

CLIMATE CHANGE

ADAPTATION RESOURCE GUIDE

Nunavut's Economy and Competitiveness



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Building *Nunavut* Together
Nunavut liuqatigiingniq
Bâtir le *Nunavut* ensemble



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MARTIN FORTIER, ARCTICNET



1 INTRODUCTION

Climate change is happening, as is evident from increases in global average air and ocean temperatures, widespread melting of snow and ice, and rising global sea levels.¹ In Nunavut the annual average temperature is rising twice as fast as the rest of the world. Climate change has a wide variety of implications for a number of sectors with key importance to the economy of Nunavut, including transportation, tourism, infrastructure, agriculture, resource development, and offshore work, as well as international impacts which have secondary effects on the territory. Meanwhile, climate change provides a number of economic threats and opportunities, and both climate change adaptation and non-adaptation are associated with various costs.

Climate change adaptation is about taking action and changing behaviour to reduce the negative impacts of climate change and take advantage of new opportunities. In the context of a changing climate, there is an economic impetus for conducting adaptation activities, and adaptation activities are both a product of and accompanied by economic costs and benefits.

This resource guide provides an easy-to-use reference base for policymakers and practitioners concerned with the economic competitiveness of Nunavut. The goal of this resource guide is to provide an overview of the information and resources that are available to assist in incorporating adaptation-based activities and policies, recognizing climate-related vulnerabilities, and reducing risk.

2 CURRENT CONTEXT

2.1 Economy and Competitiveness in Nunavut

Nunavut's economic wellbeing has been improving in recent years, with employment and average personal income rising alongside a growing economy. Growth in the future will be dependent on large resource development projects and large construction projects. There is also potential growth in the fishing, tourism and arts sector. Future challenges include the sustainability of the renewable resource industry with increased harvesting pressures, energy production, and transportation challenges.²

2.2 Climate Change Impacts and Projected Changes in Nunavut³

Climate change impacts are already being witnessed by hunters, elders, and others in Nunavut. Over the past 100 years the Arctic has experienced an average warming of 1.5°C, with regional increases between 1 and 3°C. Over the next 100 years, average temperatures are expected to increase by 5 to 7°C in Nunavut, with shorter winters, longer summers, and more extreme weather events. Many of the changes which have already been witnessed are projected to increase over time, and still more changes are projected to occur in the future. Some climate-change-related changes which have been witnessed in Nunavut thus far or are projected to occur in the future include changes to permafrost, changes to sea ice and accessibility, changes to resource access, and more.

¹ International Panel on Climate Change [IPCC], 2007

² Nunavut Economic Forum, 2013.

³ Information on climate change impacts comes from Government of Nunavut 2003, 2005 a,b,c,d, 2011 and 2014.

⁴ Information on mining and resource development comes from Nunavut Mining Symposium, 2012

TOURISM

- Longer summers could potentially result in a longer high season for tourism in Nunavut, and increased tourism activity. This could have effects of increased economic activity in some sectors, including accommodations, arts and crafts, and more.
- Decreases in the extent of ice cover are likely to result in increased shipping traffic, including increases in cruise ship activity in areas that were previously inaccessible.
- There could also be negative effects with the possibility of fuel spills, disturbance to wildlife, and naval collisions from navigating poorly marked water ways.
- The impact of increased marine tourism will have both opportunities and challenges for communities, historic resources, and the environment in general.

MINING AND RESOURCE DEVELOPMENT⁴

- Current climate change projections include reduced sea ice cover and warmer temperatures. These conditions are likely to lead to an increase in exploration and industrial activities. Furthermore, because the Canadian Arctic Archipelago has potential for vast hydrocarbon and other mineral deposits, oil and mineral resource development are expected to increase.
- Beyond its direct effects on infrastructure as described below, degradation of permafrost under conditions of climate change has many implications for mining and resource development, such as impacts to buildings, roads, airstrips, quarries and pits, and tailing ponds

TRANSPORTATION AND INFRASTRUCTURE

- Climate change has a significant impact on transportation infrastructure because of its effect on permafrost. Degradation of permafrost has negative implications for transportation infrastructure, especially older infrastructure, where permafrost thaw causes buildings to shift and destabilize. This may compromise the strength and integrity of buildings, pipelines, roads, and airstrips. Concern has been expressed that alterations to existing infrastructure to adapt to climate change may divert necessary resources from the construction of new buildings.
- Because of the above, collapsed roadways, shifting permafrost, and other damages could occur.

AGRICULTURE AND FOOD

- Two possible impacts of climate change on food security are a longer shipping season and longer growing season in the south, resulting in lower prices in Nunavut grocery stores.

