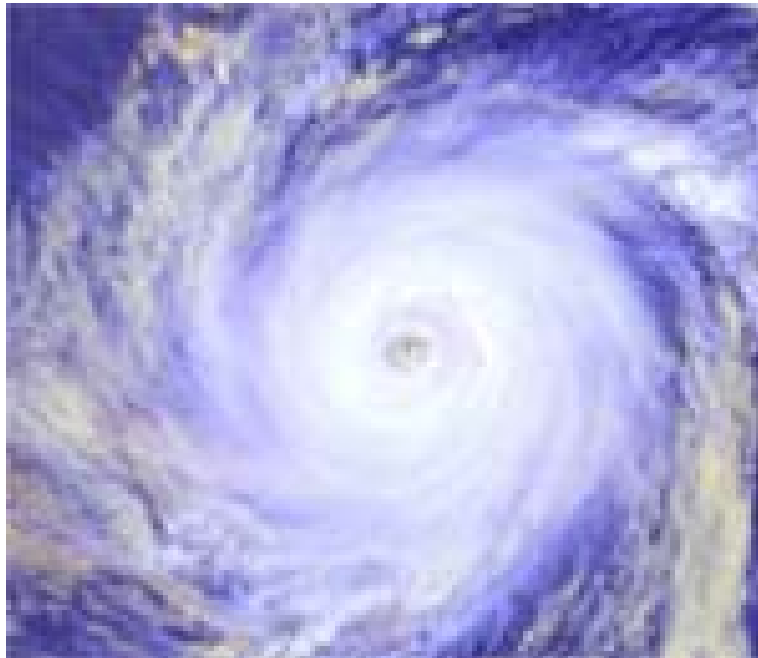


FROM SILOS TO SYNTHESIS



***Interdisciplinary Issues for Climate
Change Impacts and Adaptation
Research***

Canada 

UNIVERSITY
of GUELPH



Canadian Climate Impacts and Adaptation Research Network

AGRICULTURE

Summary Report from the Special Session Series:

Communities and Climate Change Impacts, Adaptation and Vulnerability

**Held during the *Canadian Association of Geographers*
Annual General Meeting,
Moncton, NB, 27-28 May 2004**

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C-CIARN AGRICULTURE

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Foreword

This report summarizes the presentations and discussion from the CAG/C-CIARN 2004 meeting in Moncton, New Brunswick, and provides recommendations on how to pursue interdisciplinary research for climate change adaptation issues. The need for methods that support interdisciplinary analysis and results is becoming more obvious to policy-makers and researchers involved in climate change impacts and adaptation issues. Both are looking for ways to integrate the outcomes from diverse relationships and interactions at different conceptual, spatial, and temporal scales. The purpose of this document is to provide some assistance for their efforts in producing useful research results, policies, and programs related to climate change impacts and adaptation.

C-CIARN itself represents a type of structural integration given that it is a network of networks each focused on a distinct topic (Agriculture, Coastal Zone, Fisheries, Forests, Health, Landscape Hazards, Water Resources, Atlantic, British Columbia, North, Prairies, Ontario, and Quebec). In turn, each of the regions and sectors brings multiple perspectives on the climate change issue because they all link representatives from industry, policy and research interested in climate change impacts and adaptation pertinent to their particular region and/or sector. Many network members are themselves directly involved with interdisciplinary research in climate change issues.

The topic of climate change is becoming increasingly important. In Canada, as in many parts of the world, adverse climate conditions (eg. extended droughts and extreme temperatures) and variability appear to be having detrimental impacts on various regions and sectors. Given the severity of impacts, the recent Tenth Conference of the Parties to the UN Framework Convention on Climate Change emphasized the need for bolstering our knowledge and implementation of climate change adaptation. To date, in Canada, climate change adaptation is being considered, but the way it is approached needs some attention. Most climate change adaptation studies include the role of adaptation **after** modeling impacts, treating it as an add-on, rather than a fundamental aspect of research design. With most studies, there is also a tendency to conceptualize climate change adaptation in isolation from other risk management practices. This can pose challenges for generating research findings that are scientifically sound yet relevant for decision-making.

The need for effective adaptation research presents an opportunity to pursue new perspectives founded on interdisciplinary research. Addressing the issues underlying such a need was the main goal for the C-CIARN sponsored meeting described in this report. In partnership with members from the Global Environmental Change Unit (Geography Department, University of Guelph) C-CIARN issued invitations to recognized experts in several fields broadly paralleling C-CIARN networks (agriculture, forestry, water, health, coastal zone, Prairies, Atlantic, North) and in the international context. The program is found in Appendix A. Presenters addressed the question: **how do we integrate the natural and social and medical sciences into the assessment of climate change impacts, adaptation and vulnerability?** A panel of experts from various disciplines (health, sustainable development, geography, economics) summarized and synthesized a response to this question in light of the presentations.

This report includes introductory comments on interdisciplinary studies, a table summarizing strategies for enhancing interdisciplinary work in the field of climate change impacts and adaptation, and summaries of the presentations and discussion.

Introduction

Interdisciplinary approaches to climate change adaptation research

Since the 1980s, two forces: systems thinking and concern for sustainable development, have helped to raise the profile and value of interdisciplinary approaches. Researchers and policy-makers alike recognize the need for new and more integrated methods if they are to find effective solutions for problems which transcend traditional disciplinary and sectoral boundaries. This is particularly true for cross-cutting issues such as climate change, that have mutually interdependent environmental, economic and social dimensions.

The term interdisciplinary refers to a number of different approaches based on the level of integration achieved. At one extreme, individual disciplines are nominally connected by virtue of their common presence in a department, program, or institution without having to work together on common projects. Some refer to this situation as multi-disciplinary. At the other extreme, interdisciplinary work involves a true melding of ideas and interpretation to create new insights that would otherwise be unattainable. The term trans-disciplinary has been used to describe this type of interdisciplinary effort.

