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The food security of Inuit women in Arviat, Nunavut: the role of socio-economic factors and climate change

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ABSTRACT. Climate change has been identified as compromising food security in many case studies with Inuit communities in Canada. Largely neglected in the scholarship however, is research focusing on the gendered dimensions of Inuit food security in a changing climate. This paper reports on a community based participatory research project involving semi-structured interviews with Inuit women (n = 42), 10 focus groups (n = 40), key informant interviews (n = 8), and participant observation, to identify and characterise the determinants of food security among Inuit females in the community of Arviat, and examine the role played by climate and climate change. Results indicate that significant changes in climate being observed are not currently affecting female food security, with socio-economic-cultural factors primary determinants of food security. The nature of the traditional food system in Arviat based on harvesting land mammals reduces sensitivity to changing sea ice conditions which have been problematic in other Inuit communities. However, dependence on a limited number of animals for diet (primarily caribou, arctic char) increases sensitivity to potential future disruptions caused by climate change to these species and reduces response diversity as a coping mechanism.

Background

Food systems globally are sensitive to climate change. While the vulnerability of agricultural-based food systems has been widely studied, there has been comparably less work focusing on indigenous populations that depend on subsistence based hunting, gathering, and fishing (Ford 2012). In the Arctic, several aspects of the Inuit food system, notably hunting and fishing, are already being affected by a rapidly changing climate, with implications for diet, health, and socio-cultural well-being (Berkes and Jolly 2001; Ford and others 2009; Pearce and others 2010; Ford and others 2013).

Research focusing on food systems has become an increasingly important component of human dimensions of climate change (HDCC) research in the Arctic over the last 5 years (Ford and Pearce 2012; Ford and others 2012), developing a baseline understanding of how current changes in climate are impacting food security (Furgal and Seguin 2006; Beaumier and Ford 2010; Nancarrow and Chan 2010; MacDonald and others 2013; Statham and others in press). Largely neglected in the scholarship, however, is research examining what climate change means for the food system of Inuit women. While women living in low income nations have been identified as vulnerable to climate change due to lower socio-economic status and increased exposure to environmental hazards (Costello and others 2009), in the Arctic, male hunters are generally associated with a higher vulnerability due to their higher exposure to climate risks through direct engagement with land-based livelihood activities (for example hunting, fishing) (Ford and others 2006a; Ford and others 2006b; Furgal and Seguin 2006; Dowsley and others 2010). Nevertheless, the general scholarship demonstrates higher levels of food insecurity among Inuit women compared to men, as does the general northern food security literature on Indigenous populations, and therefore potential heightened vulnerability to climate change (Duhaime 2002; Lambden and others 2006; Rosol and others 2011; Huet and others 2012).

This deficit in understanding provides the context for this paper which examines the role played by climate-related risks and change in affecting the food security of Inuit women. The study uses a case-study from the community of Arviat, Nunavut, and employs mixed methods to document the factors affecting food security for Inuit females and examine the role played by climate and climate change. We begin the paper by describing the nature of the Inuit food system, which provides context for identifying and understanding the determinants of food security. From analysis of how the current food system works, we examine if climate change is already having an impact and identify potential future vulnerabilities.

Methods

Inuit food systems and food security

Inuit food systems comprise traditional foods (commonly called 'country foods') and store-bought foods. The emergence of this 'dual food system' is the result of rapid changes that have occurred since the 1950s in Arctic Canada, including the transformation of Inuit livelihoods and socio-cultural structures as Inuit were re-settled from semi-nomadic hunting camps to fixed communities by the federal government. One consequence has been a decrease in the consumption of traditional foods and

an increase in the consumption of store foods, what has been termed the *nutrition transition*, and is particularly pronounced among younger generations and women (Kuhnlein and others 2004; Kuhnlein and others 2009). Despite these changes, traditional foods remain a central component of the contemporary Inuit food system and have significant social, cultural, and economic importance (Wakegijig and others 2013).

