

Integrated Climate Change Adaptation to Increase Resilience in Canadian Coastal Communities

Literature Review

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Prepared by:



In Association with:

Linda Mortsch, University of
Waterloo

and

Dr. Lawrence Hildebrand, World
Maritime University



Canada's Coast



Contact the Author:

Peter J. Zuzek, 905-719-8980, pzuzek@zuzekinc.com

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BACKGROUND

A literature review was completed for Natural Resources Canada to investigate the role and benefit of integrated climate change adaptation to increase the resilience of Canadian coastal communities. A keyword search of the scientific peer-reviewed literature, UN- and International NGO-published reports, and national and sub-national climate change adaptation assessments, was conducted to identify the most contemporary research findings, experiences and insights on climate change adaptation.

A standard template was used to summarize the relevance of each research project and initiative, including an online link, the geographic scope, an overview, and summary of key findings. The potential role of the research and lessons learned from the initiatives for advancing integrated climate change adaptation is also outlined.

The findings are also summarized in the full technical report that includes perspectives from practitioners across Canada, relevant case studies, and recommendations for advancing integrated coastal climate change adaptation for communities across the country.

The citation for the full report is:

Zuzek Inc., 2023a. Integrated Climate Change Adaptation to Increase Resilience in Canadian Coastal Communities. Prepared for Natural Resources Canada.

INTERNATIONAL GUIDANCE ON CLIMATE CHANGE ADAPTATION

TITLE: Olazabal, M., deGopegui, M.R., Tomkins, E.L., Venner, K. and Smith, R. 2019. A cross-scale worldwide analysis of coastal adaptation planning. Environ. Res. Lett. 14 124056.
Type of publication: peer-reviewed journal article
Link: https://iopscience.iop.org/article/10.1088/1748-9326/ab5532/pdf
Geographic scope: International
Overview: The Paris Agreement requires measurement of the progress made on adaptation. The authors outline the current state-of-the-art in public adaptation planning affecting 136 of the largest coastal port urban agglomerations, covering 68 countries. They identify 226 adaptation policies: 88 at national level, 57 at regional/state level and 81 at city/metropolitan level. This set of adaptation policies can be considered the latest, most up-to-date database of governmental and public-led adaptations.
Key findings: <ul style="list-style-type: none">• The analyses show that (1) in one half of cases, there is no evidence of policy implementation, (2) in almost 85% of cases, planned adaptation actions are not driven by present or future climatic impacts or risks, and (3) formal adaptation planning is relatively recent and is concentrated in more developed areas and countries.• They document government-led (top-down) adaptation initiatives across national, regional and local administrative scales relative to the 136 largest coastal port cities world-wide.• Overall, adaptation policy is distributed reasonably evenly across national (38.9% of all policies found), regional/state (25.2%) and city/metropolitan (35.8%) scales.• Seven main types of adaptation-related policies have been identified: climate adaptation policies, climate change policies including both mitigation and adaptation objectives, coastal management policies, coastal adaptation policies, disaster risk reduction policies and disaster and adaptation policies. The rest are sustainability, resilience and master plans.• Policies can be either strategic (40.3%) in nature with broadly defined objectives and proposed lines of action or more tangible (59.7%) if they define concrete measures and interventions. Local and regional/state adaptation-related policies tend to be more concrete (67.0% of the cases), while half (51.1%) of national policies are more strategic.• The majority of the policies (81%) define adaptation measures, as defined as both groundwork (measures to increase the level of knowledge) and actions (measures to initiate changes in policies, programmes, or the built environment).• Adaptation policies rarely (20.4%) use future socio-economic projections for their assessments and these are mostly limited to population projections only.• These results, for the first time, provide a global cross-scale baseline assessment of where government-led policy is happening, and where it is not, in coastal regions.
Path forward: <ul style="list-style-type: none">• Non-governmental institutions and actors undertake adaptation, and the importance of multilevel governance (including informal processes and networks) in delivering adaptation.

TITLE: OECD. 2021. Adapting to a Changing Climate in the Management of Coastal Zones: Policy Perspectives. OECD Environment Policy Paper No. 24. Paris.
Type of publication: International organization policy paper
Link: https://www.oecd-ilibrary.org/docserver/b21083c5-en.pdf?expires=1644946486&id=id&accname=guest&checksum=979F8C334A4D4EBD7F2A22065F846D19
Geographic scope: Global
Overview: This paper provides a comprehensive assessment of the recent and projected socio-economic development of coastal areas. It reviews the environmental pressures exerted by human activities on coastal areas, as well as the impacts of climate change that exacerbate existing challenges. The paper calls for a co-ordinated and well-adapted policy response to address these challenges.
<p>Key findings:</p> <ul style="list-style-type: none"> • This paper demonstrates that the interactions between intensive socio-economic development, their impact on coastal ecosystems and growing climate risks pose complex challenges. • To address such complexity, it is important to provide comprehensive policy responses that aim at strengthening the resilience of coastal zones to any detrimental impact. • This policy paper provides an overview of these issues with a view to understand how appropriate policies can be developed to address these complex challenges.
<p>Path forward:</p> <ul style="list-style-type: none"> • The challenge for coastal zone management strategies lies in integrating different policy responses, ranging from spatial and urban planning to disaster risk reduction, from ecosystem conservation to infrastructure planning, from climate adaptation to agriculture and resource management. • In this process, it is important to integrate and balance different policy objectives, accounting for their trade-offs and the synergies across them. • Hence, the co-ordination among different policy makers from different sectors and levels of government, as well as those of non-governmental stakeholders (such as private infrastructure operators), is key to strengthening coastal resilience. • Any coastal zone management strategy developed or updated today needs to consider the projected impacts of climate change and the measures that need to be taken to safeguard communities and economic development. • More work is then needed to understand whether climate resilience policies can be promoted as separate policies or whether they would benefit from further integration with ICZM strategies.

