Proactive adaptation to climate change:
Building bridges between science and local government

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ABSTRACT

The global climate is changing. Impacts are increasingly visible, and the trends are undeniable. Nowhere will these impacts be more severely felt than in the human and natural environments that comprise coastal areas. Through support received from the Canadian government, researchers at the University of Ottawa in Canada and the University of the West Indies in Trinidad and Tobago have initiated a joint Canada-Caribbean initiative to assist coastal communities to plan for and adapt to the changes anticipated from sea level rise and severe storm events. Impending changes to coastal ecosystems and to local infrastructure are anticipated to have both direct and indirect impacts to local societies and economies. The C-CHANGE partner communities were selected to reflect a range of conditions including population, reliance on ecological services, and economic conditions, and encouraged to share interests and ideas across the project. Relying largely on available information and data, C-CHANGE teams will assist each partner community in the development of a pragmatic and locally relevant Community Adaptation Action Plan (CAAP). Each CAAP will direct mitigation of sea level rise and severe storm impacts to existing ecosystems and infrastructure and serve as a guide for future development. Working over a five year period, the C-CHANGE university-community alliances will collaboratively evaluate potential impact scenarios, assess adaptation and mitigation tools and recommend changes to policy and planning instruments. The project will also increase capacity to manage climate change impacts through the training of community decision-makers and the creation of a cadre of highly trained graduates skilled in interdisciplinary work.

KEY WORDS

Climate change, adaptation, coastal ecosystems, science and local knowledge, community-university research alliance, coastal management

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Introduction

The global climate is changing. Impacts are increasingly visible, and the trends are undeniable. Nowhere will these impacts be more severely felt than in the human and natural environments that comprise coastal areas. Rising temperatures are melting polar ice and together with the thermal expansion of water are contributing to: sea level rise, changing precipitation patterns, more frequent and intense weather events, storm surges and flooding, coastal erosion, increased sedimentation of coastal waters, and, especially worrisome, pollution and storm runoff and from flooded or destroyed infrastructure (IPCC 2007a,b, IISD 2007, FAO 2007, UNEP 2007). There is little doubt that ecosystems, habitats and species, and the economies which depend upon them, will also suffer disruption as a result of extreme weather and shifting climate normals. Canada has the largest coastline in the world, over 240,000 kilometres that wind along the Arctic, Pacific and Atlantic oceans, and the shores of the Great Lakes. Melting of our polar ice is not only a threat to the survival of sentinel species such as polar bears, it is a harbinger of change at a pace and scale never before experienced by our northern communities. In more southern areas of the nation, both natural and built environments will be affected by escalating sea level rise, storm surges, severe weather and shifts in local climatic norms. While Canada will share these impacts of climate change with other coastal nations, nowhere in the Americas is the problem more imminent or intense than in the small island states of the Caribbean, whose ecosystems and economies are amongst the most vulnerable in the world (UNEP 2007, 2006, UNFCCC 2007, Bueno et al. 2008).

In Canada, we have considerable capacity to predict severe storm events and coastal vulnerabilities to sea level rise. Yet there are growing concerns that too little effort has been spent to establish critical linkages between the scientists who are generating new knowledge on anticipated climate impacts and opportunities for adaptation, and staff within local governments that are responsible for needed changes to planning and development policy, preparation for changing weather norms and shifting coastal conditions, and emergency response to crisis situations. In the past decade, severe weather events such as Hurricane Juan (2003) and increasingly frequent extreme storm surges have tested the response capacity of local governance systems, industrial sectors, and communities. As in other nations, there has been a growing appreciation throughout Canada of the need to improve the working linkages that better connect local knowledge and response networks of coastal communities with the existing scientific resources vested within universities, and with the diverse capabilities of national, regional and provincial governments and the economic sectors. It has been increasingly accepted that early planning for climate change can improve local capacity to anticipate potential impacts, to plan for avoidance of impacts to

natural systems and to local infrastructures and economies, and to ensure that during times of crisis, limited resources will be strategically and effectively applied to identified priority areas to reduce negative impacts.

