WORKSHOP:
CLIMATE CHANGE AND COASTAL COMMUNITIES: Concerns and Challenges for today and beyond

Bouctouche, NB,
November 11-13, 2004

Final Report
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CONTENT

EXECUTIVE SUMMARY ..............................................................................................................3
ABSTRACT AND BIOGRAPHIES ............................................................................................4
ROUND TABLES SUMMARY ....................................................................................................5
CONCLUSION .............................................................................................................................61
APPENDICE .................................................................................................................................62
  Agenda ......................................................................................................................................62
  Participant list ............................................................................................................................67
  Comments .................................................................................................................................72
  Press Release ............................................................................................................................74
  Newspaper articles ....................................................................................................................78
Greetings Workshop Participants,

On behalf of the Southern Gulf of St.Lawrence Coalition on Sustainability, I would like to sincerely thank you for attending the recent *Climate Change and Coastal Communities* Workshop in Bouctouche, NB. We were very pleased with the turn-out and the keen participation with the roundtable sessions.

The idea for this workshop evolved during a meeting of the Southeastern New Brunswick Sea-Level Rise project in early summer. Initial findings for the study were ‘in’ and needed to be shared with the public. In turn, the Socio-economic Impacts component and Adaptation Strategies component of the project required learning how people can adapt to climate change and how economies and communities will be affected as a result of the changed environment. It was then decided to host a conference/workshop with a two-prong approach: first - to deliver important climate change information from a national perspective and to then focus on the local scenario with the results of the Sea-Level Rise project; and second – to provide an opportunity for the ALL stakeholders to comment on this very important issue.

In collaboration with the linking Science and Local Knowledge node of the Ocean Management and Research Network (OMRN), it was with much enthusiasm the Coalition-SGSL assumed the lead with hosting the event because we are a community-based organization and the workshop objectives addressed all aspects of our mandate. In short, the Coalition is excited to have been involved with this workshop and we look forward to tackling the directives put forth by participants! In keeping the momentum, we hope to play a valuable role with recommending priority strategies to government leaders and then monitoring their progress.

I hope you find the enclosed proceedings informative and useful. Should you have any further comments or inquiries, please feel free to forward them to coord@coalition-sgsl.ca.

Many regards,

Nadine Gauvin
Executive Director
**Abstract**

The project *Inuit Observations of Climate Change (IOCC)* that was recently carried out by the IISD, the Hunters and Trappers Committee of Sachs Harbour, and the University of Manitoba was initiated by members of the Inuvialuit community of Sachs Harbour on Banks Island, who wished to record and share observations of climate change and its impact on life in the Arctic. It brought scientific and Inuvialuit experts together in participatory workshops, semi-structured interviews, community meetings and the production of a broadcast-quality video.

This presentation summarizes the outcomes of the Inuit Observations of Climate Change project with particular focus on the following questions:

- What is the impact of climate change on communities in Canada’s High Arctic?
- How can local knowledge contribute to scientific understandings of climate change?
- How can coastal communities adapt to climate change?

The video product of IOCC, “Sila Alangotok: Inuit Observations of Climate Change” was presented during the public open house on Saturday evening.

**Biography**

*Eleanor (Elly) Bonny is the Coordinator of the Integrated Management Node of the Oceans Management Research Network (OMRN). She is a member of the Natural Resource Institute at the University of Manitoba and is beginning graduate work on the role of traditional ecological knowledge in co-management systems.*
Impacts and Adaptations to Climate Change in Atlantic Canada: communities, fisheries, & tourism
Norm Catto
Department of Geography,
Memorial University, St. John’s, NL

Abstract

Climate change is not a new phenomenon in Atlantic Canada. Residents are keenly aware of the weather and the environment. In a region where resource-based activities (including tourism) are critical to socio-economic activity, climate change and variation represent a new twist to a well-established story.

Evidence of climate change in Atlantic Canada includes 200 years of numerical meteorological data, historical records, agricultural records, mariners’ logs recording sea ice extent and iceberg numbers, tree-ring data, and data provided by pollen and other biological indicators. Throughout the North Atlantic, a cyclic pattern of natural climate change and variation is evident over the last 2000 years. The human-induced modifications of the climate during the last 200 years have been imposed on the natural cycle.

Atlantic Canada’s communities face a distinctive set of issues related to climate change. The impacts of marine climate changes are more important than atmospheric warming. Communities will be subject to an increased influence of the Gulf Stream and southwest air masses; increases in storm severity and activity; and more anomalous events. Atlantic Canadians contemplating future climate change can expect to see ‘more of the same’: more storms, drier summers, more winter and spring precipitation, stronger winds, and greater inconsistency in ocean current strengths and temperatures. Communities will not see any types of events that Atlantic Canada has not experienced previously.

In Atlantic Canada, limited population and the nature of our industries lead to low greenhouse gas emissions. Local mitigation measures are thus of less importance than adaptation to the effects of climate variability and change. Communities must deal with the effects of climate variability, without having the power to influence anthropogenic changes in climate, and frequently without seeing direct local evidence of climate change in terms of increased temperatures or decreased winter precipitation. Groundfish stocks, crab harvesting, tourism, and growth in the number of summer residents are all currently being influenced by climate variation. Recent increases in summer economic activity in some rural communities are notable.

Climate influences on human communities have been superimposed on other political, socio-economic, and technological factors. This is particularly evident for the communities most dependent on biological resources. The role of climate change on fisheries, fish harvesters, and fishing communities has varied throughout the northwest North Atlantic, both by place and over time, from that of “supporting player” to mere “background noise”. Only in cases of collapse of stocks due to purely ecological causes could climate change be considered as the “driving force”.

Climate change impacts extend beyond fish species. In addition to changes in species type and abundance, and changed pathogens, predators, and pests, there are numerous human and economic consequences, including impacts to fishery-related infrastructure and transportation, marketing, and communications systems. Changes in seasonality and storminess may necessitate operational changes by fish harvesters, with implications for both health and safety and search-and-rescue operations. All of these impacts create socio-economic consequences.

Ongoing climate change and variation impacts natural areas and tourism on several levels. Along the southern and eastern shorelines of the Gulf of St. Lawrence, variations in snow cover, decreases in sea ice cover, and limited ice foot development will result in increased wave erosion by winter storm surges. Climate variations, in conjunction with rising sea level, have resulted in increased coastal erosion and narrowing of beaches, coarsening of beach sediments, and increased degradation of coastal dunes. Stronger winter winds sweeping across exposed dunes, which have been eroded due to human pressure during the previous summers, result in enhanced erosion and lowering and flattening of dune profiles. Some dunes are migrating at rates in excess of 2 m per year.

Interior areas will also see the effects of climate change, including changes in vegetation and fauna, increased flooding, slope erosion, and frost heaving in exposed areas. The pattern of predicted climate change suggests that these effects will become more pronounced in the near future. Trail design should account for both increased usage and climate-induced stress.

Increased visitation, lengthening of the tourist season, enhanced tourist use of natural areas, and geomorphic stresses induced by climate change in combination have affected sites throughout Atlantic Canada, and could have an impact on the long-term sustainability of both natural areas and tourism. Comprehensive assessment of all the stresses on natural areas is necessary.

Increased visitation to Atlantic Canada has resulted from effective promotion, abetted in some degree by ongoing climate warming in Western Europe and central North America. Tourism is a vital component in the economic viability of many Atlantic Canadian communities, and is seen as a key component in the economic revitalization of formerly fishery-dependent communities. However, increased foot traffic and vehicle access to beaches and backing dunes have accelerated erosion of coastal tourist sites. Increased visitation, lengthening of the tourist season, enhanced tourist use of coastal areas, and geomorphic stresses induced by climate change in combination have affected sites. Differences in erosion rates and changes to beach sediments between adjacent protected and non-regulated areas, along both the north coast of PEI and in south-western Newfoundland, indicate that anthropogenic stress is a significant factor modifying dune-backed shorelines. Comprehensive assessment of the stresses induced by tourist activity at coastal sites is necessary, in order to recognize the potential for erosion and changes in beach sediment before substantial degradation occurs.

Impacts resulting from climate change happen, regardless of the cause of the changes. My research focuses on effects and impacts: determining the proportion of 'natural' vs. 'human' climate change is not as important as coping with rising sea level, increased coastal erosion, increased frost heave and debris flow activity, increased flooding, or changing water supply. Changes are being identified and measured right now, and as the climate changes, adaptations are necessary. Most, if not all, suggested adaptations represent application of current 'best practices'.
We face similar types of risks, and only the frequency and the consequences of disregarding our existing knowledge will change. Many adaptations are already ongoing, and a combination of information, communication, dissemination, and planning involving all members of our communities will result in successful adaptation to future climate change.

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**Biography**

*After postdoctoral research at the University of Stockholm, and lecturing at the University of Alberta, Norm Catto has joined Memorial University in 1989. His research interests include coastal landforms, sea level change, impacts of climate change; rivers and flood risk assessment; coastal dunes; slope failures and landslide risk assessment, and glacial features. His research has included projects and investigations in Scandinavia, Estonia, Russia, the Dominican Republic, Argentina, New Mexico, and throughout Canada. He is a member of the steering committees for the Canadian Climate Change Impacts and Adaptations Research Network (C- CIARN) node dealing with Atlantic Canadian issues, chair the C-CIARN node dealing with coastal issues, and also serve on the steering committee of the Ocean Management Research Network’s ‘Sustainability’ node and the Canadian Hazard Research Network.*
Future Research Directions and Needs
Michael Chadwick
Oceans and Science Branch, Gulf Region
Fisheries and Oceans Canada

Abstract

There are many interesting issues in the southern Gulf and all of them are linked to climate change. One important feature of the southern Gulf is that it is very productive. Nearly 20% of Canada’s marine production and most of its molluscan aquaculture industry is from this relatively small area, which is <1% of Canada’s marine zone. The high productivity is because the southern Gulf is shallow and warm and has many highly- branched estuaries. These areas provide an interface between terrestrial and aquatic ecosystems and could be considered as analogous to lungs, or Canada’s Everglades. Our coastal waters are also retentive, meaning that material released into them remains in the immediate area and is not easily flushed away.

This retentive property coupled with the close association with land has resulted in two pressing issues. The first one is eutrophication, where coastal waters are fertilized by nitrates from outfalls, processing plants, sewage treatment plants, other land-based activities and airborne pollution. Eutrophication results in the growth of algal mats and has profound consequences on the health of our estuaries because it removes oxygen and makes these highly-productive areas inhabitable for marine life. In addition, eutrophication coupled with poor land practices and coastal erosion result in our estuaries becoming filled in with sediment and lost productivity.

The second issue is bacterial contamination. Bacteria from outfalls and other land-based activities find ideal growing conditions in the southern Gulf. The result is that much of Canada’s richest shellfish grounds are closed to harvest for varying periods every year. In 2003, over 220 oyster and mussel beds were closed. The surface area of these closures was about 3,000 km² and equal to nearly half of coastal waters less than 10 meters in depth. Global warming will likely exacerbate these problems further because warm water increases the rates of eutrophication and bacterial contamination.

A third problem also encouraged by warmer water is invasive species. Over the past five years, four invaders have made their way into the southern Gulf. The invaders include green crab, two species of tunicate, and an alga called oyster thief. It is believed that the main vector for introducing these species is shipping and boating.

A fourth issue is exploration and development of offshore hydrocarbons. Recent work suggests that seismic activity could impact the reproductive health of female snow crab. This work is not definitive and needs to be completed, particularly because the southern Gulf likely has the highest density of snow crab in the world.

Another key issue is the status of our marine and estuarine resources, including species at risk. Species of concern include striped bass, American eel, American plaice, Atlantic cod and striped wolffish.
Almost all of our information on marine fish comes from an ecosystem-trawl survey that has taken place every September since 1971. This survey provides a snapshot of about 100 species of aquatic animals and their mid-shore environment. These snapshots can be compared from one year to the next. We can say that large-bodied fish like Atlantic cod, American plaice, white hake, winter flounder and yellow-tail flounder are at a low level of abundance today compared to previous years. We can also say that small-bodied pelagic animals like herring, capelin, mackerel and jellyfish are at high abundance.

This survey also provides information on environmental conditions. We know that the percentage of the southern Gulf covered by cold bottom water (<1°C) increased during the 1990s. These conditions were favourable for Arctic species like snow crab. During the same time period, summer surface water increased in average temperature. Without this survey, we would be unable to say much about this highly-productive ecosystem.

By contrast, there are no consistent surveys of our near-shore waters, and we are unable to make definitive statements about the status of species in these environments. This gap is an important shortcoming. We need to develop a consistent sampling program of our estuaries, which would include monitoring of water properties, water quality (nutrients, oxygen and contaminants), sediments, currents and the status of key habitats such as eel grass beds, oyster reefs and tidal prisms. We also need to identify sensitive areas and clear targets for nutrient loading and other forms of water use.

The challenge ahead is how to fund such activities. Currently, federal and provincial departments are looking for ways to save money, not spend more. Vessels are a large expense. Almost one-quarter of the total DFO science budget is spent on ships and these costs are increasing. The future means that there will be less time at sea, at least on federal vessels, and a lower frequency of sampling the marine environment.

At the same time, universities, watershed groups, community associations, First Nations and fishermen’s organizations will find themselves more involved with monitoring and the collection of critical information on our aquatic environments. New technologies that make precise measurements repeatedly and automatically will help. But there are many challenges to validating and providing access to this information once it is collected.

The role of federal departments will be enhanced in data management and access because this activity requires long-term investment for the public good. Federal departments will also facilitate the peer review of scientific questions related to impacts of human activities on the aquatic environment. The biggest challenge of the future will be to work in large networks across diverse organizations, including many volunteers, and to make effective use of sporadic funding. The southern Gulf is a special place because we already have a strong network and we are able to work together.
Biography

Michael Chadwick is interested in solving problems related to the management of aquatic resources, with an emphasis on making science more accessible to the public. He studied at University of Guelph (B.Sc., M.Sc.) and at Memorial University of Newfoundland (Ph.D). He has conducted research on fish, invertebrates and environmental issues throughout Atlantic Canada. He lives in Moncton, New Brunswick. He is Regional Director of Oceans and Science, Gulf Region, with Fisheries and Oceans Canada. He is also associate professor in Environmental Studies at Université de Moncton. He has served as editor of ICES Journal of Marine Science and Canadian Journal of Fisheries and Aquatic Sciences and as member of the Interdisciplinary Committee of the Natural Sciences and Engineering Research Council of Canada (NSERC). He has over 120 scientific publications.
Abstract

According to Naomi Oreskes (Science, 3/12/2004) a consensus has been created in the scientific community around the idea that human activity has had an impact on earth surface warming. The Geological Survey of Canada (Shaw et al., 1998) holds that “climate change at the global level is feared because so many unknowns are involved.” According to these same authors, among the geological processes that act to change the Earth’s surface, “the forces with which we are more familiar are water and wind, which act on the surface by eroding (removing) materials from one place and depositing them in another.” The authors consequently conclude that “because the climate plays a major role in driving these processes, climatic changes will result in increases or decreases in the nature and intensity of these processes.” On Canada’s Atlantic coast, and more specifically in the Southern Gulf of St. Lawrence region, the storm surge phenomenon should accelerate during the course of the 21st century, resulting in increased erosion and flooding. While this is not a new phenomenon, the accelerated frequency of these extreme weather events caused by climate change are to be feared. Now that studies are converging (Oreskes, 2004) we have a duty as scientists to act.

