



CAVIAR

Community Adaptation and Vulnerability in Arctic Regions

Framework Document for an
International Polar Year Consortium

Prepared by
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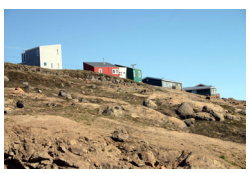



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2008

Published by
Department of Geography, University of Guelph
Occasional Paper No. 28
ISBN 978-0-88955-567-9

Suggested Citation: Smit, B., G. Hovelsrud and J. Wandel. 2008. *CAVIAR: Community Adaptation and Vulnerability in Arctic Regions*; University of Guelph, Department of Geography, Occasional Paper No. 28.

Acknowledgments:
This document was produced with the support of the Canadian and Norwegian International Polar Year Programs, ArcticNet NCE, the Canada Research Chairs Program, the Norwegian Research Council and the Social Sciences and Humanities Research Council of Canada. The authors acknowledge the contributions of the members of the International CAVIAR team. Layout and logistical support were provided by Adam Scott.

Library and Archives Canada Cataloguing in Publication

Smit, Barry
CAVIAR (community adaptation and vulnerability in arctic regions) : framework document for an International Polar Year consortium / prepared by Barry Smit, Grete Hovelsrud and Johanna Wandel.

Co-published by: CICERO- Center for International Climate and Environmental Research -Oslo.
Includes bibliographical references.
ISBN 978-0-88955-567-9

1. Climatic changes--Research--Arctic regions. 2. Social change--Research--Arctic regions. 3. Climatic changes--Risk assessment--Research--Arctic regions. 4. Human ecology--Research--Arctic regions. 5. Arctic regions--Research. I. Hovelsrud, Grete II. Wandel, Johanna, 1971- III. University of Guelph. Global Environmental Change Group IV. CICERO (Research center) V. Title.

GF891.S54 2008 363.738'740720113 C2008-900532-5

CAVIAR
COMMUNITY ADAPTATION AND VULNERABILITY IN ARCTIC REGIONS

1. Introduction

The Arctic is experiencing rapid changes in environmental conditions and in many aspects of northern economies and societies. The Arctic Climate Impact Assessment (ACIA) predicts unprecedented climate change for Arctic regions, and changes have already been documented by instrumental records and local and indigenous observations (Huntington and Fox, 2005; McBean et al., 2005). The Arctic Human Development Report (AHDR, 2004) demonstrates that Arctic peoples are susceptible to changing environmental conditions, and are already having to adapt. Among the changes related to climate, there are expected to be increases in temperature, reductions in ice extent, increases in precipitation, and increases in the frequency and magnitude of hazardous conditions, including those associated with permafrost thaw, coastal erosion, ice stability, and increasing exposure to storms along the Arctic coast (Christensen et al., 2007; Couture et al., 2002; Johannessen et al., 2004; Kattsov and Kallen, 2005). In turn, the presence, location, and distribution of animal species and vegetation dynamics will be affected (Anisimov and Fitzharris, 2001; Derocher et al., 2004). These changes have serious implications for ecosystems and for people's livelihoods and wellbeing, and they will occur in the context of ongoing social, cultural, economic, and political transformations in northern communities (Anisimov et al., 2007; Fenge, 2001; Ford and Smit, 2004).

While there is general agreement that changes in climate, and associated conditions, are likely to pose significant challenges for communities, the nature of these risks and the most effective means of dealing with them are poorly understood (Duerden, 2004; Ford and Smit, 2004; McCarthy and Martello, 2005; Nuttall, 2001, 2005; Schneider et al., 2007). The particular environmental conditions to which local communities are sensitive have yet to be comprehensively documented. The strategies employed to deal with changing conditions in communities across the Arctic, and their effectiveness, have not been assessed. The conditions that facilitate or constrain the adaptive capacity or resilience of Arctic communities have not been substantiated. The wealth of information from local and indigenous knowledge has yet to be integrated with scientific knowledge to understand the nature of the opportunities to better deal with changing conditions. Insights into sensitivities, vulnerabilities or resilience of communities have not been compared across the Arctic countries nor well connected to decision-making or policy in Arctic regions.

This Framework Document outlines the CAVIAR research program in terms of its rationale, goals, conceptual basis, analytical approach, integrative methods, structure for comparison and synthesis, and practical applications. This Framework Document builds on the proposal document (February 2006) "A Pan-Arctic Research Framework" and the CAVIAR Consortium Workshop (Oslo, October 2007). This document is intended primarily to provide a context and guide for CAVIAR researchers conducting community vulnerability and adaptation studies and contributing to an inter-community comparison and synthesis across the circumpolar north.

The assessment of vulnerabilities and adaptations has been identified as a priority area for research by policy makers, local and indigenous communities, the Arctic Climate Impact Assessment, the Arctic Human Development Report, and the International Polar Year planning committee (ACIA, 2005; AHDR, 2004; Denmark Ministry of Environment, 2004; Ford and Smit, 2004; Government of Nunavut, 2003; ICARP, 2005; IPY, 2005; McCarthy and Martello, 2005; NRI, 2002; Watt-Cloutier et al., 2005). In particular, the following have been identified as important research questions:

- What aspects of people's livelihoods are at risk, and to what?
- What conditions are problematic for people and the ecosystems on which they depend?
- What changes can be accommodated by existing ways of life?
- What is the ability of local communities to manage changing conditions?
- What local and external factors influence vulnerability and in what ways?
- What are the critical thresholds of adaptability or resilience?
- How do social, cultural, economic, and political processes operating at multiple scales affect sensitivity to climate change and adaptive capacity?
- What is the effectiveness of adaptive strategies across the Arctic?
- How do conditions affecting communities and their adaptive capacities vary among communities?
- What can be done to enhance community adaptability?
- How can lessons be shared among Arctic communities?

