Chapter 7
Adaptation to Climate Change in Canada: A Multi-level Mosaic

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Abstract The necessity for adaptation is now widely recognized in Canada. However, the developing pattern of response is an expanding mosaic. Individual pieces – i.e., initiatives at the provincial, territorial, and municipal levels – are visible, but the overall strategic design is lacking clarity and cohesion. This is likely due, in part, to Canada's federalism, and to the conceptualization of adaptation in the United Nations Framework Convention on Climate Change (UNFCCC). The negotiations leading to the UNFCCC conceived of adaptation as largely a place-based and local matter; of concern only to those most vulnerable communities and countries. In consequence, a bottom-up approach was viewed as the preferred option. Over the life of the UNFCCC, adaptation has grown in significance and has come to be seen as requiring top-down strategic approaches. A major challenge now facing Canada – and indeed all Parties to the Convention – will be the effective and simultaneous management and coordination of both top-down and bottom-up approaches. Currently, in Canada, the blend has been allowed to evolve almost unguided, with modest encouragement from the federal government. Leadership has emerged at both provincial and municipal levels across the country. But it is not clear what the consequences of such an approach will be.

Keywords Canada • Adaptation • Climate change • Top-down • UNFCCC • National assessment • Province • Territory • Municipality • National strategy

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J.D. Ford and L. Berrang-Ford (eds.), *Climate Change Adaptation in Developed Nations: From Theory to Practice*, Advances in Global Change Research 42,
DOI 10.1007/978-94-007-0567-8_7, © Springer Science+Business Media B.V. 2011

Adaptive Learning

The necessity for adaptation is now widely recognized in Canada. The developing pattern of response is an expanding mosaic. Individual pieces are visible, but the overall strategic design is lacking clarity and cohesion (Lemmen et al. 2007). This is not an unusual experience in Canada. Canada is geographically large, with a relatively small and scattered population. More significantly, Canada is a federal state with ten provinces and three territories. This constitutional arrangement involving a complex division of powers and allocation of responsibilities among three levels of government is constantly under question, shifting at the margins, especially in areas of so called shared jurisdiction (Gardner 1994; Morton 1996). When a new issue such as adaptation to climate change emerges, there is almost always some uncertainty about how the needed policies and actions will be identified, developed, and shared. Important parts of the climate change adaptation (and mitigation) debate still remain unanswered and even unaddressed: who will pay what share of the costs for adaptation of different kinds, in different places, and in relation to what risks? In addition, how will allocation of costs and responsibilities be decided for climate-resilient infrastructure (design of buildings, highways, drainage systems), agriculture (new cultivars and drought losses), control of invasive species (pine beetle spread and infestations), public health (heat episodes, and heat/health alerts), and the impacts of extreme climate-related weather events and many others?

Adaptation to the impacts of climate change is a new challenge for all countries. In some instances, a sense of urgency has led to the development of strong top-down-guided approaches. This is especially the case in the least developed countries, where support has been provided under the United Nations Framework Convention on Climate Change (UNFCCC) through the Global Environment Facility (GEF) for the preparation of National Adaptation Plans of Action (NAPAs) (Government of Canada 2010; COWI and IIED 2009). Support for national adaptation planning is now an expanding part of many bilateral aid programs, along with multilateral aid agencies, the World Bank, and several regional development banks. The World Bank, for example, has instituted a Pilot Programme for Climate Resilience (PPCR) that aims to help selected developing countries adopt a programmatic and "transformational" approach to adaptation (http://siteresources.worldbank.org/INTCC/Resources/progressreportPPCR.pdf). This approach is now spreading to many developed countries.

On the other hand, an overarching and top-down approach or framework has yet to emerge in Canada. Pieces are added to the multi-level mosaic in a spontaneous and loosely connected way. To date, there is no overall strategy or grand design. What is therefore happening can best be described as adaptive learning or learning to adapt. The adaptation that is occurring in Canada is place- and region-specific, involving a diverse range of risks, sectors, and ecosystems. To develop an overall strategic design from a Canadian perspective requires an Olympian vision. This is not to say that it is an impossible feat, but it does require far-sighted leadership, time, and resources. The last chapter of the national assessment (Lemmen et al. 2007), for

example Chap. 10, *Moving Forward on Adaptation*, presents four relatively modest suggestions for "building the momentum" and four similarly modest "near-term steps" (see Box 7.1).