We have known for the last decade (Shaw, 1995) that the crust of the Southern Gulf of St. Lawrence’s coastal terrain has been sinking at a rate of 20 cm per century because of the subsidence phenomenon. Moreover, we know that there is an inverse relationship between “the volume of water in glaciers and that in oceans (e.g. warmer climate will reduce glacier size with the meltwater ending up in the oceans).” (Everell, 1998). This has led these scientists to predict an approximate increase of 70 cm by the year 2100. This study’s results show that certain portions of the area between Baie Verte (around the Confederation Bridge) and Miramichi Bay have low, vulnerable relief and are at moderate risk. Before the 1960s, the coast’s littoral was allowed to lie fallow by the local populations of the Southern Gulf of St. Lawrence. But the attraction these lands hold for urban populations wishing to build coastal residences by the seaside has accelerated in the last 40 years (since about the mid-1960s) and has represented, for the last decade or so, a veritable “rush to the coast”. The province of New Brunswick, after having written a draft of the Coastal Areas Protection Policy in 1996, whose priority was to “protect the integrity of the coastal zone”, changed headings in 2002 to primarily “reduce the risk of threats to personal security caused by storm surges.” (New Brunswick, 2002)

Since the mid-1070s, the coastal residents of Southeastern New Brunswick between Miramichi Bay and the Confederation Bridge in the Southern Gulf of St. Lawrence have taken numerous adaptation measures. In an effort to understand relevant perceptions, researchers working on the socio-economic aspect², with those working on the adaptation aspect³, have conducted a survey

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² The socio-economic aspect of the sea level rise project is under the direction of Kelly Murphy of Environment Canada, Halifax.
³ The adaptation aspect of the project is under the direction of Sue Nichols of the University of New Brunswick, Fredericton.
with 27 representatives of groups (municipal groups, planning commissions, sustainable development groups, tourist groups, watershed groups, elders, wharves authorities, national parks, as well as entrepreneurs and businessmen from the CBDC) that have installations or residences within a kilometer of the coastline. The idea was to learn what each of these group representatives understood of climate changes and of climate change adaptation strategies. This was a first step towards understanding local governance of the coastline. In addition to semi-directed interviews, the onsite investigation was also comprised of three focus groups composed of 32 people from Shemogue to Kent County. These focus groups were essentially set up to validate interview results, and contained both interview participants and new people concerned by climatic change adaptations. These investigations were conducted between August 2003 and February 2004, and a report was published in March 2004.

The results that most allowed us to understand the diversity of respondents’ perceptions regarding climate changes can be summarized in 6 points. 1) Erosion is seen as a visible and inexorable phenomenon. Some sandbanks appear while others disappear, habitats are destroyed while others are created. Though erosion is not a new phenomenon, extreme weather events are more frequent. 2) Attraction to the coastal zone has led to the proliferation of residential construction, creating stress on coastal habitats and increasing risks of fresh water contamination and availability problems. 3) Uncertainty about seasonal variations remains a controversial issue where no consensus could be reached in the interviews and focus groups. 4) On the subject of extreme weather events, some respondents believe we must resist them using stone walls and gabions to protect infrastructures and residences, while others resigned themselves to retreating from Mother Nature. 5) On the question of economic changes and the new economy, respondents recognize that fishing activities are on the wane, while tourism and aquaculture are being developed as complements to the traditional fishery. All respondents agree that urban migration towards the coast causes usage conflicts, and residents feel more and more excluded from coastal areas. 6) As for governmental responsibility and the role of communities, there is a consensus that it is important for communities and various levels of government to cooperate in the face of climate change effects, in addition to promotion, as much on the reduction of impacts, as on concrete adaptation procedures.

Finally, we can conclude that the biggest issue for integrated management of the territory is the development of a culture of compromise and negotiation, but also of mediation so that the various user groups have room to coexist.

The next step will focus on twelve citizens representing various coastal groups that have done, or contributed to, adaptive work, and how they managed to do so: what information they had access to, availability of procedural guides, adaptive management, etc. By better understanding how various groups proceed in their adaptation strategies, i.e. use local knowledge, we will be better able to link them to scientific knowledge obtained with technological research tools to then equip coastal community citizens with the negotiation culture necessary for integrated management of a coastal area in accelerated transformation due to climate changes and human invasion.
Biographies

Omer Chouinard is a Sociology professor and director of the Environmental Studies Masters program at the Université de Moncton. He is co-researcher in the Linking Science and Local Knowledge Node of the Ocean Management and Research Network (OMRN) funded by both the SSHRC and Fisheries and Oceans Canada. He also works with the Network’s group on sustainability. He is part of the New Brunswick Sea Level Rise Project and works on its socio-economic aspect under the direction of Environment Canada’s Kelly Murphy, and on its adaptation aspect under the direction of UNB’s Sue Nichols. He is a member of the New Rural Economy Project’s research group on community capacity building under the direction of Concordia’s Bill Reimer. He works more specifically on the Project’s governance aspect under the direction of Rimouski’s Bruno Jean. Along with Bruno Jean, he is part of territorial development group funded by Quebec’s Society and Culture Research Fund. Along with Jean-Paul Vanderlinden, he is co-researcher on the interdisciplinary aspects of aquaculture research in the AquaNet project, as well as on interdisciplinary aspects of the SSHRCM’s climate change research project. He is also part of the Research Committee on social innovations in businesses and unions, a consortium of eight Quebec universities. His work focuses on the participation of civic society to new forms of governance in natural resource management by rural coastal communities, and on the impact on minority groups of rural populations’ migration toward urban centers.

Kénel Délusca is a graduate student at the Université de Montréal’s Geography department. He is a research professional with the New Brunswick Sea Level Rise Project, where he works on the integration of the project’s various aspects. His specialty is erosion and the loss of soil materials caused by storm surges, whose frequency has accelerated because of climate changes.

Murielle Tramblay holds a Masters degree in Environmental Studies from the Université de Moncton. She is a research assistant with the New Brunswick Sea Level Rise Project, where she works on various civic society groups’ perceptions regarding climate change and its effects.
Abstract

The mission of the Eastern Canada Soil and Water Conservation Centre (ECSWCC) is to promote sustainable natural resource management in cooperation with Atlantic Canada agricultural stakeholders. The Centre gathers, interprets and disseminates information, acts as a networking catalyst, provides specialized advisory services, facilitates technology transfer and assists in the provision of professional development with agricultural stakeholders. Within this mandate, the Centre has been involved for some time in raising awareness of climate change in the Atlantic agricultural community and in examining the needs for agricultural adaptation to climate change.

Jean-Louis Daigle and Dr. Gordon Fairchild from the Eastern Canada Soil and Water Conservation Centre were members of the Agriculture and Agri-Food Industry Discussion Table in the National Climate Change Secretariat consultation process. The results of that Table’s discussions were published by the federal government in 2001 as the Agriculture Options Report. The report recognized that there was a need for both further research on Greenhouse Gas (GHG) mitigation in agriculture and also for adaptation to climate change. It was also felt that the general level of awareness of climate change in the Atlantic agricultural community at that time was not very high.

Consequently, the Centre was one of the partners in a Climate Change Action Fund (CCAF) who funded a national project to raise awareness of climate change amongst agricultural producers. This project was led nationally by Agriculture and Agri-Food Canada (AAFC), with the participation of the Canadian Federation of Agriculture, the Canadian Cattleman’s Association, the Soil Conservation Council of Canada and the Eastern Canada Soil and Water Conservation Centre. Efforts within this project successfully raised the awareness of climate change within the agricultural community. The Centre continues to maintain a role in Climate Change awareness through ongoing participation in the New Brunswick Climate Change Hub and through awareness components in other ongoing GHG mitigation projects.

The main focus of our Centre’s participation in the climate change issue subsequently changed to GHG mitigation and adaptation to climate change. Jean-Louis Daigle is a member of the AAFC GHG Mitigation Advisory Committee (MAC) which provides advice to researchers on prioritizing research efforts on agricultural practices that may mitigate GHG emissions. Dr. Fairchild is a member of the National Advisory Committee of the Climate Change Impacts and Adaptation Research Network’s Agriculture node (C-CIARN Agriculture). Jérôme Damboise from the Centre is managing the Soil Conservation Council of Canada’s GHG mitigation demonstration and awareness initiatives for Quebec and the Atlantic. Nicole McLaughlin, also with the ECSWCC, has been managing the Canadian Cattleman’s Association efforts within the same program in the Atlantic region. Atlantic GHG mitigation demonstration efforts within these programs have largely focussed on nutrient management, manure management, riparian area...
management and pasture management practices that could potentially either reduce GHG emissions or sequester carbon in the soil.

The predictions for climate change in the Atlantic region are generally for a slightly longer growing season, some increase in temperatures, perhaps somewhat warmer winters with an earlier snow melt and more runoff from increased winter precipitation, increasing climate variability, an increasing frequency of extreme or intense weather events and an increasing crop season soil moisture deficit. The prediction of increased soil moisture deficits in the crop season may indicate a need for adaptive measures such as supplemental irrigation or for improved soil management practices to conserve plant-available water in the soil. Increased early season runoff and an increase in intense rainstorms could increase the risks of soil erosion and environmental pressures on agriculture.

These potential impacts of climate change on Atlantic agriculture underline the need for the development of adaptation strategies to climate change, particularly with respect to soil erosion and runoff control. Appropriate adaptive measures for soil erosion and runoff control includes: better crop rotations, strip cropping, winter cover crops, green manures, conservation tillage, residue management, mulching, cross-slope and contour cropping, diversion terraces and grassed waterways, land drainage enhancement, and nutrient and sediment control basins. With the increased variability of precipitation flooding may be a concern in some low lying agricultural areas such as river flood plains, dyke lands and coastal areas. On the other side of the coin, adaptive measures for drought and soil moisture deficits in the crop season may include consideration of the development of irrigation infrastructures, on-farm water storage structures, and policy adjustments for water use and allocation.

To effectively respond to all these GHG mitigation and climate change adaptation requirements in agriculture we need an appropriate balance of Policy Instruments and voluntary programs. In particular, we need technology transfer of adaptation measures, including on-farm demonstration of cost effective and acceptable agricultural Best Management Practices (BMPs). Additional Research and Development and Technology Transfer efforts on long-term sustainable resource management in agriculture will be required, including cost effective and practical solutions, monitoring and public outreach. There are “tools” and mechanisms in within in agriculture that will aid in this process including Environmental Farm Plans, soil and water conservation plans, feasibility studies for supplemental irrigation, and policy instruments.

Climate Change will have significant implications for agriculture in the Atlantic, particularly with respect to the potential for increased soil erosion and runoff from cropland and resulting increases in environmental pressures on agriculture. We need to develop proactive long-term programs and policy for both adaptation and mitigation. Improved communication of cost effective risk management strategies and technology transfer at the farm gate will help to sustain our rural communities in the face of a changing climate.
Biography

Jean-Louis Daigle was appointed Executive Director of the Eastern Canada Soil and Water Conservation Centre in April 1998. He received his Bachelor's Degree in Applied Sciences in Agricultural Engineering from l'Université Laval, Québec, in 1976. He quickly demonstrated his interests and conviction of the need for soil erosion control activities and for the protection of agricultural land at local, regional and national levels through his extension abilities and implementation of on-farm soil conservation systems. He is well-known to the agricultural community since he spent part of his professional career as an engineer and soil conservationist in Grand Falls, NB, from 1976 to 1991. Mr. Daigle was then named Head of the Agricultural Engineering Section, Land Resources Branch, with the NB Department of Agriculture and Rural Development. He was responsible for the direction and coordination of engineering services and programs related to land improvement, soil and water conservation and environmental stewardship.

He has been very active among several national and international associations related to his area of expertise such as: the Soil and Water Conservation Society of America, the Canadian and American Societies of Agricultural Engineering, Soil Conservation Canada, the Canadian Water Resources Association and the Canadian Irrigation and Drainage Association. He was inducted in 1990 to the Canadian Conservation Hall of Fame by Soil Conservation Council of Canada in recognition of his outstanding efforts in soil conservation extension.
Abstract

The objective of this 3-year multi-disciplinary research project is to quantify the impacts of climate change and more specifically sea-level rise, storm surge and coastal erosion on the Gulf of St. Lawrence coastal zone of southeastern New Brunswick, in support of sustainable management, community resilience and the development of adaptation strategies.

LIDAR data will be used to generate a detailed Digital Elevation Model (DEM) of the coast, critical for delineating flooding and inundation zones, natural protection structures such as coastal dunes, and backshore elevation for estimating sediment supply from shore erosion. Meteorological, geological and hydrographic studies will include investigations into measured and forecast sea-level changes due to crustal subsidence and climate change. This project will model the benchmark storm surge events of January 21, 2000 (declared a disaster by the federal government) and October 29, 2000 and develop a “maximum potential” storm surge along this coast given our understanding of historical events. These ranges of storm surge events along with the proposed climate change induced sea level rise scenarios will be placed on the DEM to identify areas along the New Brunswick Gulf of St. Lawrence coast that will be vulnerable to flooding, coastal erosion and inundation over the next 100 years. These impacts will be defined in terms of likely risk with scales of inland penetration of storm surges based on the scenarios presented and their effect on infrastructure, industry and coastal ecosystems.

The coastal zone of south-eastern NB is home to several threatened species of plants and animals. An important aspect of the ecosystem research will be to determine how sea-level rise and future storm events will impact critical habitat and species at risk. Based on existing habitat conditions, the impacts of sea-level rise and storm events on future habitat availability will be predicted. The distribution of keystone species, habitats at risk, and habitat suitability models, will be integrated in order to determine potential impacts on wildlife populations.

The presentation will include an overview of the project with specific examples of the LIDAR-derived DEM showing various regions of the coastline at risk from storm surge flooding.

Project partners include Environment Canada, Natural Resources Canada, Fisheries and Oceans Canada, Parks Canada, the New Brunswick government, Université de Moncton, University of New Brunswick, Mount Allison University, Laurentian University, Dalhousie University and the Centre of Geographic Sciences, in consultation with municipalities and planning commissions, and with additional financial support from the Government of Canada's Climate Change Impacts and Adaptation Program, and Public Safety and Emergency Preparedness Canada.
Biography

Réal Daigle received his Bachelor in Physics from the Université de Moncton in 1970, after which he completed Operational Meteorology training with Environment Canada in 1971. He has worked as a meteorologist for 34 years throughout Canada, including in Nova Scotia, the Yukon, Newfoundland, and New Brunswick. Since June 2003, he is the manager of a multidisciplinary project on rising sea levels in Southeastern New Brunswick.
New Brunswick Sea Level Rise Project
Socio-economic Impacts
Lisa DeBaie
Community and Departmental Relations Branch, Environment Canada, Dartmouth, NS.

