

Food Security, Ice, Climate and Community Health: Climate change impacts on traditional food security in Canadian Inuit communities

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Abstract

The importance of traditional/country food as a critical resource for the health and well-being of northern populations is well documented. Traditional/country foods are critical resources for physical, as well as mental, social and economic health of individuals and communities across the Arctic. Despite this, shifts in traditional/country food consumption have been taking place over the past 15 – 20 years related to a variety of changes in northern ecological, social, political and economic systems. Those related to ecological shifts have been in part previously associated with reduced confidence in food safety due to identified threats from environmental contaminants such as mercury and PCBs, and more recently the changes in species availability and accessibility due to shifting climatic conditions. Specifically, climate related changes and variability in the North have been associated with changes in animal, fish and plant population health and distribution, while changes in ice, snow, precipitation regimes, and other environmental factors have the potential to influence human travel and transportation in the North, and thus Inuit access to these wildlife resources. As such, climate change and variability has the potential to influence nutrition and health status among Inuit via impacts on aspects (availability, accessibility and quality) of traditional/country food security. Earlier phases of this project identified both positive and negative changes in the traditional/country food harvest of Inuit communities in relation to changes and variability in climatic conditions. It was documented that environmental changes are already having impacts on both the availability of wildlife species and hunters' access to them in all regions studied. Additionally, during the Nunavik Regional Inuit Health survey, respondents reported some influence of climate and environmental change on wildlife access and availability in comparison with the same hunting season in previous years. However, the impacts are not homogenous among all hunters and communities, and both individuals and households show differential ability to adapt successfully. Factors such as access to economic resources and equipment, experience, and the nature of the adaptive strategy

used appear to influence the success of hunter adaptations. This project studies these factors among individuals and households in Inuit communities influencing climate change impacts on nutritional and food security status. Further, through the analyses of harvest and local consumption data in Nunavut we determined that it is feasible to relate wildlife harvest data to traditional/country food use at both community and regional levels. Thus, it is possible to begin to model the relationship between climate projections, impacts on key environmental variables influencing availability of wildlife and/or Inuit access to traditional/country food species (e.g. ice conditions), and the level of viable consumption of those species in the community which we are now doing. These two pieces of information are critical for furthering our understanding of the major determinants of traditional/country food consumption in Arctic communities and of the current and future impacts of climate variability and change on traditional/country food consumption.

This project is working in all Inuit regions under 6 sub-projects to investigate issues related to food security in Inuit communities. These sub-projects include: an analysis of the relationships between harvest statistics, wildlife numbers and human consumption levels; the development of an adapted food security assessment tool for Inuit households and communities; Continued analysis of the Inuit Health Survey and Nunavik Regional Health survey databases for interactions among factors influencing household food security status; the development of an integrated modeling tool for Arctic food security decision support; the evaluation of the impacts (risks and benefits) of one adaptation tool for food security, the community freezer in Inuit communities; and finally, an analysis of the relationship between extreme weather events and food security status.

Key Messages

- Food security in Inuit regions is a complex phenomenon, and forces such as environmental change and variability impact household food

security status quite differently depending on such factors as household composition, geographic location, access to economic resources, numbers of hunters in the household, etc. Impacts on food security status are often just as variable within a community as they are between communities as a result.

- An analysis of the circumpolar food security literature shows an exponential increase in the publications and interest in the concept of food security fueled in part by the WHO World Food Summit in 1987.
- The large majority of circumpolar food security focus has been on Inuit societies in Canada Traditional or Country Food security in the circumpolar north and is comprised of issues related to Availability (diversity and abundance of species), Accessibility (Social, Economic, Physical, Political) and Quality (Chemical/ Nutrient, Biological, Social/Cultural).
- The focus on this issue in the past has been predominantly on issues of food quality (chemical), and significant gaps in our understanding exist in terms of other barriers to access than economic purchasing power.
- Both nutritional food security and cultural food security are equally important for the health of Inuit. Cultural food security is obtained through securing an adequate supply and utilization of traditional/country food. This also tends to promote nutritional food security.
- There are serious ecological obstacles to substituting other traditional/country food species for caribou in some Inuit diets.
- The existence of the Canadian Reindeer Herd in the MacKenzie Delta and a long-standing tradition of reindeer herding and meat consumption provides a promising culturally and nutritionally sustainable substitute for caribou in the Inuvialuit diet.
- Impacts of environmental change pressures on food security of individual hunters varies depending on hunter experience, economic status, knowledge of the land, access to different

equipment and modes of transportation. The existence of community freezers in Inuit communities may be significant mediators of the impacts of environmental change on traditional/country food security in some communities.