The production, processing, distribution, and consumption of traditional foods are generally structured around the extended family unit and differ significantly from store-bought food (Wenzel 1995; Usher and others 2003; Kishigami 2004). Country food consumption varies with season and by community, household, and individual, and is obtained locally through picking, hunting and fishing activities undertaken by community members and distributed through sharing networks. In some instances, such foods can also be bought from local stores, although there is a widespread reluctance to exchange traditional foods directly for money (Gombay 2007). Store-bought foods are also important in Inuit food systems and communities usually have a number of small stores which stock a limited variety of fresh and processed foods that can be found in southern Canada.

A well-functioning food system provides food of adequate quality (nutritionally and culturally) for all people at all times, underpinning food security. Food insecurity, in contrast, manifests itself when food systems are stressed such that adequate food is not accessible, available, and/or of sufficient quality (FAO 1999).

Case study approach

A community case study was conducted in Arviat, Nunavut (population 2,318), to identify and characterise the factors affecting female food security with specific reference to the role played by climate and climate change. Arviat (61° 06′ N, 94° 03′ W) is the southernmost community on the Nunavut mainland located on the western coast of the Hudson Bay. The community was established as the result of governmental relocation in the late 1950s and early 1960s. Over the past 50 years, the people of Arviat have undergone social and cultural dislocation as the societal strengths and cultural beliefs that sustained them for millennia have been displaced (Tester and Irniq 2008; Tester 2009). Nonetheless, Arviat remains a traditional community where hunting is an important activity for diet, cultural identity and local economy. People commonly hunt and consume caribou, seal, fish, geese, eggs, muktaaq (beluga blubber) and berries which are viewed as core components of local diet.

Participatory research

A community-based participatory research approach (CBPR) was used to draw upon the observations and knowledge of community members to identify and characterise factors determining food security among Inuit women. CBPR is widely recognised to be essential for successful community-based health research and is increasingly the norm in northern regions. This research involved extensive consultation with territorial level policy makers, local leaders, community members, and northern science bodies to identify research priorities, develop the methodology, conduct the research and interpret the findings.

A key activity in research development herein was the use of Photovoice to introduce the project to the community and identify key themes for the research. Photovoice involves giving participants cameras to photograph their experiences and perceptions of a particular issue, which are then later discussed in an individual or group setting (Healey and others 2011; Lardeau and others 2011; Hofmeijer and others 2012). The question posed to women was: 'What influences what you eat, when you eat, and how much you eat?' Ten participants volunteered based on community radio advertisements made by the research team. The photographs were then discussed in a group setting, and allowed the women to be fully engaged in the research process from the beginning. No photos or quotes from this activity are used in this paper however, as this activity was used to inform project development.

Data collection

Semi-structured interviews

Semi-structured interviews (n = 42) were conducted with Inuit women >18 years of age and permanent residents of Arviat. Women were selected through a purposive sampling strategy designed to include a cross-section of those who were 'food secure' and 'food insecure' based on food bank usage and employment status, as well as women who were of different ages, marital status and with or without full time hunter(s) in the household. Sample size was directed by theoretical saturation, with respondent characteristics profiled in supplementary data at: (http://www.jamesford.ca/wp-content/uploads/2014/06/supp-data.pdf)

Interviews were structured using an interview guide (see supplementary data) and aimed to: i) identify and characterise those conditions and risks related to food access, availability, and quality that Inuit women have had to deal with and are currently dealing with, particularly those affected by climate; ii) provide insights into the strategies employed to manage these conditions; and iii) identify the factors that influence the ability to manage food system risks. Interviews were conducted by the lead author in collaboration with local team members, and interviewees were compensated with $40 food vouchers for their time. Interviews were conducted in the preferred language of the participant (Inuktitut or English). Quotes from the interviews are used here to illustrate key points in the participants own words, and to preserve confidentiality are referred to as 'participant'.

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Key informant interviews

Key informant interviews (n = 8) were conducted with professionals in the health and education sector, community and territorial government representatives, store managers, and a wildlife biologist and officer to provide additional contextual information essential to understand the broader scale factors affecting Inuit women's food system.