Research is required to develop and apply frameworks that analyze how vulnerability is shaped by various forces or drivers across scales from local to global. The research needs to incorporate multiple sources of knowledge to enhance understanding about what makes communities vulnerable or resilient to change (Duerden, 2004; Ford et al., 2006; Nuttall, 2005). There is also a practical need to identify opportunities to enhance communities' adaptive capacities, or to promote their well-being or sustainability. CAVIAR is designed to address these needs across the Arctic countries.

2. Goal and Objectives of CAVIAR

The underlying purpose of CAVIAR is to better understand how Arctic communities are affected by environmental changes in order to contribute to the development of adaptive strategies and policies. The broad goal of the CAVIAR research program is to enhance the theory, empirical understanding, and practical application of processes that shape adaptation and vulnerability in communities across the polar region by:

- further developing the concept of vulnerability (Tyler et al., 2007; Chapin et al., 2004; Turner et al., 2003; Smit and Pilifosova, 2001) and refining an integrative interdisciplinary research framework for vulnerability studies (i.e. Ford and Smit, 2004; Huq and Reid, 2004; Keskitalo, 2004; Kruse et al., 2004),
- applying the framework to a selection of communities across the Arctic region to identify the social and environmental factors, processes and interactions that shape differential vulnerability and adaptive capacity,

- comparing results among Arctic communities to identify commonalities and transferable lesssons, and
- improving understanding of interrelations between local vulnerability and decision-making related to adaptation, across multiple scales from local to international.

The goal of CAVIAR is more than data collection or monitoring of change; it involves interdisciplinary integration and collaboration with Arctic community partners, in order to characterize vulnerabilities or risks, to document the processes and forces that facilitate adaptation or management of risks, and to identify and evaluate means to improve the capacity of communities to adapt to changing conditions. By undertaking studies in communities in all of the Arctic countries, using a common research framework and consistent methodologies, the program will be able to compare results and synthesize findings across the circumpolar north.

3. Research Strategy

The program of research will be undertaken by an international interdisciplinary team, representing all the Arctic nations. The team will build upon existing research initiatives, operating independently in their local (case study) applications, but with common goals, concepts, research framework and consistent methodologies. The comparison and integration will be based on the case studies. Team members, along with stakeholder representatives, partner agencies and organizations and local communities, will implement the CAVIAR research program.

The main components of the CAVIAR program are:

- Development of the **conceptual framework** for community vulnerability, including the role of exposures and sensitivities to multiple stresses and the adaptive capacities or resilience of communities.
- Refinement of a common **methodological approach** that is stakeholder-based, systematic, and draws upon traditional and local knowledge and scientific knowledge in order to document exposures and adaptive capacity or resilience (and their broad determinants) of selected communities in a consistent fashion.
- Establishment of procedures for **case study** selection and implementation of community case study vulnerability assessments with northern collaborators across the Arctic region.
- Development and implementation of a process to **compare and integrate** results from the case studies for a pan-Arctic assessment of community vulnerability and adaptability.
- Application to **policy** and decision-making relating to community adaptive capacity, by ensuring the research scope and approach substantively include institutions and governance structures, and
- Incorporation of on-going, substantive stakeholder engagement and partnerships so that **outreach** is an integral feature of the vulnerability assessment.

3.1 Theoretical Basis and Core Concepts

Current research in the human dimensions of global change and natural hazards communities notes the importance of locally grounded, context-sensitive assessments (Flax et al., 2002; Smit and Wandel, 2006; Stephen and Downing, 2001). Although actions on adaptation are taken at scales from individual to national, community-based assessments are a necessary step to formulating effective strategies to address climate-related challenges in Arctic regions.

Several conceptual models of community sustainability, resilience, risk and vulnerability have common elements (Flax et al., 2002; Ford et al., 2006; Schröter et al., 2005; Turner et al., 2003). Given the importance of climate change in Arctic regions, and the formal recognition of vulnerability in the United Nations Framework Convention on Climate Change (UNFCCC) (Smit and Wandel, 2006), CAVIAR employs the term "vulnerability" as its central concept. CAVIAR is interested in the overall well-being or sustainability of communities and their susceptibility or vulnerability to changing conditions. **Vulnerability** refers to the manner and degree to which a community is susceptible to conditions that directly or indirectly affect the well-being or sustainability of the community. This would include the sensitivity or resilience of the ecosystem of which the community is part or on which the community depends. Use of this term does not presume that communities are particularly vulnerable – some may have relatively few or no vulnerabilities. Vulnerability is a function of both exposure-sensitivity and adaptive capacity (Adger and Kelly, 1999; Ford and Smit, 2004; Keskitalo, 2004; Kofinas, 2005; Smit and Pilifosova, 2001; Turner et al., 2003; Wisner et al., 2004).

