



Spring 2014 Newsletter

From the Editor's Desk

Greetings from Ottawa! I am happy to point out two additions to this newsletter. We have an enclosed page in this newsletter—the entire Iqaluit article has been translated to Inuktitut! Also mentioned in this issue is the contribution our C-Changers have made to the Sustainability Science Special Issue—C-Change papers took up a large portion of the issue and we are very proud of that! Congratulations to all involved, we were represented well.

Kathy Cunningham, Editor

It is a pleasure to provide this fifth and final C-Change Newsletter and to report to you on our communities of Iqaluit, Nunavut and San Pedro, Belize. These C-Change communities are especially important because they forewarn us all of pending environmental change. In the Canadian Arctic, our scientists continue to be alarmed about the extent of warming, the faster than anticipated melting of old sea ice. In the endangered waters of the Belize Barrier Reef, ocean acidification is pronounced and worrisome. In this year 2014, the final joint C-Change project meetings will take place during and immediately following the Coastal Zone Canada Association Conference in Halifax. In 2014, the IPCC will present AR5 – the latest Water Report. All indications are that all trends for sea level rise and melting of the polar ice sheets are tracking at the highest levels anticipated. Thus, while our C-Change work with coastal communities will formally end in 2014, the problems of coastal environmental change will continue to challenge coastal communities in Canada and the Caribbean region. We must never give up our vigilance and we must redouble our need to look ahead and to adapt continuously.

Dan Lane, Co-Director Canada

It has been a real pleasure to be associated with the C-CHANGE project. I am quite certain that the personal and professional relationships developed there will last a lifetime. Needless to say, I have a deep sense of gratitude to my Caribbean co-applicants but I am, particularly indebted to our community partners and collaborators in the four Caribbean sites: Bequia (St. Vincent and the Grenadines), Georgetown (Guyana), Grande Riviere (Trinidad & Tobago) and San Pedro (Belize). We received tremendous support from them all, without which the scholarly reports and policy documents completed would not have been possible. The case of San Pedro is highlighted in this Newsletter and it exemplifies the relationships developed as well as the quality of work produced. Thank you, everyone.

Patrick Watson, Co-Director Caribbean

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Photo Courtesy of Michael Sutherland



CARIBBEAN | BELIZE

By Dr. Michelle Mycoo, C-Change Community Champion—San Pedro, Belize



C-CATs Canada

by Colleen Mercer Clarke, C-Change Community Coordinator

In this, the final year of the C-Change project, community partners and researchers throughout Canada and the Caribbean have been actively involved in an array of initiatives intended to assist the efficient implementation of adaptive planning to the impacts of current and potential climate change.

In the Caribbean, working to advance local understanding of the impending challenges associated with environmental change, C-Change researchers enlisted the participation of PANOS, a Caribbean-based non-profit organisation working to amplify the voices of the poor and marginalized using the media as an advocacy tool. Through a C-Change contract, PANOS has developed a collaborative education program on climate change and its consequences aimed at public school audiences throughout the Caribbean region. Recently the team held successful workshops in Belize and Bequia, to implement the PANOS material and to engage local community members and school children. Heavy weather events this past summer in Georgetown, Guyana gave further importance to the contribution being made by C-Change researchers as they work with local planning authorities to better understand the scope

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San Pedro is a small town located on Ambergris Caye which lies to the north of the mainland of Belize. It once formed part of the Yucatan Peninsula. Topographically, Ambergris Caye is flat and therefore vulnerable to projected sea level rise. The caye is about 40 kilometres long from north to south, and about 1.6 kilometres wide. Like the rest of Belize, it is also vulnerable to natural hazards associated with climate change, such as hurricanes and storm surges that traverse the Caribbean Sea with increasing frequency and intensity.

Approximately 11,510 persons live on the island according to provisional estimates of the 2010 census. San Pedro was once dependent on fishing, but tourism is now the economic mainstay that provides livelihoods for many of its inhabitants. It is attractive to visitors because of the Belize Barrier Reef which is the second largest barrier reef after the Australian Great Barrier Reef. It is also famous for its sandy beaches, the Hol Chan Marine Reserve as well as the Mayan archaeological sites found in some parts of the island. Ambergris Caye has the highest density of tourism accommodation in Belize. It provides a range of visitor accommodation which includes low-rise hotels, guest houses, boutique style resorts and condominiums. If sea level rise occurs its tourism investments and archaeological sites may be vulnerable to sea level rise.

