



## **CACCON and Partner Knowledge Networks: Arctic Coastal Engagement Network of Future Earth Coasts**

Donald L. Forbes<sup>1,2</sup>, Trevor Bell<sup>1</sup>, Martin LeTissier<sup>2</sup>, Andrey Petrov<sup>3</sup>, Peter Pulsifer<sup>4</sup>, David E. Atkinson<sup>5</sup>, Laura Eerkes-Medrano<sup>5</sup>, Joan Nymand Larsen<sup>2,6</sup>, Nicole Couture<sup>7</sup>, Gleb Kraev<sup>8</sup>, Elizabeth Marino<sup>9</sup>, Paul Overduin<sup>10</sup>, Rasmus Ole Rasmussen<sup>11</sup>, Rudy Riedlsperger<sup>1</sup>, Peter Schweitzer<sup>12</sup>, Tatiana Vlasova<sup>8</sup> and Katherine Wilson<sup>1,13</sup>

<sup>1</sup>Department of Geography, Memorial University of Newfoundland, St John's, NL, Canada

<sup>2</sup>Future Earth Coasts, University College Cork, Ringaskiddy, Cork, Ireland

<sup>3</sup>Department of Geography, Northern Iowa University, Cedar Falls, IA, USA

<sup>4</sup>National Snow and Ice Data Center, University of Colorado, Boulder, CO, USA

<sup>5</sup>Department of Geography, University of Victoria, Victoria, BC, Canada

<sup>6</sup>Stefansson Arctic Centre, University of Akureyri, Akureyri, Iceland

<sup>7</sup>Geological Survey of Canada, Natural Resources Canada, Ottawa, Canada

<sup>8</sup>Russian Academy of Sciences, Moscow, Russian Federation

<sup>9</sup>Social Science Program, OSU-Cascades, Bend, OR, USA

<sup>10</sup>Alfred Wegener Institute for Polar and Marine Research, Potsdam, Germany

<sup>11</sup>Nordic Centre for Spatial Development (Nordregio), Stockholm, Sweden

<sup>12</sup>Department of Social and Cultural Anthropology, University of Vienna, Vienna, Austria

<sup>13</sup>Canadian Ice Service, Environment and Climate Change Canada, Ottawa, Canada

## **Abstract**

The Circumpolar Arctic Coastal Communities Observatory Network (CACCON) functions as the Arctic Regional Engagement Network for Future Earth Coasts. In partnership with other Arctic knowledge networks and programs, including the Exchange for Local Observations and Knowledge of the Arctic (ELOKA) and Arctic-COAST, CACCON promotes consensus and collaboration to advance local knowledge availability and accessibility for adaptation planning and sustainable development in Arctic coastal communities and regions. Components of the CACCON agenda include: integrative analyses of sustainability challenges in Arctic coastal communities using co-developed situational and sustainability indicators; solutions-oriented research for actionable, proactive adaptation policies in Arctic coastal communities; sharing insights among existing community-based research and resilience programs; responding to community-based agendas and building resilience by growing local and regional knowledge co-production and dissemination capacity. These activities support the Global Coastal Futures initiative of Future Earth Coasts, rooted in the Future Earth principles of co-design and co-production of knowledge involving a broad cross-section of stakeholders and consensus-building on pathways for transformation to more sustainable strategies for enhanced present and future well-being on Arctic coasts.

## Introduction

This paper addresses the challenges of rapid environmental and social change in the Arctic coastal zone and the information needs of residents and other stakeholders for effective decision-making that supports sustainability goals. It reports on a number of interrelated initiatives that seek to support transitions to more sustainable pathways in the circumpolar Arctic and global coastal zone. A common thread is the recognition that access to critical knowledge synthesizing information from multiple sources at appropriate scales can enhance the ability of individuals and institutions to respond to or proactively prepare for coastal change.

## Arctic Coasts and Coastal Communities

The circum-Arctic coastal zone is the locus of complex interactions among marine, terrestrial, and atmospheric processes. It is a key interface in the Arctic environment, a focus of human habitation and activity, a rich band of biodiversity, high productivity, and critical habitat, and among the most dynamic components of the northern landscape. Thus the coast and residents who depend upon it are particularly sensitive to ongoing and projected environmental change, exacerbated by anthropogenic stressors<sup>1</sup>.

