Arctic Health Research Network-Yukon

Climate Change and Food Security in the North

A Literature Review 2010

Written for: Arctic Health Research Network-YT

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Introduction

This document is a short review of some of the most recent literature that currently exists with respect to climate change, food security, and Arctic Indigenous communities. It provides a basic overview of the current status of climate change and food security research over the last four years.

What is food security?

Food security "exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO 2009). The four pillars of food security as defined by the Food and Agriculture Organization (FAO) are access, availability, utilization, and stability of supply. This definition that was developed at World Food Summit in 1996 was adopted by Canadian Government, Agriculture and Agri-food Canada in Canada's Action Plan for Food Security in 1998, and is the definition that continues to be used today. In addition, according to the Dieticians' of Canada, community food security exists when "all community residents obtain a safe, personally acceptable, nutritious diet through a sustainable food system that maximizes healthy choices, community self-reliance, and equal access for everyone" (2007).

Within Indigenous communities, measures of food insecurity typically include factors such as affordability and dietary intakes. Other measures such as foods which are considered safe, and those that are personally acceptable and healthy are generally not accounted for (Lambden et al. 2007). From an Indigenous perspective, there are specific criteria that need to be taken into account when assessing food security because of the importance of traditional/country foods in many Indigenous peoples diets. Traditional/ country food and market food systems must both be accounted for when assessing food security. The Canadian government currently does not account for traditional/country foods when measuring levels of food insecurity and focuses on the ability of individuals and families to purchase market foods (Power 2008). The harvesting, sharing, and consumption of traditional foods also impact the four pillars of food security: access, availability, supply and utilization (Power 2008). With respect to *access*, food security may be affected by access to traditional/ country foods as well as market foods. Environmental contamination, global warming, and climate change may influence *availability* and *supply*. And for the fourth pillar, *utilization*, the nutritional quality of traditional/ country foods are very important for the quality of diets of many Indigenous people, as market foods generally do not have as high a level of nutrition (Power 2008). Power (2008) also argues that an additional element to food security must also be taken into account, and that is cultural food security. Indeed, harvesting and preparing food from the land enforces the relationship that many Indigenous people have with the land and is a primary venue for the passing on and sharing of cultural values, skills, and

spirituality (Power 2008). "The procurement, sharing and consumption of traditional food contributes significantly to cultural identity, tradition, and social cohesion, and estimates of the value of Nunavut's land-based economy are between 40 and 60 million Canadian dollars per year" (Ford et al. 2008: 45). Food security is therefore, integral to cultural health and survival.

Food insecurity not only has impacts on individual health, but also can affect families and communities on multiple levels; this includes stress, feelings of hopelessness, anger, or revolt (Lambden et al. 2006). Access to nutritious market foods is dictated by an individual's ability to financially afford to purchase them (Loring & Gerlach 2009). In Nunavut, a family of four has to spend more than twice the cost for a basic nutritious diet as compared to the southern Canadian average (Ford et al. 2010). Canadian statistics indicate that 33.3% of Aboriginal households (off-reserve) in Canada (excluding populations living in the territories) are food insecure, versus 9.2% of non-Aboriginal households (Health Canada 2004). What is more, 14.4% of Aboriginal households are severely insecure in comparison with 2.7% of non-Aboriginal households (Health Canada 2004). The Aboriginal Peoples Survey that was conducted in 2006, found that 30% of Inuit children, experience hunger; in Nunavut 39% (aged 6-14), Nunavik 33%, Inuvialuit 12%, and Nunatsiavut 30% (Tait 2006). In the Yukon approximately 39% of surveyed participants could not afford the food they needed (Lambden et al. 2006). Hunting was considered to be too expensive by more than 14% of Yukon First Nations surveyed (Lambden et al. 2006).