- Extreme weather conditions and ‘anomalous winter’ characteristics (e.g. El Nino winters) have been shown to significantly impact household food security (Nunatsiavut).
- Data originating from current methods of assessing food security in the Canadian North should be interpreted with caution as there is great variability in the adaptation and application of standard assessment tools; an Inuit specific tool more able to capture the non-monetary inputs into household food system is required.

Objectives

General objectives

- Gain a better understanding of Inuit food security, the role of environmental and socio-economic factors and their variability in household food security status, and the effectiveness of potential intervention mechanisms to address these issues in Inuit communities;
- Assess the role of key adaptation strategies to address environmental change pressures on household food security in remote Inuit communities;
- Develop a quantitative ecosystem-based modeling framework integrating determinants of arctic food security, from the regional to the local scale, to support future decision-making;
- Help support the creation of a national mechanism for information exchange and learning among regions on this topic (Inuit Food Security Working Group through cooperation with ITK).

Region specific objectives

Nunavik

- Develop standardized protocols to characterize and assess vulnerability and adaptation for traditional food security in Inuit communities;
- Identify and evaluate factors influencing household food security status (including climate and environmental change and a series of socio-demographic variables) and their distribution in Nunavik communities.

Nunatsiavut

- Determine the prevalence of factors influencing vulnerability and adaptive capacity for food security impacts of climate change;
- Assess the role of environmental (and other) factors in influencing individuals' use of a key food security adaptation mechanism (community freezer) in one community (Nain).

Inuvialuit Settlement Region

- Determine traditional food species key to both nutritional and cultural security and identify means to balance sustainable harvesting, nutrition and cultural use, if this becomes necessary;
- Determine the local and regional parameters of adaptation that are acceptable and viable among communities of the Inuvialuit Settlement Region (ISR);
- Develop detailed adaptation planning to allow the communities of the ISR to maintain food and cultural security;
- Incorporate the risk and benefits of traditional foods into planning for food security;
- Scale adaptation planning from the local to the regional level;
- Construct a comparative anthropological model to guide adaptation to climate change impacts on

food security was completed in four communities in the ISR;

- Determine the current state and future prospects for cultural food security in the Inuvialuit Settlement Region. In the long term it will facilitate community adaptation planning and assist the communities in developing region-wide adaptation planning for the maintenance of traditional food security across all the communities in the ISR.

Nunavut Region

- Determine the level of wildlife harvest needed to sustain the current traditional diet and projected future needs.

Introduction

The importance of traditional/country food as a critical resource for the health and well-being of northern populations is a public health issue that has been well documented (Donaldson et al., 2010; Van Oostdam et al., 2005). Traditional/country foods are critical resources for physical, as well as mental, social and economic health of individuals, households and communities levels across the Arctic. Despite this, shifts in traditional/country food consumption have been taking place over the past 15 – 20 years in the same time as dramatic changes in northern climatic, ecological, social, political and economic aspects.

The changes related to ecological shifts have been in part associated with reduced confidence in food safety due to identified threats from environmental contaminants such as mercury and PCBs (e.g. Donaldson et al., 2010; Van Oostdam et al., 2005), and more recently the changes in species availability and accessibility due to shifting climatic conditions (e.g. Furgal and Prowse, 2008; Ford and Beaumier, 2010; Guyot et al., 2006; Berner et al., 2005; Chan et al., 2006). Specifically, climate related changes and variability in the North have been associated with changes in the diversity and distribution of the biotope (game, fish and and botanic) (Prowse et al., 2009;

Wrona et al., 2005; Loeng et al., 2005; Callaghan, 2005). Changes in ice conditions, snow distribution, and rainfall frequencies and other climatic factors have the potential to influence human travel and transportation in the North, and thus Inuit access to their wildlife resources (Tremblay et al., 2006; Furgal and Seguin, 2006; Furgal and Prowse, 2008)). As such, climate change and variability have the potential to impact nutrition and health status in the Inuit population through changes in traditional/country food availability, accessibility and quality.

Food security in Inuit regions of the North is already at alarming rates (Rosol et al., 2011; Egeland, 2011) and therefore understanding the nature and distribution of pressures placed on this public health issue by environmental change is important. Previously under this project we have identified both positive and negative changes in the traditional/country food harvest in five Inuit communities in relation to changes and variability in climatic conditions. It has been documented that environmental changes are already having impacts on both the availability of wildlife species and hunters' access to them in all regions studied (Nunavik e.g. Alain, 2008). Additionally, during the Nunavik Regional Inuit Health survey, respondents reported some influence of climate and environmental change on wildlife access and availability in comparison with the same hunting season in previous years (Furgal and Rochette, 2007).

