

Understanding Adaptive Management and Resilience of Coastal Communities in the Hudson Bay Inland Sea Region

IISD REPORT



With support from Natural Resources Canada through the Adaptation Platform



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Pauline Gerrard

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Executive Summary

The impacts of climate change on the Hudson Bay ecosystem are predicted to be one of the greatest drivers of change within the region in the next 50–75 years. Northern regions have been recognized as especially susceptible to climate stress and are expected to see greater degrees of change than other regions around the world.

Climate adaptation is defined as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects in order to reduce harm or take advantage of opportunities (Pachauri, 2007). Policy-makers are increasingly aware of the need to strengthen our ability to adapt to climate stress and address vulnerabilities as part of public policy programs and development initiatives. Part of the growing efforts to plan for climate adaptation includes the mainstreaming of adaptation into policies, regulations and programs in multiple sectors. As a practical concern, governments need to understand if existing policies and programs, which were developed to address other goals and objectives, are themselves adaptive to change. Policies that are not adaptive are likely to fail to achieve their intended objectives as circumstances change.

In 2013 the University of Winnipeg received Natural Resources Canada funding support to undertake an analysis of existing policies and practices relevant to coastal management in the Hudson Bay Inland Sea region to identify enablers and barriers to adaptation at the community and regional levels. The objective of this analysis is to inform future adaptive management and networked governance approaches across the Hudson Bay Inland Sea region for anticipating and managing the risks and opportunities associated with a changing climate.

Research Flow and Methodology

This research was designed as a series of steps building on each other to improve our

understanding of adaptive capacity at the policy level and identify enablers and barriers to adaptation for community and regional planning. The general research flow included: situation analysis, stakeholder engagement, identification of key policies or plans, and adaptive policy analysis.

Situation Analysis

The research is set within the spatial context of the Hudson Bay region and topically linked to the broader Hudson Bay Inland Sea Initiative – Connecting the Bay. The Connecting the Bay Initiative is a multi-year effort to explore and advance ways to “connect the Bay” through innovative management and governance that can adequately anticipate and adaptively manage the risks and opportunities associated with the transformations being experienced by this region. The Hudson Bay Inland Sea Initiative (HBISI) works to catalyze the development of innovative approaches for a coordinated management and networked governance system (socially and technologically) across the Hudson Bay region to support sustainable development and resilience in and around the Hudson Bay.

To frame the research in the context of Northern development and the Hudson Bay inland sea region, a situation analysis of transportation and information and communications technology (ICT) and infrastructure was conducted and available information mapped for the region. The analysis and mapping exercise showed that transportation infrastructure is highly focused on small airports with a minimal amount of road or rail networks. Additional infrastructure includes ferry networks that connect communities in the summer, allowing the shipping of goods and products into and out of the region. A road is also planned into Churchill and connecting Manitoba and Nunavut between Churchill and Arviat. However, it is clear that the communities and industry working in the region are reliant on air infrastructure to connect to each other and access goods and services in the south. The strength and



resilience of this infrastructure is thus an important component of community well-being and industry growth.

From an ICT perspective, communities in the Hudson Bay Region are also considerably limited in access and cost compared to other Canadians. The vast majority of communities around the Hudson Bay rely on satellite services with a connection speed of 1,500 kbs download and 384 kbs upload at a significantly higher cost than other parts of the country (Fiser, 2013). Access to technology, information and skills has been identified as a key component of adaptive capacity at the community level (Smit & Pilosova, 2001). Affordable access to the Internet is critical to industry development in the North and can

directly support community resilience by providing access to education, technical knowledge and networking that is otherwise difficult in these remote areas.

Vulnerability Assessment: Identification of Climate Vulnerabilities and Associated Action

To understand the ways in which the transportation and ICT sectors in the North are vulnerable to the uncertainties related to climate, a series of consultations were conducted. Interviewees identified a number of specific vulnerabilities and necessary adaptation actions to cope with the specific climate change issues for these sectors. These are described in Table ES1.

Table ES1. Climate Vulnerabilities and Potential Adaptation Actions for Transportation and ICT Networks and Infrastructure in the Hudson Bay Region.

How will climate change impact transportation and ICT networks and infrastructure?	
Vulnerabilities and Opportunities	Potential Adaptation Actions (Suite of Responses)
Integrity of road, rail and runway foundations due to permafrost instability	• Appropriate planning
Integrity of road, rail and runway foundations due to flooding and erosion	
Integrity of transportation related building foundations due to permafrost instability	• Appropriate design
Winter road reliability and shorter season due to higher temperatures	
Increase in shipping traffic and more shipping routes due to ice-free Arctic Passage	• Ongoing monitoring
Integrity of road foundations due to increased freeze-thaw cycles	
Potential for more weather-related accidents due to unpredictable weather	• Ongoing funding available
Potential loss of/threats to both transportation (and ICT) infrastructure due to forest fire	
Changes in snow and ice conditions affecting utility of snowmobiles and dogsleds	• Emergency response in place
Changing ice conditions and associated costs affecting local transportation for hunting and other livelihoods	
Physical issues resulting from the impact of thawing permafrost on towers, antennas and cable trenches	• Participation in the process by communities
Increased cooling requirements for switches and servers related to ICT	
Increased incidence of lightning strikes on ICT infrastructure	
Increased fire risk on ICT infrastructure	
Increased radio interference resulting from changing weather patterns, etc.	
As the North opens to economic development, there may be opportunities to locate server farms at sources of natural air conditioning and renewable energy (such as hydroelectric power and wind), if high-speed connections to backbone networks are available.	
Thawing permafrost might make it easier to lay high-capacity fibre optic cables on land.	
Receding ice might make it possible to lay high-capacity fibre optic cables underwater.	



Policy Selection and Analysis

A series of relevant policies or programs were proposed for review by the project team with the overarching goal of identifying provincial and federal policy instruments and programs (economic, regulatory, expenditure, institutional) that are important to the development and operation of the transportation and ICT sectors in the North.

Policies or Programs identified for review included:

1. **Federal Northern Transportation Adaptation Initiative** – A federally funded initiative aimed at supporting the development of tools and technology; improving knowledge and building Northern capacity, ensuring knowledge is available; and understanding the future costs associated with maintenance and operations of transportation infrastructure in the context of climate change.
2. **Northern Manitoba All Weather Roads Program** – A provincial program for construction, upgrade and communications regarding Manitoba’s winter roads, recognizing their important role in overcoming social and economic challenges facing the Northern and remote communities in Manitoba.
3. **Ontario Far North Act** – Legislation to initiate community based land-use planning in the Far North that, (a) sets out a joint planning process between the First Nations and Ontario; (b) supports the environmental, social and economic objectives for land-use planning for the peoples of Ontario that are set out in section 5; and (c) is done in a manner that is consistent with the recognition and affirmation of existing Aboriginal and treaty rights in section 35 of the Constitution Act, 1982, including the duty to consult.
4. **Growth Plan for Northern Ontario** – A strategic framework that guides decision making and investment planning in

Northern Ontario building on themes of economy, people, communities, aboriginal peoples, infrastructure and the environment.

5. **Nunavut Transportation Strategy** – The Government of Nunavut’s Strategy for prioritizing and securing resources to invest in transportation needs for the territory. The strategy examines the historic and existing transportation system, including operations and policy improvements and future needs. It also identifies processes for resourcing and prioritizing projects based on these needs.

Key Findings

Based on the adaptive capacity analysis, we found that all five selected policies scored fairly high on both autonomous and planned adaptability, indicating that these policies are flexible in light of uncertainty and have built-in mechanisms that allow them to be responsive to both anticipated and unanticipated climate changes.

Under the planned adaptability section of the analysis, of the 85 adaptation actions identified, only those related to emergency response were not addressed by any of the policies analyzed. Although emergency response is an increasing issue related to transportation systems in the context of climate change, the policies and programs assessed are focused on the infrastructure itself and emergency response was largely seen as outside of their scope.

The relative contributions of each of the policies analyzed in this report to planned adaptability (the ability to effectively cope with predictable uncertainty) and autonomous adaptability (the ability to cope with unpredictable uncertainty) are shown in the adaptive policy summary analysis figure (Figure ES1). The position of the policy along the vertical axis of the diagram reflects: its support for anticipated adaptation actions; the potential vulnerability of the policy itself to climate change; the ability of the policy to contribute to key determinants of adaptive capacity (economic resources, access to technology, infrastructure



needs, information and management skills, institutions and networks, and equitable access); and the degree to which the policy development process included consultation with stakeholders during its scoping and design phase. The position of a policy along the horizontal axis is a reflection of the degree to which stakeholders have input during policy implementation; the policy’s ability to enable self-organization through the sharing of best management practices and lessons learned; whether the policy is sufficiently decentralized to respond to local adaptation needs; and whether or not the policy has a formal review process to trigger key policy improvements and detect emerging issues.