Focus groups

Seven focus groups with 28 women were carried out to expand on interview data in a group setting, and were also used as a respondent validation strategy to gather feedback on preliminary findings and to verify the validity of the researchers' interpretation. Each woman was compensated for her time with a $40 food voucher, and was selected based on their participation in the interviews. Additionally, three focus groups were conducted with 12 female elders and two focus groups were conducted with 13 experienced hunters. These supplementary focus groups aimed to acquire additional information on food security among women and to expand on specific subjects, including: traditional practices and beliefs, country food accessibility, quality and availability, hunting and trends of climate change over time. Participants for both groups were purposively selected through community networks and through advertisements made over the radio. Focus groups with elders and hunters were conducted in Inuktitut by one or two research assistants assisted by the lead author. When transcribing the discussion, it was not possible to attribute specific quotes to a participant. Thus, quotes that appear in this article are referred to as 'hunters' or elders' focus groups'.

Data analysis

All data gathered from the interviews and focus group discussions were transcribed and analysed thematically (in QSR NVIVO) to create common categories related to factors affecting the Inuit women's food system, with specific attention directed towards climatic factors. From this analysis, percentages were sometimes calculated for answers related to commonly asked questions such as: 'Have you run out of food over the past year?' or 'Do you ever worry about running out of food?' In the results section, it is indicated when the question was not asked to all 42 women. Concept mapping was used to illustrate the interactions between multiple factors operating at different spatial temporal scales.

Results

This study demonstrates that the food system of Inuit women is susceptible to climate-related risks and change, but that climate change is not currently an important determinant of food security among them. Food security is complex and results from interactions between multiple human, historical and environmental factors that affect the food system on different levels and scales. Currently, socio-economic and historical factors are the primary determinants affecting the food system for Inuit women in Arviat. These factors interact together at different scales, to create conditions of food security/insecurity, and determine how climatic conditions are experienced and responded to. It is necessary to first profile these factors before examining the role of climate and climate change.

Stresses to the food system for women at a household and community level

Cost of living

The cost of living is high in Arviat and in the Canadian north generally, associated with transportation costs to Arctic regions. The price of a weekly basket of store food for a family of four in Arviat ($552.51) is more than twice that of the same basket in Montreal, Québec ($223.40). Food was reported to be one of the main expenses for women in Arviat. The high price of food combined with low income reduced considerably women's purchasing power. Harvesting costs for procuring traditional foods are high and are most often covered by hunters and their family, and reflect the initial investment in hunting equipment such as snowmobiles and boats, as well as ongoing costs related to equipment maintenance, fuel for hunting trips, and necessary ammunition. These costs have increased significantly in recent years, and have resulted in a recent trend in hunters selling country food to other community members. Generally, only fish is sold, with prices averaging between $15–20 per fish. Caribou is rarely sold due to traditional beliefs that it should be shared. Additionally, caribou cannot be sold through commercial stores, as opposed to fish and muktaaq, because it requires food inspection.

Given the high cost of living, financial resources are an important factor affecting women's capacity to access store and country foods. In 2005, the median post-tax income for married or common-law couples in Arviat was $36,960 and for female single-parent families was $16,352 (Statistics Canada 2007). This is considerably lower than the median incomes of female single-parents families for Nunavut ($22,069) and Canada ($32,609) (see supplementary data). In Arviat, male single-parent families also had considerably lower incomes ($18,240) in 2005 compared to couple families (Statistics Canada 2007); however, they are less frequent in Arviat than female lone parent families.