TITLE: Lesnikowski, A., Biesbroek, R. and L. Berrang-Ford. 2019. **A policy mixes approach to conceptualizing and measuring climate change adaptation policy.** Climatic Change, 156(4): 447-469.

Type of publication: peer-reviewed journal article

Link: <https://doi.org/10.1007/s10584-019-02533-3>

Geographic scope: Global

Overview: Comparative research on climate change adaptation policy struggles with robust conceptualization and measurement of adaptation policy. Using a policy mixes approach to address this challenge, the authors characterize adaptation policy based on a general model of how governments govern issues of societal interest. They argue that this approach allows for context-sensitive measurement of adaptation policy, while being both comparable and frugal. This approach is tested in a study of adaptation policies adopted by 125 local governments located in Canada, France, Germany, the Netherlands, and the UK. Using a systematic data collection protocol, a total of 3,328 adaptation policies were identified from local council archives between the periods of January 2010 and May 2017. Results of this analysis suggest that there is structured variation emerging in how local governments govern climate change adaptation, which justifies calls for comparative adaptation research to use measurements that capture the totality of adaptation policies being adopted by governments rather than focusing on specific types of adaptation policy. The authors conclude with a discussion of key issues for further developing of this approach.

Key findings:

- A desire to reduce vulnerability to climate change impacts and build adaptive capacity is encouraging a rapid increase of adaptation adoption by national and subnational governments.
- There is an understanding of public policies as the actions of public actors (generally governments) to address challenges of societal interest. Policy approaches to addressing boundary-spanning challenges like climate change adaptation can encompass a wide range of policy goals and policy instruments, which are defined as the various techniques available to governments to achieve their policy goals, such as regulations, market interventions, or behavioral nudges.
- Policy mixes are defined as combinations of policy goals and policy instruments that emerge over time around a specific policy issue.
- Adaptation policy goals tend to be highly qualitative and diffused across diverse policy sectors, which creates a challenge for systematic identification of policy goals.
- Current research suggests that large urban areas are more likely to be engaged in adaptation policy design, and that the countries identified are among the forerunners on taking adaptation action.

Path forward:

- The dimension of governing logic specifies two distinct approaches that governments can take to implement policy: direct provision of services (substantive policy instruments), or indirect efforts to change the beliefs and behavior of actors (procedural policy instruments).
- The authors propose that the concept of policy mixes offers a promising path forward in addressing the pernicious challenge of how to conceptualize and measure adaptation, and has particular potential for improving the robustness of comparative adaptation research.

TITLE: UNFCCC. 2021. Glasgow Climate Pact. Decision -/CP.26
Type of publication: International agreement
Link: https://unfccc.int/sites/default/files/resource/cop26_auv_2f_cover_decision.pdf
Geographic scope: Global
Overview: The Glasgow Climate Pact is an agreement reached at the United Nations Climate Change conference in 2021.
<p>Key findings:</p> <ul style="list-style-type: none"> • Nations adopted the Glasgow Climate Pact, aiming to turn the 2020s into a decade of climate action and support. • The package of decisions consists of a range of agreed items, including strengthened efforts to build resilience to climate change, to curb greenhouse gas emissions and to provide the necessary finance for both. • Nations reaffirmed their duty to fulfill the pledge of providing 100 billion dollars annually from developed to developing countries. • And they collectively agreed to work to reduce the gap between existing emission reduction plans and what is required to reduce emissions, so that the rise in the global average temperature can be limited to 1.5 degrees C. • For the first time, nations are called upon to phase down unabated coal power and inefficient subsidies for fossil fuels.
<p>Path forward:</p> <ul style="list-style-type: none"> • Acknowledging that climate change is a common concern of humankind, Parties should, when taking action to address climate change, respect, promote and consider their respective obligations on human rights, the right to health, the rights of indigenous peoples, local communities, migrants, children, persons with disabilities and people in vulnerable situations and the right to development, as well as gender equality, empowerment of women and intergenerational equity. • The Pact recognizes the important role of indigenous peoples, local communities and civil society, including youth and children, in addressing and responding to climate change, and highlighting the urgent need for multilevel and cooperative action. • The PACT urges Parties to further integrate adaptation into local, national and regional planning.

