

Understanding the determinants of effective policy instruments: Case studies of climate change adaptation in Québec, Atlantic Canada and Massachusetts

Final project report



Observatoire Québécois de l'adaptation aux changements climatiques (OQACC),
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Principal Investigator: Pierre Valois

Coordination of report: Nathalie Beaulieu

Contributors:

- Emanuel Nicolescu, CBCL Limited, co-developed the case study in Nova Scotia and participated in developing the case study in New Brunswick
- Patricio Belloy, David Sulewski and Stacy VanDeveer conducted case studies in Massachusetts
- Lise Poisblaud, OQACC, contributed to the analysis of data of the Canadian case studies and to writing of the report

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We welcome comments on this report, sent to ogacc@fse.ulaval.ca

We finally thank the participants of the six case studies, whose expressed views were the primary sources of information for this report. When they have given their consent, their contributions are detailed in each case study in Chapters 3 through 8.

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Summary

Six case studies identified factors that motivate jurisdictions to develop specific policy instruments and others that facilitate their implementation and promote their positive outcomes. Three studies examined the mechanisms used by provinces or states to support municipalities in their climate change adaptation planning. They looked at the instruments used in Nova Scotia, New Brunswick and Massachusetts. Another study examined the environmental assessment of bank stabilization projects in the North Shore region of Québec. A fifth study examined the consideration of climate change adaptation in the Regional Land Use and Development Plan of the Montreal agglomeration. A sixth study looked at the Climate Ready Boston planning process.

Results show that the effectiveness of public policy instruments depends on the motivation to implement them, as well as on a range of facilitating factors whose absence may constitute barriers. Motivating factors include anticipated benefits in terms of risk reduction and improved quality of life. Solutions that pursue both of these goals, such as greening, parks and conservation of natural environments, can motivate jurisdictions to act and can encourage buy-in from residents. Perceived social pressures, which may result from government requirements, expectations expressed in public consultations or previous commitments, also influence motivation. The effectiveness of a policy can be reduced by a lack of motivation of its targeted actors, or by barriers experienced by them.

Governments use the results of scientific research in planning, stakeholder engagement and decision-making processes. They use them to choose the instruments to implement but also to motivate and facilitate those they seek to influence with their public policies. In the cases we studied, governments were able to advance climate change adaptation by combining different types of instruments, as well as by putting in place new measures to overcome the barriers they faced and to help the targeted actors overcome theirs. The different types of instruments that aim to influence targeted actors can have an effect on the variables in the conceptual framework that serves as the theoretical basis for this project: instruments that seek to inform about the benefits of a promoted behaviour, those that make the behaviour compulsory in order to gain approval, thus creating social pressure, and those that have a facilitating effect (e.g. by providing financial, human, organisational and information resources).

The case studies highlighted challenges related to engaging the most vulnerable populations, coordination between adjacent municipalities, and the need to establish standards on what restrictions to put in place. Our results suggest that strategic planning tools for regional land use planning can foster synergy among different actors around long-term collective goals while taking climate change into account. Equity and environmental justice must also be considered in the objectives and measures put in place.

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List of main acronyms

ACASA: Atlantic Climate Adaptation Solutions Association

ALUPD: Act respecting Land Use Planning and Development (Québec)

CCAT: Coastal Community Adaptation Toolkit (developed by ACASA)

CCAP: Climate Change Action Plan (Nova Scotia)

CRB: Climate Ready Boston

EEA: Energy and Environmental Affairs (Massachusetts)

ELG: Environment and Local Government (New Brunswick)

EQA: Environmental Quality Act (Québec)

FEMA (Federal Emergency Management Agency (U.S.)

FRQ: Fonds de recherche du Québec

GRC: Green Ribbon Commission (Boston)

LSD: Local Service District (New Brunswick)

MAMH : Ministère des Affaires municipales et de l'Habitation (Québec)

MCCAP : Municipal Climate Change Action Plan (Nova Scotia)

MELCC : Ministère de l'Environnement et de la Lutte contre les changements climatiques (Québec)

NRCan: Natural Resources Canada

MVP: Municipal Vulnerability Preparedness (a program in Massachusetts)

OQACC : Observatoire québécois de l'adaptation aux changements climatiques

PACC: Plan d'action sur les changements climatiques (Québec)

PÉEIE : Procédure d'évaluation et d'examen des impacts environnementaux (Québec)

PMAD : Plan métropolitain d'aménagement et de développement (Québec)

RCM : Regional County Municipality (Québec)

SHMCAP : State Hazard Mitigation and Climate Adaptation Plan (Massachusetts)

SSL: Sustainable Solutions Lab (Boston)

UMB: University of Massachusetts Boston

WAWA: Watercourse and Wetland Alteration (New Brunswick)

Chapter 1 Introduction and context of the project

1.1 About This Report

This report is intended for the project partners and more generally, for decision-makers and policymakers. This first chapter includes the rationale and objectives of the project and describes the research team, institutional arrangements and methodology employed. Chapter 2 presents the conceptual framework used in the development of the case studies. Chapters 3 through 8 present the case studies in detail, while allowing readers to review key findings in the chapter summaries, tables, and conclusions. Chapter 9 presents lessons learned across the project. The research team has written the case studies in a way that makes them understandable even without having read the conceptual framework.

The case study chapters vary in length. Those on the Massachusetts studies are shorter as they refer to a detailed working paper that will be published separately by the Sustainable Solutions Lab (SSL) at the University of Massachusetts Boston (Belloy, Sulewski and VanDeveer, 2021).

The case studies refer to public policy instruments in the bibliographic references of the chapters, but sometimes also in footnotes and hyperlinks directly in the text.

1.2 Project Rationale

Climate adaptation policies have been effective in many cases, resulting in resilient solutions that address multiple objectives. The Québec Observatory for Adaptation to Climate Change (OQACC), the Ouranos consortium on climate change, CBCL Limited in Atlantic Canada, the University of Massachusetts Amherst and the University of Massachusetts Boston have all been involved in recent years in identifying, observing and designing adaptation processes in their own jurisdictions. This project comes in response to limited knowledge of the factors that lead to the success or failure of such policies. Identifying these factors is necessary to ensure that policies implemented in various sectors and at various jurisdictional levels achieve their intended outcomes.

This project contributes to the efforts of the Coastal Management Working Group under [Canada's Climate Change Adaptation Platform](#). The Coastal Management Working Group is co-chaired by Natural Resources Canada and the Government of Prince Edward Island. This project addresses the third priority outlined by the working group, that is, to identify, evaluate, and provide guidance on how to implement adaptation options. The project also addresses the need identified in the report on Canada's Marine Coasts in a Changing Climate (Lemmen *et al.*, 2016) for "improved monitoring and evaluation of adaptation measures that have been implemented in order to promote shared learning and identify best practices" (p.16).

1.3 Project Objectives

The general objective of the study is to provide policymakers with examples and lessons learned from the application of policy instruments in Québec, Atlantic Canada and Massachusetts, by investigating the factors and characteristics of policy instruments that enable or impede adaptation.

Ultimately, this project aims to help policymakers at the local, provincial and federal levels to design effective policy instruments and processes, and to improve existing ones, in such a way that they enable adaptation.

The project specifically aims to improve understanding of the following:

- individual and contextual factors and policy instrument characteristics that enable or hinder adaptation;
- use of information and knowledge that contributes to the effective implementation of adaptation strategies and measures;
- the role of stakeholder engagement in the successful implementation of policies; and
- the most relevant indicators for policymakers to consider when assessing progress in their adaptation strategies.

The project also proposes to develop a coherent and unified framework to guide the development of case studies and the lessons to be learned from them.

1.4 Methodology

This project had three stages: 1) development of tools for inquiry and analysis; 2) selection of case studies; and 3) development of case studies. The second stage, which was shorter in duration, unfolded in parallel with the first. Case study development was the longest stage, extending from July 2019 through March 2021. Figure 1-1 summarizes the stages and activities for each stage. The following sections describe them in more detail.

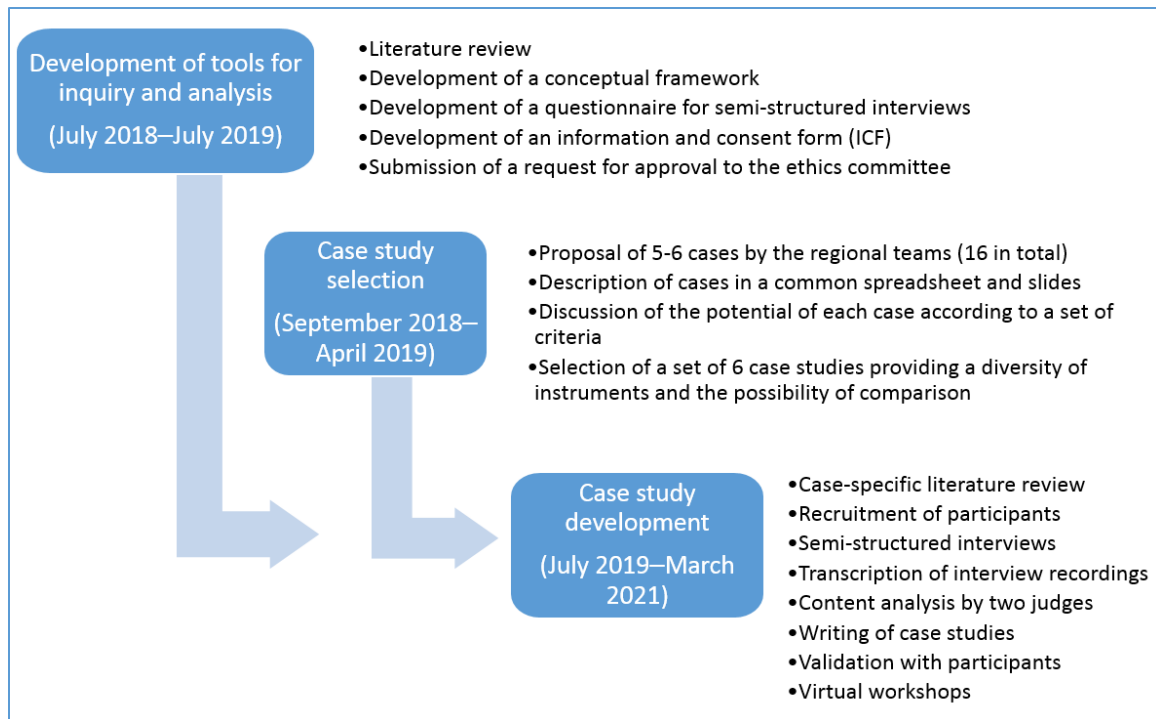


Figure 1-1 : Project stages and activities

1.4.1 Development of Tools for Inquiry and Analysis

In the summer and fall of 2018, the project team conducted an initial review of the state of the art regarding factors that impede or enable climate change adaptation. This literature review also examined existing frameworks for evaluation, policy analysis and knowledge systems, with the objective of developing a unified conceptual framework to guide the development of the case studies. Chapter 2 of this report describes the resulting framework. From this conceptual framework, the team developed a questionnaire for semi-directed interviews, presented in Appendix 1.

Once the selection of case studies was completed, the team at Université Laval submitted an application to the ethics committee for authorization to conduct the research. This application included the questionnaire, generic emails to recruit participants, and the information and consent form (ICF). Although the ethics approval process at Université Laval puts emphasis on the confidentiality of participants, we wanted to be able to acknowledge their contributions and cite them with their consent. Thus, the ICF had three levels of consent. The first was to agree to participate in the study, the second to be named as a contributor, and the third to be quoted in the text of the case study, as long as the participant agreed with what was expressed on their behalf. Appendix 2 presents an example of an ICF.

1.4.2 Case Study Selection

Beginning in September 2018, team members in the different regions proposed cases that could be the object of studies, describing various aspects of them in a shared spreadsheet. In March and April 2019, team members presented 16 different possible cases (five or six in each region) to the advisory committee, presenting their advantages along with the following criteria: potential to illustrate use of information and knowledge for policy development and/or implementation; potential for learning about the process of deploying policy instruments; and potential for learning about factors that facilitated or impeded adaptation. After discussions among the team members and with members of the advisory committee, the team selected six case studies in April 2019, aiming to include diverse instruments and administrative levels while also allowing some comparisons between cases focused on similar instruments. In the province of Québec, the initial choice concerned the instruments to study. The team later defined the location in which to document their application of the instruments. As a result of these processes, the following case studies were selected:

In Québec:

- Consideration of climate change adaptation in the regional Land Use and Development Plan of the Montréal Agglomeration (*Schéma d'aménagement et de développement (SAD) de l'agglomération de Montréal*)
- Consideration of climate change impacts in the environmental assessment of bank stabilization projects in the North Shore region

In Atlantic Canada:

- How Nova Scotia is supporting municipal climate change adaptation planning
- How New Brunswick is supporting community adaptation planning

In Massachusetts :

- Climate Ready Boston
- The Municipal Vulnerability Preparedness (MVP) program

This set of studies presents three local planning support programs in two Canadian provinces (Nova Scotia and New Brunswick) and one American state (Massachusetts). It therefore offers the opportunity to draw comparisons. The other three case studies explore other types of instruments that governments can use to enable climate change adaptation.

1.4.3 Case Study Development

The development of the case studies began with a literature review specific to each case, and in particular a review of the documentation on the policies under study. The team then recruited participants for each study. In some cases, project team members had previously worked with the governments involved and were able to identify participants to invite. For example, the SSL lab at

the University of Massachusetts Boston invited participants for the Climate Ready Boston case study. CBCL Limited identified participants for the Nova Scotia case study. In other cases, an initial contact within the relevant government suggested other potential participants, for example in Montréal. In New Brunswick, the Climate Change Secretariat facilitated the participation of a research professional from Université Laval in meetings organized by partners so that she could establish contact with potential participants. In all cases, participation in the project was voluntary; a few individuals declined to participate. Participants included municipal and provincial government staff, Regional Service Commission staff, consultants, members of non-governmental organizations (NGOs), and, in Massachusetts, citizens attending Municipal Vulnerability Preparedness (MVP) planning meetings.

Most of the semi-structured interviews were conducted in person, but a small number were conducted by telephone or videoconference due to the COVID-19 pandemic. In Massachusetts, in addition to semi-structured interviews, team members conducted participant observations at planning workshops as part of the MVP. Some interviews involved more than one person, thus a total of 38 people were interviewed (19 in Canada, 19 in Massachusetts), in a total of 35 interviews.

The recordings of the semi-structured interviews from the Canadian studies were transcribed by transcription companies. These transcripts were then coded separately by two research professionals with expertise in qualitative methods until 100% inter-judge agreement was achieved. They were then analyzed according to the themes and sub-themes identified during coding based on the conceptual framework and objectives of the project. The research team then drafted the texts and briefs of the case studies and validated them with the participants. Finally, the project was completed by holding virtual workshops in Québec and Atlantic Canada with participants and other key stakeholders.

1.5 The Study Area

Each case study focuses on a specific location or jurisdiction, described in its corresponding chapter. Nonetheless, it is useful here to situate these places in relation to each other and to highlight what they share and what distinguishes them regarding climate change impacts.

Québec, New Brunswick and Nova Scotia are provinces in eastern Canada. They share borders with each other, and all three have coastlines along the Gulf of St. Lawrence. New Brunswick and Québec share Chaleur Bay (Baie des Chaleurs); New Brunswick and Nova Scotia share the Bay of Fundy. Massachusetts is a state in the northeastern United States, geographically close to Canada but not sharing a border. Massachusetts, Nova Scotia and New Brunswick all have coastlines along the Gulf of Maine.

Like all coastal regions of the world, these regions are being affected by a gradual rise in sea level. However, the vertical movement of the Earth's crust, related to the isostatic rebound that followed the melting of the glaciers of the last ice age, is causing differences in relative sea level rise. Indeed, this rebound causes the crust to rise in the continental areas previously covered by glaciers, but to sink at their edges. Figure 2, from Daigle (2020), illustrates how this variation in

vertical land motion (VLM) impacts sea level rise across the East Coast Region. In Québec, the isostatic rebound partially offsets sea level rise (negative values correspond to upward movement), however, in Nova Scotia, sea level rise is amplified. The value of relative sea level rise corresponding to the 95th percentile for the year 2100, in an RCP 8.5¹ scenario, will be 70 cm for Sept-Îles (QC), 87.4 cm in Québec City, 106.5 cm in Gaspé (QC), 113.4 cm in Westford (MA), 121.1 cm in Shediac (NB), 129.6 cm in Halifax (NS) and 131 cm in Baddeck (NS) (Daigle, 2020, p.14 and 15). The sea level rise value used by the City of Boston (MA) for the year 2070-2100 projection is 40 inches, or 101.6 cm.

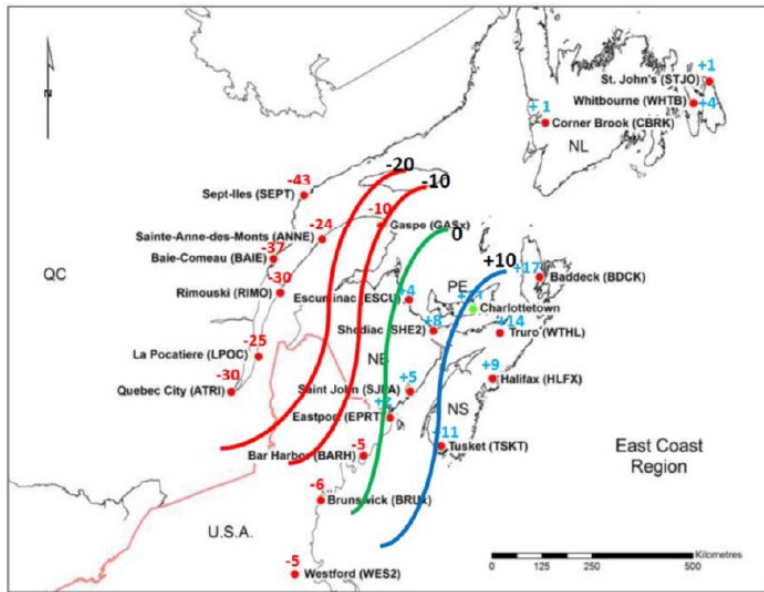


Figure 1-2: Map of East Coast Region plotting vertical land motion (VLM) impact on regional sea level change values (in cm) for the period 1995 to 2100. : (Reproduced from Daigle, 2020)

Note: Green contour shows the dividing line between red areas of rebound and blue areas of subsidence across Nova Scotia and New Brunswick. (Data source: James et al., 2014)

Weather events of concern in these regions include synoptic storms (horizontal scale of about 1000 km) that reform or intensify off the U.S. coast and move into the Gulf of St. Lawrence, often crossing Nova Scotia (Daigle, 2020). In addition to the wind, storms often cause a drop in atmospheric pressure that raises local sea levels, creating storm surges. When such storms occur at high tide, they can have devastating effects. Most of these storms have wind blowing from the northeast and are therefore called nor'easters.

¹ Representative Concentration Pathway (RCP) 8.5 corresponds to a scenario of high emissions of greenhouse gases

1.6 Research Team and Institutional Collaboration

The Québec Observatory for Adaptation to Climate Change (OQACC), based at Université Laval, coordinated this project. OQACC conducted the research in collaboration with Ouranos, University of Massachusetts Boston, University of Massachusetts Amherst and CBCL Limited in Halifax. The project is supported by Natural Resources Canada's Climate Change Adaptation Program and the Government of Québec, as part of the Québec Research Funds and the 2030 Plan for a Green Economy.

The project team was composed of:

- Pierre Valois (Project Lead), Nathalie Beaulieu and Lise Poisbleau (Research Professionals), OQACC-Université Laval;
- Caroline Larrivée and Marie-Anta Diop, Ouranos consortium;
- Emanuel Nicolescu, Léa Baschi and Vincent Leys, CBCL Limited;
- David Cash, Rebecca Hearst, Stacy VanDeveer, Patricio Belloy and David Sulewski, University of Massachusetts Boston; and
- Richard Palmer, University of Massachusetts Amherst.

Under the direction of Professor Pierre Valois, this team developed the project in response to a call for proposals issued by Natural Resources Canada (NRCan) in support of Canada's Climate Change Adaptation Platform. The Ouranos consortium facilitated the financial make-up of the project by obtaining the support of two governmental funding agencies in Québec. The proposal was completed in November 2017 and submitted to NRCan by Ouranos. It was selected for funding by NRCan in February 2018.

The funding agreement between NRCan and Ouranos was signed in November 2018 and a collaboration agreement between Ouranos and Université Laval was signed in December 2018. Université Laval then developed service agreements with the University of Massachusetts Boston to conduct the case studies in Massachusetts, and with CBCL Limited to support case study development in Atlantic Canada. These agreements respected the expectations of all parties regarding intellectual property while also allowing Ouranos to publish and disseminate research results in a timely manner. The agreement between Université Laval and CBCL Limited was signed in April 2019; the agreement with University of Massachusetts Boston was signed the following June.

The project team invited the following four people to participate in an advisory committee in November 2018: Amy Luers of Future Earth, Jennifer Graham of Environment Nova Scotia, Marc Pacheco, Senator of the Commonwealth of Massachusetts, and John Sommerville, Policy Analyst with NRCan. Members of the committee helped select the case studies and offered guidance during the development of case studies in their region.

Due to a combination of factors, including delayed signing of research agreements and restrictions related to the COVID-19 pandemic from March 2020 onward, the project was extended by six months with the projected end date of May 31st, 2021.

1.7 Summary of Project Outputs and Benefits

The contributions of this project are mainly the knowledge developed on the factors that determine the effectiveness of public policies and their instruments. The project has also benefited participants by providing opportunities for reflection and exchange.

The detailed case studies are contained in this report, in chapters 5 to 8. To complement the report, the project team produced a series of fact sheets, one for each case and one for the lessons learned from the project as a whole. These documents are available on the OQACC webpage (www.oqacc.ca) under publications.

Scientific papers will be written in the coming months, aimed at an audience from the fields of policy science and assessment of progress on climate change adaptation. These articles will discuss the results of the case studies according to the state of knowledge in these fields.

The project also has benefits for stakeholders who have had an opportunity to reflect through the interviews and discussion sessions. Some of them were able to express needs or make their views known to their government. A total of 38 people were interviewed, 19 in Canada and 19 in Massachusetts. Three discussion sessions were held in Canada with some of the interviewees and eleven other stakeholders:

- December 2, 2019 in Montreal, with seven participants (excluding research team members)
- February 24, 2021 virtually, with five participants, for the case study on environmental assessment of shoreline stabilization projects
- February 25, 2021 virtually, with ten participants from the New Brunswick and Nova Scotia case studies

In addition, three stakeholders from the regions provided comments on the case study texts, bringing the total number of participants to 52.

Contrary to what was initially planned, it was not possible to hold a final workshop with all participants.

In addition, the project results were presented to a wider audience on five occasions:

- 27 October 2020; virtual presentation at the Ouranos Symposium
- December 1, 2020; presentation at the ICLEI Livable Cities Forum
https://www.dropbox.com/sh/738cgyisert8nwp/AAB1-Hi8trIjzNiiXY7V7V-a/Day%20%20-%20December%201/Engagement%20and%20Outreach?dl=0&preview=Pierre+Valois.pdf&subfolder_nav_tracking=1
- January 28, 2021; webinar at the Climate Risk Institute hosted by the Coastal Zone Management Working Group of the Canadian Climate Change Adaptation Platform
<https://climateriskinstitute.ca/2021/01/15/webinar-understanding-the-determinants-of-effective-policy-instruments-for-climate-change-adaptation-lessons-from-ongoing-case-studies-in-coastal-areas-of-quebec-atlantic-canada-and-massachusetts/>

- March 23, 2021; virtual conference at the St. Lawrence Forum
<https://tcrsudestuairemoyen.org/wp-content/uploads/2021/04/Presentation-NBeaulieu-au-forum-Saint-Laurent-23-mars-2021-c.pdf>
- May 5, 2021; colloquium on the decompartmentalized governance of adaptation to climate change during the ACFAS conference
- May 26, 2021; webinar organised by Ouranos
<https://www.youtube.com/watch?v=x8oHw0teM1E>

The project has also strengthened the institutional links between the project partners. The project has also contributed to the strengthening of collaborations between the Canadian partners and the University of Massachusetts in Boston, which has contributed to the [Massachusetts-Québec Collaborative Research Council](#).

The project also makes a methodological contribution. The theoretical framework used in the project could be used to develop new studies or to facilitate workshops on the effectiveness of public policies in other areas.

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Chapter 2 Conceptual Framework

The conceptual framework informed the questionnaire used in the semi-structured interviews, analysis of the transcripts, presentation of the data in the case studies, and synthesis of the lessons learned across the case studies. This chapter defines the main concepts used. It describes our use of the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019) to explain the influence mechanisms of public policy instruments and to categorize the factors that determine their effectiveness.

2.1 What are Policy Instruments?

We consider policy instruments to be the strategies or means used to achieve the goals of a public policy (Harman, 2005; Henstra, 2015). They allow policy agents, in this case governments, to act, either:

- directly on the environment to improve problematic conditions, such as through a greening program or shoreline stabilization structure; or
- indirectly, by influencing the behaviours or practices of actors targeted by policy (e.g., through information, participatory processes, plans, regulations, or funding).

The actors targeted by a policy can be individuals (citizens, landowners), businesses or other governments. For example, provincial-level instruments may target local governments within their jurisdiction.

2.2 Applying the Theory of Reasoned Goal Pursuit to the Use of Policy Instruments

To identify categories of factors that support policy agents' choice and implementation of instruments, the project team employed the Theory of Reasoned Goal Pursuit² (Ajzen & Kruglanski, 2019). Figure 2-1 presents our adaptation of this theory to the use of policy instruments (PIs).

² This theory was developed from the theory of planned behavior (Ajzen 1991) and the theory of goal systems (Kruglanski et al., 2002). The theory of planned behavior is derived from the theory of reasoned action (Fishbein and Ajzen, 1975).

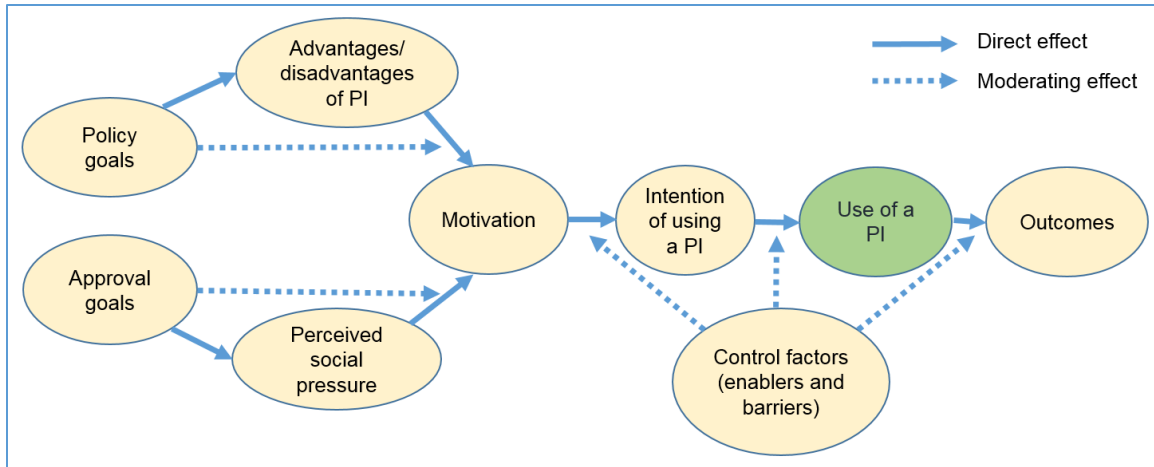


Figure 2-1: Adaptation of the Theory of Reasoned Goal Pursuit to the use of Policy Instruments (PI)

The Theory of Reasoned Goal Pursuit (TRGP) suggests that behaviour results from intention and intention results from motivation. In our project, the behaviour of interest is the use of policy instruments (PIs). The extent to which motivation to perform a behaviour leads to intention to perform a behaviour depends on *perceived behavioral control*. Perceived behavioural control refers to one's beliefs about the presence of factors that can facilitate or impede one's performance of a given behaviour. "Control factors include required skills and abilities; availability or lack of time, money and other resources; cooperation by other people, and so forth" (Ajzen & Kruglanski, 2019, p. 776). Behavioural control moderates the effect of intention on behaviour. In other words, a person might have strong intentions but, while preparing or attempting to perform the behaviour, might encounter more impeding factors or less facilitating ones than expected and therefore not take action.

Control factors are not necessarily under the control of the agent but can increase or decrease their control. They can also affect the extent to which the instruments implemented will produce the desired outcomes, which greatly impacts the effectiveness of instruments. Consideration of outcomes (the variable at the far right of figure 2-1) is an addition we have made to the TRGP model in order to apply it to the field of evaluation.

A person's motivation to perform a given behaviour is influenced by their perception of the degree to which that behaviour is likely to advance two kinds of currently active goals: (a) *procurement goals*, which directly benefit the agent, or (b) *approval goals*, which allow the agent to gain the approval of personally significant others. In our application of the TRGP, we replace procurement goals with the policy's goals. In relation to policy goals and approval goals, respectively, we consider that factors contributing to motivation can be categorized according to 1) perceived advantages and disadvantages of the instrument under consideration; and 2) perceived social pressures.

Fluctuating goals, which can result from new opportunities or events, is another factor that may explain why intentions sometimes do not result in behaviour. Goal stability therefore also moderates the effect of intentions on behaviour (Ajzen & Kruglanski, 2019, p. 775). Feedback on

the performance of a behaviour provides information that can alter beliefs related to motivation and control and can lead a person to implement new behaviours to overcome barriers. It can also lead to abandonment of intentions.

2.3 The Systemic Nature of Policies and their Instruments

We note that the influence of policy instruments often occurs in causal chains where agents of different administrative levels mutually influence each other. In addition, like goals and means, policies and their instruments are often like nested Matryoshka (Russian) dolls. Each mean or instrument will have its own specific goals with more specific means to attain them, and so on. For example, a provincial Climate Change Action Plan (CCAP) is an instrument that a province uses to achieve its broader environmental goals. Some of its actions (instruments) will aim to support local adaptation planning, eventually leading to the development of municipal adaptation plans or the inclusion of adaptation goals in broader municipal planning. These planning instruments, once used by local governments, will lead to the identification of measures that will be the instruments of the local plans.

The effectiveness of a provincial Climate Change Action Plan (CCAP) regarding local adaptation will not only depend on the effectiveness of its instruments in that respect, but also on the effectiveness of local adaptation plans and their instruments. The effectiveness of a given instrument will therefore also depend on the effectiveness of the means used by the targeted actors, which depends on their motivation, their capacity and other control factors. Moreover, the TRGP model informs us about the mechanisms through which public policy instruments can influence the behaviour of targeted actors. They can do so by fostering their motivation, either by giving them credible and convincing information about the need for or benefits of a given action, or by imposing requirements. Public policy instruments can also contribute to actors' control by providing enabling factors, such as financial resources, technical assistance, or knowledge about how to proceed. Figure 2-2 illustrates how public policy instruments and factors at different levels of governance interact.

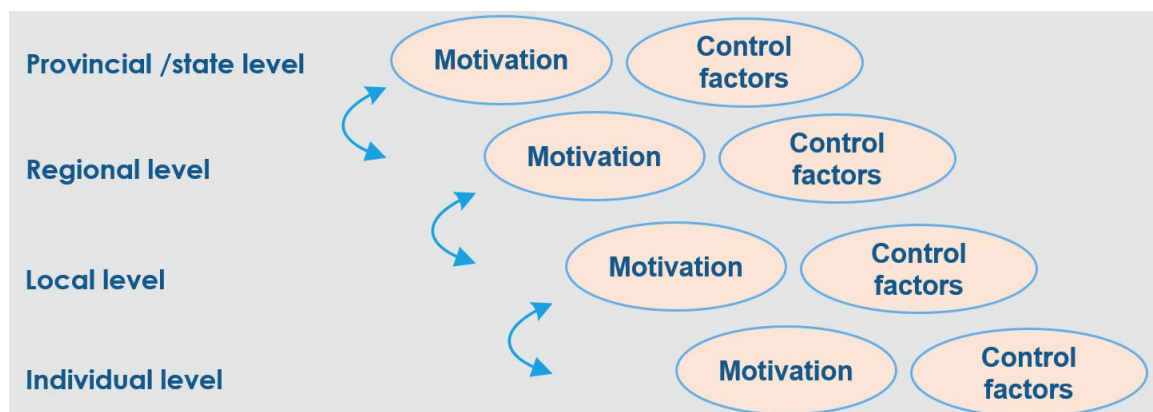


Figure 2-2: Interaction of motivating and control factors in multilevel governance

Therefore, we consider policies and their instruments, like goals and means, to work in nested systems. A system is “a set of elements or parts that is coherently organized and interconnected in a pattern or structure that produces a characteristic set of behaviours, often classified as its ‘function’ or ‘purpose’” (Meadows, 2008, p. 188).

For our case studies, rather than using the TRGP in a nested fashion, we chose to focus on a specific policy and its instruments that aimed to achieve specific goals. The TRGP allows us to consider factors associated with other actors, including those at other administrative levels, and their interactions. Approval goals and perceived social pressures are considered to reflect, for example, policy requirements at higher administrative levels, approval processes of municipal and regional councils, desires expressed in participatory planning exercises, requests made in public consultations, and expectations of constituency members. Perceived advantages and disadvantages are considered to express the potential positive and negative effects of the instruments on the environment and on the targeted actors. We include as control factors all factors that facilitate or impede the implementation of the instruments or their outcomes, including changes in the behaviour of targeted actors. The TRGP can also be used to describe dynamics, such as how public authorities may implement new actions to address barriers they face or barriers encountered by targeted actors.

Taking a systems approach allows us to identify situations where different types of factors interact to create situations unfavourable to change. These include vicious circles or decisions made at a certain moment to respond to a situation that later constrain available options. A large body of literature on barriers to climate change adaptation has highlighted the importance of these phenomena, often referred to as “path dependence” (e.g., Barnett et al., 2015; Matthews et al., 2015; Eisenack et al., 2014; Travis, 2014; Wise et al., 2014; Moser & Ekstrom, 2010; Burch, 2010; Levin et al., 2007). An example of this type of systemic phenomenon is escalating investments related to coastal protection. The more infrastructure there is in a coastal area, the more benefits there are to developing coastal defense infrastructure and the more these options will be implemented. The resulting sense of security encourages new constructions, making relocation increasingly difficult to consider. As sea level rises, this phenomenon can result in very significant losses. The systems approach also identifies virtuous circles, or “snowball” effects, where the increased capacity of some actors may allow them to pressure governments to invest more in projects that increase community resilience.

2.4 Policy Instruments as Boundary Objects

We suggest that policies and their instruments are “boundary objects” (Guston, 1999, 2001; Cash et al., 2003) and that they are shaped through interactions between the leading governmental or municipal administration, elected officials, civil society, the private sector and scientists. Interactions that can be described as “boundary work” occur during review of technical studies, public consultations, and formal and informal approval processes, as well as through the perceived expectations of the stakeholders who approve or disapprove of a given policy and its instruments. While Guston (1999, 2001) and Cash et al. (2003) consider boundary work to happen at the interface of policy and science, we expand the concept to consider other policy-related

boundaries and the boundary worker roles played by many members of public administrations. Policymakers are under pressure to consider the interests of many stakeholders, in addition to considering the results of scientific research. The boundary worker or interface role can allow a policy agent to mediate between the goals of various actors and to address equity concerns. Effective boundary function will also allow a policymaker to maximize their credibility, legitimacy and salience (usefulness) for the different audiences they seek to influence (Cash et al. 2003).

The approval goals/perceived social pressure branch of the TRGP captures some of these interactions with stakeholders, especially the consideration of various interests. For instance, broad consultation and consideration of the points of view and needs of vulnerable groups in addition to those of actors who have power over the approval of the policy could be an indicator of good “boundary work” or boundary function. Collaborations with universities, involvement of experts, and hiring of consultants can be considered enabling factors for use of scientific research in the decision-making process.

Also, we suggest that providing credible information and salient (useful) support and putting in place legitimate processes, especially for stakeholder engagement, will influence the perceptions of targeted actors, therefore influencing their motivation and level of control. This will ultimately lead to their intentions and behaviour contributing to policy goals. Having a combination of instruments with these functions would also be necessary for creation of effective policies.

2.5 Justification of the Terms Used

Godin (2013), in his book on behavioural health sciences, uses the term “barrier” to refer to unfavourable control factors. We note, however, that scientific articles on climate change adaptation often use the terms barriers and constraints very broadly to refer to unfavourable factors for adaptation. This nomenclature can include factors related to the motivation of jurisdictions, whereas we are looking for a term that would apply only to control factors. For example, in the IPCC Fifth Assessment Report³ (Klein et al., 2014), barriers to adaptation included social and cultural factors as well as others related to governance and institutional processes.

Thus, we adhere to the definition of Eisenack et al. (2014), who defined a barrier as an impediment to specific adaptations for specific actors in their given context that arises from a condition or set of conditions (p. 868). These authors note that a barrier can be valued differently by different actors and can, in principle, be reduced or overcome. We also noted in the analysis of our results that a barrier encountered in the implementation of an instrument can become the source of motivation for a new action or can lead to the implementation of a facilitating factor. The lack of motivation of targeted actors (e.g., municipal governments) can be a barrier to the success of a policy (e.g., a provincial program to support local government adaptation). A disadvantage that arises for another actor can lead to social pressure on the agent who wishes to implement the instrument. For this reason, our case studies focus on one instrument at a time and identify factors from the perspective of the implementing jurisdiction.

³ <https://www.ipcc.ch/assessment-report/ar5/>

Several authors distinguish between the concepts of limits, and surmountable barriers or constraints (Klein et al., 2014; Eisenack et al., 2014). Limits “constitute thresholds beyond which existing activities, land uses, ecosystems, species, sustenance or system states cannot be maintained, not even in a modified fashion” (Moser & Ekstrom, 2010, p. 1). The concept of limits is most applicable when planning for time-modulated adaptation approaches that include adaptation pathways (Wise et al., 2014; Haasnoot et al., 2013). One can define the threshold at which an implemented adaptation option is no longer relevant (e.g., the sea level elevation at which a bank stabilization structure would be submerged at high tide) and plan for other options going forward. In our case studies, we do not identify limits to the options considered.

Table 2-1 summarizes the terms used in our case studies in this regard.

Table 2-1: Summary of the terms used in our case studies to categorise the determinants of effective policy instruments

	Factors linked to motivation		Control factors
Favourable factors (favouring adaptation)	Perceived advantages	Favourable social pressure	Enablers, or enabling factors
Unfavourable factors (compromising adaptation)	Perceived disadvantages	Unfavourable social pressure	Barriers

2.6 Structure of Synthesis Tables

Table 2-2 presents the structure of the tables used in the case studies to summarize the factors that determine, from the perspective of project participants, the efficacy of the studied policies and their instruments.