In 2009, two major funders of conjoined community-university research initiatives, Canada's Social Sciences and Humanities Research Council (SSHRC), and the International Development Research Centre (IDRC), extended the established Community University Research Alliance (CURA) program into the international sphere. The ICURA program supports the creation of alliances between community organizations and postsecondary institutions which, through a process of ongoing collaboration and mutual learning, will foster comparative research, the creation of new knowledge, and training in areas of shared importance for the social, cultural or economic development of communities in Canada and in other countries. The ICURA initiative also facilitates collaborations across sectoral, organizational and international boundaries.

One of the first four ICURA projects funded is a Canada-Caribbean climate change project (C-CHANGE) intended to close some of the gaps between impending impacts to natural and built environments and the urgent need to assist coastal communities in anticipating and planning for the associated changes to their physical, economic, and social well-being. Development and management of the C-CHANGE project is a collaboration between the Telfer School of Management at the University of Ottawa in Canada and the Sir Arthur Lewis Institute of Social and Economic Studies (SALISES) at the University of the West Indies, St. Augustine Campus in Trinidad and Tobago. C-CHANGE is completing the first of a five year program of research and collaborative planning. In this paper we provide a summary of the project goals and objectives, our progress to date, and our plans for the future.

The primary goal of the C-CHANGE project is to improve planning for coastal community adaptation through the development and incorporation of new policy and management measures. These measures are consistent with established planning theory and guidelines and utilize practical local alternatives for coastal resource management. Our team of researchers and community partners recognize that planning to reduce adverse effects and to adapt to change draws heavily on the capacity of the natural and human systems that comprise coastal communities to adjust to changing conditions within both local and global environments and economies. Sale et al. (2008) confirm that the keys to improving local capacity for adaptation and emergency preparedness lie in the successful integration of local and traditional knowledge with available information drawn from the scientific, management, and institutional sectors. C-CHANGE focuses on the need to inform and strengthen municipal and private sector capacity to make the changes needed to development policy and practices, to existing and evolving infrastructure, transportation and utilities, health services, water and sewage distribution and treatment systems, and to the management of resource sectors in agriculture, aquaculture, and fisheries. Governance at the

community level can take many forms, dependent as much on local resources as on cultural influences, and institutional structure. The project also recognizes that impacts to coastal biodiversity emerging as a result of changing climates will have a domino effect on coastal resources, and on their dependent economies. Our work plan relies on the development of scenarios and measures to assist adaptation to environmental change that will be best achieved through the cooperative sharing of knowledge, resources and expertise between academic institutions and community governance and organizations in an output-driven, applied research effort. As a collaborative community-university research program, C-CHANGE will support the creation of positive, multi-level, working alliances among:

- eight coastal communities (four in Canada and four in the Caribbean);
- five postsecondary institutions in Canada and the Caribbean strategically equipped to provide needed research and training resources;
- lead staff within local, provincial, regional and national governments; and
- an array of local stakeholders with interests in both environmental conservation and/or economic development.

These alliances are aimed at developing policies, strategies and decision-making tools that will better equip coastal communities in their planning for sea level rise and for storm-related emergencies. The program will establish formal collaboration and mutual co-learning opportunities among the selected Canadian and Caribbean coastal communities on comparative research on policy implementation for adaptation to coastal environmental shifts. C-CHANGE also recognizes the fundamental need for capacity building through the training of university graduates and community decision-makers and through the creation of new adaptive policy and management measures.

C-CHANGE Community Partners

, C-CHANGE coastal communities are located in Canada's Atlantic, Pacific and Arctic regions and throughout the Caribbean region, and involve populations in a range of economic, social and environmental conditions whose livelihoods are affected by rising sea levels and severe storms. The Canadian community partners are:

- the provincial capital city of Charlottetown, Prince Edward Island;
- the collective communities on the island of Isle Madame off Cape Breton Island in the province of Nova Scotia, located along Canada's Atlantic coast;
- the community of Iqaluit, territorial capital of Nunavut located on Baffin Island in Canada's Arctic; and
- the community of Gibsons, British Columbia located on the Sunshine Coast along Canada's Pacific coastline.

These Canadian communities range from a large urban area and capital city with attendant diversity of economic activity, to more remote and geographically isolated island communities with a greater economic focus on natural resource use and eco-tourism.