Arctic and sub-Arctic Inuit communities are almost exclusively located in coastal settings that provide access to marine and terrestrial food resources, transportation and communication corridors, and culturally significant landscapes. These coastal communities and their critical infrastructure are also exposed to a range of coastal and marine hazards in addition to other landscape hazards common throughout the permafrost regions of the circumpolar Arctic. Combined with challenges of economic and social development, demographics, globalization, mixed cash and non-cash economies, maintenance of linguistic and cultural integrity, health, and well-being, the already-noticeable effects of environmental change are an added source of uncertainty and concern. Food security in many communities is dependent on access to country food, the harvesting of which entails interaction with the changing physical environment in ways that depend, for example, on the continued viability of travel on ice. There are direct connections between environmental change and measures of well-being such as fate control and food security. Communities and industrial operators in the north are also sensitive to ice and weather conditions and require timely and accurate observations and forecasts to conduct activities in a way that maximizes opportunity while minimizing risk. In the near-absence of road connections, northern communities are particularly affected by impacts on aviation and sealift operations. Coastal archaeological sites in Arctic Canada are also under threat, with important knowledge of the region's history and prehistory potentially lost to erosion. Climate change will exacerbate existing coastal hazards, leading to more rapid loss of archaeological resources and culturally significant sites in the future. All of these factors represent potential vulnerabilities and challenges to health and safety, community resilience, cultural integrity, sustainability, and well-being.

The *State of the Arctic Coast 2010* report<sup>1</sup> included the following recommendations:

- The need for an integrated approach to Arctic coastal change;
- The value of recognizing Arctic coasts as complex social-ecological systems;

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<sup>1</sup> Forbes, D.L. (ed.), 2011, *State of the Arctic Coast 2010 – Scientific Review and Outlook* ([www.arcticcoasts.org](http://www.arcticcoasts.org)).

- The value of combining western science and traditional ecological knowledge for enhanced understanding of change;
- The importance of integrating co-produced knowledge into Arctic policy and decision-making.

This vision paper is based on the conviction that an integrated, collaborative, and holistic approach to monitoring, understanding, and managing the many sources of change in northern communities, working closely with community researchers and knowledge-holders, is a key to local empowerment and sustainable development for present and future generations

## CACCON

The Circumpolar Arctic Coastal Communities Observatory Network (CACCON) was initiated in 2014 as an ICARP-III<sup>2</sup> activity of the International Arctic Science Committee (IASC) and a regional engagement initiative of LOICZ (now Future Earth Coasts). It was launched as a pilot in Canada in 2015 with funding from the ArcticNet Network of Centres of Excellence. CACCON aims to foster a web of community-engaged, locally directed, multifaceted, and integrative coastal observatories (knowledge production centres and hubs). It is founded on the premise that co-designed and co-produced knowledge in the hands of decision-makers is the key to successful adaptation and resilient communities. The challenge is to determine what knowledge is required, where and how it can be sourced (including local traditional and purpose-developed knowledge), and how it can be made readily available when and as needed.

An important opportunity arises when knowledge can be shared with partners across the network to enhance co-learning and realize the benefits of this collaborative effort (see *SmartICE* example below). In recent years, there has been a rapid expansion of interest and activity in community-based monitoring (CBM) in the Arctic. Residents, northern communities, researchers, and policy-makers have increasingly come to appreciate the strengths of CBM in local resolution and detail, potential for continuity, integration of traditional knowledge, capacity-building and, above all, relevance to community knowledge-gap priorities. However, as noted in a recently published review of Arctic CBM for the 2013 Arctic Observing Summit, “CBM initiatives remain little-documented and are often unconnected to wider networks, with the result that many practitioners lack a clear sense of the field and how best to support its growth and development” (Johnson et al., 2015)<sup>3</sup>. CACCON specifically aims to build capacity through sharing experience between stakeholder peers across the circumpolar world, to help identify information needs and transformational insights.

The CACCON agenda includes the following:

- Integrative analyses of sustainability challenges in Arctic coastal communities using co-developed situational and sustainability indicators;
- Solutions-oriented research for actionable, proactive adaptation policies in Arctic coastal communities;
- Sharing insights among existing community-based research and resilience programs;

<sup>2</sup> Third International Conference on Arctic Research Planning, Toyama, Japan, April 2015

<sup>3</sup> Johnson, N., Alessa, L., Behe, C., Danielson, F., Gearheard, S., Goffman-Wallingford, V., Kliskey, A., Krümmel, E.-M., Lynch, A., Mustonen, T., Pulsifer, P. and Svoboda, M. 2015. The contributions of community-based monitoring and traditional knowledge to Arctic observing networks: reflections on the state of the field. *Arctic*, 68, Supplement 1, 28-40.

- Responding to community-based agendas and building resilience by growing local and regional knowledge co-production and dissemination capacity – thematic pilot focused on landfast ice;
- Serving as an Arctic Regional Engagement Network for Future Earth Coasts.