Box 7.1 Suggestions from the National Assessment for "Building the Momentum" and "Near-Term Steps"

Building the Momentum
1. Maintain and strengthen the knowledge base
2. Synthesize and share knowledge
3. Remove barriers to action
4. Review and contribute to international initiatives

Near-Term Steps
1. Broaden engagement and collaboration
2. Lead by example
3. Enhance institutional capacity
4. Promote and mandate adaptation measures

These suggestions and steps seem to be valid and useful as far as they go, but by most criteria fall well short of a national strategy of the sort required to meet the growing and future impacts of climate change.

Characteristics of the Canadian Approach

For much of the life of the United Nations Framework Convention on Climate Change, Canada, like other high income developed countries, has focused its attention on mitigation with less interest being given to domestic adaptation (several reasons are outlined in Dickinson 2007; Burton et al. 2007). At the federal level, Canada has two major adaptation groups: (1) Adaptation Impacts and Research Service (AIRS) housed in Environment Canada; and (2) the Climate Change Impacts and Adaptation Division (CCIAD) within Natural Resources Canada. In 1997, Environment Canada completed the first major Canadian climate change assessment, *The Canada Country Study* (CCS). In the last few years, beginning around 2005, there was a rapid international awakening about the need for adaptation in developed countries. It is widely recognized that we are entering the "period of consequences" (see Chap. 5 of this volume, by Susan Moser). Consequently or coincidentally, in 2007, Natural Resources Canada (NRCan) published the second national assessment, *From Impacts to Adaptation: Canada in a Changing Climate*. The report represents the most comprehensive assessment of the impacts of climate change in Canada to date. The report concludes that:

- Adaptive capacity is generally high, but is unevenly distributed between and within regions and populations.
- Some adaptation is occurring, both in response to, and in anticipation of, climate change impacts.

- Integrating climate change into existing planning processes, often using risk management methods, is an effective approach to adaptation.
- Barriers to adaptation need to be addressed, including limitations in awareness and availability of information and decision-support tools.
- Although further research will help to address specific knowledge gaps and adaptation planning needs, we have the knowledge necessary to start undertaking adaptation activities in most situations now.

These conclusions seem to be accurate but cautious, and lacking in a strong sense of direction or cohesion. The message seems to be "let the mosaic evolve."

Many developed countries have created or are in the process of creating national climate change adaptation plans, strategies, and/or programs. Implementation of these is well underway in the member countries of the European Union, including the United Kingdom. This is also true of Australia, Japan, and now, after some hesitation, the United States. In Canada, at the federal level, emphasis has not been on developing a national plan or strategy, but rather has been focused on climate change model and scenario development, as well as on providing research to the growing community of adaptation scientists and networks; the Canadian Climate Change Scenarios Network (CCCSN), for example, is Canada's state-of-the-art network that has contributed to the reports of the Intergovernmental Panel on Climate Change (IPCC) (IPCC 2007). Public servants in Environment Canada and Natural Resources Canada have been promising for at least the past 3 years that a national framework for adaptation will shortly be issued.

Abroad, Canada continues to respond to requests for financial support for vulnerability, impacts, and adaptation projects in developing countries. To illustrate, Canada was among the first contributors to the GEF-administered Least Developed Countries Fund (LDCF), and the Pilot Programme on Climate Resilience (PPCR) managed by the World Bank. Canada has provided project level support for the Canada–China Climate Change Cooperation Project (C5) to help increase the capacity of Chinese research institutions and government agencies to identify and assess the sensitivities and vulnerabilities associated with climate change. Owing to this collaboration, the Chinese government began to integrate adaptation strategies into development and planning initiatives. Canada is also supporting the building of adaptive capacity in Western Africa (Government of Canada 2010).

Nevertheless, top-down directed action based on a shared vision or framework has been slow to evolve as different levels of government look to each other for leadership. Canada, by any measure, has the capacity to adapt: the country possesses high national income per capita, highly skilled and educated human resources, effective and efficient public organizations and institutions, a strong private sector, and access to technology. But federal hesitation exists. The mantra "adaptation is local" still lives in the minds of those at the highest policy level, and, unlike mitigation, the notion persists that the benefits of adaptation fall largely to those who invest in it, at the place where the investment occurs. This idea has also slowed adaptation at the international level, and only recently has a more strategic view of adaptation gained ground – one requiring planning, policy, and action at national

levels. Such an approach is needed for Canada, one where actions at the federal level support both provincial and municipal adaptation.