The most common interpretation of the term, however, lies somewhere between multi- and transdisciplinary approaches. In this case, interdisciplinary efforts involve close linkages between subjects without each discipline losing its separate character. By drawing on established scholarship, approaches, and methodologies within each discipline, researchers each fulfill a specific role in supplying research results. Examples include projects where data or information regarding one dimension of an issue is the input for analysis by other disciplines working on the same problem. For instance, climate modelers project possible future agroclimatic conditions so that crop scientists can determine potential consequences for yield. Land resource scientists can then suggest different management strategies, and agricultural economists can provide cost/benefit analyses. Together these researchers are able to generate an integrated assessment for potential climate and weather impacts on specific farming systems in a particular region.

Most research into climate change impacts and how to adapt to them is based on climate change scenarios (*i.e.* plausible future climate conditions), which in turn derive from General Circulation Models (GCMs). Climate scenarios represent a “top-down” view of climate change. Such studies begin with some assumed future climate, usually focused on changes in temperature (*i.e.* global warming). They can be used to generate estimates of future climate conditions, mainly temperature norms and some moisture attributes. Researchers then downscale the climate model outputs to estimate future local climate and to predict impacts and the implications for the sector and/or region of interest.

Uncertainty is inherent in this approach and is due to challenges in modeling variability and working with coarse resolutions as well as the wide range of estimated impacts and assumptions about the conditions prevailing in the wider socio-cultural environment. Following a standard interpretation of interdisciplinary approaches, scenario-based climate change assessments invariably treat adaptation options as discrete measures to incorporate into the model, offsetting detrimental impacts.

If the information from scenario-based impact studies were to stay in the theoretical realm, then its relevance for stakeholder implementation might not be an issue. However, there is a demonstrated need to move in the other direction with research proposals requiring stakeholder involvement to ensure that relevant parameters are studied and the outputs directly contribute to policy and programs. The need for such integration is also increasingly evident in policy making.

Thus, for climate change adaptation research and policy to be effective, methods that value stakeholder perspectives have to be embraced.

The need for stakeholder involvement is also emphasized in the latest climate change adaptation report from the Government of Canada¹. In this case, the authors recommend following a “vulnerability approach” where stakeholder involvement is the first and formative principle. With this perspective, adaptation options for future climate change emerge from a process built on the certainty of current experience, existing perceptions, and effective action. The multi-faceted nature of climate risk management is not ignored (as it may be in scenario-based impact assessments) but an integral part of the analysis.

Including stakeholder involvement puts further pressure on climate change adaptation research to pursue interdisciplinary methods that favour synthesis. The need for integration across disciplines is mirrored in the need for integration across a range of vested interests, including those who have to develop policy and those who have to work with the results.

Interdisciplinary and Integrative Strategies

Despite the pronounced interest in more integration, more sensitivity to alternative perspectives, and more comprehensive research results, processes for achieving these goals are not necessarily well documented. The presenters and panelists for the CAG/C–CIARN meeting pointed out (both explicitly and implicitly) various techniques that will assist researchers and policy makers in their attempts to be more interdisciplinary and integrative-- to move from their silos to synthesis as the title of this document suggests.

Table 1 summarizes the range of strategies recommended and employed. They are presented according to the basis for integration and include the research orientation, focus, the research problem, topics, research frameworks, language, and institutional support.

¹ Lemmen, D. and F. Warren (eds) 2004. Climate Change Impacts and Adaptation: A Canadian Perspective. Government of Canada.
http://adaptation.nrcan.gc.ca/perspective/summary-10_e.asp

**TABLE 1 STRATEGIES TO ENHANCE INTERDISCIPLINARY RESEARCH
(AND INTEGRATIVE POLICY-MAKING)**

BASIS FOR INTEGRATION	DETAILS
Research Orientation	<ul style="list-style-type: none"> ▪ Not only project design but researchers themselves should be interdisciplinary as much as possible; ▪ Researchers should be flexible and willing to learn; ▪ Recognize that approaches are not static but need to be refined according the groups involved; ▪ Re-think meaning of expertise (eg. treat stakeholders as experts in their own rights).
Focus	<ul style="list-style-type: none"> ▪ The more specific the research project's goals and objectives the better; ▪ Limit opportunities for going off on tangents; ▪ Organize results based on the focus; ▪ Limit project to specific locality (eg. Watershed) but do not ignore the broader political economic structure
Research Problem	<ul style="list-style-type: none"> ▪ Be as specific as possible; ▪ Root the research in real concerns from a specific community and/or region; ▪ Acknowledge relationships between/among different scales and their implications; ▪ Formulate the problem as concretely as possible and aid communication by using appropriate tools (eg. maps, satellite imagery).
Research Topics	<ul style="list-style-type: none"> ▪ Some topics are more integrative by nature than others (eg. health, water); ▪ Stress and risk are both integrated phenomena; they cannot be understood fully without incorporating multiple perspectives; ▪ Link research to work on issues with obvious connections to the topic of interest (eg. Climate change adaptation is closely related to: resilience; sustainability; risk management, etc.).
Research Framework	<ul style="list-style-type: none"> ▪ Research components should follow similar steps; ▪ Some methods are more conducive to interdisciplinary work (eg. Case Studies); ▪ Stakeholders need to be included in defining the problem, gathering the data, and interpreting the results.
Language	<ul style="list-style-type: none"> ▪ Agree on precise definition of terms; ▪ Avoid language that could be offensive (eg. vulnerability) and/or convey homogeneous responses (eg. community)
Institutional support	<ul style="list-style-type: none"> ▪ Remove barriers to Interdisciplinary work.

