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Being on Land and Sea in Troubled Times: Climate Change and Food Sovereignty in Nunavut

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Abstract: Climate change driven food insecurity has emerged as a topic of special concern in the Canadian Arctic. Inuit communities in this region rely heavily on subsistence; however, access to traditional food sources may have been compromised due to climate change. Drawing from a total of 25 interviews among Inuit elders and experienced hunters from Cambridge Bay and Kugluktuk in Nunavut, Canada, this research examines how climate change is impacting food sovereignty and health. Our results show that reports of food insecurity were more pronounced in Kugluktuk than Cambridge Bay. Participants in Kugluktuk consistently noted declining availability of preferred fish and game species (e.g., caribou, Arctic char), a decline in participation of sharing networks, and overall increased difficulty accessing traditional foods. Respondents in both communities presented a consistent picture of climate change compounding existing socio-economic (e.g., poverty, disconnect between elders and youth) and health stressors affecting multiple aspects of food sovereignty. This article presents a situated understanding of how climate change as well as other sociocultural factors are eroding food sovereignty at the community-scale in the Arctic. We argue that a communal focus is required to address resilience and adaptation at the local level through programs that protect the local cultural knowledge, traditional ways of life, and indigenous sovereignty to reduce the severities of food insecurity in the Arctic stemming from climate change.

Keywords: Inuit food sovereignty; food security; Inuit health; climate change; Inuit subsistence practices

1. Introduction

Food sovereignty in the Arctic is deeply tied to an ethic of subsistence, of being able to harvest fresh food from the immediate environment year-round [1,2]. The Inuit have provided for themselves through hard work and ingenuity for centuries directly from the land and sea with knowledge passed down to them through generations [3,4]. Inuit take pride in being self-reliant and resilient [2]. Subsistence is not just a socioeconomic system, but it also holds a deep cultural and spiritual tie that provides a source for recreation, connection, therapy, beauty, and knowledge and hence is central to the physical as well as social, cultural, and spiritual wellbeing of Inuit communities [3–5]. Subsistence is a way of life that binds Inuit to the natural world.

While the practice of subsistence has suffered many setbacks by colonization, assimilation, and globalization over the years, it has carried through to this day to face yet another challenge of an environment that is changing too fast [3,6]. Climate change has brought a sharp increase in surface temperatures in the Arctic. Parts of the Arctic are warming twice as fast as the global average [7–9], with the most dramatic changes occurring in the winter seasons [9]. As a result, the sea ice that the Inuit travel over and where they hunt has generally become thinner, recedes faster in the spring, and arrives

later in the fall [10]. Sea ice change also affects the availability of the marine mammals and fish that Inuit hunt and rely on as staples of their traditional diets [11,12].

Sea ice change is particularly consequential for the Arctic ecosystem because it affects all levels of the Arctic food web, from primary producers such as phytoplankton to higher predators such as polar bears [8,12,13]. While some species may benefit from an increasingly ice-free Arctic (e.g., seasonally migrant cetaceans), declines have been observed in marine mammals (ring-necked seals) and in terrestrial species (caribou) [11,13,14]. There are numerous reports of the direct impacts of climate change on traditional food availability in Arctic regions. Hunters and elders in Igloodik (Nunavut) describe a situation of declining availability of walrus, caribou, and seal [15]. Fort McKay in Yukon is seeing considerable changes in food availability due to climate change [16]. Widespread changes in habitats, migration patterns, and distribution of species have also been noted [17–19]. Further, pathogens and diseases in wildlife are an increasing threat in the warming Arctic [20–25].

In addition to impacts on food availability, climate change affects the network of activities related to the practice of subsistence—hunting, trapping, gathering, processing, storing, distributing, and consuming wild foods. Many Arctic communities are remote and not connected to the roads and other distribution systems and many hunters travel considerable distance on snowmobiles for harvesting. Sea ice or rivers often serve as road networks that Inuit's use for travel, these activities especially become more risky as the climate warms. For instance, hunters in several Arctic communities report greater hazards and risks as a result of extreme and unpredictable weather, shifts in freeze and melt cycles, thinner ice, and other climate-related changes [26–33]. Adaptations to these changes are affected by existing social, cultural, and economic factors such as poverty, changing social practices, and wage employment. In Iqaluit (Nunavut), Statham and colleagues [33] found that sea ice freeze-up occurred 59 days later, and temperatures were 4.9 degrees (C) higher than average in the winter of 2010–2011 impacting the traditional food system. They found that participants' ability to access traditional food supply was compromised due to climate-related stressors as well as socio-economic and cultural factors such as income, participation in sharing networks, and hunting experience. Similarly, in Igloodik, Ford [27] showed that climatic conditions overwhelmed the adaptive capacity of many community members, particularly those who were dependent on traditional foods and had limited access to financial resources. In both studies, the authors report increased consumption of non-nutritious processed foods due to constraints on the traditional food supply; other responses included skipping meals, eating less, and asking friends and relatives for food.

Loss of indigenous food sovereignty due to climate change has become a topic of great concern to Arctic residents. Much of the food security and climate change literature has focused on impacts in the tropics, where the majority of the food security problems currently exist. This paper examines food security in a relatively understudied region—In the Arctic which is likely to experience the most severe climatic changes in the 21st century [29,34]. In an already food insecure region, climate change threatens access to healthy subsistence resources and overall food sovereignty. This research examines stressors and linkages between recent environmental changes and impacts on food sovereignty and health in two Inuit communities of Kugluktuk and Cambridge Bay in western Nunavut. We argue that climate change threatens food sovereignty and increases structural inequities in the Arctic. We identify that decolonial practices and increased transfer of intergenerational knowledge are essential to increase food sovereignty in the Arctic.

