account in decision-making (Ford, 2009b; Forbes et al., 2009).

3.3 **Positionality**

Scholars and researchers more broadly are increasingly recognizing the need to identify one's personal position when conducting research and when discussing interpretations and results/data. Positionality recognizes that the position of researcher carries a number of biases and is affected by influences and perspectives which must be recognized and taken into account by the author in order to lessen their impact on results (Kovach, 2010).

As a Qallunaat, or to use Hugh Brody's term a 'Euro-Canadian,' my view of the north and Inuit life is fundamentally charged by the impacts of Canada's colonial past (Brody, 1978). I am a southern resident and this plays a major role in my interactions with northern communities. I live and work in southern Canada and as such my field trips to the Arctic remain only brief stays after which I fly south. I am not privy to the full reality of life in the Arctic and more specifically in the community of Iqaluit.

Recognizing that there are many elements of daily life that I have not experienced is important to appreciating that much of the human-animal relationship that is at the heart of my work, will always be to some degree intangible and foreign to me. This 'dynamic of social integration' as it is termed by Robinson (1998) is important because it requires the researcher recognize their own ontological position, meaning that they can only interpret and not truly share local knowledge. This is an understanding of the challenges of fieldwork across colonial and indigenous cultures echoed by Smith (1999) and Kovach (2010).

CHAPTER 4: RESULTS

In this chapter key results from the research are profiled. Through multiple methods employed, this section establishes the nature of caribou harvesting in Iqaluit and how it has changed over time; identifies key factors affecting the land use of Iqaluit hunters in general and relating to caribou in particular; and documents the nature of caribou ecology and how this is changing over time, based upon the interviews.

4.1 Caribou Hunting Behaviour in Iqaluit

Through interviews with a range of hunters and community members it became clear over the course of this investigation that the area utilized by caribou hunters from Iqaluit has shrunk considerably from past decades. Speaking to older hunters who had been active on southern Baffin Island since the 1980's, stories were often told of major hunting trips occurring several times throughout the winter with routes which would take in large loops through the centre of the island (see Fig. 3), often deep into the Koukjuak Plain and even south towards Cape Dorset (Ferguson and Messier, 1997; Kraft, 1984).

The area which participants described travelling today included portions of both the Meta Incognita and Hall Peninsulas but was largely focused on an area relatively close to town and easily accessible by established trails. Specifically, the areas around the trail between Iqaluit and Kimmirut as well as the area towards Amadjuak Lake and Sylvia Grinnell River valley were receiving the most traffic and attention from hunters. During interviews and while out on hunting expeditions it became clear that there were a number of key factors acting to limit the area travelled by hunters, documented in the following sections.

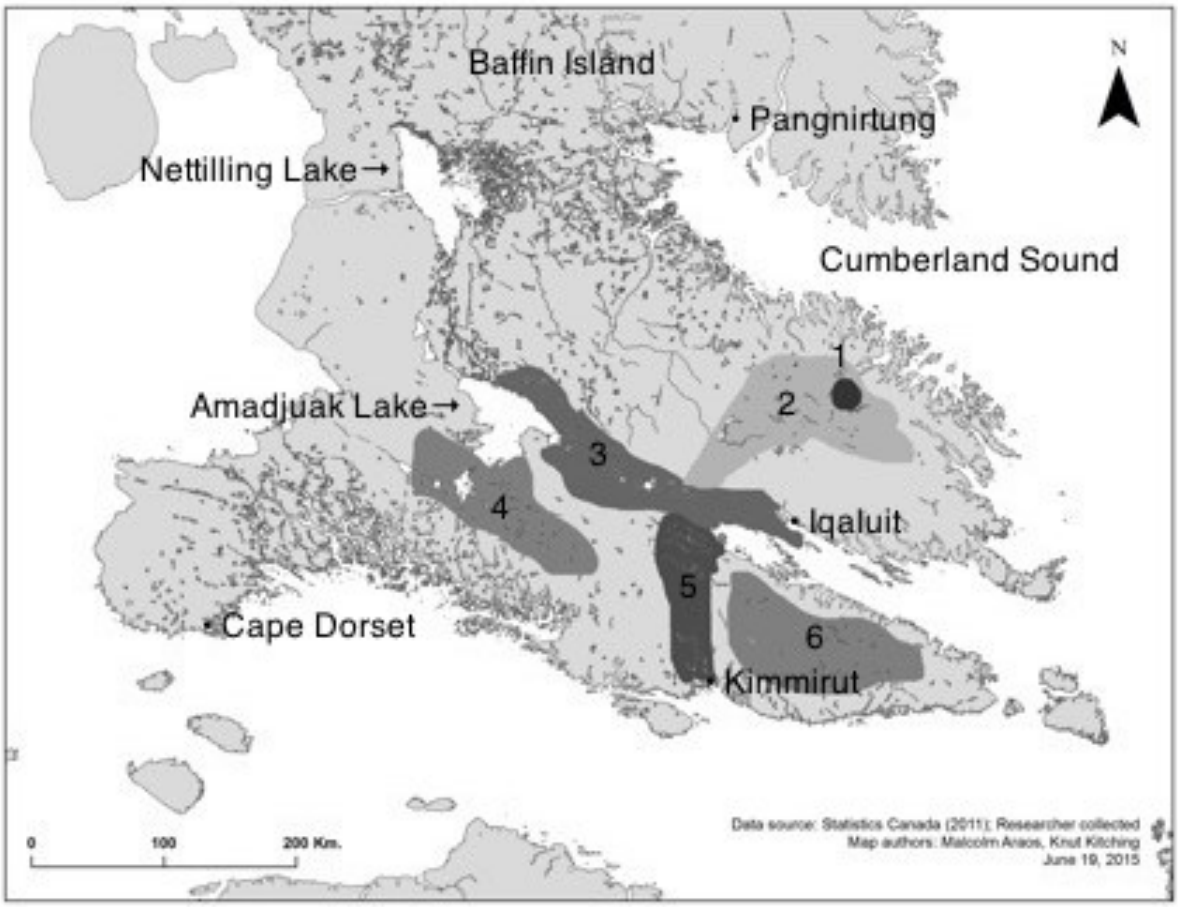

Figure 3. Key Caribou Hunting Sites of Southern Baffin Island - demonstrating key areas of heaviest community hunting traffic. Key numbered sites are explained in the following table:

Numbered Locations		
Number	*Place Name*	*Explanation*
1	*Chidliak Mine*	*Site of an expanding diamond mining operation, linked to Iqaluit by a rough road*
2	*Hall Peninsula*	*This shaded portion of the Hall Peninsula receives intensive hunting traffic as access is eased by Chidliak infrastructure and because there are a set of established trails here.*
3	*Sylvia Grinnell River and Amadjuak Trail*	*Likely the area receiving the most heavy traffic from Iqaluit, this corridor is in use for hunting, fishing along the river and for accessing cabins and hunting inland around Amadjuak Lake*
4	*Potential Calving grounds*	*This area of low hills and marshy tundra south of Amadjuak Lake was identified by many hunters as an important calving ground. It was also identified as difficult to access from all three of the surrounding communities.*
5	*Soper River and Kimmirut Trail*	*This river valley is heavily trafficked in the winter by hunters from both communities.*
6	*Meta Incognita Peninsula*	*This area was identified as very challenging for hunters to access with cliffs, steep ravines and rocky terrain. It was frequently identified by hunters as an area where caribou were believed to retreat during times of stress where they would not be disturbed.*

4.2 Factors Limiting Hunting Territory Use

4.2.1 Hunter Knowledge and Intergenerational Knowledge Transfer

Over the course of many of the interviews and conversations with hunters, one of the factors which they felt significantly impacted caribou harvesting was the challenge of acquiring the deep local knowledge, experience and techniques required to move safely on the land. A number of scholars have commented on the challenges posed to the transfer of specialized hunting information and techniques between generations (Ford, 2009; Collings, 2014; Pearce et al., 2011b). The community of Iqaluit, given its size and heterogeneity can make some of these challenges more pronounced. These hunting skills

may be related to the techniques and tasks of hunting and preparing or maintaining gear, but they are also related to understanding the complex local topography and conditions which are required to be familiar with key trails and understand highly dynamic areas such as the floe-edge or the areas around *saqvaq* (polynyas). Many of the older hunters interviewed noted that amongst younger hunters, or those who had not grown up in the community, an understanding of ice conditions on Frobisher Bay were often missing. However, older hunters also noted that those raised in communities where hunters are very active on the sea-ice, especially at the floe-edge (Pond Inlet was mentioned as an example on several occasions) were generally more comfortable with and knowledgeable about ice-based hunting and travel. In speaking with hunters in Iqaluit I was surprised to find that even amongst mature hunters it was not uncommon for people to classify their hunting efforts as being primarily land-based due to a concern over inadequate knowledge and accompanying feelings of unease around travelling far on the sea ice or hunting at the larger polynyas or at the floe edge. These concerns about place-specific knowledge may impact caribou hunting as they may limit the location and prey hunters feel comfortable pursuing. As most caribou is pursued on land, and often on heavily travelled trails near Iqaluit, this may act to increase hunting traffic and pressure on several areas like the Kimmirut and Amadjuak trails.