Abstract

Understanding the socio-economic dimensions of climate change is a key component in the development of adaptation strategies, decision making processes, and engaging the public. The New Brunswick Sea Level Rise Project is using a multi-disciplinary approach to integrate the physical and bio-physical impacts of sea level rise, storm surge, and coastal erosion with social and economic impacts to develop adaptation strategies for communities. The socio-economic component of this study will focus on three case study areas to assess the different types of socio-economic impacts as a result of sea level rise, storm surge, and coastal erosion.

The socio-economic impacts presentation outlines the purpose of the study and the specific research objectives, the partners involved, the types of impacts being studied in each case study area, and the assessment of the communities’ perception of risk and current adaptation capacity. Each case study assessing different types of impacts uses different economic valuation techniques. The presentation discusses further the approaches used in each case study and time lines expected for results.

Biography

Lisa DeBaie is an environmental economist working in the Strategic Planning and Policy Division in the Atlantic Region at Environment Canada. Lisa and her supervisor Kelly Murphy provide strategic advice and support to Environment Canada staff, other government departments, stakeholders and communities on the linkages between environmental issues and the economy and society. Kelly Murphy is the project lead for the Socio-Economic Impacts component of the New Brunswick Sea Level Rise project. Together, Lisa and Kelly have developed the methodology for the project and have engaged key stakeholders to assist in the implementation of the methodology. In addition to the work Lisa is doing under the climate change project, she is also the project lead for an air quality study which is assessing the health costs of air pollution in Atlantic Canada and other areas of her work include environmental damage valuations of fish kills and participation in multiple teams to develop economic valuation proposals for acid rain mitigation strategies and wetland compensation/protection initiatives.
Assessing Impacts and Susceptibilities of Climate Change related risks in remote Coastal Communities: Haida Gwaii (Queen Charlotte Islands), British Columbia
A. Holly Dolan and Ian J. Walker
Department of Geography,
University of Victoria, Victoria, BC.

Abstract

Climate variability and change impacts including increases in the frequency and magnitude of damaging storms and encroaching sea-level impose a suite of direct and indirect risks to coastal communities. Susceptibility of communities to these risks results from their interdependent connections with the coastal environment such as their dependence on coastal resources and critical infrastructure such as transportation and power networks. Often overlooked, are many other indirect impacts to community services (e.g., health care and social services, communications) affected by the same risks. The degree of risk and impact depends largely on: i) geographic location (e.g., isolated or island communities), ii) exposure to short-term variability impacts (e.g., storm damage, interruptions to essential services) and iii) the capacity of communities to respond, plan and adapt to longer-term changes (e.g., future sea-level rise, increased storminess and coastline retreat).

Impacts and susceptibilities can be assessed using key indicators of response, both biophysical and socio-economic. Some of these are measurable (e.g., coastline erosion, damage/repair costs, jobs lost/created) while others are largely qualitative (e.g., resiliency of natural and socio-economic systems, perceptions of impact, effectiveness of response/coping strategies). This paper presents preliminary findings from a study of sea-level rise impacts on one of Canada’s most ‘sensitive’ coasts – northeast Graham Island, Haida Gwaii, British Columbia (Shaw et al. 1998, GSC Bulletin 505). This area is subject to high tides, frequent storm surges, extreme winds and ongoing sea-level rise (1.5 mm/yr). This produces a dynamic coastline that is eroding at 1-3 m/yr to 10s m in extreme years. Recent ‘extreme’ events including 1997-98 El Niño and a record high storm surge (Christmas Eve 2003) have resulted in various environmental and community impacts, responses and susceptibilities.

Our research approach is based on a recently developed framework for assessing adaptive capacity to climate change risks (Dolan & Walker in press). Temporally, it is recognized that short-term exposure to climate variability hazards is superimposed on long-term climate change vulnerabilities. Spatially, we acknowledge that risk exposure and susceptibilities are unevenly distributed among and within nations, regions, communities and individuals. Thus, the framework highlights determinants of adaptive capacity at the local, short-term scale and situates them within larger regional to national settings and longer adaptation timescales. Emphasis is placed on community-level experiences with climate extremes so as to identify local to regional scale responses that enable or constrain communities to recover and adapt. This contrasts typical climate change impact assessments that focus largely on reducing economic detriments on typically short planning horizons.
The research takes a community-based or ‘bottom-up’ approach to impacts assessment that incorporates local knowledge, experience and responses to climate change related risks. To this end, preliminary results from a community workshop and survey questionnaire are presented. The goal of these tools was to engage community members in the research and to solicit local knowledge that would better inform our understanding of impacts, susceptibilities and adaptive capacity. The objectives were to identify: i) areas and activities impacted by climate and community changes, ii) responses and challenges to these changes, and iii) ideas for improving responses for more effective future planning. Results will be synthesized into a report and a ‘community map’ of perceived areas of importance, impact and susceptibility. This will require further validation from the community via planned public forums. Ultimately, this information will be incorporated into an integrated (i.e., biophysical and socio-economic) assessment of key human-environmental vulnerabilities and adaptive capacity building options.

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**Biography**

Holly Dolan is an Assistant Professor in the Department of Geography at the University of Victoria. Holly is an environmental geography, with a recent focus on community and population health. She has been involved in climate change-related research for several years, having worked on projects dealing with impacts and adaptations in agriculture, water resources and community sustainability. She is currently involved in two interdisciplinary research projects that examine the vulnerability of coastal communities to environmental and social changes. The first, directed by Dr. Ian Walker in the Department of Geography at the University of Victoria, is an interdisciplinary and community-based climate change project examining the vulnerability of communities on North East Graham Island, Haida Gwaii, to climate-related impacts, specifically those associated with sea-level changes, as well as identifying, with communities, locally-relevant adaptation options. Holly also participates in Coasts Under Stress examining population health changes over time and their attribution to restructuring in several of British Columbia’s coastal communities.

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4 This project [www.geog.uvic.ca/CCAE](http://www.geog.uvic.ca/CCAE) is funded through the Government of Canada’s Climate Change Impacts and Adaptation Program (CCIAP).

5 Coasts Under Stress [www.coastsunderstress.ca](http://www.coastsunderstress.ca)
The Ocean Action Plan, Climate Change and Coastal Communities
George Emery
National Research Council, Ottawa, ON

Abstract

The Government of Canada is preparing an Ocean Action Plan (OAP) that will directly impact the activity of action groups concerned about climate change, the coastline and coastal communities. The engagement of stakeholders interested in these topics will be an important part of its development. It is essential that these stakeholders become informed early of the intentions of government in this regard and that they begin to prepare for their role in the overall planning function. This is not simply a matter of eliciting stakeholder opinion, but finding ways to involve stakeholders in realising Canada’s national and international objectives, protecting the health of the oceans, providing for the careful and integrated management/stewardship of ocean space, and developing technologies/performing scientific research that will allow us to gather information and make science-based decisions about that stewardship.

The presentation will talk about the OAP, its progress, and its relevance to local stakeholders. It will also recommend ways and means that local stakeholders might begin to use in order to prepare them for the eventual unfolding of the plan. Future research orientations, gaps and new ideas will be noted and highlighted.

Biography

Mr. Emery is presently a Senior Policy Advisor with the National Research Council of Canada. Among his other activities he is one of several individuals in the Council responsible for Technology Roadmapping, Technology Forecasting, Technology Foresight and Competitive Intelligence. Mr. Emery has been with the Council over the past four years and has worked mainly with the Institute for Marine Dynamics, St. John’s, Newfoundland and the Institute for Chemical Process and Environmental Technology on the development of Industry Technology Roadmaps.

Prior to this, Mr. Emery has held various positions of increasing responsibility within the federal government and in two separate provincial governments. Previous assignments in Industry Canada have included: building a Technology Roadmap for the Geomatics Industry; serving as Secretary of the Council of Science and Technology Ministers and Secretary to the Minister’s Advisory Committee on Networks of Centres of Excellence; acting as Desk Officer for University Matching Grants Policy in the Natural and Social Sciences with the Ministry of State for Science and Technology and Desk Officer for Federal-Provincial Relations, Industry Canada.

Mr. Emery has also served as Director of Strategic Planning and Secretary to the Cabinet (Social Policy) for the Government of Saskatchewan, and as a Research Associate with Human Resources Research Council, an early Futures Research "think-tank" within the Government of
Alberta. Other positions within the federal government include six years as a Senior Policy Analyst with the Treasury Board Secretariat and four years in the Office of the Deputy Minister of Public Works Canada. Shorter assignments with policy units in the Canadian Correctional Service and at Canada Mortgage and Housing Corporation round out his broad range of government experience.

Mr. Emery was born in Philadelphia, Pennsylvania where he worked for thirteen years as a Chemist and Chemical Technician in the private sector. He met his wife, Jo Ann, there and together they raised four children in Canada, Germany and the United States. The years spent in Wiesbaden, Germany were on active duty with the United States Army serving as a Guided Missile and Radar Technician. Mr. Emery also spent time doing anthropological fieldwork among the Cree-speaking peoples of northern Alberta and Saskatchewan and has worked extensively with First Nations peoples and the indigenous peoples of Canada and Latin America on an international trade assignment for Industry Canada.
Abstract

The Linking Science and Local Knowledge (LSLK) node, based at Simon Fraser University’s Centre for Coastal Studies, is one of three groups belonging to Canada’s Oceans Management Research Network (OMRN). The OMRN, which is funded by SSHRC and Fisheries and Oceans Canada, grew out of recognition of the need to better understand human uses of the ocean, and to improve management of the oceans – drawing more fully on social science, humanities, law and policy research. OMRN is a network of universities and colleges, governments and other organizations, and communities and individuals that are interested in sharing information on Canada’s oceans and coastal resources and in providing input into the implementation of Canada’s Ocean Strategy. The OMRN is composed of a National Secretariat, based in Halifax, NS, three interdisciplinary nodes focused on the interrelated topics Linking Science and Local Knowledge, Integrated Management, and Sustainability as well as two new working groups focusing on Governance and Coastal Community Health.

The major themes of the LSLK node are marine conservation, economic diversification and building capacity for sustainable management of coasts and oceans resources. It has many academic, government, industry, NGO, First Nations and community partners from across Canada (BC, NS, NB, PEI, NL, ON and PQ) and internationally (Australia, Europe, USA). The node uses regional and community workshops, roundtables, public forums, newsletters, reports and proceedings to share information, solutions and recommendations. Since its inception in 2001, the node has sponsored 15 or more workshops and roundtables in various locations in NS, NB, NL, and BC on subjects as diverse as community resource mapping, marine protected areas, coastal tourism, best practices in coastal zone planning, vulnerability and adaptation to change in Canada’s coastal communities, salmon and sea lice, and the present workshop on climate change and coastal erosion.

After four years of building a strong Canada-wide network the OMRN is now working to secure future long-term funding through diversified extended funding partnerships. We are looking forward to the National Conference, Canada’s Oceans: Research, Management and the Human Dimension, in Ottawa in Fall 2005.

Biography

Born and raised in British Columbia, Patricia Gallaugher, a fish physiologist, is a co-investigator of the Linking Science and Local Knowledge node of the Oceans Management Research Network (OMRN), based at Simon Fraser University’s Centre for Coastal Studies. She is Director of Continuing Studies in Science, Director of the Centre for Coastal Studies (which
she founded), and Adjunct Professor in Biosciences at SFU. Formerly a professor of Biology at Memorial University of Newfoundland, she is co-editor of a volume on marine conservation, Waters in Peril (Kluwer Academic Publications) and co-author of several book chapters, including Tying it Together Along the BC Coast in Fishing Places, Fishing People (University of Toronto Press). She is the author of numerous scientific journal articles including several recent articles on selective fishing research conducted in partnership with members of the BC commercial salmon fishing fleet and Fisheries and Oceans Canada. This work was recognized with the Murray Newman Award for Excellence in Aquatic and Marine Conservation Research. A member of the BC Ministry of Energy and Mines Scientific Panel on Offshore Oil and Gas Development in 2002 and the federal panel studying Partnering the Fishery in 1998, Patricia has been involved in a number of programs dealing with coastal resource sustainability issues in British Columbia and Atlantic Canada. Recently, she helped to organize workshops on Examining Best Practices in Coastal Zone Management in Alert Bay, BC, on Vulnerability in Coastal Communities and Adaptation to Change in Change Islands, NL, and the Future of Canada’s Coastal Communities: Some Case Studies at the recent Coastal Zone Management Canada 2004 conference in St. John’s NL.
Abstract

The coastline of Atlantic Canada is home to many species of unique plants and animals. Historically, coastal wildlife habitat was lost as a result of conversion of salt marshes to agricultural lands. Recently, coastal wildlife habitat has been destroyed and degraded through the construction of roads, cottages, and recreational developments. With an aging population in Canada, and people moving away from urban centres, there is an increasing prevalence of year-round residences being constructed in the coastal zone.

Coastal habitats are dynamic, and wildlife species have adapted to annual variation in habitat availability. However, the increased rate of sea-level rise associated with climate change, and the existence of human structures, may result in net losses of coastal wildlife habitat for certain species in the future. Efforts to conserve wildlife will only be successful in the long-term, by understanding how climate change induced sea-level rise, and increased storm frequency, will affect the abundance and distribution of coastal wildlife habitat.

The LIDAR based digital elevation model, information on erosion and deposition of sand, salt marsh accretion rates, air photos, and wetland inventory data will be used to quantify trends in habitat availability, and the amount of existing habitat. Climate and sea-level change scenarios will be used to predict future habitat availability.

Equally important the Ecosystem Impacts Team will evaluate how changes in available habitat will impact local populations of Piping Plover, Common Tern, Red-breasted Merganser, Nelson’s Sharp-tailed Sparrow, Willet, Barrow’s Goldeneye, Maritime Aster and Sweetgrass based on ongoing research into habitat use and demography of these populations.

Biography

Al Hanson is originally from Sackville, New Brunswick. He obtained his Bachelor of Science Degree from Mount Allison University, and his Masters and Ph. D. degrees from the University of Western Ontario. Al was hired as a habitat research biologist by the Canadian Wildlife Service in Sackville in 1990. Al’s main area of research is wetland ecology ranging from removing bacteria from wastewater using constructed wetlands to conducting a national inventory of wetlands using satellite technology. Al is currently the CWS Atlantic Region lead on climate change issues and is the Ecosystem Impacts Team Leader for the SE New Brunswick Climate Change and Sea-level Rise Study.
New Brunswick’s Coastal Areas Protection Policy
Paul Jordan
Environmental and Local Governments Department
Fredericton, New Brunswick

Abstract

In February 2002 the NB Department of the Environment and Local Government released the Coastal Areas Protection Policy to the public. Since then a series of public presentations were held in coastal communities around the province, with stakeholders, municipalities, district planning commissions, associations and the general public.

