

1.1 Adaptation in a Changing Arctic: Ecosystem Services, Communities and Policy (Community Adaptation)

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ABSTRACT

This project documents the changing physical, biological and socio-economic conditions that are affecting people in the Arctic and identifies policies and strategies to assist communities in dealing with these changes. The project builds on previous work on the vulnerabilities of Arctic communities, and it is feasible because of established collaborations with northern people and organizations. The project includes case studies in all four of the ArcticNet IRIS regions. One main focus of the project involves integrating scientific and traditional knowledge of ice, permafrost, coastal dynamics and wildlife with information about community use of these ecosystem services. The other main thrust is to identify the opportunities in existing policies and co-management arrangements for adaptation strategies to help communities deal with changing conditions.

KEY MESSAGES

This project contributes valuable research findings in the area of community adaptation to climate change in the Arctic. Key messages from this project are summarized as follows:

- Communities across the Arctic are continuing to experience and adapt to change, including climatic, ecological and socio-economic changes
- Adaptation and enhancing adaptive capacity occur at multiple levels, and involve adjustments to ecosystem changes by individuals, communities and policy making institutions.
- Adaptation and capacity enhancement involve learning or the co-production of knowledge, and this is occurring through collaboration amongst northern residents and scientists, policy makers and managers
- Traditional knowledge provides valuable insight into ecosystem changes and contributes to enhancing capacity when integrated within management policies and decision making processes.

- Further analysis and investigation of adaptive capacity and the significant role of institutional arrangements and policy interventions is necessary to reduce vulnerability across the Canadian north.
- Supporting efforts that increase financial, health, educational, and cultural capacity in a community will often also enhance the adaptive capacity of the community to deal with current and projected future climate change risks.

OBJECTIVES

1. To integrate natural and social science and indigenous knowledge in vulnerability assessments.
2. To examine the institutional structures and processes which facilitate or constrain adaptation to changing conditions in Arctic communities.
3. To engage northern communities in assessments of adaptation strategies and options.

INTRODUCTION

The assessment of vulnerabilities and adaptations in and for northern communities has been identified as a priority area for research by policy-makers, local and indigenous communities, the Arctic Climate Impact Assessment (ACIA), the Arctic Human Development Report (AHDR) and the International Polar Year (IPY) planning committee (ACIA, 2005, AHDR 2004, Denmark Ministry of the Environment 2004, Government of Nunavut 2003, ICARP 2005, IPY 2005, McCarthy and Martello 2005, NRI 2002, Watt-Cloutier et al. 2005). More specifically, there is a need for research that assesses vulnerabilities, provides insight into adaptation strategies and enhances adaptive capacities based on incorporating multiple sources of knowledge and including multiple scales of analysis from local to global.

This project directly addresses ArcticNet's central objective, "to generate knowledge and assessments needed to formulate adaptation strategies and policies that

will help northern societies and industries to prepare for the full impacts of the transformation of the Arctic". The research aims to document and describe the physical, biological and socio-economic conditions that Arctic societies need to adapt to today and will likely be faced with in the future, and it identifies opportunities and institutional processes for effective strategies and policies to deal with changing conditions.

The project builds on the accomplishments of ArcticNet 4.2, which documented vulnerabilities in a set of northern communities where researchers have completed baseline vulnerability assessments and have established relationships with stakeholders. This experience affords an opportunity to develop longer-term research collaborations than is normally possible within the constraints of most research programs, to address gaps in existing research such as the need to further integrate natural and social science research on relevant exposure-sensitivities faced by these communities, and to systematically analyze the ways in which community-level adaptations are facilitated or constrained by institutions and policies at higher levels.

ACTIVITIES

Smit, B.

Findings with Tristan Pearce from research on the transmission of environmental knowledge and land skills among Inuit men in Ulukhaktok were published. The data were analyzed and synthesized with local researchers Adam Kudlak, Roland Notaina and Harold Wright, and writing was a collaborative process. Pearce is continuing to work with representatives of Helen Kalvak Elihakvik (School) to help facilitate the integration of land skills teaching into school curriculum. The research findings were presented at several international meetings, including the International Congress of Arctic Social Sciences, and UNU-IAS Indigenous Peoples, Marginalized Populations and Climate Change. Publications on findings were completed in several major journals including *Climatic Change*, *Arctic*, *The Canadian Geographer*, *Regional Environmental Change* and *Human Ecology*.

With Mark Andrachuk, analysis of the vulnerabilities of Tuktoyaktuk was completed and a paper submitted to *Global Environmental Change*. With Laura Fleming, the data collected for Hopedale, Nunatsiavut, were compiled and synthesized into a manuscript for publication. With Jackie Dawson, research on impacts of tourist shipping in the Arctic was undertaken, and publication prepared.

Furgal, C.

