



Climate Change Effects on Traditional Inupiat Food Cellars

Center for Climate and Health

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This paper reports on a special health concern identified in Point Hope during the Climate Change Health Impacts Assessment performed in May 2009: the thawing of traditional food storage cellars due to warming soil temperature. This problem is reducing the quality and quantity of food available to the residents of Point Hope. Adaptive strategies are necessary to restore food security in Point Hope and in other Arctic communities that depend on traditional storage cellars.

Introduction

In May of 2009, the Alaska Native Tribal Health Consortium (ANTHC) performed a Climate Change Assessment in Point Hope, Alaska. It was performed by ANTHC's Center for Climate and Health in partnership with the Maniilaq Association, the regional tribal health consortium for Northwest Alaska. The purpose of the assessment was to record local observations related to climate change and to explore adaptive strategies for improving community health. The purpose of this paper is to raise awareness about an emerging health issue and to identify potential adaptation strategies.

Background

Point Hope is an Inupiat community of about 700 residents. It is located on a gravel spit that creates a natural peninsula extending out into the Chukchi Sea. It is an ideal location for hunting and gathering wild foods, most importantly bowhead whale. Whaling defines the identity of Point Hope and drives social and cultural activities. From a nutrition, food security and mental health standpoint, whaling is critical for overall community wellness.

During our assessment, twenty-two interviews were performed including with the Mayor, the Tribal Council President, other representatives of the city and tribal council, as well as the school, health clinic, fire department, police department, and public works. Elders were interviewed, including retired whaling captains, and there were discussions with students and presentations at Tikigaq School. Throughout the interviews, concern about the thawing food cellars was expressed repeatedly as was the desire to find a solution.

In Point Hope, underground cellars dug into the permafrost have provided food storage for thousands of years. Nature provided the Inupiat with all the necessary materials: whale bone and drift wood for the frame, sod for the roof, and frozen ground for refrigeration. The traditional cellars, “sigl-uaq” in the Inupiaq language, are still in use today. They offer convenience (located near the old town site), ample space, and an economical method for refrigeration (see a site in Figure 1 below).

However, during the last decade, average summer air temperature in Point Hope crossed a threshold, resulting in “permafrost” was no longer permanent. Above average temperatures resulted in sigl-uaqs where the ground was completely thawed and sometimes flooded with melt water. As a result, whale meat and blubber from the Spring whale hunt has being put in storage months before the ground temperature is cold enough to freeze. This can result in spoiled meat, increase the risk of food related illness, and become an attraction for polar bears and other animals. If warming trends continue in the Northwest Arctic, we can expect to see decreasing periods when ground temperatures are adequate for food storage. The loss of traditional sigl-uaqs is a crisis for Point Hope and for other Arctic villages.

National Weather Service data indicates that the Northwest Arctic climate has been gradually warming, with a 3.3°F total increase in annual temperature between 1949 and 2005. During the same period, the increase in summer temperature was 2.7°F, and 7.2°F in winter (Shulski & Wendler, 2007). Within 50 years, (2061 to 2070) Point Hope’s mean annual temperature is projected to increase by an additional 6°F to 12°F (SNAP, 2009). Climate models also project increases in precipitation across Alaska and higher summer temperatures would increase evaporation and transpiration resulting in drier conditions and reduced soil moisture (Meehl et al., 2007). Permafrost temperatures have increased throughout Alaska since the late 1970s (Lettenmaier et Al., 2008). As much as the top 30 ft of discontinuous permafrost is projected to thaw in Alaska over this century (Parson 2001). The largest increases in soil temperature have been measured in the northern part of the state (Osterkamp, T., 2007).

Vulnerability & Adaptation

Arctic indigenous peoples are known to be particularly vulnerable to health impacts of climate change, in part because of the threat to traditional food safety and food security (Confalonieri et al., 2007). The traditional subsistence diet of Alaska Natives is nutritious and protective against the development of

cancer, heart disease, diabetes and other metabolic disorders (Boyer et al., 2007). Loss of adequate storage effects food security and also raises concerns about the potential for foodborne illnesses.