The Coastal Areas Protection Policy takes a zoning approach to land use development and activity along the 5, 501 km's of NB’s coast, dividing it into protected areas A and B. Each protected area has a number of conditions and criteria for development and activities. The conditions and criteria are based on achieving the objectives of the Policy.

The Department is presently working towards moving the Coastal Areas Protection Policy into a regulatory form. In the future, it is proposed that the Coastal Areas Protection Policy will be a regulation under the NB Clean Environment Act and tied to the NB Community Planning Act. This will allow the linking of coastal planning to the existing land use planning process. Therefore, prior to a development officer issuing a development approval or building permit, the proposed development must be consistent with the regulation.

Biography

Paul Jordan is a community planner in the Sustainable Planning Branch of the New Brunswick Department of the Environment and Local Government. His primary responsibility is the New Brunswick Coastal Areas Protection Policy. Prior to working the NB Department of the Environment and Local Government, he worked for the Rural and Small Town Programme at Mount Allison University where he was involved in environmental and community planning and socio-economic research and teaching. Paul has degrees in geography and environmental planning from Saint Mary's University and the Nova Scotia College of Art and Design as well as continuing education courses from Guelph University, Concordia University and the Graduate School of Design at Harvard University.
Drowned forest and early humans in the Gulf of St. Lawrence and North shore of Prince Edward Island region

Heiner W. Josenhans
Natural Resource Canada, Sydney, NS

Abstract

Coastal erosion and shoreline migration has occurred in all coastal areas of Canada since the melting of the last glaciers about 14,000 years ago. On the west coast of Canada, we have discovered a drowned forest 150m below sea surface. This forest was flooded by rising seas about 12,300 years ago and large areas of the continental shelf were flooded by these rising seas. Stone tools found in 55m water depth suggest that early peoples occupied areas that are now under water. Rising sea levels have also flooded large parts of the Gulf of St. Lawrence since retreat of the glaciers, about 12,500 years ago. In St. Peters Bay, P.E.I. we have sampled a drowned pine tree that is now 12m underwater and grew there about 4300 years ago. Over 3000 stone tools have been found along the shores of St. Peters bay, indicating that early peoples occupied these drowned areas also. Seafloor samples from old submerged lakes found between P.E.I. and the Magdalene Islands indicate that sea-levels in the southern Gulf were about 90m below present about 9,300 years ago. Lowering sea-levels by 90m would move the paleo-coastline more than 100km seaward and would have allowed early peoples to walk to the Magdalene Islands. The studies demonstrate that coastal erosion and shoreline migration is an ongoing process. The challenge is to determine the rate and driving mechanisms.

Biography

Mr. Josenhans is a marine geologist with the Geological Survey of Canada at the Bedford Institute of Oceanography in Dartmouth Nova Scotia. He has specialized in mapping the seafloor history and post glacial evolution of the continental margins of Canada. In the past 30 years Mr. Josenhans has made maps and published papers on the seafloor history and sediment distribution of Atlantic Canada, the Gulf of St. Lawrence, Labrador Shelf, Hudson Bay and the Queen Charlotte Basin off British Columbia.
Building on Local Knowledge: Community-Based Adaptation Strategies for Sea Level Rise
Sue Nichols and Michael Sutherland
Land and Coastal Studies Group,
University of New Brunswick, Fredericton, NB

Abstract

The development of adaptation strategies is a fundamental part of the NB Sea Level Rise Project funded by the Climate Change Action Fund (CCAF). The adaptation subproject involves three components: a) research on international and national experiences in developing adaptation strategies; b) construction of a web site to communicate the research findings among the team and with coastal communities; c) development of model strategies that can be used to identify and evaluate adaptation strategies.

Three elements of the research are highlighted in this presentation. In the first part the objectives of the research and accomplishments to date are outlined. The wide scope of possible adaptation strategies (i.e., from policy to technology) are highlighted. Finally, the methodology being applied in this research, i.e., building on local knowledge, will be explored together with some of the implications for the results. By using an interactive, participatory approach the goal is to build capacity within communities for effective climate change decision making, thus linking the science to local knowledge. The challenges this approach creates for the research and the next steps will be discussed.

Finally, we will be presenting the preliminary results and how that will impact communities.

Biographies

Sue Nichols is a co-investigator on the Linking Science and Local Knowledge node of the Ocean Management Research Network (OMRN). Working with colleagues at Simon Fraser and U de Moncton, Sue and her graduate students have been exploring issues related to integrating community-based knowledge and approaches with the more traditional science-oriented research and efforts of governments and universities.

Sue is a Professor in the Dept of Geodesy and Geomatics Engineering at UNB. Her research interests include marine boundaries and information systems, as well as land policy issues in many areas around the world. She is a Past President of the Canadian Institute of Geomatics and has served on the Advisory Board for the Minister of Natural Resource Canada.

Michael Sutherland obtained in 1995 a Master of Science in Engineering degree in land information management from the Department of Geodesy and Geomatics Engineering, University of New Brunswick, Canada. He is currently pursuing a Ph.D. at the University of New
Brunswick where he is developing global boundary requirements models in coastal and ocean management. He has more than 18 year’s international experience in land information management including the development of land information management software in both Canada and Jamaica. He has also lectured in land administration at the University of New Brunswick. Michael is a member of the Canadian Institute of Geomatics, and is a Vice-Chair of the International Federation of Surveyor’s Commission 4 (i.e. hydrography, ocean governance, and marine cadastre).
O’CARROLL, Stéphane\(^1\) ; Dominique BÉRUBÉ\(^2\) ; Alan HANSON\(^3\) ; Donald L. FORBES\(^4\)
\(^1\) New Brunswick Natural Resources, Moncton, N.-B.
\(^2\) New Brunswick Natural Resources, Bathurst, N.-B.
\(^3\) Environment Canada, Canadian Wildlife Services, Sackville, N.-B.
\(^4\) Geological Survey of Canada, Bedford, N.-É.

Abstract

A pan-Canadian study published by the Geological Survey of Canada in 1994 demonstrated that the Atlantic region was especially sensitive to relative sea level rise (Shaw et al., 1994). The International Panel on Climate Change (IPCC)’s more recent report confirms the planet’s warming tendencies and postulates certain climate change-related impacts that would result from it (IPCC, 2001). The last computer models realized by these researchers suggest that the sea level could rise worldwide between 10 and 90 cm over the next hundred years because of global warming. Very recently, the Climate Change Adaptation Fund was set up by the federal government to identify and verify strategies that would potentially allow communities to better adapt to potential anticipated changes. Environment Canada has created a project for the Atlantic region: Impacts of Sea-Level Rise and Climate Change on the Coastal Zone of Southeastern New Brunswick to be realized by the Fund.

This project will study the coastal zone from Kouchibouguac National Park, to the north, to Cap Jourimain, to the south. Its goal is the sustainable management of the Atlantic’s coastal zones. The “coastal erosion” component of the project consists in predicting the milieu’s response to the accelerated rise in sea level and storminess by determining the physical impacts of this rise on coastline position and the evolution of the coastal zone. A multi-date photogrammetric study on SIG of the Shemogue sector (from aerial photograph series taken in 1944, 1953, 1963, 1971, 1973, 1982, 1996 and 2001) sets out to measure coastline position variation rates from the recent past to estimate future rates, within the context of climate change, and taking into account tide gauge measurements in Pointe du Chêne (near Shediac) that indicate the average sea level in that part of Southeastern New Brunswick has been increasing at an approximate rate of 3 mm a year for the last hundred years.

The superimposition of geocoded maps of the Shemogue (N.B.) sector from 1944, 1971 and 2001 drawn to date illustrate quite well the dynamics of the coastal zone. Preliminary observations highlight the evolution of certain coastal landscapes in Shemogue over the course of 57 years (1944 to 2001). For example, since 1944, the front and central parts of the dune located to the south of Shemogue Head were eroded when a breach occurred. In the early 1970s, this breach got wider and deeper, evolving into a tidal funnel, splitting the dune in two. The salt marsh sector located behind the dune was then directly exposed to all the energy of the strait’s waves. Under the waves’ erosive action, this salt marsh sector, including its habitats, disappeared. Opposite to this, elsewhere in the studied Shemogue sector, the advance of some dunes’ extremities are observed, dunes that lengthened following the accumulation of sediments moving along the
coast. Observations from the 1944, 1071 and 2001 maps also allow us to note the receding of sandstone and till cliffs, but at variable rates due to different factors.

Still with the help of the SIG, transects were drawn perpendicular to the coast every 100 meters, where both erosion and accumulation were measured. For example, between 1971 and 2001, the Petit-Cap dune lengthened by 535 m, on average 17.8 m a year; the Grant’s Beach dune lengthened 195 m between 1944 and 2001, or on average 3.4 m a year. On the other hand, the back and central parts of these dunes have receded 0.34 cm/year between 1944 and 2001. Moreover, a till cliff close to Cadman’s Corner has receded 8.5 m between 1944 and 1971, and 8 m between 1971 and 2001, representing an average annual migration of 0.3 m between 1944 and 2001.

These preliminary results highlight the coast’s wide range of possible responses to rising sea levels and storminess. The study begun in the “coastal erosion” component framework will be used in conjunction with the project’s other components, most notably the “ecosystems” component (to statistically process the recent evolution of the piping plover’s habitat acreage, for example) and the “LIDA” component (to help corroborate the results obtained with this new technique).

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**Biography**

*Originally from Memramcook, N.B., Stéphane O’Carroll is a coastline geomorphologist. He holds a Bachelor’s degree from the Université de Moncton (specializing in environmental sciences, 1994) and a Masters degree from the Université du Québec à Montréal (in environmental sciences, 1998). He has done a lot of fieldwork on coastline dynamics, most notably on the sandy coasts of the Gulf of Saint-Laurence. As part of his memoir, under the supervision of Serge Jolicour, he proposed a model of the recent evolution of active dunes in the Îles-de-la-Madeleine and also contributed to the development and application of large-scale ecodynamic cartography. In 1996, under the direction of Dominique Bérubé, he created an index map showing coastal sensitivity to storm surges in New Brunswick for the province’s Department of Natural Resources. He also produced a coastal zone study for the restoration of the dune in LeGoulet, N.B, which included a large-scale geomorphologic map. Hired by the Department of the Environment in Québec in 2001, Stéphane O’Carroll acted as the project manager of a feasibility study for an institute of environmental sciences and techniques in the Îles-de-la-Madeleine. He also collaborated with local groups, like the Centre d’interprétation des Portes de l’Est and Attention FragÎles. In the last few years, Stéphane O’Carroll has participated in the creation and interpretation of multi-date geocoded maps of certain sectors of the New Brunswick coastline, drawn from old aerial photographs.*
Knowledge Gaps and Future Research Orientations – Perspectives from C-CIARN Coastal Zone
Kathryn Parlee
C-Cairn Coastal zone, Dartmouth, NS

Abstract

The Canadian Climate Impacts and Adaptation Research Network (C-CIARN) is a national network that facilitates the generation of new climate change knowledge by linking researchers with practitioners and decision-makers to address key issues. The network consists of six regional offices, and seven sectoral offices. The Regions cover geographically significant issues, while the Sectors focus on areas of broad national interest such as fresh water, the coastal zone, fisheries, landscape hazards, to name a few.

Over the past three years, C-CIARN regions and sectors have been consulting with researchers, practitioners, decision-makers and other stakeholders to identify key climate change impacts, knowledge gaps and research needs that will assist in the development of appropriate adaptation measures. A series of national and regional workshops have helped to raise awareness of climate change impacts, identify issues of concern to stakeholders, outline potential adaptation strategies and discuss different research projects. In the coastal zone workshops, topics have included impacts from sea-level rise, reduction in sea-ice cover and changes in storm frequency and intensity on coastal communities, infrastructure, environment and natural resources. These workshops have provided an opportunity for participants to discuss issues and identify knowledge gaps or information needs to better understand our coasts and how climate change will affect them. C-CIARN Coastal Zone has used the knowledge gaps to highlight research needs and help to develop the basis of a climate change research agenda for Canada’s coasts.

Biography

Kathryn Parlee is the Coordinator for the Coastal Zone Sector of the Canadian Climate Impacts and Adaptation Research Network (C-CIARN). The office is hosted by Natural Resources Canada and is located at the Bedford Institute of Oceanography in Dartmouth, Nova Scotia. Kathryn has a Bachelor of Science in Geology and Physical Geography, a Masters of Environmental Studies which focused on coastal geomorphology and coastal management, and an Advanced Diploma in Geographic Information Systems (GIS). Kathryn became involved in climate change studies while working at the Canada-Nunavut Geoscience Office in Iqaluit, Nunavut. She was involved in the production of a poster entitled “Degrees of Variation: Climate Change in Nunavut”, as well as participated in the development of Nunavut’s draft climate change strategy. In 2002, Kathryn returned ‘south’ to take the position as the Coordinator of the C-CIARN Coastal Zone and has since been working to raise awareness and improve knowledge about Canada’s coasts and the implications of climate change for Canadians.
Climate Change, Governance and Community Involvement: Challenges for Integrated Coastal Zone Management
Steve Plante
Université du Québec à Rimouski, Rimouski, QC

Abstract

For some time, many situations that “are out of the ordinary or anomalous” have been considered to be the heralds of climate change. We may think here of sea-level rise, changes in coastline position, shorter periods of ice cover, stronger and more frequent storms, the rising temperatures of ocean currents, or the change in rain seasons both spatially and temporally. These changes bring up a host of issues related to sustainable coastal development on both the social and biological level: Community and ecosystem resilience, development and maintenance of existing infrastructures, drinking water supply and quality, building construction in sensitive zones and public security, and the ecological integrity of coastal areas.

Though uncertainty and caution are natural when facing these issues and increasing risks, we must recognize the need to anticipate them in coastal planning and with public actions (i.e. policies and regulations) so that we don’t find ourselves in situations that could have been avoided through better coordination of actions, increased community involvement and more efficient dialogue between agencies. These three characteristics are found in the new rural governance model developed by the Governance Team and summarily presented here.

Scientific literature on regional development deals minimally with the rural coastal environment. One of our goals is to develop a field of research in this complex realm and to document it in terms of reinforcing agents’ development capacity (the public sector, private sector and civic society), and of developing a dynamic territorial governance model that would take into account climate change and coastal community adaptation. In contrast with agricultural rural zones, coastal zones develop and transform at an accelerated pace, sometimes anarchically, in some cases even favoring social exclusion of existing populations. One element of the new rural governance model consists in identifying the usage conflicts to better understand agents’ logic and actions. This approach opens the door to anticipating and coordinating compromises and agreements. There are three levels of conflict: conflicts between coastal usage activities, conflicts deriving from regulatory coastal activities, and conflicts related to the transformation of socio-demographic and economic structures.

When we talk about usage conflicts between coastal use activities, we can think of activities and relationships that put into play competing economic and non-economic activities, and that extend spatially along the coast. The risk of conflict rests on the type of resource or interest pursued by agents. This is the case for aquaculture development, pleasure cruises, professional and sport fishing, tourism, landscapes, and offshore oil and natural gas exploration.