C-Change San Pedro Activities to Date

From the inception of the ICURA project, the collaboration between the Caribbean C-Change team and our Belizean partners has been strong. The Caribbean Community Climate Change Centre (5Cs) has been the project's community partner. Our project collaborator, Mito Paz of Belize Green Reef and Valentino Rosado formerly of the same organisation have been active in facilitating the UWI team's site visits. They both have been generous in giving of their time in facilitating the initial reconnaissance trip conducted by Dr. Michelle Mycoo in 2008 and their active engagement has continued over the last four years. Mr. Paz currently functions as a C-CAT team leader. Other supporting stakeholders include the Coastal Zone Management Authority and Institute and the University of Belize. Imani Fairweather-Morrison, Chair of the Board of Trustees of the University of Belize was instrumental in assisting in the logistical planning of site visits by the UWI team in 2008 and subsequently in 2011.

As mentioned, the first trip to San Pedro in 2008 was a reconnaissance trip to select a suitable case study for the ICURA project. The next trip to San Pedro occurred between 10th to 15th in October 2011 and comprised UWI team members Dr. Michelle Mycoo (team leader), Dr. Sandra Sookram and Dr. Michael Sutherland. During this visit several meetings were conducted in Belmopan the capital with the aim of determining data availability for the project. On October 11th 2011, Dr. Sandra Sookram met with the Statistical Officer Mr. Marvin Moody to request population census data needed to conduct the socio-economic analysis for San Pedro. On the same day, Dr. Michael Sutherland met with Mr. Alain Robinson, GIS Technician to discuss spatial data needs of the project and how to access the data sets. Dr. Michael Sutherland met with Mr. Jose Chulin, surveyor to discuss spatial data sets (i.e., contours and spot heights for San Pedro) for the ICURA project and was referred to Mr. Wilbert Vallejos, Commissioner of Lands. The team also held discussions with Dr. Leandra Choricketts, Marine Science Director of the Environmental Research Institute of the Faculty of Science and Technology, the University of Belize. This meeting gave the UWI team an update on research in progress on San Pedro.

The UWI team met with the San Pedro community on October 12th 2011. The meeting was attended by 20 community members including Mr. Mito Paz of Belize Green Reef and Mr. Valentino Rosado, Field Manager of the Coral Reef Alliance, San Pedro. A power point presentation was delivered to the community by Dr. Michelle Mycoo, which served to introduce the ICURA project, its team members, goals and objectives, outputs and work plan.

In July 2012, a questionnaire was administered in San Pedro to capture data relevant to the ICURA project. Data entry has been completed and is currently being analysed. Dr. Sandra Sookram is supervising Sherry-Anne Ganase, PhD candidate whose research is entitled "Assessing the Vulnerability Level in Coastal Communities in the Caribbean: a Case Study of San Pedro, Belize". The study examines the vulnerability of the coastal community of San Pedro, Belize to climate change by modifying and empirically applying a Vulnerability Index. Five pillars were developed that comprised different indicators and sub-indicators which were populated with primary data from the questionnaire.

Valentino Rosado attended the University of the Cayman Islands Conference with the UWI team in 2012, which presented the opportunity to further discuss on-going fieldwork in the San Pedro community.

Mr. Mito Paz our C-Change partner assisted the UWI team in conducting a training workshop in San Pedro to introduce the manual on climate change education and awareness which was well received by the community. Ms. Indi Mclymont-Lafayette Country Coordinator of PANOS-Caribbean, Jamaica Office, delivered the manual and held awareness sessions in the schools and in the community on 26th September 2013.

The UWI team has been actively engaged in San Pedro in 2011, 2012 and 2013 to advance collaboration between the partners, collaborators, C-CAT team, the community and the researchers.