Presentations Summaries

The vulnerability approach: Context and scope of the special sessions on climate change adaptation and vulnerability assessment (Johanna Wandel and Barry Smit, University of Guelph)

Wandel provided the background and context for the theme of the special session by describing the vulnerability approach basics, noting the term has been used in natural hazards, sustainable livelihoods, food security, political ecology, and other literature. Although several interpretations of “vulnerability” exist, two distinct themes can be found in all of them. One is the notion of **potential** (or to use the jargon from various disciplines, risks, accessibility, likelihood, exposure, and so forth, for harm, or disaster, hazard, damage, injury, loss, calamity, adverse affects, etc..). And secondly, the notion that every system, or every community, or every person has some **level of ability to cope** with preservation, also referred to as adaptability, capacity, adaptive capacity, capability, and/or flexibility.

Vulnerability can be understood as an **end point**, that is a condition that results when a number of factors related to exposure and capacity come into play. This approach to vulnerability corresponds to impact assessment work where **interdisciplinary** research often follows a “top-down” method. The problem is approached primarily by predicting impacts, subsequently assuming or predicting adaptation, and finally an estimation of “residual” impact. Integration in this approach is sequential: it begins with climate scientists who predict what will happen to a number of pre-determined climate variables, the impacts of change in these variables are extrapolated to biological and physical systems by natural scientists, social scientists then assess/predict how humans will adapt to these. The end result is a “net impact”, which does not quite address the needs of policy-makers: while giving valuable insights to the question of “what might happen”, we have failed to address “how can we ensure that we manage it as effectively as possible”.

By contrast, vulnerability can be considered a **starting point** and favours a “bottom-up” or **grounded** assessment. This approach aims to first establish the criteria of what the system is exposed (sensitive) to and what capacities exist to manage change. Prediction, including scenario-based prediction, is still an important element, but researchers ensure that community-relevant variables are included. Assessment of adaptive capacity coupled to prediction of potentially problematic conditions together highlight future challenges. Integration in this case means integration of stakeholders and researchers as well as integration of social and natural scientists, with a more direct link to policy-makers through the identification of relevant areas of concern.

BOTTOM-UP APPROACH TO VULNERABILITY

- start with community/system of interest to determine its vulnerability
- “what aspects of climate are relevant for this community?” “how do they cope with stresses?” “what pre-existing conditions affect coping?”
- identify exposure and adaptive capacity **before** using future scenarios

As Wandel relates: We start with the system of interest (for example a community, a family, a region) and ask questions such as; what aspects of climate are relevant to this community, how does the community cope with stresses and what pre-existing conditions affect coping, what is it like there, how do these people manage their day to day lives. In the language of the climate change community, from the IPCC 3rd assessment report, we are identifying exposure and adaptive capacity before employing scenarios. And those together can provide some estimation of the vulnerability in this place, at this time-i.e. the starting point. Once parameters that are relevant to the community are known (based on in-depth field work) the next step is to develop climate scenarios for the relevant conditions and generate an estimation of future exposure to them. Socio-economic scenarios are also of value at this point, based on what we know of the community's existing capacity to adapt. This provides some estimation of future vulnerability, grounded in the real experiences of today.

Both end point and starting point approaches to vulnerability require input from multiple disciplines. The key differences are the **level of engagement** with the group being studied (and the importance of **their perceptions and experience to the assessment**) as well as the **relationship to “mainstreaming” or producing research results which are directly relevant for decision-makers**. End point studies can be carried out without community participation but starting point studies cannot. This distinction between the two is also apparent in the style of interdisciplinary research associated with each.



Agricultural Vulnerability and Capacity for Adaptation -Merging the Environmental Change and Rural Community Research Agendas

(David Burhoe and Mike Brklacich, Carleton University)

Research conducted by Burhoe and Brklacich favours the **grounded** approach for understanding vulnerability and focuses on enhancing the adaptive capacity of agricultural communities. There is a **strong association** between adaptive strategies for managing climate change risk and those for managing environmental conditions. In order to understand the decision-making environment for farmers faced with pressures from changing climate and weather conditions, researchers need to take in to account several factors, including:

- Globalization & trade agreements;
- Agriculture within a political-economy context;
- Devolution of responsibilities to municipalities;
- New environmental legislation
- Policy emphasis on senior government

A primary way to appreciate the interplay of these and similar factors is through the use of **case studies**, a method closely tied to interdisciplinary approaches. Focus groups and interviews conducted with members of the same rural community or commodity organization provide rich opportunities to gain insights into how farm operations function and management decisions are made. Without such practical insights, the value programs and policies related to enhancing agricultural capacity for change is severely limited.

Burhoe points out that not only is the agriculture sector changing quickly (eg. increased farm industrialization; reduced number of farms; decreased agricultural employment; reduced government support; increased conflicts with newcomers; global trade challenged; less agricultural influence on policy) but so is the natural, social and policy environment within which rural communities exist. A fundamental element of case studies includes a basic appreciation for the context within which the system of interest is functioning. In the case of agriculture, that context is the rural community, a phenomenon that is also under a variety of stresses, many of which inevitably have an effect on the agriculture practiced within its borders. In Ontario, rural communities can be characterized as moving through seven stages:

- 1) predominantly agricultural,
- 2) agricultural in transition,
- 3) marginalized agricultural,
- 4) periurban,
- 5) small mutating industrial center,
- 6) traditional, and
- 7) high-class rural amenity.

Working with the agricultural community requires integrating these **multiple, changing factors**. Adaptive capacity for climate will be enhanced by:

- Tap local experience; use farmer to farmer solutions;
- Go beyond “Big Ag” solutions; there are many legitimate rural voices;
- Find equitable solutions; address most vulnerable, multiple “rurals”;
- Implement rural-wide policy solutions; avoid fragmented decision-making;
- Acknowledge capacity building as an on-going process.