The seed network for CACCON includes communities in Canada, Greenland, Norway, Russia, and the USA. As specific funding has thus far been available only in Canada, the Canadian component of CACCON is currently underway as a pilot with support from the ArcticNet Network of Centres of Excellence. CACCON activities in Canada include community-science initiatives in Nain (Nunatsiavut), Pond Inlet (Nunavut), and Arviat (Nunavut). CACCON partners are engaged with independent community-based knowledge initiatives in the Inuvialuit Settlement Region (ISR) (Northwest Territories and Yukon) and Clyde River (Nunavut), among others. Community-defined sustainability issues range from coastal hazards and shore protection in the ISR and Hall Beach (Nunavut) to safe and healthy homes in Nunatsiavut, community infrastructure planning and decision-making in Arviat (Nunavut) and Nunatsiavut, and safety of travel on landfast ice in Nain (Nunatsiavut) and Pond Inlet (Nunavut). These issues among others resonate in other communities and with territorial government agencies focused on climate-change adaptation, health, and community planning and engineering services.

## **Two examples of CACCON prototype activities**

### *SmartICE*

Arctic climate change will result in landfast ice that is thinner, forms later and breaks up earlier than before, resulting in increasingly more dangerous over-ice travel and less reliable traditional knowledge of safe routes based on past climatic conditions. Considering that the majority of residents in Arctic communities use sea ice to access country foods and maintain cultural and family activities, increased risk or fear of travelling on the ice has severe repercussions for food security and physical and mental health. At the same time, changes in sea-ice conditions are creating longer shipping seasons while natural resource economics are driving the demand for winter shipping. Consequently, there is an urgent need to understand the emerging implications of changing shipping trends for local communities and local sea-ice users.

*SmartICE* (Sea-ice Monitoring and Real-Time Information for Coastal Environments) is a community-academic-government-industry collaboration that seeks to address the limitations in technologies and services currently used to map coastal sea-ice conditions. Most importantly, through technological innovation and science, the initiative strives to integrate and augment *Inuit Qaujimaqatuqangit* (Inuit knowledge and values) about local sea-ice conditions, not replace it. The overall goal of *SmartICE* is to develop an integrated, near real-time monitoring and dissemination system that informs decisions about coastal sea-ice travel and shipping, thereby improving safety. We are currently piloting *SmartICE* technologies and operations in Nunatsiavut (Nain) and Nunavut (Pond Inlet). Although primarily designed to support ice-travel safety, *SmartICE* observations may also inform winter fishery and harvesting programs, search-and-rescue operations, climate change adaptation planning, ecosystem monitoring, and sea-ice technology validation. *SmartICE* directly involves northern partners and communities in all aspects of the project including Inuit training Inuit across the project regions.

*Adverse marine weather in the eastern Beaufort Sea –  
Gathering community and end-user input*

The Marine Environmental Observation, Prediction and Response (MEOPAR) Network of Centres of Excellence and Transport Canada are funding a three-year project focused on weather impacts and their associated adverse effects on marine transport in the Eastern Beaufort Sea region. Transportation in this context includes travel in all sizes of vessels, from small craft used for subsistence activities to sea-lift barges and cruise ships supporting tourism. The objective is to have coastal communities, industrial/marine shippers, and operational/emergency response groups identify specific occurrences of problematic weather or wave events that have interfered with their activities. These occurrences are linked to broader atmospheric patterns, to make that large-scale to local-scale connection that national forecast services are interested to see and challenged to address.

Three communities in the Inuvialuit Settlement Region (Sachs Harbour, Tuktoyaktuk, Ulukhaktok) are participating in the study. It is hoped that this project will help to develop community resilience in the face of longer-term changes in the weather and will contribute to an understanding of how local weather relates to larger-scale climatic trends.

#### **Future Earth Coasts<sup>4</sup>**

Future Earth Coasts (formerly LOICZ<sup>5</sup>) is a core project of Future Earth. Future Earth is a new global research platform designed to provide the knowledge needed to support transitions toward sustainability, enabling people to thrive in a sustainable and equitable world. To support a human population of ~9 billion by 2050, we will need a globally shared vision and pathway to this more sustainable world, facing up to the challenges and knowledge needs that it will entail. The core project Future Earth Coasts is responding to the need to co-design and co-produce a new type of science that links disciplines, knowledge systems, and societal partners to tease out and reproduce the ingredients of success and confront inhibitors that promote adoption or continuation of unsustainable practices at the coast.