Unemployment/limited income earning opportunities

Unemployed women reported struggling to purchase enough food in stores. Amongst the 42 women interviewed, 25 were unemployed, 12 had part-time or occasional employment and five reported working full time. Formal education was identified as a barrier for employment by many of the women interviewed, which is required for most community employment. In 2006, 80% of people over 15 years old in Arviat did not

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have a postsecondary certificate, diploma or degree, and only 9% had a high school diploma (Statistics Canada 2007). With low employment rates, many women rely on income support to meet their family's needs. According to the Income Support Division (2011), in 2010, 46% of families in Arviat claimed income support. Income support allowance is normally divided into cash and a cheque restricted to purchasing food. On a monthly basis, one woman with a large family obtains $200 in cash and a single individual $100 in cash; the remaining amount differs according to family size and income, rent and heating fuel bills and is allocated as a cheque which must be spent at the local stores. Women stated that this restriction constrains their access to country food, because only the cash portion can be used to buy gas and other supplies to go hunting. Selling arts and clothing is another source of income and is also a method women use to quickly earn money in order to be able to afford food. Selling household items such as a couch, washer and dryer, or clothing was mentioned by seven women as a way of quickly generating money in times of food shortage.

Whether women have high or low incomes, financial planning is important. However, those interviewed noted money management is a challenge. According to a key informant, one of the main impediments to budgeting is the provision of income support on a monthly basis. With almost no means of saving, people cash their 'cheque on the 19th and by the 22nd, probably 70% [of beneficiaries] have spent it all.' In Arviat, there are no financial planning services available. Only ten women reported having a bank account in which they deposit their NUCB cheque automatically.

Money management skills and store food knowledge

Money management skills coupled with limited knowledge about store foods was widely reported to further stress women's access to nutritious store foods, as 'sometimes [more] money means poorer health status because of what people are spending their money on' (key informant). In fact, participants reported primarily buying the cheapest foods and the ones that last the longest, such as pasta and rice; yet observations at the local store as well as information from the store managers indicate the most popular food items are ready-to-eat foods and 'junk foods' which are expensive and short lasting. This potentially indicates limited knowledge about store foods among women in Arviat, and most women interviewed had never participated in any cooking classes.

Country food knowledge

Country food is widely regarded as the healthiest food for Inuit. Yet, young women and elders report that knowledge on country food preparation is not as readily transferred to the young generation as it used to be. This may contribute to a decline in women's consumption of traditional foods. Data from interviews and focus groups show that, in general, elders eat more country food than youth, and have integrated fewer southern foods into their diet. Additionally, elders stated that they would eat more country food if it was available and that they miss eating some parts of the caribou that are not commonly consumed anymore (for example rectum, kidney, heart, liver, tongue and guts) as well as other country foods that are less prevalent (for example goose, ptarmigan, muktaaq, mussels, and oysters). Nevertheless, even if country food knowledge is decreasingly transferred to the younger generation, women and elders confirmed that country food is still regularly consumed and prepared by all generations when available.

Presence of a hunter in the household

The availability of country food in a household is highly dependent of the presence of a full-time hunter in the household and/or in the extended household. Full-time hunters ensure a regular supply of country food to their family and community, especially caribou, the preferred type of country food in Arviat. Huet and others (2012), reporting on results from the Inuit Health Survey, observe among food insecure households, first, a significantly lower prevalence of having an active hunter in the home and secondly, a lower frequency of past-year traditional food consumption. Nowadays, many women do not have a hunter in their household or family and depend on others sharing meat. Commonly, hunters providing country foods in Arviat are between 45 and 60 years of age, which further increases their susceptibility to experiencing a sudden inability to hunt. This is indicative of the precarious situation in which many households find themselves; households that are food secure today can rapidly become food insecure with the death, injury, or illness of a hunter. Women are worried that the lack of training for young people will even further reduce the availability of country food in Arviat in the future.

Indeed, nowadays, young men are not being trained in hunting skills as they have been previously, an observation that has been documented across the Canadian north (Ford and others 2010; Pearce and others 2011b). As an elder noted: 'There should be more [training] when [young people] are not in school. They don't know how to hunt or what to do, [. . .], not being taught makes them lazy and they start making trouble so it's better if we just go ahead and tell them to follow when their father or whoever's going out on the land when they're taught they learn' (elders' focus groups). Traditionally, young men would follow older hunters, notably elders, and learned by watching and doing.