The second type of conflict is less “obvious,” but more perverse: Conflicts surrounding regulatory activities and public action. Here, we note administrative sluggishness, incoherence

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6 For our presentation’s purposes, we will only take the coastal zone into account.

7 This is a New Rural Economy Project directed by Bill Reimer and financed by the Social Sciences and Humanities Research Council (SSHRC).
between various regulations, and regulations that remain largely unknown to the principal interested parties. The lack of information limits agents’ capacity to prevent (anticipate and adapt to) or regulate conflicts before they arise.

The last type of conflict rests on socio-demographic and socio-economic transformations of the coastal zone. We are indeed witness to the migration of well-off retirees that have dreamed for 35 years of spending their retirement days on the seaside four months out the year, in effect increasing the local population’s age in the coastal zone. The type of building construction supported encroaches on fragile habitats and on everyone’s access to the coast. Some vacationers come for a number of months, renovating their small cottages to make them more comfortable or turning them into luxurious homes. Agents’ representations are thus transformed, their interests and ambitions influencing the coastal zone’s vocation (i.e. protected zones, processing plants, marinas and ports). More and more residents (seasonal and permanent) occupy previously inaccessible spaces. For those that spend the entire year there, the lack of services nearby (i.e. schools, supermarkets, telephones, pharmacies) becomes a problem. Finally, how can we stall the demand for a space that is so perfect a symbol of liberty?

To anticipate and thus be better able to adapt to new social and physical conditions, we propose a governance model and a way to coordinate actions between agents in the public sector, the private sectors, and civic society. To function, these two elements must rest on the political and social legitimacy of agents, and on relationships based on trust, without which the process is bound to fail. Moreover, governance requires a definition of the relationships of power and authority between agents.

The new governance model rests on community assets. These assets include such intangible factors as social, historical and cultural contexts, social capital, the milieu’s physical characteristics, the state of natural resources stocks, and the history of such situations tackled according to different scales of observation (from local to supranational). The relationship developed between agents may be bureaucratic, mercantile, associative or communal.

Once characterized, assets represent starting points around which agents’ issues and dynamics are developed. The issue represents the situation, the subject or object of the controversy. The relationship that ties the agents to the issues depends on their proximity relationship (i.e. geographic, organizational, family, or other). Negotiations between agents, based in mediation, compromise and consultation, modify the relationships of power and authority between them. Since no one has all the information, especially if we integrate aspects related to climate change and community involvement in integrated coastal zone management, the notion of uncertainty becomes important in the drafting of adaptation scenarios. Reaction is dynamic and generates a reshuffling of institutional arrangements, favors the emergence of new demands by civic society (i.e. zoning) and allows the anticipation of risks (i.e. destruction of homes). The starting assets will be transformed and will revive the governance process into a movement of perpetual becoming, all thanks to new foundations or new information (knowledge). But once this is expressed, how do we put this model into motion for the Southern Gulf of St. Lawrence region?
To spark the debate and to try and find elements of a possible answer, we present ten recommendations on concerted coastal management⁸. Expressed as the Ten Commandments, each will be debated by smaller groups. Here is a brief presentation of all ten:

1. Arrive at a better distribution of activities in time and space (i.e. develop the residential function in the back-country, delocalize and encourage production activities outside the coastal zone, and even encourage the ‘deseasonality’ of activities).

2. Make agents responsible instead of developing new regulations, in order to attain the goal of shared coastal management. Try to resolve conflicts through negotiation and coordination by developing a culture of auto-control, and a capacity for appropriation and reinforcement in all agents, at all involved levels (i.e. local, municipal, regional, provincial, federal and supranational).

3. Simplify coastal zone-related measures. The lack of coordination and coherence between procedures (i.e. overlapping policies or regulations by different governments) touching coastal zones can exacerbate confusion and favour misunderstandings between agents, creating unjustified fears.

4. Question the territory’s adaptations to integrated management. Is it a management space, or a space for strategic reflection? Is it both? This implies increased reflection on the limits of the territory.

5. Identify agents involved in integrated coastal zone management. Highlight and clarify agents’ mission and place them in a hierarchy according to the territorial contexts involved.

6. Anticipate difficulties rather than limit yourself to reaction and individual and sector management. This type of function is well illustrated by the allegory of the fireman trying to put out two fires. The state of our knowledge on climate change and its effects on coastal zones makes not taking into account new information in this model hazardous. Increased self-responsibility and the continuing search for compromise resting on shared knowledge are factors that are required to increase civic society involvement and upfront project consultation. Coastal zone management-related objectives must be made clear and realistic. The reinforcement of structuring objective definitions could allow a more realistic hierarchy of goals and objectives, set at the start of the process.

7. Work with a tight timetable for the realization of actions. The span of time required for management procedures and the recurring lack of funding are enough to profoundly affect agent’s motivation already, as is the case with the New Brunswick Coastal Areas Protection Policy or Phase 4 of St. Lawrence Vision 2000’s action plan.

8. Insure perennial and coherent funding. This idea increases management program efficiency while developing the feeling among agents that their actions will bear fruit in the future, and not simply within the electoral calendar. The risks of discontinuities, the dispersion of financing sources, and the demobilization of some agents can lead to the reduction of actions’ internal coherence and the risk of leaning on opportunistic financing for projects far from the targeted goals.

9. Undertake a reinforced and shared assessment of actions by setting up program and policy assessment mechanisms. Define indicators that allow the assessment of objectives’ clarity and efficiency. This approach would improve decision-making during an unfolding action or project.

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Biography

Steve Plante holds a Ph.D. in Geography (specializing in coastal and insular populations) from the Université de Montréal, and a Masters degree in Maritime Anthropology from the Université Laval. He is a professor of developmental social sciences (at the undergraduate level) and regional development (at the graduate level) at the Université du Québec à Rimouski’s Department of Humanities since June 1st, 2002. He takes an interest in modes of governance, agent dynamics (i.e. the distribution of resource access in coastal and insular environments, and the resolution of usage conflicts), community-related issues, capacity reinforcement, local community participation mechanisms, adaptation of coastal and insular populations to climatic change, and local development. He has mainly conducted research in South America, and more specifically in Brazil.

Mr. Plante is part of a Pan-Canadian research group working on aspects of governance and capacity reinforcement as means to understand the rural milieu’s devitalisation, and act on it (NRE²). He is part of the research group on evaluating rural pact action plans and their fallout. Since 2002, he has been working on the issue of the integrated management of coastal zones. He is actively involved in the integrated management of the St. Lawrence’s inhabited islands, which includes Ile Verte, Ile aux Grues, Ile-aux-Coudres, Harrington Harbour, Anticosti and Ile de la Madeleine. His great terrain experience in geography and anthropology, as well as his propensity for interdisciplinary fish and game-related training, has instilled in him a strong interest in territorial development and its links to environmental issues.
Climate Change and Coastal Communities: Future Orientations and Innovations
Armand G. Robichaud,
Planning consultant, Shediac, NB

Abstract

The main issues affecting coastal communities are storm surges, rising sea levels, coastal erosion, and flooding. These natural phenomena have impacts on community and private infrastructures, and, by ricochet, on the environment.

Residential development along the Southeastern New Brunswick coastline is a relatively recent phenomenon, but a quickly growing one. In photographs of Shediac in 1900 or Cap-Pelé in 1950, we might note that, except for port installations and fishery-related buildings, development was done far from the coast. Our ancestors had learned the lessons taught by storms, like that of 1847, which destroyed the Cap-de-Shédiac wharf, or that of the “August Gale” of 1873, which destroyed “Ferran” Gallant’s mill in Barachois and the Scovil mill in Shediac, or even that of the 1838 storm surge, which destroyed most houses on Shediac’s Dock Street, as well as the Parlee Beach Welcome Center.

The storms of January and October 2000 were ferocious, damaging 181 cottages and 81 homes in the Beaubassin District (1.6 million dollars in claims). The ice storm in February 2003 deprived 60,000 customers of electricity for four or five days. Studies show that these storms will become from frequent, causing accelerated erosion, and that rising sea levels will engender more flooding. According to a study by Jeff Ollerhead at Mount Allison University, practically the entire community of Pointe-du-Chêne would be flooded with a 3 m storm surge. The January 2000 storm surge measured more than 2 m. All it would take would be an unfortunate alignment of the planets and some unfavorable winds for the worst to happen.

And yet, there is a rush to the coast. The more coastal lands are threatened by the elements or by an eventual provincial regulation, the higher prices go for these lands. You might pay up to 500,000$ for a lot of coastal land, and one or two million dollars for a cottage. These new arrivals and their immense homes, blocking other residents’ view, sparks conflict in the community because of inadequate infrastructures.

What is being done elsewhere?
A quick search on the web reveals that, regarding adaptation to climate change’s impacts on rural coastal communities, the focus tends to be more and more on local action. Here are some examples:
• The United Kingdom has set up a scoring system that prioritizes funding based on economic benefits and environmental impacts in an effort to change land use and allow coastal communities to better absorb the effects of climate change.
• In Australia, the impact of storm surges has become progressively more important as the population has settled the coast. The idea is to establish new planning standards and new building permit mechanisms.
• During a 2000 conference in Hawaii on the subject, three priorities were identified: dialogue that engages the experts; a partnership between agents for research, dialogue and education; and
integration of information on climate changes in the formulation of policies and planning initiatives.

- As part of the CIDA Project in Oceania’s Vanuatu, the adaptive capacities of communities are reinforced, according to the problems and priorities identified by the residents.
- In the United States, one scientific association has prioritized mitigation, most notably by reducing greenhouse gas emissions, minimization, through better soil use practices, and adaptive management, by preparing coastal communities to face adverse climate conditions.
- Another American study recommends the development of risk assessment models and land use models with the use of geographical information systems.
- Another study, this one in the United States’ southern Atlantic region, identifies four precise actions: the maintenance of natural buffer zones, the reduction of waterproof surfaces, the reduction of external pollution, and the reduction of boat traffic in sensitive areas.
- According to Canada’s insurance companies, the most important factor in coastal damage is the growth of the population and its structures in vulnerable zones. Atlantic Canada is most at risk. Resilient communities must be developed. Informed citizens, weather alert systems, building codes adapted to the climate, and land management are key elements of a general strategy centered on local action.

In summary, we must think globally and act locally. A strategy containing the following elements must be developed:

- Public education and participation;
- More research, especially on better practices;
- More precise predictions, with risk assessment models and minimum elevation models;
- Policies and community strategies, including land use models, using geographic information systems, and plans for the maintenance of strategic community infrastructures (for example, Parlee Beach in Shediac, Beresford Beach, Route 134 in Charlo);
- And finally, plans for emergency measures (vulnerable communities will have to eventually be equipped with amphibious vehicles, for example).

Current initiatives are no longer enough, whether these are local zoning policies, New Brunswick’s timid and obsolete provincial policy, or public education efforts. Many relevant governmental agencies and research networks have been created in the last few years. We must coordinate this research, make sure it examines the real issues, and reorient it as needed. The project on sea-level rise in coastal New Brunswick seems to be a step in the right direction. The scattering of responsibilities in coastal management is a major hurdle. The research and both technical and professional resources are mostly at the federal level, while authority in matters of development is local. We must find ways to better plan community infrastructures and better coordinate emergency measures. We must give communities the means to tackle the issues and take charge of the situation. Can we rise to the challenge?
Biography

Armand G. Robichaud is a community planning consultant from Shediac, New Brunswick. He has studied in geography at the universities of Moncton and of Ottawa and has obtained a Masters degree in Urbanism from the University of Montreal. He was director of the Beaubassin Planning Commission in South-East New Brunswick for almost 25 years, where he had a hands on appreciation of the impact of climate change on coastal communities. M. Robichaud taught courses in Urban Geography and in Environmental Policies at the University of Moncton. He is the author of two books, the first dealing with the history and architecture of his region and the latter with the genealogy of his family. He has written numerous articles and participated in various conferences on subjects dealing with his professional and personal interests. Armand is presently an associate in Virtual Planning Inc, with two other planners, also former directors of planning commissions in South-East New Brunswick.
Study on the sensitivity and vulnerability of communities in the Gulf of St. Lawrence with respect to climate change impacts
Jean-Pierre Savard
Ouranos, Montréal, QC

Abstract

Ouranos is an organization partnering 8 Quebec governmental departments, Hydro-Quebec, Environment Canada, and four Quebec universities. Its mandate is principally made up of two missions: research on climate change, and the development of adaptation strategies following an assessment of both climate change impacts and the vulnerability of communities to these impacts. In the framework of its impacts and adaptation mission, Ouranos has submitted a project to the Climate Change Action Fund (CCAF) for a study on climate change impacts on coastal erosion. This study would be done at three reference sites representative of the wide range of issues affecting the entirety of coastal zones in the Gulf of St. Lawrence.

Adaptation to climate change in the coastal zone faces numerous difficulties, but these can be grouped into two great categories: the lack of functional knowledge on the processes that govern erosion, and political and socio-economic resistance to adaptation. The Ouranos project’s intent is not only to improve the capacity for integrating climate change into the coastal zone management process, but also to involve local and regional decision-makers from different levels of government in the research process to find solutions and adaptation methods.

The methodological approach advocated by Ouranos is more horizontal than vertical, contrary to modern university tradition, which consists of in-depth study of one or two elements in the very complex chain of causality tying climate to coastal erosion. The work method consists of examining all factors in a dynamic interaction framework between scientists, decision-makers and users of the coastal zone. The research teams’ organizational structure is divided into three groups, one for Climate/Oceanography, one for Coastal Dynamics, and one for Coordination/Adaptation. At the beginning of the project, these three groups elaborate starting scenarios on climate change impacts on the coastal zone. All the elements of these various climate/coastal erosion chains of causality are turned into parameters so that they can be expressed as starting scenarios. These scenarios are then used parallel to one another as a basis for each team’s work, and refined as information becomes available through each team’s research. This new information is transmitted regularly to each group to improve or focus the research that follows.

At the end of the exercise, we hope that the organizational model will have allowed all partners, scientists, decision-makers and users of the coastal zone to progress together toward the improvement of adaptive capacity. This approach attempts to avoid the hazards of compartmentalization often found in specialized fields, so that the research effort does not focus on parts of the process tying climate to coastal erosion that would yield little in terms of concrete applications for adaptation.
Biography

Mr. Savard is a geologist and physical oceanography specialist, and has been working as a consultant on coastal dynamics since 1980. In that capacity, he conducted a number of studies on coastal erosion and coastal zone sediment migration. These studies focused on coastal erosion issues and instability in coastal infrastructures, such as embankments, roads, ports, and others. He also conducted a number of environmental studies on estuary and coastal dynamics, in Quebec, the Maritime Provinces, and overseas.