The hunters interviewed noted that it was most common for younger hunters to learn the vital skills and highly specialized knowledge of local trails and conditions by hunting with immediate family and close relatives. Amongst hunters connected to large local Iqaluit families this was seen as essential, and most commonly these were the

hunters who felt more comfortable with hunting across a variety of weather conditions and terrain (both on land and on the sea ice) in the area.

Hunters who had not grown up in the area or who had no close older male relatives were divided into two camps. Some had found friends and now hunted with long resident partners with whom they had connected over time. Newer community members face the same task, and until they make these connections hunt alone or with another newcomer often staying close to Iqaluit. Several of the youngest hunters interviewed noted that it could be difficult if one did not have older men to hunt regularly with, as it was a challenge to develop one's skills adequately without instruction and mentoring. These younger hunters expressed concern about hunting with older hunters as they felt that their ignorance might become a source of shame for them, and so they found themselves seemingly trapped in an age-cohort of hunters.

Hunting parties in Nunavut communities are generally composed of hunters from the same family (Pearce et al., 2011b; Collings, 2014) or occasionally in the case of Iqaluit, of hunters who are originally from the same community. A by-product of the way that these groups structure themselves is that there may often be a degree of generational segregation. This can mean in many cases that younger hunters will often hunt together. This stratification or segregation can often be due to the younger hunters feeling as though they may not have the requisite knowledge and so feeling embarrassed to go out on the land with their more knowledgeable elders. Yet without adequate access to knowledge – usually learned in the presence of older hunters, they are forced to learn things by trial and error, which can be a far longer and more laborious/dangerous process. For grown men who do not wish to participate in land programs as organized for younger

community members by institutions like Nunavut Arctic College, there are few opportunities to expand their knowledge base.

4.2.2 The Rising Cost of Hunting/Providing Country Food

Land use during caribou hunting is also influenced by the increasing costs which hunters must bear in equipping themselves and maintaining their gear (Hall, 1978). Current literature often factors the high costs of gasoline (not to mention capital costs) into the economic challenges of hunting activity (Hall, 1978; Smith, 1972) but these calculations often neglect to examine the high costs of machine damage and maintenance (Muller-Wille, 1978). Qamutiq runners made from nylon or polyurethane are expensive (costing from 160-200$ for a set) and in the case of some expeditions made during the winter of 2013-2014 can be worn entirely away during the course of a single weekend's expedition to Amadjuak Lake. As hunters are forced to absorb the increased cost of equipment and the replacement costs that heightened risk of damage through poor weather brings, the area they are exploiting decreases. Hunters can no longer afford to venture as far or risk damage to snowmobiles.

What might otherwise appear to outsiders as minor economic concerns is reflected in conversation with hunters and members of the local volunteer Search and Rescue unit in Iqaluit, when it emerged that increasingly many hunters are reluctant to put themselves forward and go out on searches as there will be no compensation forthcoming should they damage their sleds, and the inevitability of this damage is a cost both in money and lost harvesting opportunities that they cannot ignore. Thus the rising cost of equipment can increase the risk that hunters are exposed to while out on the land

by potentially impacting their options for rescue support. Evaluation of risk and potential cost factors in constantly as hunters make decisions about whether or not to hunt and where they will travel.

Discussions with all three of the major snowmobile dealers and mechanics in Iqaluit generated quite different responses in terms of establishing trends or changes in the amount of damage which Iqalummiut (especially hunters) were doing to their machines. There was an acknowledgement of the costs of maintenance which heavy use on the land is liable to produce. Interviews with snowmobile mechanics put the cost of the most frequently replaced parts (skids, belt and new carbide runners) at more than $600 before the cost of labour. Interview participants amongst hunters noted it was not uncommon to spend close to a third of the price of a new machine in repairs (new machines costing between roughly $9000-$12000). The average lifespan of snowmobiles under regular hunting use was put at between 2-3 years but could often be as low as only one year if the operator was a regular, full-time hunter putting in trips over the course of the whole week and not just the weekend (Wenzel, 1991).

While advances in snowmobile technology, lighter machines, bigger and more efficient motors allow hunters' to range far from Iqaluit, the high costs that remain tied to operating and maintaining a machine in an environment such as southern Baffin still act to limit how far hunters are prepared to go and the sort of terrain they are prepared to venture into. Well-travelled trails such as the Kimmirut trail and high-traffic areas, such as along the Sylvia Grinnell River, are seen as guarantees of good snow conditions where rocks, gravel patches and other potentially damaging terrain may be avoided.

Some hunters expressed concern over what they perceived to be a trend away from 2-stroke snowmobiles towards 4-stroke snowmobiles. While the 4-stroke engines are more fuel-efficient, offering savings and potentially greater range, the engines are themselves more complicated and can involve greater computerization, which limits the amount of repairs that hunters can competently complete themselves. The relative mechanical simplicity of 2-stroke engines offers hunters greater opportunity for home-maintenance and also the cannibalization and re-use of older parts and components – although by doing this people void their warranties and thus are forced to absorb the costs of future repairs themselves.

4.2.3 Weather Impacts on Land Use: Caribou Hunting

Weather conditions which were listed by hunters as being major challenges to operating on the land included snowfall, temperature, visibility and wind speed. Winter weather conditions are particularly important to caribou hunting as the majority of caribou hunting happens in the winter when access to hunting territory is easier and cheaper through the use of skidoos. Ideal conditions for hunting and travelling on the land usually occur in the period from January-April when temperatures are consistently cold enough to ensure strong ice, good snow cover, and when the days are gradually lengthening. High winds are particularly challenging during the winter and early spring as when temperatures are still low and snow is poorly bonded, wind can act to scour areas of snow making them impassable.

During the period of late January and early February of 2014 when the author was in Iqaluit the strong winds which had occurred were certainly a factor in the focusing of

hunting energy and attention on the Meta Incognita Peninsula; however, factors such as knowledge (in particular a lack of knowledge about travelling and hunting around the floe edge) as well as communication between hunters that there had been successful caribou harvests close to the Kimmirut trail were also important drivers. While extreme weather is a factor that can disrupt decision-making and act to limit hunter movement, conversations with hunters emphasized that there are no clear lines that can be drawn around the impacts of types of weather. In particular, these comments referred to the importance of not conflating the wind events experienced over the winter of 2013-2014 with lower snowfall. Hunters noted that there is an important distinction between these two events and that they created conditions that might look similar if observed from the community but that snow conditions could be very different out on the land. While damage to machines may increase during low snow years, it is also impacted by periods following strong winds events. January of 2014 saw two separate periods of strong and consistent winds that blew snow off many of the high ridges and exposed areas. This meant that trails along the Hall Peninsula, where to a great extent travel along high and exposed ground became close to impassable due to the amount of exposed ground which had blown clear of snow. This was noted in particular by hunters in reference to struggling to travel on the trail to Amadjuak Lake and on the trails on the Hall Peninsula which lead to Souka and Crazy Lake and also to Pangnirtung. The Meta Incognita Peninsula had comparatively more snow – particularly along the Kimmirut trail area that follows a significant ravine or valley, a topography that during the periods of wind meant that snow cover was less affected. These differences between two key hunting areas may contribute to the increased pressure on the area south of Frobisher Bay along the

Kimmirut trail. It should be noted that other factors cannot be ignored in these discussions of highest hunting pressure – in late January of 2014 there were several reports of caribou being caught along the Kimmirut trail which hunters thought likely helped prompt the greater traffic and attention on this area.