The Caribbean community partners are:

- the city of Georgetown, the capital of Guyana, which is below sea-level;
- Grande Riviere, a village located on the northeast corner of the island of Trinidad and predominantly known as spawning ground for endangered leatherback turtles;
- the communities of the Belize Barrier Reef; and
- the island of Bequia located at the southern end of St. Vincent and the Grenadines.

Each of the Canadian partner communities has been aligned with a community in the Caribbean, to promote shared insight and opportunities for change, and with a view to future comparative analyses. A brief description of each community pairing, and the major threats from sea level rise (SLR) and severe storms is provided in Table 1.

The C-CHANGE communities of Table 1 are defined uniquely by their distinct context and threats. Moreover, the definition of community captures the particular environmental, economic, social, institutional and organizational, and cultural dimensions unique to each. C-CHANGE links to the communities are made through identifying the governance, professional, services, and representative community segments, in order to understand their specific environmental concerns as key members of the community.

Table 1: C-CHANGE Canada-Caribbean Partner Communities

COMMUNITY	DISTINCTIVENESS	CLIMATE CHANGE THREATS
Charlottetown **Prince Edward Island, Canada**	Provincial capital city and coastal port; population 60,000; centre of industrial and commercial activity; historic waterfront downtown area	Impacts to infrastructure and historic sites from flooding associated with predicted SLR and storm surges
Georgetown, **Guyana**	National capital city and coastal port; centre of industrial and commercial activity; population 215,000; largest city in region; 14 feet below sea level	Breaching of the protective sea walls and dykes by storm surges; salt water contamination of drinking water supplies
Iqaluit, **Nunavut,** **Canada**	Territorial capital city in Canada's high North; population 6200 projected to double by 2030; highly sensitive terrestrial and marine Arctic environment; eco-tourism including whale-watching; whale hunting permitted by native peoples using traditional methods; nearby shipping lanes	Melting/destabilization of permafrost areas of shoreline leading to erosion and sedimentation and coastal hydrological and biodiversity changes - leading to impacts on ecosystems & indigenous cultures
Belize Barrier Reef	Island atolls on 300 km section of the 2nd largest reef in world - the Mesoamerican Barrier Reef System, World Heritage Site; destination for half of region's 260,000 tourists; nearby shipping lanes	Impacts from SLR and storm surge on coral reefs, local tourism, and fish and shellfish fisheries
Gibsons, **British Columbia,** **Canada**	Sunshine Coast coastal town; population 4200; unique location with proximity to Vancouver; popular resort town; significant eco-tourism and hiking and camping area	Impacts from SLR and severe storms leading to waterfront erosion and risk of groundwater exposure to salinization
Grande Riviere, **NE Coast,** **Trinidad and Tobago**	Isolated village of fishermen and small crop farmers; popular local eco-tourism area; protected nesting area for giant leatherneck turtles; nearby shipping and important agricultural areas	Immediate potential for impacts from sea level rise, shrinking beach, and severe storms
Isle Madame, **Cape Breton,** **Nova Scotia, Canada**	Local fishing area; population in several villages 4000; eco-tourism; archipelago of small isolated coastal communities; historic settlement area for Acadians	Impacts from SLR and severe storms on unique transportation links and potential isolation due to infrastructure damage
Island of Bequia	Island archipelago and coral reefs; popular boating area for cruising yachts; marine and eco-tourism based on whale-watching; significant natural habitats; native peoples' traditional marine hunting activities; nearby shipping lanes	Impacts from SLR and severe storms, unique transportation links, potential isolation due to infrastructure damage

Using Existing Data to Mobilize New Knowledge

Because of its emphasis on collaboration with the communities, C-CHANGE represents a departure from more traditional approaches to community academic research. C-CHANGE research relies on available data and information supplied by each community. Respecting the need to work with what we have and avoiding overlap and duplication, C-CHANGE is not intended to generate new baseline data, but will rely on the communities existing resources to identify the existing and emerging threats and vulnerabilities faced by local environments, infrastructure, society and the economy.