<p>TITLE: Warren R.F, Wilby R.L, Brown K, Watkiss P, Betts RA, Murphy JM. and Lowe JA. 2018. Advancing national climate change risk assessment to deliver national adaptation plans. Phil. Trans. R. Soc. A 376: 20170295.</p>
<p>Type of publication: peer-reviewed journal article</p>
<p>Link: http://dx.doi.org/10.1098/rsta.2017.0295</p>
<p>Geographic scope: United Kingdom</p>
<p>Overview: This paper describes the novel approach to vulnerability and risk assessment which was designed and put into practice in the United Kingdom’s 2nd Climate Change Risk Assessment (CCRA2). The UK was one of the first countries to advance a national assessment of climate change risks.</p> <p>Future vulnerability is a function of exposure to climatic hazards, sensitivity and adaptive capacity, and hence a risk assessment must consider the future socioeconomic development pathway alongside the expected climatic change.</p>
<p>Key findings:</p> <ul style="list-style-type: none"> • A wide range of climate vulnerability and risk assessments have been implemented using different approaches at different scales, some with a broad multi-sectoral scope and others focused on single risks or sectors. • Novel elements of the approach include assessment of both present day and future vulnerability, a focus on the urgency of adaptation action, and a structure focused around systems of receptors rather than conventional sectors. • Both stakeholders and reviewers generally regarded the approach as successful in providing advice on current risks and future opportunities to the UK from climate change, and the fulfilment of statutory duty.
<p>Path forward:</p> <ul style="list-style-type: none"> • The need for a well-supported and open suite of impact indicators going forward is highlighted. • A series of governance recommendations were also made. Perhaps most important of these was that the UK Government should take steps to improve the wider enabling environment for regular climate risk assessment in the UK, notably with measures for: <ul style="list-style-type: none"> ○ strengthening institutional memory and governance; ○ sustaining long-term monitoring and reporting systems; ○ promoting freedom of access to data and analytical tools; ○ growing technical capacities in public and private sectors; ○ allocating resources for strategic research programmes and bridging organizations; ○ disseminating findings and advice at all levels of governance; and ○ piloting different adaptation measures. • It also developed a typology of three early adaptation interventions that were the priority for NAP and which review teams should identify: <ul style="list-style-type: none"> ○ To address existing adaptation deficit in the UK by implementing ‘low-regret’ actions to reduce risks associated with current climate variability. ○ To intervene early to ensure that adaptation is considered in decisions that have long lifetimes, such as major infrastructure developments or land-use change, in order to avoid ‘lock-in’. ○ To fast-track early adaptation steps for decisions that have long lead times and to initiate early activities that provide information to improve adaptation decisions in the future (e.g. by enabling research, monitoring and piloting to enhance learning). These three types of intervention are complementary.

TITLE: Biesbroek, R. and Delaney, A. 2020. Mapping the evidence of climate change adaptation policy instruments in Europe. Environ. Res. Lett. 15 (2020) 083005
Type of publication: peer-reviewed journal article
Link: https://iopscience.iop.org/article/10.1088/1748-9326/ab8fd1/pdf
Geographic scope: Europe
Overview: This article maps academic scholarship on climate change adaptation policy instruments in Europe.
<p>Key findings:</p> <ul style="list-style-type: none"> • IPCC (2018) highlights that adapting to climate change impacts generally refers to the process of increasing resilience, reducing vulnerability, enhancing adaptive capacity, and in some cases, to take advantage of possible opportunities climate change offers. • For the purpose of this study, the authors define adaptation policy instruments as those tools at the disposal of government that are intentionally designed to deal with the projected, long-term impacts of climate change. • Examples of policy instruments include policies, regulations, laws, subsidies, educational programs, and coordinative bodies. • This study mapped the scientific articles that analyse climate change adaptation policy instruments across Europe. The study identifies a number of critical knowledge gaps.
<p>Path forward:</p> <ul style="list-style-type: none"> • Recent literature is signalling a shift from policy instruments related to predominantly groundwork, to increasing policy efforts to mainstream and mandate climate change adaptation actions through authoritative instruments.

TITLE: American Society of Adaptation Professionals. 2022. Statement of Support for National Climate Adaptation and Resilience Strategy Act from American Society of Adaptation Professionals.
Type of publication: Statement of Support
Link: https://adaptationprofessionals.org/statement-of-support-for-national-climate-adaptation-and-resilience-strategy-act-from-american-society-of-adaptation-professionals/
Geographic scope: United States
Overview: Members of the American Society of Adaptation Professionals (ASAP) applauded the introduction of the U.S. National Climate Adaptation and Resilience Strategy Act (NCARS). They see this is a highly functional piece of legislation that would end the ad hoc nature of climate adaptation planning at the national level and form a dependable and consistent basis for the U.S. to build a more resilient country. If Congress enacts this legislation, the U.S. will move from relying on a series of individual agency activities authorized through executive action alone to a stable, long-term, coherent national strategy to ensure climate change preparedness.
<p>Key findings:</p> <ul style="list-style-type: none"> • NCARS is particularly promising because: 1) it builds on existing national and sub-national adaptation and resilience efforts and 2) the legislation itself is adaptive. • NCARS recognizes that adaptation practitioners and frontline communities across the country have been planning and implementing adaptation for a long time. • The bill's requirement is to develop not only a national adaptation strategy but also an implementation plan and monitoring and evaluation mechanisms. • There are mechanisms to ensure that justice and equity remain at the center of national action under this legislation. This includes, first and foremost, centering the needs and experiences of underserved frontline communities. It also requires using the plans and recommendations that the bill mandates to critically assess policy and programmatic adjustments needed to improve the equitability and efficacy of the agency's services and resources for climate adaptation and resilience.
<p>Path forward:</p> <ul style="list-style-type: none"> • Follow the development and enactment of this bill to derive lessons for the Canadian approach and experience.