Exposure-sensitivity refers to the manner and degree to which a community is sensitive to and exposed to particular conditions, forces or stresses. It reflects the likelihood of climatic conditions or natural hazards occurring in a particular place over time relative to the situational characteristics of places and people which make them sensitive to the conditions or hazards. Thus, exposure-sensitivity is related to the susceptibility of people or livelihoods to a stimulus, the dynamics of the potential stimulus or stress, and the community's physical location, social and economic situation, governance and political systems. **Adaptive capacity** is closely related to resilience, and reflects an individual's or community's ability to cope with or adjust to or recover from an exposure-sensitivity. It is reflected in the community's management of current and past stresses, its ability to anticipate and plan for future change, and its resilience to perturbations.

A community's exposure-sensitivity and adaptive capacity reflect the interactions of local conditions and forces at **broader scales**. Broader environmental processes have local manifestations, and the particular local conditions which shape exposure-sensitivities and adaptive capacity reflect regional, national and global social and economic conditions or trends. The functional relationship between exposure-sensitivity and adaptive capacity will vary by context and over time, but it is expected that vulnerability is positively related to exposure-sensitivity and negatively related to adaptive capacity.

3.2 Methodological Framework

3.2.1 The CAVIAR Approach

The core research is undertaken in case study communities. Community selection is undertaken in CAVIAR to cover a range of Arctic communities, and is influenced in each case by characteristics such as size, location, economic orientation, social-cultural composition, and practical matters such as access, local interest or research fatigue.

Each case study will provide answers to a common set of questions:

1. In what ways are communities affected by changing conditions? *i.e.* How, to what and why are people and their livelihoods sensitive or vulnerable to changing environmental conditions (including climate) and socio-economic conditions?
2. How do communities adapt to changing conditions? *i.e.* What are the processes, players and strategies of adaptation or adjustment, by individuals, groups and organizations, and what are the implications of those adaptations?
3. What changes can be expected in the future in the conditions that affect the community? *i.e*. In what ways are the vulnerabilities likely to change in the near and longer futures, and how will they affect the community?
4. What capacity does the community have to deal with future changes? *i.e.* What resources, institutions, types of capital does the community have to adapt, what adaptive opportunities are there, and what are the limits constraints on adaptation, on all levels?

In this document a "vulnerability case study" refers to an investigation of the four sets of questions for a particular case community. The CAVIAR Framework is designed to:

- guide the analysis of these four central questions in each case study,
- provide a structure for reporting case study results, and
- facilitate comparison and integration across case studies.

By employing a common framework and consistent methodologies, the case study data or insights are in a comparable structure. Such consistency is a necessary requirement for case studies to be included in the comparative analysis.

The methodological approach for empirical studies of community vulnerability (the case studies) is based on the principles outlined in Lim et al. (2004), Berkes and Jolly (2001), Turner et al. (2003), Keskitalo (2004) and Ford and Smit (2004). The methods applied in CAVIAR are based on the notion that a crucial aspect of vulnerability assessment is to gather and understand the stakeholders' own information on their exposure-sensitivities and adaptive capacity. The open, unbiased and active engagement of the community representatives and other stakeholders is a necessary element of this approach.

Background information on the community, also known as baseline information, is compiled and preliminary interviews with key stakeholders are undertaken to gain an appreciation of the broad features of the community that relate to vulnerability. If the

case study needs to be limited in scope due to community size or some other consideration, the scoping phase may also identify major areas of interest or focus. This phase also establishes likely sources of information (records, documents, measurements, individuals, etc.), the procedures for selection of collaborators, and the community-appropriate processes for data gathering from the community members (sampling, interview schedule, focus groups, etc.) Depending on the community, and in some cases the sector or group in the community, interviewees will include ordinary residents, practitioners, administrators or group representatives.

Once a community has been selected, community members (or their representatives) have endorsed the process, and local collaborators are familiarized (or trained), then the data gathering phases begin. The information sought relates to the items contained in the four research questions, usually in the sequences noted in Figure 1.