Food Sovereignty in the Arctic: A Theoretical Overview

The Inuit Circumpolar Council of Alaska (ICC-Alaska) defines food sovereignty as “the right of [all] Inuit to define their own hunting, gathering, fishing, land and water policies. The right to define what is sustainable and socially, economically, and culturally appropriate for the distribution of food and to maintain ecological health. The right to obtain and maintain practices that ensure access to tools needed to obtain, process, store and consume traditional foods” [2,4]. To the Inuit there is an

“undeniable connection between food sovereignty and food security. Food sovereignty in the north is necessary to avoid food insecurity.

Food security is defined by the UN Food and Agriculture Organization (FAO) as “a situation that exists when people, at all times, have physical, social and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences for an active and healthy life” [35,36]. The FAO identifies the pillars of food security as availability, access, utilization, and stability [37]. A situation of food insecurity exists when one or more of those “pillars” is lacking or destabilized. However, such a concept of food security is quite focused on a reformist ideology that focuses on the development of niche markets, agricultural subsidies, and market-led neoliberalist reform to serve the needs of fulfilling food security. Studies on food security largely measure the capability to purchase food (e.g., [38]), or use methodologies adapted from other countries (e.g., [39]). While these measures do capture certain aspects of food insecurity (access to food, skipped meals, food choices, etc.), these assessments do not represent a situated understanding of food insecurity within the Inuit socio-cultural and historical context.

Food security guidelines as defined by FAO fall short in addressing the needs of indigenous communities that rely far more on subsistence to achieve food security than through the market-led reforms. The framework outlined by the ICC underlines a view that at the core of food insecurity in the Arctic is the disruption of indigenous food systems, loss of self-reliance, and sustainability, underscoring the fundamental importance of decision-making power, autonomy, and justice as part of Inuit food security. Other studies affirm the importance of self-determination and cultural considerations (e.g., Inuit culture, self-reliance food preferences), and social or ethical considerations of sustainability, and social justice (scarcity, allocation, rights to land, and decision-making power) [40–42].

By many measures, food insecurity is widespread among Inuit families across Canada, particularly in Nunavut compared to the other Territories of Canada—Northwest Territories and Yukon. Canada’s 2016 Food Report Card notes Nunavut to be the most food insecure province in Canada, where one in four people were food insecure; notably, indigenous people in Nunavut were more than twice as likely to be food insecure compared to the indigenous people from Northwest Territories or Yukon [43]. These rates are in stark contrast to the 9% food insecurity and 3% severe food insecurity as a whole in Canada in the national surveys [44]. A study of Inuit in Arctic territories in Canada found that 69–70% of Nunavut residents were food insecure and reported skipped meals and days gone hungry [45,46].

A study conducted in Kugaaruk, Nunavut, showed that five out of six households were food insecure due to the inability to buy adequate amounts of food; almost half the families in the community were “extremely concerned” about having enough food to feed their family [40]. The “country food” (wild-harvested local food) consumption in this community was only 10% of energy intake. In a survey of 388 Inuit preschoolers in Nunavut, Egeland et al. [38] found that nearly 70% of those children were food insecure. Huet et al. [39] found that food insecurity among roughly 900 households in Iqaluit, Nunavut, was more common in households with children (33%) than those without children (23%), and also among households that consumed more frozen meat and fish compared to those that consumed more fresh foods. Widespread food insecurity in Nunavut has been further documented by other researchers [46–51]. Studies have noted lower food insecurity in households that include country food in their diet, which has been shown to reinforce social bonds and cultural identity [15,52–58]. Collings et al. [59] attribute a declining consumption of country foods to rapid social change, changing economic conditions as well as climate change.

The 2007 Nyéléni International Forum defined food sovereignty as “the right of peoples to healthy and culturally appropriate food produced through ecologically sound and culturally appropriate methods, and their right to define their own food and agricultural systems” [60]. This ideology of food sovereignty puts the aspirations and needs of those who produce, distribute, and consume food at the heart of food systems and policies rather than the demands of markets and corporations. It focuses on parity, redistributive land reform, regional food systems, and democratization of food systems by decidedly dismantling unjust corporate agrifoods monopoly of food systems [42]. The food justice

movement makes visible the structural barriers communities of color face to access local, healthy, and nutritious foods due to institutional racism and economic inequality [61,62]. It utilizes a progressive empowerment framework that advocates for rights to food, increased safety nets and investments in underserved communities, and community benefit packages for production, land, and food access [63]. In addition, for the Inuit, recognition justice and knowledge justice—Recognition of Inuit sociocultural identities and the protection of their practices, capabilities, and their knowledge systems—Is central to exercising food sovereignty. The ICC-Alaska reflects this emphasis on distribution, autonomy, and decision-making power in its food security “dimensions” by specifically identifying “Inuit culture, decision-making power and management, and health and wellness” as vital aspects of food security, alongside more conventional components of availability, stability, and accessibility [2,35].

This research uses the ICC dimensions of food sovereignty and food security [2,4]: Inuit culture, decision-making power and management, availability, accessibility, stability, and health and wellness to understand impacts from climate change on food sovereignty and health of people in Kugluktuk and Cambridge Bay in Nunavut.