GUIDANCE FOR MUNICIPALITIES

<u>TITLE:</u> David Suzuki Foundation. 2021. Managing Natural Assets to Increase Coastal Resilience: Guidance Document for Municipalities.
Type of publication: NGO-developed Guidance Document
Link: https://davidsuzuki.org/wp-content/uploads/2021/12/Coastal-Assets-Guidance-Document-2021.pdf
Geographic scope: Canada-wide, focused at municipal level.
Overview: A growing number of Canadian local governments are now recognizing that it is as important to understand, measure, manage and account for natural assets as it is for hard/grey ones. Many municipalities are developing an asset management strategy to better manage their infrastructure. A logical extension of the asset management approach is the inclusion of “natural capital,” (such as wetlands, rivers, and coastal dunes/beaches) which provide many critical services to communities and complement the forward-thinking solutions of asset management plans. The objective of the <i>Managing Natural Assets to Increase Coastal Resilience Project</i> (Coastal Resilience Project) was to help participating local governments identify, prioritize, value, and manage key coastal natural assets as part of core local government asset management systems.
Key findings: <ul style="list-style-type: none">• As local governments in Canada recover from two decades of declining public infrastructure investments, they remain painfully aware of the ever-increasing costs of delaying repairs, rehabilitation and replacements. This is exacerbated by an increase in extreme weather events that demands adaptable and resilient solutions to deliver services while containing costs.• However, while natural assets are key to sustainable service delivery, they are generally not accounted for and/or are undervalued in asset management practices.• Until recently, most local governments lacked policies and tools to quantify the benefits supplied by natural infrastructure assets and to incorporate these benefits into their policy, asset management and financial frameworks. This has contributed to a global disappearance of these ecosystems and an associated loss of ecosystem services.• The Municipal Natural Asset Initiative (MNAI) is a not-for-profit organization whose mission is to make natural asset management a mainstream practice across Canada.• The goal is to begin adoption of natural asset management. The methodology generally follows the assess, plan and implement steps.• As more research is directed toward the concept of natural infrastructure, it is becoming clear that coastal ecosystems can provide substantial protection from flooding and erosion, often at less cost and with greater long-term resilience compared to traditional grey infrastructure.
Path forward: <ul style="list-style-type: none">• Over the next century, without adaptation, the vast majority of low-lying coasts and communities face substantial risk from these coastal hazards.• MNAI created a simulation model called the Coastal Toolbox (CT) that, used within the MNAI natural asset management methodology, can help municipalities identify their relevant natural assets, understand the value of those natural assets and use that information in municipal planning and management decisions.• The Coastal Toolbox is a GIS-based simulation and analytical tool designed to help local governments identify, prioritize, and manage key coastal natural assets as part of their day-to-day asset management practices.

- The toolbox is intended for preliminary evaluations of coastal storms, beach erosion, offshore wave propagation, flooding and structural damage with a special emphasis on Canadian shorelines.
- Natural asset management strategies require a multidisciplinary, team-based approach. A coastal natural asset team should include representatives from all levels of government that have jurisdictional overlap with any proposed asset management activities. Including technical experts on the team such as local planners, coastal engineers, Indigenous representatives, ecologists and GIS specialists will help to ensure the right information and coastal system dynamics are being incorporated into the model and will aid in interpretation of results.
- Example applications of the MNAI Coastal Toolbox can provide municipalities with practical guidance.

TITLE: Federation of Canadian Municipalities. 2022. Guide for Municipal Climate Change Staff. Ottawa.
Type of publication: Guidance document
Link: https://data.fcm.ca/documents/programs/MCIP/guide-municipal-climate-change-staff.pdf
Geographic scope: Canada-wide
Overview: There is a long history of climate action at the municipal order in Canada. These local governments emerged as early climate leaders and have been a strong and united voice in national and international climate change discussions for decades. Building on this strong foundation, the Federation of Canadian Municipalities’ <i>Municipalities for Climate Innovation Program</i> published this guide with straightforward guidance and practical information, particularly for new municipal employees mandated with responsibilities for climate change planning and management.
<p>Key findings:</p> <ul style="list-style-type: none"> • This guide provides practical information to help climate change staff “hit the ground running” and work effectively and efficiently. It outlines some of the basics of municipal governance, including the people with whom they want to connect and the information they’ll need to gather. • It also zeros in on common topics and gives a heads-up on some of the challenges they’re likely to face, how to deal with them and how to take advantage of new opportunities. • While progress has been made, often other pressures and priorities make it challenging to allocate sufficient resources to climate action. The ideal is to embed a climate lens into decision making at all levels.
<p>Path forward:</p> <ul style="list-style-type: none"> • Support municipal climate change staff, particularly when they are first getting started, with a clear mandate, help in understanding the decision-making processes in their municipality, mentorship, and senior support in delivering key messages and building coalitions of support. • In Vancouver, British Columbia for example, the city’s deputy manager assigned goals from each area of the Green City Plan to a specific manager who was accountable for achieving them. All managers sat on the steering committee, with staff carrying out tasks to reach the targets. Prior to that, responsibility for climate action had seen lower-level staff members going to senior managers to try to get support for initiatives.

TITLE: HalifACT 2050: Acting on Climate Together
Type of publication: municipal climate change action plan
Link: https://cdn.halifax.ca/sites/default/files/documents/about-the-city/energy-environment/HRM_HaliFACT_vNew%20Logo_.pdf
Geographic scope: Halifax Regional Municipality, Nova Scotia
Overview: In June, 2020, Halifax Regional Council unanimously adopted HalifACT 2050, a community response to the climate crisis and a plan for a healthy and resilient future. It emphasizes that climate change is a serious threat to the community and highlights the urgent need for action in response to the existing and predicted future threats of climate change. It is (self-)declared as one of the most ambitious climate action movements in Canada.
<p>Key findings:</p> <ul style="list-style-type: none"> • Halifax’s coast (400 km), waterfront and shoreline areas are at increased risk of climate impacts; specifically, increasing risk of damage to coastal infrastructure, property, and natural areas and assets from inundation, saltwater intrusion, and coastal erosion due to sea level rise, storm surge and extreme events. • As vulnerabilities can vary from community to community and HRM is geographically a large area, consisting of rural, suburban and urban communities, adaptation plans need to be developed at a local or neighbourhood scale. • HalifACT 2050 is the Atlantic region’s first comprehensive climate action plan addressing both mitigation and adaptation, and its success will depend on collective efforts. • The creation and implementation of HalifACT 2050 is guided by a set of common principles of climate action planning. Those most relevant to coastal climate change adaptation include: <ul style="list-style-type: none"> ○ Leadership: Climate action planning requires changes to established frameworks and practices, and these in turn are most likely to succeed when they are inspired by an understanding of how they will benefit the community and are encouraged and supported by both the leadership of elected officials and senior managers in the municipality. ○ Alignment: Climate change targets and actions are more likely to succeed where they align with community goals, aspirations and policies for public health, fiscal efficiency, self-reliance, economic prosperity, resilience, inclusiveness, full employment and community planning and development. ○ Implementation: Climate literacy for municipal leadership and staff, and community stakeholder relations are mutually empowering. ○ Innovation: requires a willingness to take risks, to fail, and to learn. ○ Accountability: Transparency is key and includes following an open decision-making process, and setting goals that can be measured, reported, independently verified, and evaluated. • The Province of Nova Scotia recently enacted a new piece of legislation, the Coastal Protection Act, which will further protect coastal properties; regulations are in development. The Municipality has procured a new Digital Elevation Model to allow for detailed flood risk modelling and land use vulnerability assessments.
<p>Path forward:</p> <ul style="list-style-type: none"> • New and revised policies, regulations, standards and codes are needed to reach HRM’s targets. • New funding mechanisms are needed to enable the required investments. • Government leadership will include convening partners, developing policies, leveraging government assets and supporting research.