For the last few months, Mr. Savard has joined the Ouranos consortium, a researchers’ association specializing in climate change studies. He supervises coastal erosion cases in the Gulf of Saint-Laurence and Nunavik regions. He is responsible for coordinating research activities involving climate specialists (modeling, climate analysis) and sediment dynamics oceanographers and specialists, in order to improve Quebec’s principal governmental agencies’ capacity for adaptation to the impacts of climate change on Quebec’s maritime coastal zones.
Climate Change Impact and Adaptation Program
Ryan Schwartz
Climate Change Impacts & Adaptation Directorate, Earth Sciences Sector,
Natural Resources, Ottawa, ON

Abstract

The Government of Canada’s Climate Change Impacts & Adaptation Program (CCIAP) provides funding for targeted research and activities that will contribute to a better understanding of Canada’s vulnerability to climate change, to better assess the risks and benefits posed by climate change, and to build the foundation upon which appropriate decisions on adaptation can be made. Since 2001, the CCIAP has provided cost shared funding for nearly 100 research projects focused on water resources, human health, agriculture, fisheries, non-commercial food supply, forestry, tourism and recreation, transportation, landscapes, ecosystems, and the coastal zone. The CCIAP is hosted by the Earth Sciences Sector at Natural Resources Canada (NRCan) in Ottawa, and is managed by the Climate Change Impacts & Adaptation Directorate (CCIAD).

Biography

Ryan Schwartz is a Scientific Program Officer with the Climate Change Impacts & Adaptation Directorate at Natural Resources Canada in Ottawa. His primary responsibilities include management of Climate Change Impacts & Adaptation Program research projects focusing on forestry, agriculture, landscapes, ecosystems, non-commercial food supply, and the coastal zone. A graduate of the University of Waterloo’s Master of Environmental Studies program, Ryan’s thesis outlined a methodology to assess the potential impact of changing water levels resulting from climate change on Great Lakes coastal communities using the Lake Huron shoreline at Goderich, Ontario, as an example.
Potential impacts of climate change on La Dune de Bouctouche and Shediac

Liette Vasseur\textsuperscript{1,2} and Kenel Delusca\textsuperscript{2}

\textsuperscript{1} Université de Moncton, Moncton, NB
\textsuperscript{2} Associate Vice-President, Research, Laurentian University, Sudbury, ON

Abstract

The present work summarizes the integration component of the NB See Level Rise project supported by several agencies including CCAF, NBETF, CEAA, and Environment Canada. It is important to note that while we are presenting this integrative work, data and information are coming from different sources from the global project and we would like to acknowledge the contribution of the entire team. Integration means pooling all the data from the different disciplines in order to have a better overall understanding of the potential impacts of climate change on the communities and the natural ecosystems. Integrating the issues related to socio-economic activities, infrastructure and the natural ecosystem helps define the potential limitations, areas of greater vulnerability and therefore once scenarios combined to the current anticipation, define the potential impacts to the region. The project will gradually integrate the possible adaptation measures options to the integration to examine the consequences and implications of these measures to the communities and the natural ecosystems. This will give, to the communities, data and information that will help them make recommendations and decisions in the future on what will happen with their communities. It is expected that the maps and the information will be given back to the communities so that they can have the tools to make their own decisions. It is not the responsibility of the project to “push” for some recommendations versus others. The communities are the ones having to make the decisions.

The present presentation will give you a brief summary of two case studies that have been initiated in order to integrate the information from the other components. It is important to understand that while the region is relatively large and there was an interest to integrate all the region, the present funding does not allow for the complete and global integration of all the possible aspects of these ecosystems and the communities under study. The two case studies that will be briefly examined are the case of La Dune de Bouctouche and the town of Shediac.

La Dune de Bouctouche

La Dune de Bouctouche has been a prominent feature of the village of Bouctouche and a very important component in the eco-tourism activities of the Bouctouche region. Each year La Dune de Bouctouche and the Irving Eco-Centre have attracted several thousands visitors who come for the landscape and the ecosystem, the interpretation and educative walks, the beach and hiking or birding activities. The ecosystem has been previously under a certain level of stress with the traditional use and living of a certain number of fishing families. With the increase of ATV and other types of stress, the ecosystem became gradually degraded and under greater stress. Gradually through consultations and support of the Irving family the dune became a protected area where only research and mild activities such as birding and hiking have been allowed. These conservation initiatives certainly helped over the past decade protect this fragile natural ecosystem. This ecosystem is 12 km in length with 2 km of boardwalk. It currently limits the number of daily visitors to about 2000 in order to reduce the footprint of humans on the ecosystem.
As it was described in many other presentations, the southeastern region of NB was in 2000 affected by two major storms that trigger responses from communities, decision makers and scientists in order to understand the potential impacts and possible adaptation measures to gradually implement to sustain the communities and the natural ecosystems. These storms had major impacts of this natural ecosystem and lead to a loss of 24,000 m³ of sand from the beaches. In addition, breaches and overwash occurred in several areas along the spit. A few slides helped explain the level of changes that occurred at the dune in some areas over the past few years due to the storm surges such as those of January and October 2000 as well as the one of September 2002. It is clear that from pictures taken in July 1999 and May 2004, the level of erosion in some areas of the dune such as the first 100 m from the Irving Eco-Centre had been greater than probably expected and this means that in many sections of the dune system, there are possible breaking points that can be triggered if another storm surge occurs. At the same time, the dune system in many sections has seen its sand accumulation reduced not only in width but also in height leading to the flattening of the dune system.

These observations have been confirmed by people who have grown there and have seen changes in the dune. In addition, the integration of the land use map from the province of 1975 to the LIDAR DEM map indicates that coastal erosion has occurred and that this erosion is not constant and similar along all the dune system. For example, in Figure 1, the difference between the lines in 1975 and 2003 suggest that the dune system has been not only moving but in many sections has lost its width. This may have as consequence to separate the dune into a few islands (Figure 1). The changes in the width of the sand beaches will have important impacts on the nesting habits of some of the bird species such as piping plover. In addition, over time, it has been observed that the dune has lost in its height with frequent storms. This impact has had and will have greater impacts on other in-land species such as another species at risk, St Lawrence aster. The breaking up of the dune system into islands will lead to a potential reduction in potential gene flow and migration of the species into other habitats. This might have serious for the survival of the species at risk.

**Shediac**

The second case study that has been initiated in this project is the impacts and adaptations for the infrastructure of the coastal areas of the town of Shediac. The town of Shediac is characterized by several recent socio-economic developments. The pressure for coastal land has dramatically increased in the past few years with the establishment of new residential areas. Infrastructure near the shore is dense and put pressure on the natural ecosystems that usually buffer the habitats against storms surges and floods. Low land is more at risk but it is the most area with intensive use. This is exemplified by the growing populations and economic activities of this area.

The objectives of this component of the project are to:

- Define the spatial-temporal picture of the area including the land use of the ecosystems;
- Identify the changes in land uses, especially in inhabited areas;
- Estimate through time the level of susceptibility of these zones and the potential impact this might have ton the community.
The Figure 2 is summarizing the level of integration on which the framework for the analysis will be based on for the integration component in Shediac. In this diagram we can see how the information from the past using the 1975 land use data compared with the current LIDAR to evaluate the changes of the past and then using the current data and the different projections (pessimistic and optimistic scenarios described from the socio-economic assessment), how we can expect changes in the future depending on the ways the communities will deal with climate change. Looking at the differences between the different scenarios and the current scenarios using the LIDAR data we can estimate the level of adaptive responses the community is ready to undergo in order to maintain their land use and current or future infrastructure. For example, the next two figures show the changes in the level of occupancy of the coastal zone in Shediac between 1975 and 2003. The colored zones demonstrate the increasing level of pressure that infrastructure have been adding to the coastal areas.

The data that have been accumulated and the future data that will be integrated will help better understand the trends and the future potential impacts due to climate change. Bringing the information together for planning, policy making, adaptive measures and recommendations is of great importance for the Shediac community that will have to decide our they want their future lives to flourish. Gradually it will be important to plan for the future and find adaptive solutions that will lead to a greater wealth of the community.

We hope that in the future steps of this project we will be able to integrate information to a point that communities will be able to evaluate their own lives and potential impacts in front of climate change. In additional through their own experience and the integration of potential adaptive responses, we will be able to determine the possible ways and solutions for the future.

Acknowledgements
CCAF, CEAA, NB ETF for support and various community groups for the data provided for the integration.
Figures

*Figure 1.* Part of the dune system of La Dune de Bouctouche and the changes that occurred between 1975 and 2003. In some cases, it can be shown that breaking points are located along the dune and may happen any time with future storms because of the weakening of the system over the past decades.

*Figure 2.* Diagram of the analytical framework used in this case study to examine the changes in land use and potential impacts of climate change.

*Figure 3.* a) land use of the Shediac area in 1975 and b) land use of Shediac in 2003.

Figure 1.
Figure 2.

![Diagram showing the relationship between different datasets and scenarios for coastal communities.](image-url)
Biography

**Dr. Liette Vasseur** is the new Associate Vice-president, Research at Laurentian University. She is also a full professor in the Department of Biology at Laurentian University. Previous to this position, she was full Biology professor at the University of Moncton where she held the K.C. Irving Research Chair in Sustainable Development since August 2001. She maintains an adjunct status there and is also affiliated with the Master degree in Environmental Studies. Her strong research program is mainly in sustainable development, community-based ecosystem management and conservation ecology. Her projects are currently on climate change, sustainable forest management, ecosystem restoration, conservation, biodiversity assessment, sustainable development and community-based ecosystem management. Conservation and ecosystem management are among the most important actual research topics, with focus on species at risk and habitat protection. Funding is coming from various sources (e.g. NSERC, CIDA, CCAF, Parks Canada, Environment Canada, etc.). Projects have been or are carried out in Canada or other countries such as China, Vietnam, Cambodia, Panama, Brazil, and currently in Burkina Faso, in Africa. Her projects also involve the training and support to undergraduate and graduate master and doctoral students as well as postdoctoral fellows. Dr. Vasseur is involved in many different scholarly and professional activities related to environmental issues, such as a member of the New Brunswick Premier’s Round Table in Environment and Economy, chair of the sustainable forest management working group of the Fundy Model Forest, and
member of various scientific advisory committee and research network. She is the current President of the Canadian Botanical Association. She was a member of the first Nova Scotia species at risk designation group and a member of the ACFP Recovery team. In 1999, Hon. Christine Stewart, Minister of Environment appointed her to the Joint Public Advisory Committee of the Commission for Environmental Cooperation under the North American Agreement for Environmental Cooperation (of which she was also chair in 2001). She is also one of the Associate Editors of the Canadian Journal of Botany. She holds a B.Sc. in Ecology from the Université de Sherbrooke, a M.Sc. in Biology at Univ. du Québec à Montréal, her Ph.D. in Biology at Queen’s University and postdoctoral experience at McGill and Sherbrooke. Prior to coming to Moncton, she was associate professor at Saint Mary’s University where she was also coordinator of the Environmental Studies Program.
New Brunswick’s Climate Change Action Plan
Hermel Vienneau
Deputy Minister, New Brunswick Department of Environment and Local Government
Fredericton, New Brunswick

Abstract

Mr. Vienneau discussed the steps undertaken for the proposed New Brunswick Coastal Areas Protection Policy.

Biography

A Political Science graduate of l’Université de Moncton, Hermel Vienneau has more than twenty years of experience in government, journalism and public relations. Mr. Vienneau began his journalism career with the daily newspaper L’Evangeline in 1974 as regional correspondent for the Chaleur area. In 1978, he became legislative correspondent for the same daily newspaper in Fredericton. From 1979 to 1984, he served as Director of Research and Communications with a provincial organization. In 1984, he was appointed special assistant to the Canadian Minister of Mines and Forestry. From 1988 to 1994, he occupied the position of Operations and Media Relations Director with the Atlantic Canada Opportunities Agency (ACOA). In 1989, he accepted an 18-month assignment as Press Secretary to the Minister responsible for Public Works Canada and ACOA. In 1994, he joined the private sector as Managing Editor of Canadian Medical Informatics Magazine, a national publication distributed to all Canadian physicians and medical specialists. In 1996, he was appointed Editor-in-Chief of L’Acadie Nouvelle, a New-Brunswick provincial daily newspaper. After co-chairing Premier Lord’s transition to power in June, 1999, Mr. Vienneau was appointed Deputy Minister of Intergovernmental Affairs. On August 9, 1999, the Premier gave him additional responsibilities as President and CEO of the New Brunswick Regional Development Corporation. On January 1, 2002, he was appointed Chief of Staff to the Premier of New Brunswick. On October 1st 2003, he was appointed to his present position of Deputy Minister of the Environment and Local Government.
Abstract

During the last several decades, the Arctic Ocean has experienced striking large-scale changes in oceanic and sea-ice properties. Recent studies suggest that this region is a highly variable system undergoing major regime shifts at time scales from several years to decades. The ongoing research tends to link these climate shifts to the changing atmospheric dynamics and/or to variations in Arctic-Subarctic oceanic and sea-ice fluxes. Key signatures of Arctic climate change include an increased heat flux into the Arctic Ocean and a significant reduction in thickness and extent of the Arctic perennial sea-ice cover. Some global climate models predict an 80% decrease of the Arctic ice pack within the next 50 years or so. On the other hand, analyses based on both observations and models suggest at least two regimes in the arctic atmospheric circulation (cyclonic versus anticyclonic) directly influencing sea-ice conditions and the distribution and fluxes of freshwater and Atlantic Water. Whether these regimes result primarily from an oscillatory mode (i.e. Arctic Oscillation) typical of the North Polar Vortex, or from a coupling with lower latitudes (i.e. NAO) similar to the southern hemisphere ENSO, or are they part of a trend related to global changes, is yet to be determined.

The subpolar gyre of the North Atlantic has also undergone dramatic changes during the past five decades. In particular, between the early 1970s and the mid 1990s the entire water column of the subpolar gyre experienced significant freshening and cooling. The magnitude of this freshening was an equivalent to mixing an extra 4 meters of fresh water over the whole gyre. A significant fraction of this change arose from an extreme development of the winter convection in the Labrador Sea in the early 1990s. In addition, based on hydrographic data and direct current measurements, important changes have been reported regarding the North Atlantic Current flow in the subpolar basins and into the Nordic Seas as well as the southward flux of fresh and cold waters across the Greenland-Scotland Ridge.

The observed changes in the heat and freshwater content in the subpolar North Atlantic can be considered a result of the combined local atmospheric forcing and remote advective forcing traced back to its source in the Arctic Ocean and the Nordic Seas. In particular, changes in the ocean intermediate layers were triggered by high wintertime surface heat losses and subsequent exceptionally deep convection in the Labrador Sea. This mixing happened soon after the arrival to the Labrador Sea of anomalously large volume of fresh water from the Arctic Ocean (during the 1980s and early 1990s). The combination of strong local forcing and advective supply of fresh water resulted in one of the largest change ever seen in the ocean - freshening of the subpolar gyre.