Vulnerability of Canadian water resources to climate Variability and Change (Phil Adkins, Agriculture and Agri-Food Canada-PFRA)

Much of the research focus for Canadian climate change adaptation has included work on the Canadian Prairies. Adkins reminds us of why this is the case by reviewing the damaging effects of historical and recent periods of drought in that region. Although material in his presentation reflects the “top-down” impact assessment approach to understanding vulnerability, there are many points supporting the need for bringing in “grounded” approaches as well.

Adkins presents impacts on water resources in terms of supply and demand factors and suggests both aspects must be addressed to prepare for future impacts from climate change and



variability. According to projections for the Prairies, it is likely that there will be fewer water resources available for an increasing demand. Generally speaking, supply factors can be enhanced by :

- Incorporating a number of well known management strategies to conserve water;
- Ensuring funds exist to improve infrastructure;
- Improving our understanding of groundwater;
- Developing increased water use efficiency.

Efforts to improve rural water supply include: constructed ponds / small reservoirs; groundwater – deep wells; rural water pipelines; and pasture pipelines. In turn, demand factors can be reduced primarily through making water use systems (eg irrigation) more efficient, incorporating water concerns into land use planning, and focusing on water quality not just quantity aspects of the issue. Many adaptive strategies from Prairie residents can also be more informal and based on the common sense and practical approaches they have developed over time.

In keeping with vulnerability studies, Adkins emphasized the need to build adaptive capacity at the **institutional level** as well as in the community and individual or family groups. The benefits from having the PFRA (Prairie Farm Rehabilitation Administration) sponsor projects and work directly with the end users were offered as examples to build on. Agriculture and Agri-food Canada has a role to play here and can do so through the “Risk” and “Environment” dimensions of the Agricultural Policy Framework.

For interdisciplinary research, water itself is an ideal topic to draw disparate and even conflicting groups together. Its physical fluidity has parallels with its dominant place throughout all aspects of Canadian society and human life. Water issues are ideal for focusing an interdisciplinary team researching a particular climate change and variability problem.

Climate change and Inuit health: Impacts and adaptation in the Canadian North (Chris Furgal, CHUL, Université Laval)

Conditions in northern regions of Canada indicate there are climate changes taking place that have significant implications for Inuit health for a number of reasons, especially those related to diet. However, climate change factors are not the only stresses that are being felt on health in communities. Transport of industrial pollutants to the north and socio-cultural changes among a population going through a rapid state of transition are dramatically affecting northern residents and must be taken in to account when assessing vulnerability to climate and other forces in this region.

Furgal's research follows a **community-based** approach to understanding vulnerability and adaptive capacity. It has **directly involved** the community residents in formulating the problem, in data gathering and in interpreting the results. Climate change has and will continue to have direct and indirect impacts on Inuit living in arctic regions. Details from the research findings are summarized in Tables 1 and 2

Table 1 Possible Direct Health Impacts	
Mediating Process	Direct Impact
Exposure to thermal extremes	Changed rates of illness and death related to heat and cold exposure
Changes in frequency or intensity of other extreme weather events (floods, storms, etc.)	Death, injuries, infectious diseases, stress related disorders, psychosocial disruption
Increased UV exposure	Increased risks of skin cancers, eye damage (cataracts), potential for immuno suppression therefore increased vulnerability to disease

Table 2. Possible Indirect Health Impacts	
Mediating Process	Direct Impact
Exposure to thermal extremes	Infectious disease, stress related disorders, other social health related disorders (such as psychosocial disruption)
Changes in ice distribution and stability, and Snow composition and amount	Death, injuries related to travel and hunting accidents. Dietary problems associated with availability of food sources and inability to fish and hunt traditional items and locations
Effects on range and activity of vectors and infective parasites	Changes in geographical range and incidence of vector-borne diseases and their transmission to humans increasing disease

Changes in local ecology of water-borne and food-borne infective agents	Changed incidence of diarrheal and other infectious diseases- emergence of new diseases
Changes in traditional food and drinking water availability and productivity (Food and drinking water security)	Diet related problems – poor nutrition (deficiencies), hunger, diet shift and related health outcomes (diabetes, etc.), impacts to social and mental well-being due to change or loss of hunting opportunities, changes contaminant exposure, etc. New species available to hunt
Changes in distribution and composition of permafrost	Psychosocial disruption related to damages to infrastructures and population displacement Dietary problems associated with impacts through ecosystem changes (e.g. vegetation for animals)
Sea level rise	Increased risks of infectious diseases, salt water inundation of drinking supplies Psychosocial disruption associated with infrastructures damage and population displacement, erosion and social distress in communities
Changes in air pollution (contaminants) pollens and spores	Increased incidence of respiratory (asthma, hay fever) and cardiovascular diseases Increased contaminant exposure and related immunosuppression, neurodevelopmental problems

Tables 1 and 2 portray the results and connections between climate change and health impacts in a standard “determinants of health” format, one that most academic researchers can follow easily. However, Inuit and aboriginal people in the north have **a different understanding and view** of their relationship with the environment. So the need to engage individuals, in many ways in informing the scientists about the association between individual health and their environment, is just as, if not more, important than the reverse.

Figure 1 is an example of an alternative view of the relationship between individuals and their environment, as well as the path through which climate or another form of environmental change may impact individuals. It stands in contrast to the simplified linear associations of Tables 1 and 2. In Figure 1, if there is a change in some climatic variable then it must be followed through and understood as the association between a number of different environmental components (as understood by Inuit and by Cree) that then comes to influence their livelihood and their health.