Specific findings related to the components of adaptive policy include:

Support to Anticipated Adaptation Needs (planned adaptability). The suite of policies and programs do address vulnerabilities to climate change through support to a wide range of direct and indirect adaptation actions. Loss of permafrost and increases in shipping routes scored particularly high while there is somewhat less focus on increased flooding and erosion or increased

variability in the freeze-thaw cycle. The suite of programs and policies also has a strong focus on the process and many support planning and community engagement in relation to the climate vulnerabilities identified.

Policy Vulnerability (planned adaptability). The selected policies demonstrate different degrees of vulnerability to the stressor. The Manitoba Winter Roads Program and the Nunavut Transportation Strategy are vulnerable to the stressor itself because of the possible cost increases projected with increases in weather variability.

Support to Stakeholder Adaptive Capacity (planned adaptability). The six determinants of adaptive capacity (Smit & Pilifosova, 2001) (access to economic resources, technology, infrastructure, information/skills, institutions/networks, and equitable access to resources) were directly supported by the selected policies in some cases and partially or indirectly supported in others. In cases of partial or indirect support, the policy may not provide direct access to relevant information, technology, skills, institutions and networks, although it does present information or create sources of information for stakeholders on where to obtain access to these.

Use of Multistakeholder Deliberation (planned and autonomous adaptability). All of the policies analyzed scored high in the use of multistakeholder deliberation as part of both planning and implementation. This aspect of adaptability was a strength across the policies and programs.

Enabling Self-Organization and Networking (autonomous adaptability). All of the policies assessed supported some level of self-organization and social networking as part of implementation, largely in the form of sharing lessons learned across stakeholder groups, regular meetings or through partnerships.

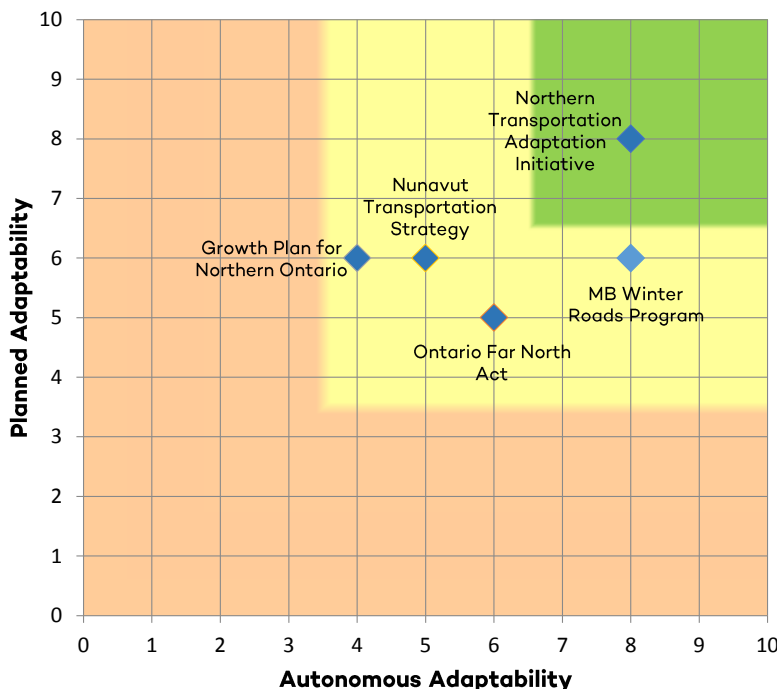


Figure ES1: Adaptive Policy Summary Analysis (Green contributing, yellow marginally contributing, and red not contributing)



Decentralization (autonomous adaptability).

Both the Far North Act and the Growth Plan for Northern Ontario could be made more adaptable by increasing aspects of decentralization, including devolution of authority and resources to regional offices.

Variation in Policy Instruments Employed

(autonomous adaptability). The suite of policies provides variety in policy instruments, including regulatory, economic and expenditure. There is a fair amount of variety in instrument support both by the suite of policies or programs assessed and with the programs or policy implementation themselves.

Formal Policy Review and Improvement

(planned and autonomous adaptability). The adaptability of all of the policies reviewed could be strengthened through the implementation of more formal adaptive review processes. Regular reviews can help address emerging issues and trigger value-added policy or program adjustments and can greatly improve the ability to adapt to changing situations.

Recommendations

- While the selected policies and program offer a range of direct and indirect support for sector-specific adaptation, there is a need to improve lessons learned and information sharing between jurisdictional programs around adaptation action and vulnerabilities.
- A specific area of unsupported climate vulnerability is emergency response related to infrastructure instability or increased storms. An assessment should be conducted about whether this is crucial for sector adaptation needs and if it is covered by other policies or programs.
- Areas of vulnerability that are less supported include the integrity of road, rail and runway foundations due to flooding and erosion, and the integrity of road foundations due to increased freeze-thaw cycles. These

ought to be addressed clearly in these and other complementary policies to ensure the long-term sustainability and viability for transportation sector development.

- The adaptability of the Federal Northern Transportation Adaptation Initiative, the Northern Manitoba Winter Road program and the Nunavut Transportation Strategy could be strengthened through the inclusion of formal policy review mechanisms.
- The Ontario Far North Act could support adaptation by including climate change-related issues in the act itself, stating specifically that land-use applications should or have to consider climate change.
- Climate change has the potential to increase the severity and frequency of the damage and disruption inflicted on transport systems by extreme weather. Adaptive management will also require actions, policy-making and behavioural changes in energy use to develop transport networks that are resilient to climate change and extreme weather events. Resilient transport systems in the Hudson Bay region will need to include energy conservation measures and increased efficiency as part of adaptation policies and programs for sustainable Northern transportation networks.



Table of Contents

1.0 What is Adaptive Policy or Programming?	1
1.1 Integrated and Forward-Looking Analysis	1
1.2 Multistakeholder Deliberation	1
1.3 Automatic Policy Adjustment	2
1.4 Enabling Self-Organization and Social Networking	2
1.5 Decentralizing Decision Making.....	2
1.6 Promoting Variation	2
1.7 Formal Policy Review and Continuous Learning	2
2.0 Research Process and Methodology	4
2.1 Situation Analysis	4
2.2 Stakeholder Engagement: The CRiSTAL Tool	4
2.3 The Adaptive Design & Assessment Policy Tool (ADAPTTool).....	5
3.0 Results	7
3.1 Situation Analysis.....	7
3.2 Stakeholder Engagement: Climate Vulnerabilities and Adaptation Actions	9
3.3 Policy Identification and Analysis	10
4.0 Adaptive Policy Conclusions and Recommendations	12
4.1 Vulnerability/Adaptation Analysis	12
4.2 Adaptive Capacity.....	13
4.3 Conclusions and Recommendations	16
Recommendations	17
References	18
Annex 1. Analysis and Conclusions for Specific Policies	19



1.0 What is Adaptive Policy or Programming?

Over the past several decades, there has been recognition that public policies and programs intended to achieve stated objectives can, even if well designed, lead to unintended consequences as conditions change. Public policy operates in a dynamic and complex environment. Actors in the policy domain interact with new external factors, changing economic and market conditions, new information, changing technology and evolving networks of exchange. With increased global interconnection, dynamic economic conditions, shifting climate and rapid changes in technologies, the resulting complexity and pace of change make outcomes difficult to predict. As conditions change, policies and programs may become less effective, or even counterproductive. Adaptive policies are policies that explicitly consider changing circumstances and include key elements in their design and implementation to increase their adaptability and help avoid these kinds of failures.

IISD collaborated with The Energy Research Institute (TERI) in India over a four-year research project to explore case studies of policies in the agriculture and natural resource management sectors in both countries and identify characteristics of adaptive policies based on evidence of their actual performance. The results are described in the 2009 book *Creating Adaptive Policies: A Guide for Policy-Making in an Uncertain World*.¹

- This research identified seven characteristics of policies that were adaptable to changing conditions. Some of these characteristics were designed to build-in adaptability to anticipated change and projected future conditions, while others are useful in helping policies adapt to unanticipated conditions.

- The ADAPTool version for *existing policies* used in this project is structured around these seven characteristics. Different questions in the tool are used to assess and score policies in relation to these factors.

The characteristics of adaptive policies/programs are: 1) integrated and forward-looking analysis; 2) multistakeholder deliberation; 3) automatic policy adjustment; 4) self-organization and social networking; 5) decentralizing decision making; 6) promoting variation; and 7) formal policy review and continuous learning. Each of these characteristics is explored in more detail below.

1.1 Integrated and Forward-Looking Analysis

Integrated and forward-looking analysis is systematic analysis using analytical and deliberative methods that can identify key factors that affect policy/program performance and scenarios for how these factors might evolve in the future, so that policies and programs can be made robust to a range of anticipated conditions. These tools can also be used to develop indicators that will trigger adjustments when needed. Modelling tools of varying sophistication can be used to support this kind of analysis, which is often integrated through scenario planning.

