Climate change, environmental risks, and the food security of subsistence communities in Greenland and Alaska

Christine DeMyers, The University of Texas at San Antonio, San Antonio, TX
Advised by Dr. Igor Krupnik and Dr. Bill Fitzhugh, NMNH Department of Anthropology, Washington, D.C.

NSF EAR-1062692

BIG PICTURE

Throughout Earth's history the climate has been shifting naturally. During the 14th century, the climate in the North Atlantic began to change from a prior Medieval Warm Period (MWP) to a cooler phase later called the Little Ice Age (LIA). Today, in the 21st century, the warming climate is an increasing global concern and many marginalized, indigenous communities are already experiencing its harsh effects. When assessing possible adaptive and mitigation strategies, it is important to look to historical accounts of human groups' relations to the changing climate. As the shift from the Medieval Warm Period to the Little Ice Age has already proven less dramatic than the current shift in climate since the Little Ice Age, careful considerations need to be taken about the risks posed to human populations that result from anthropogenic climate change. The Arctic is a pertinent area of study as temperatures in these areas are increasing at rate of twice the global average.

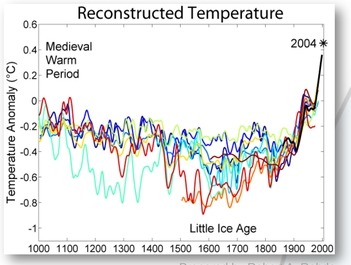
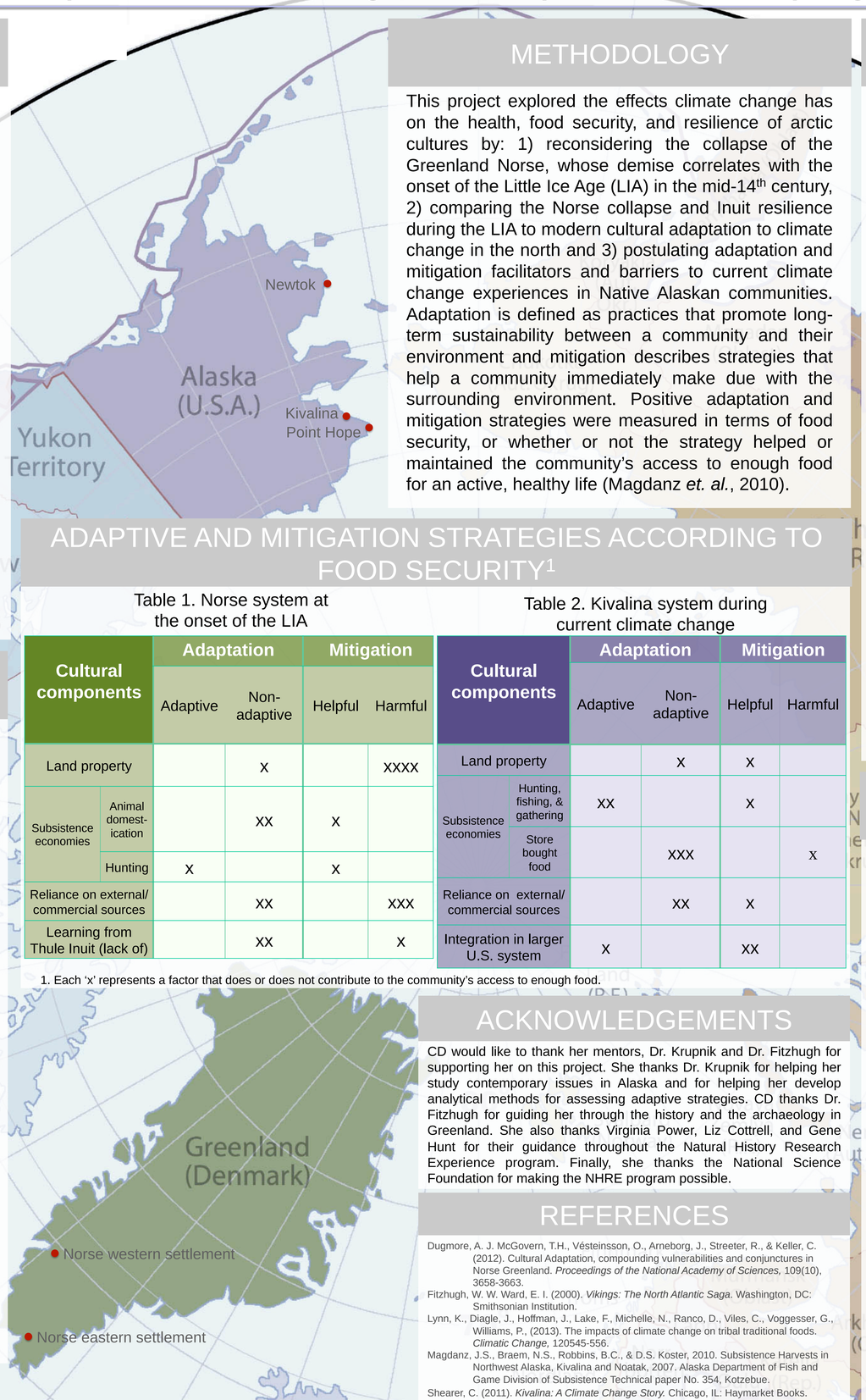