- Investment in data collection and research will support an understanding of the current situation, risks, hazards and opportunities and will support future evaluation.
- The success of HalifACT 2050 is tied to community action and stakeholder participation.
- Coastal preparedness actions include conducting a detailed spatially-based risk and vulnerability analysis of HRM's coastal, waterfront and shoreline area, and developing a coastal-specific adaptation strategy with coastal communities.
- HRM will mobilize its resources to support the implementation of the actions in HalifACT 2050, allocating responsibilities across the organization, and in many cases coordinating with partner organizations and other levels of government.
- In the next five years, Halifax will focus on seven priority actions. Those directly relevant to coastal climate change adaptation include conducting risk and vulnerability assessments and enhancing capacity building.
- The Municipality will review and update flood models, land use bylaw regulations and consider the implications of the N.S. Coastal Protection Act and any associated regulations and policies that are passed.
- HalifACT 2050 is intended to be a living document that will continue to be updated and supported with supplementary costing and technical plans during implementation out to 2050.

<p>TITLE: Birchall, S.J., MacDonald, M. and N.N. Baran. 2022. An assessment of systems, agents, and institutions in building community resilience to climate change: A case study of Charlottetown, Canada. Urban Climate, Vol. 41.</p>
<p>Type of publication: peer-reviewed journal</p>
<p>Link: https://www.sciencedirect.com/science/article/pii/S2212095521002923</p>
<p>Geographic scope: Municipal, PEI</p>
<p>Overview: This qualitative study, based in Charlottetown, PEI, examined adaptation planning where sea level is rising, and storm surge and precipitation are becoming more severe. It utilized the framework of resilience theory to examine the relationship between systems, agents, and institutions in addressing climate vulnerability to build community resilience. This study highlights the importance of robust local government agents and institutions as a prerequisite to enable local-scale climate adaptation.</p>
<p>Key findings:</p> <ul style="list-style-type: none"> • Municipal-scale action is a prerequisite to robust climate adaptation planning. • Municipal agents play a critical role in responding to ongoing climate change stressors such as sea level rise. • Reactionary plans and bylaws hinder the ability of municipal agents to implement proactive climate adaptation. • While scholars have noted that climate adaptation action is beginning to manifest in municipal strategy, it can often be reactive, with action occurring only after a community has experienced an extreme event. Such measures often correspond with disaster response efforts, and do not take into account the persistent, unpredictable, and evolving nature of climate change. • Findings suggest that while non-municipal agents such as senior orders of government and external organizations are championing proactive adaptation through climate impact research and adaptation initiatives, the municipality has taken a non-urgent, reactionary approach in the face of climate stressors, often implementing initiatives that further exacerbate climate vulnerability. • Flexibility must be built into the strategy to allow for changes as new information becomes available and impacts change. • Planning for climate change adaptation at the local level can become ineffective, reactionary, or entirely absent due to a combination of factors. Conventional social and economic norms, expressed through policy or informal practice, can limit opportunities for action and influence how climate change adaptation is approached • Underpinning the sluggish response to climate adaptation is a lack of urgency to climate risks and vulnerabilities • local adaptation is often restricted by a lack of cross-sectoral communication and cooperation
<p>Path forward:</p> <ul style="list-style-type: none"> • Collaboration between governments and external organizations is needed to ensure efficient use of resources and expertise. • To build urban resilience to climate stressors, institutions must enable synchronized responses to system vulnerabilities, obtain and apply scientific knowledge in decision-making, and promote the flow of information among the community. • In order for local adaptation action to be successful, agents and institutions need to facilitate vertical and horizontal collaboration across different sectors and levels of government • An integrative approach that combines scientific knowledge with community buy-in is also required to craft a robust adaptation plan.

- Based on the direction of this strategy, components of the plan should be incorporated into other municipal planning processes to become imbedded within day-to-day thinking.
- Successful adaptation must therefore be an ongoing, iterative process that addresses immediate threats and prepares for long-term changes.
- Scholarship recognizes the importance of commencing adaptation planning with a narrow, yet specific adaptation plan, which is then followed by the gradual implementation of adaptation components throughout the municipal planning framework.
- Recommend that municipalities start with an adaptation plan that is narrow in focus to a prominent climate-related natural hazard, setting the stage to action specific strategies to reduce risk and vulnerability. An effective municipal adaptation strategy can pave the way for the mainstreaming of adaptation into other planning processes.
- Propose a three-step framework for adaptation planning that can be applied to build resilience in Charlottetown (and other municipalities): (1) develop a knowledge base that presents multiple future outcomes; (2) formulate flexible adaptation policies to respond to climate-induced vulnerability; and (3) create a program for implementation and progress monitoring.