Table 2-2: Structure of the tables used in the case studies to summarize factors that favour the attainment of policy goals with the identified instruments

Policy goal	Instrument or means	Factors linked to motivation		Control factors
		Perceived advantages (☺) and disadvantages (☹)	Perceived social pressure, favorable (☺) and unfavourable (☹)	Perceived enablers (☺) or barriers (☹)
Goal 1	Instrument 1	☺	☺	☺
		☹	☹	☹
	Instrument 2	☺	☺	☺
		☹	☹	☹
Goal 2	Instrument 3	☺	☺	☺
		☹	☹	☹
	Instrument 4	☺	☺	☺
		☹	☹	☹

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Chapter 3 How Nova Scotia is Supporting Municipal Adaptation Planning

Abstract

Nova Scotia's support for municipal adaptation planning was a response to municipalities across the province identifying climate change as an issue in their Integrated Community Sustainability Plans. In its 2009 Climate Change Action Plan, Nova Scotia committed to requiring climate change strategies from municipalities as a condition of being eligible for gas tax funding. The requirement, combined with guidance and financial support, led all 50 municipalities to produce a Municipal Climate Change Action Plan (MCCAP) by the end of 2013. Seven years later, while there have been advances, municipalities still struggle to implement what they had planned and to control development in areas at risk of coastal flooding and erosion. This case study discusses the enablers and barriers encountered by municipalities in the advancement of their adaptation processes. In response to some of the municipal barriers, the provincial government subsequently developed the Municipal Floodline Mapping Project and the Coastal Protection Act (CPA). It also developed new amendments to the Municipal Government Act that make it mandatory to develop a municipal planning strategy. The province is now developing regulations for its CPA.

3.1 Introduction

3.1.1 Why Nova Scotia?

Nova Scotia's mainland is a peninsula in the Atlantic Ocean. The province also includes various islands. It faces a range of climate change-related risks resulting from increased climate variability, rising sea levels and associated impacts such as erosion, storm surges and flooding.

The project's team and advisory committee initially chose to study Nova Scotia's initiative to foster Municipal Climate Change Action Plans (MCCAPs), as it was the first province in the country to require such plans. That initiative led all 50 municipalities in Nova Scotia to develop MCCAPs from 2011 to 2013. This case study also looks more broadly at several provincial policies involved in the support for municipal adaptation planning.



3.1.2 Our Methods

The research team began by reviewing the Municipal Climate Change Action Plan Guidebook developed by the provincial government of Nova Scotia (Fisher, 2011). We identified the province's goals and planned actions related to supporting municipalities in developing adaptation plans. We then conducted interviews with key informants, including:

- Graham Fisher, Senior Planner at Nova Scotia's Department of Municipal Affairs and Housing;
- Shawn Andrews, Director of Fire Emergency and IT Service, and Deborah Torrey, Development Officer in the Municipality of the District of Guysborough;
- Dylan Heide, Chief Administrative Officer, and Katherine Dorey, Climate and Energy Outreach Coordinator of the Town of Mahone Bay;
- Gordon Smith, Director of Planning at Nova Scotia's Department of Municipal Affairs and Housing, who is in charge of the Province's Municipal Floodline Mapping Project; and
- Dr. Patricia Manuel, Professor at the School of Planning at Dalhousie University.

The project's conceptual framework, described in Chapter 2, and based on the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019), inspired the questionnaire used in the interviews. These questions addressed the factors that motivated the development of provincial policies as well as the enablers and barriers to their implementation and outcomes.

3.2 Policies Supporting Municipal Adaptation in Nova Scotia

In Canada, citizens and businesses pay taxes to three levels of government. Property tax is collected at the local level, and income tax and sales tax at the provincial and federal levels. In addition, the federal government and provinces collect taxes on fuels.⁴ Each of these three levels of government can use tax resources to support adaptation to climate change. Local governments, which are municipalities in Nova Scotia, are closest to citizens and therefore have the greatest potential to influence individual adaptation. They offer a range of services to their constituency: drinking water, sanitation, parks and recreation, fire protection and emergency management, and the maintenance of municipal roads. In addition to being the ones who directly attend to the needs of a population during climate-related emergencies, climate-related hazards such as erosion and flooding also affect the infrastructure they use to deliver their services. Municipalities also award building permits and therefore are the key actors controlling development in at-risk areas.

This case study focuses on provincial policies used by Nova Scotia to support municipalities in their adaptation planning. In addition, provincial governments in Canada have many other mechanisms to support adaptation, including their authority over environmental and planning regulation, developing and maintaining the provincial road network, etc. They are also responsible

⁴ Some Canadian municipalities also impose taxes on fuels, but not in Nova Scotia. More details at: <https://www.nrcan.gc.ca/our-natural-resources/domestic-international-markets/transportation-fuel-prices/fuel-consumption-levies-canada/18885>

for managing public (“crown”) land. The federal government offers general orientation and can support provincial and municipal actions through a range of mechanisms. For instance, the federal government uses the Gas Tax Fund to provide funding to provinces who then distribute it to local governments, who in turn identify priorities and carry out projects.

3.2.1 The Policy Development Process

From 2005 to 2010, the Canada-Nova Scotia Agreement on the Transfer of Federal Gas Tax Revenues provided \$145.2 million in federal funding to the province to invest in eligible municipal infrastructure projects. The province administered the Gas Tax Fund and transferred funding to municipalities. As an obligation in their municipal funding agreement with the provincial government, municipalities were required to prepare and report their progress on an Integrated Community Sustainability Plan (ICSP). In 2009, the group managing the Gas Tax Fund reflected on the opportunity to use the next round of funding as an incentive to advance key issues expressed in the ICSPs. This new round disbursed \$223 million from 2010 to 2014.

Graham Fisher, a senior planner with the Department of Municipal Affairs and Housing,⁵ oversaw coordinating the sustainability plans. He conducted an analysis of the 50 plans and noticed that municipalities across the province mentioned climate change as an issue of concern. They often linked this issue to the increased costs of repairing infrastructure after storms. In response to that observation, the group managing the Gas Tax Fund agreed to include a new requirement in municipal funding agreements that municipalities must develop climate change action plans to add to their sustainability plans. At the same time, Nova Scotia was developing its provincial climate change action plan (Nova Scotia Environment, 2009) and included this requirement in its commitments.⁶

Municipal Climate Change Action Plans (MCCAPs) were not previously required. Nova Scotia was the first province in Canada to require such plans from municipalities and was the only province to include a new reporting requirement for the second round of gas tax funding.

Some municipal officials indicated that meeting the Gas Tax Agreement’s reporting requirements was challenging. As the municipalities had already conducted two major planning exercises within five years, involving significant public consultation, to reduce this burden Mr. Fisher and his department did not ask for mandatory monitoring reports or progress updates on the plans. Instead, they encouraged municipalities to focus on the local implementation of their plans.

Once all 50 municipalities had produced climate change action plans, Mr. Fisher again conducted an analysis of the plans. Municipalities across the province noted the lack of flood maps as a barrier to effective land use planning. A few years later, there were significant floods in Nova Scotia, such as in Sydney on Thanksgiving (October 10th) of 2016. In 2018, an opportunity arose to use federal disaster management funds to develop a project to prevent flooding-related disasters.

⁵ At the time, his department was called Service Nova Scotia and Municipal Resources.

⁶ *Toward a Green Future: Nova Scotia’s Climate Change Action Plan, Action 48 - Amend funding agreements with municipalities by 2010 to require climate change strategies in municipal Integrated Community Sustainability Plans.*

These factors contributed to the development of the Municipal Floodline Mapping Project, led by Gordon Smith and his colleagues.

During the same period, based on extensive consultations, the Province developed Bill 106, the Coastal Protection Act, which passed in April 2019. The Act's regulations are currently in development.

Table 3-1 presents the policies most relevant to supporting climate change adaptation in Nova Scotia.

Table 3-1: Policies of interest in supporting climate change adaptation in Nova Scotia

Policy name	Date	General description	How it supports municipal adaptation
Statement of Provincial Interest Regarding Flood Risk Areas	1998	These statements are part of the Municipal Government Act.	The statement aims to protect public safety and property and to reduce the requirement for flood control works and flood damage restoration in floodplains, recognizing that floodplains are nature's storage area for flood waters.
Toward a Green Future: Nova Scotia's Climate Change Action Plan	2009	The province's climate change action plan	Action 48 - <i>Amend funding agreements with municipalities by 2010 to require climate change strategies in municipal Integrated Community Sustainability Plans.</i>
Canada-Nova Scotia Federal Gas Tax Agreement	2005-2010	Promotes the economic, social, environmental and cultural sustainability of Nova Scotia municipalities	To receive funding, municipalities were required to prepare and report progress on an Integrated Community Sustainability Plan.
	2010-2014		To receive funding, municipalities were required to prepare an MCCAP by the end of 2013.
	Since 2015		The federal government encourages municipalities in all provinces to conduct asset management and in future will require asset management plans.
Flood Risk Infrastructure Investment Program	Since 2013	Provincial funding of up to 50% of eligible project costs	The program aims to encourage municipalities to invest in infrastructure that reduces flood risks and community vulnerability.
The Municipal Floodline Mapping Project	2018	Co-funded by the province and Public Safety Canada's National Disaster Mitigation Program	This project aims to discourage development in unsafe places and to contribute to climate adaptation planning. In future will provide updated flood maps incorporating sea level rise and storm surges.
New amendments to the Municipal Government Act	2018	The amendments make it mandatory to have a municipal planning strategy	The Act also makes it mandatory to incorporate the provisions of Statements of Provincial Interest ⁷ into these documents.
Coastal Protection Act	2019, regulations currently in development	Meant to help protect natural ecosystems	The regulations will set clear rules to prevent activity and development in locations where they would be at risk of sea level rise, coastal flooding, storm surges or coastal erosion.

⁷ Statements of Provincial Interest (SPI) pertain specifically to drinking water, flood risk areas, agricultural land, infrastructure, and housing.

3.2.2 Goals of the Policies and Planned Actions

The Gas Tax Fund promotes the economic, social, environmental and cultural sustainability of Nova Scotia municipalities. The reporting requirement for municipalities to develop a Municipal Climate Change Action Plan (MCCAP) by the end of 2013 aimed to help municipalities reduce greenhouse gas emissions and identify priorities for climate change adaptation. In order to help them develop their plans, the provincial government developed a guidebook and an accompanying template. It also gave municipalities the option of covering the costs associated with the development of their plans through the Federal Gas Tax Transfer Program, in whole or in part. Municipalities could use in-house resources, when available, or hire consultants. They could use data and climate projections disseminated by the Climate Change Directorate within Nova Scotia Environment. The Directorate hosted and administered a climate change adaptation clearinghouse⁸ that aimed to inform adaptation decisions.

The Municipal Floodline Mapping Project aims to keep development out of flood-prone areas. The provincial government hired CBCL Limited to develop a mapping methodology and standards and hired three consulting companies (including CBCL) to test them in three watersheds. It also acquired airborne LiDAR⁹ imagery over the entire province to allow hydrodynamic modelling and precise mapping of flood-prone areas. The flood mapping takes into account the effect that sea level rise will have on inland flooding of tidal rivers. The project is also considering coastal flooding resulting from sea level rise and storm surges.

3.3 Key findings

We observed that there has been a chain reaction in the development of policies and instruments. Needs identified in the sustainability plans motivated the requirement for the Municipal Climate Change Action Plans (MCCAPs). Needs identified in the MCCAPs led to the development of the Municipal Floodline Mapping Project. The Canada-Nova Scotia Agreement on the Transfer of Federal Gas Tax Revenues provided an opportunity to set a reporting requirement and to make MCCAPs a condition for municipalities to receive funding. Federal funding for disaster mitigation then provided an opportunity to fund and implement the Municipal Floodline Mapping Project.

For the provincial government, implementing the requirement and developing the guidelines for MCCAPs was relatively straightforward. It used the funding from the federal gas tax as an incentive to encourage municipalities to develop their plans. These funds also allowed municipalities to pay consultants to support them in the process and to implement adaptation options. By the end of 2013, all 50 municipalities in the province had their own MCCAP.

Important questions remain, however, including 1) if and how these plans have fostered adaptation, 2) what factors facilitated the planned adaptation measures and 3) what factors impeded the planned adaptation measures. The next sections will discuss these factors from the points of view of the individuals interviewed. Table 3-2 summarizes the enablers of and barriers

⁸ This information is available on the Nova Scotia Environment website:
<http://www.climatechange.novascotia.ca>

⁹ Light Detection and Ranging, a form of active remote sensing used to develop digital elevation models that are necessary for flood mapping

to municipalities implementing adaptation, along with factors that motivated the province to develop the requirement for municipal adaptation plans. Table 3-2 lays out these factors following the conceptual framework of the project, as described in Chapter 2 of this report, which is based on the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019). These factors include the perceived advantages and disadvantages of actions, perceived social pressures, as well as the enablers of and barriers to the implementation or outcomes of the actions.

Perceived advantages and disadvantages of actions and perceived social pressures are motivating factors; they are the reasons why the provincial government considered a specific action to achieve the policy's goal. Once an action has been included in a policy or plan, for example, the enablers and barriers can determine whether the action is implemented, and whether the action will produce the intended outcomes. In addition, sustained motivation will more likely lead to maintaining the actions and overcoming the barriers. The next sections of this chapter further discuss these findings.

Table 3-2 : Factors associated with Nova Scotia’s requirement of Municipal Climate Change Action Plans (MCCAPs) ¹⁰

Provincial policy goal	Provincial actions linked to MCCAPs	Motivating factors		Perceived enablers (☺) and barriers (☹)
		Perceived advantages (☺) and disadvantages (☹)	Perceived social pressure, favourable (☺) and unfavourable (☹)	
Help municipal governments plan for climate change	<p>Instituted MCCAPs as a requirement for accessing the Gas Tax Fund.</p> <p>Provided a guidebook .</p> <p>Facilitated the use of gas tax funding to help municipalities develop their plans.</p>	<p><u>For the province</u></p> <p>☺ Municipalities would start to think about the impacts of climate change and plan accordingly.</p> <p>☺ Could help prevent coastal disasters, which IPCC reports indicate will worsen in the future</p>	<p>☺ Due to floods and storm surges, climate change came up as an issue in municipalities’ sustainability plans across Nova Scotia.</p>	<p><u>For the province</u></p> <p>☺ The province paying attention to the needs of municipalities, in large part through reviewing ICSPs and MCCAPs;</p> <p>☺ Ability to take advantage of federal funding opportunities to motivate and enable adaptation;</p> <p>☺ New policy and actions in response to barriers described by municipalities.</p> <p><u>For municipalities:</u></p> <p>☺ Supportive council and staff;</p> <p>☺ Comprehensive strategic planning;</p> <p>☺ Additional sources of income beyond taxation;</p> <p>☺ Ability to hire experts to assist with planning;</p> <p>☺ Collaborations with universities and NGOs; and</p> <p>☺ Asset management and transportation plans offering opportunities to advance adaptation goals.</p>
		<p><u>For municipalities:</u></p> <p>☺ Protecting assets and the population;</p> <p>☺ Adaptation measures with concrete quality of life benefits.</p> <p>☺ Local champions advocating for the necessity and advantages of adaptation;</p>	<p>☺ Municipal and provincial emergency management organizations called for better prevention of flood risks.</p>	
		<p>☹ The MCCAP is sometimes perceived as a solution but it is only the beginning of the adaptation process.</p> <p>☹ A decline in concern for coastal risks between one storm or flood and the next;</p> <p>☹ The difficulty of seeing the concrete benefits of adaptation (disaster avoided = disaster unrecognized);</p> <p>☹ Landowners’ reluctance to accept limitations to what they can do on their own property; and</p> <p>☹ People being very attached to the place where they live, making it difficult to consider migration or relocation.</p>		<p><u>For municipalities:</u></p> <p>☹ Limited human and financial resources strained by multiple priorities, especially in small towns;</p> <p>☹ Needing additional funding for their shovel-ready projects;</p> <p>☹ Limited provincial contributions to infrastructure funding; and</p> <p>☹ The unavailability of up-to-date flood maps.</p>

¹⁰ A discussion of the underlying framework used in this analysis can be found in Chapter 2.

3.3.1 The Point of View of Provincial-Level Policymakers

Graham Fisher, Senior Planner at Nova Scotia's Department of Municipal Affairs and Housing, played a key role in the policy leading to the development of Municipal Climate Change Action Plans (MCCAPs). He admits to having mixed feelings about them. While he feels that they were a great advancement and asset, he fears that the action plans can too easily be thought of as a solution to the problem, rather than a tool to help municipalities identify problems. Some outcomes are already observable, such as changes in land use bylaws, especially for areas at risk from flooding. But many of the actions included in the plans entail developing other plans, such as plans for stormwater management that most of the municipalities still lack seven years later.

Mr. Fisher finds that adaptation is perceived as complex because it can involve many different interests and can be challenging to implement. He also points out that, when adaptation works, nothing happens – in other words, there is no flood to see. Reducing greenhouse gas emissions, on the other hand, involves tangible things such as new furnaces or solar panels, for example. Adaptation actions that involve integrated planning efforts can also strain the limited resources of municipal staff and councils.

In contrast, Mr. Fisher noted that sustainability plans were more positive, more focused on quality of life, and included such considerations as walkability and environmental services. He would like to see adaptation and sustainability integrated into community-level land use planning in a coordinated way that, for example, would facilitate greater synergy between recreation, conservation and natural disaster prevention. Until fairly recently, only about 60% of the province's municipalities had comprehensive strategic land use plans. He understands that people and property owners often view planning as taking something away from them rather than as giving them valuable advantages, such as protecting property from damages. Until recently, it was not mandatory to have a municipal planning strategy or land use bylaws. New amendments to the Municipal Government Act now make it mandatory to have such a planning strategy. The Act also makes it mandatory to incorporate the provisions of Statements of Provincial Interest¹¹ in these documents.

Mr. Fisher finds that there is the most progress when there is at least one local champion advocating for adaptation goals with the municipal council. Municipalities that host universities or environmental non-governmental organizations (NGOs) usually have several champions. However, he finds that there is a lack of information to support municipalities making crucial decisions, such as when to consider relocation rather than shoring up or adapting existing infrastructure. He supports an approach whereby the province would take the lead on an overarching strategy for climate change adaptation, and emergency management would be combined with a proactive, coordinated, long term approach to planning.

As we mentioned earlier, a significant barrier to controlling development in at-risk areas has been the unavailability of up-to-date flood risk maps to replace existing maps that do not incorporate climate change. The Municipal Floodline Mapping project is addressing this issue by mapping the projected areas for floods with a 1% and 5% likelihood of occurring each year. Gordon Smith,

¹¹ Statements of Provincial Interest (SPIs) pertain specifically to drinking water, flood risk areas, agricultural land, infrastructure, and housing.

Director of Planning at Nova Scotia's Department of Municipal Affairs and Housing, and who is in charge of the Province's Municipal Floodline Mapping Project, explained that the maps express this risk in percentages because expressing risk in return periods (also known as recurrence intervals) leads to confusion. Indeed, after a flood described as having a return period of 100 years, people tend to mistakenly assume that it will not occur again for another 100 years.

However, the availability of floodline maps does not guarantee that municipalities will plan accordingly. For example, in 2014, CBCL Limited produced flood maps for the Municipality of Truro under the Flood Risk Infrastructure Investment Program, but their approval by municipal council is still pending. The flood maps produced by the provincial government will be available publicly and municipalities will be obligated to consider them in their planning, to conform to the Statement of Provincial Interest Regarding Flood Risk Areas issued in 1998 under the Municipal Government Act. Homeowners, buyers and insurance companies will also have access to these maps, which is likely to reduce the development of new buildings in flood-prone areas. As pointed out by Gordon Smith, this will restrict the ability of landowners to use their property as they choose, but it is necessary for reduction of flood-related risks.

3.3.2 Municipal Points of View

With its commercial downtown along the coast, the Town of Mahone Bay is at serious risk of coastal flooding and erosion during storms. Sea level rise progressively increases this risk. The Town's Chief Administrative Officer, Dylan Heide, manages assets that are very close to the waterfront, such as roads, electrical systems and lift stations for the wastewater system. He seeks to ensure the sustainability of that infrastructure despite the projected impacts of climate change. In addition, commercial companies have assets along the coast that are worth tens of millions of dollars. The town attracts many tourists in the summer, who come to see the coastal scenery and local heritage. Activities related to tourism are another source of motivation to protect the historical heritage of the town.

Following the development of its MCCAP in 2013, the Town of Mahone Bay developed building guidelines that integrate the results of the latest climate projections. Along the coast, it only permits construction on the footprint of existing buildings, and requires a plan that makes builders responsible for protecting their works against coastal flooding. Building on community discussions in the intervening years, in 2015, Mahone Bay contracted CBCL Limited to assist in developing design concepts for different options available to mitigate coastal floods and erosion. Among these options, the town would like to implement a living shoreline project to protect Edgewater Street (which represents about one-third of the town's coastline), but has not yet been able to secure funding for the project. According to Mr. Heide, the municipality – with a population of just over 1,000 year-round residents – only has the capacity to pay for 7% of the project's estimated total cost of \$3.2 million. The federal government has programs such as the Investing in Canada Infrastructure Program (ICIP) that can cover up to 60% of the costs, so the remaining 33% would need to be covered by the provincial government. The federal budget suggests that provinces pay 33% of the costs of such infrastructure for communities below the 5,000 population threshold. With a population well under that threshold, Mahone Bay hopes to be awarded 93%

funding under the ICIP, which has yet to be made available to Nova Scotian municipalities. In September 2020, the City of Mahone Bay conducted a demonstration installation of the living shoreline concept on a portion of the Edgewater Street shoreline with the NGO Coastal Action and financial support from the Intact Foundation.

Mahone Bay is presently developing a transportation plan that incorporates climate-related risks, again with support from CBCL Limited. On May 12, 2020, CBCL Limited staff presented their draft transportation planning report, which included numerous improvements to support active transportation. According to Katherine Dorey, Mahone Bay's Climate and Energy Outreach Coordinator, improvements such as a walking trail, bike lane and pedestrian bridge would bring additional benefits to the proposed living shoreline concept, and could have many positive impacts on residents, including families and the older population, while also reducing greenhouse gas emissions. The CBCL Limited transportation planning report further notes the priority of protecting Edgewater St. from erosion and wash-out as it is part of the provincial highway system. Beyond the living shoreline proposal and active transportation components, Mahone Bay's concept for Edgewater St. also includes extension of municipal water and wastewater services to properties where wells and septic systems are potentially at risk from rising waters.

According to Mr. Heide, there is systemic inequity between small towns and the neighbouring rural districts in Nova Scotia that further compounds the challenge for towns seeking to adapt their infrastructure to a changing climate. Towns like Mahone Bay are responsible for their roads and other infrastructure. Rural districts have a higher population and therefore receive more resources from the Gas Tax Fund while the provincial government has the responsibility of maintaining their roads. In addition, many small coastal towns are surrounded by a rural district that forms a distinct municipality. In some cases, they have no spare land available allowing them to develop further away from the coast, or to move some of their installations inland. It is for these reasons that higher funding levels (93%) for small communities (those under 5,000) are essential.

The former Town of Canso became part of the Municipality of the District of Guysborough in 2012. The Guysborough district completely surrounds the Town of Mulgrave and borders the St. Mary's Municipal District to the west, Antigonish County to the north and the Strait of Canso to the east. As part of a project funded by the Federal Disaster Reduction Program, Guysborough hired CBCL Limited to assist in the development of a Climate Change Mitigation Plan in 2020. This plan, which is complementary to the Municipal Climate Change Action Plan (MCCAP) developed in 2013, aims to inform disaster mitigation strategies and adaptation decisions such as, for example, potential modifications to the sewer and wastewater treatment infrastructure. This federally-funded project will provide strategies for implementation of the mitigation plan. The Guysborough district has been able to pay its project consultant out of income-generating activities not related to taxation, such as windfarms and royalties from industry. While most Nova Scotia municipalities rely on taxation for 90% or more of their budget, taxation accounts for only 35-40% of the Guysborough municipal budget. The municipal council is highly supportive of sustainable development and adaptation to climate change. Guysborough is planning to integrate into a single document their ICSP, MCCAP, Climate Mitigation Plan, Active Transportation Plan and Asset

Management Plan, along with their Municipal Planning Strategy and Land Use Bylaw once these have been reviewed.

The District of Guysborough is not responsible for maintaining roads, but that makes it dependent on provincial decisions about road repairs and maintenance. Maintenance of coastal roads is an important issue because, in some instances, they are the only way to travel in and out of communities. Many road sections in Guysborough have a low elevation, especially when they cross brooks and coves. They become flooded when there are storm surges, sometimes cutting off access to critical infrastructure or certain communities. Guysborough would encourage additional investments by the province when they are repairing roads to protect or elevate those lower sections. However, as sea level rise progresses, some sectors of the communities, along with roads and other infrastructure, may become permanently flooded. Luckily, Guysborough has inland roads that the provincial government could, in the future, condition to serve the community and new developments farther from the coast. Some of these roads are unpaved, but paving them would be much less expensive for the province than expropriating land to build new roads, or raising roads prone to flooding. However, the attachment of residents to the place where they live can make it difficult for municipalities to consider migration further inland as an adaptation option.

The interviewed staff members of the District of Guysborough are looking forward to seeing what regulations the province is developing under the Coastal Protection Act. They would much rather have a consistent provincial regulation in place and enforce it than enact changes in their own municipal planning documents.

3.3.3 An Overlooked Resource for Municipalities

From 2013 to 2015, several members of the Atlantic Climate Adaptation Solutions Association (ACASA) developed a toolkit for coastal adaptation. The project was led by the University of Prince Edward Island and supported by Natural Resources Canada and the four Atlantic provinces (Prince Edward Island, Nova Scotia, New Brunswick and the province of Newfoundland and Labrador). Dr. Patricia Manuel, Professor in the School of Planning at Dalhousie University, was part of this team of academic and private industry partners working with communities across the region, including three in Nova Scotia, to develop and test the toolkit. The web-based Coastal Community Adaptation Toolkit (CCAT) guides users through a sequence of questions about coastal risks of concern, the coastal environment, and existing capacity for coastal adaptation. The CCAT interface outputs a list with documented examples of the most suitable land use planning and engineering options to manage coastal erosion, flooding or both. According to Professor Manuel, the provincial government did not sufficiently promote the toolkit, despite the current great need for it. While municipalities fulfilled the requirement to produce their Municipal Climate Change Adaptation Plans (MCCAPs) seven years ago, many communities still need to identify concrete solutions to cope with coastal risks.

It appears that the toolkit was before its time. It has tremendous potential for use now, especially with the mandatory plan requirement. Dr. Manuel indicated that it could eventually be updated to consider the recent policy changes in the participating provinces and that there are now many new examples of green infrastructure that could be added.

3.4 Discussion

We have drawn these findings from interviews with seven informants who expressed their perceptions of the situation.

Earlier, we showed that the provincial government has been responsive to barriers indicated by municipalities in their planning documents: the funding requirement for municipal plans was a response to considerations expressed in sustainability plans; the Municipal Floodline Mapping project was a response to barriers described in Municipal Climate Change Action Plans (MCCAPs). We believe that this responsiveness on the part of the provincial government, and the shaping of policy instruments in a way that contributes to the enablers and removes the barriers faced by municipalities, are determining factors for the relative success of these instruments. This responsiveness involved examining the plans and paying attention to the needs of municipalities, as well as taking advantage of opportunities related to federal funding.

In 2009, the provincial government decided to use gas tax funds as an incentive for municipalities to develop their Municipal Climate Change Action Plans (MCCAPs). In 2018, the province secured federal disaster reduction funding to hire experts and acquire data that would later allow a precise mapping of flood risks in the province. By taking advantage of such opportunities, it secured enablers to implementation of its policy. This also made the province accountable to the federal government regarding use of those funds, thereby adding a motivation linked to social pressure. Using the conceptual framework of the project to explain these findings, we would say that success lies in combining sources of motivation, securing enablers and overcoming barriers. This applies to ensuring successful tool implementation by a policymaker but also to influencing the behaviour of those targeted by the tools. To support adaptation planning and implementation by municipalities, the province had to provide an assemblage of information about climate-related risks, incentives, funding and guidelines. The province is still developing strategies to help municipalities overcome the barriers they face. According to Vogel et al. (2020), “the MCCAP succeeded by combining the leverage of financial and regulatory measures to incite, activate and motivate local climate change actions” (p. 1647).

Some municipal officials indicated that meeting the Gas Tax Agreement’s reporting requirements was challenging. This social pressure contributed to the province determining that monitoring reports and updates on these action plans would not be mandatory. The initial plans provided the government with valuable information about enablers and barriers, including a lack of flood maps. Monitoring reports could have been used by municipalities to provide feedback and to express their achievements, enablers and barriers, in order to obtain the specific support they needed. A “light” feedback system, which could apply more generally to issues of comprehensive planning and asset management, could contribute to the province’s responsiveness to the needs of municipalities.

Even when municipal administrations have information about risk-prone areas, it is difficult for them to develop legislation because of pressure from landowners. The Municipal Floodline Mapping Project and the regulations in development for the Coastal Protection Act will help

municipalities overcome this barrier while restraining development in areas threatened by coastal flooding and erosion.

With the new amendments to the Municipal Government Act, a renewed opportunity to use the Coastal Community Adaptation Toolkit (CCAT) has arisen. A suggested area for future research would be conducting cost-benefit analyses in specific circumstances in order that municipalities could choose, based on the resulting examples, between the different options available to them. It would also be useful to identify criteria allowing municipalities to decide when to consider relocation of certain assets rather than adapting or repairing existing infrastructure, while also considering that residents have an attachment to the place where they live.

The provincial government could examine its rural roads and rail rights-of-way near the coast and consider a long-term investment plan to provide alternatives to coastal transport routes.

Even if Nova Scotia has progressed immensely in supporting municipal planning of adaptation, the province lacks an overarching provincial strategy to support the implementation of necessary actions and to coordinate among the various actors involved.

3.5 Conclusions and Recommendations

The impetus to introduce the MCCAP requirement stemmed from a desire to encourage municipalities to think about the impacts of climate change and plan accordingly. In addition, the province was responding to several pressures, or expressed needs, including:

- the emergence of climate change as an area of concern in municipalities' sustainability plans; and
- municipal and provincial emergency management organizations calling for better prevention of flood risks.

Enabling factors for the provincial government to develop this policy included:

- the province paying attention to the needs of municipalities, in large part through reviewing ICSPs and MCCAPs;
- the province's ability to use federal funding opportunities to motivate and enable adaptation, in turn facilitated by:
 - its role in the transfer of funds to municipalities from the federal Gas Tax Fund since 2005;
 - an opportunity to update the requirements for the 2010-2014 period; and
 - the availability of federal disaster mitigation funding enabling the development of the Municipal Floodline Mapping Project.
- new policy and actions in response to barriers described by municipalities (some still in development), including:
 - the Municipal Floodline Mapping Project;
 - the Coastal Protection Act and associated regulations;
 - new amendments to the Municipal Government Act; and

- a framework for asset management planning that considers the impacts of climate change.

Motivating factors for municipalities included:

- protecting assets and the population;
- adaptation measures with concrete life quality benefits such as recreation, active transportation, public access to the coast and nature conservation helping to gain public acceptance; and
- having at least one local champion advocating for the necessity and advantages of adaptation.

However, some factors can reduce motivation, such as:

- a decline in concern for coastal risks between one storm or flood and the next;
- the difficulty of perceiving the benefits of avoided disasters;
- the reluctance of landowners to be limited in what they can do on their property; and
- people being very attached to the place where they live, making it difficult to consider relocation.

In addition to the support by the provincial government, enabling factors for municipalities included:

- having a supportive council and staff;
- comprehensive strategic planning;
- having additional sources of income beyond taxation;
- the ability to hire experts to assist with planning;
- collaborations with universities and NGOs;
- using asset management, transportation plans as opportunities to advance adaptation goals.

barriers faced by municipalities included:

- limited human and financial resources strained by multiple priorities, especially in small towns;
- needing additional funding for their shovel-ready projects;
- limited provincial contributions to infrastructure funding; and
- the unavailability of up-to-date flood maps.

Opportunities for further research or reflection include:

- developing a “light” feedback system that could provide the provincial government with information on adaptation enablers and barriers faced by municipalities without unduly burdening municipalities with reporting requirements;
- evaluating the costs and benefits of different adaptation options in specific circumstances, in order to support municipalities making informed decisions;

- developing criteria to help municipalities decide when it is better to relocate infrastructure rather than to continue repairing or adapting it;
- developing a long-term strategy to provide alternatives to coastal roads, using inland roads and rail rights-of way; and
- developing a comprehensive provincial strategy for adaptation.

3.6 Acknowledgements

This chapter is based on interviews with Graham Fisher, Senior Planner at Nova Scotia's Department of Municipal Affairs and Housing; Shawn Andrews, Director of Fire Emergency and IT Service, and Deborah Torrey, Development Officer in the Municipality of the District of Guysborough; Dylan Heide, Chief Administrative Officer, and Katherine Dorey, Climate and Energy Outreach Coordinator of the Town of Mahone Bay; Gordon Smith, Director of Planning at Nova Scotia's Department of Municipal Affairs and Housing, who is in charge of the Province's Municipal Floodline Mapping Project; and Dr. Patricia Manuel, Professor at the School of Planning at Dalhousie University.

3.7 References

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Chapter 4 How New Brunswick is Supporting Community Adaptation Planning

Abstract

New Brunswick developed its 2016 Climate Change Action Plan following extensive public consultation. As specified in the commitments laid out in its plan, the province is supporting community adaptation planning by providing information and guidelines and by encouraging a supportive environment. It has also made the development and implementation of adaptation plans mandatory for cities and coastal municipalities who apply for provincial infrastructure funding. With its Environmental Trust Fund, New Brunswick has also been supporting a highly active network of NGOs and community organizations who, in turn, support communities in their adaptation planning. At the end of 2020, 35 of the province's 104 municipalities have completed adaptation plans and 17 more are in the process of developing one. Some of these municipalities have adopted land use bylaws that impose conditions or restrictions for development in areas that will become at risk of flooding from storm surges due to sea level rise. Some Regional Service Commissions have been developing a regional approach to adaptation planning and/or have been supporting communities develop their plans. However, the lack of province-wide standards could be slowing down local adaptation processes and hindering a comprehensive response to climate change.

4.1 Introduction

4.1.1 Why New Brunswick?

New Brunswick is one of Canada's four Atlantic provinces. It has 5,500 km¹² of coastline along Chaleur Bay (Baie des Chaleurs), the Gulf of St. Lawrence, and the Bay of Fundy. It is otherwise bordered by Québec's Gaspésie region to the northwest, the US state of Maine to the west, and Nova Scotia to the southeast, via the Isthmus of Chignecto. Like Nova Scotia, described in Chapter 3, it faces a range of climate change-related risks resulting from increased climate variability, rising sea levels and associated impacts such as erosion, storm



surges and flooding. It has also experienced very significant inland flooding in recent years along the Saint John River.

New Brunswick is also much less densely populated than the other Atlantic provinces, with a population of 747,101 residents as of the 2016 Census, on a land area of 71,389 km². About half of its population lives outside urban areas. It has a range of local government types, including eight cities, 26 towns, 61 villages, eight rural communities and one regional municipality (Government of New Brunswick, 2020 a). According to the same source of information, approximately 89% of the geographical area of the province, where 32% of the population lives, is unincorporated, which means there are no local governments. This area is divided into 236 Local Service Districts (LSD), which are governed by New Brunswick's Department of Environment and Local Government (DELG). There are also 15 First Nation communities and 32 reserve locations in the province (Government of New Brunswick, 2020 b)

The project team and advisory committee chose to study New Brunswick's ongoing initiatives to support municipal adaptation planning. These initiatives were the result of commitments made in the provincial government's 2016 Climate Change Action Plan (CCAP), developed after extensive public consultations. The initiatives resulted in half of New Brunswick's municipalities developing adaptation plans between 2016 and 2020. By the end of 2020, 35 of these municipalities had completed their plan and 17 were still in development (Government of New Brunswick, 2020 c). In New Brunswick, environmental and community NGOs play a key role in supporting municipalities in their adaptation planning. Recent revisions to the province's Local Governance Act and the creation of the Community Planning Act (replacing the Municipalities Act) also provide a favourable context for local planning and collaboration between jurisdictions and agencies.

This case study provides insight on the possibilities available to provinces aiming to foster local adaptation in a range of local communities. This case study also looks more broadly at several provincial policies that support community adaptation planning.

4.1.2 Our Methods

The research team first reviewed documents related to New Brunswick's environmental and local governance policies, with special emphasis on the province's Climate Change Action Plan (CCAP). In the latter document, we identified which goals and planned actions were related to supporting adaptation planning in communities. Team members had informal discussions with Robert Capozzi, Director of Climate Change Adaptation at the Climate Change Secretariat of New Brunswick's Department of Environment and Local Government (ELG). The Secretariat facilitated the participation of Nathalie Beaulieu, Research Professional at Université Laval, as an observer in the following two meetings organized by supporting partners, to allow her to learn from these meetings and to make contacts with potential interviewees:

- The Advisory Committee meeting of the project entitled "Natural and Nature-Based Infrastructure Capacity Building for Engineers, Land Use Planners and Environmental Organizations in New Brunswick", under Natural Resources Canada's Building Regional

Adaptation Capacity and Expertise (BRACE)¹³ program. This meeting was organized by the New Brunswick Environmental Network (NBEN) in Moncton on February 28th, 2020.

- The introductory workshop of the Coastal Flood Mitigation Canada project for a case study on the Acadian Peninsula.¹⁴ The workshop was organized by the Valorès Institute in Shippagan on March 12th, 2020, and co-facilitated by Natural Resources Canada, the project leader.

We then conducted interviews with key informants at the regional level and partners of some communities, including:

- Raissa Marks, Director of the New Brunswick Environmental Network;
- Sabine Dietz, Consultant with the Aster Group;
- Benjamin Kocyla, Director of Planning at the Acadian Peninsula Regional Services Commission;
- Marc Bouffard, Director of Planning at the Regional Services Commission of Chaleur; and
- Serge Larochelle, Project Coordinator at the Pays de Cocagne Sustainable Development Group.

The project’s conceptual framework, described in Chapter 2 and based on the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019), inspired the questionnaire used in the interviews. These questions addressed the factors that motivated the development of provincial policies as well as the enablers and barriers to their implementation and outcomes. The project team then shared a draft of preliminary findings with key informants and integrated their feedback.

A virtual workshop was held on February 25th, 2021 to discuss the findings of the case study. Feedback from the workshop participants was incorporated into this report.