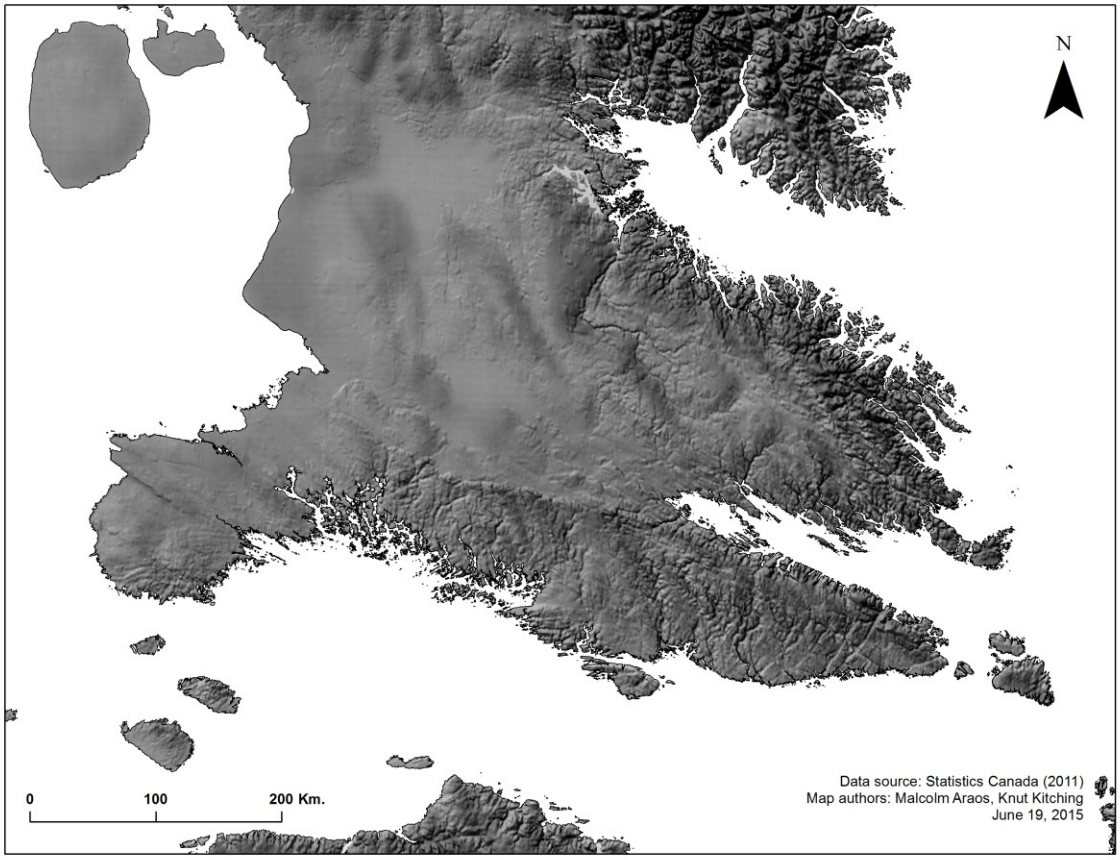

Figure 4. Elevation map of Southern Baffin Island – depicting the higher ground of the Hall and Meta Incognita Peninsulas and the large inland plain of the Koukdjuak

4.3 Southern Baffin Caribou Ecology – Responses to Change

A key theme emerging across interviews concerned changes in caribou ecology. In particular, caribou were reported to be sensitive to environmental change in three main ways: hunters were noticing that caribou were in the middle of a cycle of population

decline, that they were actively seeking refugia, and that sizes of herds, or groupings of animals which would be encountered had decreased significantly.

Caribou cycling has been widely commented upon by Inuit in a number of settings (Ferguson and Messier 1998). During preliminary fieldwork in Iqaluit during the spring of 2013, several hunters mentioned these multi-decadal cycles. Amongst the older hunters interviewed, it was suggested that these patterns were driven by the vicissitudes of weather, and by the restlessness of the animals themselves. Their movements were described as less purposeful and more wandering, which suggested that some hunters did not see the population as fluctuating so much as they simply saw the herd shifting location. Previous scholars who have interviewed elders and examined oral history in the area point to these cycles as lasting between roughly 40-70 years on Baffin (Ferguson and Messier 1998). Where the population currently was within that cycle the hunters interviewed could not say, although several older hunters and longtime residents of the communities noted that as recently as the 1990's there were large numbers of caribou to be found, even in the vicinity of the community. Thus while hunters were unprepared or unwilling to speculate about what stage of the population cycle caribou were currently in, some were very aware that there had been a dramatic and very noticeable decrease in numbers. Populations of ungulates are often noted for going through cycles of population growth and decline driven by environmental drivers such as the availability of forage – potentially depleted in the case of southern Baffin by over-grazing in the 1990's (Ferguson and Messier, 1997), insect infestations which may be linked to warmer temperatures (Bergerud et al. 2007), and spring ice events (Bergerud et al., 2007; Forbes et al., 2008; Forbes and Kumpula, 2009; Rennert et al., 2009). These cycles have often

been noted among populations of caribou on mainland Nunavut (Thorpe 1997) and in Alaska (Burch 2012).

During discussions with some more experienced hunters in Iqaluit, the tendency of caribou to seek refuge on some of the small islands in Frobisher Bay (specifically Pugh Island, Resor Island, Pike Island, Fletcher Island and Culbertson Island) was remarked on. Hunters commented on the caribou seeking these islands out as locations in times of persistent bad weather that are generally well-supplied with lichen and where there were fewer insects (related to bad weather and exposure). Hunters also commented on caribou 'hiding' in the deep inlets and at the ends of ravines where they were difficult to reach and less visible to predators. These areas were often remarked upon as corresponding to areas where families would traditionally go to hunt caribou during times of scarcity, as they could consistently find animals there (similar to behavior recorded amongst Cree – Scott (1986)). This corresponds to the behavior of caribou in other locations dispersing to secluded refugia (Ferguson and Messier, 2000; Gadgil et al., 1998). This behavior may be as a result of avoiding hunting pressure from predators or, it may be a direct adaptive response to decreasing forage (caused by a short or particularly harsh growing season, or overgrazing) in the home range of a group of caribou. Seeking these areas of refugia, caribou are likely looking for particular conditions that are rarely found elsewhere during periods of stress, such as higher quality forage or escape from pests – this corresponds to hunters comments about these refugia for the South Baffin caribou being located in deep valleys and drainages and on small islands in Frobisher Bay (Gadgil et al., 1998).

Understandings varied amongst the hunters interviewed about how caribou behave during the different points of their population cycle, but the majority seemed to broadly agree on a movement between lowland areas (usually either in coastal lowlands or in the bottoms of drainages), and upland areas (ridges and hilltops). The habitation of caribou in these two different environments is driven by forage conditions, exposure to biting insects and temperature, and is marked by two different agglomerations of the animals. When in upland areas, it was reported that animals group in smaller numbers, often remarked upon as closely resembling family groups. In the lowlands and plains areas it was reported that caribou generally are found in larger numbers (often many families coming together to form large herds).

These movements between upland and lowland environments were discussed in terms of movements across large areas, suggesting that hunters perceived there to be a number of factors determining caribou movements around southern Baffin Island. It was commonly understood by those hunters interviewed that during periods of starvation, poor forage and bad winter/spring weather conditions caribou have a tendency to split into smaller groups and forage in smaller numbers – presumably to maximize a limited resource; according to all those interviewed, it had been some years since caribou had last been seen in a group of more than four animals. During these periods the small (family) groups disperse over a larger area – and subsequently may be far more difficult to locate (for hunters and biologists attempting to count). Hunters descriptions of these changes in group size amongst caribou have been described in detail by Burch (2012) who in his comprehensive studies of the caribou herds of Alaska suggests that the term ‘herd’ is often an inappropriate descriptor, as it does not accurately describe the full range of

group sizes into which caribou aggregate during either their lifecycle and or in the course of the regular seasonal cycle. This corresponds closely to expressions of a family concept in relation to the caribou of Baffin Island (Wenzel: personal communication), with Inuit suggesting that most of a caribou's life is spent amongst its parents and siblings, in a rough family structure, rarely numbering more than 10 individuals. During periods of calving and when forage is easily available these groups may gather together into what is then more commonly called a 'herd' on the Nunavut mainland. This is an important distinction to note in the context of the caribou hunting traditions of Baffin Islanders, as according to Wenzel (personal communication), it has been in the past seen as good practice to harvest all of the animals of one of these small 'family' groups when a hunter came across one. During discussions of appropriate and respectful behavior towards animals, there was considerable disagreement as to whether this practice was still considered to be good hunting behavior. To leave animals alive, or to let them escape was seen as cruelty if one had just harvested their parents or siblings (Scott, 1989). Equally, in a relatively caribou-poor environment like Baffin Island, where caribou do not gather in the huge numbers seen in the Kivalliq Region and other parts of the mainland, this practice could also be interpreted as sound hunting and food provision policy, as the hunter stood a good chance of not seeing caribou in some time. Interpreting this hunting practice in the context of conservation ethics is challenging, as it seems to contradict a conservative approach which would suggest one was wiser to take the older or weaker animals and leave at least a few strong animals as reproductive stock. The difficulties of this choice were reflected in the divided attitudes of the hunters who were interviewed.

CHAPTER 5: DISCUSSION

This chapter of the thesis discusses the local and regional implications of changes in environmental and social conditions observed in Iqaluit and described in Chapter Four. In addition, challenges at the centre of the caribou management process are examined. At the time of writing, several management tools were being employed in-light of stresses on the caribou population including a brief moratorium and a quota system. Comprehensive discussion and evaluation of these tools and regional management institutions remain critical.

Caribou hunting by the community of Iqaluit is limited by a number of factors which influence where hunters are able to travel, when they are doing so, and who is participating in the hunt. Frequently unpredictable weather conditions make it difficult for hunters to access key areas. The timing of spring thaw and fall freeze-up are no longer reliable. These changes to weather and the local environment are also causing damage to equipment, increasing costs of hunting. As the community of Iqaluit continues to grow the relationships and networks of kinship and reciprocity which sustain core hunting and food sharing activity are becoming more complex and fragmented. Hunting networks are an important determinant of hunting behavior as are access to reliable equipment, partners and knowledge.

While environmental factors are limiting the range of caribou hunters, other factors are also causing changes in the behavior of the caribou of Southern Baffin Island. As described in the previous chapter, these changes in behavior and patterns observed by Inuit hunters constitute shifts which likely represent adaptive behavior by caribou facing

challenges accessing forage. In addition, amplified hunting pressure has occurred in a number of areas in the vicinity of Iqaluit.