GOVERNMENT OF NUNAVUT



GOVERNMENT OF NUNAVUT

3 ONLINE RESOURCES

The list of resources in this section is not comprehensive; however it does include those which were identified as the most applicable to Nunavut's economy and competitiveness. The resources listed are all available online and include publications, websites, online tools, and case studies.

3.1 Publications and Websites

3.1.1 Nunavut-specific Publications and Websites

This section includes a list of resources specific to Nunavut or produced in Nunavut that provide information on climate change and Nunavut's economy and competitiveness.

- Title:** Nunavut Climate Change Centre
Agency: Government of Nunavut, Climate Change Section
Summary: The Nunavut Climate Change Centre (NC3) is a web-based climate change resource centre intended to provide current climate change information relevant to Nunavummiut. It was developed with the Government of Nunavut (GN) Department of Environment.
Link: <http://www.climatechangenunavut.ca/>
- Title:** Tourism Change and Adaptation in Northern Communities
Agency: Lakehead University
Summary: Lakehead University provides a website and online resource entitled Tourism Change and Adaptation in Northern Communities. This site describes ongoing research taking place in Nunavut related to changing environmental conditions in the north and tourism, particularly cruise tourism. Among other resources, it links to community reports, community blogs, information on last change tourism in the Arctic, and more.
Link: <http://www.arctictourismandclimate.lakeheadu.ca/>
- Title:** Community Climate Change Adaptation Action Plans
Agency: Government of Nunavut and Canadian Institute of Planners
Summary: Community Climate Change Adaptation Action Plans were developed for Arviat, Cambridge Bay, Clyde River, Hall Beach, Iqaluit, Kugluktuk, and Whale Cove. These plans contain many useful tools and resources, including hazard maps and recommendations for adaptations with respect to extreme weather events. In conjunction with these adaptation plans, a Nunavut Toolkit for Climate Change Adaptation Planning was developed for use in other communities for the development of their own community climate change adaptation plans.
Link: <http://www.climatechangenunavut.ca/en/resources/publications>
<http://www.planningforclimatechange.ca/wwwroot/Docs/Library/CIPReports/NUNAVUT%20TOOLKIT%20FINAL.PDF>
- Title:** Nunavut Economic Development Strategy
Agency: Sivummut Economic Development Strategy Group
Summary: Nunavut's Economic Development Strategy identifies climate change as a threat to the economy. It includes the development of Nunavut's climate change strategy as a step towards securing economic development in Nunavut.
Link: <http://www.nunavuteconomicforum.ca/public/files/strategy/NUNAVUTE.PDF>

- Title:** Community Climate Change Hazards Mapping Projects
Agency: Government of Nunavut with community and academic partners
Summary: Community Climate Change Hazards Mapping projects have been or are being undertaken in a number of Nunavut communities as part of the Nunavut Climate Change Partnership. The goal is to create hazards maps for communities as a useful tool for planners and engineers in Nunavut. The projects involve evaluating existing and potential landscape hazards and the impacts that climate change may have on infrastructure and resource development in communities.
Link: <http://gov.nu.ca/eia/news/climate-change-community-consultations>
<http://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb>
<http://arviat.tv/compendium-of-research/2011/item/290-arviat-research-climate-change-hazard-mapping-nunavut>
- Title:** Homeowner's Guide to Permafrost in Nunavut
Agency: Government of Nunavut, Climate Change Section
Summary: A Homeowner's Guide to Permafrost in Nunavut is a document which provides homeowners in Nunavut with knowledge and resources to make simple changes around their homes to preserve the permafrost frozen beneath them. The guide also provides local decision-makers with adaptation actions that are relevant to the communities they serve.
Link: <http://www.climatechangenunavut.ca/en/resources/news/homeowners-guide-permafrost-nunavut-just-released>
- Title:** Assessing permafrost conditions in support of climate change adaptation in Pangnirtung, Nunavut
Agency: Nunavut Climate Change Partnership
Summary: The Nunavut Climate Change Partnership provides a dataset entitled Assessing permafrost conditions in support of climate change adaptation in Pangnirtung, Nunavut, in PDF format. This data is intended to provide a tool in support of economic development through infrastructure maintenance and community planning.
Link: <http://data.gc.ca/data/en/dataset/d29bf844-b480-5e6a-9d40-0b0781e8299d>
- Title:** National Municipal Adaptation Survey
Agency: National Municipal Adaptation Project
Summary: A National Municipal Adaptation Survey (NMAP) was conducted for Alberta, Northwest Territories, and Nunavut, and provides a variety of information from local governments regarding adaptation, risks, challenges, and resources in their communities.
Link: <http://www.localadaptation.ca/resources/NMAP%20FS%20-%20Alberta,%20NWT%20and%20Nunavut%20J2014.pdf>
- Title:** Canadian Inuit subsistence and ecological sustainability: if the climate changes, must the Inuit?
Agency: Wenzel, G.
Summary: An article entitled Canadian Inuit subsistence and ecological sustainability: if the climate changes, must the Inuit?, was published in 2009. It examines the impact of climate change on the customary institutional mechanisms by which the Inuit share and distribute hunting products, and other cultural practices.
Link: <http://www.polarresearch.net/index.php/polar/article/viewFile/6103/6782>