Many factors play a role in reducing the opportunities for young men to go hunting with experienced hunters. First, the establishment of schools has reduced the time available for children to go out hunting with their families to nights and weekends. In addition, the southern education system promotes a more passive way of learning that is less applicable to hunting skills. Even if the schools, along with community elders, organise trips to bring students out on the land and teach them traditional skills,

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hunters consulted believe that traditional training should be done by parents, and if the schools are to be involved, they should work with the parents: 'The school is taking over [the] parent's role to teach hunting and survival to their children. Parents and school should work together' (hunters' focus groups). Hunters also believe that those trips are not long enough to properly learn land skills: 'We have to be out on the land for two full weeks to learn how to hunt and butcher meat, staying out there and not come back to the town in between. It seems like we haven't done that for a couple of years now' (hunters' focus groups).

Second, Arviat is a very young community with 1,140 people out of 2,318 (49%) under the age of 20. There is an inequality between the high number of young men that could be trained and a far fewer number of experienced hunters available to train them. As a hunter (focus groups) says: 'There are too many kids, too many to teach! They are mostly waiting for trips with the school.'

Third, hunters mentioned a lack of hunting equipment and transportation as important factors impeding young men to learn how to hunt. Hunting today requires expensive equipment which many young men and even more experienced hunters cannot afford. In addition, hunters who can afford hunting often have a full time employment and thus have limited time to go. Only few families in which women have a well-paid employment can afford having men hunting full time.

Substance abuse and gambling

The aforementioned factors were also reported to be affected by substance use and gambling, which are taking money away from purchasing food, engaging in hunting activities and sharing. Drug and tobacco use, as well as gambling, are a phenomenon often associated with acculturative stresses related to assimilation and colonial policies implemented by the federal government between the 1940s and the 1970's (for example residential schools, relocation), and their associated intergenerational trauma (Tester and Irniq 2008; Richmond and Ross 2009; Tester 2009).In Arviat, health and education professionals confirmed that there are high rates of smoking and tobacco use. One pack of cigarettes in Arviat cost approximately $16 in 2010. The general food security literature highlights higher prevalence of food insecurity among children and adults living in households with smokers (Cutler-Triggs and others 2008). Women also confirmed that gambling is widespread in Arviat. Patik is a local card game that is popular and involves money. Online gambling such as poker has gained in popularity amongst Arviarmiut over the past 10 years. Local Bingo and Nevada (instant lottery ticket) are the most popular, and Arviarmiut may spend a considerable share of their revenue to play. Some interviewees described the situation of women going into debt, not able to buy food and essential infant care supplies due to losses of money playing Bingo, to the extent that they would try selling personal items to make a little bit of money.

Sources of resilience in the food system for women

Sharing networks and strong social bonds were documented to strengthen the food system of Inuit women in Arviat and elsewhere in the north, albeit coming under increasing stress in a contemporary context. Family is central to the sharing network. As illustrated by a hunter: 'We give to our family first, then we let anybody who want some get the left over's for free' (hunters' focus groups). Women mostly ask their close family members for food or go to their houses to eat a meal: 'Sometimes [for] 2 weeks we don't have food so we'll go eat at my mom's when we don't have food. I don't go anywhere else or ask anyone else for food, only to my mom's or go eat at my sisters, when we run out of food we try to go eat there' (Participant 14). Even when family members live in another community, women in Arviat may still obtain country food shipped by air. There is a subsidy programme (discussed subsequently) that reduces the shipping cost for country food, yet the cost remains high and prohibitive for many. This illustrates the importance of family units in sharing and in managing food security. When family cannot provide country food, women may try to obtain it from other hunters in the community who sometimes offer it through the local radio. Few participants reported asking for country food through the local radio, with some feeling embarrassed to do so. Store food is not shared as country food is because it has a high direct cost and it was not shared traditionally, but rather traded for fur and provided during times of country food scarcity.