The Multi-level Evolving Mosaic

Although the federal government has yet to develop a national plan or strategy, a number of Canada-wide initiatives have been supported on an interim or temporary basis. Following the release of the 2007 national assessment, NRCan announced a $35 million project to establish six Regional Adaptation Collaboratives (RACs) across Canada (with the requirement of matching provincial funding). Prior to the RAC program, in 2001, Natural Resources Canada developed Canadian Climate Impacts and Adaptation Research Network (C-CIARN), with funding that was sustained until June 30, 2007. From the perspective of the major users of these funds, their short-term and temporary nature creates difficulties for the development of longer-term strategic adaptation planning or capacity building. The recent RAC program fits this pattern: this program is aimed at coordinating sustained action to reduce vulnerability to climate change by advancing adaptation planning and decision-making – yet is funded for just over 2 years.

The lack of sustained federal leadership has forced (perhaps intentionally) a multitude of provincial, municipal, and nongovernmental players to develop their own plans, strategies, and programs. Over the past decade, several climate change consortiums have cropped up at the provincial level: Ouranos in Québec; Pacific Climate Impacts Consortium (PCIC) in British Columbia; and Ontario Climate Change Impacts and Adaptation Research group (OCCIAR) in Ontario. However, while these and several other climate change consortiums exist across Canada, there is no mandate to exchange information or lessons learned, and neither are there mechanisms in place for formal knowledge transfer. The Council of the Federation (COF) hopes to change this with the development of the Climate Change Adaptation Community of Practice (CoP), proposed during a 2008 Climate Change and Adaptation Forum in Vancouver. The online community, set to launch in August 2010, will attempt to bridge this disconnect by promoting knowledge transfer between provinces and territories across Canada. Similar to other such initiatives, committed funding is only available for 2 years and beyond that the support remains unclear.

In spite of this ad hoc federal support, strategic thinking has been demonstrated in several provinces in Canada. In Ontario, the Minister of the Environment established the Ontario Expert Panel on Climate Change Adaptation, which submitted its report in November 2009. The report contains a total of 59 recommendations, most of them specific action items addressed to a wide diversity of government departments. Most recommendations are directed to situations where immediate action in response to or in anticipation of climate change can be undertaken. In addition, and more importantly for this discussion, the report makes five major recommendations:

1. Launch a province-wide climate change adaptation action plan.
2. Establish a Climate Change Adaptation Directorate (CCAD).

3. Ensure that the CCAD has ongoing access to expertise.
4. Enhance climate change science and modeling capacity.
5. Identify dedicated funding for climate change adaptation initiatives.

Provinces across Canada are also undertaking similar initiatives as illustrated in Table 7.1.

More recently, at the municipal level, the Federation of Canadian Municipalities (FCM) has worked closely with ICLEI to promote mitigation and, of late, adaptation at the local level (FCM 2009). Their Partners for Climate Protection (PCP) program has 180 municipal governments actively involved in their 5-milestone framework for reducing greenhouse gas emissions. The need for leadership is felt at the municipal level, with officials asking FCM for more information, resources, and tools to aid them in adapting to climate change. FCM has called upon the federal government to establish a municipal adaptation fund to assist municipal governments in responding to climate change. Additionally, in the fall of 2010, ICLEI Canada is planning on launching a new adaptation initiative to help cities develop climate change adaptation plans. This comes after several communities across Canada have initiated their own adaptation activities, including:

Calgary, Alberta
Capital Regional District, British Columbia
Clyde River, Nunavut
Dawson City, Yukon
Delta, British Columbia
Edmonton, Alberta
Halifax, Nova Scotia
Iqaluit, Nunavut
London, Ontario
Metro Vancouver, British Columbia
Montréal, Québec
Oakville, Ontario
Ottawa, Ontario
Peel Region, Ontario
Pickering, Ontario
Port Alberni, British Columbia
Prince George, British Columbia
Portage la Prairie, Manitoba
Richmond, British Columbia
St. John's, Newfoundland
Sudbury, Ontario
Toronto, Ontario
Vancouver, British Columbia
Yellowknife, Northwest Territories
York Region, Ontario
(FCM 2009)