It was concern for contaminants in traditional food systems and the implications of a changing diet in the 1990's that spurred food security research in the Arctic (Ford 2009). Figure 1 represents some of the different determinants that influence food security in northern Indigenous populations. From the increased attention on food security research, multiple determinants are now recognized as factors contributing to Arctic food insecurity. These include lack of income, cost of hunting, increased purchasing store food, lack of active hunters in the household, and changes at the societal level; including decreased transfer of hunting skills and traditional knowledge to younger generations, reduced sharing of food, shifting food preferences, and limited government involvement/support (Ford 2009). Access to traditional foods directly influences food security in the Arctic, and is especially important for Indigenous women (Lambden et al. 2007). Climate change is also having implications on food security in the North (Ford 2009). The relationship between food security and climate-related conditions in the North remain poorly understood/unexamined, and there is little information available on the inter-relationships between climate change, food security and human health. With the projected accelerated changes, there is a need to gain a deeper understanding of these relationships (Ford 2009; Tong et al. 2010). Globally, climate change will have impacts on agricultural systems and food production. Tong et al. (2010) predict that

the socio-economic status of each affected country will primarily influence the level of impact that climate change will have on food security, in addition to the extent of climate change in different regions.

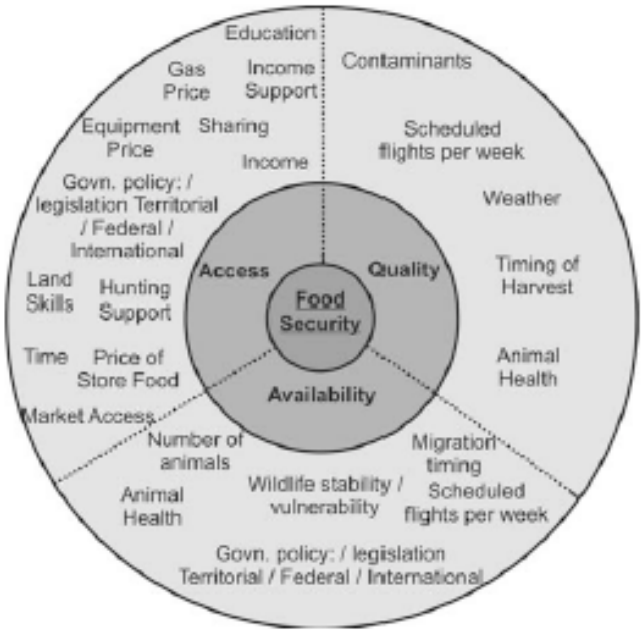

Figure 1: Food security determinants (traditional and store food) for Canadian Inuit (northern Indigenous) communities (Ford 2009: 87).

Climate Change Projections

In the Arctic, temperatures have been rising at twice the global average (Ford et al. 2010). Climate change models are predicting an average warming of the Arctic from 2°C-9°C by 2100, with projected warming to be greatest in the fall and winter and over the polar oceans where there are areas of sea ice loss (Pearce et al. 2010). In the Dawson region of the Yukon, models are predicting an annual temperature increase of 2.5°C to 3.5°C by 2050 (Werner et al. 2009). The greatest warming is projected for the winter and is between 4°C to 6°C. Indeed, these temperature projections are some of the largest projected increases in temperature for Western North America and are above the average 2.6°C increase projected for British Columbia (Werner et al. 2009). Annual precipitation is expected to increase by 10-40%, with a 30% to 50% increase in winter precipitation being projected in the Dawson area (Werner et al. 2009).

Overall, it is expected that future climate changes in the Polar Regions will be among the greatest anywhere on earth because of amplification by positive feedbacks in the

climate system (Ford & Smit 2004). Rapidly increasing temperatures are reducing summer sea ice extent and ice thickness, in addition to extreme weather conditions occurring at greater intensity and frequency (Ford et al. 2010).

Existing climate risks are expected to increase in magnitude and frequency. It is unknown how these changes will influence socio-economic-demographic trends in the North (Ford & Pearce 2010). Changes in the North will be experienced differently in each community across the Arctic. It is thought that within common eco-zones, communities may experience different effects from identical climate-related events because of differences in site, situation, culture, and economy (Duerden 2004).