Inuit notions of sharing and self-reliance have concurrently evolved with societal changes in Arviat. Richmond and Ross (2009) note that with the introduction of modern Canadian law, education and welfare systems, Inuit have seen their traditional values, knowledge and way of living diminished which led to reduction of self-esteem and ability to care for one-self. Particularly, Arviarmiut became accustomed to obtaining money and goods through different governmental support programmes, such as Family Allowance and income support, without having to give back. This has led to changing perceptions of self-reliance over time and contributed to current assumption that country food should be shared without having to give back; in other words, that country food is 'free'. 'Free' country food was a recurring theme described by women during the research. This notion was identified by women participants to the Photovoice activity who selected a picture of country food and, to describe it, added the title 'Free' and the quote 'country food is free and is healthy'. This notion was also noted by many interview participants, often those with limited financial resources: 'it's better if they [hunters] give country food to the people for free' (Participant 18), and '[we have] no worries about country food cause they're always free' (Participant 8).

However, the assumption that country food is 'free' is challenged by other community members who believe that sharing should be reciprocal, even within families,

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whether it is by offering material goods or services in return. Harvesting country food is expensive, and hunters and their families are not as willing as they used to be to give out country food free of charge outside of their family: 'When we want some [country food] for free, no one answers but when we want to pay them someone offers' (Participant 15). Some women agree with local people selling country food: 'Local people. I am ok with it because they're trying to make a living out of it. They probably don't have a job' (Participant 7), or accept to contribute to their fuel expenses in exchange for country food, a practice already in place in Arviat. Nevertheless, those who cannot obtain country food from their family, and have limited financial resources remain vulnerable and have the least access to country foods.

It is also noteworthy that sharing systems in Arviat are increasingly stressed by the decreasing availability of country food per capita. Data from the Survey of Resource Harvesting (McEarchern 1978) and the Nunavut Wildlife Harvest Study (Priest and Usher 2004), shows that the harvest of the three main staples, caribou, beluga and ringed seal, has not increased from 1975 to 2001. Yet, during this period, the population of Arviat has increased by approximately 245% (Statistics Canada 1997, 2002, 2007; Nunavut Planning Commission 2008), leaving less country food to be shared to people outside of hunter's family circle.

Territorial and federal level factors affecting Inuit women's food system in Arviat

Most airlines provide a subsidy to ship country foods between communities (supported by the land claim organisation, Nunavut Tunngavik Inc (NTI)). Inter-community sharing networks can be a way of coping with country food scarcity. Even with the subsidy however, this remains an expensive strategy given the reality that country food must be transported over long distances via plane. In addition, the NTI Nunavut Harvesters Support Programme (NHSP) manages four different programmes through which financial assistance is provided to Nunavut residents who need equipment for hunting or to promote traditional learning skills (Ford and others 2007). In Arviat, the Hunters and Trappers Organisation (HTO) hires hunters in December and January to hunt caribou, which is then distributed to people in need, such as elders, single parent families, and families that have no means or transportation to hunt. Approximately 70 caribou are provided to the community through this programme. In addition, the Arviat HTO runs the Capital Equipment Programme, which administers an annual draw among community members who fill out an application form and whose applications meet the criteria, which are sent to the NTI for final approval. The successful applicant receives a snowmobile, a boat and motors or an all-terrain vehicle (ATV). This programme has been criticised however, by people who believe that the equipment distributed is not being used for harvesting purposes. Participants have suggested that the HTO more closely monitor how recipients use their equipment.

Finally, the Federal government subsidizes the sending of nutritious perishable and non-perishable food items as well as other essential items (such as toilet paper and diapers) to northerners living in isolated communities through the Nutrition North Canada programme, which replaced the former Food Mail Programme on April 1st 2011.

Women also have the possibility of ordering individually from participating grocery stores in the south to benefit from the Nutrition North Canada freight reduction. It is not clear whether it is less expensive to order individually or buy at the local store. Even if it is, there are several barriers preventing women from using the Nutrition North programme: the majority do not have a credit card, are not aware how to access the programme, do not have a computer with internet access, or cannot save enough money to buy in bulk a year in advance. In addition, with limited knowledge about healthy store foods, it is uncertain to what extent Inuit women benefit from this program with regards to food security.