There are a number of challenges for interdisciplinary climate and health research that takes account of not only different academic disciplines but also the active participation of those being studied. These include :

- lack of local scale comparable data;
- validated sources of information for local scale impacts and change;
- challenges to addressing a multitude of factors implicit in climate change adaptation

Vulnerability to Environmental Change in the Canadian Arctic

(Gita Laidler, University of Toronto)

In deriving assessments of northern community vulnerability to climatic change, and in developing viable adaptive strategies, Inuit want their voices to not only be heard, but also consulted and incorporated.

(Kusugak, 2002)

Laidler agrees with many of the points raised by Furgal and provides insights into several aspects of Inuit perceptions of climate related to changes in their environment. Inuit of northern communities have been observing and **adapting to variations in sea ice and climate for generations** and note that shrinking, thinning, and/or disappearance of arctic sea ice could have a severe impact on their social, economic, and cultural practices.

Interdisciplinary thinking is necessary to capture the complexities of interactions between the biophysical and social worlds. These may be more obvious in northern communities or those where livelihoods are directly connected to natural resource bases.

Employing traditional **anthropological methods**, Laidler notes that adaptation has been and continues to be an essential feature of Inuit life. She documents specific community concerns about being able to adapt given alterations in:

- Travel routes
- Predictability of sea ice or weather changes
- Health and condition of the animals
- Position of the floe edge
- Freeze-up and break-up timing
- Ice thickness and safety
- Access to information



These form the basis for looking more closely at the community capacity to adapt to the changes residents are noticing. As the introductory quote suggests community members **expect to be part of** the research and strategic planning process. But how do researchers actually go about doing it? One possible way is to identify common areas of interest, common areas of concern and then build outward by using both types of expertise, both types of knowledge. Another option is **exploring new technologies and communication techniques** because these are becoming increasingly important. For instance, maps can be a useful tool to communicate, by using the map as a focus for discussions. The Inuit in Laidler's study are very interested in satellite imagery. They enjoy looking at the images and feel it is important for them to collaborate on how to use the images and how to interpret them.

Interdisciplinary approaches to vulnerability assessment **are not static**; they need to be revised, moderated and refined according to the specific needs and conditions of the group under study.

Nouveau enjeux de la gouvernance environnementale locale dans les communautés côtières du Sud-Est du N.-B. posée par les effets des changements climatiques dans l'Atlantique Nord

(Omer Chouinard, J.P. Vanderlinden, K. Delusca and M. Trambly, Université de Moncton)

One of the main objectives for the research details presented by Chouinard *et al* is to understand the **climate change perceptions** of those who live in coastal areas of southeast New Brunswick, and in many cases derive their livelihood in that region. The area is susceptible to major storms, high tides, sea level rise, erosion and flooding, all of which have impacts on ecosystems and communities. Included in their study are focus groups and interviews with representatives from tourist groups, national parks, watershed groups, fishermen groups, wharves authorities, municipal groups, planning commissions, businessmen, entrepreneurs, and elders from first nations.

The diverse sources for information are typical of interdisciplinary efforts focused on **a particular region and a specific problem**. Integration is achieved by looking for **commonalities and consensus** among the opinions and perspectives of different groups. Chouinard reports that it is rare to get perfect agreement on any one factor. However, results can be grouped into several categories where opinions ranged from being fairly close to being fairly wide apart.

Most agreed that the coast has been badly eroded by both natural factors (strong wind and wave action during storms, winter ice) and human factors (buildings not on rock but on vulnerable sandy soils; increased use of the beaches and coastal area). A majority also pointed out that climate and weather conditions appear to be more extreme now than in the past.



How to respond to these conditions is a major challenge and addressing them is an additional objective for the research project. Difference on action ranged from “resistance” (many property owners were taking steps to repair damages and protect from future impacts) to “resignation” (other respondents were willing to accept climate and weather conditions changes, noting it was better to redesign infrastructure, improve forecasting and generally enhance security).

Responses from the diverse set of respondents in this study also

reinforce the need to understand climate and weather risks and impacts **in light of other significant factors**. All respondents acknowledged that the climate change implications for an economy under transition (from fisheries dominated to tourism) had to be taken into account. They also pointed to the need for the governments (federal and provincial) to **be active agents** in coordinating climate change responses and actions that include diverse local groups.

Impacts of Climate Variation and Adaptations for Atlantic Canadian Fisheries Communities (Norm Catto, Memorial University of Newfoundland)

Catto provides many examples of why interdisciplinary studies are so important for climate change adaptation research. First, as many presenters repeated throughout the session, **stresses are integrated**. Climate is not necessarily the main player for assessing impacts on a particular region or community; it has to be understood in light of a multitude of factors. This means considering climate in the role of “supporting player”; as such community residents tend not to perceive it as significant.

Second, adaptive strategies have to be developed and understood in terms of the regulatory environment surrounding them; research will therefore be more useful if it includes some type of **policy component**. Whereas it appears that farmers can adapt by planting different crops and follow altered planting schedules while also employing times different farm management practices, the same does not hold true for fisheries. “...If I were to go to a fishing community in Newfoundland and say, well why don't you just fish a different species, or why don't you fish at different times, or why don't you use a different form of gear, they would politely inform me of the various regulations that Fisheries and Oceans Canada has imposed upon this sort of activity you simply cannot adapt as you want to in the current regulatory climate”.