Working with the communities in this manner, we are promoting local involvement, and encouraging the use of existing data as an appropriate tool for the generation of new knowledge and an improved understanding of the threats and opportunities posed by sea level rise and severe weather. As the project progresses, much of this knowledge will be broadly communicated to decision makers and to the public using social networking tools made possible by the Internet. Information flows electronically between the C-CHANGE Secretariat sites in Canada (Telfer School of Management, University of Ottawa), and the Caribbean (University of the West Indies, St. Augustine Campus, Trinidad and Tobago) and the C-CHANGE team members and communities via the C-CHANGE website and the C-CHANGE Facebook site. The website is the core of communication, data-sharing and knowledge exchange among researchers and community participants. The social networking site is the active location of ongoing events, discussions, and new information that engages all community members in Canada and the Caribbean locations.

The partnership alliances between the universities and the communities will also collaboratively assess and evaluate adaptation and mitigation tools by presenting methods, best practices, and community-based policy recommendations for the express use of local and regional governments. The end result will be the development by each community of a Community Adaptation Action Plan (CAAP), a pragmatic tool unique to that site, which will guide the future development of the community to mitigate the impacts of sea level rise and severe storms.

Working through the C-CATs to Improve Local Collaboration

C-CHANGE partner communities are already actively engaged in the process. Community representatives have attended a number of meetings to discuss the project, its information needs, and the nature and availability of relevant data. The C-CHANGE Canada Community Coordinator is responsible for working with the Canadian research team and the Canadian community partners to establish the local C-CHANGE Community Action Team (C-CAT). The composition and membership of the C-CAT are determined by the C-CHANGE community partner, based on the local context. C-CAT membership is broadly accepted as including individuals drawn from one or more of the following:

- key municipal government staff responsible for planning for and/or response to climate change impacts, e.g., town managers;
- elected representatives of local governments, e.g., mayors and councillors;
- private and public infrastructure services, e.g., town planners and design professionals, utilities and services, engineers, insurance and legal representatives;
- business and economic activity organizations, e.g., company managers, small business operators, members of boards of trade and commerce;
- citizens' groups, e.g., environmental non-governmental organizations (ENGOs), representatives of indigenous communities; and affected individuals, e.g., special interest or disadvantaged members of the local society who are socially differentiated by poverty and across gender, class, race and age;
- other individuals that can provide information needed to inform the project; and
- the C-CHANGE champion for that community, the assigned member of the research team.

The C-CAT appoints a lead person to act with the Community Coordinator as the primary liaison between the research team and their community. C-CAT membership is expected to start small, especially in rural communities that are not used to this kind of a working partnership, and slowly expand as the project evolves and the need to inform and engage a broader representation of the community rises in importance. C-CAT meetings with the C-CHANGE research team are developed to identify the concerns and priorities of the representative community segments leading to focus groups on the analysis and evaluation of specific adaptation strategies. Public community information sessions will be a tool best handled by the local C-CATs themselves, as needed, and with the assistance of the C-CHANGE research team.

C-CAT members are expected to play key roles in the initial stages of the C-CHANGE project through addressing the following questions:

- Engagement of key community resources and individuals re: "What resources of information and people can the community provide to aid in the development and analysis of integrated community action plans?"
- Identification of community interests, concerns and priorities re: "What are the environmental, economic, social, institutional, organizational, and cultural issues that need to be considered for adaptation?"
- Development of a Community Profile Report based on the unique context and key conditions within the community re: "What are the main priorities and environmental concerns of the community segments?"

The information collected via electronic and other communication means will assist in identifying local priorities and inventory community resources, services, institutional and governance linkages. This information permits the locally-assisted development of environmental vulnerability indices for the community. Leveraging the results of previous research and using a multidisciplinary approach, the research from this interdisciplinary data will incorporate aspects of sociology, economics, management science, and geomatics engineering.