Fig. 1 Sigl-uaq – Old Town Site, Point Hope (note: bail buckets) Photo by M. Brubaker

The most common types of foodborne illnesses in humans are caused by bacteria such as *Campylobacter*, *Salmonella* and *E. coli*, and viruses such as Norovirus. Higher temperatures have been found to increase incidences of *salmonella* cases (Kovats et al., 2004). These pathogens typically cause symptoms such as fever, diarrhea and abdominal cramps. Pregnant women, infants, the elderly and those with weakened immune systems are at higher risk for severe infections. Community health aides have not reported any unusual change in the number or type of food related illnesses in Point Hope (Davenport, A., 2009). However the health aides and other residents, including whaling captains, have expressed concern about the decreasing quality of sigl-uaq stored whale meat (Towksjhea, J., 2009).

The environment inside the sigl-uaq critical to food safety. Bacteria must multiply before enough are present in food to cause illness. Given warm, moist conditions and an ample supply of nutrients, one

bacterium can produce millions of progeny in a single day. Below freezing temperatures (32°F to 0°F) impede most bacteria growth but allow some to survive. The optimal storage temperature for most frozen foods is from 0°F to -10°F (USDA, 1994). Whale meat and whale blubber preserve differently, temperatures below -10°F are ideal, allowing for preservation of up to one year (Drum, D., 2009).

Preservation of food is accomplished in several ways. In addition to refrigeration, high levels of salt, sugar or acid keep bacteria from growing, which is why salted meats, jam, and pickled vegetables are time honored methods for preserving foods. Similarly, microbes are also killed by heat. If food is heated to an internal temperature above 160°F for even a few seconds it is sufficient to kill most parasites, viruses and bacteria. The toxin that causes botulism is completely inactivated by boiling. This is why canned foods must be cooked to a high temperature under pressure as part of the canning process. To address food security and safety problems in Point Hope, alternative methods for food storage can be developed. There are several possible adaptive approaches: 1) improve the storage environment at the current location, 2) establish new *sigl-uaqs* at a location with a better subsurface environment, and 3) develop an alternative method for food storage.

1. Improve the environment at the current location

The conditions at the *sigl-uaq* location in Point Hope make continued use of the traditional sites very challenging. Erosion has caused many of the *sigl-uaqs* to be reclaimed by the sea, and storm surges can flood the old town area. Permafrost thaw creates two problems; the lack of adequate soil temperature and high moisture and humidity. Factors including ventilation, drainage, and temperature should be considered in developing appropriate storage strategies.

*2. Establishing new *sigl-uaqs* at a location with a better subsurface environment*

There may be other locations near Point Hope where the conditions are better suited for underground food storage. With an understanding of local permafrost conditions, other sites could be considered. Year round soil temperature is a key measure of suitability. Currently there is at least one soil boring located in Point Hope actively logging soil temperatures throughout the year. This was established through a collaborative project between the Tikigaq School and Kenji Yoshikawa of the University of Alaska Fairbanks, Geotechnical Institute. There are also plans underway to install temperature loggers inside *sigl-uaqs* to acquire more information about year round temperature. Development of test borings in other areas could help identify potential alternative storage sites.

3. Develop an alternative method for food storage

There are alternative methods of food storage that could be considered, such as community freezers using conventional systems and alternative approaches that blend new technology with traditional knowledge. Alternative methods for using underground cellars have been developed in many places around the Arctic and provide models that are efficient and cost effective. Training courses are available in Alaska that provide instruction on how to build food storage structures that achieve optimal temperatures (0°F to -10°F) with maximum efficiency (Drum, D., 2009). Another possibility is the development of sigl-uaqs that are assisted during warm months from refrigeration. It is possible to construct efficient systems powered by alternative energy (H'ebert, J., 2009).

Discussion

Loss of traditional food storage cellars is occurring in Point Hope and other Arctic communities in Alaska, due to warming soil temperatures and permafrost thaw. This phenomenon is reducing the quality and quantity of food available to residents. Adaptive strategies are necessary to restore food security. Any adaptation response should be locally driven, culturally appropriate, economical, sustainable and meet public health guidelines. Adaptive practices for food management can help to reduce the negative effects of climate on health (Lake et al. 2009). Without adaptive measures, current climate conditions will continue to destabilize food security and increase the risk of foodborne illnesses in Point Hope.

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