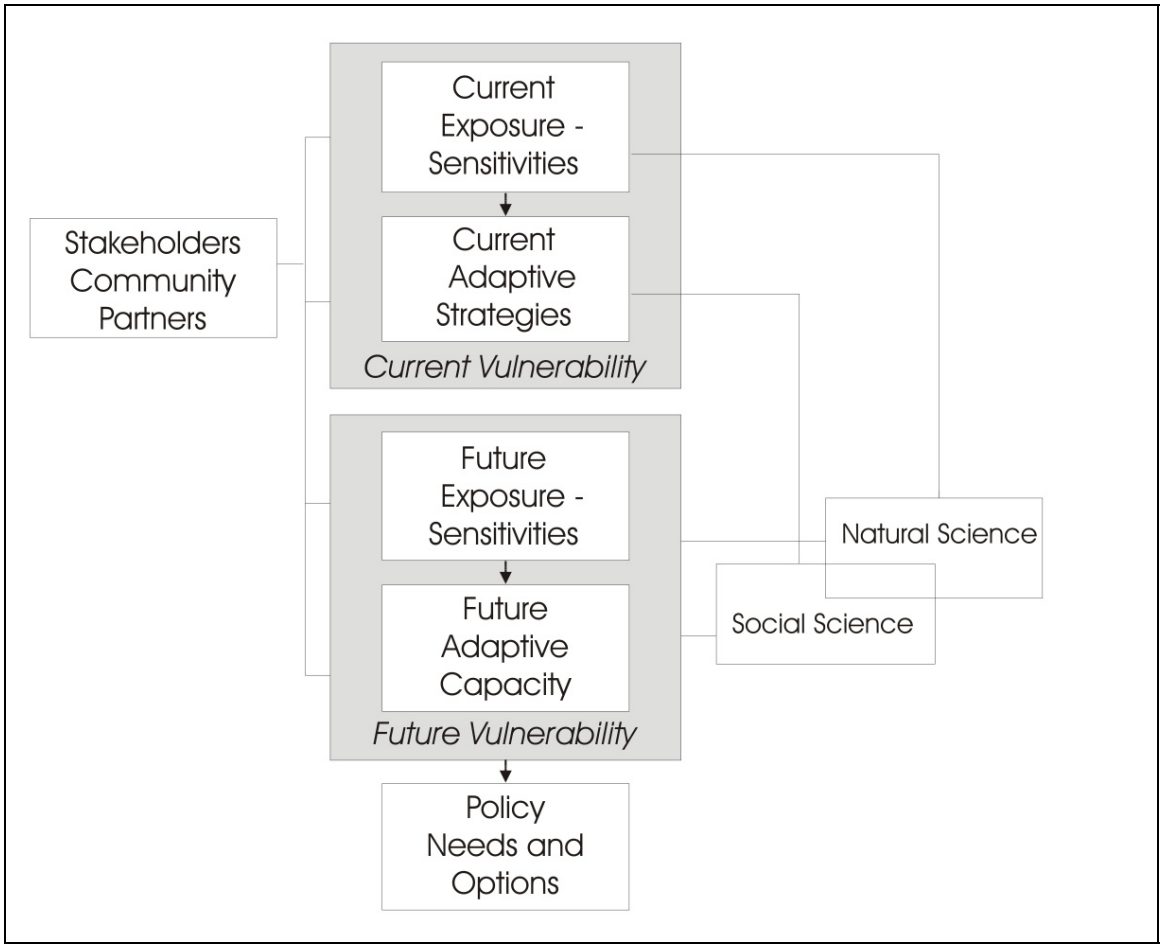

Figure 1 Key Elements in the Vulnerability Assessment Framework

Figure 1 indicates the relationships between the main categories of information needed in a vulnerability assessment of any community, consistent with the conceptual model. The four core components of the framework correspond to the four questions presented at the start of Section 3.2. The researchers first document past and **current exposure-**

sensitivities (question 1) in order to identify the conditions that are of particular relevance to the community. They also (often concurrently) identify and document the **adaptations strategies and processes** (question 2) to describe the ways in which communities have managed the conditions to which they are exposed and sensitive. Together, these characterize current vulnerability. They also provide the basis for estimating future vulnerability (both **future exposure-sensitivity** and **future adaptive capacity**). This involves assessing the likelihood of changes in the conditions that are pertinent to the community, drawing on scientific predictions of change in natural and social systems and characterizing the scope and limits to adaptive capacity. The assessment of future risks and prospects for adapting provides the basis for collaboratively identifying **policy needs and options** and the initiatives that could enhance the capacity of the community to adapt.

3.2.2 Current Exposure-Sensitivities

The first research task is to document the conditions and processes that represent **current exposure-sensitivities.** This requires the identification of forces, stresses or processes which affect the livelihoods or well-being of people in the community. It also requires providing evidence of the exposure-sensitivities and explaining the processes and trends that underlie them. Some conditions may be important for the whole community, while in other cases only as a certain group or sector may be sensitive to a change or condition.

To illustrate, the community of Arctic Bay (Nunavut, Canada) is sensitive to changing sea ice conditions (timing of freeze-up and break-up, thickness, etc.) because of their dependence on sea ice for travel to hunt (providing food, livelihood) and the related cultural importance of participating in subsistence activities. However, in recent years, the timing of freeze-up and break-up have changed and community members have noted less predictable ice conditions (e.g. thickness, location of leads and polynyas) which in turn introduces greater hazards for snowmobile travel. This exposure-sensitivity reflects the nature of the community's society and economy, technology, the physical location and the dynamics of ice, ocean and atmosphere. This exposure-sensitivity can be described by outlining the underlying processes, interactions among these processes, and evidence of these. This might include documenting the degree to which community members are reliant on hunting and on sea ice, and where current travel routes are. Insights may be gained from data on the contribution of animals hunted on (or via travel on) sea ice to the food and incomes of residents, and data on changes in sea-ice dynamics and travel conditions (e.g. snowmobile vs. sled dogs). Relationships between sea ice dynamics and climate and ocean conditions could also be documented, as could changes in alternative food sources and the wage economy which affect the role in hunting in Inuit livelihoods. Other exposure-sensitivities might relate to resource development, wildlife dynamics and availability, or infrastructure and permafrost changes. It is not necessary that an exposure-sensitivity will apply to the entire community or to all residents in a similar way. It is important to note that, to be comparable in CAVIAR, exposure-sensitivities are identified empirically, from insights and evidence gathered in the community – they are not assumed *a priori* nor derived arbitrarily or exogenously from hypothesis or models.