2. Methods

This research is not conducted by Inuit scholars. The primary author identifies herself as South Asian and the secondary author is a white American. Most of this research was conducted by the primary author when she was working at the Arctic Institute of North America at the University of Calgary where she was working on community-based tracking projects. The present research was conducted as part of a larger project looking into how navigational practices are being impacted by climate change on Dease Strait [32]. Cambridge Bay is directly situated on Dease Strait and Kugluktuk is the nearest community located west along the Northwest Passage. Hence, these communities were picked in relation to this larger project and were not randomly picked nor are they the most vulnerable to climate change, nor do they have the highest food insecurity in the Arctic.

2.1. Profiles of Cambridge Bay and Kugluktuk (Nunavut, Canada)

Kugluktuk (population 1450) and Cambridge Bay (population 1609) are two majority-Inuit communities located along the Northwest Passage in Nunavut, Canada [64]. Inuit people of both communities are descendants of the Copper Inuit or the Thule people, and Inuinnaqtun is spoken today in both towns. Cambridge Bay is located in a protected cove along the southeastern shore of Victoria Island, at the western end of Queen Maud Gulf that is part of the Northwest Passage. Kugluktuk (formerly called Coppermine) is the westernmost town in Nunavut, located on the Canadian mainland, at the mouth of the Coppermine River on the southwestern shore of Coronation Gulf.

Cambridge Bay is the administrative center of the regional Kitikmeot government, and a regional hub for transportation, communication, and research. The Inuinnaqtun name for Cambridge Bay is *Iqaluktuuttiaq*, or “good fishing place” and today the town supports the region’s largest commercial fishing industry for cod, Arctic char, and other species [65]. In 2015, the Canadian High Arctic Research Station was established in Cambridge Bay, bringing technological development, infrastructure, and scientists to the Cambridge Bay community [66]. In Kugluktuk, tourism, government, and mining play a large role in the local economy [67,68].

Both communities are relatively young: the median age in Kugluktuk is 24.3, and 27.4 in Cambridge Bay—far below Canada’s median age of 40. Kugluktuk is a much poorer hamlet compared to Cambridge Bay. According to the National Household Survey, Kugluktuk has the third-highest unemployment rate, while Cambridge Bay has the fifth-lowest unemployment rate in Nunavut. Nearly half of Kugluktuk’s population (49.3%) receive social assistance, compared to 31.9% in Cambridge Bay; the territorial rate is 41.1% [69]. Social assistance provided by the Government of Nunavut is a program of last resort for Nunavummiut (People of Nunavut) to help individuals meet a minimum standard of living [70].

2.2. Data Collection and Analysis

We collaborated with the local Kugluktuk Angoniatit (Hunters and Trappers) Association in Kugluktuk and Ekaluktutiak Hunters and Trappers Organization (HTO) in Cambridge Bay to administer this research. The participants were identified with the help of both the HTOs and do not represent a random sampling. We conducted 25 semi-structured interviews with elders and experienced hunters in these two communities in 2015. The interviews largely included a set of 16 questions on perceptions on climate change, challenges with navigation and hunting, safety concerns, impacts on food security, and health. The majority of the participants in this study were male since hunting is predominantly a male activity. A small sample of four women was represented in the study; these women were either managers of the Hunters and Trappers Organizations (HTO) or women who have accompanied their partners to hunting and trapping expeditions. The interviews were conducted in English and the Inuit language of Innuinaqtun, with local collaborators providing translation and guidance. In this report, we use pseudonyms in order to protect the identity of the participants. The participants were remunerated according to local guidelines. Interviews were transcribed and coded using HyperResearch (ver. 3.7.3) software.

The results from this study based on a small sample size of 25 interviews are not representative and its results are not broadly generalizable, hence not applicable in decision making. The study however provides a situated understanding of challenges to climate change and food security at the local community-scale which is useful in planning local adaptation and resilience strategies. Larger studies are required to understand how climate change is impacting food security in the Arctic.

Ethics approval to conduct interviews in Cambridge Bay and Kugluktuk was obtained from the University of Vermont Institutional Review Board (CHRBSS 16-113). A research license (05 014 16N-M) was issued from the Nunavummi Qaujisaqtulirijikkut (Nunavut Research Institute) to conduct interviews in the study locations. An additional research license (04 018 15R-M) from the Nunavut Research Institute was issued for work related to weather stations in the study region. Participants provided both written and oral informed consent.

3. Results

We use the ICC-Alaska Food Security dimensions to organize our observations of food security-related issues into six categories: (1) changing Inuit culture, (e.g., loss of cultural capabilities and self-reliance); (2) changes in local availability of food; (3) lack of direct, financial, and familial access to country foods; (4) agency and decision making power regarding food systems; (5) concerns over long-term stability and sustainability of the food systems; and (6) impacts on health and wellbeing. We cite excerpts from our interviews as well as other published literature sources to illustrate these changes in the two communities. A summary of major themes noted in each category is presented in Table 1.

3.1. Changing Inuit Culture, Loss of Cultural Capabilities and Self-Reliance

Food security issues cannot be contemplated apart from a recognition of the unique historical, political, and socioecological context of Inuit culture [71]. Traditionally, Inuit led a nomadic subsistence way of life, sourcing food from their immediate environment across vast areas of the Arctic land, ocean, and “icescape”—A concept analogous to landscape but specific to ice-bound regions of the North [72]. Over the years, the Inuit bond with land and wildlife was weakened due to colonial encroachment, policing, restrictive land management, forced assimilation, and residential school education. These new systems of settler colonialism systematically and deliberately disrupted the generational transfer of traditional knowledge [73].