1.2 Multistakeholder Deliberation

Multistakeholder deliberation is a collective and collaborative effort to examine an issue from different points of view as part of a decision-making process. Deliberative processes strengthen policy and program design by building recognition of common values, shared commitment and emerging issues, and by providing a comprehensive understanding of causal relationships. The key aspects of this process are that it involves participants in sharing multiple perspectives in an attempt to reach consensus on a relevant decision. This approach goes beyond stakeholder consultation.

¹ The full text of the book is available on-line at: [http://www.coastalchange.ca/download_files/external_reports/Swanson_\(2009\)_CreatingAdaptivePolicies.pdf](http://www.coastalchange.ca/download_files/external_reports/Swanson_(2009)_CreatingAdaptivePolicies.pdf)



1.3 Automatic Policy Adjustment

Automatic adjustment mechanisms can speed up the process of response to conditions that are more or less anticipated. They can be used in complicated policy/programmatic environments by separating the various issues into units in which the understanding of the system is high, allowing for fine-tuning of the system and making adjustments that help reduce risks and maintain performance. Automatic adjustment can be fully and/or semi-automatic.

1.4 Enabling Self-Organization and Social Networking

The intent of this characteristic is to ensure that policies do not undermine existing social capital, but instead create forums that enable social networking, facilitate the sharing of good practices and remove barriers to local self-organization. Local responses, self-organization and shared learning all strengthen the ability of stakeholders to respond to unanticipated events through innovation.

These practices take advantage of the capacity of complex adaptive systems to generate solutions without external input or formally organized interventions. The ability of individuals and groups to self-organize in response to stresses, crises or unexpected problems is well documented in social and ecological literature, and a key aspect of healthy adaptation. For policy-makers and program managers, the idea is to foster self-organized responses to unexpected conditions by enabling and supporting interaction, learning and networking, without trying to control or dictate outcomes. This includes facilitating sharing and copying of best practices, providing resources to reduce barriers to self-organization and creating spaces for adaptive collaboration.

1.5 Decentralizing Decision Making

In governance terms, the principle of “subsidiarity” means decentralizing decision making to the lowest effective and accountable unit of governance.

This has adaptive advantages because there are better opportunities for feedback and information sharing to ensure that decision-makers are aware of unexpected problems and effects of proposed interventions, as well as the nature of different interests. For policies/programs directly concerning infrastructure, municipal staff typically notice significant change earlier and can mobilize affected local interests to address these changes more simply. Because local conditions vary widely, decentralization provides a way to implement policies and programs more flexibly, to ensure effectiveness and adaptation to change. The potential for decentralization in any particular policy or program area will depend on the scale of intervention needed, the extent of local knowledge and capacity, and the structure of governance mechanisms for accountability and coordination.

1.6 Promoting Variation

Given the complexity of most policy settings, implementing a variety of policies to address the same issue increases the likelihood of achieving desired outcomes. Diversity of responses also forms a common risk-management approach, facilitating the ability to perform efficiently in the face of unanticipated conditions. Variation may be actively designed, as when a range of alternative options is provided to meet the diverse needs of different stakeholders. This can be facilitated by:

- Using a mix of policy instruments
- Exploring synergies with other policies
- Providing opportunities for risk-spreading

Another approach is to use policy tools to facilitate variation by removing barriers to alternative solutions and providing information to support exploration of options.

1.7 Formal Policy Review and Continuous Learning

Regular review, even when the policy or program is performing well, and the use of well-designed pilots throughout the life of the policy/program



to test assumptions related to performance can help address emerging issues and trigger value-added policy adjustments. Formal review is different than automatic adjustment, where triggers and responses may be determined in advance. Formal review is a mechanism for identifying and responding to unanticipated circumstances and emerging issues. This assessment process can be very useful in detecting emerging issues that can have an impact on the policy's performance. A formal review mechanism includes triggers for the review, definition of the nature of the review, and a learning process to determine who needs to be involved in the review, who will take action on the results and what kinds of action are to be considered.

Together, these seven characteristics of adaptive policies are relevant in the planning and design of policies and programs, as well as in their implementation and evaluation. The ADAPTool analysis gauges the inclusion of these elements in existing policies and is intended to encourage discussion of these characteristics in various phases of the policy cycle.



2.0 Research Process and Methodology

The Impacts, Adaptation and Vulnerability Working Group of the Intergovernmental Panel on Climate Change outlined six determinants of adaptive capacity or the ability to cope with changes in climate including variability and extreme conditions. According to Smit & Pilifosova, (2001) the ability of a community or region to adapt directly depends on a number of societal and economic factors including: access to economic resources, access to relevant technology, access to relevant infrastructure, access to information and management skill, access to institutions and networks, and equity.

This research has focused on the aspects of adaptive capacity that address the connectivity of a region from a built and social capital perspective, namely: access to information and communication technology (ICT), and transportation infrastructure and systems. The research was designed as a series of steps building on each other to inform future adaptive management and networked governance approaches across the Hudson Bay inland sea region (see Figure 1). The detailed methodology of each step is summarized below.

2.1 Situation Analysis

To frame the research in the context of Northern development and the Hudson Bay inland sea region, a situation analysis of ICT and

transportation technology and infrastructure was conducted for target communities around the bay. The inventory was conducted by project partners and included a collection of existing and accessible spatial data, which were then compiled into a series of maps summarizing findings across the region.

2.2 Stakeholder Engagement: The CRiSTAL Tool

CRiSTAL, or the Community-based Risk Screening Tool – Adaptation and Livelihoods,² was developed with an international coalition of partners and has been applied at the community level around the world. It is a project-planning tool that helps users design community consultation activities that support climate adaptation. CRiSTAL recognizes that, while climate variability and change may not always be the most important stresses affecting a specific community, they should always be considered when designing and implementing a development project, particularly in communities characterized by climate-sensitive and/or natural-resource-dependent livelihoods.

The full application of the CRiSTAL tool requires considerable community consultation and was outside the scope of this project. Key lessons and processes were drawn from the tool to engage Northern stakeholders in identifying transportation, ICT and social infrastructure that is most important to their daily lives and guide them to consider what vulnerabilities these services and infrastructure may face in the context of climate change for their community or region.

² See <http://www.iisd.org/cristaltool/>

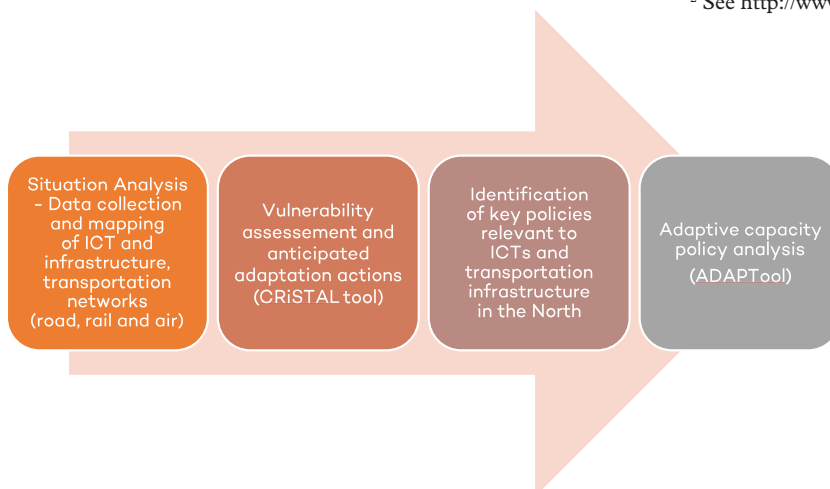


Figure 1. Research Flow



Initial consultation was conducted as part of a Northern Leadership course on governance including youth (ages 19–35) from across the North. The Hudson Bay region, and Nunavut in particular, has a very young population when compared with the rest of Canada (Conference Board of Canada, 2013). Youth perspectives and engagement in Northern development issues are critical to sustainable development across the North.

Guiding questions included:

- What do you expect to be the biggest impacts on your community as a result of climate change?
- What transportation infrastructure is important to you as part of your daily life?
- What communication technology and infrastructure is important to you as part of your daily life?
- What social networks and resources are important to you as part of your daily life?
- How will climate change impact the transportation infrastructure you listed as important above?
- How will climate change impact the communication technology and infrastructure you listed as important above?
- How will climate change impact the social resources you listed as important above?
- Please describe the most relevant approaches for helping your community maintain the core resources and services necessary given the possible climate change impacts.

The results of this consultation were used to identify key vulnerabilities Northern communities face with respect to transportation and ICT infrastructure.

As a parallel process, experts in the ICT and transportation sectors were asked to identify vulnerabilities and potential adaptive responses that are relevant to Northern regions of Canada, including the Hudson Bay region. This information was compiled and cross checked with the youth consultation and reviewed by the project team,

resulting in a list of vulnerabilities and adaptation actions to be used in the policy analysis described below.