However, as documented in earlier phases of this project, the impacts are not homogenous among individuals (e.g. hunters) in the same community or between households. Variability in adaptive capacity is evident representative of the reality of Inuit communities today. Factors such as access to economic resources and equipment, long-term experience, and the nature of the adaptive strategy employed seem to influence the success of hunter adaptations. Therefore, it is important to study further these factors at different levels of organization in Inuit regions.

Further, through the analyses of harvest and local consumption data in Nunavut we determined that it is feasible to relate wildlife harvest data to traditional/country food use at both community and regional

levels. Thus, it is possible to begin to model the relationship between climate projections, impacts on key environmental variables influencing availability of wildlife and/or Inuit access to traditional/country food species (e.g. ice conditions), and the level of viable consumption of those species in the community. This information is critical for furthering our understanding of the major determinants of traditional/country food consumption in Arctic communities and of the current and future impacts of climate variability and change and adaptation on traditional/country food consumption.

As the pace and variability of change increases, it is important to identify key aspects of individual and collective adaptive capacity that require enhancement to affect positive change and support effective responses with the aim of protecting and promoting traditional/country food consumption for Arctic Indigenous populations into the future. Our understanding of the determinants of adaptive capacity can be further enhanced by extending our work to larger groups of individuals in multiple communities, and exploring regional patterns of change and adaptation in the food sector.

The detailed diet information collected in the Inuit Health Survey (IHS) in Nunavut, ISR and Nunavutsiavut in 2007-8 provide us opportunities to study impacts of climate change on food security and nutrition. This study will continue to build on and extend the work of earlier phases of this project and the IHS data, to better understand the impacts of climate change and variability on traditional/country food security, and on Inuit community health.

The main goals of this project are to further understand the factors influencing individual, household and community vulnerability to the effects of climate change on traditional/country food security and to explore how adaptation strategies can be developed, implemented, supported and evaluated. Further, this project aims to learn how adaptation strategies can be informed through the use of regional food security modeling activities that have relevance for traditional/country food availability, accessibility or quality.

Activities

National (all Inuit regions)

- An Inuit Food Security Working Group was proposed to Inuit Tapiriit Kanatami (ITK) and the National Inuit Committee on Health. It was presented and accepted in May of 2011, and ITK has now hired a dedicated senior food security analyst and policy advisor. The Inuit Food Security Working Group should be operating shortly with support from the project leads (Chan and Furgal) as the initial supporters of the creation of the group. The Food Security Network of Newfoundland and Labrador are similarly supporting the group, once created through a new Public Health Agency of Canada funded project to K Jameson (Collaborator) and C Furgal (co-lead).
- The analytical framework developed by Furgal and Rajdev (in re-review) to organize analysis of food security issues and work in Inuit regions has been applied to both Nunavut and Nunatsiavut communities to show the limited focus on many aspects of food security in these regions to date. The review of Nunavut food security research and generation of policy options for addressing food security, based on this approach, was completed for the Government of Nunavut in March of 2012 and delivered in April of that year. It is currently being used in the context of ongoing discussions around the formulation of a Territorial Food Security policy.
- The review of food security assessment methods and tools in Inuit communities has identified the limitations of the current approach in assessing the non-monetary components of food security in the Inuit household.

Nunavik

- A food security working group was struck as part of this project under the Nunavik Nutrition and Health Committee, Nunavik Regional Board

of Health and Social Services in the spring of 2010. This committee has been reviewing and directing ongoing analysis of the Nunavik Inuit Health Survey data to investigate the factors influencing food security status in that region and their interactions. This analysis is focusing the discussion on (1) food security in the region at the Nunavik Nutrition and Health Committee table and (2) the potential for the creation of a Regional Food Security policy as is currently being developed in Nunavut. Among other things it has identified the need to explore an Inuit-specific (regional or national) food security metric that considers the non-monetary contribution of traditional/country foods to household food security status. A proposal was developed and submitted this year by K Jameson (FSN NL – Collaborator) and C Furgal (Trent U) to the Public Health Agency of Canada which was successful (\$1.6M over 4 years) to work on community food planning strategies, intervention development and evaluation, community food planning training and capacity building, and the development of a new Inuit-specific food security assessment metric/tool to address identified challenges in this regard. While this work will be focused in Nunatsiavut, it is applicable to other Inuit regions including Nunavik.

- A PhD student (U King, Australia National University) has been working under the supervision of C Furgal with the database to explore the relationship between Inuit participation in hunting and other land based activities and health, including food security status.