Observed Changes in the North and the Implications for Food Security

Water & Ice

Hydrological effects due to climate change including river ice dynamics and increased variability in break-up and freeze-up times have many interconnected consequences, including impacts on food and water security for northern communities. Many Indigenous communities rely on ice and waterways for transportation and access to traditional/country foods. Communities tend to live near the coast and bodies of water, whereby waterways are critical for accessing and acquiring traditional/ country foods (White et al. 2007). The changing patterns can have influence on the movement of fish and wildlife species. The warming of permafrost, degradation, and receding glaciers can have serious implications for surface water in the Arctic (White et al. 2007). Surface water is important for drinking, domestic, subsistence, and industrial needs in the North (White et al. 2007).

Throughout the North, warmer, shorter winters are having affect on ice conditions and consequently access to traditional territories and resources (Tremblay et al. 2008). Ice conditions are no longer stable and there are greater risks for travel. Indeed, with respect to ice and river dynamics, the *Vuntut Gwitchin Climate Change Risk Assessment* discussed that the most significant change in the Old Crow region, in Yukon Territory is the thinning of river ice. Thin ice is affecting many elements of Vuntut Gwitchin culture and safety because travel is difficult; it impairs ice fishing, and prevents trappers from getting out to their trap lines. The ice thickness is changing annually and the freeze-up and breakup times are happening later and earlier respectively (Dickson et al. 2009).

Similarly, in Igloolik Nunavut, access to hunting grounds are becoming difficult with unreliable ice conditions that are susceptible to changing ice and snow conditions (Ford 2009). When ice is unsuitable or land lacks adequate snow cover, hunting may not be possible. Traditional food species are also vulnerable to these changes, and many depend on the presence or absence of ice, snow and precipitation to

determine migration timing, abundance, and health (Ford 2009). In Nunavik, an integrated community-based monitoring program (ICBM) was developed to improve local adaptive capacity and to create adaptation options in order for the communities to have safer access to the land and resources (Tremblay et al. 2008).

A Changing Landscape

Melting permafrost and extreme weather events, which can cause erosion, and flooding are greatly altering the land in many northern regions. It is expected that there will be greater instances of erosion and flooding of river valleys as a consequence of climate change. In the Yukon, for example, the flooding and erosion of the Porcupine River could cause great risks to the community of Old Crow (Disckson et al. 2009). In Alaska, there have been documented cases of lakes and marshes drying up and landslides (Loring & Gerlach 2009). With the degradation of permafrost, ponds and lakes have drained in areas of discontinuous permafrost; while in areas of continuous permafrost, lakes have increased in area and number (White et al. 2007). In the Crow Flats area of Northern Yukon, melting permafrost is having impact on muskrats and other small mammal and fish populations, which are traditional food sources. Entire lakes and creeks are drying up with the melting of permafrost (Dickson et al. 2009). The altered landscapes can have serious implications for fish populations and other water–dependant species, where for example, spawning grounds are disrupted from low water levels or blocked waterways (Loring & Gerlach 2009). Furthermore, access to the traditional hunting and fishing areas becomes more difficult for hunters with the changing landscape.

Traditional/Country Foods

In Ulukhaktok NWT, changing temperatures, seasonal patterns, sea ice and wind dynamics, and weather variability are impacting traditional food species. Not only are these factors influencing the health and availability of some species, but also increasing risks related to hunting and travelling on the land; this has direct implications on food security (Pearce et al. 2010). Changes in migration patterns and timing, species population health, quality of meat and furs, and the availability of species are being reported across the North (Ford et al. 2010). In Alaska for example, over the last two decades, but also most intensely over the last 2-3 years, there have been noticed changes in the distribution, abundance, and migration patterns of traditional/country food species (Loring & Gerlach 2009).

In the North, Lambden et al. (2007) found that 10%-38% of study participants had noticed recent changes in the quality or health of traditional/ country foods. Changes in physical condition and declining numbers were the primary changes (Lambden et al. 2007). The most common responses were physical deformities, decreased

accessibility, contamination, smaller animal size, and taste and other sensory changes to the traditional food species (Lambden et al. 2007). It was noted by Lambden et al. (2007), that while the percentage of people who noticed changes was fairly low, it was still a significant issue to consider because changes to the quality/ health of traditional foods may prevent people from eating their desired food choices.