Table 1. Summary of food security related changes observed by participants.

ICC-Alaska Food Security Dimension	Major Changes Observed by Participants (CB = Cambridge Bay, K = Kugluktuk)
Inuit Culture	<ul style="list-style-type: none"> Elders recall transition to permanent settlements and effects of residential school (CB/K) Hunting now blends modern technology with traditional practices; requires cash investment and participation in wage economy (CB/K) Concern about youth not carrying on traditions (CB/K) and decline in sharing networks (K)
Availability	<ul style="list-style-type: none"> Caribou were less abundant and farther away (CB/K) Later freeze of Northwest Passage (NWP) and less snow/rain has caused a decline in caribou availability (K) Later freeze of NWP does not affect caribou availability (CB) Whitefish more abundant (CB/K); Arctic char less abundant (K) Participation in hunting is down among elders (CB/K) and youth (CB/K) Population increase may strain wild resources (K) Later freeze-up of the NWP delays access to hunting grounds (CB/K) Lack of snow makes travel difficult (K)
Access	<ul style="list-style-type: none"> Shipping and icebreaking disrupt hunting (CB) Travel is more hazardous, and accidents are more common (CB/K) Sharing is less common; selling country food is more common (K) Cost is a barrier to preferred foods (CB/K)
Agency and Decision-Making Power	<ul style="list-style-type: none"> Dependence on government and reliance on money has fundamentally altered the Inuit way of life (CB) Inuit skills offer the key to adapting and surviving (K)
Stability and Sustainability	<ul style="list-style-type: none"> Concern that some species will not be available (CB/K) Quality of important country foods is declining from disease and contamination (CB/K) Arctic char is declining and of poorer quality (K)
Health and Well-being	<ul style="list-style-type: none"> Spending time on the land is healing and essential to wellbeing (CB/K) Mental health, suicide, and substance abuse are major concerns (K) Imported foods are causing sickness (K)

These major cultural shifts were part of a not too distant memory for many of the participants. Among the elders interviewed in Kugluktuk, only three were born in Kugluktuk; four participants moved there when they were young, and one participant recalled growing up a nomad living in “little communities” in the region. Among Cambridge Bay participants, three grew up there, three moved from Peary River, and two others moved to Cambridge Bay from other neighboring places. The remaining participants did not disclose their background information. Some discussed moving to Cambridge Bay because the outpost camp or the trade center in their community closed. One of the elders in this study, moved to Cambridge Bay from Peary River in 1961 because his father was sick with tuberculosis and had to be close to a nursing station. Another elder, John, used to trap years ago until Hudson Bay Company personnel told him that foxes were not going to be worth much anymore, and he found a job at the DEW line site in town in the 1960s. He has also worked briefly in mining, which he found was more lucrative. Sammy from Cambridge Bay shared he still misses living out in the land: “We are used to this way of life and feel [we] are stuck here, we’re stuck here, having to be in one place.”

Food was a central theme in recollections of these exchanges. Christine of Kugluktuk describes how eating “southern” food was a part of the residential school experience, as notable as learning English: “Growing up, I would have caribou blood for juice, all these traditional foods. Cooked intestines and whatnot. I was taught syllabics in my language and everything and then going to school, I learned a whole different story, a whole different thing. I had to learn 1-2-3, ABCs. Plus, I learned how

to have pizza and all these kinds of food, and speak this English language.” Several other participants described how residential schools separated them from their families and from learning the skills of subsistence hunting and survival and being able to learn and practice these skills only during their summer trips home.

Despite the difficulties people have faced in learning and practicing traditional ways of living, participants in both communities said that they relied heavily on the land and strongly preferred traditional foods. Hunting expeditions have now evolved and involve a blend of traditional practices combined with modern technologies like GPS, snowmobiles, motorboats, high-powered rifles, fuel, and other equipment [32,74]. While this modern equipment increases access to the land, it is also expensive to purchase and maintain. This results in a dynamic tension between wage employment and hunting, as involvement in the wage economy restricts the amount of time available for hunting and harvesting, but it provides the necessary capital for outfitting hunting expeditions. This tension is summarized well by Nuttall [74]: “The reality for most Nunavummiut is that the best return for one dollar comes from hunting, but without a dollar, hunting is not possible.” These pressures on the traditional food system were concerning to many participants, who noted that young people were growing up with a focus on jobs and money and new technology, not on hunting or learning from their elders. Participants in both communities worry that skills and traditional knowledge may not be passed on to the young generation.

For households that lack an active hunter, participation in the food sharing network is one way that the household may still access country food [59]. This system of sharing food, *ningiqtuq*, is found throughout Inuit communities in Nunavut [57]. This system involves a complex web of hierarchies and traditions for sharing food harvested from hunting. This sharing may be among family or “restricted extended family” or it may take place in community-wide sharing in the form of communal meals or radio announcements to share a harvest with someone in need [74]. Among participants in Kugluktuk in particular, there was a concern that sharing has decreased. A decline in hunting among elders, and a reported lack of interest in traditional ways among youth, are also reported and discussed in the following sections.