Nunatsiavut

- Focus groups were conducted with residents of Nain, Nunatsiavut during the summer of 2010 by RA R Laing, and summer students M Robinson, D Kouril and community researchers S Webb and S Karpik. Focus groups gathered information on the impacts of the El Nino winter and the factors influencing impacts and adaptations at

the individual and collective scales, including impacts to wild food/traditional food security in that community.

- A survey tool was developed from the focus group analysis and was applied using an innovative iPad technique during Nov-Dec 2010 to assess the prevalence of impacts to health and well-being including food security from the El Nino winter of 2009-10 among the residents of Nain. The analysis was conducted in 2011-12 and initial results were returned to the community with a follow-up year study planned for this winter as well as to look at successive year adaptation challenges to food security. Ongoing analysis of this database has been conducted and the first manuscript from this database has been prepared for submission this spring.
- All interviews, data collection, verification and validation were completed by grad student J Organ on the development and establishment of the Nain community freezer program as a strategy for adaptation to climate change impacts on food security in the community. Analysis, thesis writing and defense, and return of results

to the community took place in 2012-13 in association with a land access and safety project (MA student A Durkalec). Two manuscripts have been prepared from this work for submission to journals this winter/spring.

- The community-based ice monitoring activities in Nunatsiavut have been refocused in new proposals for funding submitted to AANDC and Health Canada to look more specifically at development of technologies for surveillance of safe ice conditions. Annually, community-based ice stations are repaired, installed and being deployed in selected Nunavik and two Nunatsiavut communities to continue community-based monitoring of ice and ice safety conditions around these communities in relation to accessible wildlife resources for health and nutrition. One manuscript from these activities has been drafted in this past year for submission.
- A PDF (Dr. C Juillet) was recruited this year to work with C Furgal on the development of a quantitative integrated tool to model the complex relationship between climate and Arctic food

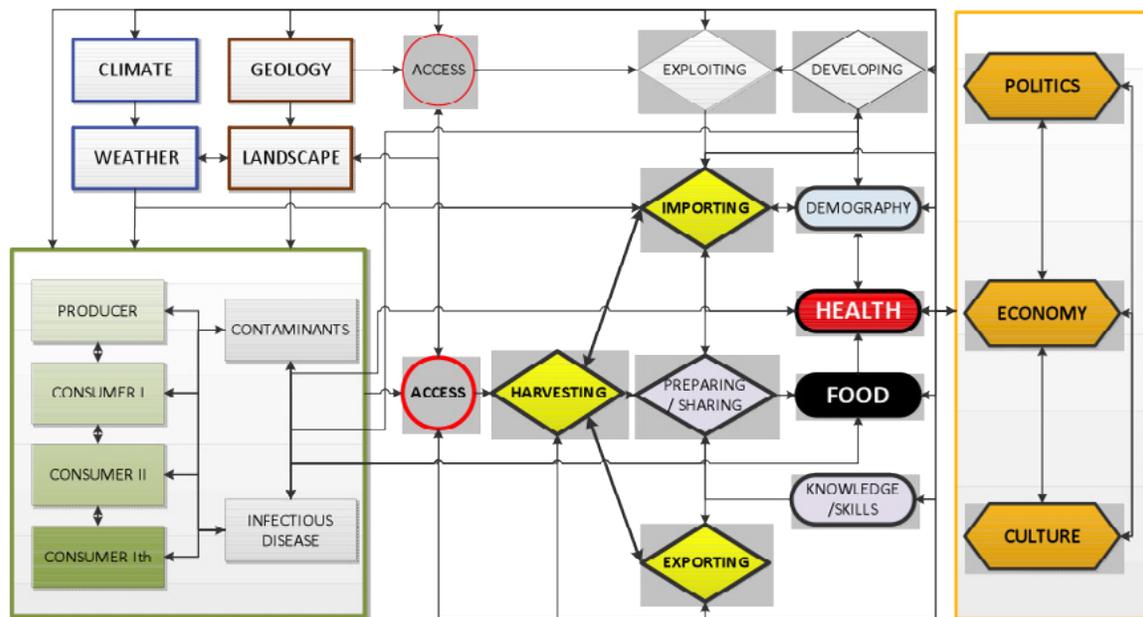


Figure 1. A systems model for food security analysis and understanding.

security. This tool is based on a more rigorous approach to the integrated modeling of Arctic systems combining research on wildlife, climate and community health and when completed will serve as a support for decision making on the topics of food security and wildlife management on both regional and local scales. The conceptual framework of the integrated model is complete (Figure 1) and was presented at the 2012 annual ArcticNet meeting at Vancouver, B.C. (peer reviewed publication in progress).