4.2 Policies Supporting Community Adaptation in New Brunswick

This case study focuses on the provincial Climate Change Adaptation Plan (CCAP) adopted in 2016. However, a number of other policies and instruments contribute to supporting community adaptation planning and implementation in the province. Table 4-1 presents them for reference, organized by year of adoption.

Table 4-1: Policies of interest in supporting climate change adaptation in New Brunswick

Policy name	Year	General description	How it supports municipal adaptation
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¹³ <https://www.nrcan.gc.ca/climate-change/impacts-adaptations/building-regional-adaptation-capacity-and-expertise-brace-program/21324>

¹⁴ That project has identified one case study on each of Canada’s three coasts. The Acadian Peninsula was the case chosen for the Atlantic coast. The project is funded by Defence Research Development Canada and led by Natural Resources Canada, in partnership with the National Research Council and other agencies from other levels of government and academia. The project’s overarching goal is to develop and demonstrate best practices in coastal flood risk assessment to help coastal communities better understand and manage flood risk from storm surge, tsunamis, and rising sea levels.

Environmental Impact Assessment Regulation NB 87-83 under the Clean Environment Act	1987	Provides a legislative framework for proactive environmental planning including opportunities for public involvement.	Requires projects to be designed in such a way as to avoid or reduce environmental impacts that increase the vulnerability of communities to climate change. Can lead to projects deemed harmful being denied an environmental permit.
Watercourse and Wetland Alteration Regulation 90-80 under the Clean Environment Act	1990	Defines the criteria and process to obtain an alteration permit	Having the provincial government restrict development and other activities on watercourses and wetlands helps protect sensitive areas and reduce risks related to flooding and erosion. In addition, the province can issue Wetlands Designation Orders.
Coastal Areas Protection Policy	2002, updated in 2019	Sets minimum standards for public and private coastal developments in current climate conditions. It is applied by the provincial government through the Watercourse and Wetlands Alteration (WAWA) Regulation.	This policy defines a 30m setback along beaches, dunes and marshes where only certain activities are permitted with a WAWA permit and/or an Environmental Impact Assessment Certificate of Determination and/or approval.
Flood Risk Reduction Strategy	2014	Aims to reduce flood risks by identifying flood hazards and fostering planning to avoid and mitigate flood risk	This strategy is leading to updated flood risk maps.
Transitioning to a Low-Carbon Economy, New Brunswick's Climate Change Action Plan	2016	Plan for reducing greenhouse gas emissions while promoting economic growth and increasing New Brunswick's resilience to climate change through adaptation	This action plan includes several commitments related to supporting communities in their adaptation planning and making it mandatory for them to have an action plan.
Local Governance Act	2017	Sets out the powers and responsibilities of New Brunswick's various local entities and defines the legal framework for their general operations.	This act gives councils the authority to make bylaws and lays out the process for doing so.
Community Planning Act SNB 2017, C19 (Replaces a former version, RSNB 1973, c C-12.)	2017	Aims to support sustainable communities, guide local and regional planning decisions, articulate provincial priorities and enable cooperation between jurisdictions and agencies at different administrative levels.	Sets out how planning documents are to be adopted and changed, including rural plans, municipal plans, regional plans and Statements of Provincial Interest. It defines the role that Regional Service Commissions can play in local planning.
Climate Change Act	2018	Legislative framework for carbon pricing and levy on transportation fuels as ways to reduce greenhouse gas emissions and provide revenue for the province's Climate Change Fund	This act defines the conditions for using the Climate Change Fund, including support of municipal adaptation activities.

4.2.1 The Policy Development Process

In 2007, New Brunswick developed its first Climate Change Action Plan (CCAP),¹⁵ which recognized the importance of community-level adaptation and committed to collaboration with them. The province used its Environmental Trust Fund to support action research projects led by universities, community and environmental groups. These created a momentum in the province. New Brunswick was experiencing increasing coastal flooding and erosion, sudden extreme weather events including ice storms and windstorms, heavy precipitation events, early and sudden spring melt causing flooding, and some saltwater intrusion into groundwater.

New Brunswick's Climate Change Action Plan (CCAP) was completely redeveloped in 2016 following extensive consultation to include more concrete actions that would allow it to achieve its goals. Overall, the plan follows the recommendations made by the Select Committee on Climate Change after consultations. Commitments 76 through 82 supporting community adaptation planning (summarized in next section) reflect, word for word, the recommendations of the Select Committee.

New Brunswick's Climate Change Act was established on March 16th, 2018. This act defines the management of the Climate Change Fund and permitted uses for the fund.

4.2.2 Goals and Commitments Related to Supporting Community Adaptation Planning

The New Brunswick Climate Change Action Plan (CCAP) proposes that communities develop adaptation plans to consider the projected impacts of climate change and identify solutions to their climate-related vulnerabilities. Communities can identify solutions after reviewing the predicted nature and scale of these impacts, listing them and ranking them in order of priority according to the level of risk they represent.

The provincial plan aspired to ensure that climate change vulnerability assessments and adaptation plans were completed by 2020 for all cities and for the highest-risk municipalities.

To support that target, and to support community adaptation planning in general, the plan laid out the provincial government's commitment to:

- ensure NGOs and local community partners are supported so they can continue to guide communities through the adaptation planning process;
- phase in the mandatory preparation for and implementation of municipal climate change adaptation plans (MCCAPs) as a condition for local and municipal governments to obtain provincial infrastructure funding. Provide capacity building support to enable this action and develop guidelines to assist in the preparation of the required adaptation plans;
- conduct climate change adaptation planning at a regional scale and empower Regional Service Commissions to coordinate this exercise;

¹⁵ <https://www2.gnb.ca/content/dam/gnb/Departments/env/pdf/Climate-Climatiques/2007-2012ClimateChangeActionPlan.pdf>

- include, in the upcoming modernization to the Community Planning Act and Municipalities Act, the ability to respond to the needs of local governments and their priorities for adaptation;
- implement Statements of Provincial Interest (SPI) under the Community Planning Act to establish province-wide standards and requirements for responding to climate change at the community level, such as flood risk reduction; and
- collaborate with cities, municipalities and Regional Service Commissions.

4.3 Key Findings

In this section, we will examine the factors that have facilitated or impeded the implementation of these commitments. Because the development of adaptation plans by municipalities is not an end in itself but a means to allow communities to adapt to climate change, we will also consider factors that could facilitate or hinder the implementation of adaptation plans by municipalities. Table 4-2 summarizes the types of factors considered in the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019; see also Chapter 2 on the project’s conceptual framework). The following sub-sections will examine the aforementioned factors that are associated with the implementation of community adaptation-related commitments in the provincial Climate Change Action Plan (CCAP).

Table 4-2: Factors that shaped New Brunswick’s choice, implementation and outcomes of actions related to supporting community planning of adaptation¹⁶

Policy goal	Planned action	Motivating factors for the provincial government		Perceived enablers (☺) and barriers (☹) to the implementation and outcomes of provincial action
		Perceived advantages (☺) and disadvantages (☹)	Perceived social pressure, favourable (☺) and unfavourable (☹)	
Ensure that climate change vulnerability assessments and adaptation plans are completed by 2020 for all cities and for the highest-risk municipalities.	Mandatory preparation and implementation of climate change adaptation plans for local governments that apply for provincial infrastructure funding	☺ Local governments are more likely to engage if they make their own choices relative to adaptation.		☺ Communication facilitated by the same provincial government department (ELG) handling issues related to environment, local government and infrastructure funding, and housing the Climate Change Secretariat. ☹ Some plans identify problems without identifying solutions ☹ Reluctance to have conversations about migration because people are deeply connected to the land where they live
	Ensure support to NGOs and local community partners so they can continue to guide communities through the adaptation planning process	☺ These organizations have the trust of communities and can help them achieve adaptation goals.	☺ During consultations, community members and organizations requested support to maintain their collaborations.	☺ The Environmental Trust Fund can support guidance work by NGOs and community partners. ☺ In the future, the new Climate Change Fund, gathering proceeds from carbon pricing, will also be available to support adaptation. ☺ The New Brunswick Environmental Network has coordinated the Climate Change Adaptation Collaborative since 2013.
	Provide capacity building support, collaboration and guidelines to assist in the preparation of the required adaptation plans	☺ Supports the opportunity for stakeholders, councillors and the public to be educated about climate-related land use issues, to change their approach and to improve their land use practices	☺ In consultations, municipalities expressed the need for guidelines, guidance, and technical support	☺ A guidebook was developed in 2015, version 2 was released in 2018 (not a public document). ☺ The online Coastal Community Adaptation Toolkit (CCAT) developed by ACASA ☺ The New Brunswick Environmental Network has been organizing training and workshops on a regular basis since 2013, funded by the Environmental Trust Fund. ☺ A member of the Climate Change Secretariat takes part in the steering committee of each of the adaptation plans developed. ☺ Staff in the Climate Change Secretariat are very dedicated and helpful. ☺ The collaboration of universities and consultants provides expertise for mapping, analysis and synthesis.

¹⁶ See Chapter 2 for an explanation of the organization of this table, based on the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019)

				☹ There is little capacity building provided to small communities.
Conduct climate change adaptation planning at a regional scale and empower Regional Service Commissions (RSC) to coordinate this exercise	<ul style="list-style-type: none"> ☺ Having regional plans and regulations could remove the need to develop bylaws in each local government. ☺ Regional plans would allow neighbouring communities to collaborate better on other issues such as energy and accessibility of services. 			<ul style="list-style-type: none"> ☺ RSCs already offer planning services to municipalities. ☺ RSCs are involved, either directly or indirectly, in supporting the development of community level Climate Change Adaptation Plans. ☺ The new Community Planning Act enables the development of regional plans and regulations (however, they are not mandatory).
		☹ Local governments are not likely to engage in regional planning unless it is mandatory.		<ul style="list-style-type: none"> ☹ At the moment, there are no regional plans in general. ☹ The capacities of RSCs vary across the province. ☹ Many larger municipalities have their own planning services. ☹ Municipalities are not always eager to implement planning principles proposed by Regional Service Commissions.
Establish province-wide standards and requirements for responding to climate change at the community level, such as flood risk reduction	<ul style="list-style-type: none"> ☺ Would make the process more consistent and mandatory ☺ Would avoid citizens questioning why a local government made certain choices 	<ul style="list-style-type: none"> ☺ Municipalities needed these standards to be applied across the board to avoid any communities becoming less attractive places to live due to more restrictive regulations. ☺ Some RSCs require standards to avoid discrepancies between regions. 		<ul style="list-style-type: none"> ☺ The New Brunswick Planners Association conducted a project over three years to draft Provincial Statements of Interest. They drafted six different statements and included considerations related to climate change adaptation.
		☹ Such standards could be unpopular with the private sector and some communities.		☹ The provincial government has not yet approved the six Statements of Provincial Interest drafted by the New Brunswick Planners Association.

4.3.1 Factors Associated with Mandatory Adaptation Planning

As a mechanism for making adaptation plans mandatory for vulnerable municipalities, the provincial government stated that having an adaptation plan would be a condition to receiving provincial infrastructure funding. The municipalities determined to be the most vulnerable by the Climate Change Secretariat were those that were either located along the coast or along the Saint John River, which floods regularly. In addition to these, municipalities that had experienced serious damage related to natural hazards were included. All municipalities approached by the Secretariat collaborated. In addition, the preparation and implementation of adaptation plans is mandatory for all cities.

In New Brunswick, the same governmental department is responsible for the environment and local government. The Climate Change Secretariat is housed within this department. According to Robert Capozzi, Director of Climate Change Adaptation at the Climate Change Secretariat of New Brunswick's Department of Environment and Local Government (ELG,) this greatly facilitates communications between the section that approves infrastructure funding and the Secretariat. This makes it much easier to implement mandatory adaptation planning and consideration of the effects of climate change in provincially funded local infrastructure.

In addition, it is mandatory to consider climate change risks in the development of environmental impact studies. The federal government also requires the application of the Climate Lens¹⁷ to infrastructure projects it co-funds through various programs.¹⁸ The Climate Lens requires considering the impacts of climate change in the location, design and management of infrastructure. These requirements reinforce the social norm of considering the impacts of climate change.

As of 2020, 35 of the 104 municipalities have completed their adaptation plans and 17 more are currently in development. This success is not only due to the requirement for plans but also to the different support mechanisms put in place by the provincial government, in collaboration with the New Brunswick Environmental Network, Regional Service Commissions and NGOs. The following sections will examine in more detail the factors that have facilitated or acted as barriers to this support.

4.3.2 Factors Associated with Supporting NGOs and Local Community Partners

As mentioned earlier, the Government of New Brunswick has been supporting adaptation work and action research with its Environment Trust Fund, in line with its 2007 Climate Change Action Plan. From 2009 to 2016, the provincial government participated in the Atlantic Coastal

¹⁷ <https://www.infrastructure.gc.ca/pub/other-autre/cl-occ-eng.html>

¹⁸ <https://www.canada.ca/en/office-infrastructure/news/2018/06/backgrounder-applying-a-climate-lens-to-infrastructure-projects.html> There are thresholds to Climate Lens requirements: some programs require it for all projects and others only when the total estimated cost is over \$10 million.

Adaptation Solutions Association (ACASA),^{19,20} which was one of six Canadian Regional Adaptation Collaboratives (RAC) co-funded by Natural Resources Canada. This collaborative aimed to develop tools for municipalities. In New Brunswick, workshops were organized in the context of this collaborative in 2011 and 2012 to present project results. In 2013, the New Brunswick Environmental Network (NBEN) launched the provincial Climate Change Adaptation Collaborative,²¹ supported by the Environmental Trust Fund. Since then, the collaborative has been organizing annual conferences, bringing together practitioners from environmental NGOs, universities, municipalities, Regional Service Commissions and the provincial government, as well as planners and engineers, and allowing them to share information about their respective projects. Some municipalities started working on adaptation plans, supported by consultants and in some cases with the help of NGOs. Several of them used the online Coastal Community Adaptation Toolkit (CCAT) developed by ACASA.

The Environmental Trust Fund has been a major factor enabling the provincial government to support NGOs and community partners in guiding communities. This fund receives half of the deposits on returnable bottles and cans under the Beverage Container Program.²² The provincial government uses the fund, in part, to support the development of adaptation planning by municipalities through a variety of mechanisms depending on the local partnerships in place. This process supports the partners financially and helps build their capacity to support communities.

The province most often grants the funds to the local governments who hire a consultant or an organization to guide them through the planning process and to develop the plan. When municipalities do not already have partnerships with such organizations, the Climate Change Secretariat provides them with a list of organizations in their region. These are often non-profit organizations or cooperatives. In some cases, the Secretariat grants the funds directly to organizations who work with various municipalities. For example, in the Acadian Peninsula, the Valorès Institute²³ supports all 14 municipalities in the region under a project called Adaptation PA.²⁴ This institute develops maps of zones at risk of coastal erosion or flooding and facilitates the planning process. The Acadian Peninsula Regional Service Commission is also involved in this collaboration and supports municipalities of the region to develop bylaws to regulate development in areas identified as being at risk.

Raissa Marks, former Executive Director of the New Brunswick Environmental Network (NBEN), has observed the evolution of knowledge about climate change impacts and adaptation in participants at the conferences and other activities organized by the Climate Change Adaptation Collaborative since 2013. Ms. Marks noted, however, that not all municipalities participate in the

¹⁹ <https://atlanticadaptation.ca/en>

²⁰

https://www2.gnb.ca/content/gnb/en/departments/elg/environment/content/climate_change/content/adaptation.html

²¹ <https://nben.ca/en/groups-in-action/climate-change-adaptation>

²²

https://www2.gnb.ca/content/gnb/en/services/services_renderer.3975.Beverage_Container_Program.html

²³ Previously the Coastal Zone Institute, affiliated with Moncton University and a private centre since 2002

²⁴ <https://adaptationpa.ca/en/>

collaborative and that sometimes key individuals on staff or council do not understand the relevance of adapting to climate change.

A consultant who has supported various municipalities in the development of their plans highlights the need to foster a long-term process of incorporating climate change into planning within each municipality, and encourage consideration of climate change adaptation and mitigation in all municipal decisions. Such consultants need to engage the public, councillors and municipal staff. This engagement closes the loop by allowing the public to influence council decisions.

The Pays de Cocagne Sustainable Development Group has facilitated the adaptation planning process for adaptation plans with the Council of Cocagne (a rural community incorporated in 2014) and the Advisory Committee of Grande Digue (a district of local services), with the collaboration of the Kent Regional Service Commission and the University of Moncton. These partners have been working together on climate change adaptation for more than ten years. Nonetheless, Serge LaRochelle, Project Coordinator, feels that one of the greatest difficulties is consultation with the overall population. On one hand, community officials are reluctant to present detailed flood maps without having solutions to offer. He also thinks that public consultation must meet people wherever they are in their psychological and emotional journey to face the realities of climate change. Those who come to public meetings are willing to speak about their challenges and about how they have started to adapt. But there are people who live in at-risk areas who are not willing to talk about the risks they face. We must find ways to reach them in a respectful way. He feels that it is important to consider risk, but that it could be easier to engage people by first identifying the community's most important cultural, social and physical assets and then discussing how to maintain those in the face of risk.

Almost all participants interviewed highlighted the important role that particular individuals have had in their motivation to work on climate change adaptation. It seems that the success of the provincial government's approach on climate change-related issues has hinged on the independent efforts of some very dedicated civil servants, consultants, regional and municipal planners, NGO employees and university professors.

Once established, the Climate Fund could contribute to supporting the costs of measures for adapting to current and future climate conditions. It could also cover the costs of public education, outreach and engagement; research into the development and demonstration of adaptation measures; and development of climate change policy and measurement, tracking and reporting of climate change initiatives. It could therefore complement the Environmental Trust Fund in supporting NGOs and other community partners.

4.3.3 Factors Associated with Providing Guidelines and Assistance in Preparation of the required adaptation plans

The Climate Change Secretariat prepared a set of guidelines that it shares with communities and partners. These guidelines include information, recommendations and examples for several distinct steps in the process: scoping and organizing; grouping facts and figures about climate change in the community based on different scenarios; assessing vulnerability; identifying

adaptation priorities, options and actions; and developing an adaptation plan. The section on facts and figures presents the results of climate projections developed by Ouranos (Roy & Huard, 2016). Réal Daigle produces regular updates of sea level rise and flooding estimates for New Brunswick's coastal areas, through provision of consulting services to the provincial government's Department of Environment and Local Government (Daigle, 2020).

To ensure that these plans lead to action, the Climate Change Secretariat is developing a tracking template based on a study by the University of New Brunswick. In addition, a member of the Secretariat sits on the Advisory Board that accompanies the development of each adaptation plan.

The New Brunswick Environmental Network (NBEN) is coordinating a project called "Natural and Nature-Based Infrastructure Capacity Building for Engineers, Land Use Planners and Environmental Organizations in New Brunswick" under the scope of Natural Resources Canada's Building Regional Adaptation Capacity and Expertise (BRACE) program.²⁵ The provincial government had identified as a gap to adequate adaptation the capacity to design and preserve existing natural and nature-based infrastructure. Indeed, features such as marshes, bogs and sand dunes play key roles in protecting coastal areas from floods and erosion. This project thus aims to develop the necessary skills, partnerships, networks, training, testing and support to give stakeholders the capacity to reduce climate-related risk through understanding and using natural features or building nature-based features.

4.3.4 Factors Associated with Regional Planning of Climate Change Adaptation

Since 2017, the Climate Change Secretariat has been working with the Chaleur Regional Service Commission (RSC) as a pilot region for regional adaptation planning. Together, they created a permanent process, with a permanent Regional Committee on Climate Change Adaptation. To date, three RSCs have completed regional adaptation plans (Chaleur and the Northwest and Southwest regions) while others are in the plan development process (Government of New Brunswick, 2020 c).

The Chaleur RSC first worked with the Valorès Institute to develop risk mapping and conduct an assessment, and then with the WSP consulting company to explore its land use planning options. This RSC is developing a set of common land use bylaws for the region while also supporting municipalities in the development of their adaptation plans and bylaws. However, Marc Bouffard, Director of Planning with the Commission, explains that municipalities in his region requested regional standards. They will be unwilling to adopt restrictive bylaws if equivalent ones are not adopted by neighbouring municipalities. This is because they are afraid that they will be penalized in their development if their bylaws are more restrictive than those of neighbouring communities. The Chaleur RSC is presently helping the village of Petit-Rocher in the development of its municipal plan, using information from the regional adaptation planning initiative. The plan states that bylaws considering sea level rise and storm surge will be proposed only when all municipalities in the region agree to implement them. But he notes that the neighbouring Districts

²⁵ <https://www.nrcan.gc.ca/climate-change/impacts-adaptations/building-regional-adaptation-capacity-and-expertise-brace-program/21324>

of Local Services do not have local planning and that even a regional approach would not apply there.

Mr. Bouffard thinks that if regional planning is not required by the provincial government, municipalities will not have the incentive to take part in it. In 2013, when the provincial government created the Regional Service Commissions, it made development of regional plans mandatory by 2018. However, the Community Planning Act, established in 2017, made regional planning optional. Until now, there have been no regional plans developed in New Brunswick.

As previously mentioned, the Acadian Peninsula RSC is supporting municipalities by developing bylaws with them in line with the assessment and maps developed for their adaptation plan. According to Benjamin Kocyla, Director of Planning at the Commission, the bylaws developed for the region have a common logic, which is to prohibit building in areas at risk of erosion and to adapt buildings in areas at risk of flooding. Municipalities have decided which return period to consider for mapping flood risks related to storm surges. The bylaws are designed in such a way to avoid people being surprised by storm surges, for example by mandating that any residential floor of a building must be higher than the corresponding water level. Thus there could be accessibility issues during a flood, but at least the lives of the inhabitants would not be in danger.

Serge LaRochelle from the Pays de Cocagne Sustainable Development Group would like to see adaptation tackled in regional strategic planning. He sees adaptation as not only related to zoning bylaws but also, by reducing the impacts of storms, to ensuring greater local autonomy in food and energy distribution. Regional planning could address issues such as, for example, ensuring that various communities' road access to grocery stores could be maintained despite flooding, or that damages to the electrical grid in one location would not limit power for an entire area.

4.3.5 Factors Associated with Developing Province-Wide Standards and Requirements

The provincial government has chosen Statements of Provincial Interest (SPIs) as the mechanism to establish province-wide standards. These are defined in the Community Planning Act (Sections 13-17) and aim to protect provincial interest in the use and development of land.

The New Brunswick Planning Association worked for three years on a project to develop six Statements of Provincial Interest. Benjamin Kocyla, Director of Planning at the Acadian Peninsula RSC, participated in this endeavour. However, the provincial government has not yet adopted the six statements. In Mr. Kocyla's opinion, this is not an obstacle for municipal adaptation because municipalities can create their own bylaws. However, adopting a bylaw is a long process requiring public consultation. Some municipalities have not yet adopted their bylaws several years after they were developed by the RSC. Standardized restrictions from the provincial government would make the process more straightforward as well as mandatory for municipalities.

Marc Bouffard, Director of Planning at the Chaleur RSC, explained that the municipalities in his region are requesting a standardized approach and that he personally feels uncomfortable with regions having different approaches and standards. He expressed a wish to have standardized guidelines from the provincial government regarding the municipal approach to planning and the flood statistics used by municipalities to determine regulations. Another advantage of a

standardized approach would be that it would also apply to unincorporated areas or Districts of Local Services. Mr. Bouffard notes that people do not seem to understand how probable a 1% flood actually is. He is also concerned that residents who suffer damages after following construction specifications in the bylaws could hold municipalities liable. He notes that the water heights used to map areas at risk of flooding during storm surges do not take into account the effects of waves, which can sometimes be 2 to 3 meters high. Finally, he would like to see provincial-level reflection on coastal defense structures. In recent years, residents have developed such structures to protect their lots from erosion, but their effectiveness seems to be compromised by a lack of uniformity. He also notes that many of these structures create significant obstacles to walking along the beach.

Another participant expressed concern about bylaws that allow development in zones at risk of coastal flooding if constructions respect a vertical setback, in other words, if they are built higher up. This participant thinks that this could lead to huge emergency management issues and would like the provincial government to step in to prevent more people from putting themselves at risk.

Various participants also pointed to the absence of specific provincial regulations enforcing the Coastal Areas Protection Policy.²⁶ Two participants mentioned their concern about Watercourse and Wetland Alteration (WAWA) permits being issued in questionable cases. Overall, these participants highlighted weaknesses in the application of provincial-level policies meant to protect environments important to a community's adaptive capacity.

4.4 Discussion

This case provides an example of a province that has included in its Climate Change Action Plan the mechanisms to raise awareness as well as to require and support community adaptation planning. In reference to the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019), the Government of New Brunswick has acted on all types of factors motivating and increasing the control of communities in their adaptation.

The Environmental Trust Fund has been an especially useful tool for the province to support municipalities and their partners, Regional Service Commissions and networking among adaptation practitioners through the Climate Change Adaptation Collaborative. In future, the new Climate Fund will increase this support.

We notice that there has been a “snowball effect” whereby support given by the province builds the capacity of individuals and organizations supporting community adaptation processes, who then in turn exert social pressure on the government to make further supportive commitments.

Delays in the production of Statements of Provincial Interest (SPIs) leave the responsibility of developing municipal bylaws to prevent coastal erosion and flooding in the hands of the

²⁶ The Coastal Areas Protection Policy identified the Watercourse and Wetlands Alteration Regulation (WAWA) as its application mechanism. However, this regulation is less restrictive than the principles expressed in the policy. It does not apply to the maritime domain, which is under federal jurisdiction. The WAWA regulation protects only 56% of the coasts because it is limited to coastline areas that intersect with watercourse outlets.

municipalities and Regional Service Commissions. This results in a bottom-up approach in some areas, but many of the actors involved continue to request provincial standards. Overall, participants have emphasized that a lack of provincial standards and regulations, and weaknesses in the enforcement of regulations protecting coastal environments, are undermining the capacity of municipalities to adapt to climate change.

Our interviews also highlighted the important role that individuals in provincial governments, Regional Service Commissions and NGOs can play in creating an environment that is supportive of community adaptation planning. These actors can also have important roles in influencing provincial policy.

This case study, however, is limited by a lack of interviews conducted at the municipal level, which makes it impossible to identify motivating factors as well as enablers/barriers that impact municipal adaptation decisions.

4.5 Conclusions and Recommendations

Increasing climate-related risks have motivated the Government of New Brunswick to foster the development of adaptation plans in the province's vulnerable municipalities. A momentum of reflection on climate change adaptation facilitated by the New Brunswick Environmental Network (NBEN) contributed to this motivation. The province chose several means (instruments) for this purpose, including a combination of requirements, support mechanisms, and standards. The province has been able to implement capacity building support and guidelines and has supported a variety of actors (NGOs, consultants, Regional Service Commissions, and universities) working with municipalities. It has made Municipal Climate Change Adaptation Plans (MCCAPs) a requirement for obtaining provincial infrastructure funding, creating a norm to abide to. However, the Statements of Provincial Interest (SPIs) developed with the intention of providing province-wide standards have not yet been approved or implemented. This lack of province-wide standards is perceived as a barrier by those who support municipalities in their adaptation planning. While it fosters a bottom-up approach through some municipalities developing their own bylaws, a province-wide standard approach would be a faster, more straightforward and more consistent process that would potentially encourage better compliance by individuals.

Factors that have facilitated the implementation of these means by the provincial government include:

- having one provincial department dedicated to managing both the environment and local government;
- the dedication of the Climate Change Secretariat staff;
- the Environmental Trust Fund as a source of funding;
- the existence of numerous environmental and community NGOs;
- the Climate Change Adaptation Collaborative, coordinated by the New Brunswick Environmental Network (NBEN);
- the important role of Regional Service Commissions (RSCs) in supporting communities;
- collaborations with universities;

- development of local sea level rise projections and storm surge studies by consultants; and
- mapping of flood risks based on the sea level rise and storm surge projections developed by experts.

Barriers identified by persons supporting municipalities in their adaptation planning include:

- the fact that many residences and infrastructures are located in at-risk areas;
- people’s attachment to the place where they live hindering conversations about migration as a possible solution;
- the reluctance of some local governments to consult the public before proposing solutions;
- adaptation plans often highlighting problems without identifying solutions;
- the lack of regional planning, and the absence of provincial requirements for it;
- a lack of province-wide standards, due to lack of adoption of Statements of Provincial Interest (SPIs);
- local governments being reluctant, in some cases, to enact restrictive bylaws unless other local governments make the same commitment;
- a lack of specific regulations for the Coastal Areas Protection Policy;
- the insufficiency of the Watercourse and Wetland Alteration (WAWA) Regulation for protecting wetlands and coastal areas; and
- small communities’ limited resources for implementing adaptation options.

4.6 Acknowledgements

The research team thanks the New Brunswick Climate Change Secretariat for their collaboration. As mentioned before, this chapter is based on interviews with Raissa Marks, Director of the New Brunswick Environmental Network; Sabine Dietz, Consultant with the Aster Group; Benjamin Kocyla, Director of Planning at the Acadian Peninsula Regional Services Commission; Marc Bouffard, Director of Planning at the Regional Services Commission of Chaleur; and Serge Larochelle, Project Coordinator at the Pays de Cocagne Sustainable Development Group. The reflections in the chapter also benefited from discussions with Robert Capozzi of the Climate Change Secretariat at the Department of Environment and Local Governance; Marion Tétégan Simon and Manuela Cess at Institut Valorès in Shippagan; Zaheera Denath at the New Brunswick Environmental Network, Omer Chouinard, retired professor at Université de Moncton, Mélanie Madore, at Public Health New Brunswick; and Lindsay Bolton, Water Resources Engineer at CBCL Limited in Saint John, New Brunswick.

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Chapter 5 Massachusetts' Municipal Vulnerability Preparedness (MVP) program.

Abstract

The findings from this case study suggest that a partnership with environmental groups helped the Commonwealth of Massachusetts develop a municipal assistance program that involves local officials and relevant stakeholders in hazard mitigation and climate adaptation planning. Examples from different cities and towns highlight the important role that vendors play in supporting planning activities and how the use of nature-based solutions for climate adaptation is rewarded by the program. These examples also expose advantages and barriers that arise when using a vendor system, the need for more involvement of vulnerable groups, or how difficult is to address relevant problems within short-term action grants.

5.1 Introduction

Massachusetts is bordered by the Atlantic Ocean to the east, the states of Connecticut and Rhode Island to the south, New Hampshire and Vermont to the north, and New York State to the west. It has a population of 6,892,503 as of the 2019 census, covering an area of 20,202 square miles. Massachusetts faces a range of climate change-related risks resulting from increased rainfall, rising sea levels and associated impacts such as storm surges and flooding. Communities in Western Massachusetts are also at risk due to extreme weather events leading to increased frequency and intensity of river floods or heat waves, among others impacts.



5.2 The research

Researchers from the Sustainable Solutions Lab (SSL) at the University of Massachusetts Boston (UMB) examined Massachusetts' Municipal Vulnerability Preparedness (MVP) program, including what motivated its development and what factors enabled or were barriers to its implementation and outcomes. The factors examined included those that motivated, enabled and constrained municipalities in carrying out the actions they had planned as part of their efforts to adapt to a changing climate. The team identified goals and planned actions from MVP program documentation, existing planning reports and action grant proposals. Interviews and meetings were conducted with officials in the Commonwealth of Massachusetts' Executive Office of Energy and Environmental Affairs (EEA), officials of the towns of Wellesley, Watertown, Dartmouth, and Somerville, consultants working as vendors of the program and participants who attended

planning workshops. The team also conducted observations in municipal planning meetings in Watertown and Dartmouth.

This chapter summarizes the main measures adopted by the MVP program to support municipalities. It also summarizes perceptions expressed in the interviews and the main observations of researchers. It organizes them according to the project's conceptual framework, based largely on the Theory of Reasoned Goal Pursuit (Ajzen & Kruglanski, 2019). This framework considers enablers and barriers, as well as motivating factors, including perceived advantages and disadvantages of the policy measures, and perceived social pressures. This chapter is based on a more detailed working paper produced by SSL (Belloy, Sulewski and VanDeveer, 2021).

5.3 The Policy Development Process

Table 5-1 presents the main policies framing the MVP program and the following paragraphs describe the process that led to the program.

In 2008, the Commonwealth of Massachusetts adopted the Global Warming Solutions Act (GWSA). This act requires reductions in greenhouse gas emissions and launched the Massachusetts Clean Energy and Climate Change Plan for 2020. The EEA established two advisory committees to provide input on the implementation of the GWSA, one related to climate protection and green economy, and another related to climate change adaptation. The latter coordinated the Massachusetts Climate Change Adaptation Report (Commonwealth of Massachusetts, 2011). This report recognized the vulnerability of many types of infrastructure that are typically municipal, such as buildings, roads, wastewater management, stormwater management, drinking water distribution, waste management and waste disposal. It also acknowledged the importance of municipalities in dealing with heat waves and that municipal boards of health are responsible for public health issues and enforcing public health regulations. The report called for Massachusetts to “Work with and provide incentives for municipalities to integrate the appropriate regional climate action plan into master, open space, and other local plans in order to ensure that they address climate change preparedness, resiliency, and adaptation over a long-term horizon” (Commonwealth of Massachusetts, 2011, p. 104). Although there was not yet a clear mandate, some organizations worked with the administration and legislature to design a program to support municipalities in their plans for climate adaptation.

In September 2016, Governor Charlie Baker issued Executive Order 569 entitled “Establishing an Integrated Climate Change Strategy for the Commonwealth”. The Order addressed greenhouse gas (GHG) emissions reductions, climate change resiliency and adaptation, and planning and assessment of climate change risks. It provided a roadmap of actions by different agencies in Massachusetts. These included coordination between the Secretary of the EEA and the Secretary of Public Safety to develop a Climate Adaptation Plan within two years. During the development of the plan, the two Secretaries were also to provide a framework and technical assistance to

cities and towns to assess their vulnerability to climate change and extreme weather events, as well as to identify and implement adaptation options and strategies.

The Commonwealth created the MVP program as a means to provide both the framework and technical assistance to support cities and towns across the state to identify and address climate change hazards and vulnerabilities, prioritize critical actions, and increase community resiliency. In 2017, the EEA offered the first MVP planning and action grants. Planning grants allow municipalities to complete a vulnerability assessment and develop an action-oriented adaptation plan. Municipalities that complete the planning process receive certification as an “MVP community” and are then eligible for MVP action grant funding, among other benefits of the designation.

The EEA created Resilient MA, the Massachusetts Climate Change Clearinghouse, as a gateway for policymakers, local planners, and the public to identify and access climate data, maps, websites, tools, and documents relevant to climate change adaptation and mitigation across Massachusetts. The Northeast Climate Adaptation Science Centre (NE-CASC) at the University of Massachusetts Amherst develops the climate projections shared through the Clearinghouse. It uses a regional model that allows downscaling of the results of global climate change models.

Since its launch in 2017, the MVP program has completed four 1-year grant cycles. In 2020, 287 of the 351 municipalities in Massachusetts (82%) had earned MVP certification and 127 (36%) had received subsequent action grants. Overall, the Commonwealth has awarded \$33 million USD in planning and action grants through the program. The average amount of an action grant in Fiscal Year 2020 was \$195,000 USD.

In July 2018, the Massachusetts legislature enacted Bill H.4835, known as the “Environmental Bond”, for which the full title is “An Act promoting climate change adaptation, environmental and natural resource protection, and investment in recreational assets and opportunity”²⁷. This new law, based on Executive Order 569, raised 2.4 billion USD to work on climate change adaptation, including expanded funding for the SHMCAP, the MVP Program, and Resilient MA. Its emergency preamble allowed it to become effective immediately.

In 2018, Massachusetts unveiled the SHMCAP, integrating climate adaptation strategies with hazard mitigation planning to encourage compliance with federal requirements for disaster recovery and hazard mitigation funding. In September 2019, Governor Charlie Baker launched the Resilient Massachusetts Action Team (RMAT), an inter-agency team coordinating SHMCAP implementation.

²⁷ <https://malegislature.gov/Bills/190/H4835>

Table 5-1: Main policies framing the MVP program

Title	Date	Description
Global Warming Solutions Act (GWSA) was signed into law	August 2008	This act is a comprehensive regulatory program to address climate change and mandates EEA to start an adaptation process.
Massachusetts Climate Change Adaptation Report	September 2011	This report covered five different sectors, bringing together over 300 stakeholders for input. Not intended as a comprehensive plan, it defined the issues at hand and made recommendations for next steps.
Community Resilience Building Workshop Guide	February 2016	This guide defines the method used by all MVP vendors in the planning workshops.
Executive Order 569: Establishing an Integrated Climate Change Strategy for the Commonwealth	September 2016	This executive order concerns greenhouse gas reduction, resilience and adaptation to climate change as well as planning and assessing related risks. It enacts the development of the SHMCAP and MVP Programs.
Resilient MA: Massachusetts Climate Change Clearinghouse , which includes an interactive map	2017	Source of climate change projections: Northeast Climate Adaptation Science Centre at University of Massachusetts Amherst
Bill H.4835 An Act promoting climate change adaptation, environmental and natural resource protection, and investment in recreational assets and opportunity (Environmental Bond Bill)	July 2018	This Bill provided additional financial resources for the MVP program and SHMCAP implementation
State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) for the Commonwealth.	September 2018	This plan integrates climate change impacts and adaptation strategies with hazard mitigation planning.

5.4 What Motivated and Enabled Massachusetts' Policy Choices and Implementation?

Launched in 2017, the MVP program grew out of a strong desire to work with cities and towns to prepare for the impacts of climate change and to improve the resilience of communities. As mentioned earlier, the need to work with municipalities had been identified in the Climate Adaptation report in 2011. The motivation came from within the Commonwealth, as supporting municipalities was not a federal requirement. The commonwealth created the MVP program as a means to implement some of the commitments made in its Executive Order 569.

The influence of environmental groups such as TNC and Mass Audubon, who have long-time experience working with government officials and constituencies, helped shape requirements for the participation of municipal authorities, relevant stakeholders and local communities in the MVP program. In addition, the MVP Core Principles require the involvement of Environmental Justice populations in meaningful decision-making, echoing the Commonwealth's policy in that respect²⁸.

²⁸ In 2002 the EEA issued an Environmental Justice (EJ) policy that identified Environmental Justice populations defined by socioeconomic, racial, ethnic and/or language factors. See https://www.mass.gov/files/documents/2017/11/29/2017-environmental-justice-policy_0.pdf

The MVP developed alongside the State Hazard Mitigation and Climate Adaptation Plan. Some of the challenges mentioned in a [presentation](#) on the SHMCAP also apply to the MVP. These included:

- changing hazard taxonomy to reflect climate change impacts on existing hazards;
- integrating climate change into the assessment methodology;
- effectively engaging and capturing relevant input from a broad audience; and
- downscaling global models to the state level.