5.1 Caribou Management: A Changing Environment

The ongoing Baffin Land Use Planning process does not yet include specific directives addressing management of caribou herds on Southern Baffin Island. While there are sites identified as important for the maintenance of caribou populations, through extensive documentation of community knowledge about important caribou sites and suggestions of possible protected areas, they are not yet mandated by law (Nunavut Planning Commission 2016). This remains an issue of utmost importance, particularly as the level of landscape intervention increases. It remains vital to monitor wildlife populations and human influences through harvesting and non-renewable resource development (particularly mining). For example, diamond mining in the Chidliak site northeast of Iqaluit will increase helicopter overflights as well as ground traffic with potential impacts on caribou. The development of linear infrastructure such as roads and powerlines will impact caribou movements, as studies elsewhere have shown (Vistnes and Nelleman 2001, Reimers and Colman 2009). In addition, roads are already being used by hunters to gain access to the Hall Peninsula. This increased human activity will disturb and interfere with caribou populations. More comprehensive data gathering efforts by institutions like the Amarok Hunters and Trappers Organization in Iqaluit will be important for understanding the total numbers of hunters in the community and their activity levels. Planning for conservation and management of caribou should include hunters in the process, just as planning for non-hunting land-use should require the

consultation of hunters who have expert knowledge of animal movements and patterns of behavior in the area.

The Government of Nunavut instituted a Baffin Island-wide moratorium on caribou hunting beginning on the January 1, 2015 and ending on August 26, 2015. This was replaced with a quota of 250 male caribou for resident beneficiaries. It remains unclear how long this quota system will be in effect. The ecological impacts of a moratorium on caribou are positive as there will be decreased hunting pressure, allowing more opportunities for caribou to occupy good calving sites and forage that may be close to communities or major trails. Allowing caribou freedom of movement is important as mobility is a critical part of their coping with changes in the quality of their forage. Mobility allows them to avoid overgrazing by cycling through pastures giving forage a chance to regenerate. It has been noted that caribou may occasionally retreat to upland areas during times of stress, exposing them to harsher weather conditions and lower quality forage.

Management techniques such as moratoriums or quotas will have positive ecological impacts by removing human predation as a stress on caribou recovery. However, these restrictions damage the dynamics of hunting culture and food security in Iqaluit and in other communities. Through brokers and direct private sales between individuals, many northerners are buying and selling country food through online social media sites. When local demand is not met by local supply, Iqalummiut may increase the amount of caribou they purchase from other communities (a process facilitated by sales organized through online communication), in turn increasing hunting in other stressed areas such as Southampton Island. There was great concern voiced, particularly among

older hunters in Iqaluit, that a moratorium on caribou would foster commercialization and trade to a far greater degree and that this might disrupt social links and ties between communities. The infrequency of data gathering by the Government of Nunavut means that the only comparable reference point for the 2014 caribou survey is the 20 year old survey (Ferguson and Messier, 1997; Wenzel et al., 2016; Pattimore, 1985). If country food is going to play a more central role in food security policy, a better dataset is required by policy makers. This dataset must include scientifically gathered population statistics and reflect a comprehensive process of hearings and consultations to gather the views of Nunavummiut.

There was concern voiced about the potential for inter-settlement competition between Kimmirut and Iqaluit. Hunters from both communities' travel and hunt in the vicinity of Soper River along the prominent trail which links the two communities over Meta Incognita Peninsula. Hunters in Iqaluit noted that the topography of the river valley meant that travelling conditions could still be good along the river during low snow years or after wind events which had scraped snow from higher ground. Thus proximity to the community and prevailing conditions made the Soper Valley heavily used. This is an important site for Kimmirut hunters travelling inland. Several members of the Iqaluit hunting community reported that hunters from Kimmirut had felt that the hunting pressure from Iqaluit was impacting their ability to find caribou.

Caribou are an essential part of the region's food system, valued as a traditional cultural component as well as a nutritious and economic food choice. *Tuktu* (caribou) is a favoured food and the practice of going out on the land to hunt is one of the few times when Iqalummiut venture into the interior of Baffin Island (aside from fishing on the

Sylvia Grinell River and at Amadjuak Lake or excursions for ptarmigan and goose hunting). Hunters surveyed in Iqaluit noted that the caribou hunt could follow a similar trajectory to walrus hunting and whale hunting. Although the circumstances are different, both walrus hunting and whale hunting have changed significantly in Iqaluit as management regulations have changed and costs of mounting these complex and expensive hunts have climbed (Glenn Williams, personal communication). These hunts are dependent on sharing networks both for the production and dispersal of meat as well as for the ownership and maintenance of the necessary gear (Reeves, 1992). The big crews and large boats involved in conducting these hunts in past decades acted to strengthen relationships and networks of kinship and reciprocity (Reeves, 1992). When large scale walrus and whale hunts became less common, these social networks were in many cases fragmented and associated large-scale sharing also decreased according to several older hunters in Iqaluit. Some Iqaluit caribou hunters are concerned that as caribou decrease, competition for the remaining animals will increase to the detriment of important social links which are central to Inuit hunting tradition.

5.2 Caribou Management: Culture Clash and Management Strategies

The future of caribou on Baffin Island needs to be carefully considered in light of changing environmental conditions and rapidly growing communities and demand. The consumption of caribou by Baffin communities is connected to the mainland communities that supply meat through trade facilitated by internet communication. Sustainable management of caribou is important to maintaining caribou as a country food central to the health and well-being of Inuit culture and communities. Country food

represents an important source of nutritious, high-value food for Inuit communities which cannot be replaced by store-bought food. The process of hunting caribou is also a cultural practice which fosters the kinship and reciprocity networks which are at the core of Inuit culture. Effective management of caribou is thus about cultural continuity more than simple herd numbers.

There are growing calls from Nunavumiut and northern scholars for the incorporation of IQ principles in government policy. This is a stated goal of the Government of Nunavut, mandated by the terms of the Nunavut Land Claims Agreement (NLCA). To date, legislators and bureaucrats have struggled with the definition of the term and its implications (Henderson 2008; Labbe et al., in press). IQ is a significant set of guiding values and principles, rather than a body of knowledge. This confusion allows IQ to be dismissed as a bureaucratic term of little consequence in the formulation of legislation and the execution of protocol.

In order to incorporate Inuit knowledge of wildlife and ecology into monitoring and policy making, this knowledge and the nature of 'traditions' must be unpacked. In this context identifying knowledge as 'traditional' may add weight and legitimacy. The conception of knowledge as accumulating over time may not fully acknowledge the dynamics of social and cultural change. Describing caribou hunting as a vital 'traditional' activity communicates the important cultural value of caribou but sheds little light on current hunting methods and obscures the channels whereby caribou meat arrives on kitchen tables and in freezers. While caribou is an important cultural food, there remains no comprehensive data detailing the amount harvested or the timing of the harvesting activity (Wenzel et al., 2016). This timing of harvesting has ecological significance but it

also has cultural significance, as a shift is taking place towards increased caribou harvesting in the winter and early spring when snowmobile based hunting is possible. There is also very little data to explain the place of caribou among other country foods that are culturally significant and locally available. Caribou is a preferred food for many and as a consequence it is being hunted more intensively than it was in the past. Caribou hunting remains a cultural practice at the heart of Inuit identity and a vital part of the life of the community of Iqaluit, but incorporating more nuanced understandings of terms such as traditional knowledge into policy making remains important. By focusing on ideas of strict cultural continuity there is a risk that the breadth and rapidity of the environmental, social and cultural changes are not acknowledged (Berkes et al., 2000).

The Government of Nunavut organized and initiated community meetings in January –February 2014 (the second caribou consultation) in order to report to local communities on their caribou research and survey results. Government officials addressed their data collection on herd location and health; and asked community members to share their views regarding a declining caribou population and herd location. These consultations were particularly important as they preceded the aerial and ground-based surveys completed over the spring of 2014. These surveys were designed to verify the population data previously produced by the Nunavut Department of Environment during its 2012 survey of the island's caribou (Jenkins et al. 2012). A press release on February 7, 2014 issued by the Government of Nunavut reported that 380 community members as well as representatives from Hunters and Trappers Organizations (HTOs) and the Government of Nunavut participated over the course of consultations in each of the ten communities of the Qikiqtaaluk (Baffin Administrative Region). In Iqaluit there

were fewer than 30 people present (including the HTO representatives), and eight of them were Qallunaat (non-beneficiaries of the Nunavut Land Claims Agreement and only resident for a few years – in other words not active or necessarily knowledgeable members of the hunting community). These rates of attendance are indicative of challenges facing the process of consultation and engagement by the Government of Nunavut, resulting in only and handful of local opinions being reported back.

The first caribou consultation meetings in Iqaluit was organized and initiated by the Government of Nunavut in July 2013 in order to report their caribou research and survey results. The outcome of these meetings was reported shortly after completion. During the following twelve months, none of the Baffin HTOs sanctioned restrictions on the activities of their members. Instead, no action was taken as the Baffin HTOs waited for the results of the survey conducted in the spring of 2014. Thus the opportunity for a community-led management effort passed. Instead this process was conducted at the territorial level by the NWMB and the Government of Nunavut through the processes established by the NLCA. Baffin HTOs involvement could assist in generating vital data from harvesting records of local conservation offices and from records kept by Baffin HTOs of members' activity levels. Community engagement through these institutions would ensure higher quality data and a process whereby the views of the communities were shared with the NWMB and the Government of Nunavut more effectively.