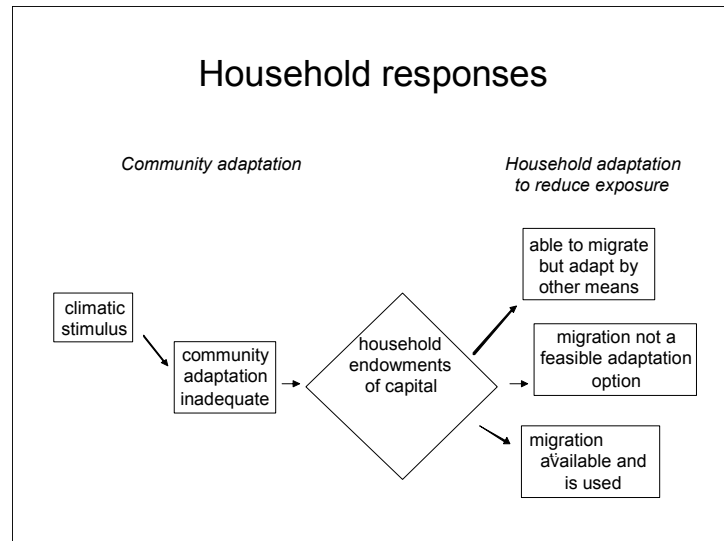
A third example of the need for interdisciplinary approaches is the realization that climate impacts on fish have substantial **interconnected sets of implications for socio economic and work-related issues** in fishing communities. Catto provides a rich example:

Among these are “...changes in terms of infrastructure. There are changes for operations when you can go on the water, how far you can go, what you can do when you're actually out there and there are implications in terms of health and safety, and for search and rescue. Both of those things are currently being down-sized and down-graded and not maintained throughout much of Atlantic Canada. There are implications in terms of the transportation and marketing of the product. For example, the situation that we have in Newfoundland, where fish is landed on the west coast and trucked to the east for processing, meanwhile passing another truck headed in the opposite direction, because one plant has a license for species A and the other has a license for species B. Then when it finally is processed and ready to go to market ready to be sent down to the 'Boston States' or ready to be sent to Toronto how do we then get it physically off the island and market it in other places? So there are implications in terms of that, and when we put all of these things together, there are substantive socio-economic results that impact the fishery communities ..when I'm thinking about climate change in terms of talking to and about fishery communities I usually don't end up thinking very much about the actual fish, it's much more what's happening in the other parts of the environment in terms of people trying to harvest the fish, in terms of people watching out for people trying to harvest the fish, in terms of the infrastructure necessary to catch the fish and get the fish to land and process and send them off to market so that people have enough money to survive. Those are much greater impacts of climate change perhaps than the actual impacts on the fish communities.”

The role of capital in adaptation to climate change in rural and developing communities
(Robert McLeman, University of Guelph)

Capital is one of those concepts that can **integrate results across disciplines**. As McLeman notes, the idea of capital is rooted in economics and most often used in terms of financial resources. However, in recent years scholars have found it useful to refer to natural, human, social, political and cultural capitals (among others) when discussing community assets.

McLeman's research focuses on levels of economic, social, and cultural capital as factors that help to explain in why people make migration decisions or how they make them. Migration is one adaptive response to adverse climate conditions. Let us assume for what ever reason, the community is unable, at the community level, to cope successfully with the new climatic regime that they are faced with. Then we can identify three possible groups within that community. The first one will be those who might be able to migrate but given their household's endowment of capital



they have other adaptive options available to them and they use those instead of leaving are community. Another group are people who might want to leave the community but they simply don't have the wherewithal to leave. And then the third group would obviously be those that not only have the opportunity of leaving, but who actually decide to leave the community given the climatic conditions.

McLeman explores the role of capital endowments in **the context** of prevailing political, social, and economic conditions by completing a case study of climate based migration in the southern United States during "dust bowl" era of the 1930s. A migration took place from central Oklahoma to the San Joaquin Valley in Southern California. Between 50 and 70 thousand people migrated during a period of extreme drought in Oklahoma and unusually above average temperatures. Based on early findings he concludes:

•Changes in household capital were identifiable during drought

- cash economy reduces
- farm assets decline (eg livestock sold off)

•Particular types of capital were common among migrants

- migrants owned livestock, equipment, vehicles but had been renting farm land
- migrants were particularly skilled in cotton production and managing draught animals
- social networks relied on for assistance

•Macro-economic forces constrain adaptive capacity

- all farm product prices decline steeply
- economic depression means no chance for off farm employment

•Government responses miss majority of households

- different programs aimed at land owner meant tenants (who were more destitute) missed out

Vulnerability to climate change and adaptive capacity in Samoa: The case of Saoluafata Village (Karen Sutherland, University of Guelph)

Moving outside Canada to the South Pacific, Sutherland reports on research findings from her work with a Saoluafata village in Samoa where she gathered data directly from community residents. As she notes, developing countries are considered to be particularly vulnerable to climate change due to their limited capacity to cope with the associated climate risks. Small island states are particularly susceptible to sea level rise, which could cause enhanced coastal erosion, loss of land, and dislocation of communities. Changes in tropical cyclone systems may result in widespread damage to human settlements where water supply and food production are also subject to impacts from changes in climate.

Sutherland's **case study** builds on the vulnerability approach described in the first presentation (Wandel). It begins with the **system in question** and examines the conditions of that community and of the various stimuli acting upon that community that give rise to its vulnerability. Following that step, opportunities to **strengthen the adaptive capacity** of the community to deal with future climate risks are identified, based on actions already proven to be useful.

Currently village residents rely on **social networks** to bring financial resources into the community from relatives working overseas. They also count on continuing **institutional support** from the traditional sources: Village Council, church, government and development aid. **Physical infrastructure** has also been built and maintained, including, drainage ways, partial seawall, land reclamation. In addition there has been some **relocation** away from more vulnerable areas.