By Don Forbes, C-Change Co-Researcher, Community Champion—Iqaluit

The City of Iqaluit is the northernmost community in C-Change and its physical environment is dramatically different from that of all the other communities in the project. It lies north of the tree line, it is affected by permafrost (year-round frozen ground), the sea at its waterfront is covered by ice for eight months of the year, and it has a mean annual temperature of -9.3 °C (-26.9 °C in January). By contrast, the monthly mean temperature in Georgetown, Guyana, the southernmost C-Change community, ranges from +26.1 °C in January to +27.6 °C in October. Nevertheless, apart from the contrast in physical environment, the environmental, social, and capacity issues facing Iqaluit are similar in many respects to those affecting all C-Change communities, in Canada and in the Caribbean.

Iqaluit has a history of a pro-active approach to climate change, having completed its first municipal assessment of potential vulnerability to climate change in 2007 (*The City of Iqaluit's Climate Change Impacts, Infrastructure Risks & Adaptive Capacity Project*). This involved early identification of potential risks to infrastructure such as roads, buildings, and services (potable water supply, wastewater treatment, and waste disposal), and the beginnings of an adaptation strategy. The latter included enhanced awareness of climate change issues, developing partnerships and collaborative projects, monitoring climate and infrastructure for changes, encouraging adjustments to standards, codes, and practices, incorporating local and Inuit traditional knowledge, revising disaster management plans, and mainstreaming climate-change considerations into the long-term planning process. These approaches were, to a large extent, endorsed by work undertaken in collaboration with the Canadian Institute of Planners under the Nunavut Climate Change Partnership and reported in 2010. The City of Iqaluit General Plan (By-Law 703), adopted in October 2010, states that "*The City of Iqaluit will take a precautionary approach to development by incorporating the best current knowledge on climate change impacts into its decision-making. By creating a monitoring system, the City will increase its knowledge base and develop policies that build the adaptive capacity of the community.*"

C-Change Iqaluit Activities to Date

Since its inception, C-Change has worked to support these objectives, partnering with ArcticNet, Natural Resources Canada, the Government of Nunavut, the Nunavut Research Institute, the Canada-Nunavut Geoscience Office, academic partners, and the City of Iqaluit to expand and deepen the knowledge base and to support the city's sustainability initiatives. New data have been acquired, including improved digital elevation and bathymetric models, mapping of surficial geology, permafrost, and potential for thaw subsidence affecting foundation stability, new short-term monitoring of tides, currents, and waves, measurements of infrastructure elevation and analysis of coastal hazards, including sea-level rise, ice ride-up or pile-up, wave impacts, and risk of flooding. Some of this work has been reported in Scott Hatcher's M.Sc. thesis at Memorial University, completed in 2013, and in earlier C-Change reports and conference presentations. The very high tidal range and wide intertidal boulder flats reduce the probability (frequency of occurrence) of severe ice, wave or flooding impacts at or above the high-tide line and there appears to be little potential for storm-surge flooding. The highest recorded coastal flooding, largely due to an extreme tide, occurred in 1964, well before the development of present-day waterfront infrastructure, so there is little community memory of this occurrence and limited appreciation of the potential for flood or wave run-up in rare extreme events. On the other hand, some flooding in extreme high tides has occurred within the past decade. There has been no community experience of extreme high water with high onshore winds and waves. C-Change work has identified some components of infrastructure at risk of flooding under plausible scenarios for sea-level rise in extreme events, highlighting in particular the vulnerability of subsistence infrastructure on the upper beach. In planning for sustainable development, the exposure of this informal infrastructure component, which contributes to food security, quality of life, and social cohesion, may require particular attention.

The engagement with City staff has been a valuable aspect of the project, providing opportunities through conference exchanges and the C-Change Community of Practice to share experience and insights from Iqaluit with other communities in Canada and the Caribbean and vice versa. The City of Iqaluit has recently completed the preparation of a Sustainable Community Plan, with Part 2, the Action Plan, released recently in draft form (<http://sustainableiqaluit.com/>). This provides a long-term vision for the city and is intended to guide and inform development over the coming 50 years. As such, it recognizes the importance of climate change and the need to incorporate adaptation in future planning and development. The work of C-Change and partners has contributed to heightened awareness and to the knowledge base required to inform adaptation actions.