To overcome these challenges, the MVP program used the TNC-developed Community Resilience Building Workshop Guide and trained vendors who could provide facilitation and planning services to municipalities. Participating municipalities applied for a planning grant and used a certified vendor to conduct the workshops and develop a planning report.

The program also hired six regional coordinators to encourage regional collaboration and facilitate the work between municipalities that may share common climate risks and strategies to increase resilience. To stimulate such collaboration, action grant proposals that include two or more municipalities in their work receive extra points in their score.

5.5 What factors Motivate or Enable Municipal Participation in the MVP?

Motivating factors for cities and towns to participate in the MVP include the possibility of reducing the risks heightened by climate change. In addition, the possibility of obtaining certification required to apply for action grants is an incentive to complete the MVP planning process.

Enablers for cities and towns include:

- the role vendors play in facilitating the planning process and the expertise they bring;
- the supporting role of regional coordinators in connecting with vendors and other aspects of proposal development;
- the possibility of teaming up with other municipalities to propose collaborative projects;
- short workshops (one day or two 4-hour sessions) favouring better attendance; and
- the easy-to-understand approach laid out in the *Community Resilience Building Workshop Guide*.

Because it is less technical and expert-driven than a formal vulnerability assessment, the MVP planning workshop has the potential to foster a community-driven process. We note that regional planning agencies sometimes play the role of vendors, like the Metropolitan Area Planning Council (MAPC) serving some towns in the Greater Boston region. Some vendors go further in public consultation, for example administering surveys and conducting focus groups with vulnerable populations. Many municipalities have developed relationships with MVP vendors through previous state programs, such as the Green Communities.

5.6 Barriers faced by municipalities

Barriers faced by municipalities included:

- municipal staff having limited time to devote to the planning process;
- difficulty translating a multitude of priorities into adaptation actions;
- the short window of time for workshops and a prescribed approach that may limit in-depth discussions and the possibility of covering all vulnerabilities that require action;
- workshops often lacking representation from certain vulnerable groups including low-income populations, immigrants, non-English speakers and people with disabilities;
- the long process required to make changes to municipal regulations; and
- a lack of regional governance or collaboration mechanisms

The first series of action grants lasted only one year, which limited the choice of eligible projects. In response to requests from municipalities, the EEA increased the length of the grants, but the projects for a given fiscal year must nonetheless be completed by the middle of the following year. The length of grants remains a constraint for supporting some lengthier processes involved in building community resilience.

Otherwise, the research team found that only a third of municipalities that conducted MVP planning workshops and have Environmental Justice populations included specific mention of the term “environmental justice” in their planning reports. After the first cycle of the program, the MVP management liaised with different organizations to reflect about how to improve the participation of Environmental Justice populations in the planning workshops.

Regarding the lack of regional governance and collaboration mechanisms, we note that some regional non-profits like the Resilient Mystic [River] Collaborative have contributed to fill this gap. However, there remains a need to develop more partnerships and to define responsibilities at the regional level. Factors like the elimination of traditional county-level government in the late 1990s and Massachusetts’ adherence to the principles of home rule, enhancing self-governance in cities and towns, may pose an obstacle for regional adaptation collaboration. Such collaboration is necessary, for example, to tackle flooding problems that cross municipal boundaries. Massachusetts has competent regional planning agencies, but they have no regulatory power.

Some participants have criticized the Community Resilience Building framework as being still too technical to allow in-depth discussions and the engagement necessary to develop solutions. There are trade-offs between participatory and technical approaches.

5.7 Discussion

Among the determinants of success of the MVP program, the team at Sustainable Solutions Lab considered the role played by vendors of services to municipalities. All vendors receive training and certification to facilitate MVP planning processes. However, the vendors represent a broad range of agencies with different expertise, some in engineering, others in community engagement. As a result, vendors facilitating the planning process will bring particular skills to the conversation and can influence the decision-making process in different ways, depending on their background. In addition, towns that already have a clear plan in mind before embarking on the planning process may select the vendor based on whether the vendor's skills align with the kind of project that town wants to pursue. So, while the MVP program provides training across the board and a framework to provide a degree of consistency in the planning processes across the state, a wide variety of actors, from vendors to municipal departments to engaged civic groups, can also exert considerable influence on which kinds of projects get selected.

5.8 Conclusions and Looking Forward

The findings from this case study suggest that a partnership with environmental groups helped the Commonwealth of Massachusetts develop a municipal assistance program that involves local officials and relevant stakeholders in hazard mitigation and climate adaptation planning. Examples from different cities and towns highlight the important role that vendors play in supporting planning activities and how the use of nature-based solutions for climate adaptation is rewarded by the program. These examples also expose advantages and barriers that arise when using a vendor system, the need for more involvement of vulnerable groups, or how difficult is to address relevant problems within short-term action grants.

The study noted that further progress is needed to ensure that municipalities work towards reducing inequalities in vulnerability and adaptive capacity. More research should focus on exploring whether outreach efforts result in increased participation of Environmental Justice population in a way that allows their concerns to translate into concrete actions.

For those municipalities receiving an action grant, research should address whether priorities for these communities resulted in just adaptation efforts and whether unintended consequences were taken into consideration. To date, most adaptation research and practice focuses on the processes that establish conditions for affected communities to participate in planning, but not so much on how affected communities are given power over the decisions that affect them.

Other opportunities for further research or reflection include examining avenues to increase regional governance of adaptation issues that cross municipal boundaries, such as in watersheds, valleys, and other areas exposed to similar climate impacts.

5.9 References

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Chapter 6 Consideration of Climate Change Impacts in the Environmental Assessment of Bank Stabilization Projects in the North Shore Region, Québec

Abstract:

Bank stabilization projects are considered to be climate change adaptations, but they can have significant environmental impacts and even accelerate coastal erosion in some cases. Environmental assessment of such projects is thus important to avoid adaptations that could increase some communities' vulnerability to climate change. This assessment obliges developers to consider removal of infrastructures from the areas that pose risks as well as so-called soft stabilization options, such as beach replenishment and phytotechnology. Furthermore, consideration of climate change effects in environmental impact studies has been mandatory in Québec since March 2018. Moreover, the recent acceleration of coastal erosion and submersion processes during storms is threatening vital roads in some regions. Unfortunately, some bank stabilization projects become urgent and may be exempted from the Environmental Impact Assessment and Review Procedure (PÉEIE) and thus miss out on its benefits.

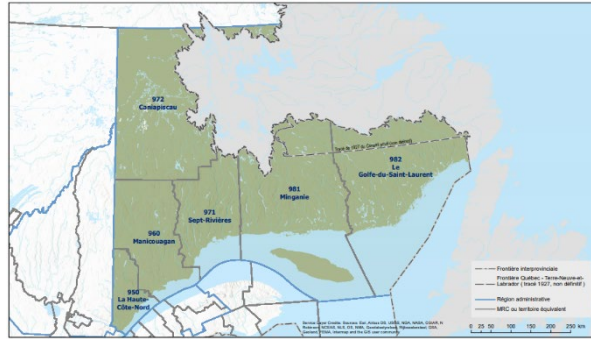
This case study pertains primarily to climate change adaptation in one of the PÉEIE tools: the directive regarding the conduct of an environmental impact study for bank stabilization projects. The study also concerns the challenges encountered in the development and environmental assessment of bank stabilization projects in the North Shore region. Moreover, it underscores the importance of land-use tools for developing a long-term vision and for planning the relocation of some infrastructures when it is unavoidable.

6.1 Introduction

6.1.1 Why this Study?

The project team and the advisory committee selected environmental authorizations as a study topic because it is a practice that can help encourage climate change adaptation by developers. When the project began, Québec had just incorporated climate change consideration in its environmental authorization scheme, as part of the modernization of the *Environment Quality Act* (EQA; Chapter Q-2). To contribute to the reflections of the Coastal Management Group of [Canada's Climate Change Adaptation Platform](#), the study centred on the assessment of bank stabilization projects and aimed at considering examples on the coast of the St. Lawrence. It

focused on the North Shore region because it is the location of the first project in which the effect of climate change was considered in the environmental assessment process. The localities and human activities in this region are established along the estuary and the gulf of the St. Lawrence. Route 138 is the only access road to the communities in this region and it is threatened in several places by coastal erosion (Drejza, Friesinger & Bernatchez, 2014). Québec's Ministry of Transportation (Ministère des transports du Québec [MTQ]) is the most frequent applicant for environmental authorizations concerning bank stabilization projects in this region. This issue of maintaining road infrastructures exists in other Québec regions as well, including Gaspésie, Bas-Saint-Laurent and Îles-de-la-Madeleine.



In Eastern Québec, climate change is causing a decrease in sea ice coverage in winter, thus contributing to an increase in the erosive impacts of waves on the coast. The increase in storm severity and relative rise in sea levels are also heightening the risks of erosion and of submersion. Bank stabilization projects are frequently contemplated as adaptive solutions to these impacts of climate change. However, these projects may have significant negative environmental consequences, such as greater risks of erosion in the long term (Bernatchez & Fraser, 2012). If poorly planned, they may be maladapted and thus increase the vulnerability of the area to the effects of climate change. Environmental authorization processes could help prevent maladaptation.

The study focused on the Environmental Impact Assessment and Review Procedure (PÉEIE), which applies to projects that pose high risks for the environment.

6.1.2 Our Approach

The project team first studied the literature concerning the environmental authorization scheme, to identify the associated public policies and regulatory tools. It examined, more specifically, how climate change adaptation was taken into account in these public policies and their tools.

The team then collaborated with Mrs. Isabelle Nault, team leader at the directorate of environmental assessment of water and industrial projects (Direction de l'évaluation environnementale des projets hydriques et industriels) at the Ministry of the Environment and the Fight Against Climate Change (Ministère de l'Environnement et de la Lutte contre les changements climatiques [MELCC]), to identify projects that could be the topic of an in-depth study. The stabilization and protection project on the banks of the Mingan River on the territory of the Mingan Reserve municipality ([Projet de stabilisation et de protection des berges de la rivière Mingan sur le territoire de la municipalité de la Réserve de Mingan](#)), initiated by the MTQ, was chosen for this purpose. After reviewing the literature relating to this project, the team conducted a semi-structured interview, in June 2020, with Mrs. Josée Gagnon of the MTQ, to obtain the developer's point of view. This interview led to a greater appreciation of the issues

faced by this ministry regarding the environmental assessment of bank stabilization projects. It also helped to identify other examples of projects to study and, especially, to learn about new practices being implemented to remedy the situation. A joint interview was then conducted with Mr. Guillaume Thibault, project leader at the MELCC, and Mrs. Nault. Afterwards, documents relating to other bank stabilization projects on the North Shore, where climate change was considered in some manner or other, were made public. These documents were studied to present additional examples in this chapter. This text was shared with the participants as well as with other people who could suggest improvements. A virtual meeting took place on February 24, 2021, and served to gather other points of view.

6.2 Incorporation of Climate Change Adaptation in Environmental Assessments in Québec

Climate change adaptation was incorporated in the environmental authorization scheme by adapting a series of regulatory tools and creating new ones. Section 2.1 presents the tools governing this scheme, and Section 2.2 describes the process used to incorporate climate change adaptation in these tools. Tables 6-1 and 6-2, at the end of Section 6.2.2, describe all the tools involved.

6.2.1 Regulatory Framework of the Environmental Authorization Scheme in Québec

Since 1972, the *Environment Quality Act* (EQA; Chapter Q-2) and some of its regulations have governed the environmental authorization scheme in Québec. In 1998, the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains further defined these zones and the uses for which authorization is required. The procedures and regulations governing environmental authorizations differ according to the location and the level of risk²⁹ represented by the project. Before proceeding, high-risk projects need government authorization at the end of the environmental impact assessment and review procedure. Moderate-risk projects, for their part, must receive ministerial authorization in virtue of Article 22 of the EQA. Finally, low-risk projects may require a statement of compliance, whereas negligible-risk projects are exempted.

Ministerial authorizations are governed by the Regulation Respecting the Regulatory Scheme Applying to Activities on the Basis of Their Environmental Impact (REAFIE). This regulation further details³⁰ the conditions that entail the need for authorization (triggers). It also defines the work or activities that may be exempted (negligible risk) or be granted a statement of compliance³¹ (low risk). The statement of compliance is a mechanism that reduces the MELCC's processing

²⁹ This notion of risk was introduced in the EQA quite recently, at the same time as the incorporation of climate change. It was previously expressed implicitly, through specific applicability criteria for the various procedures.

³⁰ Complementarily with Article 22 of the EQA, which defines the authorization triggers, and of which Paragraph 10 refers to the triggers defined by the REAFIE

³¹ The activities that are eligible for a statement of compliance are described at:
<http://www.environnement.gouv.qc.ca/autorisations/declaration-conformite/index.htm>

times, but that obliges the developer to take certain steps to ensure compliance with Québec's environmental protection standards. The developer must submit a declaration form³² as well as the required documentation, for example, studies on the characterization of the site performed by professionals who are competent in the matter. The statement of compliance must be submitted at least 30 days before the work is expected to begin. Developers who are unsure of the level of risk posed by their project can consult the MELCC regional directorate concerned to identify the type of authorization required, if applicable. It is the regional directorates that analyze the files concerning ministerial authorization applications.

The projects that require government authorization must undergo one of the four environmental assessment procedures, depending on their geographical location³³. Three distinct Nordic procedures apply in the zone concerned by the *James Bay and Northern Quebec Agreement* (JBNQA). The PÉIE applies to projects in Southern Québec, which is south of the zone concerned by the JBNQA. This procedure is governed by the Regulation Respecting the Environmental Impact Assessment and Review of Certain Projects (RÉIE, Chapter Q-2, r. 23.1), which defines the work to which it applies and the procedure to follow. The work concerned includes "dredging, clearing, filling, or levelling off work, for any purpose whatsoever, within the 2-year flood line of a river or lake, over a cumulative distance equal to or greater than 500 m or over a cumulative area equal to or greater than 5,000 m², for a same river or lake." Moreover, in virtue of Article 31.7.1 of the EQA, the government "may, on the conditions it determines, exempt all or part of a project from the environmental impact assessment and review procedure, provided the project is necessary to repair damage caused by a disaster within the meaning of the *Civil Protection Act* (Chapter S-2.3) or to prevent damage that could be caused by an apprehended disaster." In this case, the developer will have to apply to the government for an exemption and, if it is granted, will have to apply for ministerial authorization.

Government authorization requires an environmental impact study to be conducted. It is the general directorates interested in each type of project that process these applications and seek the advice of experts from all the ministries concerned. After the developer has filed the project notification, if the PÉIE applies, a project leader from the MELCC takes charge of the file. A government directive is issued for each project, to specify the content required from the impact study. In Southern Québec, a sample directive is available to the public and comes with appendices describing the other information required for each type of project. These documents were written in collaboration with experts from the other ministries concerned.

Once the directive is issued, the developer must produce the environmental impact study, a task that is usually delegated to an engineering consulting firm. Once completed and submitted to the MELCC, the impact study is examined by experts from the MELCC and other ministries. The project leader must take into consideration these experts' advice, to determine if the impact study contains the information needed to ascertain its environmental and social acceptability, in other words, its receivability. When the information contained in the impact study is insufficient, the

³² Specific forms for each eligible activity are available online at:

<http://www.environnement.gouv.qc.ca/autorisations/declaration-conformite/index.htm#documentation>

³³ See the map of the zones targeted by each of the procedures. The PÉIE corresponds to Chapter I of the EQA. <http://www.environnement.gouv.qc.ca/evaluations/regproc.htm>

project leader must formulate questions and comments to help the developer improve the text of the impact study. An environmental assessment process can consist of several series of questions, comments, responses, clarifications and improved versions of the impact study. Once the impact study is deemed receivable, the MELCC conducts an environmental analysis. In the case of a favourable recommendation, the file is then submitted to the Executive Council with a view to obtain an authorization by decree. Environmental authorization always entails a series of conditions and commitments that the developer must fulfil to attenuate the impacts of the project in terms of the various issues identified.

Once government authorization is granted, the developer must obtain ministerial authorization from the MELCC as well as authorization from Canada's Department of Fisheries and Oceans (DFO) in virtue of the Authorizations Concerning Fish and Fish Habitat Protection Regulations.

6.2.2 The Process of Incorporating Climate Change in This Regulatory Framework

The following paragraphs describe the process of incorporating climate change in the regulatory tools described in the previous section. They also explain the new tools created. Tables 6-1 and 6-2, at the end of this section, list the various tools and provide links to the documentation.

In its 2013-2020 Climate Change Action Plan (Gouvernement du Québec, 2012), the province had made a commitment to incorporate climate change consideration in the environmental authorization scheme. In the Action Plan, priority 10 was to incorporate concern for climate change in public administration. Action 10.1 consisted in updating authorization and control processes and adapting environmental requirements according to the risk. Furthermore, the EQA had not been thoroughly revised since 1972. Several actors were calling for its simplification, to make it more efficient. The MELCC³⁴ opted to modernize this law, also incorporating climate change consideration. This modernization also aimed at making the authorization scheme clearer, more predictable and more transparent. The MELCC submitted a "Green Book"³⁵ to Parliament in June 2015 to catalyze the discussions leading to Bill 102, entitled *An Act to Amend the Environment Quality Act to Modernize the Environmental Authorization Scheme and to Amend Other Legislative Provisions, in Particular to Reform the Governance of the Green Fund*, which was tabled in June 2016. The National Assembly adopted this bill on March 23, 2017, and the amended EQA came into effect a year later.

Regarding climate change consideration in ministerial authorizations, the following statement was added to Article 24 of the EQA: "The Minister may also take into account the expected climate change risks to and impacts on the project and the milieu in which it will be carried out, the adaptation measures the project may entail and Québec's commitments with regard to the reduction of greenhouse gases." In Article 25, which deals with what the minister can prescribe when issuing an authorization, the following text was added: "the adaptation measures required because of the expected climate change risks to and impacts on the activity or the milieu in which

³⁴ At that time, it was called "Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques" (MDDELCC).

³⁵ A "Green Book" is a document submitted by the Executive to Parliament to explain an issue of public interest and to propose administrative or legislative measures that could be taken to resolve it.

the activity will be carried on.” Concerning government authorizations, in Article 31.9, which gives the government the power to adopt regulations for various purposes, the following text was added for the purposes listed in Paragraph b1: “determine the parameters of an environmental impact assessment statement on the greenhouse gas emissions attributable to a project and any expected climate change risks to and impacts on the project and the milieu in which it will be carried out.”

Further to a regulatory impact analysis (MDDELCC, 2017), a proposed regulation concerning the procedure for the environmental impact assessment and review of certain projects was published in the *Gazette officielle du Québec* on December 13, 2017, and was the object of public consultations. On March 23, 2018, the new Regulation Respecting the Environmental Impact Assessment and Review of Certain Projects (RÉEIE) was adopted, replacing the Regulation Respecting Environmental Impact Assessment and Review. This new regulation states that the impact study must include an analysis of the expected impacts and risks of climate change for the project and the environment where it will be carried out (Section IV, Paragraph 5). It should be noted here that applicability thresholds for several types of projects were amended. The distance considered for bank stabilization projects, which was 300 m under the old regulation, is now 500 m under the new one. This new regulation, however, concerns a larger number of industrial projects because of their greenhouse gas emissions.

In consultation with experts from the various ministries concerned, the MELCC prepared new texts and appendices for the directive concerning the design of an environmental impact study. It also prepared supplementary information specifically on climate change consideration. Appendix 1 provides the other information required for a bank or shore stabilization project or program. It now specifies that future climate projections must be considered in the description of the flow rate and hydrodynamics of the waterway or body of water. These documents were finalized and made public at the same time as the regulation came into effect. A guide to climate change and environmental assessment intended for developers, entitled *Les changements climatiques et l'évaluation environnementale*, was prepared to help with this consideration in the design of projects, impact studies and applications for environmental authorizations. It was published in March 2021. Climate change consideration in the tools of the environmental authorization scheme concerns both the reduction of greenhouse gases and climate change adaptation. This case study pertains solely to the incorporation of adaptation.

Climate change consideration is not yet regulated for ministerial authorizations, which are governed by the Regulation Respecting the Regulatory Scheme Applying to Activities on the Basis of Their Environmental Impact (REAFIE)³⁶. In the absence of MELCC control over the consideration of climate change adaptation in ministerial authorizations, the land-use tools are of great importance. In the constraint maps appearing in their land use and development plans (schémas d'aménagement et de développement [SAD]) and in their metropolitan land use and development

³⁶ A proposed Regulation Respecting Ministerial Authorizations and Declaration of Environmental Compliance (Règlement relatif aux autorisations ministérielles et à la déclaration de conformité en matière environnementale [RAMDCME]) had been published³⁶ in the *Gazette officielle du Québec* on February 14, 2018, and had been the object of consultations. It received much criticism because of its great complexity, among other things. It included a “climate test” pertaining to greenhouse gas emissions, but no requirements concerning climate change adaptation. It was never adopted.

plans (plans métropolitains d'aménagement et de développement [PMAD]), regional county municipalities (MRCs) and metropolitan communities can take into account climate change and ensure that authorized projects on their territory are not in a zone where the risks of erosion, flooding or landslide, for example, would be exacerbated. In fact, when granting authorizations, the MELCC must take these constraint zones into account. Moreover, it must ensure that the developer has minimized losses of wetlands and is compensating for the unavoidable losses in accordance with the Regulation Respecting Compensation for Adverse Effects on Wetlands and Bodies of Water, which came into effect at the same time as the amended EQA. Wetlands play an important role in protecting coastal environments against several weather hazards.

It is thanks to the new RÉEIE that the environmental assessment registry ([Registre de l'évaluation environnementale](#)) was created. This public registry presents the information available on all the projects undergoing one of the four environmental assessment procedures (the PÉEIE or one of the three Nordic procedures). The MELCC opens a file in the registry upon receipt of an applicable project notification and the relevant documentation is entered in the registry when it is considered receivable. The public can search in the registry for a project under assessment and follow the entire process, including the filing of the project notification, the directive for the design of the environmental impact study, the successive versions of the impact study sent to the Ministry, the questions, comments and responses exchanged between the initiator and the project leader, the experts' opinions, the notification of receivability for the impact study and the environmental analysis.

Table 6-1 presents the public policies and instruments for the environmental assessment of bank stabilization projects in Québec. Table 6-2 presents other public policies and instruments of interest that have an impact on the application of the tools described in Table 6-1.

Table 6-1: The Government of Québec's Public Policies and Instruments for the Environmental Assessment of Bank Stabilization Projects

Name of the public policy	Dates or periods	General description	Connection with the environmental assessment of bank stabilization projects and the adaptations made to consider climate change
Environment Quality Act (EQA)	Adopted in 1972, amended in 2017	Governs the entire environmental authorization scheme.	The amendments, in 2017, provide for consideration of the expected impacts and risks of climate change for the project and the environment where it will be carried out
Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains	Adopted in 1998, last amended in 2014	Aims at protecting lakes and waterways as well as “water” itself as a resource	Led to the amendment of the EQA and of several other laws. Clarifies the definition of the target zones and defines the applicable restrictions.
Green Book on modernizing the environmental authorization scheme in the EQA, entitled, Moderniser le régime d'autorisation environnementale de la Loi sur la qualité de l'environnement , having led to the filing and adoption of Bill 102.	Green Book submitted in 2015, Bill 102 adopted March 23, 2017	Reflection tool for specific consultations before a bill is tabled at the National Assembly.	Intended to provide Québec with a clearer, more predictable and more efficient scheme, while maintaining the most stringent environmental protection requirements and incorporating the issue of fighting climate change.
Act Respecting the Conservation of Wetlands and Bodies of Water and Regulation Respecting Compensation for Adverse Effects on Wetlands and Bodies of Water	Law sanctioned June 16, 2017, regulation in force March 23, 2018	Aims at curbing the loss of wetlands and bodies of water in Québec	This law also led to the amendment of the EQA. The environmental authorization scheme must now ensure that the developer commits to compensating for damage to wetlands and bodies of water, through conservation, restoration or creation projects or through financial contributions
Environmental Impact Assessment and Review Procedure (PÉEIE; Chapter Q-2, r. 23.1)	The new regulation came into effect March 23, 2018	Defines the work requiring government authorization	Section IV, Paragraph 5, an environmental impact study must contain, notably, in Paragraph 6 “an analysis of the expected climate change impacts on and risks to the project and on the environment in which it will be carried out”
Directive for the design of an environmental impact assessment (Directive pour l'élaboration d'une étude d'impacts sur l'environnement)	Amended in 2018	Specifies the content of the impact study for projects subject to the PÉEIE	Appendix I, Autres renseignements requis pour un projet ou un programme de stabilisation des rives et des berges , provides other information required for a bank and shore stabilization project or program.
A guide for developers to climate change and environmental assessment entitled Les changements climatiques et l'évaluation environnementale	March 2021		Provides developers with clear indications and guidelines for climate change consideration in the design of projects, impact studies and authorization applications

Table 6-2: Other Public Policies of Interest, Related to the Environmental Assessment of Bank Stabilization Projects

Name of the public policy	Dates or periods	General description	Connection with the environmental assessment of bank stabilization projects and the adaptations made to consider climate change
Land use and development plans (schémas d'aménagement et de développement [SAD]) and metropolitan land use and development plan (Plan métropolitain d'aménagement et de développement ([PMAD]))	Since 1979	Tools from the Act Respecting Land Use Planning and Development	Environmental authorization processes must take into account the constraint zones included in the MRCs' SAD and the metropolitan communities' PMAD.
2013-2020 Climate Change Action Plan (PACC 2013-2020) and the measures identified.	2012	Québec's Climate Change Action Plan	Incorporation of climate change in the environmental authorization scheme provided for by Measure 10.1
Disaster prevention framework (Cadre pour la prévention des sinistres [CPS]) of the Ministry of Public Safety (ministère de la Sécurité publique [MSP])	Since 2013	MSP's subsidy and support program	Supports analysis, research, prevention, attenuation and communications for the risks related to various hazards, including coastal erosion and submersion. This program funds projects that are subject to environmental assessments.
Hydroclimatic Atlas of Southern Québec	Since 2013, updated in 2015 and in 2018	Describes the current and future water regime for the rivers in Southern Québec	The results concerning the 2030 and 2080 horizons are described in the synthesis files associated with each section of river.
Federal government: Authorizations Concerning Fish and Fish Habitat Protection Regulations	Amended in August 2019	In virtue of Canada's <i>Fisheries Act</i> and the Fish and Fish Habitat Protection Policy	The developer will also have to obtain authorization from the Department of Fisheries and Oceans (DFO) for any bank stabilization project.
2030 Plan for a Green Economy	Since November 2020	Equivalent to the Climate Change Action Plan.	Investments in adaptation are planned, with an emphasis on the solutions found jointly by the municipal and scientific communities in the flood-prone zones

6.3 Results of the Case Study

This section presents the interviewees' perceptions of the factors that motivated, facilitated or impeded the incorporation of climate change adaptation in the application of the environmental assessment procedure to bank stabilization projects. It also presents findings in this regard from readings of the literature relating to the environmental assessment of recent bank stabilization projects in the North Shore region.

In Section 6.3.1, we explore the factors associated with climate change consideration in the environmental assessment procedure. In Section 6.3.2, we look into the factors related to the various options for maintaining the integrity of the North Shore roads.

6.3.1 Factors Associated With Climate Change Consideration in the Environmental Assessment Procedure

As team leader at the general directorate of environmental assessment of water and industrial projects at the MELCC, Mrs. Nault hopes to improve the environmental assessment procedure to increasingly meet its objectives, in the three spheres of sustainable development: economic, social and environmental. Since 2018, she has also been working to improve climate change consideration in Québec's environmental authorization scheme, for both government and ministerial authorizations. She stressed that the decision to incorporate climate change in this scheme stems from the political will to react to this truly global issue. She mentioned that this political will is not limited to climate change but applies rather to environmental protection in general. Furthermore, Mrs. Nault is convinced that this consideration helps to improve the projects, to make them more suitable and sustainable, and that it allows to better anticipate future costs. She firmly believes that the adaptation will help developers to reduce their costs in the long run.

She acknowledges, however, that there is still much uncertainty associated with the extent of the impacts of climate change. Expanding protective work to resist future conditions may lead to unnecessary environmental impacts. She thus advocates an adaptation that is modulated over time and that allows for potential future occurrences based on currently available climate projections. For example, instead of stabilizing shores with oversized riprap to resist future climate conditions, it is possible to use approaches that integrate better into the area, such as beach replenishment or soil bioengineering, even if it means having to intervene again when conditions have changed.

Mrs. Nault stressed that when the regulation came into effect, the tools were not all available. Despite the supplementary information on climate change consideration, developers, project leaders and administrators of projects under environmental assessment did not always know the exact requirements in this regard in each section of the directive concerning the design of an environmental impact study. A guide to climate change and environmental assessment for developers, entitled *Les changements climatiques et l'évaluation environnementale*, was published in March 2021 and clarifies these requirements with explanations and examples that will include tables for presenting the data. This will help to standardize the procedure used by developers.

Mr. Guillaume Thibault is project leader at the MELCC. In projects assigned to him, he interacts with the developer during the procedure, and he seeks and gathers advice from the experts. He must ensure consideration of this advice and compliance with the directive and the various requirements of the environmental impact study. He mentioned that, for bank stabilization projects, several of the requirements related to climate change adaptation already existed before the regulation came into effect.

In fact, environmental assessment of bank stabilization projects aims at reducing the damage they cause by ensuring that all options are seriously considered, starting with the removal of infrastructures from the at-risk zone. The directive indicates that if removal is not possible, the developer must prioritize so-called soft methods, such as beach replenishment and

phytotechnology, and must demonstrate that these options are not suitable before being allowed to proceed with so-called hard methods like riprap. Although worded differently, these requirements were already stipulated in the directive issued by the MDDELCC in 2016³⁷. As project leader, Mr. Thibault must often insist that these solutions be considered. In his experience, riprap seems to be a reflex among developers because, in his opinion, engineers who sign the stabilization work need some guarantee of its effectiveness.

However, impact studies from a large number of projects had been conducted before March 23, 2018, in accordance with a directive that did not include climate change consideration. Nonetheless, this aspect had to be taken into account before the Executive Council issued a government authorization decree. The practice of environmental assessment thus found itself in “catch-up” mode. In the case of the [project for bank stabilization and protection of the Mingan River on the territory of the municipality of the Mingan Reserve](#), the MELCC was able to address climate change consideration in its first series of [questions and comments](#). In its [response](#), the Englobe engineering consulting firm, which had conducted the impact study, had already created a more robust design, providing for a 100-year flood recurrence interval, whereas consideration of a 50-year flood recurrence is generally deemed acceptable. In a second series of questions and comments, the project leader requested additional details and expressed reservations related to the fact that the flow rates considered far exceeded those set out in the Hydroclimatic Atlas of Southern Québec, which risked leading to an oversizing of the work. In its [response to this second series of questions and comments](#), Englobe demonstrated that it had correctly calculated the flood flows based on those measured in neighbouring stations. It was able to demonstrate that the 9.4% increase factor between the 50- and 100-year floods was close to the increase factor of the flood flow established in the Atlas, which was 6.9% at the 2050 horizon. This brought to light the fact that in the case of ungauged rivers, the Atlas presents values derived from a digital model and may underestimate the rises in water levels.

This is also the case for the [stabilization project in the sector of Rochelois Beach in Port-Cartier](#), a project initiated by the municipality of Port-Cartier providing for beach replenishment and a riprap breakwater. Because the directive was issued in January 2018, it did not contain the items concerning climate change consideration. The environmental impact study, also conducted by Englobe, was submitted in June 2020. It is in the [first series of questions and comments](#) in August 2020 that the MELCC requested details to ensure that the rise in sea level had been considered in the work design.

Climate change can also be considered when a project is exempted from the PÉEIE. In April 2020, the village municipality of Pointe-aux-Outardes [applied for an exemption](#) from the procedure for an [emergency beach replenishment project to the east of the municipal dock](#)³⁸. This project is funded in large part by the Government of Québec through the framework for disaster prevention (Cadre de prévention des sinistres [CPS]), which is managed by the Ministry of Public Security (Ministère de la Sécurité publique [MSP]). Its purpose is to protect Labrie Street, a municipal road,

³⁷ <http://www.environnement.gouv.qc.ca/evaluations/documents/Berges.pdf>

³⁸ See <https://www.securitepublique.gouv.qc.ca/ministere/salle-presse/communiqués/detail/15569.html>, <https://www.lemanic.ca/2020/02/19/pres-de-9-m-pour-la-protection-des-berges-a-pointe-aux-outardes/> and <https://ici.radio-canada.ca/nouvelle/1531442/erosion-berge-cote-nord>

as well as 76 homes, by means of a replenishment using coarse materials on nearly 1.5 km of the beach. This replenishment will prevent erosion of the sandy cliff, which is over 10 m high and which receded an average of 0.8 m/year between 2007 and 2017³⁹ (FQM, 2020). After the MELCC conducted an [analysis](#) of the application, a government [decree](#) was issued in June 2020 to exempt the project from the PÉÉIE. This decree states several conditions with which the developer must comply in the project. Among the measures to be incorporated in the project, to eliminate or reduce the intensity of the negative impacts and nuisance associated with the work, the decree stipulates the following:

[Translation]

Hazards resulting from climate and hydrological conditions that could occur during the life span of the protective work, that is, the replenishment, and that are likely to affect it must be considered in the design, planning and conduct of the project. Adaptation measures must be implemented, as needed, to adapt the project and sufficiently protect the environment, people and property for a duration equivalent to that of the project.

Table 6-3, on the next page, presents a summary of the factors associated with the requirement for climate change consideration in environmental impact studies.

³⁹ Data provided in the exemption application and derived from an analysis of the digital models of the land obtained by LiDAR in 2007 and 2017. Moreover, the UQÀR is also monitoring the coastal recession using a system of markers.

Table 6-3: Summary of the Factors Associated With the Requirement for Climate Change Consideration in Environmental Impact Studies

Adaptation objective	Means identified for meeting the objectives	Motivating factors		Perceived enabler (☺) and barriers (☹)
		Perceived advantages (☺) and disadvantages (☹)	Perceived social pressure, favourable (☺) or unfavourable (☹)	
Encourage consideration of the risks related to climate change in the project design, environmental impact study and analysis process.	Requirement for climate change consideration in environmental impact studies	☺ Helps to improve the projects, to make them more integrated, adapted and sustainable ☺ Makes it possible to anticipate and reduce costs in the long run ☺ Gives rise to innovation by the developers	☺ Scientists, policy makers and the population acknowledge the issue of climate change; it is global. ☺ There is a real political will to ensure environmental protection	☺ Collaboration of experts from various ministries to amend the directive and revise the information supplement and the guide ☺ Some firms and Ouranos helped to create tools for the guide ☺ Feedback and results observation mechanisms are implemented within the MELCC ☺ Advocating an adaptation that is modulated over time helps avoid oversized work
		☹ Climate change consideration may increase the time it takes to conduct an impact study ☹ Guarding against all possible impacts may result in an oversized job and increase its environmental impact	☹ Some projects are eagerly awaited by the communities and the government, which find the time frames too long ☹ Damage to a road may have significant repercussions for mobility and emergency management	☹ There is still much uncertainty about the extent of the long-term impacts of climate change ☹ Having a regulation but not all the tools complicated the task of developers and of ministry officers responsible for assessing the projects ☹ Several impact studies were conducted before the regulation came into effect, leading to catch-up activities ☹ Difficulty in carrying out fish habitat compensation projects in the same watershed (requirement of the DFO) lengthens time frames ☹ Because of the time frames, projects often become urgent and must be exempted from the procedure ☹ Developers tend to favour riprap despite their impacts on the environment

6.3.2 Factors Associated With Options for Preventing Damage to North Shore Roads

Mrs. Josée Gagnon is a biologist who has worked at the MTQ since 2017, notably at the general directorate of the North Shore territory, in Baie-Comeau. She is interim coordination and community relations director. She is working to maintain sufficient mobility for the North Shore populations, but would like to do so with the least environmental damage possible. She mentioned that before the road was built, the St. Lawrence River was the only means of transportation on the North Shore. The populations, of which several practised fishing, settled in villages along the coast. Route 138 was built to connect these villages. The development continued on both sides of the road, which borders the St. Lawrence, sometimes very close to the coast. The 138 is the only connecting road on the North Shore. Because of climate change, natural erosion and submersion phenomena are multiplying and intensifying. Where the road is far from the shoreline, coastal ecosystems may move towards the interior of the lands, and a new balance may develop. However, when it is closer, it prevents this shift and leads to a phenomenon called “coastal squeeze.”

Erosion and submersion are increasingly affecting the road itself. Raising it is one solution to the submersion problems, whereas bank stabilization offsets the erosion problems. When these solutions are too costly or too difficult to carry out, relocating a section of the road may become necessary. This option is generally considered as a last resort after an analysis, backed up by figures, of the various potential solutions. Sometimes, it is possible to displace the road by a few dozens of metres and make it pass behind the homes, while maintaining access to them. But in other cases, it must be moved farther. If the municipality is unable to upkeep the old road, the residents lose their access and must also relocate. Yet, some families have lived in the same home for generations and are also very attached to their property as well as to their view of the St. Lawrence. Therefore, relocation projects are not generally well accepted by the population, which is perfectly understandable, according to Mrs. Gagnon. In addition to social acceptability, relocation projects often encroach on the natural environment. Sometimes, they come up against environmental issues because there are many rare species on the North Shore. Land acquisition is not an issue because the new roadway usually goes through public lands managed by the Ministry of Natural Resources (Ministère des Ressources naturelles [MERN]). Acquisition is a significant issue, however, in more southern regions of Québec, where the proportion of private properties is higher.

According to Mrs. Gagnon, the best long-term solution from an environmental protection standpoint would be to move the entire length of Route 138 by 250 m towards the interior of the lands, except where it is already far from the coast. This would allow nature to take its course and the coastal environment to find a new balance, while saving the MTQ from carrying out piecemeal relocation projects. In the long term, it could cost less than stabilizing shores and raising the road, while providing some peace of mind to all the actors. Nonetheless, there is a social issue, given that people are attached to their home, property and current living environment. Therefore, road relocation does not seem socially acceptable.

In the past, shores were stabilized mostly with riprap. However, we are now aware of their impacts on the environment and know that they may exacerbate the erosion problems. Furthermore, Mrs. Gagnon mentioned that on sandy shores, riprap is only a temporary solution.

Better results can be obtained with beach revegetation or replenishment, which can be done with sand or coarser materials, or even pebbles. However, in an emergency, the MTQ almost always opts for riprap, with its associated environmental impacts.

Recently, the ZIP⁴⁰ Committee of the Côte-Nord du Golfe approached the MTQ's general directorate of the North Shore territory to jointly conduct a pilot beach replenishment project in the Rivière-Pentecôte sector, near Port-Cartier. This replenishment would serve to both stabilize the shores and ensure spawning areas for the capelin. The option proposed by the Laboratory of Dynamics and Integrated Coastal Zone Management⁴¹ at the UQÀR consists in installing rock breakwaters on the coastal plain to linearize small streams uphill from the gulf of the St. Lawrence. These streams are currently very sinuous and thus favour the deposit of sediment from the watershed. Linearizing them would allow the sediment to reach the gulf and rest on the beaches.