In keeping with the vulnerability perspective, Sutherland acknowledges that broader conditions are also important influences on future adaptive capacity. In this case, cultural changes from traditional to more "western" values may bring substantial alterations to how social networks function (and therefore alter their effectiveness in lessening impacts from climate change). Differences in power and authority can also determine who receives aid and related benefits. She also noted that proximity to an urban centre appears to have a substantial influence on some communities' capacity to adapt since jobs opportunities and networks with city residents could increase resources going into an affected village.



Summaries of panelists opening remarks:

Jacinthe Séguin (Health Canada, Ottawa, Ontario)

Coming from a government department focused on health issues, Séguin is well aware of the need for cutting across disciplines and incorporating different scales and perspectives into studies involving impacts on humans and their ecosystems. Often understanding human health issues is the underlying concern, even if not stated explicitly. Health is a good example of an **integrating concept** for bringing together results from different disciplinary approaches.

Of particular concern is **cumulative vulnerability**, that is understanding how certain impacts are compounded, creating a web of complex connections that are difficult to analyze. **One approach** to vulnerability studies is not likely to be sufficient for dealing with cumulative vulnerability.

Vulnerability has a host of questions attached to it that must be specified: who in the community is vulnerable? Not everyone is vulnerable. Or if it's the community, is it the government of the community? The institution? Or the individual? And what are they vulnerable to? Being vulnerable to climate change, is a broad topic, it must be narrowed down to a **specific focus**.

Séguin supports the point many others made namely that climate change is one of **several stress factors** in most cases. She went on to note that engaging the group under study must include **sensitivity** to how they approach climate change themselves. If there is resistance to the idea, it is counter-productive to persist and changes should be made to how the research is presented.

Colin Polsky (Clark University, Worcester, MA)

Polsky offered a basic definition of vulnerability that can be applied beyond climate change issues:

Vulnerability is the sensitivity of a *coupled human-environment system* to exposure to stresses, accounting for the process of adaptation.

Inherent in this interpretation of vulnerability are several points that require interdisciplinary studies. **Coupled human-environment systems** cannot be studied without including social and biophysical sciences; using **systems analysis** likewise requires connecting distinct elements; stresses can be from a multitude of different sources at varying scales and degrees; and understanding adaptation as a process focuses attention on capturing change and interactions in "real time".

No one discipline can meet all these needs.

Based on his own work Polsky notes the importance of being **very specific** about the research objectives. When the material under investigation is highly inter-related, a clear focus is necessary to counteract the pull from multiple factors. His research experience has resulted in delineating eight steps for assessing vulnerability, three are important for setting up the modeling exercise while five refer to the elements of conducting a modeling exercise and disseminating the findings.

- 1)select people and places carefully
- 2)get to know places over time
- 3)hypothesize who is vulnerable to what
- 4) develop a causal model of vulnerability (with stakeholders)
- 5) find indicators for the components of vulnerability
- 6) weight and combine the indicators
- 7) project future vulnerability
- 8) communicate vulnerability creatively

This recommended procedure for vulnerability assessments requires that each researcher involved is capable of **interdisciplinary thinking** him/herself. With the exception of steps 2 and 7, people involved in such work will have to be familiar with the community they are working with and especially sensitive to their viewpoints on human-environment interactions, risks, and possible solutions.

Liette Vasseur (Université de Moncton, Moncton, New Brunswick)

Vasseur comes to climate change issues from the field of **sustainable development**. They have much in common including the explicit recognition of the value of interdisciplinary approaches. In both cases human activity is the key both to creating the original “problem” and therefore to finding the best solutions. Like sustainability, climate change has to be taken seriously; governments have to start moving on it. **Holding sessions** where researchers from different disciplines can meet face to face is important for fostering the type of research that is needed. Adaptations can become **maladaptations** if we do not think through the implications of specific strategies. This requires multiple perspectives and interdisciplinary thinking.

There is no question about the need for adaptation to climate change. The main challenge is determining just how to encourage and facilitate it, from three dimensions- policy, research and stakeholder viewpoints. Exploring the idea of adaptation further, Vasseur points out that adaptation options for current stresses might not be adequate or appropriate for future stress. The implications from different types of adaptation options can be understood in light of the **precautionary principle**, even though it may slow incorporation.

For climate change adaptation to succeed, there will have to be a **change in mentality** at different levels. Granting councils have to support interdisciplinary studies, modifying their entrenched approaches so it can go ahead. Researchers have to work together on finding workable solutions and communities have to take the lead in incorporating changes they know are necessary.

Martha MacDonald ((St. Mary's University, Halifax, Nova Scotia)

Experience working on a national project called “Coasts under Stress” provides MacDonald with some insights into interdisciplinary work and climate change issues. There are many complex **linkages and feedbacks** within and across systems that have to be taken into account somehow. Also, it is very important to acknowledge that **adaptation strategy at one scale or in one system may create problems at another scale or for another system**. “One person’s adaptation is another person’s constraint”. For instance, individuals may practice seasonal migration for work out of the community as an adaptive response to unemployment (related to lack of fish) but their absence could have negative impacts for the family and community left behind. Likewise company flexibility strategies can lead to a loss of household flexibility. MacDonald reinforces the need to understand local problems in the **context of macro political economic factors**. The way a resource industry is structured as well as a number of political and

institutional constraints all influence what can be accomplished locally. There is also a great deal of diversity at the local level in terms of capacity to adapt; the situation is **not homogenous**. Because terms like “community” can accentuate similarities play down the different capacities and impacts within a population, it is important to be careful with the use of such terms.

The need for integration across **different knowledge bases** (“traditional” and “scientific”) is also vital to develop adaptive strategies and build capacity. To work in both realms requires a major commitment to interdisciplinary approaches. Such approaches will also enhance our ability to understand the interaction between climate conditions and other factors; to appreciate the “why” questions related to the shaping of risks, exposure and adaptive capacity; and to find community based solutions that address climate related problems.