Table 7.1 Overview of Provincial climate change plans and adaptation characteristics

Province/territory	Summary/status of plan	Selected characteristics of plan or planned actions (unless otherwise indicated below)
Northwest Territories		
Climate change adaptation plan	In 2008 the Northwest Territories completed a climate change impacts and adaptation report in which the government stated it is working toward developing a climate change adaptation plan for the government and a territorial plan for the territory.	• Repair and replace foundations damaged by ground movement or water accumulation under buildings. • Rehabilitate runways in Inuvik and Yellowknife due to damage caused by permafrost degradation. • Award contracts to supply vendors 1 month earlier as a result of shorter winters. • Use climate data from communities in the territory with the highest amounts of snow, rain, and wind as outlined in the National Building Code of Canada. • Integrate climate change into school curriculum for kindergarten to grade 12 students. (Northwest Territories Government 2008)
Yukon		
Climate change action plan	In February 2009, Yukon released its Climate Change Action Plan focusing on forests, water, permafrost and infrastructure, climate change scenarios and community information and needs assessments. Currently, work is underway in the areas of land-use planning, human health, community adaptation planning, emergency response planning, agriculture, and building standards.	• Complete a Yukon infrastructure risk and vulnerability assessment and determine adaptation strategies in response. • Develop an inventory of permafrost information for use in decision-making. • Complete a Yukon water resources risk and vulnerability assessment. • Create a tool to facilitate the collection and distribution of water quantity and quality data. • Conduct a Yukon forest health-risk assessment and tree species and vulnerability assessment. • Enhance knowledge and understanding of climate change. • Establish a Yukon Research Centre of Excellence. (Yukon Government 2009)

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Table 7.1 (continued)

Province/territory	Summary/status of plan	Selected characteristics of plan or planned actions (unless otherwise indicated below)
Nunavut		
Climate change adaptation plan	In 2003, the Department of Sustainable Development released the Nunavut Climate Change Strategy. A Climate Change Adaptation Plan is currently being developed with several pilot adaptation projects already underway. The project "Addressing Climate Change Adaptation: A Collaborative Approach in Support of the Nunavut Climate Change Adaptation Plan" is scheduled to be completed by March 2011.	• Support community-based climate change adaptation planning. • Conduct feasibility studies and pilot projects for wind, solar, and hydroelectric energy being developed across the territory. • Develop energy efficiency projects throughout Nunavut, including residual heating projects, new efficient building practices, and efficient housing retrofits. • Work to develop climate change science and Inuit traditional knowledge research and monitoring initiatives in partnership with federal government, universities, institutes, and Inuit organizations. (Nunavut 2003)
British Columbia		
Preparing for Climate Change: British Columbia's Adaptation Strategy;British Columbia Regional Adaptation Collaborative (BC RAC)	British Columbia was the first province to announce its Regional Adaptation Collaborative, which will include forest, watershed, and floodplain management. In 2009, the province released Preparing for Climate Change: British Columbia's Adaptation Strategy, which outlines several intended goals for adapting to climate change.	• Build a strong foundation of knowledge and tools to help public and private decision-makers across British Columbia prepare for a changing climate. • Make adaptation a part of the Government of British Columbia's business, ensuring that climate change impacts are considered in planning and decision-making across government. • Assess risks and implement priority adaptation actions in key climate-sensitive sectors. • Develop initiatives including Mountain Pine Beetle Action Plan; Drought Response Plan; and B.C.'s Fire Smart initiative. (British Columbia Government 2009)