As mentioned earlier, beach replenishment was selected for the emergency stabilization of the sector to the east of the Pointe-aux-Outardes municipal dock, to protect Labrie Street and the homes built on both sides of it. This option was chosen after a long process involving an environmental assessment and questioning of its initial design by the MELCC. This project, initiated by the municipality of Pointe-aux-Outardes and backed by the MSP, had been the object of the PÉEIE since 2008. To highlight the advantages, disadvantages and barriers of each of the options, we will provide a basic description of the process of selecting among the ones that were considered to stabilize the sectors to the east and to the west of the municipal dock.

The design of this project was based, on the one hand, on a study comprising a cost-benefit analysis and a multicriteria analysis by the INRS-ETE, Aquapraxis and colleagues (Leclerc & Dupuis, 2008) and, on the other hand, on a revision of the economic component of this study (Éco Ressources Consultants, 2009). The options considered included removal, entailing the relocation of Labrie Street along 1.56 km, linear stone packing of the entire sector (riprap), as well as six scenarios combining breakwaters and beach replenishment. These scenarios are distinguished by the type of breakwaters and the number of planned replenishments. Two of these scenarios combined breakwaters and replenishment with the relocation of part of Labrie Street. The option selected further to these analyses consisted of a combination of a beach replenishment and eight riprap breakwaters, along with the relocation of part of the street. The breakwaters were considered necessary to slow the longitudinal transit of the replenishment materials and to reduce the energy of the waves on the banks. In 2011, a 900-metre stretch of the street was moved towards the interior of the lands, allowing access to several homes from the back way. This move also led to the relocation of two homes and the demolition of a third one (Municipality of Pointe-aux-Outardes, 2016). [An impact study](#) conducted by CIMA was submitted in December of the same year (Municipality of Pointe-aux-Outardes, 2011) for the stabilization work. As it examined the receivability of the impact study, the environmental analysis team formulated questions and comments, and the municipality decided to undertake new studies to be able to respond. A technical report was drafted (Consultants Ropars, 2013) to this end.

⁴⁰ Zones d'intervention prioritaire (Area of prime concern)

⁴¹ <https://ldgizc.uqar.ca/Web/about>

After major storms in 2014 and 2015, the municipality made an addition to its file for stabilization work to the west of the dock. It submitted [an update of the impact study in 2016](#), also produced by CIMA. Further to two series of questions and comments, the municipality decided to divide its project in two to deal separately with the portions to the east and to the west of the municipal dock. This decision allowed the municipality to take the time to respond to the outstanding questions concerning the environmental impacts on the east side. A new technical study (Consultants Ropars, 2020), based on far more accurate data than those previously available, led to the conclusion that a replenishment without breakwaters could protect the embankment for 30 years with fewer environmental impacts and at a lower cost.

A [government authorization decree was issued in November 2017](#) for a linear breakwater of a maximum length of 2 km for the section to the west of the Pointe-aux-Outardes municipal dock⁴². An initial intervention to stabilize the 770 m that were deemed the most critical was executed in winter 2017–2018, once ministerial authorization was obtained. The embankment in this portion to the west of the dock already had 2 km of riprap, of which some portions dated back to the 1980s. The [environmental analysis](#) and the impact study indicated that the existing riprap had already had negative environmental impacts, including accelerated erosion of the adjacent zone (called “end effect”) and the near disappearance of the beach. These previous impacts served as an argument to minimize the expected footprint of the chosen option, that is, riprap on only the most critical part. Relocation of Labrie Street was considered among the possible solutions, but the municipality dismissed it because of the numerous disadvantages, the social constraints, as well as the delays that would have resulted from the land rezoning procedures with Québec’s commission for the protection of the agricultural territory (Commission de protection du territoire agricole du Québec [CPTAQ]). Beach replenishment was also considered as a solution, but it was dismissed due to the high costs. The cost of beach replenishment was established on the basis of the replenishment of one 2 km beach and two applications, considered necessary to ensure a useful life of some 40 to 50 years (Municipality of Pointe-aux-Outardes, 2016). The cost of the riprap was estimated only for the most critical part (770 m), making this option less costly than replenishment.

The MELCC’s analysis team qualified the municipality’s choice of riprap, which was based on economical aspects, as questionable. The team deplored the absence of a multicriteria analysis, which could have highlighted the positive impacts of a beach restoration on the traffic, commercial income, scenery, quality of life and natural habitats. In addition to underscoring its negative effect on the quality of the landscape and on recreational tourism activities, the analysis team expressed the opinion that artificialization of the bank was not desirable and that it ran counter to the direction of the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains, which prioritizes renaturalization. Nonetheless, the team understood the urgency of the situation. Furthermore, sporadic emergency interventions had had to be executed in winter 2016–2017, to prevent Labrie Street from collapsing, after an exemption decree and two ministerial authorization certificates were issued. To prevent other work from being conducted in a rush, the analysis team deemed the solution justified and acceptable. It recommended its authorization, as long as a series of attenuation measures were implemented for each of the

⁴² [Stabilisation le long des berges du fleuve Saint-Laurent du côté ouest du quai municipal sur le territoire de la municipalité de Pointe-aux-Outardes](#)

issues identified. Moreover, it invited the municipality to continue to reflect on adapting to coastal hazards in a context of climate change, notably through proper monitoring of the shore erosion and of the preventive interventions.

The UQÀR's coastal resilience program is working with actors from the communities in Eastern Québec. The MTQ is participating in this process. Further to public consultations, workshops and interviews with various actors, the team reflected on the reasons why riprap was favoured, despite the known disadvantages of this approach for the vast majority of types of coasts. The article by Sauv , Bernatchez, and Glaus (2020) identifies three categories of obstacles indicated by engineers and other professionals working in the engineering consulting offices to choose options other than riprap. The first type of obstacle concerns the engineers' professional responsibility, in virtue of the *Engineers Act* and the Professional Code. In fact, engineers tend to choose proven approaches that they trust. The second type of obstacle concerns the complexity of the regulatory framework and the length of the process required to obtain environmental authorization. The third category of obstacles is related to the fact that government support for bank stabilization projects generally pertains only to the design and implementation phases and not to their entire life cycle. Therefore, activities related to the development and monitoring of pilot projects are not covered by these support programs. Moreover, the EQA requires monitoring for beach replenishment but not for riprap. Furthermore, adaptive management, necessary to prevent oversized work, also entails monitoring.

On the North Shore, if Route 138 has to be closed for more than a few hours because of a major break, a state of emergency is declared. In 2016 and in 2017, several storms accelerated the erosion and submersion problems. Mrs. Gagnon and her colleagues from the MTQ saw that the actions that had to be executed urgently to maintain the integrity of the road had been planned but could not be carried out in time because of red tape. In most cases, the MTQ had to proceed with riprap, whereas other solutions had been considered. Those other solutions could have stabilized the shores with fewer environmental impacts had they been implemented earlier. The delays observed were due not only to the project development process, but also to the environmental authorization processes. In 2019, to ensure early management, the general directorate of the North Shore territory implemented a system for monitoring problematic coastal sectors. This system includes an annual reflection on possible solutions, based on the recession rates observed.

Table 6-4 presents the factors associated with the various options for dealing with shore erosion and preventing damage to the North Shore roads. It includes information drawn from the documents mentioned as well as the perceptions expressed by the participants in this study.

Table 6-4: Summary of the Factors Associated With the Options for Preventing Coastal Erosion Damage to the Road

Adaptation objective	Means identified to meet the objectives	Motivating factors		Perceived enablers (☺) and barriers (☹)
		Perceived advantages (☺) and disadvantages (☹)	Perceived social pressure, favourable (☺) or unfavourable (☹)	
Guarantee the integrity of the road and preserve the community's mobility	Stabilize the shores through beach replenishment and/or revegetation	☺ May have positive impacts on fish habitats depending on the materials used ☺ May allow people access to the shore and improve the potential for recreational tourism	☺ The directive for conducting an impact study requires that these solutions be considered. Beach replenishment must be considered when there is a beach at the base of a slope.	☹ Québec engineers lack experience with this type of work and may be reluctant to sign off on the design
		☹ Replenishment does not apply if there is no beach at the base of a slope ☹ Replenishment must be applied to the entire beach to be effective ☹ Monitoring is required by the MELCC for replenished beaches but not for riprap ☹ The collection of borrowed materials for replenishment can cause environmental impacts		
	Stabilize shores using riprap	☺ May be implemented relatively quickly ☹ Harms fish habitats ☹ May accelerate erosion in adjacent zones (end effects) and the disappearance of the beach at the base of a slope ☹ Not suitable in sandy zones (temporary solution) ☹ Reduces the quality of the landscape and the potential for recreational tourism		☺ Engineers have more experience designing riprap than other approaches
Relocation of a section of the road		☺ More sustainable and often less costly in the long run than the other options ☺ Allows a return of the coast to its natural state and a balance of the geomorphological processes	☺ The directive concerning the conduct of an impact study requires that relocation be considered	☺ No need for expropriations when public lands are used for the new roadway ☺ Present the projects to the citizens and elected representatives
		☹ May cause environmental impacts if the new location is sensitive or is home to rare species ☹ The old road must often be abandoned due to a lack of resources (provincial and/or municipal) for its continued maintenance ☹ May encroach on agricultural lands	☹ Low social acceptability because it involves social constraints, including relocation of homes, farms and commercial enterprises	☹ Administrative delays caused by acquisitions or expropriations, zoning processes and impact studies if needed.

6.4 Discussion

It has been mandatory since March 2018 to consider climate change impacts in projects that are subject to the PÉEIE. Climate change consideration is also specified as one of the conditions for conducting projects that are exempted from the procedure because of their urgent nature. The introduction of this requirement led to a period of transition where it had to be dealt with retroactively in already developed projects. In new projects, it is considered immediately at the design stage.

Perhaps the new knowledge acquired regarding the sector to the east of the Pointe-aux-Outardes municipal dock will lead to beach replenishment becoming a viable option in the future for stabilizing the entire portion to the west. The Rochelois Beach replenishment project, in Port-Cartier, may also help to “normalize” beach replenishment in Québec.

Generally, and as expressed in its 2019–2023 strategic plan (MTQ 2019, p. 11), the MTQ aims to make its management practices more preventive and intends to develop an integrated and concerted approach that will ensure management of contexts in which emergency or imminent emergency interventions take place. As part of its action plan for infrastructure management in a context of climate change, the MTQ is reflecting on these issues. It would be wise to pair this approach with the long-term development of the territory by the MRC and municipalities. This is the case, for instance, of the MRC of Minganie, which is contemplating the expansion of the urban perimeter of some local municipalities and has opened discussions with the MTQ regarding sectors of the road that are particularly threatened by erosion.

Reflections on land use planning could include consideration of relocation options as well as the possibility of restoring the beaches and creating recreational tourism facilities on the banks. Relocation could become more acceptable if it were contemplated progressively and for the long term and if it provided benefits for the communities. One of the disadvantages of progressive relocation is the need to maintain two roads in some places, but it could provide more resilience to the region. Moreover, waiting until a situation is urgent limits the available options, especially in agricultural communities, where the rezoning processes required for a relocation may lead to long delays.

Some beach replenishment options using natural sources will be tested in Port-Cartier by the UQÀR, the Côte-Nord du Golfe ZIP Committee and the MTQ. This research could lead to more generalized consideration of this type of solution.

6.5 Conclusion and Recommendations

Climate change consideration in environmental assessments is the result of the Government of Québec's political will, which was expressed in 2012 in the 2013-2020 Climate Change Action Plan. Legislative regulation changes were needed. This consideration in the PÉEIE has been mandatory since March 2018. In addition to this legal requirement and this political will, the person responsible for ensuring climate change consideration in the environmental authorization scheme is motivated by her conviction that this consideration makes projects more sustainable, less costly in the long run and helps in anticipating the costs that might arise over the duration of the project.

On the North Shore, bank stabilization projects are part of the processes of climate change adaptation, and environmental authorizations put pressure on developers to consider road relocation options as well as so-called soft options, rather than install riprap, as is the tradition.

Included among the factors that facilitate, or facilitated, the amendment of the regulatory tools and those intended to support the actors is the collaboration of experts from the MELCC, from other ministries, from private firms, as well as from Ouranos.

The barriers encountered by the MELCC and the developers include the following:

- A transition period during which the tools were not all available and climate change had to be considered retroactively for projects where the impact study was already developed.
- Because of the delays, projects often become urgent and must be exempted from the procedure.
- The difficulty in carrying out fish habitat compensation projects in the same watershed (requirement of the DFO) prolongs the time frames.
- One barrier to the adoption of beach replenishment is the fact that Québec engineers have less experience with these approaches.

Furthermore, there are several challenges involved in relocating sections of roads, including:

- Significant costs;
- Reluctance on the part of residents who would be obliged to move;
- Sometimes requires zoning changes, expropriations or new environmental authorizations;
- Takes longer to implement and is thus not favoured in an emergency.

We noted several avenues for moving forward:

- Several replenishment projects will be carried out soon by the MTQ and the municipalities on the North Shore.
- As part of its action plan for infrastructure management in a context of climate change, the MTQ is contemplating an integrated and concerted procedure to make its approaches more preventive. Significant progress should be seen over the next few years.

- The investment in pilot projects and in the entire life cycle of the projects (including monitoring, maintenance and potential adjustments) by the MTQ and the disaster prevention programs would help promote soft approaches as well as an adaptation modulated over time (or adaptive management).
- Consideration of the risks of erosion and of submersion by the Regional County Municipalities (RCM)s in their land use and development plans helps to develop a long-term vision, to open discussions with the local actors and various ministries concerned to be able to consider, more globally, the relocation of some sections of Route 138.

6.6 Acknowledgements

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Chapter 7 Consideration of Climate Change Adaptation in the Regional Land Use and Development Plan of the Montréal Agglomeration

Abstract

The results of this case study, pertaining to the Montréal Agglomeration, show that regional land use and development plans are valid tools for encouraging climate change adaptation at regional and local levels. These plans help to establish a strategic vision of development and objectives related to climate change adaptation and to identify means to attain them. Their mechanism for influencing local-level adaptation rests mainly on the conformity obligations introduced in the Act Respecting Land Use Planning and Development. Local planning programs and bylaws must be made to comply with the objectives and provisions contained in the regional plan. Nonetheless, urban planning bylaws allow control only over new developments, constructions and transformations. To intervene in what is already developed or built, complementary measures are needed and they may also be proposed in the regional plan.

Among the factors that motivated the Montréal Agglomeration to include climate change in its regional plan are public health issues related to episodes of extreme heat and to sewer backup and overflow, exacerbated by increasingly abundant rains. Requirements from various levels of government, as well as demands or pressure from citizens and elected representatives also

contributed to this motivation. Among the factors that fostered consideration of climate change adaptation in the Montréal Agglomeration's regional plan are the involvement of team members who are competent in the subject, the formation of a multidisciplinary working group and an external group of experts, a previous adaptive process having led to a number of measures being identified, the fact that the adaptation options considered help to meet some of the agglomeration's other objectives and the fact that boroughs and linked cities had made regulatory innovations that could serve as examples during the compliance-achievement period. Greening and natural settings contribute to the fight against the effect of heat islands and to the reduction of runoff while helping to improve the living environment and providing opportunities for leisure activities and for access to nature and the river banks. The factors impeding greening and conservation of natural environments include significant maintenance costs. Social housing policies are important to ensure neighbourhood diversity and to prevent greening from causing rent increases for low-income residents. The use of green infrastructures to retain and filter rainwater has significantly increased in Montréal in recent years, which may allow for the inclusion of provisions to this effect in the next revision of the plan.

7.1 Introduction

7.1.1 Why this Study?

The project team selected regional land use and development plans (schémas d'aménagement et de développement [SAD], hereinafter referred to as "regional plans") as one of the public policy instruments to study. These regional plans are planning and intention documents (MAMH⁴³, 2020) provided for in Québec's *Act Respecting Land Use Planning and Development* (ALUPD⁴⁴) for the regional level. The ALUPD refers to them as "RCM plans." The regional plans must enable regional county municipalities (RCMs⁴⁵), as well as some cities and agglomerations with certain RCM jurisdictions, to coordinate choices and decisions regarding land use on their territory around a regional vision of sustainable development. Moreover, the ALUPD defines planning tools of other decision-making levels (local and metropolitan) and establishes conformity obligations as a mechanism to coordinate between them as well as with the Government of Québec's strategic directions. Studying a regional plan leads to consideration of the ALUPD in its entirety.

This case study focused on the Montréal Agglomeration because its revised regional plan, in effect since April 2015, includes a section on climate change adaptation. This section pertains mainly to the risks related to the increasingly intense heat and abundant rain that are creating issues in terms of runoff water management. Furthermore, issues addressed in other sections of the regional plan are important for the coastal zones. Montréal is an island situated at the confluence of the St. Lawrence and Outaouais Rivers. It has been dealing with river floods, which have become more common in recent years, but without a connection to climate change being demonstrated. Montréal is in the St. Lawrence fluvial zone, of which the level is not affected by the rise in sea level. Nonetheless, the planning tools used in Montréal are also relevant in marine and estuary coastal zones that are affected by this rise.

The purpose of this document is to provide information on factors to consider and practices to implement to help the RCMs, agglomerations and cities to use the regional plans to meet their objectives in terms of climate change adaptation. Its goal is also to inform provincial, territorial and state governments on factors and practices enabling them to foster consideration of adaptation in regional planning. It further aims at contributing to the reflections of actors from the Montréal Agglomeration on their climate change adaptation.

⁴³ <https://www.mamh.gouv.qc.ca/amenagement-du-territoire/guide-la-prise-de-decision-en-urbanisme/planification/schema-damenagement-et-de-developpement/>

⁴⁴ *Act Respecting Land Use Planning and Development*, L.Q. 1979, c. 51, changed to L.R.Q., c. A-19.1. The first schemes pertained to the name of the land use schemes (Schémas d'aménagement [SA]), and it was in 1994 that the term "development" was added to the name.

⁴⁵ The RCMs were created in 1979 by the *Act Respecting Land Use Planning and Development*. There are 87 RCMs in Québec.

7.1.2 Our Approach

The project team first studied the document concerning the regional plan that is currently in effect in the Montréal Agglomeration. More specifically, it took note of the objectives related to climate change adaptation as well as the means identified, namely, the recommendations, interventions, provisions, elements in the action plan, etc.

The team worked with Mrs. Nancy Giguère, from the City of Montreal's Office of Ecological Transition and Resilience, as well as with Mrs. Nathalie Bleau, from Ouranos, so that this study could contribute to the joint reflections between the two organizations. It conducted individual semi-structured interviews with two land planning advisers from the City of Montréal who were involved in developing the regional plan, Mrs. Julie Tellier from the Department of Urban Planning and Mobility (Service de l'urbanisme et de la mobilité) and Mrs. Sabine Courcier from the Department of Large Parks, Mount-Royal and Sports, as well as with Mr. Yves Faucher, an engineer for the technical projects and studies section of the directorate of wastewater at the water works department. A group discussion was held with Mrs. Giguère, Mrs. Tellier, Mrs. Courcier and members of the City of Montréal's Office of Ecological Transition and Resilience. An interview was conducted also with Mrs. Marion Vincens, from the Ministry of Municipal Affairs and Housing (Ministère des Affaires municipales et de l'Habitation [MAMH]), regarding the consideration of climate change effects in land use and urban planning in general. The questions asked during the interviews and discussions aimed at highlighting the influencing factors in the consideration of climate change effects within the regional plan, in the choice of measures and of provisions, as well as the factors that influence the effects of the regional plan on adaptation.

The questionnaire used in the semi-structured interviews was based on the conceptual framework of the project, as described in Chapter 2. It rests in large part on the theory of reasoned goal pursuit (Ajzen & Kruglanski, 2019). The interview questions and the results analysis pertained to the factors that motivated consideration of climate change adaptation in the regional plan as well as to the factors having favoured or impeded their implementation or results.

Throughout the writing of this chapter, we obtained additional documents to corroborate or complement the participants' accounts. For example, we consulted media articles to find out the point of view of elected representatives or citizens affected by weather hazards or who had criticized some of the proposed measures. The draft of the text was submitted to the interviewees, and their comments were taken into account in a new version. Because Mr. Faucher had retired, Mr. Rémi Haf and Mr. Brahim Amarouche commented and clarified the document.

7.2 The Public Policy and Its Instruments

Public policy instruments are the means identified to meet policy objectives. These means may in turn be public policies with more-specific instruments. The regional plans can be considered to be one of the ALUPD instruments. From the standpoint of the cities, agglomerations and RCMs, their regional plan constitutes a complete policy in itself. In it, they define a series of objectives and identify a series of means to achieve them. Our study concerned the Montréal Agglomeration's regional plan as a public policy and the means chosen to meet its objectives regarding climate

change adaptation. However, since the regional plan acts as an interface between local planning and other decision-making levels, it was important to also consider the other urban development and planning tools.

7.2.1 The Regional Plan as an ALUPD Tool

Box 1 presents the planning tools provided for in the ALUPD for local, regional and metropolitan authorities. It also discusses mechanisms for standardizing between them. The mechanism through which the regional plans influence local-level adaptation rests mainly on the conformity obligations defined in this law.

The Montréal Agglomeration has RCM jurisdiction over urban planning of the territory. The agglomeration includes the City of Montréal (the “centre city”) as well as the 15 other cities on the Island of Montréal (i.e., the “linked cities”⁴⁶). For those cities, the municipal administration represents the local decision level, which is in charge of developing and updating the plan and the urban planning bylaws. The City of Montréal, for its part, is divided into 19 boroughs⁴⁷. It is responsible for developing and adopting its planning program (plan d’urbanisme), which has specific chapters for each borough. For their part, the boroughs develop, adopt and apply their urban planning bylaws in accordance with the City of Montréal’s planning program. It is the boroughs and the linked cities that issue construction, transformation and demolition permits. The City of Montréal presides over the Montréal Metropolitan Community (MMC).

At the time of the 2016 census, the City of Montréal⁴⁸ had 1,704,694 inhabitants, spread over a surface of 366 km². The agglomeration counted 1,942,044 inhabitants across a surface of 499 km² (Ville de Montréal, 2018). The 2018 population decree estimated the population of the metropolitan community, which covers 4,360 km², at 3,994,990.

⁴⁶ The linked cities are Baie-D’Urfé, Beaconsfield, Côte-Saint-Luc, Dollard-Des Ormeaux, Dorval, Hampstead, Kirkland, Montréal-Est, Montréal-Ouest, Mont-Royal, Pointe-Claire, Sainte-Anne-de-Bellevue, Senneville, Westmount and Île Dorval.

⁴⁷ The 19 boroughs of the City of Montréal are Ahuntsic-Cartierville, Anjou, Côte-des-Neiges–Notre-Dame-de-Grâce, Lachine, LaSalle, Le Plateau-Mont-Royal, Le Sud-Ouest, L’Île-Bizard–Sainte-Geneviève, Mercier–Hochelaga-Maisonneuve, Montréal-Nord, Outremont, Pierrefonds-Roxboro, Rivière-des-Prairies–Pointe-aux-Trembles, Rosemont–La Petite-Patrie, Saint-Laurent, Saint-Léonard, Verdun, Ville-Marie and Villeray–Saint-Michel–Parc-Extension.

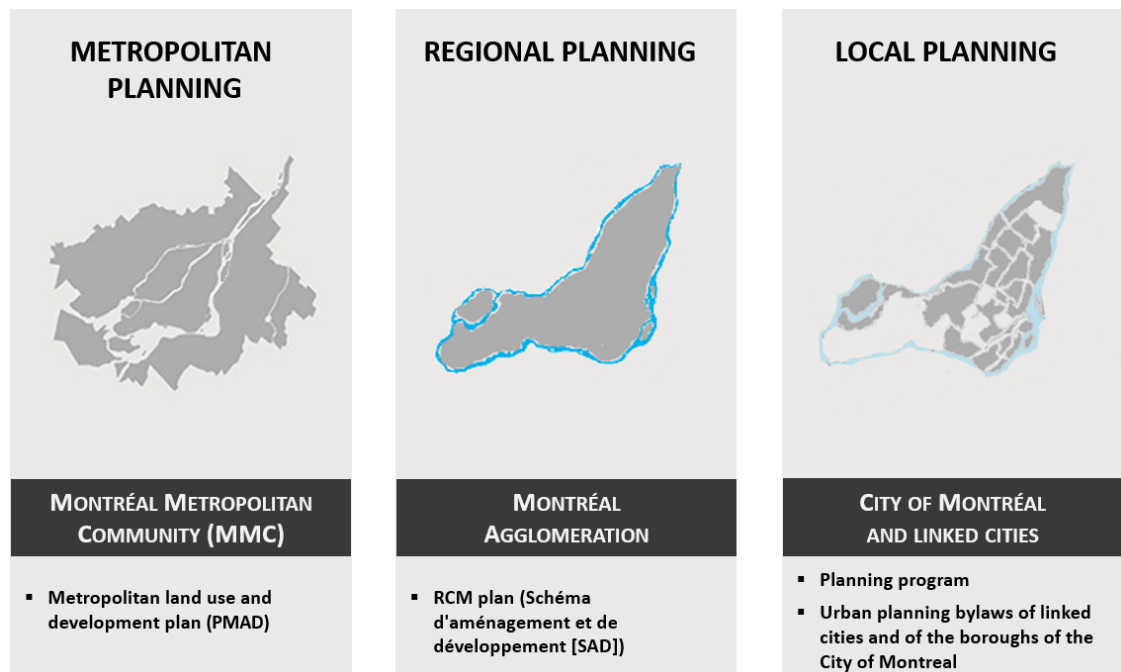
⁴⁸ <https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=F&Geo1=CSD&Geo2=PR&Code2=01&SearchType=Begins&SearchPR=01&TABID=1&B1=All&type=0&Code1=2466023&SearchText=montreal>

Box 1: Planning Tools of the *Act Respecting Land Use Planning and Development (ALUPD)*

Regional land use and development plans are planning instruments that are required on the part of the regional county municipalities (RCMs). They are also mandatory for the cities and agglomerations that have RCM jurisdiction over land-use planning, as is the case for the Montréal Agglomeration. Furthermore, the two metropolitan communities in Québec, which comprise the cities of Québec and Montréal, are obliged to create a metropolitan land use and development plan (Plan métropolitain d'aménagement et de développement [PMAD], hereinafter referred to as "metropolitan plan"). For their part, local municipalities must develop and implement land use plans and bylaws.

The metropolitan, regional and local plans (see the figure below) must be standardized between them as well as with the Government of Québec's strategic directions in terms of land-use, environmental and emergency planning. The ALUPD conformity obligations establish a certain hierarchy in the compliance process. In fact, urban planning bylaws must comply with the local planning program. Then, the planning documents of each administrative level must comply with those of the higher administrative level. However, the influence is not only top-down. Whereas the regional plans and the metropolitan plan must comply with government directions, government interventions in a locality must comply with the metropolitan plan and its objectives. Moreover, the process of approval by the metropolitan community and agglomeration councils, which consist of elected representatives from the various member municipalities, provides motivation to take into account local planning documents. Public consultation processes, required by the Act, serve to inform citizens, take into consideration their points of view and give them the opportunity to influence decisions.

The regional and metropolitan plans must present the strategic vision of development, strategic land use directions and broad land use designations for their territories. They must also identify zones where land occupation is subject to constraints for public safety reasons (e.g., landslide zones, coastal erosion or submersion zones) or environmental protection purposes (e.g., areas targeted by the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains).



7.2.2 The Regional Plan Revision Process

The regional plan that was previously in force had been written by the Montréal Urban Community (MUC)⁴⁹ in 1987. Its revision was catalyzed by the implementation, on March 12, 2012, of the MMC's metropolitan plan. According to the ALUPD, the regional plan had to comply with the metropolitan plan within two years after its implementation. The revised regional plan thus reflects the directives, objectives and criteria of the metropolitan plan as well as the agglomeration's aspirations and specificities. A completely new document was written, even if it is officially considered to be a revision of the previous plan.

Developing the metropolitan plan was also mandatory according to the ALUPD. The MMC, created in 2001, had gone through a vision exercise (MMC, 2003) and had adopted planning tools in its area of jurisdiction. A metropolitan land use and development regional plan had been adopted in 2005, but it had not come into effect. The MMC was motivated to develop the metropolitan plan by the desire to implement this vision, combined with issues of urban sprawl, downtown traffic congestion and an assessment of greenhouse gas emissions showing a large contribution from motor vehicle transportation. Implementing a metropolitan plan was urgent and necessary to be able to act on these issues by influencing the development and use of public transportation within the member municipalities of the MMC through the compliance mechanisms provided for in the ALUPD.

The team revising the agglomeration's regional plan included Mrs. Tellier, who coordinated the section on climate change adaptation. She formed a multidisciplinary working group to address these issues, which included advisers from the various departments. She also assembled an external group of experts, which included practitioners from the boroughs, whose role was to propose recommendations and provisions to be incorporated in the regional plan.

The ALUPD specifies mandatory content and accompanying documents, to which optional content may be added. There is no legal obligation to incorporate climate change consideration in municipal planning or bylaws. For its part, the metropolitan plan suggested examining adaptation but did not include obligations in that respect. The sources of motivation to incorporate climate change in the regional plan came rather from the inside, notably through other, previously developed, plans. Heatwaves, floods following heavy rains, as well as sewer overflow, were already problematic. Projections produced by the Ouranos consortium⁵⁰ suggested that climate change would exacerbate these issues. Montréal's public health directorate had produced a study showing the effects of the 2010 heatwave on the excess mortality recorded in the health system (Roy et al., 2011). The agglomeration has an emergency plan in case of oppressive heat, coordinated with the public health directorate. The fight against heat islands is considered complementary to the emergency measures, intervening at the prevention level. In the City of Montréal's land use plan (Ville de Montréal, 2004 a), the fight against heat islands had already been considered. Also, the policy on protection and enhancement of natural environments (Politique de protection et de mise en valeur des milieux naturels, Ville

⁴⁹ The MUC existed from 1970 to 2001 and encompassed all the municipalities of the Island of Montréal

⁵⁰ The reference included in the scheme is the Ouranos web site. Since then, Ouranos has developed a synthesis and a mapping tool of the portraits of climate change in Québec, which is easy to use for the municipalities and regional authorities.

de Montréal, 2004 b), advanced objectives in terms of increasing areas of protected natural environments. The Montréal community's 2010-2015 sustainable development plan (Ville de Montréal, 2010) already contained objectives related to the quality of runoff water and the improvement of green infrastructures. The 2012-2021 canopy action plan (Ville de Montréal, 2012) aimed at increasing the canopy by 20% to 25% across the agglomeration's entire territory.

When the regional plan was under revision, the agglomeration had the benefit of consultations on Montréal's development plan, held in Montréal in June 2013 (Office de consultation publique de Montréal, 2014). The permanent commission on Montréal's land use and development regional plan organized a public consultation in autumn 2014 around the proposed regional plan. This commission held twelve public sessions (four information sessions, seven hearings on opinions and one session to adopt the commission's recommendations). It sat for almost 29 hours, heard the opinions of nearly 80 citizens, organizational representatives and elected representatives and examined 103 position papers. A series of 53 amendment recommendations was adopted at the public session on December 11, 2014.

Environmental pressure groups (e.g., the Conseil régional de l'environnement de Montréal, the David Suzuki Foundation, the Sauvons l'Anse-à-l'Orme organization, the Jacques-Cartier ZIP Committee and other organizations) submitted position papers during the public consultation. It is thanks to the pressure from these groups that an agreement was concluded to increase the target for protected land areas, which was only 6% in 2004. One recommendation from the Commission proposed a 12% increase, but the objective was finally set at 10%. The majority of the recommendations were taken into account in the final regional plan document that was submitted and adopted by the agglomeration council on January 29, 2015, and that came into effect in April of the same year.

The two-year time frame that the team was allowed after the metropolitan plan came into effect, in 2012, was very short, and two extensions⁵¹ had to be requested from the MAMH⁵² so the revision work could be completed. Because approval of the regional plan was urgent, only one public consultation was possible. The MAMH thus considers the regional plan to be a revision of the 1987 plan, not a second-generation regional plan. This has no bearing on its validity; however, it means that the MAMH's web page showing the global portrait of the regional and metropolitan planning⁵³ lists only the 1987 version.

Since the regional plan came into effect, in 2015, two bylaws to amend it have been adopted, to allow the development of the east beach (in October 2016), and of the Verdun beach (December 2016). In fact, the opening of the Verdun beach to swimming since summer 2019 is creating more pressure on the city to improve rainwater management because sewer overflows affect the quality of the water along the shore. This beach provides access to water so the population can cool off during periods of intense heat.

⁵¹ See page 9 of the

http://ville.montreal.qc.ca/pls/portal/docs/PAGE/COMMISSIONS_PERM_V2_FR/MEDIA/DOCUMENTS/RA_PPORT_FINAL_20150129.PDF

⁵² MAMOT, now the ministère des Affaires municipales et de l'Habitation (MAMH)

⁵³ <https://www.mamh.gouv.qc.ca/amenagement-du-territoire/portrait-global-de-la-planification-regionale-et-metropolitaine/>

7.2.3 Objectives of the section on Climate Change Adaptation

Chapter 1 of the regional plan presents the agglomeration's vision for the future, which is to improve the living environment and encourage sustainable development. This vision consists of three broad themes: 1- favour a quality living environment, 2-support the vitality of the agglomeration and of the centre of the metropolis and 3-enhance the territories of interest. For each of these themes, which are themselves divided into subthemes, Chapter 2 presents the strategic directions for planning and development, the objectives and interventions proposed, all supported by a portrait of the situation and a rationale. Chapter 3 then presents the considerations and objectives related to land designation and density of occupation.

The subtheme pertaining to climate change adaptation falls under the broad theme related to favouring a quality living environment. It aims at decreasing the risks associated with the impacts of climate change. Its objectives are to:

- Adopt the appropriate measures to fight heat islands;
- Increase the canopy index to 25% by 2025 as well as general greening of the territory;
- Reduce the quantity of runoff water and improve its quality.

Moreover, other aspects of the regional plan are relevant for climate change adaptation because they contribute to the above-mentioned objectives. Under the theme related to enhancing the territories of interest, the regional plan contains conservation objectives and aims at increasing the areas of protected land from 5.8% to 10%. In fact, in addition to their other ecological and social benefits, protected areas and green spaces contribute to greening and to decreasing runoff and the effect of heat islands. When located in flood-prone zones, protected areas and green spaces also help to prevent disasters by storing water and preventing residential development.

7.2.4 The Means Identified to Meet the Objectives

The means identified to meet the objectives include recommendations, interventions and provisions. They are proposed in various places in the Montréal Agglomeration's regional plan. Chapter 4 of the regional plan constitutes the complementary document and pertains to the provisions and requirements with which the boroughs and linked cities will have to comply when developing or revising their urban planning tools. Chapter 5 concerns implementation. It includes an action plan and an estimation of the costs of the equipment and intermunicipal infrastructures.

The interventions in the section on climate change adaptation in the main document refer first to the provisions in the complementary document, located in Chapter 4 of the regional plan, with which the boroughs and linked cities will have to comply:

- Provisions relative to greening, which concern the increase in land greening;
- Particular provisions for trees, including cutting restrictions and requirements for protecting trees and their roots as well as increasing the canopy;
- Particular provisions for heat islands stipulating that the urban planning bylaws of a municipality or a borough must incorporate provisions concerning a decrease in ground waterproofing and in the effects of heat caused by roofs, by requiring, for example, small

islands of greenery, the use of permeable paving⁵⁴ for parking lots or light-coloured, white or green roofs.

The sub-section on interventions proposes, notably, the following recommendations:

- Take into account the topography and the drainage system operation to determine constraint zones, where the bylaw must govern the affected uses and define forms of constructions that protect against basement flooding;
- Favour slowing and surface retention of runoff water;
- Standardize regulations on water runoff retention and include design criteria for green infrastructures;
- Encourage the use of runoff water to improve the water supply in natural environments
- Develop outdoor parking lots inspired by the *Design Guide* of the Bureau de normalisation du Québec on Reducing the urban heat island effect ([BNQ 3019-190](#));
- Implement measures to fight the emerald ash borer;
- Implement tree planting measures.

It should be noted that the boroughs and linked cities may follow these recommendations voluntarily but are not obliged to do so.

Regulations concerning rainwater retention are included in the environmental bylaws of the City of Montréal and of the linked cities.

The action plan in the regional plan proposes the following plans, policies and interventions, which are relevant for adaptation:

- Prepare a climate change adaptation plan;
- Implement the Canopy action plan to plant 300,000 trees by 2022;
- Develop a protection and enhancement plan for the Bois-de-Saraguay environmental and cultural heritage site;
- Develop conservation plans for the natural environments;
- Contribute to updating the agglomeration's various strategic plans concerning large parks, natural environments, greening, the blue network, as well as sports and cultural equipment, in accordance with the green and blue belt;
- Continue working to obtain humanized landscape status from the Government of Québec for the western part of Île Bizard, in virtue of the *Natural Heritage Conservation Act* (NHCA; Chapter C-61-01);
- Develop an action and funding plan to implement the green and blue belt (Trame verte et bleue).

The regulatory provisions of the regional plan reflect those from the [Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains](#) (Chapter Q-2, r. 35 of the *Environment Quality Act* [EQA]), but it is the agglomeration that defines the zones where the restrictions apply. In the Section on constraints, the complementary document to the regional plan presents two-, 20- and 100-year recurrence intervals for the St. Lawrence River and Rivière des Prairies, which makes it possible to identify the zones where the various restriction levels apply.

⁵⁴ Permeable environments favour cooling by promoting evaporation of water from subjacent soil

The land designation map is another tool to help meet adaptation objectives. It includes a conservation category as well as a “large green space and recreation” category. Moreover, highlighting the importance of an approach involving dialogue with the citizens and partners, the regional plan delimits ecoterritories, which are zones with a potential for developing protected areas. Ecoterritories had been first defined in the policy on protecting and enhancing natural environments (Ville de Montréal 2004 b), at a time when the City covered the entire territory of the current agglomeration. While the regional plan was being developed, the agglomeration specified its limitations for including conservation projects that had already been carried out, new natural environments and some riverbanks. This exercise also led to the removal of sectors where there was no longer a potential for protection.