2.3 The Adaptive Design & Assessment Policy Tool (ADAPTTool)

ADAPTTool is a Microsoft Excel-based workbook designed by IISD and partners to evaluate a suite of public policies and/or programs for their abilities to contribute to the capacity of key economic sectors (e.g. mining, agriculture, forestry) to adapt to a specific socioeconomic or ecologic stress, such as climate change or market price volatility. A policy's ability to help stakeholders adapt to the stress and the policy's ability to adapt itself to the stress is assessed by answering 15 questions across three worksheets, with a fourth worksheet aggregating the results. ADAPTTool is based on the book *Creating Adaptive Policies: A Guide for Policy-Making in an Uncertain World* (Swanson & Bhadwal, 2009).

The spreadsheet workbook serves as the basis for scoring each of the programs in response to the assessment questions identified in Box 1. The questions cover both planned adaptability (i.e., how well the policy or program anticipates the likely impacts of the stressor) and autonomous adaptability (or adaptability to unanticipated impacts of the stressor).

The tool follows the logic model shown in Figure 2 below and examines two things:

1. Whether policies and programs support adaptation to a particular stressor (in this case, climate change).
2. Whether the policies or programs themselves are inherently adaptable, due to the features of their design and implementation.



BOX 1: ADAPTool Questions and Worksheet Structure

I. Scope of Evaluation Worksheet:

- 1) What is the geographic scope of the analysis (e.g., watershed, conservation district, municipality, region, province)?
- 2) What is the stressor of concern (i.e., climate change, market price instability)?
- 3) What are the policies/programs to be assessed?

II. Vulnerability & Adaptation Analysis Worksheet (for planned adaptability):

- 4) What are the main sectors active in the geographic area?
- 5) In what ways are the sectors vulnerable to the stressor?
- 6) What adaptation actions might be necessary if this stressor becomes more severe in the future?
- 7) Are the identified adaptation actions supported by the policies/programs?

III. Adaptive Capacity Analysis Worksheet (for both planned and autonomous adaptability):

- 8) Is the policy itself vulnerable to the stressor identified?
- 9) Does the policy enhance the capacity of actors within each sector to adapt (with respect to access to finances, technology, infrastructure, information and skills, institutions and networks, and equitable access)*?
- 10) Were foresight methods and multistakeholder deliberation used in the scoping and design of the policy?
- 11) Are foresight methods and multistakeholder deliberation used in the implementation of the policy?
- 12) Does the policy enable self-organization and social networking among affected stakeholders? (Does the policy provide mechanisms for the sharing and copying of best practices and lessons learned?)
- 13) Is decision making for policy implementation adequately decentralized?
- 14) Is there adequate variety in the suite of policies and programs directed at the policy issue? (e.g. economic, regulatory, expenditure, institutional policy instruments)
- 15) Does the policy have a regular formal review process in place that can detect emerging issues?

IV. Synthesis Worksheet

An aggregate ranking of planned adaptability and autonomous adaptability is provided for the overall suite of policies, as well as for each individual policy.

* Based on Smit & Pilifosova (2001).

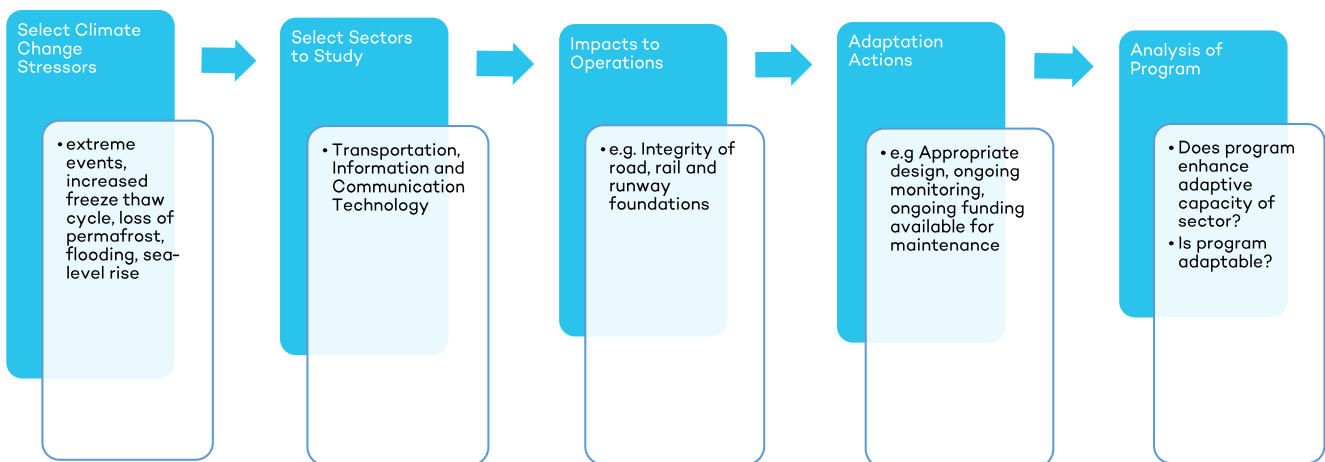


Figure 2. ADAPTool Logic Flow Diagram



3.0 Results

3.1 Situation Analysis

The analysis and mapping exercise of the selected sectors in the Hudson Bay region showed that transportation infrastructure is highly focused on small airports with a minimal amount of road or rail networks (Figure 3). As with many Northern communities, those in this region are extremely isolated and often dependent on a single form of transportation connecting the community to other communities or regions. Nunavut in particular is the only jurisdiction in North America that remains isolated from the National Highway System and the North American Trade Corridor (Government of Yukon, 2008). Communities in Nunavut and Northern Quebec have no road infrastructure between them, with only snowmobiles and all-terrain vehicles as surface transportation options (Government of Quebec, 2011; Government of Yukon, 2008).

All communities around Hudson Bay rely on air transportation. Building supplies and

fuel are brought in by ship, while most food and consumables are transported to by air (Government of Yukon, 2008). The result is infrastructure failure that can lead to loss of basic services and supplies including food or medical assistance (National Round Table on the Environment and the Economy, 2009).

Additional infrastructure includes ferry networks connecting communities in the summer allowing an annual resupply of fuel, oil and bulk goods. The shipping season ranges from one to five months and boats are commonly used for intercommunity travel and transport. Despite this reliance on and connection to the sea, Churchill is the only deep-sea port and there are not even basic breakwaters or marshalling areas in most communities (Government of Yukon, 2008).

There is recognition that accessing Northern resources, including mining and hydro potential, will require significant construction of inland and inter-community roads. There are known mineral resources in the Kivalliq and Nunavik regions, and hydroelectric potential exists in the rivers draining

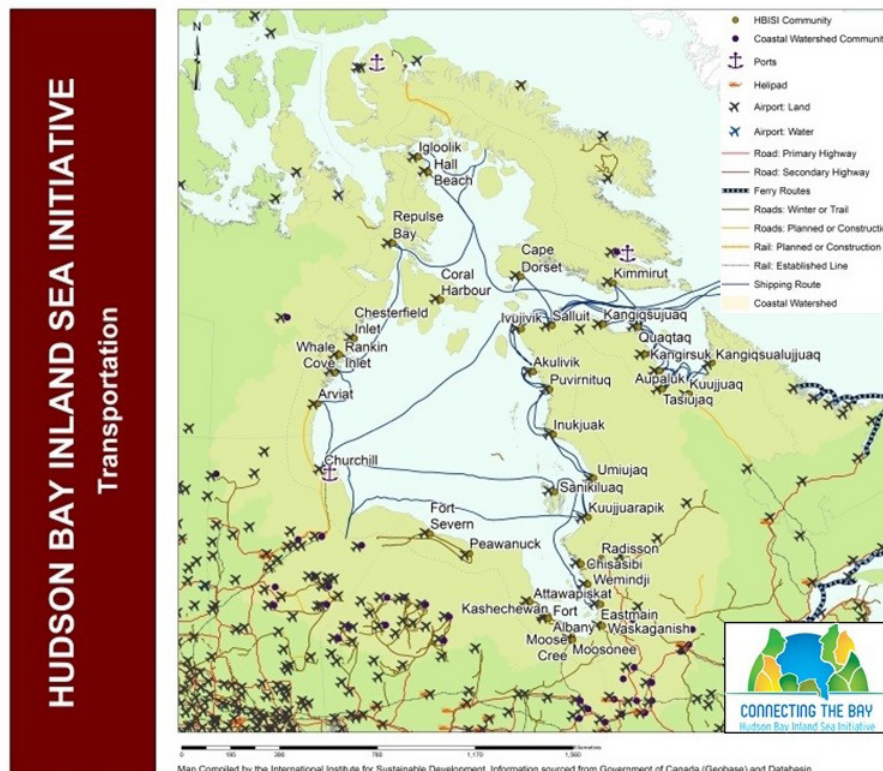


Figure 3. Transportation Infrastructure in the Hudson Bay Region

Data sources: Government of Canada (Geobase) and Databasin (2011).



into Hudson Bay. Road corridors are needed to bring these deposits into viability. They will also provide competitive options for community re-supply and reduce costs in nearby communities (Government of Yukon, 2008). There are plans to build a road into Churchill that also connects Manitoba and Nunavut between Churchill and Arviat; however, it is still in the initial planning stages.