The limited availability of caribou has increased tensions within the hunting community in Iqaluit. Current hunting regulations stipulate that quota and licensing requirements of caribou hunters vary according to their residence status and whether they are beneficiaries of the NLCA. Under the terms of the NLCA, "transmission of rights" is

permissible in certain circumstances. This allowance was made to protect the rights of spouses and children. The hunting regulatory system created a framework that would ensure Inuit access to country food. Under these terms the non-beneficiary spouse of a beneficiary assumed their hunting privileges, thereby becoming exempt from certain restrictions. This process was divisive among Iqaluit hunters, as some felt that it allowed for more harvesting by hunters with higher wage /salary incomes, who were not exposed to the risks and costs of being full-time hunters. This issue was only noted in Iqaluit, a community unique on Baffin Island due to its size and diversity. It is unlikely that this would become a point of contention in smaller communities where the populations of non-beneficiaries are far smaller. In an environment of extreme caribou scarcity this tension highlights the feeling among Inuit hunters that they are being ill-served by the regulatory framework.

In the 1950s and 1960s Canadian Wildlife Officers believed that Inuit hunters used underpowered rifles (low caliber) and that as a result hunting was inefficient and wasteful (Kulchyski and Tester, 2007). Restrictions were imposed that disregarded the local knowledge of hunters and the food requirements of communities, and in some cases led to serious food shortages and starvation (Kulchyski and Tester, 2007). The history of wildlife management in Nunavut was marked by paternalism and a disregard for Traditional Knowledge that was both locally specific and was accrued over generations of observation and trial. This difficult history makes solving modern disputes over rights and trusting scientific data challenging. There has been a deep mistrust born of the damage done to northern communities when hunting was restricted.

In the course of the rapid decline of Baffin Island caribou, the imposition of a moratorium was an important decision (the impact is discussed further below). To continue without immediate action to curb the decline of the caribou population would have risked their extirpation. Going forward a more nuanced management of the resource will be required. The NLCA stipulates that the hunting techniques of Nunavummiut cannot be restricted in the Greenlandic fashion, where hunter's behavior is regulated, but there are still important lessons that can be learned from Greenlandic hunting and wildlife management institutions. Greenlandic caribou hunting regulations govern weapons, calibers and hunting seasons. Further, regulations dictate that most hunting is on foot. Summer and fall hunters are required to boat in to their hunting location and after hunting on foot they must carry their caribou back to the coast. This hunting method limits the amount of caribou harvested and restricts where the hunt takes place. In addition, Greenlandic regulations restrict a) certain seasons, thus reducing the impact on the spring calving and fall rut, and b) certain geographic locations, thus avoiding refugia and calving ground (referenced in Chapter Four). While there is still winter hunting of caribou, the balance of the hunting actually occurs during the summer and fall, in contrast to current behavior on southern Baffin Island. Caribou management in Greenland is able to make rapid year to year adjustments to these regulations on the basis of consistent and comprehensive community-based monitoring of caribou populations and harvesting efforts. The NLCA stipulates that the Inuit right to hunt is unconditional; however, communities governed by local HTOs and HTAs could invoke local restrictions without oversight by the NWMB or Government of Nunavut. These local initiatives would likely

have a greater chance of gathering the necessary community acceptance than a centralized approach.

5.3 Conclusion

This thesis explores challenges facing the Inuit caribou hunters of Iqaluit. Inuit caribou hunting culture as a socio-ecological system is vulnerable to a range of environmental factors which include environmental and socio-economic change. A range of adaptive techniques and behaviours have been employed by the Iqaluit hunting community to manage the impacts of environmental factors. A variety of social factors have acted to make Iqaluit a community where country food demand is high, and the networks through which residents obtain this food complex. While adverse environmental conditions and economic factors act to limit the hunting range of Iqalummiut, these same environmental conditions may also be acting to limit the ranges and areas occupied by caribou. When taken in sum, these two shifting patterns of territory use mean that the hunting pressure of Iqalummiut is amplified.

The decline of caribou populations on Baffin Island poses a number of challenges to harvesting communities and to the management institutions that govern these harvesting activities. In attempting to assess and understand their interactions and behavior, a number of important conclusions emerge from the thesis that have a bearing on a consideration of adaptive co-management and of the challenges of providing communities with country food, which continues to be important culturally, nutritionally and economically (Gombay, 2005b). The case of caribou population decline on southern Baffin Island suggests that the management process is being driven by the Government of

Nunavut with secondary involvement from Nunavut Tunngavik Inc. and inadequate community level involvement from HTOs and RWOs. The flexibility built into principles of co-management requires consistent and comprehensive involvement by communities and local governments.

Effective co-management requires a constant stream of data to be analyzed by the management board. Wildlife harvest surveys and population studies are expensive to run and to process; but without the data they provide, wildlife management is seriously constrained. This lack of high-quality data applies also to the question of food security. Without dependable and comprehensive data on caribou numbers, the inclusion of country food in territorial food security policy is challenging.

Changing weather patterns are an important factor for the health of caribou populations on southern Baffin Island. However, given the high demand for country food, human intervention is a critical factor. Severe weather and unpredictable conditions on the land and sea-ice undoubtedly constrain the active range of hunters; however, it should be noted that socio-economic factors, such as high costs and the need for highly specialized knowledge, may play a greater role in facilitating or preventing hunter activity when it comes to caribou harvesting. Thus weather conditions, and environmental change, are acting to multiply and accelerate other stresses on caribou hunters and on the herd. The Inuit hunting community of Iqaluit is highly resilient, but if caribou populations in the area are to be preserved, action will need to be taken to determine a wildlife management policy which takes into account the sustainability of the herd as well as the importance of caribou as country food.

References:

ACIA (2005) Arctic Climate Impacts Assessment. Cambridge University Press, Cambridge, UK.

Agrawal, A. (1995). Indigenous and Scientific Knowledge: Some Critical Comments." Indigenous knowledge and Development Monitor 3(3):3-6

Aporta, C. (2009). The trail as home: Inuit and their pan-Arctic network of routes. *Human Ecology*, *37*(2), 131-146.

Arnakaq, M. (1999). Healing Circles. *Inuktitut*, *85*, 33-39.

Bergerud, A. T., Luttich, S. N., & Camps, L. (2007). *Return of caribou to Ungava* (Vol. 50). McGill-Queen's Press-MQUP.

Berkes, Fikret. (1999). *Sacred Ecology: Traditional Ecological Knowledge and Resource Management.* Taylor and Francis, London.

Berkes, Fikret. (2009). Evolution of Co-management : Role of Knowledge Generation, Bridging Organizations and Social Learning. *Journal of Environmental Management* 90: 1692–1702.

Berkes, F., & Folke, C. (1998). Linking social and ecological systems for resilience and sustainability. *Linking social and ecological systems: management practices and social mechanisms for building resilience*, *1*, 13-20.

Berkes, F., Folke, C., & Colding, J. (2000). *Linking social and ecological systems: management practices and social mechanisms for building resilience*. Cambridge University Press.

Berkes, F., & Jolly, D. (2002). Adapting to climate change: social-ecological resilience in a Canadian western Arctic community. *Conservation ecology*, *5*(2), 18.

Bernard, H. R. (1995). Research methods in anthropology . Walnut Creek. *CA: Alta Mira*.

Borre, Kristen. (1990). A biocultural model of dietary decision making among North Baffin Island Inuit: explaining the ecology of food consumption by native Canadians. PhD diss.,

Bourque F, Willox AC (2014) Climate change: The next challenge for public mental health? International Review of Psychiatry 26:415-422.

Briggs, C. L. (1986). *Learning how to ask: A sociolinguistic appraisal of the role of the interview in social science research* (No. 1). Cambridge University Press.

Brody, H. (1978). Ecology, politics and change: the case of the Eskimo. *Development and Change*, *9*(1), 21-40.

Brook, Ryan K, Susan J Kutz, Alasdair M Veitch, Richard a Popko, Brett T Elkin, and Glen Guthrie. (2009). Fostering Community-based Wildlife Health Monitoring and Research in the Canadian North. *EcoHealth* 6 (2) (June): 266–78.

Bryman, A. (2004). Interviewing in qualitative research. *Social research methods*, *2*, 318-344.

Burch Jr, E. S. (2012). *Caribou Herds of Northwest Alaska, 1850-2000*. University of Alaska Press.

Callaghan, T. V., Johansson, M., Brown, R. D., Groisman, P. Y., Labba, N., Radionov, V., ... & Yang, D. (2011). The changing face of Arctic snow cover: A synthesis of observed and projected changes. *Ambio*, *40*(1), 17-31.

Cameron, E. S. (2012). Securing Indigenous politics: A critique of the vulnerability and adaptation approach to the human dimensions of climate change in the Canadian Arctic. *Global Environmental Change*, *22*(1), 103-114.