TITLE: O’Mahone, C., Gray, S., Gault, J, and Cummins, V. 2020. ICZM as a framework for climate change adaptation action–Experience from Cork Harbour, Ireland. Marine Policy, 111.
Type of publication: peer-reviewed journal
Link: https://research.fit.edu/media/site-specific/researchfitedu/coast-climate-adaptation-library/europe/united-kingdom-amp-ireland/O'Mahony-et-al.--2015.--ICZM-as-a-framework-for-cc-adaptation-action-Experience-from-Corck-Harbour-Ireland.pdf
Geographic scope: Cork, Ireland
Overview: National level policy for climate adaptation is reviewed with a local ICZM initiative in Cork Harbour, Ireland with a focus on process, principles and people. Lessons learned and critical contributions are identified that can inform endeavours in similar coastal environments, and ensure that ICZM is optimised to support the implementation of climate adaptation and resilience enhancement. A local-scale ICZM effort was examined to ascertain if it could meet and/or support the implementation requirements of nascent national policy on climate adaptation through action at the local-level.
<p>Key findings:</p> <ul style="list-style-type: none"> • Evidence suggests that despite being implemented through different institutional and policy frameworks, the local partnership-based ICZM model can provide enabling mechanisms, facilitate capacity building and harness knowledge exchange and learning to support the local scale implementation of national climate policy. • In addition to an overlapping of issues, climate adaptation and coastal management can: involve the participation of similar constituents; rely upon analogous processes as part of the approaches and methods used; and work to similar principles. • Typical aspects of ICZM such as joined-up approaches to governance, impact assessment and data management, and implementation through spatial planning suggests a number of benefits can accrue with regard to climate adaptation. • The objectives of many ICZM efforts in Ireland resonate with the stated aims and intended actions of Ireland's climate policy, e.g. “...adopting [an] open, transparent, and inclusive approach to sectoral adaptation planning” and to “...consult and encourage partnership with stakeholders when addressing adaptation matters at a local level”. • Climate adaptation can perhaps be considered synonymous with ICZM with regard to making a transition from a primarily theoretical focus towards a comprehensive body of good practice emerging from shared experiences of actions undertaken. • The academic literature reflects a clear disjuncture in developed nations between the formulation of high-level climate policy and effective, ‘on-the-ground’ adaptation, prompting “concerns about the likelihood of effective adaptation given the speed of climate change and limited window of opportunity for action” • Identifying how certain stakeholders or groups will be impacted by climate change, and to what extent they can contribute to a collaborative response is a critical undertaking in the climate adaptation process. • A further aspect of the ICZM process in Cork Harbour that benefitted the subsequent adaptation exercise was a prior stock take of the datasets pertaining to the harbour, many of which are held by different organisations and not all publicly available, and are directly applicable to improving the knowledge base for climate adaptation planning. • Partnership is an established component of ICZM and integrated approaches to coastal and marine planning and is seen to provide for greater legitimacy and transparency in decision-making, delivery of plans of action through consensus and fuller agreement, and increased buy-in from all parties engaged with a particular management or planning issue.

- ICZM, like climate adaptation, is a cross-cutting thematic area which has implications for many sectors and will require many sectors to act in different ways but in a co-ordinated fashion to ensure interventions achieve the desired societal outcomes. Similarly, both ICZM and climate adaptation have many direct and indirect policy linkages.

Path forward:

- With sustainability underpinning ICZM, initiatives that represent sound coastal management practice should therefore be expected to implement climate change adaptation.
- Explore the mutual benefits of the relationship between coastal management and climate adaptation, and putting the lessons to emerge into practice.
- The value of ICZM good practice can be transferred to climate adaptation, an appropriate approach that entails examination of both concepts to see where synergies exist.
- There is now a clear imperative to advance climate adaptation action and to support such endeavours through existing processes, such as ICZM, and exploit such opportunities where they arise.
- Shared elements such as an iterative nature, potential for common constituents, mutual principles, and an under-lying agenda of sustainability make a clear case for considering the potential for synergy between adaptation to climate change and ICZM.
- The argument put forward here is not that ICZM is considered essential to the implementation of climate adaptation in coastal settings, but it does provide added value in terms of mobilising stakeholders to engage with climate issues and contributes to an improved knowledge base (across sectors and levels of governance) to facilitate implementation of climate adaptation.