3.2.3 Current Adaptive Strategies

The second research task (Figure 1) is to identify and assess the **current adaptive strategies** or management responses employed in the community to deal with the identified exposure-sensitivities. This involves describing and documenting the ways in which individuals, groups or organizations have adapted to the conditions and changes that have affected them. Understanding adaptations entails outlining the specific adaptive measures or actions and the broader processes of which they are part.

To illustrate, in Arctic Bay adaptations to sea ice exposure-sensitivities include changing travel routes, changing timing or location of hunting, seeking alternative income sources, securing alternate food sources, and employing remote sensing data and VHF radio and GPS technologies in order to identify potentially hazardous locations and communicate with search and rescue personnel in the community. Each of theses strategies can be documented and explained relative to the employment situation, available transportation technologies, food preferences, etc. In addition, adaptation strategies can be assessed according to their consequences and implications. For example, securing alternate food sources in the diet requires the financial resources to purchase southern foods at the store, and this in turn has implications for people's health. Changing the timing or location of hunting may not be an option for people with insufficient time flexibility (due to participation in the wage economy) or who are unable to cover additional costs of equipment or fuel.

Information on these aspects of current vulnerability (exposure-sensitivities and adaptive strategies) are acquired from community residents directly and from secondary sources such as existing documents and reports and other inventories, and data from community-based monitoring. In addition, researchers draw on instrumental or remotely gathered records of conditions pertinent to the livelihoods and lives of community members (e.g. long-term climate records and federal population censuses).

3.2.4 Future Exposure-Sensitivities

The gathering of information about future vulnerability (Figure 1) also involves both scientific assessments and community insights. Ideally, estimates of **future exposure-sensitivities** will be determined via two routes. First, the conditions identified as current exposure-sensitivities are analyzed by scientists in order to estimate possible changes, trends or probabilities of change in those conditions in order to describe the ways in which existing exposures might change in the future. Second, possible changes in conditions from climate (or other) scenarios would be specified regardless of whether they were identified by community residents. To illustrate for the Artic Bay case, future changes in travel opportunities relative to sea-ice conditions could be estimated by applying scientific knowledge of ice dynamics to trends and expectations in break-up and freeze-up time relative to harvesting areas and travel routes. This could include insights from climate change scenarios linked to cryosphere and oceanographic models applied to the locations and conditions of importance to Arctic Bay people. This analysis of future exposure-sensitivities could also include using information from those who rely on sea ice, such as hunters, to identify the types and degrees of change in ice conditions that

Arctic Bay residents would find particularly problematic, thus providing specific targets for probability estimates of future ice conditions.

3.2.5 Future Adaptive Capacity

The future exposure-sensitivities are then examined in terms of the community's **future adaptive capacity**, with information gathered from community members' responses to presented future exposures, from key informants involved in the institutions, risk management processes, resource management structures and policies related to adaptive capacity, and from social sciences that might bring insights from elsewhere on the nature of community resilience and adaptive capacity. The analytical task is to identify the conditions in the community (various forms of capital, technology, institutional arrangements, etc.) that would either facilitate or constrain adaptation. This could include describing the ways in which economic conditions or institutional arrangements (for example) could accommodate the changing conditions, or perhaps not be able to deal with certain types of changes.

3.3 Community Vulnerability Case Study Methods

A variety of research tools and methods can be employed in a community case study to identify, describe and explain each of the items in the CAVIAR Framework. The Framework indicates the types of information to be gathered; this section provides ideas on how the information might be acquired.

The information gathered in the four core elements of the framework (Figure 1) match the four research questions outlined in section 3.2. These four bodies of information, if gathered in a consistent manner in each of the case communities, provide the "data" to be analyzed and synthesized in the pan-Arctic inter-community comparative exercise (see section 3.5). The comparison will seek to identify exposure-sensitivities and their driving forces that are common to several communities, and to indicate how and why these are distinct in some place or types of society/economy. The comparative exercise will also serve to identify adaptive strategies and processes that have been effective (or otherwise) as a basis for sharing lessons among communities across the Arctic regions, and for relating findings directly to decision-makers and policy processes from the local to international scales.

Table 1 outlines key elements in the process of community-level vulnerability assessment consistent with the CAVIAR framework. The elements reflect what is done (e.g. assessing exposure-sensitivity), who does it (e.g. researchers, stakeholders) and what data sources are used (e.g. interviews, climate records).

CAVIAR case studies involve research with and about people in communities and establishing mutually supportive collaborative arrangements is a necessary first step (Table 1). This usually entails preliminary field visits for information exchange, approvals, research planning and scheduling, identification of local research collaborators, protocols, fees, etc.