Agata Durkalec conducted field work in April and May 2011 in Nain and surrounding areas, Nunatsiavut, NL consisting of participant observation during multiple sea ice trips, consultation with Nain Ground Search and Rescue, and verification meetings with interview and focus group participants. Analysis of data and writing of thesis by Durkalec have been main activities since May 2011 to present. Results have been disseminated via several presentations and publications, including in *The Canadian Journal of Public Health*.

Bradshaw, B.

Kelsey Peterson completed a 10-week field season in Baker Lake, NU in summer 2011 to document the ways in which community capacity is being impacted by local mine development. Interviews were completed with 52 Baker Lake residents. A summary of this work is being delivered to the Hamlet of Baker Lake shortly, and will be presented at the upcoming joint IPY-ArcticNet meeting. Work with Prno on the vulnerability of Kugluktuk to climate and other changes was published in *Polar Research*.

Armitage, C.

Jennifer Fresque continues to work on adaptation to environmental change in Fort Resolution and undertook field visits (although funded through NSTP), and will be disseminating her results in the coming year. Findings on environmental changes and adaptation in Arctic societies were published in several journals including *Global Environmental Change*. Due to a move by Armitage of institutions (WLU to UW), changes in the

status of a student (Johnston), etc., limited substantive new activity was undertaken.

RESULTS

Smit, B.

- The transmission of land skills was studied among Inuit men in Ulukhaktok, Northwest Territories. The research found that there is a difference in the rate of land skills transmission among generations, with average transmission rates lowest among younger respondents. Several skills had not been transmitted, or were transmitted incompletely among younger respondents. Whereas these same skills had been transmitted by that age among older Inuit. Changes in skills transmission are attributable to changes in the educational environment, loss of native language, absence of skills teachers, and declining levels of involvement in some subsistence activities. These factors appeared to impair the traditional mode of skills transmission and hands-on learning in the environment, resulting in several skills not being transmitted to younger respondents. Incomplete skills transmission has already reduced some individuals' involvement in subsistence, and has increased the sensitivity of others to changing climatic conditions. The findings from this research were published in the journal *Human Ecology*.
- Contributions were made to the advancement of climate change vulnerability and adaptation research focusing on the subsistence sector in Canada by identifying and describing opportunities for future research, some of which are currently underway. This research is accepted for publication in the *Canadian Geographer*.
- A methodology for climate change adaptation planning in remote, resource-dependent communities was developed, applied, and published in the journal, *Regional Environmental Change*.
- Community member's perspectives on the development of the cruise ship tourism industry in the

Arctic and their communities were documented across the Arctic, including in Ulukhaktok. Findings from this research are in review in the journal, *Polar Geography*.

Furgal, C.

- Health benefits of travel on sea ice for the majority of participants was linked to experiences of place – being on and moving freely on the land and ice, and being outside of the community – as well as hunting for wild foods.
- Most participants reported that travel on sea ice had never been bad for their health, despite many having also experienced some physical impacts (exertion, injury, frostbite, hypothermia) or impacts on emotional and mental health (stress) related to previous sea ice use.
- Perspectives on factors that contribute to making a trip difficult and/or unsafe or good and/or safe primarily centered on ice and weather conditions, and the knowledge of ice users or their travel companions.
- NGSAR and police search and rescue data indicate that weather and ice conditions have been the most significant contributing factor to search and rescue incidents in Nain from 1995-2010.
- Data do not indicate trends in the frequency of search and rescue incidents over time.
- Participants described individual and collective risk management and health promotion strategies based on land skills; preparation; knowledge gathering, assessment and sharing; and navigating obstacles independently, with social support or with institutional support.
- Many participants expressed satisfaction with their access to social and institutional support for safety on the land, while some perceived the NGSAR and related institutions as having exclusionary practices and providing insufficient support for them and for the community.

Bradshaw, B.

Baker Lake residents hold varying opinions on the impact of mine income, the impact on local businesses, family and community well-being and the future of Baker Lake youth, among many other examples. Many residents see an institutional disconnect, which is a function of Inuit-determined institutional arrangements. A widespread, notable impact of the mine for the community is that it has negatively affected the capture of benefits for local residents (especially with respect to infrastructure). In this way, these arrangements have added to, rather than ameliorated, historical processes of disempowerment. This disempowerment is detracting from the community's potential resilience in the face of future externalities, including new mining development and climate change. Ideally, governance structures will be refined to effectively capture the positive impacts of mining and thereby add to community resilience and adaptive capacity.

Armitage, D.

Fresque and Armitage have synthesized conceptual findings on place identity and adaptation showing how beliefs and values influence adaptation to climate change. A paper based on these results is tentatively accepted (pending acceptance of revisions) in WIREs Climate Change.