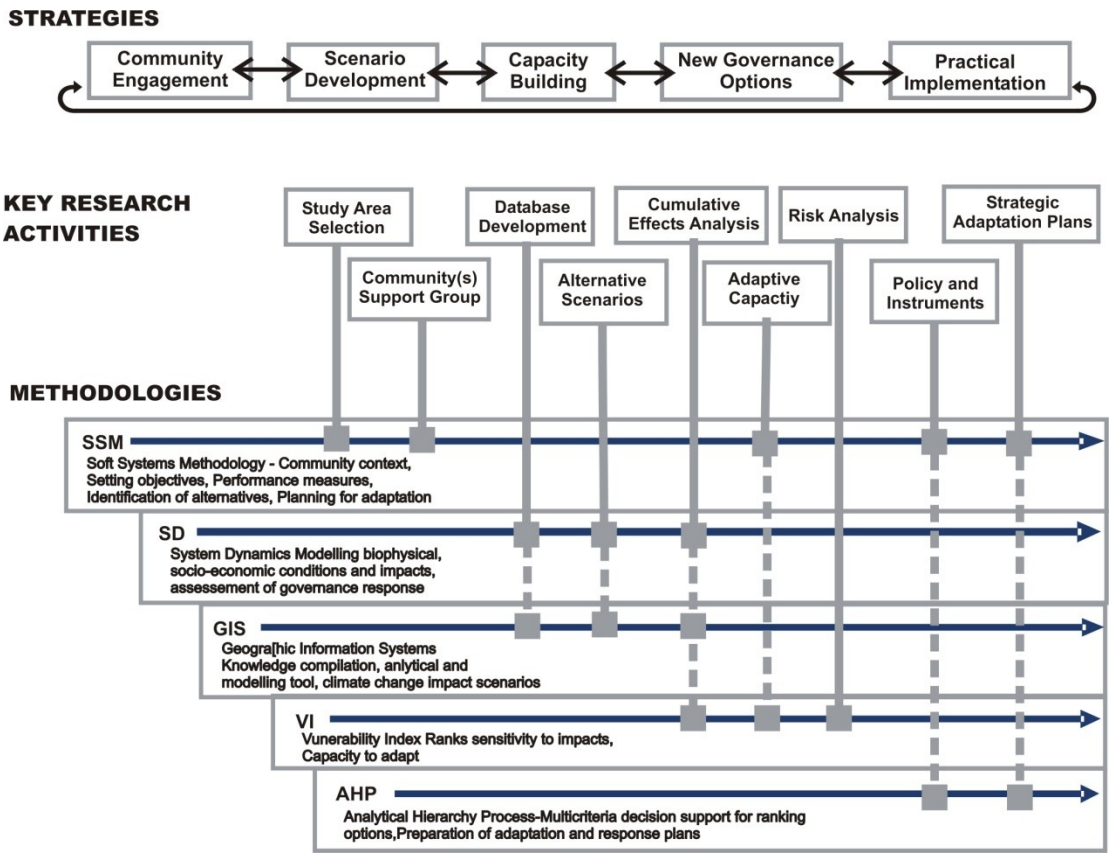
Community information will be used to develop spatial models that will be presented to the C-CATs to examine environmental impact scenarios including integrated econometric and socioeconomic impacts models from data projections, for community discussion and review. Baseline indices will be updated regularly over the course of the project with changes to the value of the community vulnerability and adaptive capacity indicators to reflect ongoing project activities and the recommended policy measures.

The C-CATs will view alternative strategies, suggest recommendations and facilitate 'buy-in' by the wider communities including taking ownership of local community meetings and workshops with the assistance of University researchers. Local community workshops will provide training in "Managing Adaptation to Environmental Change" and use of the vulnerability index and adaptive capacity measures to build knowledge towards planning for change. Working documents from local workshops will be prepared and disseminated through the C-CHANGE project website to community leaders, practitioners and policy makers. Graduate students will work on specific project elements such as geomatics and information management, web database development, multicriteria decision making, policy evaluation, and risk management. They will be overseen by academic as well as community team members, with opportunities to gain experience working in the practical application of research findings.

Elements of the C-CHANGE Research Plan

The C-CHANGE research process is based on established steps of problem solving and risk management (Australia 2007). The major elements of the research plan are graphically presented in Figure 1. The following discussion details the research elements identified in the Methodologies of Figure 1 below.

Figure 1. Research Process



Source: ICURA Formal Proposal, submitted November 2008.