Where does climate and climate change come in?

In the western Hudson Bay region where Arviat is located, several manifestations of a changing climate have been documented. Most notably, and consistent with circumpolar trends, declining sea ice extent has been documented in recent decades, with winter 2011 recording the lowest ice coverage since satellite records began, occurring in conjunction with temperatures over the Hudson Bay about 6°C above normal (Gough 2004; NSIDC 2010, 2011; Overland and others 2011). Local observations of changing conditions by Arviat residents are largely consistent with regional-level instrumental data, most notably documenting changes in duration and timing of season, instability in and changes of weather patterns and wind direction, changes in snow cover, later ice freeze up and earlier melt down and thinning of sea and freshwater ice (Government of Nunavut 2005; Sullivan and Nasmith 2010). These observations are consistent with those documented in research on Inuit observations of climate change across Nunavut (Gearheard and others 2006; Laidler and Ikummaq 2008; Laidler and Elee 2008; Gearheard and others 2010; Weatherhead and others 2010).

Only a limited number of impacts of changing climatic and biophysical conditions on the food system were reported in Arviat, however. The caching of caribou meat for preservation in autumn, known as pirujuaq, was reported as being shortened by observed increases in temperature and permafrost loss. Pirujuaq preservation was also reported to be more difficult: 'Today, I think it's useless [to do pirujaq] because of polar bears or grizzly bears will eat it. [...] Back then, there were hardly any polar bears, and today, they are all over. [...] Polar bears used to eat only sea animals, but today they eat

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anything they can find. [. . .] Grizzly bears never used to be around, but they are now' (hunters' focus groups). The expansion of the grizzly bears from the west has also been documented across the Kivalliq and Kitikmeot regions. Increasing inability to make pirujauq particularly affects those who do not have a freezer large enough to save meat during the winter (that is the poorest families). Some hunters have responded by making pirujuaq later in the autumn if necessary, and removing the meat before the temperature rises too high in the spring. Storing meat in the community freezer during the winter was also described as a potential response, although the freezer currently only opens in the summer and is small in size.

Caribou (*Rangifer tarandus*) health and availability were a key concern articulated by elders, hunters and women participants, with Arviat experiencing a severe caribou shortage from October 2010 to May 2011. The shortage occurred as a result of a change in migration pathway of the Qamanirjuaq caribou herd, and may or may not be linked to changing climatic conditions. Hunters and key informants revealed that during the autumn 2010 migration to wintering grounds, the majority of caribou passed abnormally far away away from the community (approximately 800 km), at a distance that would have taken an experienced hunter some 4–5 days under good weather conditions to travel via snowmobile. Almost no hunters had the time or the money to travel such distance, especially with the high price of equipment and fuel and the limited financial resources available in poorer families. Additionally, only a few hundred caribou were found scattered within a range of 160 km from Arviat during the winter, and these were mostly cows and calves. Very few bull caribous were harvested during this period. Bulls are preferred for the larger amount of meat per animal they provide. Furthermore, the spring northern migration to calving grounds in 2011 occurred four weeks later than usual, coming at the end of May rather than the end of April.

Participants commonly referred to this alteration in migration pathway of caribou as an important stress on their food system, which led to caribou shortage for men and women in Arviat from October 2010 to May 2011. This event is indicative of potential future sensitivities to climate change induced impacts on caribou (Sharma and others 2009). It shows the precarious nature of Inuit food security, which depends largely upon access to caribou, the main staple of country food in Arviat along with fish and muktaaq. The country food diet was historically more flexible as people used to consume a variety of food such as ptarmigan, fish, muskox, and hares in times of caribou scarcity (Arima 1984). Today, while elders still consume other country foods when caribou is not available, younger women turn to store foods, and most often cheap foods, ready-made meals and non-perishable goods as revealed by interviews. Available store food (including store meat) do not compare well with country food nutritionally or culturally: it has a different taste, does not provide the same feeling of satiety, is expensive and nutritionally inferior (Lawn and Harvey 2003; Berti and others 2008; Sharma and others 2010; Egeland and others 2011a).