Somewhat different tendency of long term temperature and salinity variability can be seen in the subtropical regions, where the upper ocean has recently become warmer and saltier. The warming of the upper layers accompanied with increasing evaporation (causing in its turn in increasing salinity) provides more favourable conditions for hurricane development and intensification. The higher evaporation in the subtropics was also likely a reason of higher transport of moisture to the
higher latitudes, resulted in extreme precipitation in the Atlantic Canada. Although some of these statements are still hypothetical, the ocean studies conducted in the recent years have already shown how important is the knowledge of the ocean circulation and variability for the understanding of the climate change on the entire Planet.

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**Biography**

Igor Yashayaev has graduated from Geography faculty of the Moscow State University in 1988. Between 1988 and 1995, he worked and obtained PhD in State Oceanographic Institute (Moscow, Russia) and P.P.Shirshov Institute of Oceanology (Moscow, Russia). Since 1995, he is associated with Bedford Institute of Oceanography (as a visitor, post-doctoral fellow, contractor, and presently, research scientist). Igor has participated in and led numerous oceanographic expeditions. He’s first steps in the ocean sciences (PhD) dealt with sea surface temperature variability in the North Atlantic on the weekly-to-decadal scales, with participation in scientific expeditions he’s scientific interests became wider and until present he is involved in collection, analyses and interpretation of hydrographic (temperature, salinity, density, flow field) measurements. The recent major works (two Nature papers) reveal some immense changes in salinity in the North Atlantic suggesting significant shifts in the planetary climate system. As a part of he’s organizing activity, he convene and chair sessions at the large geosciences conferences (EGU, AGU) and initiated a special issue in Progress Oceanography on the oceanic changes in heat and fresh water budget and transports.
ROUND TABLES SUMMARY

The round tables were organized in order to allow participants to share their opinions on the state of current research on sea-level rise caused by climate change. These round tables took the form of group discussions in which new ideas, anticipated results and the potential reactions of communities were shared.

Round tables were conducted over a period of two days, and started with a general presentation on integrated management by Professor Steve Plante of UQAR and Armand Robichaud from Planification virtuelle Inc. Participants were afterwards divided into five round table groups on Friday, and four on Saturday. Each round table had a mediator that directed and stimulated discussion and encouraged participation.

Round table mediators
A. Pat Gallaugher, Simon Fraser University
B. Omer Chouinard, Université de Moncton
C. Sue Nichols, University of New Brunswick
D. Maureen Woodrow, Carlton University
E. Christian Fraser, Regional Environmental Council, Gaspésie/Îles-de-la-Madelaine

FRIDAY (November 12th, 2004)

The round tables discussed ten questions on integrated and concerted coastal management. These questions were followed by an exchange on the roles of governments, municipalities, management commissions and RCM, and community groups in climate change adaptation.

1) How can we better share activities across both time and space?

- Have a management structure.
- Have a work plan.
- Have appropriate funding.
- Work within networks and partnerships.
- Better communication between the different levels of government and between the different community groups.
- Know what tasks are involved, and who does what.
- Exchange information with various key agents.
2) **How do we make shared coastal management valuable?**

This question raised some general observations. For example, the importance of working to resolve usage and competition conflicts would require users to submit to negotiation and compromise. Laws and regulations cannot solve everything. We must internalize and share the notion of general interest.

3) **Is a simplification of measures (laws, regulations, etc.) possible in a coastal context?**

- Overlapping of responsibilities between provincial and federal regulations. Action needs to be on the local level through rural communities, municipalities and DSL.
- Government agencies must be responsible for creating laws and regulations, but more responsibility should be given to the local level in enforcing them (a decentralization of law and regulation application, etc.)
- Watershed groups must be supported and consulted on local issues.
- The local population must be consulted at the very beginning.
- *It is important to educate the local population and raise its awareness so that it can respect laws and regulations.*

4) **Do we have a territory adapted to integrated management?**

- Yes, if we take watershed groups into account.
- The territory cannot be managed without taking its watersheds into account.
- Watershed groups must include the territory’s principal agents.
- Watershed groups must have access to stable sources of funding to insure their permanence.
- The region’s existing resource management mechanisms and its population’s cultural context must be taken into account.

5) **Do we know the agents and their missions well enough?**

- We do not know the agents well.
- We are aware that agents exist at all levels in a community.
- The governmental departments must be better educated.
- New Brunswick must implement the Coastal Areas Protection Policy.
- NGOs and community groups must get more involved.
- Universities must get more involved.
- The public does not always know whom to turn to for answers to its questions.
6) Why do we need better anticipation of difficulties, and how do we achieve it?

- LIDAR images and other maps represent possible scenarios quite well.
- Communication and awareness-raising at the start of a project are key to encouraging the participation of civil society groups.
- The message must be clear and well understood, especially if coming from the scientific community.
- Different groups should transmit information, not just scientists.
- Scientists, governments and communities must work together to make the data more credible.
- Take measures to adapt to climate change.

7) How do we define clear and attainable objectives?

- Clear and precise language.
- Know who the agents involved are, and what their roles and objectives are.
- Link objectives to goals… always have attainable objectives.
- Know the community’s history and its development context well… This is important to its long-term success.
- Objectives must be practical and realistic.
- Identify key agents in the community.
- Have short-term and long-term goals.
- Work with interested people.
- Take into account the interests of the agents involved.

8) What would be the advantages of a tight schedule for elaboration and implementation?

- Keeps the same parties involved for the duration of these steps.
- Reinforces the community’s capacity to participate and commit to action.
- Adaptive management and flexibility instead of too rigid a framework.
- Knowing the responsibilities of each group involved.

9) How do we attain perennial and coherent funding?

- Find a way to set up projects that last more than four years (an electoral period).
- Favour information sharing to better distribute action results.
- Integration into pre-existing community groups, watershed groups, etc.
- Find funding in the private sector. For example, oil companies could award funds to be used to counter the effects of climate change, elaborate adaptation methods, etc.
- Shared funding (between federal, provincial and community levels).
• Participation of the local population, businesses and governments. The government will be more likely to help if citizens get involved.
• Use governmental emergency funds for prevention.
• Raising awareness so that the public can exert pressure on decision-makers.

10) How do we evaluate integrated and concerted management, and how do we favour the sharing of actions between agents?

• Success indicator – action results and efficiency
• Establish success criteria for each group or sector.
• Establish attainable objectives on which to follow up.
• Quantify and qualify the success.
• See if objectives were attained within a reasonable timeframe, with a minimum of costs.
• See if there is more consolidation in decision-making since the creation of the integrated management group.
• Incite the participation of agents and decision-makers.
• Decision-makers must take part in discussions, and there must be transmission of know-how leading to an action, not just discussion and data collection.
• Collaboration with universities to share resources and information.
• Incite all coastal management agents to attend the meetings.

General question: What are the roles of governments, municipalities, management commissions, community groups, and individuals in climate change adaptation?

• Governments
  o Coastal Area Protection Policy (to be approved soon).
  o Distribution of information.
  o Regulations.
  o Reinforcing communication between levels of government.
  o Encouraging the media to communicate the information.
  o Give community groups better financial support.
  o Give industries better support in the development of new sustainable technologies.
  o Have a long-term vision of sustainable development.

• Community groups
  o Raising citizens’ awareness.
  o Finding available information and distributing it.
  o Working with the media to communicate the information.
  o Being proactive.
  o Vulgarizing the information.

• Municipalities and management commissions
  o Imputable (giving construction permits only for appropriate territory).
1) What immediate challenges are we facing?

- Favour better communication:
  - Between different levels of government.
  - Between governments, scientists, communities, etc.
  - Between communities, municipalities and private corporations.
- Climate change education and awareness:
  - Favour education and awareness in communities and the public.
  - More education and better awareness of climate change for public servants.
  - Vulgarization and distribution of information for the public, so that communities have a better understanding of climate change issues, and better means of adapting to climate change.
  - Inform the population about adaptive methods and measures.
- Integration of economic, environmental, social and cultural interests, to favour an integrated approach.
- Favour interdisciplinary approach.
- Better integration of traditional knowledge in activities.
- Involve as many people as possible.
- Reinforcement of existing laws.
- Long-term planning.
- Improve research. There is still a lot of missing data.
- Favour multidisciplinary and environmental studies starting in elementary school.
- More media experts in scientific fields.
- Better budget administration to favour sustainable development.
- Give existing groups a more important place when elaborating strategies.

2) What are the key messages to come out of this conference?

- Raise awareness at all levels.
- Information sessions.
- Educational programs.
- Public consultations.
- Vulgarizing information.
- Raise awareness at all administrative levels (municipal, provincial, federal) as well as in the public arena.
- Organize other workshops and round tables to insure a follow-up.
- Multiply meetings, information sessions and educational programs.
- Public consultations during the elaboration of projects.
- Climate Change Awareness Day.
• Distribute information related to climate change causes and effects.
• Use television and other media as marketing tools.
• Establish a communication plan for the transmission of information.
• Adopt a clear and simple message on climate changes based on the most important trends.

• Adopt a concrete action plan about which all agents have been consulted.
• Establish land protection directives.
• Set up local planning strategies.
• Propose action plans and solutions.
• Assemble a team to implement the action plan and propose preventive methods.
• The groups responsible for issuing construction permits must be made imputable.
• Make recommendations to governments, municipalities and DSL to encourage them to get involved in development planning.

SUMMARY
Saturday afternoon

After two days of round table discussions, participants highlighted recommendations and important information that can be summarized into eight points. These will give the Coalition a direction to follow for the sustainability of the southern Gulf of St. Lawrence’s coastal zone management.

• Climate change is an issue that integrates all environmental issues.
• The land-sea interface is a highly productive component of the marine ecosystem, particularly in the shallow retentive waters of the southern Gulf.
• As a result of climate change, sea level is expected to rise. In the southern Gulf, this increase is about 0.70 meters by 2100.
• Because of its soft shoreline (sandy beaches and wetlands), the southern Gulf is one of Canada’s most impacted areas with regard to rising sea level.
• In an effort to protect expensive shoreline real estate, coastal habitats are being destroyed by sea walls and other structures.
• New Brunswick’s coastal zone policy is a minimal approach towards preventing further destruction of the coastal zone. Compliance with this policy is poorly enforced.
• Better communication of NB’s coastal zone policy at the community level is urgently required to prevent further loss of valuable coastal habitat.
• Communities must be more directly involved with the decision-making process and require access to information on their coastal zones to support this activity.
Key sentence

«Research results clearly show that the impacts of climate change require a strategic communication and education action plan built on the principles stemming from the integration of all agents.»
CONCLUSION

The *Climate Change and Coastal Communities* Workshop has been heralded as a success. People from all corners of Canada came and offered presentations, and were able to share their thoughts on current research and future leads to follow regarding climate change. This meeting proved to be the perfect occasion for an update on current research efforts to understand the sea-level rise and the storm surges caused by climate change.

After two days of discussions and round tables, three key messages were underlined. First, studies clearly show that the sea level will rise by some 70 cm by the year 2100 in the southeastern Gulf of St. Lawrence. Second, New Brunswick’s Coastal Areas Protection Policy must be applied as soon as possible. The policy already requires certain amendments to reflect the speed of erosion caused by sea-level rise (a meter a year in some areas). Third, climate change is an issue that contains ecological, social and economic aspects, and links science to local knowledge. Society must be informed and made aware of the causes and effects of climate change.

The Southern Gulf of St. Lawrence Coalition on Sustainability, working closely with various civic society groups, governments and businesses, must now take on several responsibilities and meet some sizeable challenges head on.
APPENDICE A

Agenda
Climate Change and Coastal Communities:
Concerns and challenges for today and beyond

Conference, Workshop and Open-House
November 11-13, 2004

Clément Cormier High School
Bouctouche, New Brunswick

Thursday, November 11, 2004
ARRIVAL of Participants and Afternoon Field Trips

Objectives: to visit the various coastal erosion sites within the region and learn of the different types of adaptation methods, impacts to habitat, etc.

Agenda
13:00-16:00  Registration - Clément-Cormier High School
13:00-16:00  Field trips, hosted by Dominique Bérubé
    Welcome and background remarks on the sites to visit
16:00-17:00  Discussions on lessons learned and future actions – Clément-Cormier High School
18:00-22:00  Social Evening – Bouctouche Golden age club

Friday, November 12, 2004
Workshop – Climate Change: Linking Science and Local Knowledge

Objectives:
To discuss and bring together lessons learned from current and past projects involved with research on climate change scenarios and adaptations in Canada’s coastal ecosystems; and to link these with the local knowledge of community members. The main goal from these discussions is to determine what researchers need from community groups; how community groups can contribute with the monitoring of their coastlines; and how they can better access and utilize the data collected from research studies.

Agenda
8:00-8:30  Registration
8:30-9:00  Welcome & opening remarks
    Liétte Vasseur, Coalition-SGSL Past-president
    Gary Sanipass, Bouctouche First Nations
    Mr. Aldéo Saulnier, Maire de Bouctouche
    Mr. Claude Williams, MLA Kent-South
    Honourable Dominic LeBlanc, MP - Beauséjour
9:00-10:20  Four presentations - research focus
Igor Yashayaev, (Bedford Institute of Oceanography)- *Ocean current variabilities*

Jean-Pierre Savard (OURANOS), *Climate change and coastal erosion impacts in the Gulf of Saint-Lawrence estuary*

Josehans Heiner (Geological Survey of Canada), *Drowned forests and early humans in the Gulf of St. Lawrence and north shore of Prince Edward Island region*

Jean-Louis Daigle, (Eastern Canada Soil and Water Conservation Centre) *Agriculture and climate change*

10:20-10:40 Refreshment break

10:40-11:40 Three presentations - community focus

Holly Dolan (U of Victoria), *Coastal Vulnerability to climate change and sea-level rise in Haida Gwaii, BC.*

Eleanor Bonny (OMRN), *Inuit Observations of Climate Change*

Norm Catto (Memorial University), *Impacts and Adaptations to climate change in Atlantic Canada: communities, fisheries and tourism.*

11:40-13:00 Lunch

13:00-13:20 Presentation of the afternoon round table

Steve Plante (Université du Québec à Rimouski)

13:20-14:50 Round Table

Question: What roles should/ can government, municipalities, planning commissions, community groups, and individuals play in adapting to climate change?

14:50-15:10 Refreshment break

15:10-16:00 Summary of the main results from the round tables

16:00-17:00 Future research orientations from governments

Paul Jordan (NBDELG), *NB Coastal Areas Protection policy*

Ryan Schwartz (NRCan), *Climate Change Impact and Adaptation Directorate*

Michael Chadwick (Fisheries and Oceans Canada)

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Banquet at Le Pays de la Sagouine

18:00-19:00 Reception

19:00-20:30 Banquet & Keynote speaker, Mr. Yves Gagnon, National Sciences and Engineering Research Council of Canada (NSERC)

20:30 Acadian music, *Les étoiles de l’Acadie*
Appendice A - Agenda

Saturday, November 13, 2004
Workshop – New Brunswick Sea Level Rise project results

Objectives:
To present the preliminary results on climate change scenarios, potential impacts and possible adaptations to the communities of the region that has been targeted by the CCAF New Brunswick Sea-Level Rise project and to discuss results, new ideas, reactions, potential responses from communities and research gaps in relation to the presentations of the results.