3.2. Changes in Local Availability of Food

In this research, we use “availability” to represent the general supply side of food security, both in terms of the amounts of basic resources such as wildlife available as well as production and procurement (e.g., hunting or fishing). In both communities, hunting and fishing supply a significant portion of the community’s food intake. According to government reports, “country foods” comprise about two-thirds of the dietary intake (by weight) in both towns: caribou alone supplies 40%, fishing accounts for an additional 13–15%, with muskox, marine mammals, and birds contributing an additional 8–10% of all dietary intake [75]. Imported and local foods are also available for purchase at stores and co-ops. Two major changes in availability that were reported by the community members in both communities are changes in wildlife (e.g., migration patterns, population size, species), and changes in harvesting (e.g., number of active hunters in the community).

In both communities, caribou was the most frequently discussed wildlife species. In Kugluktuk, there was widespread agreement that caribou were changing their migration routes and were further away from the town than before. In Kugluktuk, a later freeze-up of the Northwest Passage was consistently described as the reason why caribou had moved farther away: “They would be coming from Victoria Island and they don’t do that anymore. Because of the late freezing, I think they go by more east, towards Cambridge Bay and somewhere around Bathurst area maybe.” A decline in precipitation (rain and snow) and subsequent lack of plant growth was considered as another reason caribou may be declining: “If we have lots of snow, lots of rain, we have lots of plants for the animals. But we don’t get very much snow, we don’t get very much rain. The creeks, the river, anywhere you have the lakes. Most of them are drying out too . . . That’s why it’s getting harder for people to hunt

caribou.” In total, changes in weather and sea ice were mentioned in seven interviews (half of the interviewees) in Kugluktuk in connection with declining caribou stocks.

While several participants in Cambridge Bay also commented on the decreasing abundance and proximity of caribou, two interviewees seemed not too worried about the caribou stocks in Cambridge Bay. Another participant clarified that the later freeze-up (widely noted among respondents in both communities: see [32]) had not affected their caribou supply as much, because the caribou wait on Victoria Island for the Passage to freeze before heading south for the winter—Providing Cambridge Bay with access to caribou no matter the timing of the freeze. However, other interviewees from Cambridge Bay described how caribou were declining in general in the past few years, so larger population-level effects may become an issue for those in Cambridge Bay. Some participants in Cambridge Bay noted that the caribou were also thinner than usual; others described caribou drowning from trying to cross when the ice was not yet thick enough. Development in Cambridge Bay, according to two participants, has pushed wildlife away from the town. Some acknowledged this as a tradeoff: Ned, for instance, notes that seals and game animals used to come close to the town, but now they stay away. He concludes “We have to get food in our stores and stuff.”

Fish stocks were also a common concern among participants from both communities. In Kugluktuk, several interviewees mentioned an alarming decline in Arctic char. Participants in both communities reported a recent increase in the abundance of whitefish.

Participation in hunting was another major topic discussed in the interviews—especially among participants in Kugluktuk. While one interviewee in Cambridge Bay was said to go hunting less as he was getting older (according to his wife), in Kugluktuk, four interviewees mentioned that the older, more experienced hunters were going out less. Bob from Kugluktuk, for instance, notes that “as an elder, there’s not very many of us that stay out on the land for a time now . . . we’ve gotten older, I’m having some health problems and I can’t get out on the land very much anymore.”

Finally, in over half of the interviews in Kugluktuk, participants expressed concern or frustration that youth were not as interested in hunting. As one participant, Betty, from Kugluktuk describes, fewer people hunting means less food available to share with the community: “Yup, they’re going to the mines, getting jobs. There used to be lots of hunters, I think there’s less hunters now . . . we depend on people to get the meat and everything. If we can’t get it or if they can’t give it to us, we have to buy the meat. And it gets harder and harder. Like we don’t have jobs for where we get the money to buy meat.”

Lastly, Bob from Kugluktuk expressed concern about the strains of population increase on food availability: “Our basic ingredients, like the fresh fruits, our vegetables, animals, aren’t keeping up with the population of people. I’ve noticed that lately. As a child I’ve known Kugluktuk to have a population of 500 maybe, compared to today, there’s 1500 people. And that makes a huge difference.”

3.3. Lack of Direct, Financial, and Familial Access to Country Foods

We use the accessibility category to describe issues and obstacles related to obtaining food, either in hunting, sharing, or purchasing food. Food access was discussed in these interviews primarily in relation to ability to participate in hunting, barriers to hunting safely or successfully, as well as the participation in distribution networks (e.g., social sharing); monetization of food and ability to afford food was another common theme in the interviews. There was general agreement that harvesting and accessing country food is very dependent on money and getting prohibitively expensive for some, financial hardship limits access to all foods, both country foods and store-bought.

However, it was clear to many participants that environmental changes have made accessing country foods more challenging in recent years. A later fall freeze-up of Queen Maud Gulf and Coronation Gulf (both are part of the southern route of the Northwest Passage) was mentioned by nearly all participants in both towns as delaying access to hunting grounds. In Kugluktuk, lack of snow was an additional concern for many participants, since less snow meant rougher travel in the winter, and extra time and expense navigating around rough patches and repairing damaged machines.

Accidents have become more frequent due to thinner ice, shallow snow patches, and other navigational difficulties during storms (also discussed in [32]). An increase in shipping and icebreaking was mentioned in connection with both wildlife disruption and hunting grounds access. One participant in Cambridge Bay recounted a story of a hunter being stranded for several days after an icebreaker cut off his ice route back to town. Other environmental changes that presented challenges to navigation are given in Figure 1 and discussed in more detail in Panikkar et al. [32].

Figure 1. Environmental changes observed by participants in Cambridge Bay and Kugluktuk.