- *The 2050 agenda of Future Earth Coasts is to institutionalise a process for assessing the global status of our coasts and identifying innovative solutions for policy makers, practitioners, the market place, and civil society to enhance stewardship, well-being, and sustainability in our relationship with the coastal zone.*

This is undertaken in the context of the recently adopted Sustainable Development Goals (SDGs)<sup>6</sup>. These define many aspects of a more secure, just, and liveable future, but have fallen short of articulating the specific risks and opportunities of living on the coast. Bridging this gap between the

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<sup>4</sup> Much of this section is taken directly from an overview document *Future Earth Coasts – Setting the Agenda*, 2015, (Future Earth Coasts IPO, Cork, Ireland), authored by Martin LeTissier, Val Cummins, Bruce Glavovic, Ramesh Ramachandran, Michelle Mycoo, Mark Pelling, and Donald Forbes.

<sup>5</sup> Land-Ocean Interactions in the Coastal Zone (LOICZ) was a core project of the International Geosphere-Biosphere Program (IGBP) and the International Human Dimensions Program for Global Environmental Change (IHDP), both of which have now been superseded by Future Earth.

<sup>6</sup> See <https://sustainabledevelopment.un.org/sdgs>

ambition of the SDGs and the lived experience, political realities, and biophysical limits of the coast is an opportunity and responsibility that Future Earth Coasts aims to meet.

As a global coastal research platform, Future Earth Coasts supports a web of regional engagement networks from East and South Asia to West Africa, South America, the Caribbean and the Pacific. CACCON has been nominated as the regional engagement network of Future Earth Coasts in the Arctic. This calls for a collaborative engagement and co-learning relationship with northern residents and the many other players in the Arctic observing community. Acknowledging SDG 11 (“*making cities and other human settlements inclusive, safe, resilient and sustainable*”), CACCON aims to foster conversations and research on the components and processes that need to be encouraged, developed, and in place to move toward this goal in the Arctic coastal zone. It is our conviction that local ownership and accessibility of relevant data and knowledge are two of these key components.

The ‘*Global Coastal Futures*’ process envisaged by Future Earth Coasts will play out in a number of ways, not least of which will be a focus on the documentation and sharing of solutions strategies (ingredients of success or failure) in the pursuit of sustainable or transformative development in coastal communities around the globe. The Coastal Futures approach also aims to deliver sharp science and policy messages of regional and multi-sectoral relevance, as well as speaking to specific local sustainable development questions. It goes beyond the description of the state of the coast (‘status’) to define:

- A process of inquiry that is as important as the product.
- An approach rooted in the Future Earth principles of co-design and co-production of knowledge involving a broad cross-section of stakeholders.
- Tools to develop capacity to roll out methodologies for replication at all scales.
- Consensus-building on pathways for transformation.

Obviously the Arctic is an important component of such a global initiative and may stand to gain insights from an engagement network in the circumpolar North as well as from parallel efforts in other parts of the world. This is a logical extension and application of CACCON as well as a follow-up to the *Arctic Human Development Report* and activities of the IASC Social and Human Working Group, the Exchange for Local Observations and Knowledge of the Arctic (ELOKA), the anticipated Coastal Permafrost in Transition (CPiT) working group of the International Permafrost Association, the *Arctic Resilience Report* of the Arctic Council, and the Arctic-COAST project.

### **Exchange for Local Observations and Knowledge of the Arctic (ELOKA)**

ELOKA facilitates the collection, preservation, exchange, and use of local observations and knowledge of the Arctic. ELOKA works with community partners around the circumpolar Arctic, a network of technical practitioners, and academia to co-produce locally appropriate and effective methods and technology for sharing local observations and Indigenous knowledge. Established during the International Polar Year 2007-2008, ELOKA promotes sharing within and between Arctic communities and fosters collaboration between resident Arctic experts and visiting researchers. This work includes engaging in dialogue on how to appropriately share across knowledge domains. Most recently, the results of an ELOKA workshop were presented during the

International Polar Data Forum<sup>7</sup> as a summary statement which has been expanded as an Arctic Observing Summit white paper<sup>8</sup>. As stated, CACCON aims to foster a web of community-engaged and directed coastal observatories and knowledge hubs. ELOKA activities will complement CACCON and members, particularly in making information and knowledge readily available when and as needed. Members of each network are working to establish practical ways of collaborating and sharing knowledge, best practices and technology through hands on projects.

## **Arctic-COAST**

This recently launched US National Science Foundation Research Coordination Network (RCN) shares goals with the CACCON and Future Earth Coasts agendas outlined above, with a specific focus on building sustainability in the Russian Arctic coastal zone.