Given the current situation, it is clear the communities and industry working in the region are reliant on air infrastructure to connect to each other and access goods and services in the South. The strength and resilience of this infrastructure is thus an important component of community well-being and industry growth.

Communities in the Hudson Bay region also face considerable limitations when it comes to access to and the cost of Internet and mobile services compared to other Canadian regions (Figure

4). The vast majority of communities around Hudson Bay are reliant on satellite services with a connection speed of 1,500 kbps download and 384 kbps upload. This is considerably slower than the Canadian Radio-Television and Telecommunications Commission (CRTC) target of 5,000 Kbps download /1,000 kbps upload which is the standard for the rest of the country (Fiser, 2013). Similarly the cost of satellite backhaul is considerably higher than fibre optic cable options available in other parts of the country because of the requirements of substantial equipment and upfront installation fees (Fiser, 2013).

Access to technology, information and skills has been identified as a key component of adaptive capacity at the community level (Smit & Pilifosova, 2001). Affordable access to the Internet is critical to development in the North and can directly support community resilience by providing access to education, technical knowledge and networking, which is otherwise difficult in these remote areas.

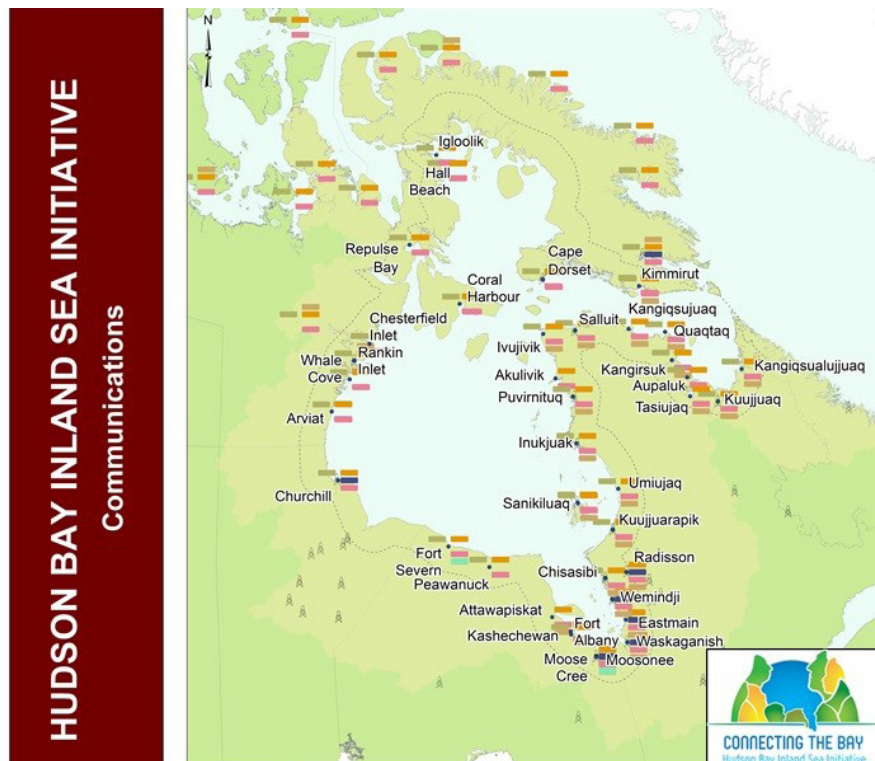


Figure 4. ICT infrastructure in communities around Hudson Bay

Source: Map was created by IISD (Rosemary XXX?) for this project. Data sources: Government of Canada (Geobase) and Databasin.



3.2 Stakeholder Engagement: Climate Vulnerabilities and Adaptation Actions

Northern youth identified a range of climatic impacts on their communities, including sea-level rise, invasive species, winter road instability and security in general. They were especially concerned with changes in ice conditions and the impacts on wildlife populations. Many linked these changes to food stress and hunting limitations with overall security.

From an infrastructure perspective, young people were most concerned about air and road infrastructure and the impacts of permafrost degradation. They recognized the reliance of infrastructure on permafrost and indicated their concern about increasing instability in the future particularly in relation to access.

In response to the question, “What do you expect to be the biggest impacts on your community as a result of climate change?” one interviewee responded: *“I believe the two biggest impacts on my community as a result of climate change will be food security and permafrost. Permafrost is already having a major effect on our roads, highways, infrastructure, and lakes and rivers.”*

From an ICT perspective young people are most reliant on Internet and mobile technology and identified potential climate impacts, including permafrost degradation and possible flooding on cell phone towers and other infrastructure requirements.

In response to the question, “How will climate change impact the communication infrastructure you identified as important to your life?” one interviewee responded: “Intense flooding due to climate change can lead to negative impacts in the Northern communities as technology can also be influenced. Cellphone towers and internet/telephone lines can be affected with sea level rise and hence, flooding in these regions.”

Based on these discussions, a series of key vulnerabilities were listed and possible adaptation responses/actions were identified. Community input was then compared with that from experts in the ICT and transportation sectors and the information was compiled, cross-checked and reviewed by the project team, resulting in a list of vulnerabilities and adaptation actions to be used in the policy analysis described below.

Adaptation actions identified focused on the planning, implementation and monitoring process of infrastructure design and development, as opposed to details of engineering requirements, which will be location-specific. The list of adaptation actions is not meant to be definitive, but to provide examples of the types of actions that would be constructive in response to climate impacts identified.



Table 2. Climate Vulnerabilities to Transportation and ICT Infrastructure in the Hudson Bay Region

Vulnerabilities and Opportunities	Potential Adaptation Actions (Suite of Responses)
Integrity of road, rail and runway foundations due to permafrost instability	<ul style="list-style-type: none"> • Appropriate planning • Appropriate design • Ongoing monitoring • Ongoing funding available • Emergency response in place • Participation in the process by communities
Integrity of road, rail and runway foundations due to flooding and erosion	
Integrity of transportation related building foundations due to permafrost instability	
Winter road reliability and shorter season due to higher temperatures	
Increase in shipping traffic and more shipping routes due to ice-free Arctic Passage	
Integrity of road foundations due to increased freeze-thaw cycles	
Potential for more weather-related accidents due to unpredictable weather	
Potential loss of/threats to both transportation (and ICT) infrastructure due to forest fire	
Changes in snow and ice conditions affecting utility of snowmobiles and dogsleds	
Changing ice conditions and associated costs affecting local transportation for hunting and other livelihoods	
Physical issues resulting from the impact of thawing permafrost on towers, antennas and cable trenches	
Increased cooling requirements for switches and servers related to ICT	
Increased incidence of lightning strikes on ICT infrastructure	
Increased fire risk on ICT infrastructure	
Increased radio interference resulting from changing weather patterns, etc.	
As the North opens to economic development, there may be opportunities to locate server farms at sources of natural air conditioning and renewable energy (such as hydroelectric power and wind), if high-speed connections to backbone networks are available.	
Thawing permafrost might make it easier to lay high-capacity fibre optic cables on land.	
Receding ice might make it possible to lay high-capacity fibre optic cables underwater.	

3.3 Policy Identification and Analysis

Based on the identified vulnerabilities and possible adaptation actions, a series of relevant policies were proposed for review by the project team. The criteria for policy identification and review were those policies or programs relevant to Northern development planning and having impact on transportation or ICT infrastructure development, planning or management.

Policies identified for review included:

Federal Northern Transportation Adaptation Initiative – A federally funding initiative aimed at: supporting the development of tools and technology; improving knowledge and building Northern capacity, ensuring knowledge is available;

and understanding the future costs associated with maintenance and operations of transportation infrastructure in the context of climate change. These funds will help:

- Design, develop, and adopt innovative technologies, tools, and best practices
- Know and understand more about the impacts of climate change on the Northern transportation system
- Help make existing and future Northern transportation infrastructure and operations more resilient and adaptable to climate change
- Encourage the development of Northern expertise



The initiative was selected for review because of its importance in guiding infrastructure adaptation knowledge and understanding in Canada. As one of the leading programs supporting integrated approaches to infrastructure research and adaptation, it provides support to address infrastructure adaptation needs and has the potential to directly contribute to the way transportation infrastructure is designed and delivered for Northern Canada.

Northern Manitoba All Weather Roads Program – A provincial program for construction, upgrade and communications regarding Manitoba’s winter roads, recognizing their important role in overcoming social and economic challenges facing the Northern and remote communities in Manitoba.