Caribou, an important subsistence species throughout the North are known to be sensitive to environmental change. During the winter, caribou survival is critically dependent on the ability to access forage underneath the snowpack (Ford et al. 2008). Climate change has been documented to negatively affect forage, which caribou depend on as food sources and this can impact caribou health and their survival. For example, a deep snowpack can limit foraging and cold snaps, following wet snow or icing on the ground surface can cause forage to become inaccessible (Ford et al. 2008). This consequently will result in a decline in harvesting by populations that depend on caribou as a food source (Lambden et al. 2007). In the Yukon, the Porcupine caribou herd has already had to face these challenges. In addition to access to forage, the vulnerability of lichens and mosses to warming and freeze-thaw events is also an issue (Dickson et al. 2009). Furthermore, ice has been freezing later or insufficiently on the rivers and lakes; if the ice cannot hold the weight of the caribou, they are forced to stay in areas, which are less productive for longer periods of time, and they also become more vulnerable to predators (Dickson et al. 2009). With unpredictable and variable weather patterns, hunters are having difficulty predicting caribou behaviour, making it more difficult to hunt. Migration routes are changing and more unpredictable. An earlier thaw in the spring is also impacting the Porcupine caribou in the Yukon. Some cows are calving earlier, before they go to their calving ground. They have to cross rushing river waters with their calves, resulting in thousands of calves being washed away (Dickson et al. 2009).

In Old Crow, from the climate change risk assessment study, participants indicated different changes to diet as a result of climate change. They found they were eating more store-bought food, traditional foods were not tasting as good as they used to, they were changing their diet and eating less caribou to conserve it (Dickson et al. 2009). It was also noted that plants in the area of Old Crow were changing. The most significant changes in plant growth were more willows, hot summer temperatures that were destroying plants, and fewer berries available (Dickson et al. 2009). The berry season has become more unpredictable and less people are going out and are spending more time to collect and pick them. Melting permafrost is having impact on muskrats and other small mammal and fish populations that are traditional food sources. Entire lakes and creeks are drying up with the melting of permafrost.

The traditional territory of the Vuntut Gwitchin, Crow Flats are showing great changes that can be attributed to climate change. There are fewer waterfowl and small mammals, willows are growing in making it difficult to travel and access lakes,

there is less snow, more insects, and some lakes are drying up or getting wider (Dickson et al. 2009).

Impacts of Change on Food Security

Duerden (2004) discusses how there is great uncertainty regarding the impacts of climate change on human activity. This uncertainty is in part due to the large scale in which physical data is gathered, versus the distinct local conditions and geographies in which communities are experiencing the change. Models of climate change see communities as passive actors to change, where local conditions, population attitudes, cultural history, or economic relationships will influence their responses to change (Duerden 2004). It is at the community-level that the magnitude of possible changes and effects need to be assessed.

The first changes to be noticed will be variability, unpredictability and greater incidences of extreme events (Duerden 2004). Unpredictability and extreme events will cause individuals and households to be unable to make decisions as they once did in the past. Duerden (2004) argues that even if the local climatic and environmental changes can be predicted, one cannot assume what the community's reactions and adaptations will be. Community response to change will be reflected by existing conditions and factors, which will vary from location to location and are based on social, economic, cultural, and land-use practices (Duerden 2004).

"The demography and economy of the community and the population's view of the reality or expectation of change are the filters that condition the way physical changes in environment will be experienced at the local level" (Duerden 2004: 206). It is therefore essential that there must be effort put into understanding multiple elements of local-level conditions.

A major challenge to food security is when people are unable to supplement their diet with traditional foods due to the inability to hunt or fish. Environmental cues and the unpredictability of many changing conditions (for example, the timing of ice break-up and freeze-up) are causing it to be more and more difficult for people to read the land and predict weather and behaviour of animals as they are traditionally used to (Loring & Gerlach 2009). A changing landscape can prevent people from accessing traditional lands, places of historical significance, seasonal camps and traditional harvest areas (Ford et al. 2010). Ford et al. (2010) note that as the structures of households change (due to a variety of factors), and hunting and fishing activities become marginalized (which can in part be contributed to climate change in some cases), this can have implications on gender role structures and other longstanding relationships of power and reciprocity because of new cultural and

economic arrangements that develop. In many cases, it is not only climate change that is influencing food security, but other confounding factors such as development (oil, gas and mining) projects and resource constraints that are inhibiting peoples access to traditional/ country foods (Loring & Gerlach 2009). This has resulted in more households turning to market-based foods to help supplement their diet, which as already discussed, has multiple financial, nutritional, and cultural implications.