Arctic-COAST develops the transdisciplinary science-policy-community interface between the academic domains of biophysical, socio-economic, and decision-making research and policy applications to address the resilience of coastal social-ecological systems. By integrating data-rich regional case studies, developing data management tools, and presenting information through an educational web-based portal, the network will contribute to research cyberinfrastructure in the circumpolar Arctic. Using a resilience framework as an overarching concept, Arctic-COAST will be instrumental in closing knowledge and policy gaps to foster sustainable development of Arctic ecosystems and communities.

Arctic-COAST will synthesize and disseminate knowledge about the state, dynamics and resilience of Arctic coastal SESs. To bridge existing knowledge gaps, Arctic-COAST will (1) provide systematic, synthetic knowledge about Eurasian and North American Arctic coastal SESs; (2) compile spatial, systems-based understandings of SES resilience for different geographical scales and regional contexts; (3) craft future research directions for Arctic SES resilience and ecosystem stewardship, focusing on governance issues; and (4) foster a new generation of scientists, policy and decision makers capable of adaptive management. Arctic-COAST will fund regular meetings and workshops to promote exchange, collaboration, training and educational opportunities for scientists, early career and indigenous scholars, students and local community members.

Arctic-COAST comprises five working groups:

- (1) Monitoring Change in Social-Ecological Systems;
- (2) Resilience of Arctic Communities;
- (3) Governance and Adaptation;
- (4) Arctic Futures (Scenarios);
- (5) Young Arctic Leaders in Research and Policy.

Key questions driving the network include the following:

- What are the major changes and drivers within coastal social-ecological systems in the western Russian Arctic vis-à-vis other Barents and polar regions?
- What are the most important elements to measure or monitor to understand impacts and responses within coastal social-ecological systems and assess their resilience?

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<sup>7</sup> <http://www.polar-data-forum.org/>

<sup>8</sup> Original statement: <http://bit.ly/1Ow9TMF> [insert reference to AOS white paper when available]

- What experience is available in the Russian Arctic with respect to observations and community-based monitoring?
- What are viable avenues to connect data and knowledge with governance, particularly on the Russian Arctic coast?

## Next steps

We aim to facilitate face-to-face and virtual meetings among CACCON communities at neighbouring, regional, national, and pan-Arctic (network-wide) scales. A prime objective is the encouragement of peer-to-peer capacity transfer, exemplified by the Nain to Pond Inlet connection under *SmartICE*. Opportunities for such interaction will arise in conference side meetings, such as at the Arctic Observing Summit (AOS) in 2016, and future AOS, Arctic-COAST, ELOKA, CpiT, or other meetings.

More directly, through targeted network development, regular voice and video-link communications, a network web hub, and the establishment of local or regional working groups, we hope to promote the CACCON goals of co-designed and co-produced knowledge acquisition and sharing to support sustainable development practices in northern settlements. This includes the identification and plugging of critical knowledge gaps through collaborative research involving local and/or indigenous leads, community research champions and teams, and collaboration with external researchers and data sources such as satellite imagery, census data, circumpolar compilations, or other publicly available data.

As the Arctic regional engagement network for Future Earth Coasts, CACCON and partners will provide a platform for the exploration of community, institutional, or governance challenges for adaptation planning and decision-making. One objective would be to identify ‘bright spots’ (and perhaps ‘grey spots’ or even instructive ‘dark spots’), around which small working groups, largely composed of local knowledge-holders, can be organized to tease out the enablers and inhibitors of success. Understanding the strengths and weaknesses of innovation will be a major goal. A range of approaches may be applied as appropriate, from indicators to social/institutional/decisions mapping to narrative insights, with parallel co-produced documentation on the social and biophysical context and challenges in various locations or regions. A key goal is to work out and share solutions strategies that show promise in one or several locations and may be replicated, or further developed, in others.

The CACCON objectives and those of Future Earth Coasts, as noted earlier, call for collaborative engagement with northern residents and the many other players in the Arctic observing community. Working with knowledge-network partners ELOKA and Arctic-COAST, community-based observing networks such as the Alaska Arctic Observatory and Knowledge Hub (A-OK), the Bering Sea Sub-Network, or other key players such as the Inuit Circumpolar Council, Inuit Qaujisarvingat (Inuit Knowledge Centre), and the Coastal Expert Monitoring Group (Coastal Biodiversity Monitoring Program), CACCON promotes consensus and collaboration to reach common goals of local knowledge availability and accessibility for informed decision-making and improved well-being in northern coastal places.