- The conceptual framework has helped identify key components necessary to model Arctic food security systems and attract experts from different disciplines to identify sources of data pertinent to the completion of the quantitative model. Collaborators to date include; Drs. Steve Côté and Jean-Pierre Tremblay (Université Laval and Centre d'études nordiques) and Dr. Esther Lévesque (Université du Québec à Trois-Rivières et Centre d'études nordiques).

Inuvialuit Settlement Region

- The four ISR communities that participated in this research project were visited in late June – early July. In each community, a meeting was organized in collaboration with a contact person from the Hunters and Trappers Committee (HTC). Community members were invited to the meeting via posters and radio announcements. In each community, the up-to-date results of the project were presented during a 30-minute presentation. Participants were asked to comment on the results and add any elements they felt were missing. A community report was presented to each community. A final regional report that incorporates all the input from the participants will be presented to the region by March 2013.
- A regional workshop was convened in collaboration with the Inuvialuit Regional Corporation (IRC). The idea of this workshop was to develop a multi-stakeholder participatory approach to discuss health issues related to

food safety and food security in the ISR. The participants invited to the workshop were from organizations that had previously been participating in this study and the Inuit Health Survey, either as steering committee member organizations or as advisors to the ISR steering committee, as well as regional and territorial organizations involved with Inuit health. A group of researchers, ISR community representatives, as well as local and territorial government organization stakeholders, gathered to discuss the results of the 2007-2008 IHS regarding food security and safety and the promotion of Inuit health.

Participants at the workshop were divided in three discussion groups and the following questions were posed to them:

- Vision: What is our goal, what do we want to achieve?
- Mission: How would we achieve these goals?
- Activities and programs: What are the initiatives, ideas and activities that could be implemented to fulfill our missions?
- The three groups had a brainstorming session on each question and presented their results back to the plenary. After all groups presented their inputs on questions 1 and 2, the vision and missions were developed following a common agreement on the elements that these should include. After brainstorming on the third question, participants presented their suggestions of programs and used colour-coded stickers to prioritize them. Researchers synthesized these ideas and organized them into global themes that were presented as the Activities and programs to put in place in order to fulfill the missions.

Nunavut

- Using the data collected from the Inuit Health Survey, we have established estimates of regional harvest requirements for ringed seal, beluga and

caribou in 2007-2008 to match consumption levels in communities. Using frequency responses from a total of 806 Inuit men and 1275 Inuit women, we characterized annual traditional/country food consumption in Nunavut, ISR and Nunasiavut. Daily consumption equivalents for children and adolescents were estimated by applying conversion factors to adult consumption results.

Results

Nunavik

In Nunavik half of the Inuit Health Survey participants reported that some species are more difficult to locate and hunt than in previous years; 60% of these reported that this was the case for caribou while 53% reported that this was the case for beluga whales. Fourteen percent reported that caribou were more difficult to locate and hunt because of changes in land, sea or weather conditions while 18% reported that beluga were more difficult to hunt because their distributions have changed.

The Nunavik rate of food security is slightly less than three times lower than the rate reported for Nunavut. The Nunavik Nutrition and Health Committee and research team members have begun to discuss why this is and what dataset is more accurate. It is believed that the current assessment method for Nunavik is more accurate than the tool used in Nunavut which has a tendency to report significantly higher rates of food insecurity because of a lack of financial resources to purchase food from the store. At the same time, significant food access issues exist in the region and, it is believed that perhaps the Nunavik assessment tool underestimates actual household food insecurity and need.

Preliminary analyses of the Inuit Health Survey data from this region indicate that a high level of participation to hunting, fishing and gathering activities are not positively correlated with many

health metrics. Similarly, there is a more complex relationship between hunting, fishing, collecting, sharing of food, and then preparation and consumption of traditional/country foods than previously thought. The PhD thesis by U King is currently deconstructing these relationships to better understand the complexity of food security issues and health in Nunavik in support of the development of more helpful interventions for the region to address food-related concerns.

Nunatsiavut

The El Nino winter of 2009-10 had some significant impacts on wild food accessibility in Nain, differentially influencing individuals and households throughout the community. The winter conditions impacted not only wild food access but also store food access for a short period of time; furthermore, these conditions are a unique analogue to potential future anomalous year conditions of warm winter thaws and periods of rain. The changes in weather and ice conditions had a large impact on the ability of residents of Nain to access the land and resources needed for daily life, including accessing food (36%), hunting areas (34%) and wood (33%). Typical travel and hunting routes were affected, with 49% of people not being able to use their traditional routes; 82% of those created or used new routes. This resulted in 45% of people taking more risks during sea ice travel and 32% taking fewer risks. Sea ice conditions were reported to be the main parameter affecting access to wild foods during that winter and resulted in a significant proportion of individuals reporting impacts to their ability to get food with 67% reporting that they spent more money on food that year compared to previous years because of these challenges. Caribou, seal, geese and duck were reported to be less accessible than in previous years and caribou, geese, ducks specifically, were reported to have been available, however much later in the year than is typical for the area. Environmental changes also were reported to have impacts on the number of animals hunted and caught with a larger number of individuals reporting catching fewer animals that winter (Laing et al., in prep).