Manitoba		
Climate change action plan Partner in the Prairie Regional Adaptation Collaborative; Manitoba Rural Adaptation Council (MRAC)	In 2001, Manitoba established the Manitoba Climate Change Task Force. Manitoba's current Climate Change Action Plan contains several adaptation initiatives. The province is integrating climate change adaptation into environmental assessments and land use instruments and is relocating winter ice roads to land. Manitoba is planning on developing a separate Climate Change Adaptation Strategy. Manitoba's Climate Change Action Plan contains over 60 initiatives, of which 10% relate to adaptation.	• Continue developing integrated watershed management plans to address water budgeting and water conservation. • Improve flood protection throughout the province, including upgrading the Red River Floodway from protection against a 1-in-90 year spring flood to a 1-in-700 year spring flood. • Continue expanding Manitoba's hydrometric network. • Continue introducing incentives such as the Riparian Tax Credit and a Nutrient Management Regulation to protect lakes and rivers. • Work with municipalities to establish local emergency management plans to prepare for extreme weather events, and increase the speed and effectiveness of local and regional emergency response measures. • Invest in the realignment of winter roads and in improved river and stream crossings, along with work on all-weather roads. (Manitoba Government 2008)
Saskatchewan		Expected outcomes include:
Partner in the Prairie Regional Adaptation collaborative (PRAC)	In 2009, Saskatchewan introduced greenhouse gas emissions legislation that includes adaptation. The province is currently working toward development of a provincial adaptation strategy. Saskatchewan is a partner in the Prairie Regional Adaptation Collaborative, which includes plans for effective drought management, water conservation, and adaptation planning.	• Overview of the range of probable future climates, which will provide the basis for appropriate adaptation actions. • Report describing Saskatchewan biophysical assessment scenarios based on potential future climate scenarios. • Report describing Saskatchewan climate change impacts and potential adaptation strategies. • Recommendations to enhance Prairies water management. • Recommendations to enhance forest adaptation to climate change. • Web-based Wizard Adaptation Tool that includes future climate scenarios and the key climate variables that will enable users to make informed decisions adjusted to Saskatchewan's future climate. • Coordinated programming under the Prairie Regional Adaptation Collaborative. (Saskatchewan Government 2009)

(continued)

Table 7.1 (continued)

Province/territory	Summary/status of plan	Selected characteristics of plan or planned actions (unless otherwise indicated below)
Alberta		
Adaptation strategy Partner in the Prairie Regional Adaptation Collaborative (PRAC)	In 2008, a report on Climate Change Vulnerability Assessment for Alberta was released. In 2009, Alberta released Phase 1 of its Adaptation Strategy, which focuses on risk assessment, capacity building, taking action, evaluating outcomes, and strategic integration. Alberta is a partner in the Prairie Regional Adaptation Collaborative.	• Develop a provincial Climate Change Adaptation Strategy to provide overall direction, identify measures, and indicators of climate change, provide information about the impacts, and identify risks and vulnerabilities.Planned actions include: • Coordinate policy and research on adaptation. • Communicate and inform Albertans on the potential impacts of climate change. • Develop appropriate responses to adapt to climate change. (Alberta Government 2008)
Ontario		
Climate change action plan Expert panel on climate change adaptation; Ontario Regional Adaptation Collaborative (ORAC)	Ontario's Climate Change Action Plan was released in 2005. In December 2007, Ontario established an external Expert Panel on Climate Change Adaptation. The province has also established the Ontario Regional Adaptation Collaborative to be launched in 2010.	Actions already taken: • Create new rules for green energy projects to improve the climate resiliency of the province's energy grid. • Consider the impacts of climate change on protecting sources of Ontario's drinking water. • Increase public awareness of health hazards associated with extreme weather. • Consider climate change vulnerabilities and risk when developing the Northern Growth Plan. • Set up research centers to look into developing pest- and drought-resistant crops. • Consult on a plan to develop a water conservation and efficiency strategy for Ontario. (Ontario Government 2007)

Newfoundland and Labrador		
Climate Change Action Plan; Regional Adaptation Collaborative (RAC) for Atlantic Canada	Newfoundland and Labrador released its Climate Change Action Plan in 2005. Recently, the province provided $1.3 million toward the development of the necessary tools, policies, and strategies to help communities assess and adapt to climate change impacts. The province is also partner in the Regional Adaptation Collaborative (RAC) for Atlantic Canada.	• Organize a workshop on climate change impacts and adaptation for local municipalities. • Require that infrastructure projects receiving public funds meet a standard set of criteria with respect to climate change. • Initiate dialogue with Fisheries and Oceans Canada, industry, and stakeholders on climate change mitigation and adaptation. • Promote the consideration of climate change impacts in areas of the province that have initiated efforts toward Integrated Coastal Zone Management Planning. • Include climate change considerations in its Sustainable Development Strategy. • Report annually on the provincial Climate Change Action Plan. (Newfoundland and Labrador Government 2005)
Prince Edward Island		
2008 climate change strategy	A risk-based approach to adaptation is included in the province's 2008 Climate Change Strategy, which establishes a provincial, interdepartmental working group to identify and manage current and projected climate-related risks.	• Incorporate climate change outcomes into the environmental impact assessment process. • Conduct coastal erosion sensitivity mapping • Including risk assessment. • Improve the ability to withstand future climatic conditions by designing better bridges, roads, dams, water supplies, sewers, and buildings. • Improve coastal communities' preparedness to cope with severe weather events. • Avoid decisions that make adaptation harder or that increase vulnerability, by preventing development in areas at risk from increased flooding, storm surges, and catastrophic erosion events. (Prince Edward Island Government 2008)