The data gathering from community residents on exposure-sensitivities and adaptations (Table 1) involves a variety of methods frequently used in ethnography, sociology, social anthropology, geography, resource management, health research and sustainability and development initiatives. **Participant observation** and living in the community are usually necessary. Commonly, **semi-structured interviews** are conducted in the local language (frequently by a community collaborator). In CAVIAR the interview usually has a loose structure, but generally aims to acquire insights into:

- The general situation of the interviewee: livelihood, socioeconomic situation, living conditions, etc. (This element serves to establish a comfort zone between interviewer and interviewee and provides information on the interviewee to help prompts later.) The subsequent four elements relate directly to CAVIAR's four questions and components (Figure 1).
- The conditions, environmental and otherwise, to which the interviewee is sensitive, or which are important in some way, or by which the interviewee has been affected or impacted. (This element provides information on *current exposure-sensitivities* and the broader social, economic, institutional and technological conditions and processes that facilitate or constrain adaptations.)
- The strategies, coping mechanisms or other measures employed by the interviewee to deal with, cope with, respond to or recover from the conditions identified, including the reasons for these strategies being employed and not others. (This element provides information on *current adaptive strategies* and the processes and forces that underlie them.)
- The interviewee's assessment of future changes in conditions, including those provided by natural science scenarios, particularly as they relate to him/her. (This element provides information on *future exposure-sensitivity*.)
- The interviewee's expected ability to adapt to or deal with changes in conditions, including those broader factors that may be necessary for certain strategies or those that may constrain options. (This element provides insights into the *future adaptive capacity*.)

A **focus group** format may also be used to gather the information about exposure-sensitivities and adaptive capacities, either as an alternative or parallel exercise or as a follow-up method to interviews of residents or key informants. The information gathered from interviews with community members is supplemented by information relating to current and future exposures and adaptive strategies/capacity from all other available sources including archival records, institutional measurements, and traditional knowledge.

Table 1: Activities, Data Sources and Actors in CAVIAR Case Studies

Stage	Activities	Data Sources	Actors
Facilitation / Legitimization	Field visit to establish legitimacy/acceptance Identify local partners, collaborators, terms, issues, sensitivities, protocols and schedules	Published literature Key informants	Natural and social scientists with community representatives and local collaborators
Current and Past Exposure-Sensitivities	Field visit Data collection Documentation	Available secondary sources Remote sensing info Climate record Archival records Interviews Focus Groups T/L Knowledge	Natural and social scientists with local collaborators
Current and Past Adaptations and Capacities	Field visit Data collection Documentation	Available secondary sources Remote sensing info Archival records Interviews Focus Groups T/L Knowledge	Social scientists with local collaborators
Future Exposure-Sensitivities	Field visit Modeling Projections Probability estimation	Scientific experiments and models Interviews Focus groups	Natural and social scientists with local collaborators
Future Adaptations and Adaptive Capacity	Field visit Social science predictions	Social science models Interviews Focus groups	Social scientists with local collaborators
Integration (Overall Vulnerability)	Analysis Interpretation	Field results and secondary sources	Natural and social scientists
Feedback / Dissemination	Field follow-up visit Media Scholarly publications	Case study outcomes	Natural and social scientists with policy-makers and collaborators
Comparison / Integration	Integration of circumpolar cases	Individual case study outcomes	Natural and social scientists with policy-makers

In addition to data from community members, insights and evidence relating to vulnerability and adaptation should be incorporated from other sources. For example, data on changes in the timing of sea ice break-up in Arctic Bay may be available from instrumental or satellite records or from documents kept by local organizations, archives or businesses. Data on changes in food choices may be available from the community retail stores, and information on changing diets may be available from the health clinic or health surveys. Information on likely future changes in ice, wildlife, permafrost and climate can be acquired from natural science analyses and scenarios. Information on the decision-making structures and processes and their capacities to incorporate adaptations should be available from analyses of institutions and governance and from organizational respondents and other stakeholders. Data from these sources can be incorporated with the information gathered from the community members themselves to address each of the components of the CAVIAR framework. In addition, it is likely that an overall integration of the case-study findings can be undertaken (Table 1) to generate interpretations and summaries of the results.

The insights gained on the nature of vulnerability important to the community on adaptation needs, and on constraints to adaptation, provide a robust basis for identifying practical interventions to reduce exposures and/or to enhance the community's capacity to adapt. The initiatives may involve risk management strategies, community planning, resource management plans or regulations, technology, and policies at levels from the community to national and international institutions. This process of identifying and developing **adaptive strategies** is undertaken with the full participation of community members and stakeholders.

The **feedback** phase involves supplying the community with information gained from the research. In practice this occurs throughout the field research (keeping the community informed about the broad goals and findings), and especially after the results have been analyzed. A common form of feedback is a return visit to the community to provide a summary of results (and related insights from other work) through local radio, website, newspaper, community gathering/feast, school visits, briefing with local officials etc. – whatever are the appropriate means for each community.

In addition, community collaborators may participate in workshops, conferences or media events beyond their own community to disseminate findings more widely and influence policymakers, and to benefit from initiatives occurring beyond the community.

A distinctive type of feedback possible through the CAVIAR consortium and its pan-Arctic comparison relates to the sharing of insights about experiences with changing condition, vulnerabilities and adaptations among the various communities spread across the Arctic regions (see section 3.5).

3.4 Case Study Selection

The CAVIAR research program focuses on people and their livelihoods in communities. The term community has long had a range of contested meanings. For the purposes of CAVIAR, a northern/local "community" is treated as a collection of individuals and families sharing a geographic space in the form of a town or village with its associated institutions (social networks, local government, businesses, service clubs, etc.). This interpretation of community includes all those who physically share the space for all or part of the year, regardless of diverse "communities of interest", occupations, livelihoods, activities, locations, and existence or lack of kinship ties.