C-Change was well represented in the recent **Sustainability Science Special Issue on Understanding and Managing Global Change on Small Islands**. Please visit <http://link.springer.com/journal/11625/8/3/page/1> to find links to the articles. Great work, C-Changers!

Forbes, D.L., James, T.S., Sutherland, M., Nichols, S.E. 2013. Physical basis of coastal adaptation on tropical small islands. *Sustainability Science* 8:327-344.

Mycoo, M., Gobin, J. 2013. Coastal management, climate change adaptation and sustainability in small coastal communities: leatherback turtles and beach loss. *Sustainability Science* 8:441-453.

Lane, D., Mercer Clarke, C., Forbes, D.L., Watson, P. 2013. The Gathering Storm: managing adaptation to environmental change in coastal communities and small islands. *Sustainability Science* 8:469-489.



Photo Courtesy of Don Forbes

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of current and future risks to the local community, and to improve the options for adaptive planning.

In Canada, C-Change has been working with the communities of Isle Madame and Charlottetown to ensure that new staff are fully briefed on the latest science on climate change and its impacts in Canada. In Isle Madame, municipal staff, local leaders, and C-Change researchers and graduate students have completed research on impacts to wastewater services (Barghi), and on options for communities threatened by rising seas and severe weather. C-Change working sessions have collaboratively identified short-term measures to assist communities in protecting the most vulnerable residents from impacts and isolation resultant from severe weather systems. C-Change graduate student research has also resulted in the development of a unique smart phone application that reports on the status of well-being for vulnerable residents (Lu) and advances understanding of the gaps in local planning for disaster response (Chung). In Charlottetown, C-Change researchers have recently returned from a briefing session with senior municipal staff, in which the implications of climate change to the new Draft Plan were discussed.

As the project moves towards completion, the necessity to ensure that research outputs have resonance within our communities becomes even more imperative. To further this initiative, in 2014, the C-PAC³ will provide necessary insights into the structure and content for the proposed C-Change *Guidelines for Adaptive Planning to Environmental Change* that are proposed as a final deliverable for the project. Community Partners will be invited to participate in the development of the Guidelines and to join researchers and graduate students in the final meetings for the project, currently proposed to occur jointly in June with the Coastal Zone Canada Conference in Halifax, Nova Scotia.

Communities in Focus

Do you have photographs of one (or more) of the C-Change Communities that you would like to share with the C-Change Team?

Please email your high resolution photos (along with your name, and date & location of photo) to: administrator@coastalchange.ca

Photos will be posted on the C-Change Facebook site (www.facebook.com/coastalchange), C-Change Twitter account (@coastal_change) and may be featured in future issues of the C-Change Newsletter (credit will be given to photographer).



C-Change 2014 Upcoming Events

MAY	26-28	Canadian Operational Research Society (CORS) Annual Conference	Ottawa, ON
MAY	27-29	Environmental Studies Association of Canada (ESAC) - 2014 Annual Conference	St. Catharines, ON
MAY	29-31	Canadian Society of Landscape Architects (CSLA) Congress	Ottawa, ON
JUNE	15-19	Coastal Zone Canada (CZC) 2014 Conference	Halifax, NS
JUNE	19-20	C-Change Integrated Canadian-Caribbean Meeting	Halifax, NS
NOV	4-6	International Conference on Ocean Energy (ICOE) 2014	Halifax, NS

Photo Courtesy of Michael Sutherland

C-Change

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Social Sciences and Humanities
Research Council of Canada



Conseil de recherches en
sciences humaines du Canada



C-Change Secretariat: Canada

University of Ottawa
Telfer School of Management
55 Laurier Ave E
Ottawa, ON Canada K1N 6N5

 613.562.5800 x.2933
 613.562.5164
 administrator@coastalchange.ca



C-Change Secretariat: Caribbean

University of the West Indies
Sir Arthur Lewis Institute of Social & Economic Studies, SALISES
St. Augustine, Trinidad & Tobago

 868.662.2002 x.2394
 868.645.6329
 cchange.carib@gmail.com