Less sharing and the monetization of country food was a common concern, especially among participants in Kugluktuk. In a group interview there, participants discussed how people were buying and selling country food instead of sharing: “With all prices of groceries going up, it used to be easy to access all the country food. But it’s getting tougher to get . . . they’re not sharing no more.” Another Kugluktuk participant noted “people nowadays are selling country food like crazy. They’re selling it to their relatives or other people. They’ll sell it to maybe HTO or somewhere else, and they’ll tell their own: ‘Oh, go get your meat from there, I just bought some.’” Betty, also from Kugluktuk, expressed dismay at the idea of having to buy country foods from her own relatives: “A long time ago, even though we did have jobs, everybody used to help each other. But now we have to buy everything from one person or another person to get by. Even with anything that you really need . . . any groceries, anything you cook, you have to buy it now from people sometimes, even your own relatives. I have lots of relatives too, they get lots of meat, they get lots of caribou or anything. It’s really, really, really hard. You have to ask. If they can’t give it to you, might have to buy it . . . when you don’t have a job, you’re on old-age pension, social assistance, the meat and the food, they’re really . . . the prices are so high! Some people have to go to ask another person, ‘Can you buy this for me?’” A burdensome cost of living and food was reiterated by several Kulguktuk participants.

3.4. Agency and Decision-Making Power over Food Systems

Some participants had a grim view of their agency over the food systems due to heavy reliance on the wage economy, inability to stop impacts of climate change, and a sense of powerlessness regarding the influx of development and industry.

For Ned from Cambridge Bay, the entrenchment of money and government programs in the food system was especially difficult to accept: “I’m just kind of lost right now for words. I seen it too long, and I don’t know how to explain in a right way, to make people understand that life is changing, as an Inuk. We don’t have to change it, but it’s changing—we have no choice. We have to live off the government. We have to rely on them if [people are] not very oriented with our land . . . so food’s been kind of scarce. People love [the] food here and they still do, but you have to go further, and it costs money to go out there. Everything, it’s all money.” In Ned’s assessment, reliance on government and money is connected also with the loss of traditional knowledge.

While some shared Ned’s sentiment of being unable to stop the changes that are affecting the Inuit lifestyle, others described their strategies for adapting. Some participants noted that honing the cultural capability of traditional knowledge and skills of subsistence harvesting is key to resilience, to change, and in maintaining autonomy over food systems. Bob from Kugluktuk was especially wary of placing trust in the cash economy and southern foods: “Some of us try hard as we can to teach our young people to be out on the land, but the majority of the community, especially in my age group, they’ve never been trained out on the land anymore, and they’re the ones that are really having a hard time with country foods or . . . they’re always depending on jobs. Jobs are not forever. Jobs are only as long as the project, the life of the project. Might be a couple years, 20 years, or even my life—my life is not forever. That’s what we’re trying to teach young people all right, we want to go back out on the land as much as we can, but we keep telling them, you can’t depend on feeding yourself from the southern parts of Canada.” In a group interview in Kugluktuk, several participants said that they adapted to changes by changing their hunting routes, just like other mammals change their migrations.

3.5. Stability and Sustainability of Food Systems

A sustained harvest of traditional foods depends on hunters and wildlife: participants in this study were concerned about the long-term sustainability of both aspects of the traditional food system. The declining availability of many important fish and game species (discussed in 3.1) made some, like Betty from Kugluktuk, worried that there will not be much left to hunt: “. . . some years we probably will not even be seeing caribou, because of the climate change. And if there’s no caribou and muskox and other things, it’s gonna be hard for everybody.” Others were worried that besides the availability of animals, the current generation will not have the knowledge and skills to safely hunt. Participants in both towns described youth as increasingly likely to take risks without adequate preparation. Lenny from Kugluktuk shares: “My main concern is that none of them will go out hunting anymore. And they don’t know the sea ice conditions. They don’t know how to travel on the ice or on the ocean. They don’t know how to read the weather . . . kids these days are gearing more to staying in town and going out just for day trips. But those day trips could be dangerous for them because they don’t know what the hell they’re doing anymore.” Other participants shared accounts of young people getting lost or even dying from going out onto the land unprepared.

In addition to concerns about availability, several participants commented on issues with the quality of country foods. In Kugluktuk, Bob mentioned a decrease in quality of char and meat: “We’re noticing that the Arctic char isn’t really Arctic char anymore. It tastes more mushier or something. And the meat is a whole lot different from what it used to be. Although there’s still a few places where you can get that pristineness in the meat content, where the glaciers are.” Disease also affects meat quality. Participants in two interviews in Cambridge Bay and one in Kugluktuk mentioned an increase in diseased muskox. Both Jim and Ned from Cambridge Bay describe the toll of disease on muskox: “I used to do a lot of muskox harvesting. And there were always muskox around. But we haven’t been doing any harvest lately because they’re so far away now. And they’re getting some kind of disease

that kind of chase everybody away”; “Either way, north, west, or east. We’ll see very few now . . . sometimes I look out there and I’ll see muskox, like about eight, nine years ago. Now I can’t even see anything there. But when I travel to Victoria Island to go fishing on the lake, I’m running into more dead muskox.” These examples mirror other observations of an increase in parasitic diseases in animals [25].