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Table 7.1 (continued)

Province/territory	Summary/status of plan	Selected characteristics of plan or planned actions (unless otherwise indicated below)
Nova Scotia		
2009 climate change action plan	In 2009, Nova Scotia released its Climate Change Action Plan that contains over a dozen actions related to adaptation, including the development of an adaptation fund, departmental adaptation planning, land-use planning guidelines, a wetlands strategy and a water resource management strategy.	• Create an Adaptation Fund within Nova Scotia Environment to encourage adaptation research and development. • Develop statements of provincial interest on adaptation to provide guidance on land-use planning. • Establish criteria for the consideration of climate change during Nova Scotia Environment's environmental assessment process, and develop a guide to climate change for project proponents. • Launch a web-based clearinghouse of information and tools to support adaptation to climate change in Nova Scotia. • Update biannually a report that provides latest climate research, and review critical information gaps and policy direction for the province. (Nova Scotia Government 2009)
New Brunswick		
Climate change action plan 2007–2012	In 2007, New Brunswick released its Climate Change Action Plan 2007–2012. Since then it has released two progress reports. The Plan outlines numerous adaptation actions.	• Establish a formalized roundtable process with municipal associations, to promote and encourage regular dialogue and the exchange of ideas. • Adopt smart growth community-planning principles that consider climate change impacts/adaptation and emissions reductions. • Develop and implement a comprehensive provincial water management strategy. • Assist the tourism industry to make informed decisions and mainstream adaptation. • Incorporate vulnerability considerations into departmental decision-making processes involving economic, social, and environmental considerations in support of the public and private sectors' development and adaptation needs. (New Brunswick Government 2007)

Québec		
Climate change action plan 2006–2012	Québec has included adaptation in its Climate Change Action Plan 2006–2012. The province is focusing on health monitoring and warnings, improved water and air quality management, and research and monitoring related to coastal erosion, water, transportation infrastructure, forests, agriculture, permafrost, and biodiversity.	• Set up mechanisms to prevent and mitigate the impact of climate change on health and public safety, with an investment of $34 million. • Perform various evaluations and research related to permafrost thawing, coastline erosion, and adapting to the impacts of these climate changes, with a $6.6 million investment. • Determine the vulnerability of Québec forests and the forest sector to climate change and incorporate the anticipated effect of these changes into forest management. This component will be supported with investment of $6 million. (Québec Government 2008)

A Strategic Approach to Adaptation

As first conceived in the negotiations leading to the UNFCCC, adaptation was thought of as largely a place-based and local matter; of concern only to those most vulnerable communities and countries. In consequence, a bottom-up approach was viewed as the preferred option – with financial and technical assistance being made available from higher levels of government – supported where necessary by the international donor community. Over the life of the UNFCCC, adaptation has grown in significance and has come to be seen as requiring top-down strategic approaches. A major challenge now facing all Parties to the Convention will be the effective and simultaneous management and coordination of both top-down and bottom-up approaches. Currently, in Canada, the blend has been allowed to evolve almost unguided, with modest encouragement from the federal government. Leadership has emerged at both provincial and municipal levels across the country. But it is not clear what the consequences of such an approach will be.

At present there is a growing and relatively unconnected multi-level mosaic of adaptation activities. It is very much a learning-by-doing approach that could lead to a lack of sufficient preparedness and failure to create the needed climate resilience across regions and sectors for a variety of climate risks. The evolving mosaic has the potential to leave particular regions of Canada overexposed. Also, an uncoordinated effort may fail to take maximum advantage of new opportunities that climate change will bring to a cold northern country. Surely, Canada cannot continue to avoid the development of federally sponsored nation-wide climate change adaptation strategy for much longer. Such an activity would not obviate the current multi-level mosaic approach. On the contrary, it would give it focus and enable Canadians to see the full picture and facilitate greater awareness and stronger action in both the near and the long term.

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