It follows that the definition of a community as people in a shared geographic space with diverse membership and interests means that there is no single voice for a community (Wallerstein, 1999). Communities are not homogenous or monolithic entities, and thus the selection of people to represent a northern community must be undertaken carefully to be representative and to avoid tokenism and exclusion. It is not expected that all people in a community will have similar vulnerabilities. The research will document the types of exposure-sensitivities and adaptive strategies that vary within and between communities, as well as those that might be common in a community.

CAVIAR will employ case studies which are selected by individual researchers with knowledge and contacts in particular regions (in consultation with the coordinating researchers) to be broadly representative of the range of communities in the circumpolar north. The case studies will employ a common approach, outlined here as the CAVIAR framework, with the field methodologies adjusted to be appropriate to particular contexts and communities.

Confirmed CAVIAR case studies are:

Canada:	Attawapiskat (Ontario), Dawson City (Yukon), Arctic Bay (Nunavut), Fort Resolution (NWT), Hopedale (Nunatsiavut), Igloolik (Nunavut), Kugluktuk (Nunavut), Tuktoyaktuk (NWT), Ulukhaktok (NWT), Whitehorse (Yukon)
Investigators:	Barry Smit (University of Guelph), Trevor Bell (Memorial University), Derek Armitage (Wilfrid Laurier University), Ben Bradshaw (University of Guelph), Frank Duerden (Ryerson University), Ralph Matthews (University of British Columbia), Wayne Pollard (McGill University)
Finland:	Inari area (Northern Lapland)
Investigator:	Monica Tennberg (University of Lapland)
Greenland:	Qeqertarsuaq
Investigator:	James Ford (Post-doctoral researcher with Wayne Pollard) (McGill University)
Iceland:	Húsavik
Investigator:	Niels Einarsson (Stefansson Arctic Institute)
Norway:	Nesseby, Lebesby, Hammerfest (all in Finnmark County, Northern Norway)
Investigator:	Grete Hovelsrud (CICERO)
Russia:	Lovozero (Murmansk), Oksino (Yamal Nenets), others TBA
Investigator:	Elena Androva (State Russian Herzen Pedagogical University)
Sweden:	Multi-use forestry sector
Investigator:	Carina Keskitalo (Umeå University)
United States:	Venetie and Kaktovik (Alaska)
Investigator:	Gary Kofinas (University of Alaska Fairbanks)

Figure 2 CAVIAR Case Study Locations

3.5 Comparison and Integration

Results from the case studies undertaken by community research teams will be compared and synthesized using the structure of the framework. Although researchers will use the field methodologies most appropriate for their individual cases, the broad consistency in core concepts and approach means that comparisons can be made across case studies according to the elements of the CAVIAR vulnerability framework:

- the community-relevant exposure-sensitivities, an their underlying forces and processes,
- the adaptation strategies employed, their effectiveness and the processes through which they are undertaken,
- future exposures or risks, or conditions expected to be important for the community, and
- opportunities for improving the adaptive capacity and reducing adaptation constraints.

The comparison and synthesis exercise will combine results from cases from across the Arctic regions to identify attributes of vulnerability and adaptation that are common and those that are specific to places or types of communities. This exercise will also produce an inventory and critique of employed adaptation strategies, in order to facilitate exchange of lessons among communities across the Arctic.

The comparative analysis relies on the case studies generating results on each of the four elements of the CAVIAR framework. The results for each case study will be disseminated by the case study researchers as they are generated. In addition, as findings are gathered they are submitted in summary form (in the categories outlined by the Framework) to the co-directors who will co-ordinate the initial comparisons and integration. The more detailed results for each case study will be contained in the case study report or publications.

The summary results will be available to CAVIAR researchers for information sharing, and for more details researchers can approach the case study lead researchers directly. Once sufficient case study results are submitted (number of cases and nature of information), the initial comparison and integration exercise will be led by the CAVIAR Co-PIs and representatives from the case study communities. This exercise will scan results looking for common themes and issues, and findings distinctive to particular communities or situations. The results of the initial comparative analysis will be disseminated under the co-authorship of the Co-PIs, plus those involved in the comparative exercise and the lead researchers in the case studies included in the analysis. It is expected that subsequent comparative analyses will be undertaken and published by various members of the CAVIAR consortium.

3.6 Policy

The relevance of the CAVIAR research to policy is explicit and substantive. The research focuses directly on environment-society issues that are important to northerners, it includes decision-making processes and institutions as part of the subject of research, and it involves policy decision-makers in the research itself.

The CAVIAR research program is directly policy relevant in several ways:

- It engages community representatives and decision-makers in the research process to ensure that the items analyzed are pertinent to community members and relevant to community decisions. This engagement orients the research to the issues that are policy relevant and it facilitates the application of the research by decision-makers.
- A fundamental step in the vulnerability assessment methodology is to identify the ways in which the community's members, institutions and governance structures deal with stresses and environmental changes, so that analyses of adaptive capacities and adaptation options are undertaken explicitly in the context of actual decision-making structures, authorities and policies. The research includes

rigorous analysis of policies and decision-making as part of the vulnerability assessment, contributing to the direct policy relevance of the results.