In Nunavut, there were several key factors that influenced food security. In addition to the high costs of hunting and difficulty accessing hunting licenses, the existing Hunter's Support program was considered insufficient, with hunting equipment, community freezer, and hunting education programs thought to be inadequate (Chan et al. 2006). Further more, in Nunavut, community hunts usually only took place once a year, which was also viewed, as insufficient (Chan et al. 2006).

Health

Understanding the impacts of climate change on health is a complex process, and today, while there is some knowledge on this topic, there is not yet sufficient data for the impacts to be completely appreciated. It will not be until we have moved through several decades that we may have a better idea of all the implications climate change is having on human health (Frumkin et al. 2008).

With a greater shift in diet to a more market food based diet, there has been an impact on the nutritional quality of diet for people in the North. Diets are lower in iron, folacin, calcium, vitamin D, vitamin A, fibre, fruit and vegetables; and diets are predominately high in fats and sugars (Willows 2005). Younger people are consuming less traditional/ country foods and are consuming more high-fat, nutrient poor market foods (Berti et al. 2008; Ford et al. 2010). In both males and females, chronic diseases including obesity, diabetes, and cardiovascular disease are increasing (Berti et al. 2008; Lambden et al. 2006).

Adaptation Strategies

Human response to physical changes to their environment is not easily predictable (Duerden 2004). Duerden (2004) discusses how many predictions of change (e.g. climatic changes) are made on a large scale, however, it must be recognized that human activity is very localized and impacts and responses to changes will be influenced by local geography and many other factors such as demography, economic complexity, and experience with "change" in a broad sense. Therefore, when looking at human adaptive capacity, in response to climate change, a community-level approach is most suitable. Communities in the North have been adapting to climatic changes, unpredictability, and uncertainty for generations.

Adaptive capacity has been dependent on many factors including, extensive experience and knowledge about the local environment, mobility and flexibility of group size, the dynamic and flexible use of the environment, and strong social networks (Ford & Smit 2004).

The scale at which communities are currently experiencing climatic and environmental change is putting great pressure on their adaptive capacity (Ford & Smit 2004). While populations have been adapting to changing environmental conditions for millennia, with for example, changing resource use patterns and technology, the major challenge today, is that many affected individuals cannot financially afford adaptation options (Ford et al 2010). For example, the high costs of fuel required to travel longer distances to access resources, is a major constraint, or the high costs of market foods to supplement a traditional diet that may be more difficult to uphold.

In the Yukon, the Vuntut Gwitchin climate change risk assessment has several recommendations for adapting to accelerated climate changes. This includes land-use planning, fish and wildlife resource management, the use of an Elders panel that has youth membership, and Traditional Knowledge to inform adaptation strategies (Dickson et al. 2009).

Community strategies for adapting to climate change have generally been reactive, where behaviour and technology have been adjusted on an as needed basis (Ford et al. 2010; Pearce et al. 2010). There is increasing evidence that there is now also more proactive planning for dealing with climate change, especially as adaptation pertains to hunting (Ford et al. 2010). As has been found in various projects the importance of partnerships, which involve local experts and actively include communities, bring many benefits to the community while ensuring scientific integrity of the project (Tremblay et al. 2008).