Figure 1. In Greenland, the shift in climate from the Medieval Warm Period to the Little Ice Age was distinguished by increasingly cool, less dependable summers. The Little Ice Age was a northern hemispheric phenomena that lasted from around 1350 to 1850. With current atmospheric CO_2 levels reaching a record high in the past 500,000 years, the climate today is rapidly warming.

10TH-15TH CENTURY GREENLAND

During the onset of the LIA, the Norse colonists in Greenland faced threats to their food security. By acceding to Norwegian rule, depending on trade with other European countries, and neglecting relations with their Inuit neighbors, the Greenland Norse were unable to adapt to the changing environment. They avoided partnership with the neighboring Inuit people and consequently, they were unable to adopt the Inuit technology for arctic travel or for hunting a wider variety of marine species. When the climate in Arctic Greenland cooled after 1300AD, the Norse struggled to maintain their temperate-zone European lifestyle and their ability to support their domesticated animals declined. Around 1450AD, the Norse abandoned life in Greenland while the Thule Inuit continued to subside from year-round hunting. The Inuit were not dependent on Greenland's sparse patches of grasslands and when the climate shifted and marine resources moved away, the Inuit simply followed their migratory patterns.

Figure 2. Drift ice became more prominent in the summers during the LIA. Sea ice created navigation hazards when traveling to the northern hunting grounds and when trading with other European nations.



METHODOLOGY

This project explored the effects climate change has on the health, food security, and resilience of arctic cultures by: 1) reconsidering the collapse of the Greenland Norse, whose demise correlates with the onset of the Little Ice Age (LIA) in the mid-14th century, 2) comparing the Norse collapse and Inuit resilience during the LIA to modern cultural adaptation to climate change in the north and 3) postulating adaptation and mitigation facilitators and barriers to current climate change experiences in Native Alaskan communities. Adaptation is defined as practices that promote long-term sustainability between a community and their environment and mitigation describes strategies that help a community immediately make due with the surrounding environment. Positive adaptation and mitigation strategies were measured in terms of food security, or whether or not the strategy helped or maintained the community's access to enough food for an active, healthy life (Magdanz *et. al.*, 2010).

ADAPTIVE AND MITIGATION STRATEGIES ACCORDING TO FOOD SECURITY[1]

Table 1. Norse system at the onset of the LIA

Cultural components		Adaptation		Mitigation	
		Adaptive	Non-adaptive	Helpful	Harmful
Land property			X		XXXX
Subsistence economies	Animal domest-ication		XX	X	
	Hunting	X		X	
Reliance on external/ commercial sources			XX		XXX
Learning from Thule Inuit (lack of)			XX		X

Table 2. Kivalina system during current climate change

Cultural components		Adaptation		Mitigation	
		Adaptive	Non-adaptive	Helpful	Harmful
Land property			X	X	
Subsistence economies	Hunting, fishing, & gathering	XX		X	
	Store bought food		XXX		X
Reliance on external/ commercial sources			XX	X	
Integration in larger U.S. system		X		XX	

1. Each 'x' represents a factor that does or does not contribute to the community's access to enough food.

ACKNOWLEDGEMENTS

CD would like to thank her mentors, Dr. Krupnik and Dr. Fitzhugh for supporting her on this project. She thanks Dr. Krupnik for helping her study contemporary issues in Alaska and for helping her develop analytical methods for assessing adaptive strategies. CD thanks Dr. Fitzhugh for guiding her through the history and the archaeology in Greenland. She also thanks Virginia Power, Liz Cottrell, and Gene Hunt for their guidance throughout the Natural History Research Experience program. Finally, she thanks the National Science Foundation for making the NHRE program possible.