- The CAVIAR initiative includes partners representing organizations involved in policy making at several levels. These partnerships are with international organizations (e.g. Arctic Council) national and regional government agencies (e.g. Nunavut Tunngavik Incorporated, the Sámi Parliament, Indian and Northern Affairs Canada…), indigenous peoples organizations (e.g. the Permanent Participants of the Arctic Council, including the Inuit Circumpolar Conference, the Sámi Council, the Russian Association of Indigenous Peoples of the North) and community bodies (e.g. Hunters and Trappers Organizations, planning department…) The partnerships not only facilitate CAVIAR research, but they also provide influential entry points to policy processes at all scales.

3.7 Outreach

The vulnerability assessment methodology in the CAVIAR consortium, by definition, requires the active engagement of people in northern communities. This work goes beyond the inclusion of community members as research subjects or field research assistants and involves them as collaborators and partners. This represents a substantial outreach component, ensuring that research is locally relevant and that community members are part of the process and well informed of the findings. The CAVIAR team is committed to dissemination in communities, employing means targeted to the respective audiences, including (but not limited to) community meetings, radio, magazines, schools, television, reports, brochures, and briefings.

Dissemination and outreach are also undertaken beyond Arctic audiences through publication in scholarly journals, reporting in popular media (newspapers, magazines, TV, radio, and via the internet) and contributions to workshops and conferences including meetings hosted by United Nations Framework Convention on Climate Change (UNFCCC), the International Arctic Social Science Association (IASSA), the International Human Dimensions Program (IHDP) and the Arctic Research Consortium of the United States (ARCUS).

4. Consortium Structure/Organization

The CAVIAR consortium is comprised of research team nodes in Arctic regions, and consortium partners. Dr Barry Smit, University of Guelph, Canada and Dr Grete K. Hovelsrud, CICERO, Norway are Co-PIs of the Consortium, and will share overall responsibility for consortium development, coordination, implementation and linkages with other relevant IPY activities. The research teams will meet once per year or more frequently as required and usually in conjunction with major international conferences. Case study researchers will be responsible for organizing consultation workshops with stakeholders and others interested parties in their communities and countries.

Framework and methodological development are achieved collaboratively via the research team (through workshops, communications and document development). The case study research will be conducted independently by research teams organized in

national nodes, with primary research funds coming from respective national agencies or bi-national agreements. It is expected that at the national and case study levels CAVIAR members will acquire supplementary funds or resources in supporting CAVIAR research. Each case study team leader will employ available resources to undertake vulnerability assessment work consistent with the CAVIAR framework and using compatible methodological approaches. Communities are to be intimately involved in the field work at all stages, and thus local actors and agencies become partners in the research. Methodology and research strategy will be developed in close communication among nodes, with periodic international meetings to ensure consistency, to compare and integrate results, and to disseminate findings. Consortium partners are expected to develop their own partnerships to relevant researchers, institutes, organizations, and communities as part of their research undertaking.

5. Deliverables

Deliverables from the CAVIAR initiative include its direct influence on decision-making in communities, an edited book, scientific publications (peer reviewed journal articles), conference and workshop presentations, documents and briefing notes for decision-makers, community interactions, and dissemination via popular media. Overall these products will contribute to:

- the field of vulnerability assessment,
- the knowledge base on the human dimension of global change in the Arctic, and
- policy and decision-making dealing with adaptation to environmental change.

6. Conclusions

The CAVIAR research program is distinctive in several respects. Research addressing each of these areas is not new, and several of them have been developed in the Arctic context. What is distinctive about CAVIAR is that its scope and structure allow all of these to be addressed in a systematic, integrated program. This is possible by drawing on the experiences of researchers and practitioners who have developed the various elements and by focusing on a particular application (Arctic communities). The noteworthy features of CAVIAR are:

- It explicitly addresses issues that involve complex interactions around ecological and human systems and processes. Not only does CAVIAR consider physical, biological and socio-economic variables, but it systematically explores the links between natural and dynamic human systems.
- It is directly applied to human decision-making and policy relating to environmental changes and human communities. It brings integrated science to bear on adaptive decision-making from local to international levels.
- It is fundamentally inter-disciplinary, in that each case study involves social and natural science and scientists in addressing a common set of questions.

- It is multi-methodological in that it combines a variety of analytical tools and methods from the natural and social sciences for data collection, analysis and interpretation.
- It assesses current and past conditions and considers implications for the future – hence it combines historical analysis, comparative static analysis and prospective analysis.
- It is community-based and community-engaged, to ensure that the research is founded on the experiences of people and that its findings are relevant to their lives and the environments in which they live.
- It is both place-specific in its provision of insights in each community case study and regionally generic in its systematic comparison and integration of findings over many communities in the Arctic.

These themes (human-ecological integration, policy relevance, interdisciplinarity, past and future perspectives, community engagement, comparisons, etc.) do not represent independent goals of CAVIAR. Rather, they are necessary components of the program if it is to address its core goal of identifying practical adaptation strategies and policies to help Arctic communities deal with changing environmental conditions.

Overall, CAVIAR represents an ambitious and distinct program of interdisciplinary research to identify insights essential for the development of adaptive responses to changing conditions in the Arctic.

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