1. Problem Definition: Soft Systems Methodology (SSM, Checkland 1992) is used at the local level to establish priorities, to define the scope of the research, to pinpoint institutional arrangements, decision makers and affected organizations, to establish measurable performance indicators, and to develop decision alternatives. SSM is a useful tool that addresses issues of adaptation and sustainable development at the local community level. At the core of SSM is the conviction that many human problems are complex and issue-based requiring inter-disciplinary collaboration to develop effective solutions, and that implementation of SSM solutions is best accomplished though accommodation by community members rather than though consensus or optimization. SSM seeks 'common ground' through respectful and structured debate on management. In this context, efforts rely more on a system of inquiry and adaptive learning, reacting to events and responding to behaviour than on changing patterns of behaviour and their underlying causes (Senge 1990).

2. MetaData Inventories and Community Databases: Within C-CHANGE, the identification, analysis, and evaluation of identified vulnerabilities and risks from sea level rise and severe storms scenarios is being guided by the creation of meta-data inventories and local databases that collate available community resources, including information on environmental, economic, social, institutional and organizational, and cultural capital. Assembled data also include in addition to base maps, topography, and coastal hydrography, the documented and colloquial histories of storm events, all of which are being used to assist in assessing outcomes and in projecting the likelihood of real threats to local infrastructures, environments, economies and cultures.

3. Visual Modeling: C-CHANGE researchers are producing geo-spatial models of the integrated dynamics of ecological, socioeconomic, and cultural subsystems. Geographic information system (GIS) technologies are being used to organize and extract information from digital as well as hardcopy maps, tables, graphs and images to support visual and manual analyses. Teams are also assessing the benefits of open source GIS software that could be readily and publically available to a wide array of community participants, and provide a valuable tool for information sharing and knowledge dissemination. Systems Dynamics (SD) techniques will be used to describe and link the physical, economic and social baselines through visual spatial and temporal maps. The project simulates hypothetical situations for community discussion, including exploring the impacts and response of adaptation and mitigation strategies to perceived and real threats.

***4. Vulnerability Modeling*:** Community Vulnerability Indices (VIs) will be produced using static and dynamic maps that present both current vulnerability conditions as well as potential future scenarios subject to coastal environmental risks. VIs provide measures of the sensitivity of coastal communities and are a criterion for the allocation of financial and technical assistance. The index of community vulnerability will be designed to be simple, comparative, and transparent. C-CHANGE accepts that coastal community vulnerability can stem from detrimental impacts to natural systems that are exacerbated by factors such as a narrow economic base, dependence on trade, and susceptibility to external economic fluctuations (e.g., oil prices). C-CHANGE uses the UN/Commonwealth VI to identify risks as well as to assess community capacity to adapt to changing conditions (Sale et al. 2008, Briguglio 1995, Adger 2006).

5. Adaptive Capacity and Resilience Modeling: As expressed by Yohe and Tol (2002), local capacities to develop and implement strategies that effectively address impending change are determined by a range of factors including:

- technological options;
- available resources;
- institutional structure and decision-making;

- existing social infrastructure;
- access to risk-spreading mechanisms;
- decision-makers' ability to manage information; and
- the public's perception of the source and significance of the impact to its local manifestations.

Effective adaptation to change is constrained by the resilience of natural systems in evolution with human systems, i.e., by their respective ability to cope with external shocks (Gunderson and Holling 2002, Adger et al. 2001). Resilience refers to the coping ability or adaptation capacity of the affected community and ability of an affected community to recover from a damaging external impact. C-CHANGE works to improve resilience to change in its Partner Communities, while encouraging increased flexibility to adapt. Both resilience and the ability to adapt to change will be improved by broadening understanding of local dependencies, and adopting measures that advance economic, environmental and social resilience. Modeling consists of constructing a Resilience Index (RI) (as a companion to the VI) adapted to coastal communities that is associated with community adaptive policy (Briguglio et al. 2006) and applied to alternative policy options.