REFERENCES

Dugmore, A. J. McGovern, T.H., Vésteinsson, O., Arneborg, J., Streeter, R., & Keller, C. (2012). Cultural Adaptation, compounding vulnerabilities and conjunctures in Norse Greenland. *Proceedings of the National Academy of Sciences,* 109(10), 3658-3663.

Fitzhugh, W. W. Ward, E. I. (2000). *Vikings: The North Atlantic Saga.* Washington, DC: Smithsonian Institution.

Lynn, K., Diagle, J., Hoffman, J., Lake, F., Michelle, N., Ranco, D., Viles, C., Voggesser, G., Williams, P., (2013). The impacts of climate change on tribal traditional foods. *Climatic Change,* 120545-556.

Magdanz, J.S., Braem, N.S., Robbins, B.C., & D.S. Koster, 2010. Subsistence Harvests in Northwest Alaska, Kivalina and Noatak, 2007. Alaska Department of Fish and Game Division of Subsistence Technical paper No. 354, Kotzebue.

Shearer, C. (2011). *Kivalina: A Climate Change Story.* Chicago, IL: Haymarket Books.

MODERN DAY ALASKA

Figure 3. In the native village of Kivalina, permafrost melts and late forming ice threatens the island's stability. The land is easily influenced by storms and erosion and because of this, the community has been trying to relocate for over two decades (Shearer, 2011).

Today, the warming climate is causing sea level rise, extreme weather, erosion, and permafrost thawing in Alaska's coastal regions (Maldonado *et. al.*, 2013). For subsistence communities that depend on the land for their food and health, the changing environment directly and indirectly influences the ability to hunt, fish, and gather food. Despite this, modern communities like the native village of Kivalina are food secure as federal mandates in Alaska are designed to prioritize traditional subsistence practices over other land uses. In addition, store bought food is shipped in to the community. The increasing pressure for a lifestyle that is more integrated into non-native American lifestyle however, is a major barrier to adaptation in Arctic Alaska. Shipments of store bought foods are often unreliable in the harsh climate and a decrease in traditional food use is associated with obesity, diabetes, and cancer (Lynn *et. al.,* 2013). Ever since the establishment of the stationary settlement of Kivalina in the beginning of the 20th century, the process of relocation in the midst of growing environmental hazards has become extremely difficult.

DISCUSSION

In Greenland and Alaska, both communities practiced more mitigation strategies than adaptive strategies. Mitigation allows a community to be food secure while maintaining its established cultural practices. For the Norse, continuing the Christian European lifestyle and failing to collaborate with the Inuit was not conducive to survival during the LIA but allowed the Norse to maintain their culture. Contrarily, Native Alaskans have historically incorporated elements of the larger commercial economy into their lives. Because the village of Kivalina *mitigates* with strategies that utilizes traditional subsistence practices and integrates western technologies, they are more prepared to be food secure than the Greenland Norse were. However, the reliance Native Alaskans have on agencies and policies for relocation efforts threatens their ability to practice efficient adaptive strategies. An optimal adaptive strategy for Native Alaskans living in coastal and low lying regions is the freedom to be mobile and to relocate in their rapidly changing environment.

Both cases reveal the importance of native knowledge when informing the decision making process. After a few centuries of living in Greenland, the native Norse accumulated Traditional Ecological Knowledge (TEK), or the "accumulated knowledge of environmental variability, resource fluctuation…and the temporal and spatial patterning of these dynamics on the local scale" (Dugmore e*t. al.,* 2012). If this knowledge was considered by the foreign bishops and Norwegian church, the Greenland Norse may not have abandoned their settlements. For Native Alaskan's today, indigenous knowledge is increasingly emphasized in climate research and policy. Despite the hazards of anthropogenic climate change, the rapidly changing environment is yielding an opportunity for native villages to regain community agency by perpetuating TEK and practicing adaptive and traditional livelihoods.

Smithsonian
National Museum of Natural History