3.1.2 Northern Publications and Websites

This section includes a list of resources specific to the Circumpolar North or produced in the Circumpolar North that provide information on climate change and Nunavut's economy and competitiveness.

Title: Managing the Risks: A Guide for Arctic and Northern Communities

Agency: Centre for Indigenous Environmental Resources (CIER)

Summary: The Centre for Indigenous Environmental Resources (CIER) provides a guide entitled Managing the Risks: A Guide for Arctic and Northern Communities, intended to assist these communities in applying a step-by-step risk management framework to identify impacts and vulnerabilities to climate change in a local context. Included is an interactive map of summer and winter risks, several reports, and worksheets, as well as the Guide itself.

Link: <http://ccrm-cier.redrockconsulting.com/>

3.1.3 External Publications and Websites

This section includes a list of relevant resources from other areas of Canada or other non-circumpolar countries that provide information on climate change and Nunavut's economy and competitiveness.

Title: Database of Climate Change Adaptation Resources

Agency: Ouranos

Summary: A searchable database of existing climate change adaptation resources is provided by OURANOS (Consortium on Regional Climatology and Adaptation to Climate Change). This includes a search engine which is searchable by geographic region of interest, by topic of interest, and by subtheme.

Link: <http://adaptation.ouranos.ca/en/>

Title: Climate Change Impacts and Adaptation Resource Library

Agency: Clean Air Partnership

Summary: The Clean Air Partnership provides a web site with a large number of useful resources, information pieces, and links to documents related to climate change impacts and adaptation for buildings, development, and infrastructure. Subsections for specific subsectors are also included, including storm water and drainage, transportation, energy, and housing.

Link: http://www.cleanairpartnership.org/arc/resource_library/cc_impacts_adaptation_sector#Buildings_Development_Infrastructure

Title: A Survey of Climate Change Adaptation Planning

Agency: H. John Heintz III Centre for Science, Economics, and the Environment

Summary: A resource entitled A Survey of Climate Change Adaptation Planning has been produced by the H. John Heintz III Centre for Science, Economics, and the Environment. It provides an introductory survey of worldwide climate change adaptation efforts and a number of case studies of adaptations within Canada.

Link: http://www.tribesandclimatechange.org/docs/tribes_89.pdf

Title: Adapting to Climate Change: A Risk-Based Guide for Local Governments

Agency: Federation of Canadian Municipalities

Summary: A report entitled Adapting to Climate Change: A Risk-Based Guide for Local Governments presents a risk-based approach to adapting to climate change for planning and responses, and illustrates how the risk management process can help users determine optimum solutions to complex issues. It is intended to help local officials to identify and manage climate-related risks.

Link: https://www.fcm.ca/Documents/tools/PCP/Adapting_to_Climate_Change_a_Risk_Based_Guide_for_Local_Governments_EN.pdf

Title: Climate Adaptation Knowledge Exchange

Agency: EcoAdapt

Summary: The Climate Adaptation Knowledge Exchange (CAKE) provides a shared knowledge base and community of practice related to climate change adaptation. The CAKE website offers a number of resources, including a wide variety of case studies, a virtual library, planning tools, and a directory of people and organizations involved in climate change adaptation work.