Castleden H, Morgan VS, Lamb C (2012a) "I spent the first year drinking tea": Exploring Canadian university researchers' perspectives on community-based participatory research involving Indigenous peoples. Canadian Geographer-Geographe Canadien 56:160-179.

Castleden H, Mulrennan M, Godlewska A (2012b) Community-based participatory research involving Indigenous peoples in Canadian geography: Progress? An editorial introduction. Canadian Geographer-Geographe Canadien 56:155-159.

Chan HM, Fediuk K, Hamilton S, Rostas L, Caughey A, Kuhnlein H, Egeland G, Loring E (2006) Food security in Nunavut, Canada: Barriers and recommendations. International Journal of Circumpolar Health 65.

Chapin, M., Lamb, Z., & Threlkeld, B. (2005). Mapping indigenous lands. *Annu. Rev. Anthropol.*, *34*, 619-638.

Collings, P. (2009). Participant observation and phased assertion as research strategies in the Canadian Arctic. *Field Methods*, *21*(2), 133-153.

Collings, P. (2014). *Becoming Inummarik: Men's Lives in an Inuit Community* (Vol. 73). McGill-Queen's Press-MQUP.

Collings P, Wenzel G, Condon RG (1998) Modern food sharing networks and community integration in the Central Canadian Arctic. Arctic 51.

Cronin, M a, J C Patton, N Balmysheva, and M D MacNeil. (2003). Genetic Variation in Caribou and Reindeer (Rangifer Tarandus). *Animal Genetics* 34 (1) (February): 33–41.

Crowley P (2010) Interpreting 'dangerous' in the United Nations framework convention on climate change and the human rights of Inuit. Regional Environmental Change:10.
Cruikshank, J. (2000). *Social Life of Stories: Narrative and Knowledge in the Yukon Territory*. UBC Press.

Cruikshank, J. (2005). *Do glaciers listen?: local knowledge, colonial encounters, and social imagination*. University of British Columbia Press.

Cunsolo Willox A, Harper SL, Ford JD, Landman K, Houle K, Edge VL, Government RIC (2012) "From this place and of this place:" climate change, sense of place, and health in Nunatsiavut, Canada. Social Science & Medicine 75:538-547.

Curry, Patricia. (2007). Caribou Herds and Arctic Communities: Exploring a New Tool for Caribou Health Monitoring. *InfoNorth*: 495–499.

Cutter, S. L. (2003). The vulnerability of science and the science of vulnerability. *Annals of the Association of American Geographers*, *93*(1), 1-12.

Davis, Anthony, and John R Wagner. (2003). Who Knows ? On the Importance of Identifying ' Experts ' When Researching Local Ecological Knowledge. *Human Ecology* 31 (3): 463–489.

Dombrowski, K., Khan, B., Channell, E., Moses, J., McLean, K., & Misshula, E. (2013). Kinship, family, and exchange in a Labrador Inuit community. *Arctic Anthropology*, *50*(1), 89-104.

Dowsley, M., & Wenzel, G. (2008). " The Time of the Most Polar Bears": A Co-management Conflict in Nunavut. *Arctic*, 177-189.

Eades, G. L. (2015). *Maps and Memes: Redrawing Culture, Place, and Identity in Indigenous Communities* (Vol. 76). McGill-Queen's Press-MQUP.

Egeland GM, Williamson-Bathory L, Johnson-Down L, Sobol I (2011) Traditional food and monetary access to market-food: correlates of food insecurity among Inuit preschoolers. International Journal of Circumpolar Health 70.

Emerson, R. M., Fretz, R. I., & Shaw, L. L. (2011). *Writing ethnographic fieldnotes*. University of Chicago Press.

Ferguson, M. A., and Francois Messier. (1997). Collection and analysis of traditional ecological knowledge about a population of Arctic tundra caribou. *Arctic*, 17-28.

Ferguson, M. A., and François Messier. (2000). Mass Emigration of Arctic Tundra Caribou from a Traditional Winter Range: Population Dynamics and Physical Condition. *The Journal of Wildlife Management* 64 (1): 168–178.

Ferguson, M. A., Williamson, R. G., & Messier, F. (1998). Inuit knowledge of long-term changes in a population of Arctic tundra caribou. *Arctic*, 201-219.

Fienup-Riordan, A. (1999). Yaqulget qaillun pilartat (what the birds do): Yup'ik Eskimo understanding of geese and those who study them. *Arctic*, 1-22.

Forbes B. (2013). Cultural Resilience of Social-ecological Systems in the Nenets and Yamal-Nenets Autonomous Okrugs, Russia: A Focus on Reindeer Nomads of the Tundra. Ecology and Society 18.

Forbes, B. C., & Kumpula, T. (2009). The ecological role and geography of reindeer (Rangifer tarandus) in northern Eurasia. *Geography Compass*, *3*(4), 1356-1380.

Forbes BC, Stammler F, Kumpula T, Meschtyb N, Pajunen A, Kaarlejarvi E (2009) High resilience in the Yamal-Nenets social-ecological system, West Siberian Arctic, Russia. Proceedings of the National Academy of Sciences of the United States of America 106:22041-22048.

Forchhammer, M. C., Post, E., Berg, T. B., HøYE, T. T., & Schmidt, N. M. (2005). Local-scale and short-term herbivore-plant spatial dynamics reflect influences of large-scale climate. *Ecology*, *86*(10), 2644-2651.

Forchhammer, M. C., Post, E., Stenseth, N. C., & Boertmann, D. M. (2002). Long-term responses in arctic ungulate dynamics to changes in climatic and trophic processes. *Population Ecology*, *44*(2), 113-120.

Ford JD (2009a) Dangerous climate change and the importance of adaptation for the Arctic's Inuit population. *Environmental Research Letters* 4.

Ford, J. D. (2009b). Vulnerability of Inuit food systems to food insecurity as a consequence of climate change: a case study from Igloolik, Nunavut. *Regional Environmental Change*, *9*(2), 83-100.

Ford JD, Beaumier M (2011) Feeding the family during times of stress: experience and determinants of food insecurity in an Inuit community. Geographical Journal 177.

Ford JD, Bolton K, Shirley J, Pearce T, Tremblay M, Westlake M (2012) Mapping human dimensions of climate change research in the canadian arctic. *Ambio* 41.

Ford, J. D., McDowell, G., & Pearce, T. (2015). The adaptation challenge in the Arctic. *Nature Climate Change*, *5*(12), 1046-1053.

Ford, J. D., McDowell, G., Shirley, J., Pitre, M., Siewierski, R., Gough, W., ... & Statham, S. (2013). The dynamic multiscale nature of climate change vulnerability: an Inuit harvesting example. *Annals of the Association of American Geographers*, *103*(5), 1193-1211.

Ford JD, Smit B, Wandel J, MacDonald J (2006a) Vulnerability to climate change in Igloolik, Nunavut: what we can learn from the past and present. Polar Record 42:127-138.

Ford, J. D., Smit, B., & Wandel, J. (2006b). Vulnerability to climate change in the Arctic: a case study from Arctic Bay, Canada. *Global Environmental Change*, *16*(2), 145-160.

Ford, James D., Tristan Pearce, Frank Duerden, Chris Furgal, and Barry Smit. (2010). Climate Change Policy Responses for Canada's Inuit Population: The Importance of and Opportunities for Adaptation. *Global Environmental Change* 20 (1) (February): 177–191

Ford, J., Pearce, T., Smit, B., Wandel, J., Allurut, M., Shappa, K., Qrunnut, K. (2007). Reducing vulnerability to climate change in the Arctic: the case of Nunavut, Canada. *Arctic*, 150-166.

Fox, S. (2002). These are things that are really happening: Inuit perspectives on the evidence and impacts of climate change in Nunavut. *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change, Arctic Research Consortium of the United States, Fairbanks, USA*, 12-53.

Freeman, M.M.R. (1976). Land Use and Occupancy (Vol 1-3): Inuit Land Use and Occupancy Project Report. Ottawa, ON: Supply and Services Canada

Furgal CM, Seguin J (2006) Climate change, health and community adaptive capacity: lessons from the Canadian north. Environmental Health Perspectives 114:1964–1970.

Furgal C, et al, (2008) Health Impacts of Climate Change in Canada's North. in Séguin J (ed.) Human Health in a Changing Climate: A Canadian Assessment of Vulnerabilities and Adaptive Capacity. Health Canada.

Furberg M, Evengard B, Nilsson M (2011) Facing the limit of resilience: perceptions of climate change among reindeer herding Sami in Sweden. Global Health Action 4.

Gadgil, M., Hemam, N. S., & Reddy, B. M. (1998). People, refugia and resilience. *Linking social and ecological systems: Management practices and social mechanisms for building resilience*, 30-47. In Berkes et al. (2000)

Garibaldi, A., & Turner, N. (2004). Cultural keystone species: implications for ecological conservation and restoration. *Ecology and society*, *9*(3), 1.

