

Introduction – Arctic and subarctic communities that rely on subsistence hunting and foraging are among the most vulnerable to the impacts of rapid climate change (CC). Observations from communities in Alaska have highlighted changes in species distribution, shifts in seasonal cycles and biophysical parameters (e.g., temperature, water level), and difficulties traveling to and accessing preferred subsistence sites [1]. These challenges have forced some communities to break regulations, such as seasonal closures or gear-restrictions, to maintain their livelihoods [2]. Forming regulations that are flexible enough to accommodate these environmental changes requires an investigation of the connections between resource use, local ecological knowledge (LEK), and perceptions of environmental change.

Understanding how humans use natural resources, curate environmental knowledge, and perceive their connections to local environments are hallmarks of ecological anthropology. However, these topics often remain disparate, with researchers focusing on separate explanations for each domain. Moving forward, we need projects that integrate data from each of these domains to examine their interconnections as a complex adaptive system [3] – especially regarding CC. Social network analysis (SNA) is a vibrant interdisciplinary field suited to this task. Anthropologists were early contributors to some of the key SNA approaches, but there has been much methodological and theoretical innovation since. By utilizing these innovations to understand connections between resources, practices, and perceptions, insights into the adaptive capacity of communities to CC can be uncovered.

Objectives – The purpose of this project is to understand the connections between participation in subsistence hunting and foraging, participation in cash economies, and LEK of CC. The overall aim is to integrate ecological, economic, and cognitive explanations into a single inquiry that sheds light on community resilience. The research questions for this project are the following:

- 1) What obstacles and opportunities do environmental shifts present for natural resource use?
- 2) How does participation in subsistence harvests and cash economies influence LEK of CC?

Preliminary Research – As mentioned in my personal statement, my master's thesis work at OSU provides a foundation for this proposed study. Preliminary findings suggest that considerable time, labor, and LEK is required to maintain diverse harvests and adapt subsistence practices in response to environmental changes.

Methodologies – With the approval of the regional tribal corporation (Bristol Bay Native Association) and local village councils, I will carry out a community-based field study using a mixed methods approach. I plan to investigate participation in subsistence and participation in cash economies using social network analysis (SNA). Following the framework developed by Bodin and Tengö [4], I will use an in-person questionnaire to identify network connections between individuals, natural resources, and economic enterprises. This flexible social network approach has been developed for the explicit purposes of describing social-ecological systems and identifying patterns of access to natural resources [4]. I will complement the SNA with semi-structured interviews for two crucial reasons. First, interviews provide essential data for understanding the themes in this project in their own terms and for uncovering salient themes. Second, qualitative data provides a rich context that aids the interpretation of the social networks and quantitative analysis. By using free-lists, local observations and integrated into the social

network analysis. This method can be used to construct cognitive maps of LEK that can be used to identify consensus around observations, locate influential holders of LEK, and describe the flow of information and expertise. By investigating these questions during an extended field study (≥ 12 mos.), I will be able document LEK that pertains to specific seasons, that may now be incongruent with or adaptive to shifting seasonal patterns.

Broader Impacts – My aim is to make this project community based. By using this approach, local research assistants and experts are included in the scientific process where they are often underrepresented. Moreover, community based research encourages information sharing between local experts and scientific experts to the benefit of both parties. In addition, I have already collaborated with the Alaska Department of Fish and Game and with communities on the Alaskan Peninsula. By training a young scientist that has these collaborative connections, there is an audience that is prepared to receive insights that can inform new regulations. In the past, changing these regulations has relied primarily on the testimony of local subsistence users. With support from the NSF, this project can provide an additional line of evidence for subsistence users to help sway policymakers like the Alaska Board of Game and Board of Fisheries. Beyond these local contexts, this project will illuminate strategies for resilience to CC that may be applicable in other settings. As CC begins to impact other parts of the globe, case studies that focus on the practical and theoretical aspects of resilience will be invaluable for policy decisions, intervention strategies, and community support.

Intellectual Merit – This study advances scientific understanding in three ways. First, it replicates a novel technique for constructing networks that identifies resource access, patterns of resource sharing, and the structure of subsistence and economic collaboration [4]. This method makes use of multiple levels of network connection, an approach that has been used in Northern Europe and can be replicated in Alaska. Second, it treats social and ecological systems as interconnected, providing a holistic analysis of change in Alaska. Over an extended field season, this integrated approach will precisely identify the timing of resource instabilities. Alaska is unique in that the use of subsistence and cash economies has been studied by ADFG for close to 40 years. This longstanding research tradition provides baselines for comparison for this expanded study of subsistence. Third, this project adds a cognitive component to the study of social-ecological systems. By quantifying LEK and incorporating it into the SNA, new patterns of cognition will emerge at the individual, household, and community level.

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2. Loring, P. A. 2013. "Alternative Perspectives on the Sustainability of Alaska's Commercial Fisheries." *Conservation Biology* 27 (1): 55–63.
3. Folke, C. 2006. "Resilience: The Emergence of a Perspective for Social–ecological Systems Analyses." *Global Environmental Change* 16 (August): 253–67.
4. Bodin, Ö, & Tengö, M. 2012. "Disentangling Intangible Social-Ecological Systems." *Global Environmental Change* 22: 430–39.