The ecoterritories are located mostly on the outskirts of the island, primarily to the west. To encourage conservation initiatives in more central and urbanized zones, the regional plan introduced the concept of mosaics of natural environments. The mosaics include at least two out of four types of natural environments, namely woods, brushlands, wetlands and waterways. They may be integrated in the urban belt. In its map of territories of ecological interest, the regional plan delimits several of these mosaics, with the ecoterritories, metropolitan woods and forest corridors, the natural environments that are or are becoming protected, the local parks comprised of natural environments of interest and the primarily natural banks and shores. Moreover, the regional plan complies with the metropolitan plan, proposing a recreational tourism network structured around a green and blue belt and composed of parks and accessways to water.

7.3 Results of the Case Study

In this section, we analyze the factors associated with the attainment of the objectives in the regional plan concerning climate change adaptation through the means identified. It is divided into subsections, the first one pertaining, generally, to the issue of pursuing climate change adaptation objectives by means of a regional plan. Subsections 7.3.2 to 7.3.4 concern the objectives of the regional plan pertaining to climate change adaptation. Subsection 3.5 addresses flood-disaster prevention, whereas Section 3.6 discusses equity-related issues.

Table 7-1 includes a synthesis of the various means (presented in Section 7.2.4) that could contribute to the attainment of each of the objectives (presented in Section 7.2.3). It also includes the synthesis of the various factors having favoured or hindered the selection, implementation or effects of the measures contemplated for meeting these objectives. These factors correspond to the variables described in the conceptual framework of the project (see Chapter 2), inspired by the theory of reasoned goal pursuit (Ajzen & Kruglanski, 2019).

Column 3 in Table 7-1 concerns the participants’ perceptions of the advantages and disadvantages associated with the means identified in the regional plan to meet the objectives. Column 4 concerns their perceptions of the factors that facilitated or impeded the implementation or effects of these means. Column 5 concerns perceived social pressure, on the part of the citizens, elected representatives, municipal administration, real estate developers, funders, Government of Québec, etc. Some of these factors were already brought up in Section 7.2.2 describing the regional plan revision process and of the inclusion of a section on climate change adaptation.

Table 7-1: Summary of the Factors Associated With Meeting the Objectives Using the Means Identified in Montreal's Regional Land Use and Development Plan

Adaptation objective in the regional plan	Means identified to meet the objectives	Perceived advantages (☺) and disadvantages (☹)	Perceived enablers (☺) and barriers (☹)	Perceived social pressure, favourable (☺) or unfavourable (☹)
<p><i>Reduce the risks related to the effects of climate change</i></p>	<p>Climate change consideration in the regional plan</p>	<p>☺ The plan influences the urban planning bylaws of the City of Montréal boroughs and of all the linked cities</p>	<p>☺ Writing of the section on adaptation coordinated by staff member from the urban planning department with good expertise in climate change adaptation ☺ Formation of a multidisciplinary team, including qualified advisers, to write the section on adaptation. ☺ Formation of an external committee of experts, including practitioners from the boroughs. ☺ Mapping of the heat islands by the geography department at UQAM</p>	<p>☺ In the plan, the Montreal Metropolitan Community (MMC) recommends the incorporation of the measures contributing to climate change adaptation ☺ Climate change adaptation is increasingly important to citizens. ☺ Montréal participates in the C-40 and must present its progress in the fight against climate change. ☹ (absence of social pressure) It is not mandatory to consider climate change in a regional plan</p>
	<p>Preparation of a climate change adaptation plan</p>	<p>☹ The urban planning bylaws are not retroactive; they confer no control over that which is already developed or built ☹ Generally, there is a lack of information on the costs and advantages of the adaptation options</p>	<p>☹ The options available are not well known, and the contractors lack experience implementing them</p>	
		<p>☺ An adaptation plan makes it possible to act complementarily with urban planning and development tools and to act on that which is already developed or built</p>	<p>☺ Subsidy received from the province's Climate Municipalities Program ☺ Climate projections from Ouranos</p>	
<p><i>Increase the canopy index to 25% by 2025 as well as general greening of the territory</i></p>	<p>Provisions requiring increased greening Provisions concerning the protection of trees and their roots</p>	<p>☺ Improves the living environment ☺ Helps to fight heat islands and reduce runoff water ☺ Many scientific studies demonstrating the ecosystemic services of urban vegetation</p>	<p>☺ Local bylaws to oblige developers to make contributions for parks. ☺ Participation of volunteers in tree planting, park maintenance and removal of invasive plant species, for example on environmental action days ☺ Active transportation infrastructures are well suited for greening ☺ Decreased space for vehicles as well as vertical construction leaves room for greening</p>	<p>☺ Montréal's participation in the Local Action for Biodiversity program. The mayor of Montréal is ICLEI ambassador for biodiversity. The adoption of greening practices by some boroughs is having a ripple effect</p>
		<p>☹ Mature trees can provide shade for urban agricultural activities ☹ Greening projects may lead to increased property values and higher rents.</p>	<p>☹ The emerald ash borer led to the death or cutting of many trees.</p>	

<i>Fight heat islands</i>	Particular provisions for a heat island, particularly concerning the reduction of soil waterproofing	<ul style="list-style-type: none"> ☺ UQAM's work showed the contribution of large parking lots to the effect of heat islands ☺ Permeable surfaces also help to reduce runoff 	<ul style="list-style-type: none"> ☺ Example supplied by the Rosemont–La Petite-Patrie borough's bylaw on urban planning, which incorporated provisions to fight heat islands ☺ Availability of permeable or cellular paving on the market 	<ul style="list-style-type: none"> ☺ The Directorate of Public Health encourages the City to fight the effects of heat islands. ☺ This concern was already mentioned in the City's 2004 land use plan.
		<ul style="list-style-type: none"> ⊗ Permeable or cellular paving is less resistant than asphalt and cannot be used on high-traffic areas 		
	Particular provisions for a heat island, particularly concerning the reduction of the effects of heat from the roofs	<ul style="list-style-type: none"> ☺ UQAM's work showed the contribution of large flat roofs to the effect of heat islands ☺ Not imposing an approach gives the boroughs the opportunity to propose options that best suit them 	<ul style="list-style-type: none"> ☺ Example supplied by the bylaw for urban planning of the Rosemont–La Petite-Patrie borough, which included provisions to fight heat islands 	
			<ul style="list-style-type: none"> ⊗ The options presented and the requirements are only for low-slope roofs. 	
<i>Reduce the quantity of runoff water and improve its quality.</i>	Obligation to collect water on private properties and send water from the roof towards permeable surfaces	<ul style="list-style-type: none"> ☺ Owners maintain the structures 	<ul style="list-style-type: none"> ☺ Required by the City of Montréal's Bylaw 20-030 (and previously by Bylaw C1.1) for projects with impervious surfaces of more than 1,000 m² ☺ Low cost if planned at the beginning of the project design 	<ul style="list-style-type: none"> ☺ Pressure on the part of many residents who were flooded by runoff water or sewer backup ☺ PanCanadian standards regarding municipal sewer system overflow (2009), endorsed by the Government of Québec in 2014. ☺ Some funders include green infrastructures as a condition to provide financing. ☺ The opening of Verdun beach is putting more pressure on the city to reduce sewer overflows
		<ul style="list-style-type: none"> ⊗ Water retention alone just delays the arrival of water in the sewers. 	<ul style="list-style-type: none"> ⊗ It is not possible to send water from roofs towards permeable surfaces when the roof drains are inside or when less than 20% of the ground surface is permeable. 	
	Green infrastructures (the regional plan proposed the inclusion of design criteria in a standardized bylaw on rainwater retention)	<ul style="list-style-type: none"> ☺ Co-benefits for the fight against heat islands and improvement of the living environment. ☺ They help retain and filter part of the ground water, reducing the flow to the sewers ☺ They help to improve the quality of runoff water, which is relevant in sectors where storm drains and domestic sewers are separated 	<ul style="list-style-type: none"> ☺ Various programs propose subsidies for their implementation (for example the DMAF and a MAMH program) ☺ Possibility of including a section on green infrastructures in an overflow management plan ☺ CSA standards have been available since 2018 for the design and construction of bioretention systems 	
		<ul style="list-style-type: none"> ⊗ The infiltration function is limited in low-permeability soil and undesired in contaminated soil 	<ul style="list-style-type: none"> ⊗ Vegetation may be damaged by mud or de-icing salt ⊗ There were no standards for the construction of green infrastructures when the regional plan was revised. ⊗ Initially, the lack of experience of the City of Montréal's departments limited the inclusion of provisions on green infrastructures in the plan ⊗ The lack of experience of the actors (municipalities, professionals, contractors, etc.) restricts the adoption of these practices 	

	Floodable parks or green spaces	☺ Co-benefits for the fight against heat islands and improvement of the living environment	☺ Some residents located at the bottom of depressions are often flooded and could be favourable to the sale of their property	
		☹ Momentary flooding of parks and green spaces could favour the proliferation of invasive plants (plan document, p. 50), an opinion not shared by participants from the water department	☹ The depression zones where these parks should be made are often urbanized;	
	Protect the wetlands	☺ Natural catchment basins act as sponges for runoff water	☺ The agglomeration is currently preparing its regional plan for wetlands and bodies of water	
			☹ Since the EQA was modernized, some activities in wetlands have been or may be exempted by a statement of compliance, without the municipality being advised.	
<i>Prevent flood disasters</i>	Application of the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains and of the special intervention zone	☺ Reduces risks by restricting activities in flood-risk zones	☺ The owners are responsible for conservation and maintenance	☺ The Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains is a requirement of the Government of Québec. A new normative framework is being developed by the Government of Québec and will have to be applied by the municipalities ☹ Pressure on the part of owners to be removed from the special intervention zone or to avoid changes in designation that limit their freedom on their properties
		☹ Decreases taxes collected compared with a development scenario	☹ The boundaries of the flood-risk zones have changed ☹ The banks are dominated by private properties, in many cases with buildings constructed before the policy came into force	
	Land acquisition by cession, mutual agreement or expropriation	☺ Opportunities to set up recreational tourism facilities and access to bodies of water		
		☹ Reduction of taxes collected	☹ Costly to purchase and maintain	
	Change the zoning to delimit protected areas	☺ Shared maintenance costs, involvement of citizens and partners	☺ A concerted approach may lead to conservation that benefits all the actors	
			☹ Municipalities expose themselves to legal action on the part of owners who may claim disguised expropriation	

7.3.1 Factors Associated With the Pursuit of Climate Change Adaptation Objectives Using the Land Use and Development Regional Plan

A factor that favoured consideration of adaptation in the regional plan is the experience of Mrs. Tellier, who coordinated the management of this issue. According to Mrs. Tellier, this experience acquired in a previous job enabled her to understand the importance of the issues related to climate change, but her strength consisted in surrounding herself with experts from the City of Montréal and elsewhere to identify realistic objectives and measures. These experts worked within a multidisciplinary working group, which comprised advisers from the various departments, or in the group of external experts.

One of the important influencing mechanisms in the regional plans is the planning programs and bylaws. They will influence the granting of permits by the boroughs and linked cities, which will in turn influence owners, builders and real-estate developers. However, Mrs. Tellier mentioned that in virtue of the ALUPD, urban planning bylaws cannot be applied retroactively. They concern only new constructions and modifications to already existing ones. They do not confer any control over what is already developed or built.

Redevelopment and transformation projects provide opportunities for adaptation because they make it possible to apply, in new constructions, the regulation in effect concerning the fight against heat islands, greening and runoff water management. However, regulatory measures can weigh down municipal approval processes and increase costs for developers, who may then prefer to establish their projects somewhere else, where the bylaws are less constraining.

The transformation of urban zones to densify the territory allows boroughs and linked cities to increase their tax revenues while contributing to objectives related to reducing greenhouse gas emissions. Nonetheless, the recent development of the Griffintown neighbourhood was criticized because it would not favour social and usage diversity. These criticisms possibly contributed to the inclusion of the concept of human scale (*échelle humaine*) advanced in the priorities of the 2016-2020 sustainable development plan (Ville de Montréal, 2016).

However, regulatory influence is not the only action mechanism in the regional plan. Going through the exercise of planning strategically and identifying measures helps to reinforce the synergy between the municipalities and between the various departments involved. According to Mrs. Sabine Courcier, from the Department of Large Parks, Mount-Royal and Sports, climate change highlights the urgency of preserving the last existing natural environments, given their various contributions to risk reduction and to adaptation. The importance of rainwater management for sewer overflow management and ultimately to pursue a densified development required the involvement of water, environmental, urban planning and mobility services. The possibility of using vegetated infrastructures along street edges makes it possible to involve the department of roads and infrastructure in adaptation efforts.

The regional plan helped to identify several programs and actions that were already provided for and to make them contribute to the strategic vision. They include the agglomeration's adaptation plan⁵⁵ published in the third quarter of 2015. This plan, which was developed by the

⁵⁵ https://ville.montreal.qc.ca/portal/page?_pageid=7237,75085661&_dad=portal&_schema=PORTAL

Environmental Department, proposes complementary measures to those in the regional plan. It includes a series of actions that the boroughs and linked cities are to carry out with their own budgets. For example, some boroughs redevelop the public domain or give subsidies to community groups to establish green alleyways. One subsidy granted by the Ministry of sustainable development, the environment and the fight against climate change (Ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques [MDDELCC])⁵⁶, through the Climate Municipalities Program, fostered the development of the adaptation plan. A climate plan for 2020-2030 was developed by the City of Montréal's Office for Ecological Transition and Resilience in 2020 (Ville de Montréal, 2020), with the support of various partners.

Generally, the participants stressed that few studies are available on the economic benefits and costs of the various adaptation options, which, in some cases, made it difficult to identify measures to help reach the objectives in terms of climate change adaptation. A partnership between the City of Montréal and Ouranos began in 2017 and will contribute to the knowledge needed to further specify the adaptation measures to be implemented by the actors of the agglomeration. The purpose of this partnership is notably to link research efforts to the City's needs, share the expertise, encourage the dissemination of knowledge and data, as well as implement integrated adaptation research and development initiatives.

A Université de Montréal project mentioned in the regional plan as an opportunity for brownfield developments, which has since been named MIL campus⁵⁷, has allowed the City to conduct a pilot project in collaboration with the Université and the surrounding boroughs. This project, built on the former Outremont classification yard, incorporates green spaces and a rainwater collection system. Other ecological neighbourhood projects are being planned on brownfields. The City of Montréal ran a contest to establish a sustainable development project for its presentation in November 2019 at the C-40 meeting in Copenhagen, as part of the Reinventing Cities program. The selected project was a small island, transformed into an eco-responsible living environment, which is to be built on the De la Commune Service Yard⁵⁸, in Old Montréal. Moreover, the City of Montréal intends to develop an ecological housing project on the old hippodrome property, which it now owns⁵⁹. This 43-hectare land would be incorporated in the Namur-Hippodrome neighbourhood, which would cover a total of 75 hectares⁶⁰. This new neighbourhood would be diversified, carbon neutral and integrated in the transportation network, to encourage active mobility. With these projects, the City is increasing its expertise in green infrastructures, ecological neighbourhoods and brownfield development. This expertise could ultimately be used by the agglomeration to incorporate, in an amendment or future revision of the plan, a brownfield development strategy on its entire territory, as recommended in 2014 by the Public Consultation Commission for the regional plan that is currently in force. Until then, there is nothing to prevent

⁵⁶ Now MELCC

⁵⁷ <https://nouvelles.umontreal.ca/article/2019/09/20/campus-mil-la-naissance-d-un-quartier/>

⁵⁸ <https://www.lapresse.ca/actualites/grand-montreal/201906/25/01-5231658-montreal-une-cour-de-voirie-sera-transformee-en-quartier-vert.php>

⁵⁹ <https://ici.radio-canada.ca/nouvelle/1331603/quartier-namur-hippodrome-plante-ecologique>

⁶⁰ <https://ici.radio-canada.ca/nouvelle/1488785/forum-citoyen-quartier-namur-hippodrome-consultation>

the City of Montréal and the linked cities from developing such a strategy in their land use plan, or the boroughs from doing so through their local planning.

Since the adoption of the regional plan, a new federal government requirement has been providing additional motivation to consider climate change effects in projects affecting the development of the territory. The Climate Lens⁶¹ is a horizontal requirement that is applicable as part of the Investing in Canada Plan – Building a Better Canada Program, the Disaster Mitigation and Adaptation Fund (DMAF) and Canada’s Smart Cities Challenge. These federal programs also support large projects that favour climate change adaptation. In 2019, the City of Montréal was granted funding from the DMAF for two projects, one being the purchase of land in connection with the Grand parc de l’Ouest⁶²⁶³ (\$50 million) and the other being the construction of catchment basins (\$54 million)⁶⁴⁶⁵. As an additional condition for the funding, the DMAF requires that the projects include green infrastructures. The wetlands protected through land acquisitions for the Grand Parc de l’Ouest, made possible by the subsidy, are considered green infrastructures.

7.3.2 Factors Associated With Greening and Conservation of Natural Environments

According to the study participants, strong emphasis was placed on greening in the regional plan because of its numerous advantages. Furthermore, the regional plan underscores the benefits of trees and greenery. These benefits are environmental (biodiversity, shade reducing the effects of heat, rainwater retention, air purification), social (creation of quality areas to keep families and workers, reduction of urban stress, more time spent outdoors and socialization) and economic (increase in property values, savings on air conditioning). This understanding of the multiple advantages, written in plain language in the text of the regional plan, is the result of the collective effort by the team from the Urban Biodiversity Division, which relies on a large body of academic knowledge on ecosystemic services. For example, Mrs. Courcier is a land use planning adviser for the City of Montréal but is also a lecturer at UQÀM’s Institut des sciences de l’environnement. In her classes, she refers to several studies on ecosystemic services as well as on land use practices that help maximize them.

Regarding ecosystemic services, Mrs. Tellier mentioned that green alleyways⁶⁶⁶⁷⁶⁸ make it possible not only to create cooling islands and to better retain rainwater, but also to help keep families in the city because they create areas for children to play and for adults to socialize. In some cases, neighbours even gave up the idea of using their backyard for parking so they could

⁶¹ <https://www.infrastructure.gc.ca/pub/other-autre/cl-occ-eng.html>

⁶² <https://pm.gc.ca/fr/nouvelles/communiqués/2019/08/21/des-nouveaux-investissements-protègeront-montreal-contre-les>

⁶³ <https://journalmetro.com/actualites/montreal/2364757/financement-justin-trudeau-grand-parc-ouest/>

⁶⁴ <https://www.canada.ca/fr/bureau-infrastructure/nouvelles/2019/06/renforcer-la-resilience-aux-inondations-a-montreal-grace-a-une-meilleure-gestion-des-eaux.html>

⁶⁵ <https://www.tvnouvelles.ca/2019/06/10/gestion-de-leau-54-millions--pour-des-bassins-de-retention-a-montreal-1>

⁶⁶ https://fr.wikipedia.org/wiki/Ruelle_vert

⁶⁷ http://ville.montreal.qc.ca/portal/page?_pageid=7357,114005570&_dad=portal&_schema=PORTAL

⁶⁸ http://ville.montreal.qc.ca/portal/page?_pageid=8637,142146872&_dad=portal&_schema=PORTAL

put a grassy section in a “country lane” (*ruelle champêtre*)⁶⁹. However, noting that the advantages far outweigh the disadvantages, Mrs. Tellier also mentioned that even though they are still public spaces, some neighbours take over the alleyways to the point that others might not feel comfortable using them. Greening also has some other disadvantages: mature trees create shade that may hinder urban agriculture, for example.

Some vegetated infrastructures have several objectives, such as those associated with active transportation (pedestrian footpaths, separators between the road and a bicycle path, etc.). In addition to providing cooling islands, vegetated bulb-outs are meant to reduce the risks of pedestrian accidents. They do so by slowing road traffic, reducing the distance needed to cross the street, improving pedestrian visibility and preventing parking for five metres on each side of the intersections. However, while exercising these functions, they slow down firefighters and other emergency vehicles, reduce space for cyclists and decrease the number of parking spaces available.

One factor that helps increase greening is the reduction of space for vehicles in the urban planning bylaws of several boroughs and linked cities. This space translates, notably, to the minimal number of parking spots that should be available for each housing unit. It is also expressed in minimal width of roads. Amendments to these regulatory requirements must be combined with an offer of nearby services as well as access to public transportation or a carsharing service. However, measures for limiting parking spots hinder commercial and other businesses whose clientele come from elsewhere and travel by vehicle.

Another factor that can help increase greening is the fact that vertical construction can free space on the ground. However, the choice of species being planted must take into account the shade from the buildings and underground infrastructures like inside parking lots of condo towers.

The regional plan does not impose a contribution from real-estate developers to parks, but several boroughs and linked cities already had such requirements. In June 2017, the City of Montréal adopted Bylaw 17-055 concerning cessions for the purposes of establishing, maintaining and improving parks and playgrounds and preserving natural spaces on its territory⁷⁰. This bylaw standardizes the various applicable bylaws regarding contributions to parks. It has been applied uniformly in all the boroughs of the City of Montréal since June 19, 2018. It should be noted here that the boroughs first innovated by adopting such bylaws and that the City of Montréal then followed suit. These considerations could ultimately be incorporated into the regional plan so they apply uniformly to the entire agglomeration.

Priorities 2 and 3 of the City of Montréal’s 2016-2020 sustainable development plan (Ville de Montréal, 2016) aim respectively at greening, increasing biodiversity and ensuring sustainability of the resources; as well as ensuring access to neighbourhoods that are sustainable, healthy and built at a human scale. The inclusion of such objectives in this plan probably contributed to the

⁶⁹ For instance, for pilot project, which was the first country lane or *ruelle champêtre* in Montréal
<http://www.monclimatmasante.qc.ca/ruelles-champ%C3%AAtres-%C3%A0-montr%C3%A9al.aspx>

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http://ville.montreal.qc.ca/pls/portal/docs/PAGE/PROJ_URBAINS_FR/MEDIA/DOCUMENTS/REGLEMENTE_RAISPARCS_2018.PDF

attainment of the greening objectives in the regional plan. The directions in this plan were probably also influenced by those of the regional plan.

Except for green alleyways and other community spaces that are maintained by citizens who do so voluntarily, vegetated developments must be maintained by municipalities, and the budgets allocated to this end are limited. One Canadian accounting practice consists in separating a city's operating and project budgets, which can create significant obstacles for the long-term effects of greening projects. Mrs. Tellier mentioned that a tree can be purchased and planted as part of a street repair or park project, within the quarterly property budget financed by a loan. However, its maintenance, and replacement if it dies, must be covered by the operating budget. Acquisitions of new land to protect the territory also weigh down a city's operating budget. Natural environments need maintenance also because they sometimes suffer vandalism, illegal dumping, or the presence of invasive plants: without a large enough budget, these environments deteriorate. Consequently, they may become less efficient in their climate change adaptation role.

Parks and protected areas contribute to reducing heat and to managing runoff water while giving the population access to nature, shaded zones and bodies of water. Wetlands, in particular, act like sponges that retain, filter and purify runoff water. The boroughs and linked cities can make amendments to their zoning bylaws to create new protected areas. Nonetheless, this infringes on the owners' rights because development is severely restricted, even prohibited, in protected areas. That is why the agglomeration favours, as much as possible, an approach involving dialogue with the partners and citizens, leading to protected areas that benefit the actors concerned, who must make concessions.

As laid out in the regional plan, the Department of Large Parks, Mount-Royal and Sports and the Ile-Bizard-Sainte-Geneviève borough have applied to the Ministry of the Environment and the Fight Against Climate Change (Ministère de l'Environnement et de la Lutte contre les changements climatiques [MELCC]) for protected zone status, in the humanized landscape category⁷¹, for the west end of Ile-Bizard. This status would be granted in virtue of the NHCA. The MMC is supporting the borough in its process⁷². Humanized landscape is one of the categories of protected areas introduced by the NHCA and is considered Category V by the International Union for Conservation of Nature (IUCN). This territory would be the first of this category in Québec, and it could open the way to others. Nonetheless, some owners of agricultural land are against the project⁷³. According to opponents, recognition of humanized landscapes restricts their rights. In their opinion, the obligation to keep the low stone walls, which have become national treasures, as well as to preserve some brushlands, constitutes constraints. Some owners also hoped to dezone their land and sell it for real-estate development.

The approach involving dialogue with the partners and citizens has been successful since the implementation of the 2004 policy concerning the protection and enhancement of natural environments. Initially, technical committees had been formed to develop "concept plans," in

⁷¹ https://ville.montreal.qc.ca/portal/page?_pageid=8497,129491626&_dad=portal&_schema=PORTAL

⁷² <https://cmm.qc.ca/nouvelles/obtention-du-statut-de-paysage-humanise-la-cmm-appuie-lile-bizard/>

⁷³ <https://journalmetro.com/actualites-ouest-de-lile/601082/ile-bizard-les-proprietaires-de-terres-agricoles-sopposent-au-concept-de-paysage-humanise/>

collaboration with the partners and citizens. Such plans were drawn up for five ecoterritories, including the Coulée Verte du Ruisseau Bertrand⁷⁴. Then, in 2016, a concept plan was produced for the Corridor Écoforestier de la Rivière à l'Orme⁷⁵. Next came the adoption of a bylaw delimiting the Grand Parc de l'Ouest (RCG 19-026⁷⁶), which groups together all the ecoterritories and large parks on the West Island. Several properties in that delimited zone were acquired by the City and others belong to conservation agencies. This park differs from nature parks in that the City is not the sole proprietor of the lands concerned. It was the object of an important consultation process⁷⁷.

Concerted solutions are not always possible, and certain conservation projects are sometimes strongly opposed. This is the case, for example, of some properties concerned by the Cap Nature real-estate project⁷⁸, which ended up as part of the Grand Parc de l'Ouest. The developers of this project are suing⁷⁹ the City of Montréal, the Projet Montréal political party and Mayor Valérie Plante personally for monetary losses due to the change in designation. Currently, the provisions of the *Expropriation Act* create an inequitable relationship of power⁸⁰ because owners are compensated according to the potential property value in a scenario of real-estate development rather than their market value only. Further to a large number of legal actions against several of its municipalities, the MMC requested assistance from the Government of Québec in November 2019 to have the *Expropriation Act* amended so it would be easier to acquire land for projects of public interest. The government created a working committee and is studying the municipalities' requests.

The agglomeration is currently preparing its regional plan for wetlands and bodies of water (Plan régional des milieux humides et hydriques [PRMHH]), in virtue of the regulation respecting the conservation of wetlands and bodies of water (*Loi concernant la conservation des milieux humides et hydriques*). Certain wetlands will be identified as priorities for protection. Developers must compensate for filling wetlands through a financial contribution, payable to the MELCC. The construction of the new light rail network (Réseau électrique métropolitain [REM]) will also have impacts on the natural environments: some stations in the network are close to some sensitive wetlands, increasing the potential for environmental impacts of corresponding transit-oriented development areas that are planned around these stations.

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https://ville.montreal.qc.ca/pls/portal/docs/PAGE/GRANDS_PARCS_FR/MEDIA/DOCUMENTS/PLANCONC_EPTBR.PDF

⁷⁵ https://ocpm.qc.ca/sites/ocpm.qc.ca/files/pdf/P85/plan_concept_anse-a-lorme_rapport_preliminaire-dt.pdf

⁷⁶ <http://ville.montreal.qc.ca/sel/sypre-consultation/afficherpdf?idDoc=30790&typeDoc=1> Bylaw RCG 19-026 was adopted on October 26, 2019

⁷⁷ <https://www.realisonsmtl.ca/grandparcouest>

⁷⁸ <http://voirvert.ca/nouvelles/rubriques/regard-sur-le-projet-cap-nature>

⁷⁹ <https://www.lapresse.ca/actualites/grand-montreal/201909/24/01-5242654-projet-de-grand-parc-de-louest-montreal-poursuivi-pour-177-millions.php>

⁸⁰ <https://www.ledevoir.com/politique/montreal/567655/expropriations-protoger-la-nature-a-l-abri-des-poursuites>

7.3.3 Factors Associated With the Fight Against Heat Islands

Greening helps fight heat islands. Flat roofs and parking lots also tend to store heat and can be designed to reduce this effect.

Mrs. Tellier mentioned that, even today, the state of scientific knowledge is not sufficient to make recommendations for the best type of roof layout in all contexts. This is why the provisions in the complementary document require the inclusion of a bylaw for reducing the problem of heat from roofs, by giving examples of methods for doing so, but without specifying these methods. The provisions would include light-coloured, white or green roofs among possible options.

The fact that some boroughs had adopted such provisions before the regional plan was revised provided a model that other boroughs or linked cities could use as inspiration. This was the case for the requirements in the Rosemont–La Petite-Patrie borough's bylaw on urban planning⁸¹, which aim to fight heat islands^{82,83,84}. These requirements specify minimal solar reflectance values for materials used in flat roofs, parking lots, driveways and loading or storage areas. The permitted options also include vegetated roofs and cellular paving. The Rosemont–La Petite-Patrie borough was the first to adopt such requirements, in 2011. Afterwards, bylaws concerning roofs were adopted by fifteen other boroughs, eight of which did so after 2015, to comply with the regional plan⁸⁵.

In 2009, the Saint-Laurent borough had adopted a bylaw governing the layout of parking spaces centred on sustainable development. This bylaw is cited in the guide by the *Bureau de normalisation du Québec*, whose use is recommended in the regional plan.

Building underground parking lots is often considered as an option to fight heat islands. Nonetheless, when the water table is high, their construction requires pumping of ground water to lower the table. In sectors where sanitary and rain sewers are combined, this practice increases sewer overflows because the pumped water is sent there.

The development of the regional plan had the benefit of a map of the heat islands produced by UQAM's geography department. This map helped to assess the effect of large parking lots and large flat roofs on the surrounding temperature. Since then, an epidemiological survey conducted by Montréal's Public Health Directorate further to the heatwave in summer 2018 demonstrated the need to continue tackling this issue (Lamothe, Roy, & Racine-Hamel, 2019).

⁸¹ The last version of the urban planning bylaw is available at:

<http://ville.montreal.qc.ca/pls/portal/docs/1/89510003.PDF>

⁸² The page concerning the Rosemont–La Petite-Patrie borough's fight against heat islands is at:

http://ville.montreal.qc.ca/portal/page?_pageid=7357,82287591&_dad=portal&_schema=PORTAL

⁸³ The case of Rosemont–La Petite-Patrie was also the object of a case study published by Natural Resources Canada. https://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/mun/pdf/13-0616-Rosemont%20Case%20Study_e.pdf

⁸⁴ The case of Rosemont–La Petite-Patrie is also given as an example on an Ecohome web page:

<https://www.ecohabitation.com/guides/2925/vegetalisation-et-gestion-des-eaux-pluviales/>

⁸⁵ http://ville.montreal.qc.ca/pls/portal/docs/PAGE/COMMISSIONS_PERM_V2_FR/MEDIA/DOCUMENTS/DOCCONSULT_20161006.PDF

7.3.4 Factors Associated With Runoff Water Management

Stormwater management aims to prevent flooding from heavy rainfall and sewer overflows. It also aims to improve the quality of the water that flows into the aquatic environment. In the regional plan, several recommendations had been made in this sense but no provision was included in the complementary document making actions mandatory by the boroughs or the linked cities. One of the reasons for the absence of requirements was the lack of knowledge about the effectiveness of the measures and the lack of experience of all the actors. Since then, there have been very important advances in Montreal on stormwater management. In addition, Canadian standards have been published (CSA Group 2018 a and b) for the design and construction of bioretention systems, which is an important factor facilitating the implementation of such systems.

The regional plan recommended to standardize the bylaws on this subject which was done through the City of Montréal's Bylaw 20-030⁸⁶, which replaces Bylaw C1.1 that was in force since 2001. This new regulation adopted in June 2020 tightens the requirements for hydraulic performance of stormwater management systems, which were already required for peak flow control by the C1.1 regulation when the impervious area of a building exceeds 1000m². Flow from groundwater and cooling water must now be counted in the total stormwater discharge. The bylaw adds a criterion to prevent overflows by requiring that the system be capable of "permanently retaining" (i.e., avoiding sending to the sewer) the runoff from a 19mm 6-hour design rainfall. This water management must be through infiltration, reuse, or evapotranspiration, which promotes green infrastructure. A water retention credit can be applied when trees are planted. The new regulation also requires that stormwater discharged through gutters and downspouts, regardless of roof area, be directed to permeable surfaces when the permeable surfaces cover more than 20% of the building's roof area.

However, Bylaw 20-030 applies only to the territory of the City of Montreal and therefore excludes linked cities. The requirements for the installation of a stormwater management system apply only to applications for construction or alteration permits. Another barrier to the effectiveness of Bylaw 20-030 in reducing runoff from the existing built environment are the many buildings with roofs covering more than 80% of the lot and many roofs with central drainage, going directly to the sewer.

Several pilot projects have been developed, increasing experience of the actors working in runoff management. In 2016 and 2017, when a section of Papineau Street was being redesigned, the City of Montréal's directorate of transportation had vegetated catchment basins and bioretention basins built⁸⁷. A monitoring project by Polytechnique Montréal is underway to verify the performance of this work, for which the team had theoretically expected reductions in runoff water from the vegetated catchment basins and bioretention basins of 39% and 48%, respectively. Preliminary results presented to the City of Montréal suggest far superior reductions.

⁸⁶ <http://ville.montreal.qc.ca/sel/sypre-consultation/afficherpdf?idDoc=31975&typeDoc=1>

⁸⁷ https://ceriu.qc.ca/system/files/2019-01/B2.2_GuyTrudel_DavidCourchesne.pdf

In 2019, drainage bulbs where rainwater could be gathered and filtered were installed and tested in the Sud-Ouest borough⁸⁸. Capitalizing on this experience, the City of Montréal is currently producing standardized designs. When built where there is a sump, drainage bulbs cost less to set up than traditional ones because the sump does not need to be relocated. However, the contribution of green zones to stormwater management will be minimal if they are not designed with this objective in mind. For example, vegetated bulb-outs created in 2017 and 2018 in the Plateau Mont-Royal and Rosemont–La Petite-Patrie boroughs were made with perforated drains that send water directly to the sewers.

Simple installation practices may help increase the role played by lawns and other vegetated surfaces in rainwater management and reduce the volume of runoff water heading to the sewers. For example, paved surfaces can be designed to stream towards vegetated surfaces. Raised drains can be used to make water accumulate on these surfaces; however, this may expose them to de-icing salt and sediment. The regional plan (page 50) mentions that green spaces that are periodically flooded may be conducive to the proliferation of invasive exotic species, such as reeds and that their layout must be carefully planned.

Numerous floodable parks are currently in the planning stage. For example, the Plateau Mont-Royal borough purchased the land of a former service station to set up a floodable public space⁸⁹, partly inspired by the Water Square in Rotterdam. Three different layouts were tested to collect the opinions of the citizens and to choose which elements to incorporate in the permanent set-up, which is planned for the year 2021⁹⁰. It will have the capacity to gather up to 800 m³ of rainwater. In the Parc-Extension neighborhood, Parc Pierre-Dansereau, created as part of the MIL campus, as well as the Parc Dickie-Moore, will have floodable areas designed to reduce flood risks in the area⁹¹. Moreover, the Saint-Laurent borough has created numerous ponds and wet basins, especially in the Bois-Francis neighbourhood.

PanCanadian standards for municipal sewer system overflow (2009), endorsed by the Government of Québec in 2014, contributed to the focus on runoff water management in the regional plan. In fact, the MELCC could sanction the agglomeration if it exceeds the discharge requirements in connection with these standards. The MELCC may also block development projects that are likely to increase overflows by refusing to issue an environmental permit under Section 22⁹² of the Environment Quality Act (EQA), which is required for projects that extend the sewer system. To obtain a certificate of compliance with the sewer guidelines, developers of realty projects that entail a sewer system extension must demonstrate to the City of Montréal's Waterworks Department that their project is not likely to cause an increase in the number and

⁸⁸ <https://centdegres.ca/magazine/amenagement/arrondissement-du-sud-ouest-des-saillies-de-trottoir-drainantes/>

⁸⁹ <https://www.realisonsmtl.ca/962mont-royal>

⁹⁰ <https://www.youtube.com/watch?v=lg65OyuKKJk&feature=youtu.be>

⁹¹ <https://journalmetro.com/actualites/montreal/2624168/projet-mil-un-nouveau-parc-sera-amenage-dans-parc-extension/>

⁹² Previously, Section 32 of CEQA governed Ministerial approvals for work affecting sewage systems but was substantially amended in 2017

extent of overflows⁹³. Developers must demonstrate that their projects have a nil water balance, in other words, that they do not increase the flow and volumes of water going to the sewer. The use of green infrastructures is an avenue contemplated to favour water infiltration when the soil is sufficiently permeable and the water table is low enough. In some cases, to help the initiator obtain the environmental permit, the local government may take on the responsibility for maintenance to ensure that the infrastructure continues to be effective. For example, the City of Montreal will maintain the bioretention ponds built under the building's flower beds for the Crown housing project in Ahuntsic-Cartierville⁹⁴.

The City of Montréal or the linked cities must compensate for an increase in wastewater flow towards the sewers at one spot, by reducing it elsewhere on the territory. Reducing runoff water entering a combined sewer is thus essential for densification projects entailing an increase in the number of housing units that empty their domestic wastewater into the sewer. The agglomeration must also present the overflow management plan to the MELCC soon, with a view to continue its development work. The possibility of including green infrastructures in an overflow management plan is a factor that could motivate the City to consider them when repairing roads, for example.

Project participants mentioned that communication is deficient between urban planners and engineers. For example, the boroughs and planning advisory committees, who want realty projects to move forward, do not give sufficient consideration to the capacity of the sewer system and rainwater retention aspects in their approval process. Projects approved by the planning advisory committee are sometimes blocked when they are examined by the Waterworks Department for compliance with the bylaw (Bylaw 20-030, or previously C1.1) or the guidelines for sewers. These projects must then be modified, at high costs to the developers. This increases time frames and project costs.

It should be noted that the effect of rain on sewer backups and overflows is exacerbated by the fact that 63% of the territory on the island is served by combined systems, which combine blackwater and rainwater. The rest of it is served by separate systems. In the latter case, intercepted rainwater is sent directly to surrounding bodies of water, and only blackwater is sent to the interceptor and then to the Jean-R.-Marcotte water treatment station. Runoff water management is important also when the systems are separate, to prevent polluted water from being sent directly to water courses. Sewer backups occur when runoff saturates the local sewer system. Installation of a check valve prevents backups into buildings. The system overflows when the capacity of the interceptors⁹⁵ or of the water treatment plant is exceeded. The water treatment plant and the interceptors serve the entire island of Montréal and thus all the territory of the agglomeration.

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http://ville.montreal.qc.ca/pls/portal/docs/PAGE_EAU_FR/MEDIA/DOCUMENTS/AIDEMEMEXIGENCES%20ET%20CONSID%C9RATIONS.PDF

⁹⁴ <https://journaldesvoisins.com/gestion-des-eaux-pluviales-quand-la-nature-sininvite-dans-ahuntsic/>

⁹⁵ The water from local systems is collected by two interceptors, the south and the north

7.3.5 Factors Associated With the Prevention of Flood-Related Disasters

The regional plan proposes to take into account the topography and the drainage system operation to determine the constraint zones, where the bylaw must govern the affected usages and define the forms of constructions that protect against basement flooding. Constraint zones in the depressions or basins have not yet been defined, although their designations are strongly called for by the Waterworks Department, among others. Many of these zones are already urbanized, and defining them as constraint zones would infringe on the owners' rights by causing property values to drop and insurance premiums to rise.