Gearheard, S., Aporta, C., Aipellee, G., & O'Keefe, K. (2011). The Igliniit project: Inuit hunters document life on the trail to map and monitor arctic change. *Canadian Geographer/Le Géographe canadien*, *55*(1), 42-55.

Gearheard S, Matumeak W, Angutikjuaq I, Maslanik J, Huntington HP, Leavitt J, Kagak DM, Tigullaraq G, Barry RG (2006) "It's not that simple": A collaborative comparison of sea ice environments, their uses, observed changes, and adaptations in Barrow, Alaska, USA, and Clyde River, Nunavut, Canada. Ambio 35:203-211.

Gearheard S, Pocernich M, Stewart R, Sanguya J, Huntington HP. (2010). Linking Inuit knowledge and meteorological station observations to understand changing wind patterns at Clyde River, Nunavut. Climatic Change 100:267-294.

Gearheard, S., & Shirley, J. (2007). Challenges in community-research relationships: Learning from natural science in Nunavut. *Arctic*, 62-74.

Gibson, G. (2009). *The bedside book of beasts: A wildlife miscellany*. Random House LLC.

Gombay, N. (2005a). Shifting identities in a shifting world: food, place, community, and the politics of scale in an Inuit settlement. *Environment and Planning D: Society and Space*, *23*(3), 415-433.

Gombay, N. (2005b). The commoditization of country foods in Nunavik: a comparative assessment of its development, applications, and significance. *Arctic*, 115-128.

Gombay, N. (2010). *Making a living: place, food, and economy in an Inuit community*. UBC Press.

Gunn, A., Russell, D., & Eamer, J. (2011). *Northern caribou population trends in Canada*. Canadian Councils of Resource Ministers.

Hall, E. S. (1978). Technological change in northern Alaska. *Archaeological Essays in Honor of Irving B. Rouse*, (2), 209.

Harder MT, Wenzel GW (2012) Inuit Subsistence, Social Economy and Food Security in Clyde River, Nunavut. Arctic 65:305-318.

Harris, L. M., & Hazen, H. D. (2005). Power of maps:(Counter) mapping for conservation. *ACME: An International E-Journal for Critical Geographies*, *4*(1), 99-130.

Hay, I. (2000). Qualitative Research Methods in Human Geography. *Oxford University Press*

Henderson, A. (2008). *Nunavut: Rethinking political culture*. UBC Press.

Hovelsrud, G. K., & Smit, B. (2010). *Community adaptation and vulnerability in Arctic regions* (p. 353). Dordrecht: Springer.

Hovelsrud, G. K., Poppel, B., van Oort, B., & Reist, J. D. (2011). Arctic societies, cultures, and peoples in a changing cryosphere. *Ambio*, *40*(1), 100-110.
Huntington, H. P. (1998). Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. *Arctic*, 237-242.

Hughes, R. G. (1986). Theories and models of species abundance. *American Naturalist*, 879-899.

Huntington, H. P. (1998). Observations on the utility of the semi-directive interview for documenting traditional ecological knowledge. *Arctic*, 237-242.

Jenkins, Debbie. (2007). *Space Use and Movement Patterns of North Baffin Caribou*. Pond Inlet. Government of Nunavut, Department of Environment: Wildlife Section

Jenkins, Debbie. (2008). *The Distribution and Abundance of Peary Caribou and Muskoxen Across the North Western High Arctic Islands, Nunavut*. Pond Inlet. Government of Nunavut, Department of Environment: Wildlife Section

Jenkins, Debbie, Jaylene Goorts and Nicholas Lecomte. (2012). *Estimating the Abundance of South Baffin Caribou: Final Summary Report*. Pond Inlet. Government of Nunavut, Department of Environment: Wildlife Section

Johnson, Martha. (1992). Lore: Capturing Traditional Environmental Knowledge. Yellowknife: Government of the Northwest Territories

Jorgensen, D. L. (1989). *Participant observation*. John Wiley & Sons, Inc..

Kendrick, Anne, and Micheline Manseau. (2008). Representing Traditional Knowledge: Resource Management and Inuit Knowledge of Barren-Ground Caribou. *Society & Natural Resources* 21 (5) (April 9): 404–418.

Kishigami N (2004) A new typology of food sharing practices among hunter gatherers, with a special focus on Inuit examples. *Journal of Anthropological Research* 60:341-358.

Klein, D.R. (1996). Structures for Caribou Management and Their Status in the Circumpolar North. *Rangifer, Special Issue (Proceedings of the George River Caribou Workshop)* (9): 245–252.

Kovach, M. E. (2010). *Indigenous methodologies: Characteristics, conversations, and contexts*. University of Toronto Press.

Kraft, Paul G. (1984). *Caribou Tagging Project, Koukdjuak River Baffin Island, Northwest Territories, 1982*. NWT Wildlife Service

Krupnik, I., Aporta, C., Gearheard, S., Laidler, G. J., & Holm, L. K. (2010). *SIKU: Knowing Our Ice*. New York: Springer.

Krupnik, I., & Jolly, D. (2002). *The Earth Is Faster Now: Indigenous Observations of Arctic Environmental Change. Frontiers in Polar Social Science*. Arctic Research Consortium of the United States, 3535 College Road, Suite 101, Fairbanks, AK 99709.

Kruse, Jack, Dave Klein, Steve Braund, Lisa Moorehead, and Bill Simeone. (1998). Co-Management of Natural Resources : A Comparison of Two Caribou Management Systems. *Human Organization* 57 (4).

Kulchyski, P. K., & Tester, F. J. (2007). *Kiumajut (talking Back): Game Management and Inuit Rights, 1900-70*. University of British Columbia Press.

Labbe et al. (in press). The Climate Change Adaptation Landscape in Nunavut, Canada. *Environmental Review*

Larsen JN, Anisimov OA (2014) Chapter 28: Polar regions. Working Group II of the Intergovernmental Panel on Climate Change Fifth Assessment Report.

Larsen, J. N., & Fondahl, G. (Eds.). (2015). *Arctic Human Development Report: Regional Processes and Global Linkages*. Nordic Council of Ministers.

Lloyd-Evans, S. (2006). Focus groups. *Doing development research*, 153-163.

Loring PA, Gerlach C (2015) Searching for progress on food security in the North American North: A research synthesis and meta-analysis of the peer reviewed literature. Arctic 68:380-392.

Martin, D. H. (2012). Two-eyed seeing: a framework for understanding Indigenous and non-Indigenous approaches to Indigenous health research. *CJNR (Canadian Journal of Nursing Research)*, *44*(2), 20-42.

McDowell, G., Ford, J., & Jones, J. (2016). Community-level climate change vulnerability research: trends, progress, and future directions. *Environmental Research Letters*, *11*(3), 033001.

Menzies, C. R. (Ed.). (2006). *Traditional Ecological Knowledge and Natural Resource Management*. U of Nebraska Press.

Meltofte, H., Christensen, T. R., Elberling, B., Forchhammer, M. C., & Rasch, M. (2008). *High-arctic ecosystem dynamics in a changing climate* (Vol. 40). Academic Press.

Müller-Wille, L. (1978). Cost analysis of modern hunting among the Inuit of the Canadian Central Arctic. *Polar Geography*, *2*(2), 100-114.

Mulrennan, M. E., & Scott, C. H. (2005). Co-management—An Attainable Partnership? Two Cases from James Bay, Northern Quebec and Torres Strait, Northern Queensland. *Anthropologica*, 197-213.

Murray, David. (2000). Tempered Optimism: Recognising the Barriers to the Use of Traditional Ecological Knowledge in Arctic Canada. Carleton University.

Nadasdy, P. (1999). The politics of TEK: Power and the" integration" of knowledge. *Arctic Anthropology*, 1-18.

Nadasdy, P. (2005). *Hunters and bureaucrats: Power, knowledge, and aboriginal-state relations in the southwest Yukon*. University of British Columbia Press.

Nadasdy, P. (2007). The gift in the animal: the ontology of hunting and human-animal sociality. *American Ethnologist*, 25-43.

Nakashima, D. J. (1991). *The ecological knowledge of Belcher Island Inuit: a traditional basis for contemporary wildlife co-management*. McGill University.

Nancarrow TL, Chan HM (2010) Observations of environmental changes and potential dietary impacts in two communities in Nunavut, Canada. *Rural and Remote Health* 10.

Nickels et al. (ed.): (2006) Unikkaaqatigiit - Putting the Human Face on Climate Change: Perspectives from Inuit in Canada, Joint Publication of Inuit Tapiriit Kanatami, Nasivvik Centre for Inuit Health and Changing Environments at Universite Laval and the Ajunnginiq Centre at the Nataional Aboriginal Health Organization., Ottawa.

Nunavut Planning Commission (2016). *Draft Nunavut Land Use Plan*. 2016

Oakes, J. E. (1991). *Copper and Caribou Inuit skin clothing production*. Canadian Museum of civilization.

Orlove B, Lazrus H, Hovelsrud GK, Giannini A (2014) Recognitions and Responsibilities On the Origins and Consequences of the Uneven Attention to Climate Change around the World. Current Anthropology 55:249-275.

Pattimore, J. H. (1985). *Inuit wildlife harvest for 1984 in the Baffin Region*. Baffin Region Inuit Association.