Some interviewees expressed concerns about the impacts on wildlife due to contaminants such as mercury. Three participants from Kugluktuk specifically described mining as a cause for disrupting wildlife or changing the productivity of the land. For instance, one describes working for a company that left permanent impacts: “I’ve worked with quite a few companies, and there’s one or two companies that weren’t, how would you say it, the cleanest, but they weren’t the worst . . . they did the best they could to maintain that hazard . . . And I was fortunate enough to be there just to try and keep it contained. But hazards find ways to leave, to spread. That’s what I think of ‘hazard,’ it spreads quickly. And it devastates our economy—huge! You can see it. Like where there’s been a mining camp, you can tell, nothing’s there, just dead. Nothing at all, just like a drought happened.” Participants from both communities mentioned development, noise, and dust from the mining operations, as a reason that animals were moving farther away.

The overall sustainability and stability of country foods, therefore, depends on more than just maintaining availability: it also depends on maintaining hunting traditions, equipping the younger generation with adequate skills, and mitigating impacts from contamination, development, and disease.

3.6. Health and Wellbeing

Wellbeing was discussed both in terms of individual health and that of the land. Hunting is one of the primary ways that community members spend extended time on the land, which itself was described as healing. For instance, Dennis from Kugluktuk says: “I think . . . when you go out on land, it makes you feel so good inside. You stay in the community, you don’t have jobs, you get more stressed out. It gets harder . . . They get more stressed out without going out on the land because you heal out there.” Similarly, Ned from Cambridge Bay describes how being on the land is key to his personal wellbeing: “Just go out there and—if the air is good, and you breathe it, that’s when it hit you. You go— [takes deep breaths]—Then you finally calm down. It’s nicer out here, nice and quiet. That’s the only way we’re gonna survive, is breathe. Don’t hold anything back, let it out.”

Changing food preferences were also described as a threat to health. Dan, from Cambridge Bay, had an unfavorable opinion of imported foods: “That was our diet many years ago, that’s all we eat, native food. I would say on the land, animals in the ocean, they are fresh, the way I see. It’s all fresh. Not food from down south.” Beverly from Kugluktuk says that disease and sickness are connected to less frequent traditional food consumption: “Getting no more country food. That’s why people getting sick all the time, from northern store, co-op store—no good.” Christine, also from Kugluktuk, noted an increase in obesity in children and youth: “You see more kids today, more obese, more overweight.” In an aboriginal people’s survey on Inuit health, 26% of Inuit surveyed were reported as obese compared to 16% for non-aboriginal people [76,77]. In this study, those who were obese also had poor health and strong family ties were associated with excellent or very good health. Many studies have indicated the health and nutritional benefits of traditional food sources compared to the imported foods available for purchase in Arctic communities [78,79], suggesting that reliance on imported foods can have direct negative impacts in terms of poorer health outcomes [80].

Mental health was frequently discussed in connection to wellbeing. Participants in Kugluktuk discussed substance abuse and suicide, noting the huge toll both have taken on the community. Some relayed that poverty and lack of jobs as the major cause of alcoholism and drug use. An increase in substance abuse also impairs the traditional culture of subsistence as those dependent are incapable of carrying out these traditions. Betty from Kugluktuk noted that “we didn’t have very many people to work in social services, like mental health workers. Now it’s a good start, since beginning of the

year. I think we have three people. We're getting more help, and sending people out. A lot of people died or committed suicide through the years."

Rates of drinking and smoking are in general already much higher in the Inuit population compared to the non-aboriginal people, all of which also increases the risks of chronic diseases [81]. Only 44% of the Canadian Inuit have access to a doctor and most Inuit communities only have a nursing station, though these communities are severely socially and physically stressed [81].

As discussed in previous sections, an increase in hazards and accidents has been observed in both communities, in particular related to being unprepared and unskilled in survival techniques [32].

4. Conclusions and Discussion

Climate change makes the environment more variable and triggers unpredictable changes in bodies, spaces, and ecologies—and on the systems, functions, and processes that influence them. This research highlights that climate change threatens resource availability but also cultural capability, by making subsistence a riskier practice. Inuit who have traditionally been adept in reading the environment and surviving on the land are finding these skills both in decline and also less reliable than before in an increasingly unpredictable environment [32]. While participants in this study felt that maintaining traditional skills was essential to long-term survival, climate change challenges these coping and adaptive capabilities. These risks are further exacerbated by socio-cultural changes that have disrupted the generational transfer of knowledge, as well as increases in disease and contamination that threaten the long-term viability of traditional food sources. Overall, these combined impacts stand to undermine the food sovereignty of these communities. Climate-mediated food insecurity hence can be seen as a complex syndrome of multiple causes: ecological injury, loss of natural resources, and cultural injury.

While there were many concerns shared by both communities, participants in Kugluktuk brought up a number of concerns that were not reflected among interviews in Cambridge Bay. While many participants from both towns commented on a declining availability of caribou in general, those in Kugluktuk were especially concerned about the impact of freeze timing on caribou availability, where hunters in Cambridge Bay suggested that they were buffered from this impact by their location on Victoria Island (north of the Passage); lack of snow was also making hunting harder in Kugluktuk, a change not noted in Cambridge Bay. A decline in sharing networks, increased difficulty affording food, and having to buy food from family members were all noted in Kugluktuk only; participants in Cambridge Bay offered more general reflections about the entrenchment of money in the Inuit way of life and rising costs but did not describe similar hardships as those in Kugluktuk. Kugluktuk participants were also especially worried about the impacts of substance abuse and suicide on youth and specifically mentioned imported foods as a cause for sickness. Not all interviewees were asked the exact same questions in interviews, and the survey participants do not represent a comprehensive survey of these towns, so this observation does not necessarily prove that these issues only exist in Kugluktuk. However, as these observations were consistently raised by Kugluktuk participants, and since similar topics and questions were covered in Cambridge Bay, we believe there is cause to believe that Kugluktuk residents are facing a higher burden of climate-related food insecurity than those in Cambridge Bay. These results concur with other studies which have shown a decrease or change in the availability of wildlife in the Arctic [11,13–19]; the impacts on subsistence practices due to climatic change [4,5,33] and the adverse impacts to subsistence and country foods from climate change, and developmental pressures [82].