Agenda
8:00-8:30  Registration
8:30-8:40  Welcome remarks from Réal Daigle, Manager of the project
8:40-10:10  Four presentations
  Réal Daigle (Environment Canada) – LIDAR: monitoring the coastline
  Stéphane O’Carroll: Coastal Erosion
  Dr. Alan Hanson (Canadian Wildlife Service): Ecosystems
  Hermel Vienneau (NBDELG), Deputy Minister
10:10-10:30  Refreshment break
10:30-11:30  Three more presentations on the project
  Kelly Murphy (Environment Canada): Socio-economics impacts
  Dr. Sue Nichols, Michael Sutherland (UNB): Adaptation strategies
  Dr. Liette Vasseur (Laurentian University): Integration
11:30-13:00  Lunch
13:00-13:20  Presentation of the afternoon round table
  Armand Robichaud (Planning Consultant): Virtual Planning Inc.
13:20-14:50  Round Table: reactions and potential responses
  Possible Question: ‘What are the immediate challenges to address? How can we link them with what we already know’
14:50-15:10  Refreshment break
15:10-16:00  Summary of the main results from the round tables
16:00-17:00  Future research orientations and gaps and new ideas
  Kathryn Parlee (C-CIARN)
  George Emery (National Research Council)
  Pat Gallaugher (OMRN)
Open house - Bouctouche Community Centre

Objectives:
To present the preliminary results on climate change scenarios, potential impacts and possible adaptations to the general public of the region that was targeted by the CCAF New Brunswick sea level rise project and receive their feedback about the various aspects of the project.

Agenda
19:00-19:30       Réal Daigle - Overview of NB Sea Level Rise Project
19:30-20:00       Omer Chouinard – Community perceptions of Climate Change
20:00-21:00       Question period
APPENDICE B
Participant list
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Climate Change and Coastal Communities: Concerns and challenges for today and beyond - Final Report
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APPENDICE C
Comments
COMMENTS (Evaluation form)
Summary

From a total of 100 participants, 45 completed the evaluation forms. Most of these responded positively to the questions. An analysis of the comments demonstrated that the workshop was a huge success and that the participants really appreciated it. As for the suggestions offered, we will certainly take these into serious consideration when organizing future workshops and conferences. Here is a summary of the ‘key’ comments:

The workshop in general
«This was more of an educative/learning process coupled with well experienced scientist»
«Besoin d’une plus grande présence de décideurs clés dans les participants»
«We should have more meeting like this one»
«Un bon catalyseur pour passer à l’action communautaire.»
«IL y avait beaucoup d’informations intéressantes, pertinentes, mais pour être vraiment efficace, il faut avoir un plan de sensibilisation du public.»
«Parfois un peu trop technique pour les non-scientifiques mais c’est une initiative très valable.»
«C’est l’atelier ou j’ai fait le plus de réseautage, on a appris a connaître les participants.»
«Excellent atelier en général, très pertinent, bien organisé.»

Presentations
«More solutions guidance to community should have been offered!»
«J’aurais apprécié que plus de questions puissant être posées aux présenteurs, c’est souvent une bonne source d’informations pertinentes.»

Discussion groups
«I think groups need to be a little more diverse and questions posed were a little ambiguous. Not enough time for meaningful discussion.»
«Les questions n’étaient pas toutes reliées au sujet ou appropriées.»
«Peut-être serait-il préférable de former les groupes sur des sujets plus ciblés.»
«Les tables rondes étaient très bien animées et ont été très productives.»

Workshop organization
«The flow of presentations was excellent!»
«Pourquoi ne pas encourager la communauté qui nous accueille?»
«J’ai apprécié l’organisation. Toujours garder le focus et essayer de respecter le temps.»
«Please supply locally ground food and beverage at meals»
«J’ai beaucoup apprécié la variété des informations et l’intégration d’activités telles que le pipe ceremony et le banquet.»
APPENDICE D
Press Release
NEWS RELEASE
For immediate release

CLIMATE CHANGE WORKSHOP AND OPEN HOUSE ENCOURAGES PUBLIC COMMENTARY

MONCTON, NB – The Southern Gulf of St.Lawrence Coalition on Sustainability is hosting a three-day workshop and Open House on *Climate Change and Coastal Communities: Concerns and challenges for today and beyond* from November 11-13, 2004 in Bouctouche, NB.

The workshop will be held at Clément-Cormier High School and includes morning presentations from top researchers in the field of climate change from across Canada. Afternoon roundtable discussions will enable participants to identify research gaps and how to engage community groups with monitoring their coastlines. Limited registrations will be accepted at the door.

The ‘Open House’ session is free and is scheduled for 7-9pm, Saturday evening, November 13 at the Centre Communautaire de Bouctouche on rue Évangeline. Réal Daigle, project Manager of the study ‘Impacts of Sea-Level Rise and Climate Change on the Coastal Zone in Southeastern New Brunswick’ will provide a series of power point presentations to share the study’s preliminary results and to demonstrate scenarios using computer modeling of projected flooding and coastal erosion based on the conducted research.

Public input is a key component of the study. All stakeholders including local residents, cottage owners, fishermen, farmers, entrepreneurs, and people of all ages are invited to attend the Open House session to share their concerns, voice opinions and to learn how the effects of climate change is expected to impact the coastal zones within the study areas which is from Kouchibouguac National Park to Cape Jourimain.

The Open House session will also include a poster session and video presentations. Comment cards will be made available for participants to submit their comments or to take home for other family members to provide feedback on this very important issue. The workshop is sponsored by the New Brunswick Environmental Trust Fund, Oceans Management Research Network (OMRN)– linking science and Local Knowledge node and the Canadian Climate Impact and Adaptation Research Network (C-CIARN). For more information on the workshop and open-house, contact Nadine Gauvin at 506-858-4495.

- 30 -

Contacts: Réal Daigle Omer Chouinard
Project Manager Professor
Environment Canada Université de Moncton
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NEWS RELEASE
For immediate release

LESSONS LEARNED AT THE CLIMATE CHANGE AND COASTAL COMMUNITIES WORKSHOP IN BOUCTOUCHE

November 23, 2004

Over 115 stakeholders discussed the impacts of extreme events on the coastal communities of Southeast New Brunswick - from Kouchibouguac Park to Cape Jourimain during the recent Climate Change and Coastal Communities workshop held in Bouctouche, New Brunswick on November 11-13.

After two days of roundtable discussions workshop participants consensually agreed upon three essential key messages. First, studies clearly demonstrate that sea levels are expected to rise in the southern Gulf of St. Lawrence up to 70 centimetres by 2100. Second, the New Brunswick Coastal Areas Protection policy must be immediately regulated and enforced; and the policy itself requires certain amendments to reflect the rapid changes (one meter per year for certain places). Third, climate change is an issue that integrates ecological, social and economic aspects – and it also links science with local knowledge. Partnerships have to be established with various levels of government, private enterprise and all stakeholders to address this issue. It’s also crucial to inform and educate all aspects of society including youth in schools and elders in communities to enhance climate change awareness.

Current research stresses the land-sea interface is a highly productive component of the marine ecosystem, particularly in the shallow retentive waters of the southern Gulf. The soft shoreline (sandy beaches and wetlands) of the Southern Gulf is one of Canada’s most impacted areas with regard to rising sea levels. An emphasis is needed with protecting expensive shoreline real estate and coastal habitats which, in retrospect, are being destroyed by sea walls and other adaptative structures – in response to erosion. New Brunswick’s proposed Coastal Areas Protecting policy is at best a minimal approach towards preventing further destruction of the coastal zone; and compliance with this policy is at present poorly enforced. Improved communications of this policy at the community level is urgently required to prevent further loss of valuable coastal habitat and the communities must be more directly involved with the decision-making process. Communities also require access to information on their specific coastal zones to enable their participation.

The Southern Gulf of St Lawrence Coalition on Sustainability is ready to partner with the New Brunswick Government to develop best management practices, a code of procedures to protect our coastal zone and a guide to help people adapt to climate change. Communities, special interest groups, local governments, planning commissions and local services district need to be well informed about climate change impacts and the best possible adaptation practices – through strong cooperation with all four provinces surrounding the Southern Gulf of St. Lawrence.

Two of the workshop sponsors are making great stride with getting the climate change message out there. The Canadian Climate Impacts and Adaptation Research Network (C-CIARN) - Coastal Zone sector works as a network across the country by having links to different places...
where solutions and adaptive responses can be implemented. Also, the Linking and Science Knowledge node of the Ocean Management Research Network (OMRN) is an information exchange network of climate change impacts on coastal zones across the country.

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APPENDICE E
Newspaper articles
Effets sur les communautés côtières

Ateliers sur les changements climatiques à Bouctouche

BOUCTOUCHE - La Coalition pour la viabilité du sud du golfe du Saint-Laurent présentera une session portes ouvertes, demain, au Centre communautaire de Bouctouche, avant son thème les changements climatiques et les communautés côtières, et ce, dans le cadre d'ateliers qui auront lieu ce weekend.

Alain Lessard

Des personnalités canadiennes, qui travaillent sur l'impact et les adaptations aux changements climatiques, donneront également des conférences à l'école Clément Corriveau de Bouctouche.

Le public aura l'occasion d'en apprendre beaucoup lors de la présentation des études menées par ces chercheurs et il pourra ensuite en discuter activement lors des tables rondes qui auront lieu en après-midi, a indiqué Nadine Gauvin, coordonnatrice de la Coalition pour la viabilité du sud du golfe du Saint-Laurent.

Parmi les conférenciers, Igor Yashayaeva discutera des courants océaniques, Ian Walker fera part de la vulnérabilité de la zone côtière face aux changements climatiques, Michael Barry présentera ses recherches sur les communautés côtières de l'île de Vancouver, Eleanor Bonny fera de même pour les Inuits, Stéphane O'Carroll fera le point sur l'érosion côtière, alors qu'Alan Hanson en fera autant avec les écosystèmes.

Demain, la population pourra assister gratuitement à une conférence donnée par Rea Daigle.

Élévation du niveau de la mer

De plus en plus, la population est confrontée aux problèmes des inondations causées par les ondes de tempête et l'érosion côtière. D'après la Commission géologique du Canada, certains secteurs du golfe du Saint-Laurent figurent parmi les zones les plus vulnérables à l'élevation du niveau de la mer au Canada.

Le projet est en cours afin de mesurer les impacts du changement climatique et de l'élévation du niveau de la mer sur la zone côtière du sud-est du N.-B. Rea Daigle, directeur du projet, viendra présenter les résultats primaires de l'étude, a mentionné Mme Gauvin.

La présentation de cette étude risque d'être le moment fort de l'Atelier environnemental. L'étude, d'une durée de trois ans, dispose d'un budget de 2,5 millions $. Elle est menée par des scientifiques et des chercheurs appartenant à plus d'une douzaine de groupes universitaires et d'entités gouvernementales.

L'élévation du niveau de la mer dans le sud-est du N.-B. a déjà eu des effets importants et on s'attend à ce que le rythme s'accélère dans les prochaines années.

"Non seulement le changement climatique provoque une élévation du niveau de la mer, mais les terres, dans les Maritimes, s'enfoncent d'environ 20 centimètres par siècle," a fait remarquer Mme Gauvin.

Pendant l'hiver, la glace de mer peut protéger les côtes contre l'action des vagues cependant, elle peut devenir un danger lorsque se forment des ondes de tempête, comme l'ont prouvé les dommages subis par le quai de Cap-des-Cailloux, en janvier 2000.
L’érosion des zones côtières ira en s’accélérant au Nouveau-Brunswick

« Le mieux serait de ne pas se construire si près de la mer »

BOUCTOUCHÉ - Des tempêtes plus vigoureuses et plus fréquentes, des inondations devastatinges et l’érosion accélérée des zones côtières sont à prévoir dans un avenir très proche pour les régions de l’Atlantique. À très long terme, les spécialistes parlent même de l’enfoncement d’une partie des côtes des provinces Maritimes.

Alain Lessard
L’Avenir NOUVELLE

Non! Les provinces de l’Atlantique ne disparaîtront pas soudainement, comme le racontent les légendes sur l’Atlantide. Cependant, la population n’aura pas à attendre longtemps avant de subir les contrecoups du changement climatique.

L’élevation constante du niveau de la mer entraîne des conséquences évidentes pour de nombreuses personnes, affirme Réal Daigle, responsable de la recherche sur le changement climatique et l’élevation du niveau de la mer sur la zone côtière du sud-est du N-B. Il y a d’abord les propriétaires de l’habitation le long des côtes, les gens qui vivent de l’aquaculture, puisque l’habitat marin est directement menacé, les communautés qui tirent leurs principaux sources de revenu du tourisme et une multitude d’autres gens, indirectement concernés.


Adaptation de la population

Les chercheurs qui ont entrepris cette étude qui se terminera en avril 2006, espèrent en tirer des recommandations qui aideront la population à s’adapter au phénomène.

Avant d’en arriver là, ils doivent d’abord amasser des données, étudier les observations, prévoir l’évolution dans les années à venir et vérifier les perceptions de la population quant au phénomène qui les affecte directement. C’est pour cette raison qu’une série d’ateliers ouverts a eu lieu au Centre communautaire de Bouctouche, samedi.

« Les premières étapes sont complétées, nous en sommes rendus à présenter les résultats primaires. C’est important pour nous de communiquer ces données et de vérifier la réaction du public puisque il fait partie du processus d’enquête, a révélé le chercheur. En étant mieux informés, les gens pourront prendre des décisions éclairées et opter pour des solutions durables. »

Les rencontres ont cuit les chercheurs avec les résidents des zones côtières du sud-est du N-B. indiquant que la majorité des gens connaissent les dangers mais n’ont aucune idée sur la façon d’y échapper.

Les gens savent que la mer se rapproche davantage chaque année, ils se construisent des murs pour repousser l’imminence. Les murs de bois ont cédé leur place aux façades en ciment, mais celles-ci n’ont pas obtenu de meilleurs résultats, rapporte M. Daigle. Pour l’instant, les gens engagent des murs de roches en granit, ce qui semble assez résistant, mais le mieux serait de ne pas se construire si près de la mer, surtout si le terrain n’est pas à trois pieds audessus des plus hautes vagues.

Depuis 1991, la province envisage d’appliquer la Loi sur la protection de la zone côtière qui interdit aux gens de se construire trop près de la côte, mais l’extrême lenteur du gouvernement à prendre des engagements ferme dans ce dossier eu égard inverse. De nombreux chantiers de construction sont en cours, malgré les risques d’inondation toujours plus grands.
Global warming eats away coastline

Sea levels are expected to rise up to 70 cm over next 100 years.

N.B. expected to rise up to 70 cm

...
Appendice E: Newspaper articles

Climate Change and Coastal Communities: Concerns and challenges for today and beyond - Final Report

82