The evaluation of the Nain community freezer program by MES student J Organ showed that individuals access the freezer in association with environmental stresses, social, political and economic stressors felt at the household level. In response, the community freezer addresses these issues to some extent for the users but also creates other tensions in the community in regards to pressures on resources, challenges to previously existing social structures for sharing, the creation of a potential replacement for or threat to the importance of the development of land skills, and acquisition of knowledge among young hunters and others. It is argued that these factors need to be considered in the evolution of the freezer program as an adaptation mechanism if it is to be successful moving forward as part of the community food system (Organ, 2012; Organ et al., in prep). The thesis of E Willson (new MA student with C Furgal) will explore these issues while also quantifying the contribution of the freezer to household diets in the community of Nain.

Community ice monitoring stations continue to be deployed and managed in selected Inuit communities. The implementation of stations has been often late and impacted the data collected from these stations. In all communities, residents are interested in the results of this monitoring activity and feel that is an important initiative to continue. In Nunatsiavut they would like to evolve this monitoring process into a safety surveillance program to begin to provide more detailed and important information to residents on ice safety conditions for travel and accessing wild foods. A proposal to this effect has been written and submitted by the Nunatsiavut Government in association with C Furgal and T Bell to the Aboriginal Affairs and Northern Development Climate Change program recently.

The work in Nunatsiavut is growing through cooperation with the Food Security Network of Newfoundland and Labrador (FSN NL) to now include an element of community training and capacity building around food security issues. A recent grant received from the Public Health Agency of Canada

to K Jameson (FSN NL) and C Furgal (Trent U) will support the creation of a Nunatsiavut Food Security Working Group in cooperation with the Nunatsiavut Government and the movement towards community designed food interventions and their evaluation in 2013-17. To date, this group has supported a community-led food assessment in the community of Hopedale, Nunatsiavut. This regional food security working group will require information and data input to support decision making and the development of a regional food security strategy.

The conceptual framework which we have built for the quantitative integrated tool to model the complex relationships between climate and Arctic food security has provided valuable information on the depth and breadth of the data required to holistically model Arctic food security in a changing environment. If we take an ecological perspective to start the modeling of Arctic food security people are the top consumers in a typical ecological food chain that begins with producers (e.g. plants) followed by several levels of consumers (e.g. geese, caribou, Arctic fox, polar bear). Each level of this food chain is susceptible to the influence of contaminants in the environment and infectious disease, both of which may exacerbate effects of one another. Humans, as the top consumers, may be even more susceptible due to the effects of bioaccumulation through the food chain. Understanding the biology of species at all levels of the food chain, and how populations are affected by climate and weather is essential to be able to model the access to and availability of traditional/country foods by Arctic residents. The modeling of access to and availability of traditional/country foods in the face of climate change requires all environmental components, biotic and abiotic, such as geological and landscape characteristic which may influence climatic impacts.

When we connect the ecological aspects of the food security system with the anthropogenic aspects of the system, we incorporate complexity at a higher spatial and temporal level as we must consider the availability and use of market foods as well. The availability of market foods provides alternatives to reach a state

of food security, however, a disproportionate intake of market versus traditional/country foods also has some negative impacts on health. Societal components of the food security system, politics, economy and culture also need to be assessed as each will inevitably influence decision-making processes regarding food security and community health (Figure 1).

Inuvialuit Settlement Region

The main results discussed with each community included the following:

Ulukhaktok (June 26; 35 participants)

- Traditional education is a long-term solution to the challenges Ulukhaktok faces.
- There was a suggestion of a closer integration of the traditional/country foods and market economy.
- Increased intercommunity trade region wide could be a solution to the ongoing changes.

Participants' comments and suggestions:

- Polar bear hunt should be brought back because it was bringing a lot of traditional/country food.
- Hunting equipment is not available for young people; group hunts with elders could be organized.
- Could farming be a possibility to guarantee food security? (e.g. caribou farming in Alberta).

Tuktoyaktuk (June 29; 8 participants)

- The highest priority is access to caribou: the restrictions imposed on caribou hunting by governments quotas are too strict, and there is a lack of interest in harvesting by youth.
- Emphasis on traditional education could be a long term solution to the challenges Tuktoyaktuk faces.