In one sector of the Saint-Léonard borough, flooding occurs, sometimes several times a year, causing damage and anxiety for residents⁹⁶⁹⁷, leading to the commencement of a class action lawsuit against the borough⁹⁸. In the last years, the borough blamed the Waterworks Department who, in turn, attributed these problems to local topography and inadequate urban planning⁹⁹¹⁰⁰. Indeed, at the time when these zones were urbanized, the current territory of the City of Montréal was occupied by a multitude of distinct municipalities. Construction permits were granted without consideration of the topography whereas, ideally, parks should have been made in these depressions. Some residential projects have low driveways, which aggravates the risks of basement flooding. Damages can be prevented by adapting the buildings, by installing check valves on the drain pipes or by installing mini speed bumps at intersections with driveways. It is also possible to install watertight garage doors or to fill in in low entrances. It would thus be important to implement a program to accompany residents in implementing protect measures against basement flooding.

The borough of Saint-Leonard amended its zoning bylaw in December 2020 to prohibit basement garages for single-family residential buildings and multiplexes (less than six units). New residential projects are being developed in other boroughs with low driveways without any topographical analysis being required to obtain a construction permit. Furthermore, the existence of these low garages has led some areas to increase the number of sumps that send water to the sewer and prevents efficient use of the streets to accumulate and direct runoff water during heavy rains.

In floodplains along rivers, the City's acquisition of properties, by mutual agreement or expropriation, helps prevent flood disasters while pursuing objectives related to recreational tourism or to protecting territories of ecological interest. However, it also causes a decrease in tax revenues. In fact, waterfront homes often have high property values. Furthermore, residents of these zones are generally very attached to their properties.

⁹⁶ <https://journalmetro.com/local/saint-leonard/2374275/des-citoyens-exasperes-dune-problematique-dinondations/>

⁹⁷ <https://journalmetro.com/local/saint-leonard/2386217/saint-leonard-regler-le-probleme-dinondations-ne-sera-pas-facile/>

⁹⁸ <https://www.tvanouvelles.ca/2020/08/26/inondations-subites-demande-de-recours-collectif-contre-larrondissement-de-saint-leonard-1>

⁹⁹ Présentation de Hervé Logé du service de l'eau lors de cette rencontre
http://ville.montreal.qc.ca/pls/portal/docs/PAGE/ARROND_SLE_FR/MEDIA/DOCUMENTS/ST-L%C9ONARD_INONDATIONS_OCT2019_V7.PDF

¹⁰⁰ <https://journalmetro.com/local/saint-leonard/2391127/inondations-a-saint-leonard-aux-citoyens-de-se-proteger-juge-la-ville/>

Riparian zones are protected by the Protection Policy for Lakeshores, Riverbanks, Littoral Zones and Floodplains but numerous buildings were already built in those areas before it came into force. Furthermore, the constraint zone maps related to flood risks were revised, and some zones previously located outside the floodplain are now considered at risk. There are thus many homes that are currently in flood-risk zones.

In fact, further to the floods of 2019, which had followed closely those of 2017, the Government of Québec issued a decree instituting a special intervention zone (ZIS). This decree imposes a moratorium on the construction and reconstruction of buildings in this zone. The Government of Québec has mandated experts from the MMC to map out this zone on its territory. After passing an interim control bylaw¹⁰¹, the MMC proposed a metropolitan bylaw concerning flood-risk territories, which it submitted for consultation¹⁰². With funding from the provincial government, it mapped out the flood-risk zones (risk low, moderate, high and very high). Once entered into effect relative to the metropolitan plan, this map will have to be incorporated into the constraint zones in the agglomeration's regional plan. A new normative framework is currently being developed by the Government of Québec with respect to land use relative to flooding. It will also have to be implemented by the municipalities.

7.3.6 Equity-Related Factors

Equity issues may be addressed in the component of our conceptual framework that deals with approval goals and perceived social pressure. Are the aspirations and needs of the most destitute given as much consideration as those of the more influential actors?

In Montréal, issues of equity are raised especially regarding affordable housing and neighbourhood diversity. The first subtheme in the regional plan concerns housing (see the section on favouring a quality living environment). Its aim is to ensure a diversified residential offering, in terms of costs and typologies, in existing neighbourhoods and in sectors to be built or transformed. Its objectives are, on one hand, to stimulate the introduction of a balanced offering that can respond to all the life cycle stages of a household, by focusing efforts on filling the gaps observed and, on the other hand, to increase the offer of affordable housing.

The aspects of poverty and social inequality are recognized in Montréal's Resilient City strategy (Ville de Montréal, 2018 b) as diminishing the capacity of resilience to various types of shocks. Furthermore, the 2001–2002 housing crisis, which especially affected people with limited resources, is considered in the strategy as an event that the City must prevent in the future.

The regional plan highlights greening initiatives as favouring social interactions. These interactions can reduce isolation and thus prevent downward spiralling effects on people's mental health and socio-economic situation. Collaborating around greening projects like a green alleyway will also help neighbours collaborate to face a difficult situation. Neighbourhood parties organized by numerous green alleyway committees also help to create social relations that are important for

¹⁰¹ https://cmm.qc.ca/rci-2019-78/2019-78_RCI_Plaines_inondables.pdf

¹⁰² https://cmm.qc.ca/wp-content/uploads/2020/02/CAM_rapport_consultation_reglement_inondation_FINAL.pdf

resilience. For their part, community gardens help to improve food security in addition to encouraging greening and to breaking isolation of the people who spend time there.

Moreover, social diversity of neighbourhoods helps reduce inequities in terms of climate change adaptation and disaster prevention. However, preventing rent increases in neighbourhoods undergoing gentrification is a challenge. Sometimes, just improving the living environment of a neighbourhood with greening causes property values to rise. Policies and bylaws are needed to preserve social diversity of the neighbourhoods.

Adopted in 2005 by the City, the strategy for including affordable housing in new residential projects provided for the inclusion of at least 15% social housing and 15% affordable housing in all realty projects of at least 100 units requiring major regulatory derogations. The new bylaw for a diverse metropolis¹⁰³, in force since April 2021, set new, higher, thresholds for the inclusion of social, affordable and family housing in realty projects. For example, in projects of 50 units or more, developers now have to include 20% social housing, of which the construction will be funded by a Government of Québec program. This regulation applies to projects not requiring derogations from the bylaws. Moreover, the City is offering a subsidy program¹⁰⁴ to encourage access to property, also for the purpose of keeping families on its territory.

7.4 Discussion

This case study showed that regional land use and development plans are valid tools to encourage climate change adaptation, notably by expressing a strategic vision and clear directions in this regard. If the ALUPD, or government guidelines with provisions related to climate change adaptation, made it mandatory to consider climate change in the regional plans, other agglomerations, cities and RCMs could be brought to carry out this exercise. The 2030 Plan for a Green Economy (Gouvernement du Québec 2020) mentions that the instruments guiding land use planning may be revised to promote the role played by this activity in adapting to climate change.

Moreover, the ALUPD suggests that the revision process start five years after its coming into effect. Montréal's previous regional plan had been developed in 1987. An examination of the web page of the MAMH concerning the global portrait¹⁰⁵ of regional and metropolitan planning showed that the large majority of RCMs, cities and agglomerations have gone past the proposed deadline. We did not investigate the factors that constrain the revision of a regional plan, but we can nonetheless state that these factors will also hinder the use of this tool for climate change adaptation.

Among the factors that favoured efficient consideration of adaptation in the Montréal Agglomeration's regional plan are human resources. Having motivated, competent people on the

¹⁰³ <https://ici.radio-canada.ca/nouvelle/1488785/forum-citoyen-quartier-namur-hippodrome-consultation>

¹⁰⁴ <https://ici.radio-canada.ca/nouvelle/1094471/montreal-acces-proprietes-residentielles-programme-subvention-appui>

¹⁰⁵ <https://www.mamh.gouv.qc.ca/amenagement-du-territoire/portrait-global-de-la-planification-regionale-et-metropolitaine/>

regional plan-development team enabled the agglomeration to identify means to encourage regional- and local-level adaptation. It should be noted that people who steered the regional plan revision and the consideration of climate change effects are City of Montréal employees, not external consultants. The exercise certainly contributed to further reinforcing the technical capacities of the City and the agglomeration.

Prior steps taken to adapt to sustainable development and environmental issues also favoured consideration of adaptation in the Montréal Agglomeration's regional plan. For the City of Montréal, these steps were expressed notably in the planning program, the policy on protection and enhancement of natural environments, the Canopy action plan and the sustainable development plans (Ville de Montréal, 2004 a and b, 2010, 2012 and 2016).

Other facilitating factors are the pre-existing synergies between the objectives of the various departments and those of international, federal, provincial, metropolitan, municipal and local public policies with respect to improving the living environment, protecting natural environments and developing recreational tourism activities. These synergies were favoured by the compliance processes of the plans from the various decision-making levels. They were also favoured by the consideration of other plans and policies of the agglomeration, as well as those of the boroughs and linked cities. They also benefited from the interactions between the staff at the City Montréal's Department of Urban Planning and Mobility, who produced the document, the people and organizations who spoke up during the public consultation, the elected representatives of the boroughs and linked cities and the Government of Québec. The various approval processes make it possible for diverse points of view to be considered. The prescribed time frames to put the document into effect, however, limited the time available for interactions.

Another facilitating factor came from the co-benefits of several of the proposed adaptation approaches. For example, greening, natural environments and parks help reduce runoff, diminish the effect of heat islands and, in some cases, prevent the risks of flooding. This makes it possible to propose adaptation projects offering citizens a better living environment and opportunities for recreation, contact with nature and access to the riverbanks. These projects enable the cities in the agglomeration to offer services to the community and makes adaptation socially acceptable.

The choice of the measures proposed in the Montréal Agglomeration's regional plan was influenced by a large body of knowledge and scientific work on the ecosystemic services rendered by trees, greenery and natural environments.

A heat island map produced by UQÀM benefited the development of the regional plan, by making it possible to identify the problematic locations and by illustrating the contribution of large parking lots and flat roofs to this phenomenon. The development of pilot projects and steps taken by innovative boroughs have facilitated the choice of some measures proposed in the regional plan and have made it possible to implement some new ones since. The next amendments or revisions of the regional plan will provide the opportunity to continue the reflection and take into account further expertise with green infrastructures and the development of ecological neighbourhoods, for example.

The regional plan helps to encourage generalized adoption of innovative regulatory practices implemented by boroughs or linked cities. It thus allows a bottom-up adaptation in addition to consistency of local practices with those of regional and provincial authorities. Regulatory innovations by boroughs or linked cities (e.g., concerning the fight against heat islands in Rosemont–La Petite-Patrie, parking lots in Ville-St-Laurent or cessions for the purposes of a park) were favourable to adaptation at the agglomeration level. They influence the social standard, especially when they have given good results. Actors from other localities may want to import these practices. These innovations also provided information on the advantages and disadvantages as well as on “how to proceed,” which may motivate other localities to adopt such practices. Only the measures for which the advantages and the “how to” were clearly defined were included in the provisions of the complementary document to the Montréal Agglomeration’s regional plan. The others were included in the recommendations.

One of the factors impeding the protection of natural environments and the creation of parks is the fact that it prevents development of the zones concerned. Development brings revenue to the municipalities and developers and contributes to the offering of housing to citizens. For a municipality or a borough, this obstacle may be surmounted by directing the development towards brownfields and transforming some already urbanized zones to densify them. For example, such developments are underway on the site of the former hippodrome, of Lachine-Est and of the l’Assomption sector. However, the fact remains that owners’ rights may be infringed upon by measures aiming to protect the environments on their properties. If not done through a process of dialogue where all the actors affected share the will for conservation, the introduction of parks or protected areas may be perceived by property owners as disguised expropriations.

One of the disadvantages of greening is that it causes an increase in property values and in rents, which may contribute to the gentrification of some neighbourhoods. Social housing policies of the City of Montréal and the linked cities thus become vital to ensure the diversity of these neighbourhoods.

Rainwater management measures are not included in the regulatory provisions of the regional plan. Instead, the recommendation was rather to standardize existing bylaws and develop design criteria for green infrastructures. The City of Montreal’s new bylaw 20-030 provides many improvements with regard to bylaw C1.1, which it replaces. In addition, national standards have since been established for bioretention systems (CSA Group 2018 a et b). The possibility of including the demonstrated performance of green infrastructures in sewer overflow management plans could be an incentive for municipalities to use them more, for example, for road drainage. Pilot projects underway are increasing experience with these techniques; they facilitate decisions and implementation of these measures. With this increased experience, it would be worthwhile to explore the possibility of including provisions for stormwater management in future revisions of the regional plan.

The suggested arrangement of topographical depressions to enable floodable zones is impeded by the fact that most of these zones are already urbanized. Pilot projects for creating wetlands could eventually be developed at the bottom of the depressions, but they would entail property acquisitions. The cost would be high, but so would the construction of catchment basins. Ponds could ultimately be recreated at the bottom of the topographical depressions. Examples of

neighbourhoods built around ponds can be seen in Anjou-sur-le-Lac (Anjou borough) and in the Bois-Francs sector of the St. Lawrence borough. Establishment of constraint zones in topographical depressions that are not yet urbanized is vital to avoid homes from being built in at-risk zones. Moreover, the boroughs are creating more and more floodable parks, which allows them to acquire experience with these practices.

7.5 Conclusions and Recommendations

Included in the factors that motivated the Montréal Agglomeration to include climate change in its regional plan are public health issues related to episodes of extreme heat and to sewer backup and overflow, exacerbated by increasingly abundant rains. Requirements from various levels of government, as well as demands or pressure from citizens and elected representatives also contributed to this motivation.

Factors that facilitated consideration of climate change adaptation in the Montréal Agglomeration's regional plan include the following:

- The presence of a person who has experience with adaptation on the regional plan-revision team;
- The creation of a multidisciplinary working group consisting of advisers from various departments and of an external group of experts;
- A prior adaptive process having led to the identification of some measures;
- The fact that the adaptation options considered help to meet some of the agglomeration's other objectives;
- The fact that some boroughs and linked cities had made regulatory innovations that could serve as examples during the compliance-achievement period.

Greening and natural environments help to fight the effects of heat islands and to reduce runoff while helping to improve the living environment and provide opportunities for recreation and for access to nature and to river banks. Nonetheless, they lead to significant maintenance costs, except when the maintenance is handled by community members.

Social housing policies are important to ensure neighbourhood diversity and to prevent greening from causing rent increases for low-income residents.

Through pilot projects, knowledge has evolved in recent years on how to install green infrastructures and develop ecological neighbourhoods in brownfields. Their transformation, just like that of low-density neighbourhoods, is an interesting avenue to enable the city to develop while preserving existing natural environments.

The provisions regarding heat islands have led to the inclusion of provisions in the urban planning bylaws of the boroughs and linked cities. Moreover, several of the recommendations in the regional plan have not been followed by local authorities. There is thus an advantage to including provisions to ensure that regulatory practices are included in urban planning bylaws.

We recommend that the next time the regional plan is revised, the inclusion of the following elements be considered:

- A constraint map related to the topography and natural drainage, and provisions related to these zones, for example, limiting the construction of below-ground driveways;
- Provisions to help preserve and even enhance the role of streets in surface drainage during heavy rains, to prevent flooding of homes and other buildings;
- Provisions to set up floodable parks;
- Provisions for the use of green infrastructures, notably paired with road repair projects (bioretention systems, drainage curb bulbs, etc.);
- Provisions that would act in complement with the City of Montréal's Bylaw 20-030 to reduce runoff from roofs (e.g., require outside drains for buildings of less than 1,000 m² and permeability of at least 20% of the surface of a property, to enable runoff water to flow onto permeable surfaces);
- Provisions concerning the installation of parking lots, not only in heat islands.
- A more constraining provision for the conservation of mosaics of natural environments

The regional plan must be combined with other steps to enable the agglomeration to meet its climate change adaptation and environmental objectives. Awareness-raising activities will encourage better adherence to the principles stated in the regional plan and could encourage their voluntary application by owners, in already developed and built environments.

Among these steps that complement the regional plan, we recommend the search for ways to dispose of the groundwater currently being sent to the sewer system. The agglomeration could also develop a strategy concerning realty development and/or restoration of natural environments on brownfields, which entails decontamination of the properties, in many cases.

Moreover, we recommend that the regional plan-revision process begin as quickly as possible (as the five years since the coming into effect has elapsed) to enable the process to proceed unrushed and to ensure not only consultation of the stakeholders but also a real discussion among the actors concerned.

7.6 Acknowledgements

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coordinator of the Built Environment program at the Ouranos consortium. Joanne Zinkewich translated this chapter from its initial version in French.

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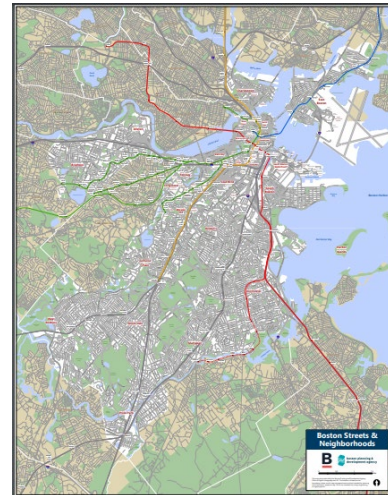
Chapter 8 Climate Ready Boston

Abstract

Case study findings suggest that a catalyzer was Hurricane Sandy in 2012 and the damages it caused in the American Northeast, particularly in New York City. Key success factors have been the Mayor's vision to face climate change as well as the ongoing involvement of the private sector in an organization called the Green Ribbon Commission. Challenges remain to ensure that adaptation will benefit all Bostonians.

8.1 Introduction

A coastal city, Boston faces a range of climate change-related risks resulting from increased climate variability, rising sea levels and associated impacts such as storm surges and flooding. The natural geometry of Boston Harbor protects Boston and neighbouring cities relatively well, but sea level rise and stronger storms are compromising safety and development on the waterfront. Following Hurricane Sandy causing significant damages in New York City in 2012, the City of Boston accelerated its climate adaptation process, developing a number of studies, plans and planning tools.



8.2 The Research

Researchers from the Sustainable Solutions Lab (SSL) at University of Massachusetts Boston examined Boston's policy measures, what motivated them, and what factors either enabled or constrained their implementation and outcomes. The team first identified goals and planned actions from a review of the Climate Ready Boston adaptation plan prepared by the City and studies developed to support it. The team conducted interviews and meetings with officials in the Boston Planning and Development Agency (BPDA), directors of the Green Ribbon Commission and faculty who managed some of the studies.

This chapter summarizes the main studies, plan and tools as well as perceptions expressed in the interviews. It organizes them according to the project's conceptual framework, based largely on the Theory of Reasoned Goal Pursuit.¹⁰⁶ This framework considers enablers and barriers, as well as motivating factors, including the perceived advantages and disadvantages of the policy measures, and perceived social pressures.

¹⁰⁶ Ajzen, I., & Kruglanski, A. W. (2019). Reasoned action in the service of goal pursuit. *Psychological Review*, 126 (5), 774-786.

8.3 The Policy Development Process

In 2007, the City of Boston developed a Climate Action Plan which aimed to reduce greenhouse gas emissions as part of international efforts to mitigate climate change. In 2010, Mayor Menino convened the business community and leaders from Boston's key sectors and launched the Boston Green Ribbon Commission (GRC) to support the outcomes of the Climate Action Plan. The Barr Foundation decided to dedicate funding to addressing climate change issues and became the GRC's main financial supporter. The GRC rallies members from the real estate, health, educational, and cultural sectors. The organization devised a plan to implement change in the numerous facilities owned by its members, with co-benefits in energy efficiency, reduced energy costs and increased air quality. When Hurricane Sandy hit the Northeastern region of the United States in October 2012, it spurred an interest in preparedness and adaptation. If the hurricane had hit Boston at high tide, damages would have been significant. One of the participants in the GRC had assets in New York City, and advocated for creation of a Climate Preparedness Working Group. This group then coordinated the Climate Ready Boston (CRB) process, which included two phases, each involving carrying out studies and developing plans. The working group also commissioned studies about potential climate impacts affecting the Greater Boston area and in support of the implementation of the plan. To develop projections of climate and sea level rise, the academic partners of GRC formed the Boston Regional Advisory Group (BRAG). It included experts from different universities and research centres, coordinated by UMB faculty. Table 8-1 summarizes the main studies, plans and tools for adaptation.

The first of these efforts was a study of the city's vulnerability to climate change impacts. A second important study was commissioned by the Massachusetts Department of Transportation (MassDOT) to evaluate the impact of sea level rise and extreme weather on the Central Artery, the 2.4 km tunnel that runs through Boston. For this study, the "bathtub" modelling approach used in the vulnerability study was not precise enough, so MassDOT worked with the Woods Hole Group which provided hydrodynamic modelling expertise. Meanwhile, BRAG continued its projections of climate change and sea level rise, culminating in the publication of a report in June 2016.

Following these three studies, the City of Boston issued the Climate Ready Boston report, its adaptation plan. A few months later, the Resilient Boston plan—part of the city's participation in the Rockefeller Foundation's 100 Resilient Cities initiative—outlined visions, goals and actions to support climate change adaptation measures and solutions targeting the most vulnerable residents of the city.

Table 8-1: Main studies, plans and tools for adaptation in Boston

Title	Date	Description
City of Boston Climate Action Plan	2007	Focused on reduction of greenhouse gases and co-benefits
Creation of the Green Ribbon Commission (GRC)	2010	Rallies together CEOs from the business community and leaders from Boston’s key sectors
Creation of GRC’s Climate Preparedness Working Group	2013	This working group coordinates the Climate Ready Boston (CRB) process
Climate Ready Boston: Municipal Vulnerability to Climate Change	October 2013	Used a “bathtub” approach to flood mapping
MassDOT-FHWA Pilot Project Report: Climate Change and Extreme Weather Vulnerability Assessments and Adaptation Options for the Central Artery	June 2015	Included the development of the Boston Harbor Flood Risk Model (BH-FRM) , a hydrodynamic model prepared by Woods Hole Group
Climate Change and Sea Level Rise Projections for Boston. BRAG Report	June 2016	Like a mini-IPCC report for the Greater Boston area
Climate Ready Boston report Executive Summary	December 2016	Boston’s adaptation plan
Resilient Boston Report: An Equitable and Connected City	July 2017	Report developed in the context of the 100 Resilient Cities program.
BPDA’s climate resiliency guidance , including flood overlay and checklist	December 2017	The flood overlay map was developed using the hydrodynamic model developed for the flooding of the Central Artery
Financing Climate Resilience report by SSL commissioned by GRC	April 2018	This report assessed the projected costs of climate resilience in Boston and evaluated various options to finance these needs.
Feasibility of Harbor-wide Barrier Systems. Preliminary Analysis for Boston Harbor by SSL	May 2018	This report was focused on the costs, technical functionality and environmental impacts of a harbor-wide flood barrier. It advised against pursuing such a strategy in the coming decades and recommended shore-based solutions
Governance for a Changing Climate: Adapting Boston’s Built Environment for Increased Flooding report by SSL, commissioned by GRC	September 2018	This report focuses on how the structure and tools of the local, regional, and state government can be modified and enhanced to minimize the impacts of climate changed-induced flooding on Boston’s built environment.
Expanding Boston’s Capacity to Build Coastal Resilience Infrastructure. Lessons from the Seaport District , Report by Arcadis, commissioned by GRC	April 2020	The report makes recommendations along two parallel tracks of action, the first focused on leveraging existing frameworks to complete initial urgent actions and the second to identify opportunities for transformative measures needed to support citywide implementation
Neighborhood CRB studies: East Boston and Charlestown ; South Boston ; Downtown and North End ; Dorchester ; Moakley Park vision plan	2017 to present	These studies develop neighborhood visions and propose catalyst projects for the short term as well as long term strategies to achieve the vision

8.4 Motivating and Enabling Factors

Even before Hurricane Sandy, Boston was facing challenges related to the impacts of climate change, such as coastal flooding at king tides, extreme heat episodes compounded by the heat island effect, and stormwater management issues caused by more intense rains. The damages occurring in New York City following Hurricane Sandy revealed challenges that Boston could face in the near future, highlighting the advantages of adaptation. The City of Boston received pressure from the private sector to act and to adapt. The private sector was already involved in the GRC and committed to reducing greenhouse gas emissions. The formation of the GRC's Climate Preparedness Working Group, alongside the funding provided by the Barr Foundation, were strong enablers of the Climate Ready Boston process, and the development of the studies and plans. Other enablers were the presence of numerous research universities in the Boston area who coordinated and contributed to the studies.

A tangible outcome of the studies conducted has been BPDA's guidance and checklist for climate preparedness, developed with funds from Massachusetts' Municipal Vulnerability Preparedness (MVP) program. BPDA's climate resiliency guidance and checklists provide developers with information on how to adapt their buildings to climate change impacts, including storms, extreme heat and flooding. The BPDA also uses the flood overlay map based on the hydrodynamic model developed by UMB to examine the effects of flooding on the underground infrastructure. The approach in Boston is to allow construction in areas at risk of flooding but to ensure that these constructions are resilient. Adaptation interventions include having a floodable first floor that does not house residents or essential electric or mechanical equipment for the operation of the buildings. The BPDA has drafted guidelines in this respect (City of Boston 2019). The Public Works Department developed guidelines to ensure flood protection of public rights-of-ways (City of Boston 2018 b).

Enabling factors for advancing actions in the plan included:

- developing an overall Resilient Boston Harbor vision, and neighborhood visions, that focus on values such as preparedness, accessibility and connectedness;
- identifying catalytic near-term projects while maintaining the search for longer-term solutions;
- co-benefits of the proposed coastal infrastructure (recreation, public access to the coast) and the fact that plans envisage access to them through pedestrian and bicycle paths;
- the quality of the climate projections and flooding studies which provided credible representations of future impacts of climate change and facilitated public buy-in;
- Boston being part of the 100 Resilient Cities network;
- Mayor Walsh participating in the C-40 association of cities taking bold climate action;
- respect for the guidelines and use of the checklist by developers;
- increased public participation in Climate Ready Boston phase II (neighborhood studies).

8.5 Barriers to Implementation

Climate Ready Boston's vision for Resilient Boston Harbor¹⁰⁷ focuses on values such as accessibility and resilience. It seeks preparedness to a 100-year storm event with 40 inches of sea level rise by 2070. It proposes a resilience toolkit, comprising adapted infrastructure (elevated roadways, strengthened seawalls and flood barriers), protective waterfront parks and elevated harborwalks. However, many aspects of its implementation remain unclear, including how to integrate this infrastructure in areas with strict zoning regulations such as Designated Port Areas (DPA); what the arrangements will be with private landowners; and how to fund these interventions. In addition, some of these interventions could involve filling the shoreline, causing environmental impacts and sometimes conflicting with existing local coastal wetland regulations and State laws like Chapter 91¹⁰⁸, which guarantees public access to the waterfront. If not taken into consideration, unintended consequences of the plan and the proposed infrastructure may be to disproportionately benefit private owners and the residents of the luxury housing on or near the waterfront.

Boston's Master Plan, *Imagine Boston 2030* (City of Boston 2017 a), promotes further development of the waterfront. Four out of five of the the areas identified for growth arhave been shown to be vulnerable to coastal flooding. The Resilient Boston Harbor approach intends to protect these areas from flooding. But the Sustainable Solution Lab's study on governance recognises that there could be some downsides to this approach:

It may end up putting more citizens in harm's way, thereby requiring further investment in emergency services; it may end up directing resources to areas that investors, businesses, and residents ultimately reject in favor of inland neighborhoods less prone to coastal flooding; and allowing new development in flood prone areas could have a serious impact on the City's budget in the future, when its responsibility to new residents and property owners requires it to make increasingly large expenditures to either maintain infrastructure or incentivize property owners to relocate. (Kruel et al., 2018, p. 24)

The 2013 vulnerability study and 2016 Climate Ready Boston final report focused on coastal flooding, extreme heat and stormwater management. Until now, coastal flooding has received the most attention due to the visible flooding that followed strong nor'easter storms in recent years, and perhaps because of the implication of the real estate sector. On the other hand, extreme heat is affecting health and quality of life, especially in marginalized neighborhoods with poor air quality, such as East Boston. A heat resilience study is presently under way¹⁰⁹, which will identify strategies to address future impacts of extreme heat. The Museum of Science developed the *Wicked Hot Boston*¹¹⁰ project, using citizen science. Increased public participation in the

¹⁰⁷ <https://www.boston.gov/environment-and-energy/resilient-boston-harbor>

¹⁰⁸ Chapter 91, the Massachusetts Public Waterfront Act <https://www.mass.gov/guides/chapter-91-the-massachusetts-public-waterfront-act>

¹⁰⁹ <https://www.boston.gov/departments/environment/preparing-heat>

¹¹⁰ <https://www.mos.org/pes-forum-archive/wickedhotboston>

studies of each neighborhood could eventually lead to a better social distribution of the benefits of adaptation.

The neighborhood studies (City of Boston, 2017 b, 2018 a, 2020 a, b) focus on coastal protection but highlight needed steps for stormwater management. For example, the Dorchester study mentions that stormwater outfalls will need tidal gates to protect against backflow and possible flooding due to storm surge and sea-level rise. It also mentions that the deployment of temporary barriers could contribute to the stormwater system becoming overwhelmed during significant rainfall events at high tide, and that other protective measures must be implemented, such as upland detention, system storage and pump stations to minimize or reduce the impacts of flooding. The report also notes that stormwater systems are owned and operated by multiple public and private entities, including the Boston Water and Sewer Commission. Boston Parks and Recreation Department developed guidelines for stormwater management in parks (City of Boston 2020 c).

Barriers faced by the city and its partners included:

- environmental impacts of the proposed shore protection infrastructure;
- a complex and multi-level regulatory system;
- the unequal distribution of benefits from proposed shore protection infrastructure;
- the fact that protection from coastal flooding can interfere with the flow of inland stormwater.

8.6 Conclusions and Looking Forward

Case study findings suggest that a catalyzer was Hurricane Sandy in 2012 and the damages it caused in the American Northeast, particularly in New York City. Key success factors have been the Mayor's vision to face climate change as well as the ongoing involvement of the private sector in an organization called the Green Ribbon Commission. Challenges remain to ensure that adaptation will benefit all Bostonians.

Increasing public participation and responding to the needs of different stakeholders appear to be key elements toward just adaptation in Boston.

Other opportunities for further research or reflection include:

- how to deal with complicated regulation issues;
- how to approach and negotiate with private coastal landowners to implement resilient infrastructure; and
- institutional arrangements to govern and fund research and the implementation of proposed adaptation strategies

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Chapter 9 Lessons Learned Across the Case Studies

This chapter synthesizes the lessons learned from the six case studies presented in Chapters 3 through 8, respectively. First, we will focus on determinants of effective policy instruments that are common to the six studied cases, divided according to the components of our conceptual framework. This corresponds to the first specific objective of the project, consisting in identifying individual and contextual factors and policy instrument characteristics that enable or hinder adaptation. Second, we will look more specifically at factors related to: 1) the use of information and knowledge; 2) stakeholder engagement; 3) equity and environmental justice; and 4) the effects of federal policies. The first two of these themes correspond to two other specific objectives of the project whereas the research team found the two others important during the data analysis. We conclude with recommendations for jurisdictions at different levels.

9.1 Common Factors

The case studies drew our attention to what appear to be key common factors in all study locations and all administrative levels: the local, regional, provincial and state levels. In this section, we divide them according to the components of our conceptual framework: 1) perceived advantages and disadvantages; 2) perceived social pressures; and 3) perceived enablers and barriers. It is important to understand that policy instruments affect the behaviour of their targeted actors by influencing these same factors. For illustrative purposes, Figure 9.1 gives examples of these factors in relation to our conceptual framework described in Chapter 2. Table 9.1 summarises the most common factors.

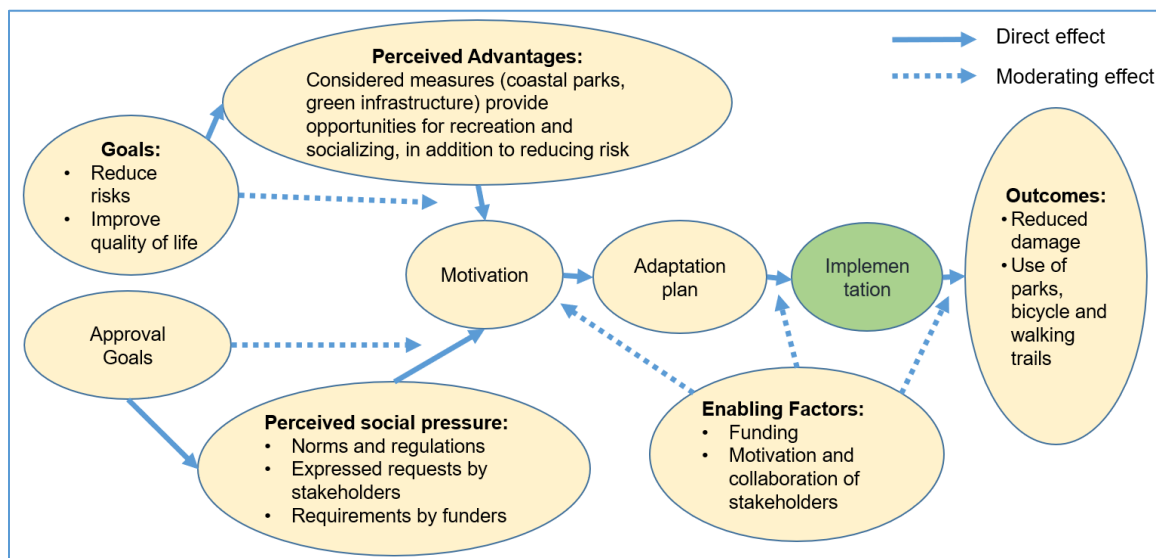


Figure 9-1: Examples of determining factors of effective policy instruments, organised along the project's conceptual framework

Table 9-1: Summary of the main determinants of the effectiveness of policy instruments

Motivating factors		Control factors
Perceived advantages (☺) and disadvantages (☹)	Perceived social pressure favourable (☺) and unfavourable (☹)	Perceived enablers (☺) and barriers (☹)
☺ Catastrophic events favour the perception that interventions are needed ☺ Considered options reduce risk ☺ Considered options improve quality of life	☺ Government requirements ☺ Industry standards ☺ Donor requirements ☺ Requests expressed in public consultations ☺ Previous commitments	☺ Motivated and competent human resources within the administration ☺ Availability of experts (academia, consultants, NGOs) ☺ Availability of information, such as climate projections, maps of risk areas ☺ Availability of funds ☺ Involvement of stakeholders/member jurisdictions ☺ Boundary work, at the interface between the different actors/entities and with scientific research. ☺ Developing new policies and instruments to overcome barriers
Considered options: ☹ Can limit what people can do on their property ☹ Can cause a reduction in tax revenue ☹ Some coastal protection measures can reduce access to the coast and have negative environmental impacts	☹ Pressure by members of the constituency or development industry ☹ Elected officials can be reluctant to adopting unpopular measures	☹ Lack in some of the enablers mentioned above ☹ Some considered options may require more resources (financial, human, organizational and informational) than others and are therefore not selected

We note that barriers can result from a lack in some of the enablers, which can in turn result from a lack of motivation of potential collaborators or targeted actors, or from barriers experienced by them. Authorities can develop new policies and instruments to overcome these barriers.

Different policy instruments can influence targeted actors and promote a given adaptation behaviour by

- motivating the actors, by
 - informing them of about the advantages of the behaviour;
 - making the behaviour compulsory in order to gain approval (e.g. preparing a municipal adaptation plan to access provincial infrastructure funding; using approved roofing materials to obtain a municipal construction permit), thereby creating a social pressure;
- providing resources (financial, human, organizational and informational) to facilitate it.

9.1.1 Perceived Advantages and Disadvantages

Governments develop and use policy instruments with the goal of protecting people and assets from climate-related impacts. They seek to reduce risks for civil security and for infrastructure. Recent catastrophic events in or near their territory, such as Hurricane Sandy in New York, storm-related flooding in Nova Scotia and New Brunswick, and heat waves in Montreal, reinforce the

belief that adaptation measures need to be developed. These events and their effects are determining factors in the effectiveness of public policies since they influence the motivation of authorities and the adherence of the actors targeted by public policies. On the other hand, risk reduction objectives may fluctuate and be less active between extreme weather events. The knowledge and experience of stakeholders will also influence their perception of the benefits of certain options considered. The lack of experience of engineers seems to have discouraged the use of so-called soft methods for bank stabilisation in Quebec (see Chapter 6) and the inclusion of binding provisions for runoff management in the Montreal urban planning and development scheme. Having industry standards such as for design, construction or insurability is also a determining factor that may favour certain options since compliance with the standard guarantees, to some extent, the effectiveness of the structure for the intended use. This is the case, for example, with the standards published by the CSA group for stormwater bioretention systems (see Chapter 7).

Often the options chosen also have benefits for quality of life, and governments can incorporate them into policies that aim to improve active transportation (for example, the living shoreline project in Mahone Bay), recreation, and access to the shore (highlighted in Montréal's Regional Land Use and Development Plan and in Climate Ready Boston's neighborhood studies). In all regions, some participants have recognized the synergies between the conservation of natural environments, greening, recreation and adaptation. Protecting dunes or marshes on the coast has the advantage of restricting development in at-risk areas as well as allowing these features to play an important role in reducing flooding and erosion risks. Greening in cities like Montréal and Boston reduces the heat island effect and can sometimes play a role in stormwater management. For example, many municipalities and boroughs in Montréal combine greening and active transportation to create corridors for biodiversity and pedestrians, bicyclists, etc. While the interest in reducing risk sometimes decreases between storms, goals to improve quality of life can sustain the motivation of governments to implement policy instruments and can help increase public support for them.

Policy instruments also have disadvantages, which in many cases, can affect the actors being targeted by the instruments. These actors can then be reluctant to act and might exert social pressure on the government, reducing *its* motivation to act. We will be examining social pressures in the next subsection. Implementing policy instruments is often costly and is often only possible when there are sufficient resources (a facilitating factor). Another disadvantage is that implementation requires human resources (also a facilitating factor) for control and application, for example, personnel to review requests for permits. A factor mentioned in the Montréal study as well as in informal conversations with participants in other case studies is that regulations that restrain development have fiscal consequences for municipalities, because development generates income through collection of property taxes. Greening projects can also increase the value of property, leading to increased taxes and rents, disfavoring residents with lower incomes.