Link: <http://www.cakex.org/directory>



Title: Adaptation 101
Agency: Natural Resources Canada
Summary: The Natural Resources Canada Climate Change Impacts and Adaptation Directorate provides an Adaptation 101 website with information about climate change impacts, adaptation, adaptive capacity, resources, adaptation initiatives in Canada, and more.
Link: <http://www.nrcan.gc.ca/environment/impacts-adaptation/adaptation-101/10019>

Title: Retooling for Climate Change
Agency: Fraser Basin Council
Summary: A website entitled Retooling for Climate Change provides a number of useful tools, resources, and case studies of climate change adaptation. Specific sections with resources are included for infrastructure, hazards management, water, management, and more.
Link: http://www.retooling.ca/retooling_essentials.html

Title: State of Play Report
Agency: ICF Marbek & Adaptation Platform Mining Working Group
Summary: The Adaptation Platform Mining Working Group has published a State of Play Report, which is intended to help develop a common understanding of the imperative for climate change adaptation for the mining sector, as well as provide a snapshot of the work that is already underway in the mining sector on adaptation.
Link: http://www.retooling.ca/_Library/docs/mining_state_of_play_2012.pdf

Title: Australian Greenhouse Office
Agency: Climate Change Impacts and Risk Management: A Guide for Business and Governments
Summary: The Australian Greenhouse Office has produced a resource entitled Climate Change Impacts and Risk Management: A Guide for Business and Governments. While focused on Australia and New Zealand, the guide is also applicable to other jurisdictions. It is directed to elected officials, general managers, and specialist risk managers.
Link: http://www.climatechange.gov.au/sites/climatechange/files/documents/03_2013/risk-management.pdf

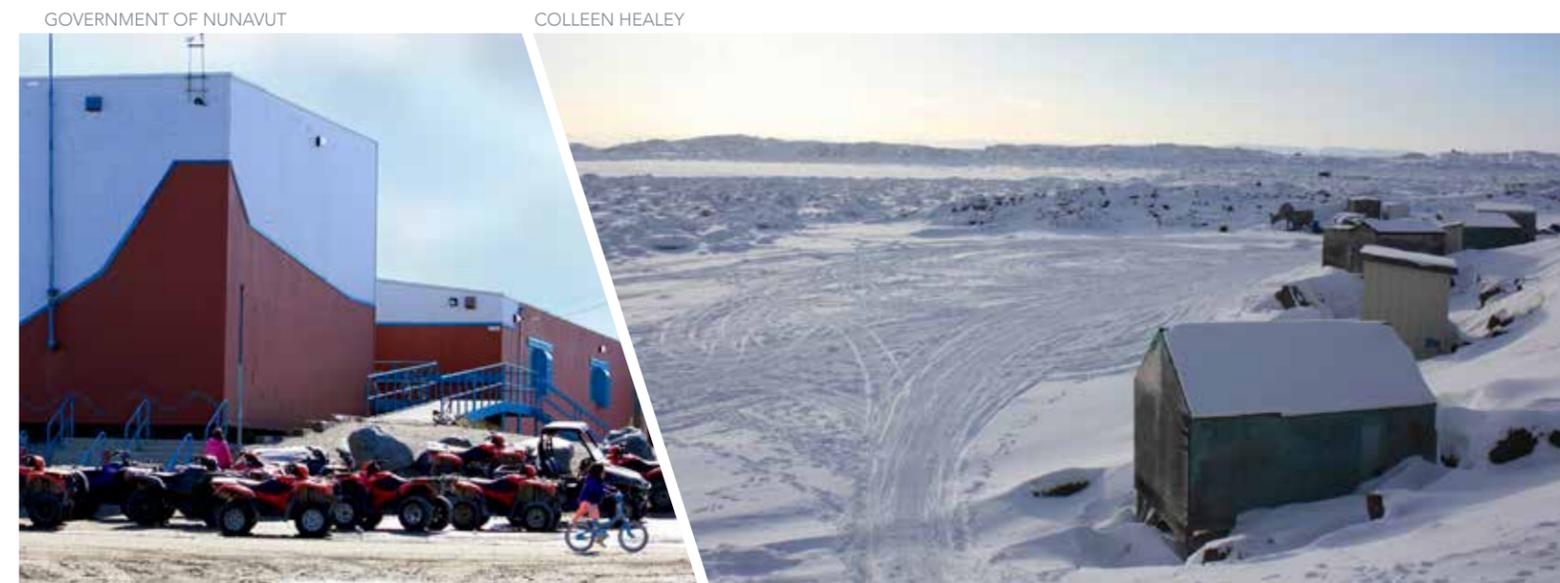
Title: Climate Change Adaptation and Canadian Infrastructure
Agency: International Institute for Sustainable Development
Summary: The International Institute for Sustainable Development released a literature review entitled Climate Change Adaptation and Canadian Infrastructure. This report covers both climate impacts by type of infrastructure (including transportation, building, water, wastewater, and marine infrastructures) as well as tools, approaches, and mechanisms to support climate resiliency (including government policy responses, codes, standards, and related instruments).
Link: http://www.iisd.org/pdf/2013/adaptation_can_infrastructure.pdf