Traditional Knowledge is important for local–scale research and the development of adaptation strategies. It incorporates long-term, experience-based history and details current and past geographies and landscapes. It is especially important for activities such as navigation, forecasting weather, reading snow and ice conditions, and wildlife and ecosystem behaviour (Duerden 2004). Traditional Knowledge is critical in supporting local adaptation to climate change, but it is noted that with the accelerated changes, it is becoming difficult for local experts to be able to manage and adapt to the changes (Tremblay et al. 2008). For example, with changing ice dynamics in Nunavik, experts are having greater difficulty describing environmental conditions (Tremblay et al. 2008). Nunavik's ICBM project has been a way to promote

the development and capacity of communities by their active participation throughout the research. The project is a forum where Traditional Knowledge and Western scientific knowledge comes together to develop community adaptive capacity (Tremblay et al. 2008). Indeed, the inclusion of both scientific knowledge bases has been critical for creating an understanding of climatic and environmental changes that is respectful of both aboriginal perspectives and scientific views (Tremblay et al. 2008). It is because of this that the project has been successful thus far and has credible, relevant information for supporting adaptation with respect to a changing climate (Tremblay et al. 2008). Adaptation policies, which support the use of Traditional Ecological Knowledge, will contribute to effective strategies for reducing the risks of climate change and promoting safe hunting practices (Ford et al. 2010). According to Ford et al. (2010), prevention, preparedness, and response are key for reducing vulnerability to climate change risks.

Cultural teaching programs that provide individuals with land-based skills training happen throughout the North, on an inconsistent basis. It is important that experiential-based teaching practices that include learning-by-doing, watching, and being on the land are promoted and supported, as these methods are traditional forms of teaching in northern Indigenous communities. Cultural schools and land-based skills programs should be a part of broader program in northern regions, in order for individuals to be better prepared to adapt to changing environmental conditions (Ford et al. 2010). These programs should focus on skills (traditional and non-traditional) and development in order to not only support adaptation but so individuals are better prepared to take advantage of economic opportunities that may also arise from climate change (Ford et al. 2010). It is essential that adaptation and food security programs are hands-on, where people can learn through experience and imitation, which not only builds specific harvesting/preparation skills but also provides a venue for the transfer of social and moral values that are important for overall community-well-being (Chan et al. 2006).

Effective adaptation requires policy intervention "to: i) support the teaching and transmission of environmental knowledge and land skills; ii) enhance and review emergency management capability; iii) ensure the flexibility of resource management regimes; iv) provide economic support to facilitate adaptation for groups with limited household income; v) increase research effort to identify short and long-term risk factors and adaptive response options; vi) protect key infrastructure; and vii) promote awareness of climate change impacts and adaptation among policy makers "(Ford et al. 2010: 177). Policies which support: the subsidization of healthy store foods; the development of food banks; an extension of food mail programs to include traditional foods; community hunts; improved networks and distribution of traditional foods between communities and the strengthening of food sharing relationships in communities; harvester support; community freezers; and the

development of commercialised operations around traditional foods were all ways identified by Ford et al. (2010) that policy could support climate change adaption strategies.

In Inuit communities, it has been recognised that changes at the community and government level are needed to address food insecurity (Chan et al. 2006). Strategies so far have included extra funding for hunter and harvester support programs, better food mail programming, traditional food hunting camps, and cooking classes in the communities (Chan et al. 2006). Hunter support programs have existed since the 1970's in Nunavik with the signing of the James Bay Agreement in 1975 (Chan et al. 2006). In Nunavut, the Nunavut Harvester Support Program was initiated in the 1993, which helps a limited number of community members with hunting and fishing supplies. This program is not securely funded, and like other programs that have happened in the past (e.g. community freezers and meat-cutting plants) is at risk of discontinuing.

Barriers to adaptation with respect to climate change could include inadequate financial resources as well as socio-cultural factors such as the erosion of traditional land skills in younger generations, the weakening of sharing networks, and the cultural value of hunting and seasonally consuming certain traditional/country foods (Ford & Pearce 2010). Many adaptation strategies are expensive, for example the adoption of new technologies for hunting and predicting weather, and many individuals, families, communities, businesses, regional governments, and regional institutions may not be able to afford them (Ford & Pearce 2010). It is increasingly becoming recognized that adaptive capacity will be unequal. Youth and those with limited income are especially vulnerable and have an increased sensitivity to climate change and adaptive capacity (Ford et al. 2008; Ford & Pearce 2010).

Conclusion

In closing, this document looked at some of the most recent literature available (~2005-2010) related to climate change and food security. It is by no means exhaustive, but creates a general picture of the current conditions and impacts that northern Indigenous communities are currently facing and adaptation strategies that are being or could be employed.

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