9.1.2 Perceived Social Pressure

Perceived social pressure to reduce risks, and to take action regarding climate change in general, comes from the constituency, emergency management organizations and higher levels of government. The constituency can express requests or pressure through consultation and engagement activities, by bringing issues to the attention of municipal councils, and by marching en masse in the streets, as happened in Montréal in September 2019. The fact that climate change is a global issue, recognized by the United Nations and documented by scientists of the IPCC, generates an international social norm. The governments of Nova Scotia and New Brunswick requiring their municipalities to develop specific plans in order to access infrastructure funds is also a form of social pressure or norm. Previous engagements in other plans are also a source of social pressure that can motivate governments to create and implement policy instruments. This was the case, for example, with Montréal's commitments to reduce the heat island effect and to manage stormwater, introduced in plans previous to the Regional Land Use and Development Plan (*Schéma d'aménagement et de développement (SAD) de l'agglomération de Montréal*). Funding agencies, who provide financial resources allowing the implementation of some instruments (a facilitating factor), also impose requirements, which add to the social pressure that can motivate governments to carry through with their interventions.

There are also forms of social pressure that reduce motivation. Municipal governments might be reluctant to adopt flood maps or implement restrictive bylaws that would be unpopular with their constituencies. Lawsuits by landowners are an extreme form of pressure that the City of Montréal and other municipalities in the region have faced on a number of occasions. In addition to being a source of pressure, it can have financial consequences because even if municipalities win, they must pay to defend themselves in court. In New Brunswick, the Chaleur Director of Planning pointed out that municipalities do not want to adopt restrictive regulations unless other municipalities in the region follow suit. Many people call for a province-wide standard that would ensure that all municipalities are under equal pressure and that would somehow equilibrate the pressure from the constituency. However, provincial governments also wish to be popular with their constituencies and are therefore reluctant to impose regulations. The Government of New Brunswick leaves the responsibility of regulating land use to municipalities, and leaves the responsibility of standardization to the Regional Service Commissions.

9.1.3 Perceived Enablers

Several factors enable, or are necessary for, implementing policy instruments. Lack of any of these factors becomes a barrier to carrying out the planned actions or to their positive outcomes. One key factor is the availability of financial resources, which are essential for hiring staff, securing technical and logistical assistance and implementing planned actions. For this reason, many policy instruments provide funding, such as New Brunswick's support for community adaptation planning, made possible by the Environmental Trust Fund, which collects half of all deposits made on beverage containers. Massachusetts' Municipal Vulnerability Preparedness (MVP) program provides planning grants to municipalities, and action grants to certified municipalities. Another important enabler is human resources within governments, including both elected members and staff. Having supportive council and staff is important. In addition, we have noticed the level of

motivation of the people we interviewed. Their drive and determination have allowed them to overcome many obstacles.

The ability to hire experts, or to sustain partnerships with universities and other community partners, can make up for limited human and technical resources, to a certain point. Partners can conduct studies and facilitate meetings, but staff and elected official participation and buy-in are necessary to ensure that a municipality addresses the vulnerabilities highlighted by the studies and follows through on planned adaptation actions.

When regulating to control development in risk-prone areas, it is necessary to have or to develop maps of these areas. Having experience in the development of adaptation options, or practical information about how to implement them, is also an enabling factor. For this reason, New Brunswick is developing capacity-building activities through its three BRACE projects. In Québec, recent projects involving beach nourishment may be increasing capacity and opening up options, whereas armouring was the preferred option until only recently. In Montréal, recent projects with roadside green stormwater management infrastructure and building ecological neighborhoods in previously industrial plots have been contributing to the City's and developers' expertise.

The involvement of members of the constituency is a facilitating factor that can enable actions and further motivate governments. We will discuss this aspect further in Section 9.2.3. What appears to be a determining factor is the government's capacity to not only involve stakeholders but also to listen to different requests or pressures and put measures in place for the collective long term. This work that we could qualify as "boundary work" is necessary to avoid certain powerful players having too much influence on policy decisions. It is also necessary to know what barriers prevent the targeted actors from performing the expected actions. It is also necessary to allow the use of scientific results in policy decisions. Boundary work requires feedback mechanisms that inform decision-makers about these barriers as well as consultation mechanisms to allow diversifying the sources of social pressure.

9.2 Factors Related to Specific Themes

9.2.1 Factors Associated with Use of Information and Knowledge

In each of the case studies, we saw how governments at different levels of government use research results in a variety of processes, including stakeholder engagement, planning, decision-making, and asset management. These scientific findings, which are often included in information products of all kinds, are enablers for governments to make decisions and know how to proceed. Governments also use them to influence the actors targeted by their public policies, either to motivate them to act or to make it easier for them to do so.

Collaborations between scientists and governments very often shape policy instruments such as adaptation plans, risk maps or regulations. These can therefore be described as "boundary objects". Sometimes consultants use projections to develop information products tailored to the needs of a particular government, for example, flood risk maps that take into account both sea level rise and projected precipitation resulting from international modeling efforts. These consultants, often from academia or NGOs, often play an important role in developing adaptation

plans or options that are based on scientific research findings. They also play an important boundary role between the scientific community and governments. In addition, Quebec, New Brunswick, Nova Scotia and Massachusetts have funded the development of information portals by universities and research centers for the benefit of municipalities and other stakeholders.

9.2.2 Factors Related to Stakeholder Engagement

All case studies highlighted the importance of stakeholder involvement and many pointed to various challenges.

Several policies required, or still require, public consultation, such as the Integrated Community Sustainability Plans (ICSPs) and the Municipal Climate Change Action Plans (MCCAPs) in Nova Scotia; Massachusetts' Municipal Vulnerability Preparedness Program (MVP); and land use planning and changes to bylaws in Nova Scotia, New Brunswick and Québec, among others. Case study participants expressed concerns about consultation issues. For example, a participant in New Brunswick mentioned that authorities are sometimes reluctant to present risk maps to residents unless they have strategies to propose. In such cases, authorities are cutting themselves off from a source of ideas, because residents can also participate in proposing relevant solutions. On the other hand, the MPV case study highlighted the challenges of ensuring that environmental justice populations, non-English speakers and people with disabilities are included in consultations. The Montréal agglomeration study highlighted the fact that tight deadlines had reduced the number of possible consultations.

Some studies highlighted processes in which authorities went farther than consultation to facilitate the active involvement of many different stakeholders. In New Brunswick for example, the provincial government supports the Climate Change Adaptation Collaborative, which organizes annual meetings and other activities. NGOs, Regional Service Commissions, universities, consultants and other community partners are very much involved in supporting municipalities in their adaptation planning. This created a momentum that further influenced the government to support a variety of organizations, knowing that they, in turn, can support municipalities. This created a "snowball effect" in which stakeholder involvement created pressure for better involvement mechanisms. New Brunswick also had three BRACE projects, led by different organizations and involving the provincial government.

The involvement of residents is also a factor that can contribute to the success of specific actions for adaptation. For example, the case study on the Montréal agglomeration has highlighted how volunteers have been helping in the maintenance of some parks. Citizens involved in the green lanes ensure maintenance of greened public space and, at the same time, create social networks that increase resilience in many ways.

The involvement of the private sector is also very important and has been a determining factor in supporting the Climate Ready Boston initiative.

9.2.3 Factors Supporting Equity and Environmental Justice

Having adequate stakeholder consultation and involvement is one way to support equity and justice but it is not adequate if the most vulnerable or the most affected are not able to participate. Massachusetts's Municipal Vulnerability Preparedness (MVP) program requires that municipalities receiving grants involve environmental justice populations in significant decisions. In Canada, many policies require consultation with indigenous communities, and federal and provincial environmental assessment processes require that assessments of projects consider potential negative effects of projects on any group of people.

Another way to support equity is to foresee the unintended negative consequences of adaptation options and to work on solutions to attenuate those consequences. For example, urban greening and parks can contribute to gentrification by making neighborhoods more pleasant and therefore increasing property values and rents. Ensuring that all neighborhoods can benefit from greening efforts is one way to prevent certain neighborhoods from becoming more attractive than others. Social housing is another way to prevent gentrification and ensure social diversity in neighborhoods.

One equity concern relates to access to the coast. Ownership of private property along the coast often restricts public access and concentrates the benefits of necessary adaptations on the owners of houses or condominiums, while also putting these people at risk. Designating and protecting coastal parks and natural areas ensures public access to the coast while reducing risks to property and civil security.

Environmental justice is a field that has been addressed for a much longer time in the U.S. than it has been in Canada. The USA's Environment Protection Agency (EPA) has an environmental justice office since 1992. In 1994 President Clinton signed Executive Order 12898 requiring that the U.S. EPA and other federal agencies implement environmental justice policies to address the disproportionate environmental effects of federal programs and policies on minority and low-income populations. In Canada, Nova Scotia MP Lenore Zann introduced Bill C-230¹¹¹ in February 2020 to compel the minister of the environment to create a national strategy to redress environmental racism within two years. The bill has passed second reading on March 24 2021¹¹².

9.2.4 Factors Related to the Outcomes of Federal Policies

This project focused on provincial, regional and municipal policy instruments. Our interviews did not include any questions about the impact of federal level policies. Nonetheless, the case studies offered evidence of how federal policies are motivating or facilitating adaptation in Québec, Nova Scotia, New Brunswick and Massachusetts.

In Canada, the Gas Tax Fund provides funding to provinces who then distribute a good portion of it to municipalities for infrastructure projects. In order to be eligible for the 2005-2009 funding round, municipalities in all Canadian provinces had to develop Integrated Community

¹¹¹ <https://www.parl.ca/DocumentViewer/en/43-2/bill/C-230/first-reading>

¹¹² <https://openparliament.ca/bills/43-2/C-230/>

Sustainability Plans (ICSPs). Nova Scotia was the only province to add a further requirement for the 2010-2014 funding round, which was to develop Municipal Climate Change Action Plans (MCCAPs) by the end of 2013. To support development of their MCCAPs, municipalities could access funding from the Gas Tax Fund. The federal government's new requirements for the fund, which involve putting efforts into asset management, are motivating municipalities to plan ahead. Municipalities and provinces are reflecting on how to take climate change into account in asset management. The importance of the impacts of climate change on municipal assets, as expressed by participants in Mahone Bay and Guysborough, NS, offers an indication of how asset management is raising municipal awareness about the effects of climate change.

Participants in New Brunswick and Montréal mentioned the Climate Lens,¹¹³ a set of guidelines from Infrastructure Canada, among the factors facilitating adaptation. Many of Infrastructure Canada's programs require considering climate change in the design of infrastructure. This sets a social norm. In addition, using the guidelines strengthens the capacity of engineers and consulting firms to consider climate change. It then becomes easier for provincial and municipal programs to put similar requirements in place to support their own infrastructure development.

Participants in Nova Scotia and Montréal mentioned funding from the Federal Disaster Mitigation and Adaptation Fund.¹¹⁴ In Nova Scotia, this fund supports the province's Municipal Floodline Mapping Project as well as the District of Guysborough's Climate Change Mitigation Plan. In Montréal, the program supported two large-scale projects, one involving the purchase of land for the *Grand Parc de l'Ouest*, and the other involving development of stormwater retention ponds. This federal program requires projects to include green infrastructure as a condition of being eligible for funding.

The Atlantic Canada case studies also highlighted the outcomes of projects funded by Natural Resources Canada (NRCan). The Regional Adaptation Collaborative program funded two regional projects carried out by the Atlantic Adaptation Solutions Association from 2009 to 2016. These led to many pilot studies in municipalities, much networking and the development of the Coastal Community Adaptation Toolkit (CCAT). This toolkit has been used in both provinces, but not to its full potential. Today, it is still an extremely relevant resource. In New Brunswick, the regional program inspired the formation of the Climate Change Adaptation Collaborative, launched in 2013 and coordinated by the New Brunswick Environmental Network (NBEN). NRCan also leads the project on Coastal Flooding case studies, for which the Atlantic case is the Acadian Peninsula.

The Department of Fisheries and Oceans (DFO) enforces the Canadian Fisheries Act, which includes provisions to protect fish and their habitats. The proponents of projects that alter fish habitats must obtain a permit from the DFO and must show that they are reducing their impact and compensating for any residual impact by creating new fish habitats.

In Canada, the ocean and coastlines fall under federal jurisdiction, which is why it is sometimes difficult for provinces to regulate issues affecting coastal adaptation. In New Brunswick, for instance, the Watercourse and Wetlands Alteration (WAWA) Regulation can only protect coasts where there are outlets from inland watercourses. The rationale for this was the federal

¹¹³ <https://www.infrastructure.gc.ca/pub/other-autre/cl-occ-eng.html>

¹¹⁴ <https://www.infrastructure.gc.ca/dmaf-faac/index-eng.html>

jurisdiction of the oceanic coast, which accounts for almost 44% of the coastline. However, during the period of 2006 to 2015, the federal government did not enforce the Canadian Fisheries Act, resulting in the destruction of many fish habitats. A large proportion of the New Brunswick coast was artificially hardened, impeding the natural input of sediments to the sea and increasing developments on the coast, increasing risks for public safety. Because coasts are under federal jurisdiction, the federal government could play a more significant role in the future in bringing back coastal resilience. A stronger application of the Canadian Fisheries Act could be a catalyst to developing greater resilience for people as well.

In the United States, disaster mitigation is handled federally, through the Federal Emergency Management Agency (FEMA). This agency has mapped flood-prone areas, and municipalities use FEMA maps to grant building permits. FEMA has put in place the National Flood Insurance Program (NFIP). To be insurable, homes must be located outside flood-prone area corresponding a 100-year event. However, FEMA flood maps are badly outdated, often dating back from the 1970's. They do not take climate change into account. A number of organizations are asking FEMA to update its maps and set tougher standards for floodplain construction¹¹⁵.

Federal programs have also influenced how Massachusetts manages its coasts. The Massachusetts coastal program was created in response to the federal Coastal Zone Management Act¹¹⁶ (CZMA) of 1972, enforced by the National Oceanic and Atmospheric Administration (NOAA). The CZMA established a voluntary program that gives coastal states the funding and the opportunity to develop and implement plans to manage coastal resources. The development of the Massachusetts coastal program began in 1974 with a Governor's Task Force on Coastal Resources, and the process included extensive participation from state agencies, the state legislature, local officials, environmental and other interest groups, business organizations, and citizens. These efforts culminated in 1978 with NOAA approval of the Commonwealth of Massachusetts final coastal zone management program plan—making Massachusetts the first state on the eastern seaboard with a federally approved coastal program. Five years after the Massachusetts coastal program received its initial federal approval, the state Legislature passed Chapter 589 of the Acts of 1983—An Act Relative to the Protection of the Massachusetts Coastline—which contained several important provisions defining the role of the coastal program and its policies in state government, including the formal establishment of the Massachusetts Office of Coastal Zone Management (CZM).

9.3 Recommendations to Provincial or State Governments

In the following sections, we divide our recommendations into the themes covered in the case studies.

¹¹⁵ <https://www.reuters.com/article/us-climate-change-usa-floods/as-climate-risks-rise-u-s-urged-to-update-flood-maps-and-building-rules-idUSKBN29B2RW>

¹¹⁶ <http://coast.noaa.gov/czm/act/>

9.3.1 Regarding Adaptation Planning

In Québec, Nova Scotia and New Brunswick, the provincial level adaptation policies studied were all measures of the provinces' Climate Change Action Plans (CCAP). Québec adopted a new Plan for a Green Economy (PEV, *Plan pour une économie verte*) at the end of 2020 after extensive consultation. Massachusetts adopted its State Hazard Mitigation and Climate Adaptation Plan (SHMCAP) in July 2018 and New Brunswick adopted its CCAP in 2016. Nova Scotia has not produced a new CCAP since developing its first one in 2009. Our case studies did not focus on province- or state-wide adaptation plans, but results suggest that these plans are effective mechanisms to motivate and support adaptation action. First, consultations help raise government awareness of barriers faced by municipalities and other actors trying to adapt to climate change. Second, they provide a mechanism around which to coordinate the efforts of the many departments and governmental agencies that have a role to play. Third, they provide an accountability mechanism through which provinces and states monitor their progress and the outcomes of their actions on other actors such as municipalities. The only recommendation from our research team regarding provincial adaptation planning would be to encourage Nova Scotia to update its plan. We suggest that it would help the province to better coordinate adaptation actions among departments and agencies and would allow it to set unifying goals.

In all the case study provinces and in Massachusetts, many departments and agencies are involved in climate change adaptation, the most important ones being those dedicated to the environment, local governments and housing, as well as public safety and public health. Other departments such as those responsible for agriculture, fisheries and tourism, have important roles as well, because climate change has important impacts on their sectors of interest. In New Brunswick, the same department is responsible for local government and the environment, which facilitates communications.

In Massachusetts, Executive Order 569 in September 2016 aimed to establish an integrated climate change strategy for the Commonwealth. It led to parallel development of the MVP program and then the State Hazard Mitigation and Climate Adaptation Plan (SHMCAP). We note that Massachusetts has coupled its adaptation planning with hazard mitigation whereas Québec has a separate civil security plan.¹¹⁷ Québec also has an entire department (*ministère*) devoted to public safety, whereas in Nova Scotia and in New Brunswick, the same department manages justice and public safety considerations but there are separate emergency management organizations. Québec's public safety plan identifies land use planning (*aménagement du territoire*) as the main strategy for preventing risks. There is much overlap between adaptation and hazard mitigation, but many hazards are unrelated to climate. A possible approach for adaptation would be to develop a plan that articulates how to integrate climate change into all the other instruments necessary for adaptation, including local instruments. Such a plan could identify mechanisms and the financial and human resources that would support the different departments, agencies and local governments in their adaptation.

¹¹⁷ In Québec, the most recent [Plan National de Sécurité Civile](#) was adopted in October 2020.

9.3.2 Regarding Support for Regional and Municipal Planning

Three of our case studies were about provinces (New Brunswick and Nova Scotia) or a state (Massachusetts) supporting adaptation planning by local governments. This allows us to make comparisons and reflect on the situation in Québec. Table 9-1 presents a comparison of approaches in the two Atlantic provinces and in Massachusetts, and Table 9-2 presents a comparison of facilitating factors. In Québec, the provincial government does not require adaptation plans. Nonetheless, a few provincial programs since 2010 have supported municipal adaptation planning or incorporating climate change considerations into municipal planning. Some municipalities find that adaptation planning is a useful exercise and then include the planned actions in their routine municipal planning instruments in order to implement them.

Table 9-2: Comparison of the New Brunswick, Nova Scotia and Massachusetts approaches to requiring and supporting adaptation planning

Aspect	In New Brunswick	In Nova Scotia	In Massachusetts
Municipalities approached or targeted by the requirement	52 of 104 (all cities and most vulnerable municipalities)	All 50 municipalities	Planning is not mandatory but is necessary for MVP qualification or to receive an action grant
Period of development of plans	Since 2016, ongoing	2011-2013	Since 2017
Monitoring plans or updates required	Planned to be in the future	No	No
Funding source for planning support	Environment Trust Fund	Gas Tax Fund	State funds
Funds used as an incentive to planning	Provincial infrastructure funds	Gas Tax Fund	State funds
Action grants	No	No	Yes

Table 9-2: Comparison of facilitating factors in New Brunswick, Nova Scotia and Massachusetts regarding support for local adaptation planning

Table 9-3: Comparison of facilitating factors in New Brunswick, Nova Scotia and Massachusetts regarding support for local adaptation planning

Facilitating factors	In New Brunswick	In Nova Scotia	In Massachusetts
Coastal protection act or policy	Since 2002	Since 2019	Since 1978: (Commonwealth of Massachusetts Coastal Zone Management Program Plan)
Regulation associated with coastal policy	Watercourse and Wetland Alteration (WAWA) Regulation	Regulations in development	Since 1983 Chapter 589 of the Acts of 1983—An Act Relative to the Protection of the Massachusetts Coastline
Mapping of flood-prone areas, taking climate change into account	Within adaptation plans	Municipal Floodline Mapping Project, by province	FEMA flood maps do not, and Climate Ready Boston flood maps do take climate change into account.
Mandatory local strategic planning	Since 2017	By 2023	Not mandatory but incentivized by the MVP program.
Mandatory regional planning	No	No	No
Statements of Provincial Interest	No	Since 1998	N/A
Mandatory incorporation of flood-prone areas in planning bylaws	No	Yes	Necessary to apply for FEMA’s National Flood Insurance Program (NFIP).
Meetings among stakeholders/practitioners	Annual meetings of the Adaptation Collaborative coordinated by New Brunswick Environmental Network (NBEN)	No provincial approach	The Global Warming Solutions Act (GWSA) Implementation Committee meets since 2012.

Many of the facilitating factors for adaptation can become barriers if they are lacking. Governments should be able to regulate land use without compensating landowners for loss of value of property or insurability. Nonetheless, the effects that land use bylaws can have on residents and landowners can generate resistance. This resistance towards municipalities will be significant unless regulation is mandatory by provincial standards. The province taking responsibility for the restrictions on coastal lands can solve part of the problem but will not reduce the consequences on landowners and residents. If there are no provincial standards, the market will eventually regulate with people becoming less interested in coastal property. In such cases, coastal residents will still be disadvantaged and at physical and/or financial risk.

9.3.3 Regarding Management of Transportation Infrastructure

In Atlantic Canada and coastal areas of Québec and Massachusetts, fishing and maritime transportation have played an important role in the economy. Governments built roads along the shore to link coastal villages. Many of these roads are low-lying and become flooded during storm surges. With sea level rise, in the relatively near future some of these roads could be permanently flooded. In some areas, erosion threatens roads in unpredictable ways. After a storm, previously stable areas can become problematic.

The case study on environmental assessment of bank stabilization projects in the Côte-Nord region of Québec (Chapter 6) discussed the difficult situation faced by the Ministry of Transport (MTQ) in their efforts to maintain roads. This department is taking important steps to manage its roads in a more proactive way. In so doing, it collaborates intensively with the Université du Québec à Rimouski. Based on the results of this case study and CBCL Limited's experience in transportation planning in Atlantic Canada, we make the following recommendations to provincial departments of transportation, who all conduct asset management initiatives, which include monitoring activities, and take climate change into account:

- Establish collaborations with universities.
- Develop a decision tree for actions to take. The tree should take into account the environmental impacts of hardening the coast to protect roads and should also consider opportunities for restoring coastal ecosystems that road relocation could offer.
- In locations where roads are threatened by erosion, engage discussions with local and regional authorities to explore options to relocate, in the context of comprehensive and long term planning, with goals related to sustainability, prosperity and quality of life.

Relocation options can include upgrading existing roads more inland as well as rail rights of way that could provide redundancy to coastal roads.

9.3.4 Regarding Environmental Assessments

Environmental assessments could make the difference between an approach that favours natural coastal ecosystems and one that hardens and further develops the coast.

In Québec, all bank stabilization projects require environmental authorizations, and projects involving a bank length of 500m or surface of 5,000 m² or more require both governmental authorization and an environmental impact assessment. In coastal areas of Québec, protecting municipal and provincial roads accounts for a large proportion of bank stabilization projects requiring environmental authorizations. The impact assessment approach requires proponents to first consider relocation of the infrastructure to outside the risk-prone area and, if relocation is not possible, to consider “soft” options such as plant engineering or beach nourishment. Proponents should therefore consider armouring shorelines only as a last resort. The Québec case study discussed a situation where the government can exempt bank stabilization projects from the impact assessment procedure because of their urgency. Relocation is sometimes not

considered in emergency situations because it takes longer to implement, especially when land for a new road is private. If the land is agricultural, zoning needs to be changed, which involves long delays.

In Québec there is a mechanism called strategic environmental assessment, which is relevant to big proponents such as the Ministry of Transport Québec (MTQ).

The federal government plays a role in environmental assessments through the Canadian Fisheries Act. As mentioned previously, DFO awards permits to project proponents on the basis of commitments to compensating any loss of fish habitat by creating new habitat.

We make the following recommendations to provincial governments:

- make coastal hardening subject to environmental assessments, and permit it only when it is necessary;
- ask departments of transportation to conduct provincial-level strategic environmental assessments for the Atlantic provinces and large regions in Québec;
- consider the recreational, touristic and environmental services of natural coasts in analyses of the costs and benefits of the different options considered.

9.4 Recommendations to Regions and Regional Municipalities

Of the various provincial/state jurisdictions studied, only Québec has mandatory regional land use planning. In New Brunswick, regional planning is a possibility for Regional Service Commissions, but it is not mandatory. No region has yet developed such a plan until now. We note, however, that it would be possible for a region to develop and enforce planning regulations. In Massachusetts, there are no regional mechanisms to handle issues that cross municipal boundaries (watersheds, valleys), or that are common to a large area. Watershed organizations such as the Resilient Mystic Collaborative fill this gap in some locations like the Mystic River watershed.

In Nova Scotia, there are no regional jurisdictions or authorities. Only municipalities can develop and enforce a Municipal Planning Strategy and bylaws. Adjacent municipalities can collaborate and coordinate their efforts informally or formally via a Municipal Services Agreement, when the collaboration involves an exchange of services involving, for example, public transit, or water and wastewater.

Even in Québec, where it is mandatory, it seems that many regional municipalities approach regional planning more as a requirement from the province than as the facilitating tool it could be to advance adaptation and other goals. Many actors are requesting changes to the Land Use Planning and Development Act (*Loi sur l'aménagement et l'urbanisme*, or LAU) and the Quebec government has initiated, in January 2021, a conversation to develop a provincial strategy on urban and land use planning¹¹⁸. Regional plans allow to involve multiple actors in defining a

¹¹⁸ <https://www.quebec.ca/nouvelles/actualites/details/la-conversation-nationale-sur-lurbanisme-et-lamenagement-du-territoire-est-maintenant-lancee/>

strategic vision of sustainable development and to envisage the strategies to achieve it. Regional planning can allow, for example, discussion of the route a road would take if it should be relocated. In Québec, regional municipalities are responsible for establishing maps of development constraints, including areas at risk of flooding, erosion or landslides. Local municipalities must then consider these maps when issuing permits.

As pointed out in the New Brunswick case study, regional planning is not only about land use but can also address issues such as access to groceries and energy self sufficiency.

Regional municipalities that are adjacent to crown land could ask the provinces to grant them land for new housing developments. In Québec, to prevent urban sprawl, the Ministry of Municipal Affairs and Housing (MAMH) is reluctant to let municipalities increase their urban perimeter. However, increasing the perimeter inland could be a strategy for progressive relocation. Regional municipalities could also plan new rural housing areas, with each lot having its own well for drinking water and on-site wastewater treatment, reducing the need to expand municipal services.

Overall, we make the following recommendations to regional municipalities or service commissions, whether regional planning is mandatory or not:

- engage the public and diverse stakeholders in developing a long-term strategic plan that takes climate change into account, that develops diverse future development scenarios and that considers the necessary inter-municipal collaborations;
- include considerations such as parks, recreation, touristic development and access to the coast in a way that increases public support for the adaptation options considered;

9.5 Recommendations to Municipal Councils and Administrations

Based on the case studies, we extend to local governments the same recommendations we made to regional municipalities. We add to these that local governments can make requests to regional municipalities or Regional Service Commissions to represent them and make requests on their behalf to provincial governments.

Even without developing full adaptation plans, local governments can develop checklists of how to incorporate adaptation into their routine planning instruments, such as strategic plans, investment plans or maintenance plans.

Asset management and long-term transportation planning are particularly good opportunities for incorporating climate change considerations. Transportation planning is also a very good opportunity to engage the public and share concerns about climate change impacts. Even when local governments don't have a strategy in hand, they can listen to suggestions made by the public. Road relocation is a difficult subject and should be addressed progressively. It is preferable for the public to be part of the decision than to suffer the decision of a transportation department.

Even when not required, municipalities can give feedback to regional and provincial authorities about the barriers they face in adapting to climate change.

9.6 Conclusions

Results of the case studies show that the effectiveness of public policy instruments depends on the motivation to implement them, as well as on a range of facilitating factors whose absence may constitute barriers. Motivating factors include anticipated benefits in terms of risk reduction and improved quality of life. Solutions that pursue both of these goals, such as greening, parks and conservation of natural environments, can motivate jurisdictions to act and can encourage buy-in from residents. Perceived social pressures, which may result from government requirements, expectations expressed in public consultations or previous commitments, also influence motivation. The effectiveness of a policy can be reduced by a lack of motivation of its targeted actors, or by barriers experienced by them.

Governments use the results of scientific research in planning, stakeholder engagement and decision-making processes. They use them to choose the instruments to implement but also to motivate and facilitate those they seek to influence with their public policies. In the cases we studied, governments were able to advance climate change adaptation by combining different types of instruments, as well as by putting in place new measures to overcome the barriers they faced and to help the targeted actors overcome theirs. The different types of instruments that aim to influence targeted actors can have an effect on the variables in the conceptual framework that serves as the theoretical basis for this project: instruments that seek to inform about the benefits of a promoted behaviour, those that make the behaviour compulsory in order to gain approval, thus creating social pressure, and those that have a facilitating effect (e.g., by providing financial, human, organisational and information resources).

The case studies highlighted challenges related to engaging the most vulnerable populations, coordination between adjacent municipalities, and the need to establish standards on what restrictions to put in place. Our results suggest that strategic planning tools for regional land use planning can foster synergy among different actors around long-term collective goals while taking climate change into account. Equity and environmental justice must also be considered in the objectives and measures put in place.

Appendix 1: Generic Template for Interviews

1-Identification of the participant

- Name
- Organization
- Title
- Role

2-In which location or area do you conduct your professional activities (if applicable)?

3-What are your overall aspirations related to your activities in the area?

4- How does climate change pose an obstacle to these aspirations?

5- If conditions were ideal, how would you like to see adaptation unfolding in the area?

6-How do you see adaptation actually taking place?

7-Why are things occurring differently from what you would consider ideal?

(If not mentioned, ask if past events or infrastructure are constraining adaptation today.)

8- What actions (or programs, plans, regulations, incentives/disincentives) are you/your organization conducting/considering in the area? (Here we aim to describe the policy instruments studied in the case. In the next questions, the interviewer will replace the word “actions” with the name of the instrument.)

9- What outcomes would you like to see resulting from those actions? (In other words, why are you implementing/considering the actions?)

10- Are your actions intended to influence the behaviour of other actors?

If so, in which way?

11- What outcomes are you already observing (expected and unexpected, positive and negative)?

Why do you think things are occurring that way?

12- Do any mechanisms allow you/your organization to observe the outcomes of the actions?

13-Are there feedback mechanisms that allow you/your organization to make adjustments on the action in response to the observed outcomes?

14-Since the initiation of your actions, have you encountered any obstacles?

15- How did you overcome these obstacles?

16-Which obstacles remain?

17- What additional actions (in addition to yours) are needed for the sought outcomes to unfold? (In other words, who else has a role to play in enabling the outcomes?)

18- What were the factors that motivated you/your organization to implement/consider the actions, in addition to the sought outcomes you mentioned earlier?

19- How do you feel about the action?

20- Do you think that the advantages surpass the disadvantages and costs of carrying it out?

21- Did any scientific, technical or jointly developed knowledge contribute to your motivation? (Explore: about environmental conditions, hazards and risks, potential consequences of not acting, potential benefits of actions?)

If so, how did you have access to this information?

How have this information been useful to you?

What makes this information credible, in your opinion?

22-Do you think other persons/organizations expect you/your organization to conduct the action?

23-Is the action required by a regulation, program or plan, or was it requested by another person/organization or encouraged in a meeting?

Why/why not? (Explore the legitimacy of the rules and processes, how the interviewee feels about the organization requiring the action.)

24-Do you think you/your organization has the capacity to conduct the action? Why/why not?

25- What support has helped you implement/consider the actions? (Explore other policies, cooperation by others, funding, information, etc.)

Why/why not? (Explore salience/usefulness.)

26-In your opinion, do the various policy instruments in place (actions, programs, regulations, incentives/disincentives) support rather than create obstacles for one another?

Can you give examples?

27- In your opinion, what would be the most effective way to move forward?

Appendix 2: Informed Consent Notes and Form

Project “Understanding the Determinants of Effective Policy Instruments: Case Studies of Climate Change Adaptation in Québec, Atlantic Canada and Massachusetts”

Informed Consent Notes and Form

Before agreeing to participate in this research project, please take the time to read and understand the following information. This document explains the objectives of the project, its activities, as well as the advantages, risks and drawbacks of participating. We invite you to discuss, with the person who presents this document to you, any questions that you have about this project and about your participation.

Presentation of the research team

This project is coordinated by the Québec observatory for adaptation to climate change (OQACC), based at Université Laval. It is conducted in collaboration with Ouranos, University of Massachusetts Boston, University of Massachusetts Amherst and CBCL Limited in Halifax, and is funded by Natural Resources Canada, *Fonds de Recherche du Québec* and the *Fonds Vert du Québec*.

The project team is composed of the following persons:

- Pierre Valois (Project Lead) and Nathalie Beaulieu, OQACC-Université Laval
- Caroline Larrivée and Marie-Anta Diop, Ouranos
- David Cash, Rebecca Hearst, Stacy VanDeveer, Patricio Belloy and David Sulewski, University of Massachusetts Boston
- Ricchard Palmer, University of Massachusetts Amherst
- Emanuel Nicolescu, Léa Baschi and Vincent Leys, CBCL Limited

Project objectives and activities

The project aims to provide policy makers with examples and lessons learned from the application of policy instruments in Québec, Atlantic Canada and Massachusetts, regarding the factors and characteristics of policy instruments that enable or impede adaptation.

Two case studies will be developed in each region covered by the project, that is, Québec, Atlantic Canada and Massachusetts. They will be developed through a comparative approach to understand how policy mechanisms affect actors’ behaviours and practices within their social-environmental systems. The case studies will focus on coastal areas because of their current and increasing exposure to the effects of climate change. The team members will conduct a literature review, individual semi-structured interviews and group discussions. They will develop and validate narratives with the persons involved in the case studies.

The case study in which you would participate is entitled “Provincial Support to Municipal Climate Change Adaptation Planning in New Brunswick”.

Your participation in the project

You can choose to take part in this project by participating in a confidential interview and/or in focus group discussions.

Interviews will be recorded and will be confidential. They will last approximately one hour and open questions will cover:

- Your vision of how adaptation would take place in an ideal situation
- The process of implementing activities that aim at supporting municipalities in their adaptation planning.
- Enabling factors
- Obstacles faced
- Your views on what could be improved and how to move forward

The first focus group discussion will allow participants to discuss each other’s perceptions and the second one, to validate the narrative document about the case study.

Advantages, risks and drawbacks of your participation

Your experience would contribute important knowledge that would help policy makers in your area as well as in other areas of Canada and the US to implement more effective adaptation programs, regulations and actions.

Your participation in the interview would allow you to reflect on your perceptions regarding provincial support to municipal climate adaptation planning and to discuss them in a fully confidential manner.

Your participation in the focus group discussions would allow you to share points of view with other participants as well as to verify and improve the case study narrative, which will become a public document. You will also be invited to participate in a seminar that will be organised in Moncton or Fredericton during the fall of 2020 to present the results of the project. The contributions of the participants who agree to have their identity disclosed will be acknowledged in the case study document, in the project report and in the seminar presentation.

The aim of the project is to identify ways to improve the implementation of policy for adaptation in general. The project team acknowledges that all efforts involve difficulties and obstacles as well as facilitating factors. There will be no attempt to identify persons responsible for these difficulties or to judge the success or failure of any initiative. Nonetheless, it is possible that you or another person could feel criticized during the discussions. The interview process could also trigger some self-criticism and generate anxiety for some participants. We encourage you to discuss this with us if you would like to.

No financial compensation will be given to the participants of this study, but the interviews will be planned in such a way as to minimize your travel expenses.

Voluntary participation and right to withdraw

You decide freely to participate in this research project. You can also interrupt your participation without any negative consequence or obligation to justify your decision. If you decide to withdraw, it is important to notify the researcher whose contact information is given in this document. All materials through which you could be identified, including the interview recording, will be destroyed, unless you give the researcher written permission to use them for the purpose of the project. In this case, they will be stored in accordance with the confidentiality measures that are described below and that will be applied with all participants.

Confidentiality

Participants in the focus group discussions agree not to disclose, outside of the groups, the contributions of other participants. Here are the measures that will be applied to the information gathered during individual interviews and focus group discussions:

During the research:

- Each participant's name and all those cited during the interview will be replaced by a code;
- Only the researchers who conducted the interview will have access to the list containing the names and the codes, and this list will be stored separately from the interview recordings and transcriptions;
- All the research material, including the recordings and transcriptions, will be stored in a locked filing cabinet, in a locked room;
- The digital data will be stored in encrypted, password-protected files to which only the researchers will have access.

In the dissemination of the results, unless participants agree in writing to have their identity revealed:

- The name participants will not appear in any document;
- The results will be presented in a global form in such a way that the individual results of participants will not be communicated;
- The results will be published in such a way that no participant can be identified or recognised
- All participants will receive the draft of the case study narratives and will be invited to comment on it.

Once the research is complete,

- Only the interview transcriptions will be kept (in its coded and encrypted form) for use in other projects on adaptation, in a format in which participants cannot be identified (sections on name and job function will be erased)
- Materials that allow to identify participants (sound recordings, code key) will be destroyed by December 2020.

Appreciation

Your collaboration is extremely important for allowing us to conduct this study. We thank you for the time and attention that you are willing to invest in it.

Additional information

If you have any questions about the project, the implications of your participation or your possible withdrawal, please communicate with Pierre Valois at the telephone number (418) 656-2131 extension 402070, or at the following e-mail address: Pierre.Valois@fse.ulaval.ca.

Signatures

I, the undersigned, _____, willingly agree to participate in the research project entitled "Understanding the Determinants of Effective Policy Instruments: Case Studies of Climate Change Adaptation in Québec, Atlantic Canada and Massachusetts." I have read the text above and I understand the objectives, nature, advantages, risks and drawbacks of participating in the project. I am satisfied with the explanations, clarifications and answers given by the researcher about my participation.

Participant's signature

Date

In addition, I agree that my contribution be acknowledged and my identity revealed in the project documents.

Participant's signature

Date

I also consent that my words be cited, with the condition that I am provided with the opportunity to verify the citation and that I provide an additional authorization before the document is published.

Participant's signature

Date

I explained to the participant the objectives, nature, advantages, risks and drawbacks of the research project and ascertained his/her understanding of them. I answered the questions asked to the best of my knowledge.

Researcher's signature

Date

Complaints or criticism

Any complaint or criticism about this research project can be communicated to the Ombudsman's office at Université Laval:

Pavillon Alphonse-Desjardins, Office 3320
2325, rue de l'Université
Université Laval
Québec (Québec) G1V 0A6
Secretariat: 418-656-3081
Toll free line: 1-866-323-2271
E-mail: info@ombudsman.ulaval.ca