- There was a suggestion of a closer integration of the traditional/country foods and market economy.
- There was an agreement that traditional/country foods are healthier both physically and culturally for Inuvialuit.

Participants' comments and suggestions:

- If traditional/country foods were included in the market economy, these would have high prices. For example, the Canadian reindeer herd is a commercial enterprise that owns a privatized resource, and you have to buy it.
- Hunting equipment is not available for everybody.
- Co-op to buy traditional/country foods could be established, as this is the case in Cambridge Bay.
- Intercommunity trade could be organized by community corporations.
- Community organizations should talk together and organize.

Aklavik (July 3; 13 participants)

- There was an emphasis on enhancing traditional education.
- There was not much interest in improving access to market foods, as there is an easy access to market food in Inuvik.
- The access to traditional/country food would be improved through intercommunity trade. There is an urgent need for a community freezer, which would have to be an industrial-type freezer, as permafrost conditions in the Aklavik region are such that an ice house might be impractical.

Participants' comments and suggestions:

- Recent environmental changes are already affecting harvesting (e.g. muskat).

- There is a need to create a central place to collect and access the data on climate change and traditional knowledge.
- Traditional knowledge programs in schools could be implemented.

Paulatuk (July 5; 28 participants)

- There was an emphasis on enhancing traditional education, as this could be a long term solution to the challenges Paulatuk faces.
- Regarding market foods, the lack of competition in the local retail market is a concern as the products are sold at very high prices.
- The lack of community freezer capacity is a major hindrance to the traditional economy; Household chest freezers are inadequate.

Participants' contribution:

- There is a lack of economic opportunities in the community.
- The oil and gas industry represent economic opportunities for the Hamlet, but the exploration might cause the fish and caribou to run away.
- Tags for caribou and char have changed hunting practices.
- Territory governments fund 5-6 day youth camps on the land once a year; this is not enough to learn how to live on the land.
- There should be more healthy market foods available at the store.

During the Inuvik meeting in July 2012, the working group developed a vision for future research and intervention.

This vision is to empower communities to promote health, well being and environmental sustainability in the ISR. The group elaborated goals for the ISR that address the following issues: (i) capacity building

within communities; (ii) promotion of the use of traditional/country foods to address food security; (iii) research to better understand the linkages between diseases and contaminants in traditional/country foods, market foods and lifestyle choices; (iv) and promotion of affordable housing. Five programs with concrete activities to fulfill this vision were developed in the following areas: harvest support and traditional/country food sharing; education and promotion; governance and policy; research; and housing. Concrete activities were suggested to guide future research and intervention projects. Participants agreed to use the summary of the discussions as a reference document for future research and intervention projects, and to maintain the interdisciplinary and multi-sectorial approach in the development of these projects. Community involvement has been a key element in developing the future research directions for this project in the ISR.

Nunavut

Our study reaffirms the importance of traditional/country food to the contemporary Inuit diet. Consumption of traditional/country food was widely reported in all 5 regions, with caribou being the traditional/country food that was consumed in highest amounts, and in highest prevalence, with no region reporting less than 90% consumption rates. Results from this study suggest that an average beluga feeds between 46 – 124 women, and 26 – 66 men, depending on the region in which it is consumed. An average ringed seal may feed between 2 – 9 women and 1 – 4 men, again, depending on the region. Regarding the consumption of caribou, we found that on the lower end of the spectrum, a caribou may feed as little as 2 – 4 people annually, however, on the higher end, an individual would require approximately 2 caribou to satisfy current dietary intake levels.

Discussion

Food security issues in the circumpolar north include those associated with food availability (abundance

and diversity of food) accessibility (social, physical, economic and political accessibility) quality (chemical/nutrient, biological, and social/cultural) and use (food skills and knowledge). Much more is known about food quality (chemical) and accessibility than other elements which may be critical in light of ongoing environmental changes influencing physical access and diversity and abundance of traditional/country food species in Arctic regions.

Much of the work to date on the topic of food security and climate change in Inuit and other regions has depicted the pattern of impacts as being homogenous among groups of individuals (e.g. hunters, communities, etc). Our results are showing that this is not the case in the present context and, in fact, the pattern of vulnerabilities and impacts associated with environmental change forces on food security are much more complex than previously thought.