Patton, M. Q. (2005). *Qualitative research*. John Wiley & Sons, Ltd.

Ford, J. D., & Pearce, T. (2012). Climate change vulnerability and adaptation research focusing on the Inuit subsistence sector in Canada: Directions for future research. *The Canadian Geographer/Le Géographe canadien*, *56*(2), 275-287.

Pearce T, Ford JD, Duerden F, Smit B, Andrachuk M, Berrang-Ford L, Smith T (2011a) Advancing adaptation planning for climate change in the Inuvialuit Settlement Region (ISR): a review and critique. Regional Environmental Change 11:1-17.

Pearce, T. D., Ford, J. D., Laidler, G. J., Smit, B., Duerden, F., Allarut, M., Wandel, J. (2009). Community collaboration and climate change research in the Canadian Arctic. *Polar Research*, *28*(1), 10-27.

Pearce T, Ford J, Willox AC, Smit B. (2015). Inuit Traditional Ecological Knowledge (TEK), Subsistence Hunting and Adaptation to Climate Change in the Canadian Arctic. Arctic 68:233-245.

Pearce T, Smit B, Duerden F, Ford JD, Goose A, Kataoyak F (2010) Inuit vulnerability and adaptive capacity to climate change in Ulukhaktok, Northwest Territories, Canada. Polar Record 46:157-177.

Pearce T, Wright H, Notaina R, Kudlak A, Smit B, Ford JD, Furgal C (2011b) Transmission of Environmental Knowledge and Land Skills among Inuit Men in Ulukhaktok, Northwest Territories, Canada. Human Ecology 39:271-288.

Pielou, E. C. (2012). *A naturalist's guide to the Arctic*. University of Chicago Press.

Poppel, B., & Kruse, J. (2009). The Importance of a Mixed Cash-and Harvest Herding Based Economy to Living in the Arctic–An Analysis on the Survey of Living Conditions in the Arctic (SLiCA). In *Quality of Life and the Millennium Challenge* (pp. 27-42). Springer Netherlands.

Priest, H., & Usher, P. J. (2004). *The Nunavut Wildlife Harvest Study, August 2004: Final Report*. Nunavut Wildlife Management Board= Nunavumi Umayuligiyit Katimayiit.

Rattenbury K, Kielland K, Finstad G, Schneider W (2009) A reindeer herder's perspective on caribou, weather and socio-economic change on the Seward Peninsula, Alaska. Polar Research 28:71-88.

Redhead, R., and E. Land. (1979). *Calving Ground Survey: South Baffin Caribou Herd (June 1976)*. NWT Wildlife Service.

Reeves, R. (1992). *What is a Narwhal Worth?: An analysis of factors driving the narwhal hunt and a critique of tried approaches to hunt management for species conservation.* PhD thesis, McGill University, Montreal, Quebec.

Reimers, E., & Colman, J. E. (2009). Reindeer and caribou (Rangifer tarandus) response towards human activities. *Rangifer*, *26*(2), 55-71.

Rennert, K. J., Roe, G., Putkonen, J., & Bitz, C. M. (2009). Soil thermal and ecological impacts of rain on snow events in the circumpolar Arctic. *Journal of Climate*, *22*(9), 2302-2315.

Riedlinger, D., & Berkes, F. (2001). Contributions of traditional knowledge to understanding climate change in the Canadian Arctic. *Polar Record*, *37*(203), 315-328.

Robinson, G. M. (1998). *Methods and techniques in human geography*. John Wiley & Son Ltd.

Scott, C. (1986). Hunting territories, hunting bosses and communal production among coastal James Bay Cree. *Anthropologica*, 163-173.

Scott, C. (1989). Knowledge construction among the Cree hunters: metaphors and literal understanding. *Journal de la Société des Américanistes*, *75*(1), 193-208.

Scott, C. (1996). Science for the west, myth for the rest?. *Naked Science: Anthropological Inquiry into Boundaries, Power, and Knowledge, New York: Routledge*, 69-86.

Simpson, L. R. (2004). Anticolonial strategies for the recovery and maintenance of Indigenous knowledge. *The American Indian Quarterly*, *28*(3), 373-384.

Smit, Barry, and Johanna Wandel. (2006). Adaptation, Adaptive Capacity and Vulnerability. *Global Environmental Change* 16 (3) (August): 282–292.

Smith, L. (1972). The Mechanical Dog Team: A Study of the Skl-Doo in the Canadian Arctic. *Arctic Anthropology*, 1-9.

Smith, L. T. (1999). *Decolonizing methodologies: Research and indigenous peoples*. Zed books.

Statham, S. (2012). *Inuit Food Security: Vulnerability of the traditional food system to climatic extremes during winter 2010/2011 in Iqaluit, Nunavut* (Doctoral dissertation, McGill University Montréal (Québec) Canada).

Statham S, Ford J, Berrang-Ford L, Lardeau M-P, Gough W, Siewierski R (2015) Anomalous climatic conditions during winter 2010-2011 and vulnerability of the traditional Inuit food system in Iqaluit, Nunavut. Polar Record 51:301-317.

Stern, P. R., & Stevenson, L. (Eds.). (2006). *Critical Inuit studies: An anthology of contemporary Arctic ethnography*. U of Nebraska Press.

Suluk, T. K., & Blakney, S. L. (2008). Land claims and resistance to the management of harvester activities in Nunavut. *Arctic*, 62-70.

Thomas, Donald C, and James Schaefer. (1991). Wildlife Co-management Defined : The Beverly and Kaminuriak Caribou Management Board. *Rangifer, Special Issue (Proceedings of the Fifth North American Caribou Workshop)* (7): 73–89.

Thorpe, N. L. (1997). The Tuktu and Nogak Project: Inuit knowledge about caribou and calving areas in the Bathurst Inlet region. *Arctic*, *50*(4), 381-384.

Thorpe, N. L. (1998). The Hiukitak School of Tuktu: collecting Inuit ecological knowledge of caribou and calving areas through an elder-youth camp. *Arctic*, *51*(4), 403.

Turner, B. L., Kasperson, R. E., Matson, P. A., McCarthy, J. J., Corell, R. W., Christensen, L., ... & Polsky, C. (2003). A framework for vulnerability analysis in sustainability science. *Proceedings of the national academy of sciences*, *100*(14), 8074-8079.

Usher, P. J. (2000). Traditional ecological knowledge in environmental assessment and management. *Arctic*, 183-193.

Vaisanen M, Ylanne H, Kaarlejarvi E, Sjoegersten S, Olofsson J, Crout N, Stark S (2014) Consequences of warming on tundra carbon balance determined by reindeer grazing history. Nature Climate Change 4:384-388.

Vistnes, I., & Nellemann, C. (2001). Avoidance of cabins, roads, and power lines by reindeer during calving. *The Journal of wildlife management*, 915-925.

Vors, L. S., & Boyce, M. S. (2009). Global declines of caribou and reindeer. *Global Change Biology*, *15*(11), 2626-2633.

Wein, Eleanor E, Milton M R Freeman, and Jeanette C Makus. (1996). Use of and Preference for Traditional Foods Among the Belcher Island Inuit. *Arctic* 49 (3): 256–264.

Wenzel, G. W. (1991). *Animal rights, human rights: Ecology, economy and ideology in the Canadian Arctic*. University of Toronto Press.

Wenzel G. (1995). Ningiqtuq: Resource sharing and generalized reciprocity in Clyde River, Nunavut. Arctic Anthropology 32:43-60.

Wenzel, George W. (1999). Traditional Ecological Knowledge and Inuit : Reflections on TEK Research and Ethics. *Arctic* 52 (2): 113–124.

Wenzel, G. W. (2004). From TEK to IQ: Inuit Qaujimajatuqangit and Inuit cultural ecology. *Arctic Anthropology*, *41*(2), 238-250.

Wenzel, George W. (2009). Canadian Inuit Subsistence and Ecological Instability- If the Climate Changes, Must the Inuit? *Polar Research* 28 (1) (April): 89–99.

Wenzel G. (2013). Inuit and modern hunter-gatherer subsistence. Etudes Inuit / Inuit Studies 37:181-200.

Wenzel, G. W., Dolan, J., & Brown, C. (2016). Wild Resources, Harvest Data and Food Security in Nunavut's Qikiqtaaluk Region: A Diachronic Analysis+ Online Supplementary Appendix Table S1 (See Article Tools). *ARCTIC*, *69*(2), 147-159.

Wesche, Sonia D, and Hing Man Chan. (2010). Adapting to the Impacts of Climate Change on Food Security Among Inuit in the Western Canadian Arctic. *EcoHealth* 7 (3) (September): 361–73.

Yannic G, Pellissier L, Ortego J, Lecomte N, Couturier S, Cuyler C, Dussault C, Hundertmark KJ, Irvine RJ, Jenkins DA, Kolpashikov L, Mager K, Musiani M, Parker KL, Roed KH, Sipko T, Porisson SG, Weckworth BV, Guisan A, Bernatchez L, Cote SD (2014) Genetic diversity in caribou linked to past and future climate change. Nature Climate Change 4:132-137.