The program was chosen because of its importance for delivery of goods and services to Northern residents of Manitoba. Manitoba’s winter roads facilitate the hauling of freight to Northern and remote communities, but also provide the residents with temporary inter-community travel as well as road access to the rest of the province.³

Ontario Far North Act – An act to initiate community-based land-use planning in the Far North that: (a) sets out a joint planning process between the First Nations and Ontario; (b) supports the environmental, social and economic objectives for land-use planning for the peoples of Ontario that are set out in Section 5; and (c) is done in a manner that is consistent with the recognition and affirmation of existing Aboriginal and treaty rights in section 35 of the Constitution Act, 1982, including the duty to consult. The objectives of land-use planning include:

- A significant role for First Nations in the planning.
- The protection of areas of cultural value and protection of ecological systems by including at least 225,000 square kilometres of the Far North in an interconnected network of protected areas designated in community-based land-use plans.

- The maintenance of biological diversity, ecological processes and ecological functions, including the storage and sequestration of carbon in the Far North.
- Enabling sustainable economic development that benefits the First Nations.

The Far North Act was selected for analysis because of its role in designating transportation and ICT infrastructure as part of development planning in Ontario. It is recognized as cross-cutting legislation that impacts the way planning takes place and infrastructure is delivered in the province.

Growth Plan for Northern Ontario – A strategic framework that will guide decision making and investment planning in Northern Ontario building on themes of economy, people, communities, Aboriginal Peoples, infrastructure and the environment. The Growth Plan was selected for review because of its role in guiding the direction and implementation of infrastructure development across Northern Ontario.

Nunavut Transportation Strategy – This is the Government of Nunavut’s strategy for prioritizing and securing resources to invest in transportation needs for the territory. The strategy examines the historic and existing transportation system, including operations, policy improvements and future needs. It also identifies processes for resourcing and prioritizing projects based on these needs. The Nunavut Transportation Strategy was selected because of its role in guiding the direction and implementation of infrastructure development in Nunavut.

Once the vulnerabilities and potential adaptation actions were identified, the project team proceeded to review each of the identified policies using the ADAPTool workbook. Analysis was done by project researchers based on the written policies themselves and in consultation with policy experts dealing with implementation and delivery.

³ See <http://www.gov.mb.ca/mit/winter/>



4.0 Adaptive Policy Conclusions and Recommendations

4.1 Vulnerability/Adaptation Analysis

In all, 85 adaptation actions were considered for each of the policies including a range of planning, implementation and monitoring processes for core vulnerabilities related to the transportation and ICT infrastructure systems, including issues such as permafrost instability, increased storm events and variability in the freeze-thaw cycle among others.

Of the 85 adaptation actions identified, only those related to emergency response were not addressed by any of the policies analyzed. Although emergency response is an increasingly important issue related to transportation systems in the context of climate change, the policies and programs assessed are focused on the infrastructure itself, and emergency response was largely seen as outside of their scope.

Not all actions were applicable to all policies identified. For example, the Manitoba Winter Roads Program and the Northern Transportation Adaptation Initiative do not include ICTs in its scope and, as a result, all ICT-related actions were considered not applicable. Table 3 illustrates findings from the vulnerability analysis.

The following observations can be made regarding the adaptation analysis of the individual policies or programs analyzed:

Federal Northern Transportation Adaptation Initiative: Permafrost and shipping are a priority, and adaptation actions in these areas are all directly supported. There is less focus on winter roads, flooding and erosion, and increased freeze-thaw cycles, although in many cases they are directly supported through individual projects. There are no provisions for issues around emergency response.

Northern Manitoba Winter Roads Program: There is strong planning, design and monitoring related specifically to seasonality and possible shorter seasons, and actions related to these components are directly supported. There is strong support for community participation, including provisions for emergency responses built into the program.

Ontario Far North Act: The Ontario Far North Act supports land-use planning processes with communities in Northern Ontario and, as such, includes strong processes for participation by communities directly supporting actions related to planning and communities’ participation. The act is not specifically focused on transportation or ICT infrastructure planning, and relatively few direct actions specifically related to climate change and infrastructure vulnerabilities are considered applicable to the act itself.

Table 3. Vulnerability Analysis Results

	Northern Transportation Adaptation Initiative	MB Winter Roads Program	Ontario Far North Act	Growth Plan for Northern Ontario	Nunavut Transportation Strategy
Total number of adaptation actions	39	25	32	61	43
Percent of actions indirectly supported	64%	52%	38%	41%	21%
Percent of actions directly supported	21%	40%	34%	51%	67%
Total score (out of a total of 2)	1	1	1	1	2



Growth Plan for Northern Ontario: The Growth Plan for Northern Ontario is a broad development plan that reaches beyond transportation and ICT infrastructure. It directly supports actions related to planning and monitoring for climate impacts as well as ongoing communication of the infrastructure plan with key stakeholders, including communities. Many specific vulnerabilities are not directly supported by the plan itself, but are rather part of implementation at a lower level.

Nunavut Transportation Strategy: The strategy is specifically focused on transportation in Nunavut and builds on past work and lessons learned giving the Northern context. As a result, it includes many direct provisions for planning, design and monitoring of climate vulnerabilities, including, specifically, permafrost and increased shipping routes. It also includes specific provisions for off-road networks that are not included in any of the other programs examined.

4.2 Adaptive Capacity

Based on the adaptive capacity analysis, we found that all five selected policies scored fairly high on both autonomous and planned adaptability. This implies that these policies are flexible in light of uncertainty and have built-in mechanisms that allow them to be responsive to both anticipated and unanticipated climate changes. Table 4 gives a summary of the scoring system.

Table 5 below shows the summary results of the ability of the policies analyzed to support planned and autonomous adaptability. Planned adaptability indicates the policy’s ability to support anticipated adaptation actions, while autonomous adaptability indicates the ability of the policy to enable sector stakeholders to respond to unanticipated issues.

Table 4. Scoring System for Adaptation Analysis Using the ADAPTool Workbook

Colour	Explanatory note	Score
Red	Barrier or hindrance	-1
Red	Not contributing	0
Yellow	Contributing somewhat or indirectly	1
Green	Contributing	2
Grey	Not Applicable	n/a



Table 5. Ability of the Policies Analyzed to Support Planned and Autonomous Adaptability

<i>Adaptive Policy Questions</i>	Overall Synthesis	Northern Transportation Adaptation Initiative	MB Winter Roads Program	Ontario Far North Act	Growth Plan for Northern Ontario	Nunavut Transportation Strategy
Programme's Ability to Support Anticipated Adaptation Needs (Planned Adaptability, score out of 10)	6.25	8	6	5	6	6
Are anticipated adaptation actions supported by the policies?	1	1	1	1	1	2
Is the policy itself vulnerable to the stressor?	2	2	0	2	2	0
Can the existing suite of programmes enhance the capacity of actors within each sector to undertake the anticipated adaptation actions?	1	2	2	0	1	2
Was multi-stakeholder deliberation used in the design of the policies?	2	2	2	0	2	2
Programme's Ability to Enable Sector Responses to Unanticipated Events (Autonomous Adaptability, score out of 10)	6	8	8	6	4	5
Is multi-stakeholder deliberation used in the implementation of the policy?	2	2	2	2	2	2
Does the policy enable self-organization and social networking?	2	2	2	1	1	1
Is decision-making for policy implementation adequately decentralized?	0	1	1	0	0	1
Is there adequate variety in the suite of policies and programs directed at the policy issue?	1	1	2	2	1	1
Do the policies have a regular formal policy review?	1	1	1	2	0	0
Overall Adaptive Policy	1	1	2	2	1	2

Figure 5 below presents the relative contributions of each of the policies analyzed in this report to planned adaptability and autonomous adaptability. **The position of the policy along the vertical axis** of the diagram reflects its planned adaptability, including: support for anticipated adaptation actions; the potential vulnerability of the policy itself to climate change; the ability of the policy to contribute to key determinants of adaptive capacity (economic resources, access to technology, infrastructure needs, information and management skills, institutions and networks, and equitable access); and the degree to which the policy development process included consultation with stakeholders during its scoping and design phase. **The position of a policy along the horizontal axis** is a reflection of the policies' autonomous adaptability, including: the degree

to which stakeholders have input during policy implementation; the policy's ability to enable self-organization through the sharing of best management practices and lessons learned; whether the policy is sufficiently decentralized to respond to local adaptation needs; and whether or not the policy has a formal review process to trigger key policy improvements and detect emerging issues.

If a policy appears in the green area of the diagram, it is contributing well to both planned and autonomous adaptability. A policy appearing in the red area signifies that there are issues to address in either area or in both—its ability to adapt to known and unknown factors related to the selected stressor within climate change. The yellow area signifies that a policy is partially contributing



and that some improvements might be warranted to help it better contribute to adaptation needs and be more adaptive itself. It is important to note that these rankings are not an assessment of policy performance relative to their original policy objective and mandate.