The differential experiences in Cambridge Bay and Kugluktuk are also supported by the difference in socio-demographic makeup of the two hamlets. The latest census data of the National Household Survey [83,84] shows that Inuit in Cambridge Bay had a higher employment rate (60%) and lower unemployment rate (14%) compared to Kugluktuk which has an employment rate of 36% and an unemployment rate of 28% respectively). Additionally, the Community Well-Being (CWB) Index shows that Cambridge Bay ranks higher than Kugluktuk in all categories, such as income, education,

housing, labor force activity, and overall CWB [85]. Recent research on Inuit participation in wage and land-based economies in Inuit Nunangat show that Nunavut had higher participation in land-based activities compared to Nunavik, and Inuvialuit [85]. A total of 74% of men and 59% of women in Nunavut participated in hunting, fishing, or trapping and 46% of women were engaged in gathering plants compared to 30% of men but these land-based activities were heavily influenced by the income and labor status of the people. Inuit not in the labor force were less likely and those with higher income were more likely to participate in land-based activities [83,86–88]. These studies show that those involved in the wage economy are more able to avail mechanisms and technology to undertake subsistence and practice it safely.

The frequent descriptions of food insecurity and economic hardship in connection with climate change among interviewees in Kugluktuk suggest that climate pressures could be exacerbating certain underlying structural inequities in these two communities. With the decreasing availability and access to country foods, both communities could be described as “food swamps”—areas where only unhealthy foods are readily available [89]. Additionally, healthier options of fruits and vegetables are available at some stores but are often exorbitantly expensive, creating “food mirages” [90] and leaving people to buy increasingly poor-quality packaged foods. Opting for cheaper food sources also brings new risks, as many chronic health challenges are connected to these non-nutritious foods [91]. Our interviews confirm the centrality of traditional foods for Inuit health and wellbeing.

The intersecting character of climate change, colonial power relations, and participating in a capitalistic globalized economy compounds the challenges of mediating cultural and relational responsibilities towards land. These changes together increase reliance on imported food regimes that fashions everyday cognitive and social behaviors away from local cultural norms and practices. Further, lack of agency, self-determination, and sovereignty keeps people in a disempowering cycle that perpetuates structural inequities.

While climate change makes subsistence riskier, approaches to address climate change alone are insufficient to reverse and prevent future threats to Inuit communities in the short-term. Declining local food sources such as caribou and Arctic char also threatens Inuit communities. Measures to protect the Arctic wildlife, addressing developmental pressures and new sources of pollution, safeguarding subsistence practices, intergenerational transfer of cultural capabilities, and enhancing human-nature reciprocity are important to ensure food sovereignty and adaptation in the Arctic in the long run. Traditional skills in navigation, survival, hunting, trapping, fishing, and gathering food and medicine are a means of resilience and survival. Inuit have used these skills to stay resilient in an environment where biological productivity is low, resources are patchy, and availability is unpredictable. Their unique ways of observing—constant monitoring for unusual signs and signals, intimate knowledge of the landscape, deep understanding of natural processes—give them a great deal of personal autonomy and sovereignty as well as competence even under conditions of resource unpredictability [4,92]. To observe and adapt to change is one of the most valued and respected skills among Inuit, it denotes alignment with the world and a refinement of the spirit [93]. While Inuit might be able to stay resilient and adaptive to the onslaught of climate change it is still morally, ethically, and legally problematic to inflict ecological injury and merely exacerbate unjust and exploitative relations. Hence, southern nations need to step up to ensure that those who cause harm help to restore balance and wellbeing [93].

Inuit and Canadian governments have an enormous historic responsibility to protect local cultural traditions and capabilities and reject policies that continue to be detrimental to Inuit long-term security, health, safety, and well-being. Firstly, further studies are required to understand the decline in resource availability (e.g., caribou and Arctic char) in these communities and how climate change is impacting local biodiversity. Many HTOs participate in biomonitoring programs to engage in responsible harvesting, these programs provide valuable service to the communities and need to be better supported and protected. Secondly, programs that encourage local adaptive capabilities and enhancing the intergenerational knowledge transfer on subsistence practices to the youth were

for the most part seen favorably by participants in this study. Youth perspectives are important to bridge the inter-generational gap between elders and younger members of the Inuit communities. Future studies should examine why the youth are less engaged or able to participate in or learn about traditional ways of life (including hunting, learning more comprehensive outdoor and survival skills, or less involved in supporting extended family members or sharing networks). Lastly, a situated understanding of how climate change is impacting the local communities is required in order to address the resilience and adaptation of these communities. Empowerment of communities, by means of better job training, job opportunities, social services including basic health and mental health services are required and implementing decolonizing strategies that retain local knowledge is important to trigger unique mechanisms of coping, problem-solving, and adaptation as climate change accelerates. In this study, we argue that ecological injury, environmental injustices, cultural injury, and food insecurity can be prevented by contesting national policies and programs that impinge on Inuit sovereignty, self-determination, and Inuit Qaujimajatuqangit or knowledge.

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