INTEGRATED COASTAL ZONE MANAGEMENT, DISASTER RISK REDUCTION & CLIMATE CHANGE ADAPTATION

<p>TITLE: Tobey, J., Rubinoff, P., Robadue Jr., D., Ricci, G., Volk, R., Furlow, J., and Anderson, G. 2010. <i>Practicing Coastal Adaptation to Climate Change: Lessons from Integrated Coastal Management</i>. Vol. 2, Issue 4. USAID.</p>
<p>Type of publication: USAID discussion document</p>
<p>Link: https://www.researchgate.net/publication/238399173_Practicing_Coastal_Adaptation_to_Climate_Change_Lessons_from_Integrated_Coastal_Management</p>
<p>Geographic scope: United States</p>
<p>Overview: This article focuses on ‘planned adaptation’ to the societal impacts and lessons and good practices from global experience in integrated coastal management (ICM) that can be transferred to climate change adaptation. These findings are based on the 2009 United States Agency for International Development (USAID) Guidebook on Adapting to Coastal Climate Change. It offers an approach for assessing vulnerability to climate change and climate variability in communities and outlines how to develop and implement adaptation measures at the local and national levels. The Guidebook features six best practices for coastal adaptation.</p>
<p>Key findings:</p> <ul style="list-style-type: none"> • The USAID Guidebook on Adapting to Coastal Climate Change lists 17 adaptation measures. • Adaptation is described as an inclusive, participatory, and on-going process. Coastal adaptation needs to be practiced as an inclusive, strategic and adaptive process for assessment of climate change risks, planning, securing commitment and funding, implementation, and evaluation. • A broad range of stakeholders should be engaged in the process to ensure salience and ownership of adaptation interventions, and therefore more effective implementation and sustainability. Political support is essential for successful coastal adaptation. • A fundamental tenet underlying the ICM approach is that decision-making should be based on the use of the best available information and science. It is the very complexity and uncertainty of the impacts of climate change that drive the need for this information in planning and decision-making. • Another good practice and fundamental feature of ICM programs is to strategically select a limited number of management issues with attention to the nature of the problem, and dimensions of capacity and complexity. This entails defining early on the goals and objectives of the management initiative. • Coastal adaptation efforts need to choose an initial focus on a limited set of key climate threats and adaptation issues that capture the interest, imagination and commitment of local residents and the government departments most directly involved. • In some cases, introducing a climate change lens may help galvanize the consensus building process by reinforcing the message that “the future will be different than the past” and that intentional, effective action is necessary to attain goals in light of these changing circumstances.
<p>Path forward:</p> <ul style="list-style-type: none"> • Coastal adaptations should be “tailored” to the local context through an inclusive process that matches the climate change issues with the technical capabilities and the capacity of the institutions and community stakeholders of the place.

<ul style="list-style-type: none"> In the climate change field, this kind of coordination is called ‘mainstreaming’, which refers to the integration of climate concerns and adaptation responses into relevant policies, plans, programs and projects at the national, sub-national, and local scales.
<p>TITLE: Lo, V. 2016. Synthesis report on experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction. Technical Series No.85. Secretariat of the Convention on Biological Diversity, Montreal, 106 pages.</p>
<p>Type of publication: United Nations report</p>
<p>Link: https://www.academia.edu/35466851/Synthesis_report_on_experiences_with_ecosystem_based_approaches_to_climate_change_adaptation_and_disaster_risk_reduction?email_work_card=view-paper</p>
<p>Geographic scope: Global</p>
<p>Overview: the Paris Agreement establishes a global goal to significantly strengthen national adaptation efforts, enhance adaptive capacity, strengthen resilience and reduce vulnerability to climate change. This report is a review and synthesis of global experiences on ecosystem-based approaches to climate change adaptation (EbA) and to disaster risk reduction (Eco-DRR). EbA and Eco-DRR enable people to adapt to the impacts of climate change and disasters by using opportunities created by sustainably managing, conserving, and restoring ecosystems to provide ecosystem goods and services. Many countries have prioritized the establishment or strengthening of collaboration between ministries and government agencies responsible for biodiversity and climate change as an important component of enhanced implementation. EbA and Eco-DRR have been demonstrated in some cases to be cost-effective, low-regrets approaches to adaptation and disaster risk reduction.</p>
<p>Key findings:</p> <ul style="list-style-type: none"> Biodiversity and ecosystem services have been recognized as an integral part of climate change adaptation and disaster risk reduction strategies as they can deliver benefits that increase people’s resilience to the impacts of climate change. This report was prepared to provide a synthesis of experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction, and an analysis of challenges, lessons learned and opportunities related to their design and implementation. Institutional arrangements and structures to enhance coordination across sectors are critical. EbA and Eco-DRR are cross-sectoral and therefore can be best led by a government body that has coordinating powers over sectoral ministries. There has been growing recognition that approaches to adaptation that utilize healthy or functional ecosystems can contribute to climate change mitigation and adaptation.
<p>Path forward:</p> <ul style="list-style-type: none"> EbA and Eco-DRR further aim to maintain and increase resilience and reduce vulnerability of ecosystems and people to adverse effects of climate change, and should therefore be integrated into broader adaptation and development strategies. Mainstreaming of EbA and Eco-DRR is most effective when top-down and bottom-up approaches converge. It is important to engage indigenous peoples and local communities as well as practitioners in policymaking processes, and ensure that knowledge, lessons and experience feed into policymaking processes.

NATURE-BASED COASTAL ADAPTATION

<p>TITLE: van Proosdij, D, Manuel, P., Sherren, K., Rapaport, E, McFadden, C., Rahman, T. and Reeves, Y. 2021. Making room for movement: A framework for implementing nature-based coastal adaptation strategies in Nova Scotia. TransCoastal Adaptations Centre for Nature-based Solutions, Saint Mary’s University. Prepared for Natural Resources Canada.</p>
<p>Type of publication: university publication</p>
<p>Link: https://static1.squarespace.com/static/5c83d5c63560c33561cc74de/t/61af943a0624555b127356c0/1638896708462/MakingRoomforMovement_Framework.pdf</p>
<p>Geographic scope: Provincial, Nova Scotia</p>
<p>Overview: Coastal ecosystems in Nova Scotia are threatened by coastal squeeze. Modern coastal development has intensified in the province through decisions that are either uninformed about or have ignored the inherent risks of coastal locations. An alternative to managing the coastal impacts of climate change is <i>Making Room for Movement</i>, the concept of allowing space for dynamic coastal systems to sustain themselves through a variety of methods including policy and legislation or soft or hybrid shore protection. This document presents a framework for Making Room for Movement as an alternative to hard coastal engineering for climate change adaptation in Nova Scotia. This report was prepared to provide a synthesis of experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction, and an analysis of challenges, lessons learned and opportunities related to their design and implementation.</p>
<p>Key findings:</p> <ul style="list-style-type: none">• Climate change is driving the need to reimagine a new relationship with this landscape – one where healthy coastal environments protect against the impacts of climate change and where development respects dynamic coastal processes.• Allowing for dynamic shoreline movement is an internationally recognized best management strategy to increase the resilience of coastal systems and enhance their protective function.• The research team developed case studies of NbCA in different coastal contexts around the province, covering wetland restoration, dyke realignment, living shorelines, dune stabilization, and letting nature take its course.• These studies of small and large initiatives demonstrate partnerships and engagement, a willingness to experiment with new techniques and lead by example, and decisions that acknowledge the long-term costs of trying to immobilize a dynamic coast.• The Making Room for Movement framework supports decision-makers and coastal practitioners in selecting NbCA options, over hard engineering solutions, as the first or preferred response to coastal impacts of climate change.• This evidence-based framework is not a step-by-step guide to designing and implementing NbCA projects; rather, it provides guidance for better aligning planning and decision-making regarding coastal development and resource use with natural systems and processes.• This report focuses specifically on NbCA, which involves reimagining the human relationship with the natural environment and keeping and restoring natural coastal environments to make room for coastal processes and ecosystem development and migration.• The framework is organized into four sections: Setting the Stage-the spectrum of soft to hard shoreline protection approaches; Guiding Principles (7) for implementing NbCA; the ‘Five R’s- Reimagine, Reserve, Relocate, Realign, and Reinforce and protecting and restoring coastal processes and habitats, and adjusting land uses and behaviours where necessary for the long-term