CONCLUSIONS

The presentations and panelists' contributions that are summarized in the foregoing pages represent contributions from biology, economics, engineering, environmental sciences, geography, political science, and sociology, among other disciplines. This diversity is also replicated in the variety of approaches, research foci, and regions implicated. These range from human health and resource management among Inuit in the Arctic to water and land management for agriculture in the central and Prairie regions of Canada; from coastal and fishing issues in Atlantic Canada to elements for capacity building in Samoa and the southern United States. A number of methods were employed in the research: ethnographic approaches common in anthropology, case studies, qualitative and quantitative assessments, and historical analysis.

Despite the diversity in focus, methodology and location, strong commonalities are evident among all the papers, particularly with respect to:

- perception of hazards;
- inclusion/integration of alternative points of view;
- relevance of climate and weather conditions to stakeholders' livelihoods;
- necessity for understanding climate change adaptation in terms of existing behaviour and patterns of response;
- emphasis on holistic approaches.

These features complement the range of strategies summarized in Table 1 where the basis for integration includes the research orientation, focus, the research problem, topics, research frameworks, language, and institutional support.

This report demonstrates the value and relevance of interdisciplinary approaches in climate change adaptation research, despite the challenges to conducting such work. The need for understanding and building adaptive capacity to climate change is increasing and calls for enlightened approaches and methods for both research and policy. It is hoped that the ideas and recommendations presented in this report will be viewed as practical strategies for pursuing interdisciplinary work and substantive examples of the insights gained when they are employed.



Canadian Climate Impacts and Adaptation Research Network

Special Sessions: Community Vulnerability to Climate Variability and Change

Sponsored by the Canada Climate Impacts and Adaptation Research Network (C-CIARN)
Canadian Association of Geographers' Annual Meeting 2004
Université de Moncton, May 27-28, Arts 206

The sessions will focus on the question: **how do we integrate the natural, social, and medical sciences into the assessment of climate change impacts, adaptation and vulnerability?** Invited presenters will address agricultural, coastal, Arctic, rural and developing world community contexts. Session IV synthesizes the paper presentations.

Thursday, 1:30-3:00 (Arts 206)

Community Vulnerability to Climate Variability and Change I : Resources

The vulnerability approach: Context and scope of the special sessions on climate change adaptation and vulnerability assessment (Johanna Wandel and Barry Smit, University of Guelph)

Vulnerability in agricultural communities (David Burhoe and Mike Brklacich, Carleton University)

Vulnerability of Canadian water resources to climate change (Phil Adkins, Agriculture and Agri-Food Canada-PFRA)

Friday, 8:30-10:00 (Arts 206)

Community Vulnerability to Climate Variability and Change II: Arctic and Coastal.

Climate change and Inuit health: Impacts and adaptation in the Canadian North (Chris Furgal, CHUL, Université Laval)

Vulnerability to Environmental Change in the Canadian Arctic (Gita Laidler, University of Toronto)

Nouveau enjeux de la gouvernance environnementale locale dans les communautés côtières du Sud-Est du N.-B. posée par les effets des changements climatiques dans l'Atlantique Nord (Omer Chouinard, J.P. Vanderlinden, K. Delusca and M. Trambly, Université de Moncton)

Impacts of Climate Variation and Adaptations for Atlantic Canadian Fisheries Communities (Norm Catto, Memorial University of Newfoundland)

Friday, 10:30-12:00 (Arts 206)

Community Vulnerability to Climate Variability and Change III: Developing World and Rural Areas

The role of capital in adaptation to climate change in rural and developing communities
(Robert McLeman, University of Guelph)

Vulnerability to climate change and adaptive capacity in Samoa: The case of Saolufata Village
(Karen Sutherland, University of Guelph)

Le développement durable face au changement climatique: Des défis à venir? (Liette Vasseur,
Université de Moncton)

Friday, 13:30 – 15:00 (Arts 206)

Community Vulnerability to Climate Variability and Change IV: Panel Discussion

Panelists

Colin Polsky (Clark University, Worcester, MA)

Colin Polsky is a geographer specializing in the human dimensions of global environmental change, emphasizing the statistical analysis of vulnerability to climate change. He is currently examining ways to blend quantitative and qualitative methods for the study of social and ecological vulnerability to environmental changes in two regions, the Arctic and the U.S. Great Plains. Colin is affiliated with Clark University's HERO project and George Perkins Marsh Institute.

Liette Vasseur (Université de Moncton, Moncton, N. Brunswick)

Liette Vasseur is professor in the Department of Biology at the University of Moncton where she holds the K.C. Irving Chair in Sustainable Development since August 2001. She has been involved in a number of projects undertaken as part of the Chair's research program such as studies on climate change, ecosystem restoration, conservation, biodiversity assessment, sustainable development and community-based ecosystem management. Projects have been carried out in Canada and other countries such as China, Vietnam, Cambodia, Panama, Brazil, and African countries.

Jacinthe Séguin (Health Canada, Ottawa, Ontario)

Jacinthe Séguin is the Manager of the Canadian Climate Impacts and Adaptation Research Network's Health Node.

Martha MacDonald (St. Mary's University, Halifax, Nova Scotia)

Martha MacDonald is a Professor in the Department of Economics, Saint Mary's University and a Co-Investigator with Coasts Under Stress. She is also active in Women's Studies and Atlantic Canada Studies at Saint Mary's. Martha has worked on issues of related to restructuring in the fisheries in Atlantic Canada since the early 1980s. Her work has been particularly concerned with changes in industry structure, livelihoods and policy (including EI, TAGS). She includes a focus on women, households and communities in her work. She has also contributed to the development of a feminist analysis in the economics discipline, focusing on issues of social security policy, economic restructuring, and globalization.