Change in caribou migration pathways combined with multiple human and historical factors created conditions of food insecurity among Inuit women. Yet, it is important to note that historically, this exceptional event might have triggered severe food shortages, even starvation. In that sense, changes in living conditions have considerably improved food security among the Inuit by ensuring constant a supply of food. However, the quality of food available and its accessibility creates a different level of food insecurity related to inadequacy of food quality consumed, which has several negative health implications for present day health.

Discussion

We initiated this project with the community of Arviat to examine the current implications of climate change on the female food system. What emerged however, was the predominance of socio-economic and historical factors in affecting food security, with women single parents being particularly at risk of being food insecure. Other studies looking at the vulnerability of Arctic food system's to climate change have also noted the high importance of non-climatic factors in determining food insecurity (Fazzino and Gerlach 2009; Ford 2009b; Loring and Gerlach 2009; Beaumier and Ford 2010; Goldhar and Ford 2010). Yet, given the rapid changes in climate observed in Arviat and indeed the Canadian Arctic more generally, this was surprising and contrasts with findings from other small Inuit communities in the north (Chan and others 2006; Beaumier and Ford 2010; Nancarrow and Chan 2010; Wesche and Chan 2010; Ford and Beaumier 2011; Pufall and others 2011).

The research suggests that the Arviat food system is not currently as sensitive as other Inuit communities to climatic risks due to the nature of harvesting activities (that is primarily land-based). Inuit living in Arviat originate from different groups of Inuit (Gabus 1944; Birket-Smith 1976), the majority of who were inland people named *Caribou Eskimo* by the Fifth Thule Expedition (1921–1924), who were highly reliant on caribou (Rasmussen 1926; Birket-Smith 1976; Arima 1984). Seals were only harvested during spring and summer by about one quarter of Caribou Inuit (Birket-Smith 1976). Still today, the majority of harvesting is secured by land and freshwater species, caribou and char being the main animals hunted (Priest and Usher 2004). Arviat residents do not regularly use the ice as a hunting platform and are therefore not as sensitive to changes in sea ice as the majority of Inuit communities of Nunavut. In fact, in many communities hunting activities have been disrupted and climate change signal has been most pronounced (Laidler 2006; Ford 2009a; Laidler and others 2009; Ford and others 2012). Notwithstanding,

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the limited diversity of animals consumed by women in Arviat increases sensitivity to disruptions in these species. Young women in particular, who have not developed the taste for a variety of country foods, rely heavily on caribou and arctic char as a country food source, and if these species were to be disrupted by climate change, their capacity to adapt through species switching would be limited; an important coping mechanism during times of stress observed in other communities (Ford and others 2013).

The current global vulnerability of *Rangifer tarandus* to climate warming and landscape change (Sharma and others 2009; Vors and Boyce 2009) and population decline of caribou herds surrounding the Qamanirjuaq herd (Gill 2010; Russell 2010) suggest that the herd harvested by Arviarmiut may not be exempt from the effects of climate change in the future. This study shows that when caribou is not available, most women increase their consumption of store food items of lower nutritional value. Choice of food alternatives is influenced by several socio-economic and historical factors previously described and the access to adaption strategy is not equal among all women, with single women parents being economically disadvantaged. The cost of switching to store foods may be high for some families as the replacement of country food with store food have been shown to negatively impact household economic sustainability (Myers and others 2005) and overall health (Kuhnlein and others 2004; Johnson and others 2009; Egeland and others 2011a). The community has initiated a community kitchen programme which focuses on cooking with country foods to improve women's capacity to use different kinds of country foods readily available around the community, such as fox and hare, to cook modern and traditional meals. The programme was successful with considerable improvement in the diet of women participants and their families but was terminated due to lack of funding.

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