DISCUSSION**Smit, B. and Pierce, T.**

The research with Inuit men in Ulukhaktok found a difference in the rate of land skills transmission among generations, with average transmission rates lowest among younger Inuit. Several skills had not been transmitted, or were transmitted incompletely among younger respondents. Changes in skills transmission are attributable to changes in the educational environment, loss of native language, absence of skills teachers, and declining levels of involvement in some subsistence

activities. Incomplete skills transmission has already reduced some individuals' involvement in subsistence activities, and has increased the sensitivity of others to changing climatic conditions.

The research findings support policy initiatives that promote the teaching and transmission of environmental knowledge and land skills in arctic communities. Societal changes have altered traditional methods of knowledge and skill transmission in the Arctic, requiring policy intervention. Detailed understanding of the transmission process can help northern decision makers and educators make informed decisions regarding the development and implementation of skills-training programs and educational curricula. Consistent with the learning ideology of, for example, the Piqqusilirivvik cultural school in Clyde River, Nunavut, this research shows that hands-on learning is important for the complete transmission of environmental knowledge and land-based skills - including the detailed knowledge and experience that allows harvesters to adapt to changing climatic conditions. Initiatives to support the teaching and transmission of environmental knowledge and land skills, while not directed at climate change adaptation specifically, will enhance the adaptive capacity of communities to deal with current and future climate change risks.

Furgal, C.

Results from this exploration into the relationship between sea ice travel and Inuit health, and how Inuit manage the risks inherent with this activity illustrate the importance of travel on sea ice for the health and wellbeing of Inuit and Kablunângajuit in Nain, Nunatsiavut. The study outlines the strategies employed to manage sea ice based risks and benefits and adapt and be resilient to changes in sea ice conditions and increasing hazards. These include both individual and collective strategies such as: preparation; knowledge gathering, assessment and sharing; and navigating obstacles independently, with social support or with institutional support.

Bradshaw, B.

With the development of the Meadowbank gold mine over the past three years, the people of Baker Lake, NU have suddenly experienced a dramatic shift in the economic make-up of their community. Mining development has impacted many aspects of community life, some positively and some negatively, though it is also clear that individual experiences with these impacts have varied greatly. Despite this variation, mechanisms designed to mitigate impacts from, and capture the benefits of, mining development (e.g. Inuit Impact and Benefit Agreements (IBAs)) have been utilized as if there is a homogenous experience with mining development. Understanding the diversity of individual experiences is critical to assessing the impact of mining development on resilience and adaptive capacity, and to effectively use governance mechanisms like IIBAs to strengthen communities in the face of future externally imposed stressors like climate change.

Armitage, D.

This research analyses the role of co-management institutional arrangements in the Canadian Arctic in helping to bring together local and traditional knowledge with scientific knowledge to enable learning, or knowledge co-production. The research has helped to define knowledge co-production as the collaborative process of bringing a plurality of knowledge sources and types together to address a defined problem and build an integrated or systems-oriented understanding of that problem as it pertains to Arctic change. We show how knowledge co-production is an institutional trigger or mechanism that enables learning within co-management settings in the Canadian Arctic. Research findings show how the knowledge co-production processes that have evolved over time in the co-management institutional arrangements in the Arctic are triggering positive social and ecological outcomes in the face of environmental change. More recently, we have started to examine the importance of place identity in framing adaptation perceptions and options.

A long time horizon is involved in building institutional arrangements and knowledge co-production processes. Part of that process involves identity and the importance of place. This is a particular concern in a rapidly changing Arctic, and it remains unclear whether knowledge co-production involving communities and hunters, scientists and managers can respond quickly enough to emergent system changes. The cases examined through ArcticNet help to illustrate the institutional mechanisms through which co-management actors can learn to learn, or learn to be adaptive, and the contextual (subjective) factors that are important to those institutional processes.

CONCLUSION

The research in this project has made substantial strides towards documenting the changing physical, biological and socio-economic conditions that are affecting people in the Arctic and identifying the policies and strategies to assist communities in dealing with these changes. The project, in particular, assesses the vulnerabilities of Arctic communities via collaborations and partnerships with northern people and organizations. Case studies provide a wealth of information on the nature of change in the Arctic and the vulnerability and resilience of Arctic communities, manifested in a broad range of ways be it health, infrastructure, knowledge transmission and integration, management arrangements, safety of travel on sea ice, access to country foods or community well being.

The research results from this project are abundant and significant for the future of Arctic communities across the Canadian north. Future research that fosters integration and cross region comparisons and lessons, will ensure the fullest utilization of these results as well as the necessary follow up, detailed analysis and dissemination with our research partners across the north in the face of an increasingly changing northern environment.

The research has provided insights beyond the first order physical impacts and adaptations associated with

climate change. It has demonstrated that communities are susceptible - and adjusting - to a variety of dynamic conditions, with social, political and economic forces interacting with physical and biological forces. It has also demonstrated that "adaptation" takes many forms, is rarely with respect to climate change alone (if at all), and involves transformation of learning, knowledge and behaviours among individuals, communities and institutions.

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