benefits to society of healthy coastal ecosystems and a shoreline that can better adapt to climate change impacts.

Path forward:

- Although developed in the Nova Scotia context, the framework can be adapted for other coastal jurisdictions, particularly in Atlantic Canada.

<p>TITLE: Eyquem, J. L. 2021. Rising Tides and Shifting Sands: Combining Natural and Grey Infrastructure to Protect Canada’s Coastal Communities. Intact Centre on Climate Adaptation, University of Waterloo.</p>
<p>Type of publication: research report</p>
<p>Link: https://www.intactcentreclimateadaptation.ca/wp-content/uploads/2021/12/UoW_ICCA_2021_12_Coastal_Protection_Grey_NbS.pdf</p>
<p>Geographic scope: Canada, East and West coasts</p>
<p>Overview: This report describes how Canada can scale-up the use of nature-based solutions, in tandem with grey infrastructure, to protect communities along the East and West coastlines. Importantly, action must consider natural processes along the coast to a greater extent than has occurred to date. Reduction of flooding and erosion at one site, if not carefully designed, can cause instability further along the coast and degradation of coastal ecosystems on which communities depend. Canada does not yet have a strategic planning framework or standard classification of approaches for coastal risk management.</p>
<p>Key findings:</p> <ul style="list-style-type: none"> • Nature-based solutions, in particular, have a vital role to play in managing coastal flood and erosion risk in Canada. • International experience and guidance demonstrate that these measures not only provide protection against coastal flooding and erosion, they also deliver multiple benefits, including improved biodiversity, carbon sequestration and storage, enhanced wellbeing and opportunities for recreational activities. • Perhaps the greatest challenge in Canada, and globally, in preparing for climate change and sea level rise along the coast, is a limited sense of urgency to act. • Decision makers in Canada must realize, sooner rather than later, that the sea level of the past will not be the sea level of the future, and prepare coastal communities accordingly. • In 2019, coastal communities were identified as one of the top six areas of climate risk facing Canada. • Action is urgently required to manage the growing risks to coastal communities, while working with natural processes along the coast. • This report outlines the range of practical measures that can be used to protect coastal communities on Canada’s East and West coasts from flooding and erosion. • It is designed to inform stakeholders in Canada involved in funding, design, implementation, management and insurance of coastal protection measures and their communities. • According to the IPCC’s “Special Report on the Ocean and Cryosphere in a Changing Climate”, adaptation responses to coastal risks have been implemented globally mainly in response to existing coastal risk or experienced disasters. • Ecosystem-based adaptation is continuing to gain traction worldwide, providing multiple co-benefits, but there is still low agreement on its cost and long-term effectiveness. • A “Protect, Accommodate, Retreat and Avoid” (PARA) framework has been proposed for the Canadian context. This classification reflects four of the six types of coastal management responses identified by the IPCC in 2019. The IPCC also identified ecosystem-based measures as an emerging approach in coastal management. However, nature-based solutions can play a role in both coastal protection and retreat. • Importantly, nature-based solutions deliver a suite of environmental and other societal co-benefits alongside improved flood and erosion management. These measures may also be referred to as approaches based on “natural infrastructure” or “natural assets”.

Path forward:

- Two common themes are increasing recognition of the need for coastal protection measures to work with natural processes and the selection of measures that deliver multiple benefits while protecting communities from coastal flooding and erosion.

Three courses of action are recommended to scale-up the use of nature-based solutions for coastal protection in Canada:

- Develop national standards to support consistent evaluation of the benefits of nature-based solutions when comparing infrastructure options, including for coastal protection. This should include minimum requirements, regional-specific standards, engagement with Indigenous people and recommended methodologies for reflecting the financial value of benefits provided by nature-based solutions.
- Develop national monitoring standards for coastal protection measures, focused on nature-based solutions. This should include consideration of minimum monitoring requirements, as well as how monitoring should be tailored to document performance against project-specific objectives. Funding for long-term monitoring and engagement with Indigenous people could be considered as minimum monitoring requirements.
- Build capacity to finance and deliver nature-based solutions by engaging the private sector. Public-private partnerships can potentially assist in financing, delivering, monitoring, and maintaining nature-based solutions. The insurance industry can also assist in managing construction risks and offering innovative insurance products that provide funds to restore natural features protecting the coastline, should they be damaged during extreme events.
- A functional systems-based approach to coastal management must be adopted to avoid undesirable impacts elsewhere within the system.