6. Development and Assessment of Policy Options: Spatial analyses are used to produce hypothetical cases of ecosystem shifts in local communities and to project spatial and socioeconomic impacts. These models are based on credible scientific research projections that use the Systems Dynamics (SD) baselines as a starting point. The SD projection models complement the delivery of participant-based SSM that is in turn used as a negotiation tool to identify areas of agreement in which to investigate future community environmental scenarios. SD is used as a dynamic simulation tool for presentation of the environmental scenarios and cumulative community effects and impact evaluations for group analysis (Forrester 1973). SD software, (e.g., *Vensim, STELLA*) has advanced iconic capability making model visualisation, development and sharing accessible to participants.

7. Evaluation of Group Decision Making: Evaluation and ranking of alternative environmental mitigation strategies is carried out using the Analytic Hierarchy Process (AHP) (Saaty 1980). AHP has been adopted to evaluate community participants' perspectives on the important problem components that are arising through community discussion in the SSM prioritization exercise. AHP provides a structured decision framework that breaks down complex decision problems by decomposition into explicit multiple criteria and sub-criteria in a hierarchical structure. The hierarchy identifies the community goal and key components of the physical ecosystem as well as its social and economic elements. Participants' feedback on the relative importance among the criteria and sub-criteria of the problem is used to determine trade-offs among problem objectives, e.g., reduce vulnerability and increase adaptive capacity, given evaluated policy alternatives (Michalowski and Szapiro 1992).

8. Implementation of Local Adaptation Planning and Action Frameworks: C-CHANGE is working to build community consensus on strategic and active planning for the mitigation of negative environmental impacts. The process will be captured in a Community Adaptation Action Plan (CAAP) that provides a coordinated set of guidance documents that inform preparedness for a relevant range of environmental shifts and coastal community emergencies and are specifically directed at community actors such as:

- governance and local decision makers;
- private and public infrastructure services;
- business and economic activity groups;
- citizens' groups; and
- special interest and affected individuals.

Each of the CAAP's is intended to be a living document that will guide the community in its development and its policies over the next 20 years and more. As new information becomes available, the CAAP will need to be updated and modified. The CAAP for each community will respond to a range of climate change scenarios that are particularly reflective of local conditions, vulnerabilities and threats. Development of the CAAP will rely on existing as well as proposed operational planning instruments as well as the existing and established mechanisms for emergency response. Each CAAP will be unique to that community.

The initial CAAP template will include the local community database, decision-support, and scenario analysis tools, and will be developed so as to be applicable to other coastal communities within the Caribbean, and across coastal Canada. Through comparative analysis of the process that each community went through and the results achieved, as set out in the CAAP, the research team will try to establish an approach to adapting to climate change that any community could use. The inclusion of both Canadian and Caribbean communities in the analysis will serve to broaden the result to one that can be used in other countries throughout the world. We are aiming for a consistent approach that will yield individual results, where the volume and accuracy of the data used in the development process is reflected in the degree of uncertainty attached to the predictions of vulnerabilities and threats, and to the sophistication of the CAAP. Given the dire consequences and costs of inaction with respect to climate change, even small or tentative steps toward adaption are definitely preferable to none.

C-CAT members will be critical in the identification and engagement of key community participants in both interactive workshops with specific sectors of the community, and in the training of local professionals and non-professionals, on the need for and the implementation of the CAAP.

Conclusion

C-CHANGE outcomes will include an increased academic, community and public capacity to serve and protect threatened coastal communities. C-CHANGE will provide a lasting impact on the capacity of coastal communities to prepare effectively for the environmental and socioeconomic threats posed by impending climate changes. By working within established societal governance systems, positive influence will be exerted on both existing policy and emerging policy, at the local, regional and national levels in coastal Canada and within our partner communities in the Caribbean region. C-CHANGE will continue to encourage both formal and informal linkages between the communities and their respective financial offices and funding sources since it is recognized that measures and policy recommendations will require government authorization and budgeting including the application of new technology and the reinforcement of community infrastructure. Communities will benefit from an increased knowledge base and a more skilled capacity to deal with anticipated climate change impacts, from the creation of collaborative working relationships with scientists, from the access to a cadre of young and highly trained graduates of the program, and from the opportunities to share their experiences with other communities in Canada and the Caribbean. The C-CHANGE research team and the community partners believe that insights derived from their experience can be used to provide guidance to coastal communities in other parts of the world.

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