As illustrated in the diagram, the Northern Transportation Adaptation Initiative is the only policy that lies within the green area, while the other four policies analyzed contribute marginally to both planned and autonomous adaptability. Based on the analysis, all policies scored high or marginally well for multistakeholder deliberation in implementation, enabling self-organization and having a variety of tools within the policies. Within the planned adaptability, there was considerable variation between the policies analyzed and no individual factor scored high in all of the policies analyzed.

It is important to note that low scores for any particular policy or characteristic do not reflect negatively on that policy. The scores merely reflect an assessment of how they would respond to characteristics relevant to climate adaptation. The policies and programs assessed were designed for purposes other than climate adaptation.

The following specific observations can be made regarding the adaptation analysis of individual policies assessed:

Federal Northern Transportation Adaptation Initiative scored well on autonomous and planned adaptability. Small areas of improvement could be made through the development of a formal review process, decentralization (in design, eligibility and decision making) and in ensuring the information/knowledge gets to the necessary stakeholders (the communities affected) and is incorporated more broadly into other plans and strategies.

Northern Manitoba Winter Roads Program demonstrated relatively strong ratings on autonomous and planned adaptability. The program is vulnerable to climate change by definition. Improvement could be made by developing a formal review mechanism for the policy.

Ontario Far North Act included less direct support to adaptation; however, this is primarily due to the fact that the scope of the act focused on land-use planning as opposed to transportation or ICTs. General improvements could be made by including climate change terminology into the act itself, stating specifically that land-use applications should or have to consider climate change.

Growth Plan for Northern Ontario is a broad program that does not focus specifically on the transportation or ICT sector. It showed a high degree of flexibility and support for partnerships and participation. It could be strengthened by incorporating a formal process for review.

Nunavut Transportation Strategy is fairly strong in both autonomous and planned adaptability. It could be strengthened through the development of a formal review process and improved processes for self-organization or social networking (sharing lessons between communities).

Adaptive Policy Summary Analysis
(Green contributing, yellow marginally contributing, and red not contributing)

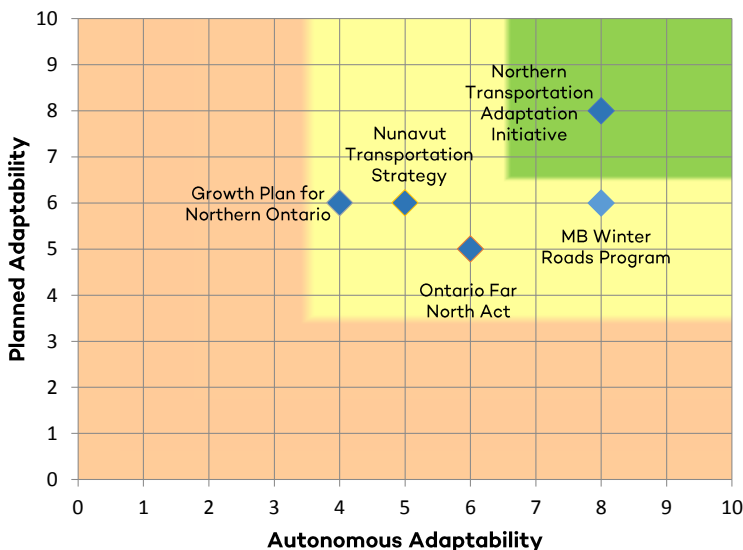


Figure 5. Adaptive Policy Summary Analysis



4.3 Conclusions and Recommendations

Overall, the five policies performed relatively well on the adaptability scale. There was a range in the types of policies and programs assessed and, as a result, not all identified adaptation actions were relevant to all policies. There was a high degree of direct support across the policies to actions related to permafrost instability and increases or changes in shipping routes and to actions related to community engagement in planning processes. There is very little direct or indirect support through these policies to emergency response related to transportation or ICT infrastructure.

The policies also performed relatively well in their ability to respond to unanticipated events. The analysis concluded that there is a high level of multistakeholder deliberation for the implementation of the policies; the policies or programs enable self-organization; and there is an adequate degree variety in the suite of policies and programs. On the other hand, multistakeholder deliberation in the design of the policies was more limited than in the implementation phase, and some of the programs or policies are vulnerable to the stressor itself.

The overall conclusions and recommendations of the adaptive policy analysis for include:

- **Support to Anticipated Adaptation Needs (planned adaptability).** The suite of policies and programs do address vulnerabilities to climate change through support to a wide range of direct and indirect adaptation actions. Loss of permafrost and increases in shipping routes are particularly supported, while there is somewhat less focus on increased flooding and erosion or increased variability in the freeze- thaw cycle. The suite of programs and policies also have a strong focus on the process, and many support planning and community engagement related to the climate vulnerabilities identified.
- **Policy Vulnerability (planned adaptability).** The selected policies demonstrate different degrees of vulnerability to the stressor. The Manitoba Winter Roads Program and the Nunavut Transportation Strategy are vulnerable to the stressor itself because of the possible cost increases projected with increases in weather variability.
- **Support to Stakeholder Adaptive Capacity (planned adaptability).** The six determinants of adaptive capacity (access to economic resources, technology, infrastructure, information/skills, institutions/networks and equitable access to resources) were directly supported by the selected policies in some cases and partially or indirectly supported in others. In cases of partial or indirect support, the policy may not provide direct access to relevant information, technology, skills, institutions and networks, although it does present information or create sources of information for stakeholders on where to obtain access to these.
- **Use of Multistakeholder Deliberation (planned and autonomous adaptability).** All of the policies analyzed scored high in the use of multistakeholder deliberation as part of both planning and implementation. This aspect of adaptability was a strength across the policies and programs.
- **Enabling Self-Organization and Networking (autonomous adaptability).** All of the policies assessed supported some level of self-organization and social networking as part of implementation largely in the form of sharing lessons learned across stakeholder groups, regular meetings or through partnerships.
- **Decentralization (autonomous adaptability).** Both the Far North Act and the Growth Plan for Northern Ontario could be made more adaptable by increasing aspects of decentralization, including devolution of authority and resources to regional offices.



- **Variation in Policy Instruments Employed (autonomous adaptability).** The suite of policies provides variety in policy instruments, including regulatory, economic and expenditure. There is a fair amount of variety in instruments supported both by the suite of policies or programs assessed and with the programs or policy implementation themselves.
- **Formal Policy Review and Improvement (planned and autonomous adaptability).** The adaptability of all of the policies reviewed could be strengthened through the implementation of more formal adaptive review processes. Regular reviews can help address emerging issues and trigger value-added policy or program adjustments and can greatly improve the ability to adapt to changing situations.
- The adaptability of the Federal Northern Transportation Adaptation Initiative, the Northern Manitoba Winter Road program and the Nunavut Transportation Strategy could be strengthened through the inclusion of formal mechanism for policy review.
- Support to adaptation by the Ontario Far North Act could be made by including climate change terminology in the act itself, stating specifically that land-use applications should or have to consider climate change.
- Climate change has the potential to increase the severity and frequency of the damage and disruption inflicted on transport systems by extreme weather. Adaptive management will also require actions and policy-making and behavioural changes in energy use to develop transport networks that are resilient to climate change and extreme weather events. Resilient transport systems in the Hudson Bay region will need to include energy conservation measures and increased efficiency as part of adaptation policies and programs for sustainable Northern transportation networks.

Recommendations

- While the selected policies and program offer a range of direct and indirect support for sector-specific adaptation, there is a need to improve lessons learned and information sharing between jurisdictional programs around adaptation action and vulnerabilities.
- A specific area of unsupported climate vulnerability is emergency response related to infrastructure instability or increased storms. An assessment of whether this is critical for adaptation in the sector, and if this is covered by other policies or programs, should be considered.
- Areas of vulnerability that are less supported include integrity of road, rail and runway foundations due to flooding and erosion, and integrity of road foundations due to increased freeze-thaw cycles. These ought to be addressed clearly in these and other complementary policies to ensure the long-term sustainability and viability for transportation sector development.



References

- Conference Board of Canada. (2013). *Territorial outlook 2013*. Ottawa: Conference Board of Canada.
- Fiser, A. (2013). *Mapping the long-term options for Canada's North: Telecommunications and broadband connectivity*. Canada: Conference Board of Canada.
- Government of Quebec. (2011). *Plan Nord. Building Northern Quebec together: The project of a generation*. Retrieved from <http://caid.ca/QueNor2011.pdf>
- Government of Yukon. (2008). *Northern connections: A multi-modal transportation blueprint for the North*. Whitehorse: Government of Yukon.
- National Round Table on the Environment and the Economy. (2009). *True North: Adapting infrastructure to climate change in Northern Canada*. Ottawa: National Round Table on the Environment and the Economy.
- Pachauri, R. A. (2007). *Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. Geneva, Switzerland: IPCC.
- Smit, B. & Pilifosova, O. (2001). Adaptation to climate change in the context of sustainable development and equity. In J. C. McCarthy, O. F. Canziani, N. A. Leary, D. J. Dokken & K. S. White (Eds.) *Climate change 2001: Impacts, adaptation, vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change* (pp. 876-912). Cambridge: Cambridge University Press. Retrieved from http://www.grida.no/publications/other/ipcc_tar/?src=/climate/ipcc_tar/wg2/
- Swanson, D. A., & Bhadwal, S. (eds). (2009). *Creating adaptive policies: A guide for policy-making in an uncertain world*. Ottawa: Sage Publications; New Delhi: IDRC.