As a result, it is important to continue to utilize the existing comprehensive databases from the Inuit Health Surveys which contain both food security status information as well as the suite of factors influencing or characterising where food insecurity occurs within a community and which types of individuals, households and communities are likely at greatest risk in the future. The Inuit Health Survey conducted in Nunavik in 2004, Nunavut in 2007 and Inuvialuit and Nunatsiavut in 2008 provide excellent data on food intake, contaminant exposure, observations of environmental change, food security status and their relationships with the health status of the participants. A variety of different assessment tools have been used to determine food insecurity rates in Canada and the Canadian North. It is only in Nunavik that it is currently possible to compare food security rates over time where the same tool has been used more than twice in the same region; results in this region are considerably lower than the other regions, yet qualitative reports from the region depict similar problems or challenges exist related to food access and availability. Recent results from Nunavut (re: the highest rates of food insecurity in the developing world, where 68% of homes are reported

to be food insecure) argue for a critical examination of the accuracy of these tools for temporal and spatial comparative purposes and as monitoring metrics for climate change adaptation programs (e.g. community freezers, institutional shifts in wildlife management regimes, etc) to address environmental change and variability stresses on food systems. This is taking place and a new tool for Inuit food security is being developed in cooperation with Jameson and Furgal's PHAC project in Nunatsiavut using a grounded theory approach in Inuit communities. It will also be explored using the existing Inuit Health data sets by the new PhD student working with L Chan.

Our continuing research efforts from this project will use these data to help Inuit in different regions develop adaptation strategies that are both feasible and culturally appropriate. Work in Nunavut is showing the number of wildlife species required to sustain current dietary habits. Further work in the ISR is showing the relationships between cultural security and food security and the importance of food security for cultural well-being and health, while the work in Nunatsiavut is evidence of the impacts of extreme conditions having far reaching impacts on food security and the relationship between people and the land. As well, work in this region in cooperation with the Nunatsiavut Government and the Inuit Community Government of Nain is showing that food security is impacted by not only environmental, but also social and economic change in communities as well as how one particular collective adaptation strategy can help minimize the negative impacts of these forces.

A variety of adaptation strategies to address environmental pressures on country/traditional food security exist, with some growing in popularity across the North. There is increased interest in community freezer programs throughout the North and their ability to act as an adequate adaptation mechanism in the face of increasing pressures on food security in Inuit households. To date the relationship between their existence and food security status has not been explored. We are now investigating this through the analysis of the Inuit Health Survey statistics on this

topic in Nunavik and through a new MA thesis in Nunatsiavut. In cooperation with a new PHAC project we will look at this topic in other regions as well. Finally, with the creation of regional and national food security working groups, there is the need to synthesize and integrate data in usable and accessible ways. The quantitative modeling initiative here, started by PDF Juillet, has started to work with ArcticNet researchers and other data managers to gather and integrate data for these purposes.

This study brings together two multidisciplinary research teams and their networks working in different Inuit regions of the Canadian North. Further, we are using different but complementary approaches to study the relationships between environmental and other forms of change and food security status in Inuit homes. The project activities are now starting to move into a phase of specific, focused analysis on critical questions in the understanding of this issue, adapt and develop new methods for improving data used for decision support on this topic, and develop decision-support analyses and integrative tools to support community, regional and national working groups challenged with this issue. In cooperation with our partners we are supporting community capacity building on the topic and the empowerment of communities in assessing strengths and weaknesses in their local food systems and designing and implementing interventions that are locally controlled, directed and appropriate.

Conclusion

Our results collected in the last few years on levels of harvest and consumption of traditional/country food provides a basis for assessing different dimensions of food-related vulnerability and adaptability in the different Inuit regions across the Canadian North. It also provides information on levels of traditional/country food dependence, alternate traditional/country food options, and existing adaptations (e.g. species substitution, community freezers, etc). In addition to environmental factors such as climate change, Inuit families face many

challenges to food security, including low income levels, changing diets, high food costs, and lack of awareness of healthy eating habits. Community members face barriers to traditional/country food consumption, such as high costs of hunting, changes in lifestyle and changes in cultural practices among Inuit. The shift in caribou numbers throughout the north is having significant impacts on household food security status and has the potential to impact nutritional and cultural well-being (e.g. recent ban on caribou hunting for the George River herd by the Government of NL). These issues surrounding key resource (staple item) viability in the future, along with other factors such as food preference and food choice, must be considered in the adaptation planning process. The complexity of interrelationships among the multiple and multifaceted features affecting food security emerge when we address the issue from a holistic food systems perspective. Valuable lessons are being learned throughout the Inuit regions and some communities are implementing adaptation mechanisms already. In conjunction with this project, we are supporting the creation of a food security working group through ITK (passed by NICOH in May 2011, still in development and formation) to exchange lessons learned and discuss the best approaches to use the knowledge gained through this and other research to help develop effective intervention and adaptation policies at both the regional and national levels.

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