Annex 1. Analysis and Conclusions for Specific Policies

Is the policy itself vulnerable to the stressor?

Policies and Programs	Is the policy itself vulnerable to the stressor? (score 2 if no; 1 if marginally; and 0 if yes)
Northern Transportation Adaptation Initiative	Funding is capped regardless of the condition of the environment or the transportation sector 2
MB Winter Roads Program	Yes. Winter roads are dependent on timely cold weather and timely snowfall 0
Ontario Far North Act	No 2
Growth Plan for Northern Ontario	No 2
Nunavut Transportation Strategy	Yes – climate change will result in greater stress on the system and greater cost 0

Does the policy enhance the capacity of actors within the sectors to adapt?

Policies and Programs	Contribution to Adaptive Capacity (2 - yes; 1 - partially; 0 - no) (based on Smit & Pilifosova, 2001)*									
	Access to Financial Resources	Access to Relevant Technology	Access to Relevant Info and Skills	Access to Relevant Infrastructure	Access to Institutions and Networks	Equitable Distribution of Resources				
Northern Transportation Adaptation Initiative	This initiative gives grants and funding 2	Some through grants and funding 1	Findings are summarized and published by Transport Canada, on the Transport Canada website and/or in hard-copy form, to serve as information for the benefit of the transportation sector 2	Provision of infrastructure is not a component of this initiative 0	Transport Canada encourages partnerships and the sharing of knowledge & best practices 2	Grants and funding are distributed based on equitable criteria 2				
MB Winter Roads Program	Construction and maintenance contracts and employment to local communities 2	Through road access (physical resources) 1	Road reporting, weather updates, and training 2	Winter roads and bridges 2	There is some intercommunity discussion, some do or don't 1	Funding is dependent on the federal government, otherwise yes 1				
Ontario Far North Act	Provides no access to financial resources 0	Enables policy to be made on ICT and transportation infrastructure but does not give access to technology 0	Assumes required information will be obtained by proponents. Only governs planning process. 0	Enables policy to be made on transportation and ICT infrastructure 1	No 0	No 0				
Growth Plan for Northern Ontario	Guides policy and planning and promotes investment for economic development, but does not directly provide funding 1	Will direct investment to required technology 1	Will direct funding to capacity building in Northern communities 1	Will direct funding to required infrastructure 1	Encourages collaborative planning and sharing of information 1	Focuses investment on "hub" communities 0				
Nunavut Transportation Strategy	Limited, but also provides provisions for accessing federal funds 1	Through support to engineering processes 1	A guiding principle of the strategy 2	Directly supports infrastructure development 2	Supports collaboration with neighbouring jurisdictions and provides support for federal funding 2	Supports municipal and community planning 2				



Were foresight methods and multistakeholder deliberation used in the scoping and design of the policy?

Policies and Programs	In the development and framing of the policy, was a foresight approach (i.e., scenario planning) used to identify key performance factors and their future evolution, and was there public consultation and feedback from diverse groups affected? (score 2 if both foresight and multistakeholder deliberation used; 1 if one or the other was used; 0 if neither were used)	
Northern Transportation Adaptation Initiative	This initiative is based on foresight re: the impacts of climate change. Provinces and territories are a significant part of deliberation.	2
MB Winter Roads Program	Foresight (planning for future conditions), and public consultation and feedback from various communities and First Nations	2
Ontario Far North Act	Works to involve First Nations and public into decision making, but it is not discernible whether public consultation was used to develop it. No scenario planning was used.	0
Growth Plan for Northern Ontario	Growth Plan is for the future, so tries to anticipate future needs of the region, but no indication that scenario planning was used. Developed in partnership with stakeholders from Northern Ontario.	2
Nunavut Transportation Strategy	Consultation process and foresight planning was applied	2

Are foresight methods and multistakeholder deliberation used in the implementation of the policy?

Policies and Programs	Does the implementation of the policy require local consultation and public discussion of planning options prior to decision making or policy activity, and do implementation decisions integrate an array of important factors? (score 2 if implementations decisions made in a deliberative and integrated analysis manner; 1 if only one or the other is used; 0 if neither deliberation nor integrated analysis used for implementation decisions)	
Northern Transportation Adaptation Initiative	Implementation incorporates public discussion in decision making. There is a broad array of factors considered in the selection criteria of eligible projects under this initiative.	2
MB Winter Roads Program	Annual local consultation and discussion are required for planning and various factors such as traditional uses of lands and previous issues/concerns are factored in.	2
Ontario Far North Act	Requires joint participation with relevant First Nations groups and public consultation	2
Growth Plan for Northern Ontario	Requires consultation and public discussion in the development of strategies and plans	2
Nunavut Transportation Strategy	Ongoing consultation and engagement as part of projects moving forward	2

Does the policy enable self-organization and social networking?

Policies and Programs	Does the policy provide mechanisms for the sharing and copying of best practices and lessons learned? (score 2 if direct support; 1 if partial support; 0 if no support)	
Northern Transportation Adaptation Initiative	Transport Canada encourages partnerships and sharing of knowledge and best practices. Findings are summarized and published by Transport Canada, on the Transport Canada website and/or in hard-copy form, to serve as information for the benefit of the transportation sector.	2
MB Winter Roads Program	Annual meetings and website allow social networking and sharing of best practices (e.g., community members comment on contractor's manual)	2
Ontario Far North Act	No, but it does provide mechanisms for amendment.	1
Growth Plan for Northern Ontario	Encourages partnerships between municipalities when planning. No mechanism provided.	1
Nunavut Transportation Strategy	Encourages partnerships No mechanism provided.	1



Is decision making for policy implementation adequately decentralized?

Policies and Programs	Is decision-making authority for the policy sufficiently decentralized to enable stakeholders most impacted to respond quickly to unanticipated events? (score 2 if adequately decentralized; 1 if only partially decentralized; 0 if not adequately decentralized)	
Northern Transportation Adaptation Initiative	Applicants are subject to a review board of experts and then to an internal Transport Canada board for acceptance. Applicants for this initiative may involve governments, academia and the private sector. In the end, the federal program has the final say.	1
MB Winter Roads Program	Discussions and decision making happen in annual meetings with communities and contractors; however, provincial and federal governments get final say, (stakeholders may not always get what they want).	1
Ontario Far North Act	The act is designed to guide community based land-use planning, not address specific events.	0
Growth Plan for Northern Ontario	Decision making for investment is open to consultation with stakeholders but ultimately decided by the province. The plan is not designed to address specific events, but assumes that communities or correct authorities will address unanticipated events	0
Nunavut Transportation Strategy	Decision making processes related to the strategy are at the territorial level; projects are supported by municipalities and communities.	1

Is there adequate variety in the suite of policies and programs directed at the policy issue?		
Policies and Programs	Type the name(s) of the policy instrument type(s) in the cell adjacent to the policy name. If only one policy type appears among all policies analyzed score 0; if two policy types present score 1; if 3 or 4 policy types present score 2. (pg. 98)	
Northern Transportation Adaptation Initiative	Expenditures and institutional, score 1	1
MB Winter Roads Program	Regulatory, expenditures and institutional, score 2	2
Ontario Far North Act	Strategy and Act, score 2	2
Growth Plan for Northern Ontario	Development Plan; score 1	1
Growth Plan for Northern Ontario	Development Plan; score 1	1
Nunavut Transportation Strategy		1

Does the policy have a regular formal policy review?

Policies and Programs	Does the program have formal review mechanisms to consider effectiveness under changing conditions? (score 2 if a formal review is required and there are publicly available reports from the review; 1 if a review is done periodically and no reports are publicly available; 0 if a review is not required and no reviews have been undertaken)	
Northern Transportation Adaptation Initiative	While there are no set formal mechanisms, the program lasts five years and then is subject for renewal based on evaluations. In addition, new/changing issues are considered/incorporated throughout the program duration.	1
MB Winter Roads Program	Formal review through treasury board annually; internal documents	1
Ontario Far North Act	Act requires land-use plans to be reviewed every ten years. Has an amendment mechanism built into it.	2
Growth Plan for Northern Ontario	There is no indication of formal review mechanisms	0
Nunavut Transportation Strategy	There is no indication of formal review mechanisms	0

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