Title: True North: Adapting Infrastructure to Climate Change in Northern Canada
Agency: National Round Table on the Economy and the Environment
Summary: A report was produced by the National Round Table on the Economy and the Environment entitled True North: Adapting Infrastructure to Climate Change in Northern Canada. This report highlights risks to northern infrastructure posed by climate change and the opportunities in adaptation. Included are specific chapters covering northern infrastructure vulnerability, the role of governments in climate change adaptation, risk-based mechanisms for adaptation, and conclusions and recommendations.
Link: http://publications.gc.ca/collections/collection_2009/trnee-nrtee/En134-44-2009E.pdf

Title: National Survey of Canada's Infrastructure Engineers about Climate Change
Agency: Canadian Standards Association & Engineers Canada
Summary: A survey report was published by the Canadian Standards Association for Engineers Canada entitled National Survey of Canada's Infrastructure Engineers about Climate Change. Key findings of this survey included that the majority of engineers believed that climate change affects their practice, that three quarters of infrastructure engineers feel they need more information to address climate change in their practice, and that the main barriers preventing engineers from addressing climate change in their practice are lack of information and resources, their beliefs that climate change has no impact on their practice, and a lack of requirements in codes, standards, and policy.
Link: <https://www.apeg.bc.ca/getmedia/4e003686-63dd-41c2-a5d6-27df561b76e4/Engineers-Canada-National-Survey-of-Canada-Infrastructure-Engineers-about-Climate-Change.pdf.aspx>

Title: Climate Change and Airports: Adaptation Planning
Agency: C2HM Hill
Summary: An overview of Climate Change and Airports: Adaptation Planning was produced by C2HM Hill. It describes a variety of risks, impacts, and adaptation options for airports in Canada.
Link: <http://www.aci-na.org/sites/default/files/vanderbilt.p-climatechangeadaptation-sunday.pdf>

Title: Developer's Risk Management Guide to Climate Change
Agency: Halifax Regional Municipality
Summary: The Halifax Regional Municipality developed a Developer's Risk Management Guide to Climate Change, which was created for developers of Halifax's coastal-low-lying fringe, and serves as a model for developers in other regions. It includes an overview of climate change, a step-by-step approach to risk assessment, and provides a checklist that can be used in planning and evaluating development proposals.
Link: <https://www.halifax.ca/climate/documents/DevelopersGuidetoRiskManagment.pdf>



3.2 Case Studies & Best Practices

3.2.1 Nunavut-specific Case Studies & Best Practices

This section includes a list of case studies and best practices specific to Nunavut or produced in Nunavut that provide information on climate change and Nunavut's economy and competitiveness.

- Title:** Alternative Diamond Drilling in Permafrost
Agency: NWT & Nunavut Chamber of Mines
Summary: The 2013 Nunavut Mining Symposium featured a presentation on Alternative Diamond Drilling in Permafrost, making explicit reference to the implication of climate change in these sectors.
Link: <http://2013.nunavutminingsymposium.ca/wp-content/uploads/2013/04/8-Buchan-NNCM.pdf>
- Title:** Climate Change and Mining in Nunavut
Agency: Government of Nunavut & IMG-Golder Corporation
Summary: A project entitled Climate Change and Mining in Nunavut was carried out to assess the vulnerability of Nunavut's mining-related infrastructure, including mine waste management facilities, docks, ports, roads, airstrips, and railways, to climate change. Best management practices were recommended in order to inform future mining development in Nunavut.
Link: http://northernadaptation.ca/sites/default/files/vulnerability_assessment_in_eng_0.pdf
http://www.climatechangenunavut.ca/sites/default/files/task1_final.pdf
http://www.climatechangenunavut.ca/sites/default/files/task2_final.pdf
- Title:** Nunavut Mining Symposium
Agency: Nunavut Mining Symposium
Summary: The Nunavut Mining Symposium, held annually, has featured a number of presentations about climate change and the mining sector, including on adaptation best practices in mining and another on the impact of permafrost degradation on mining-related infrastructure. Outlines of these presentations are available on the Nunavut Mining Symposium website.
Link: <http://www.nunavutminingsymposium.ca/>
- Title:** Stakeholder Perspectives on Climate Change and Adaptation in Expedition Cruise Tourism in Nunavut
Agency: Lakehead University
Summary: A report was published by Lakehead University researchers entitled Stakeholder Perspectives on Climate Change and Adaptation in Expedition Cruise Tourism in Nunavut. This report outlines a number of cruise challenges and opportunities related to climate change, as well as strategies for investment, development of legislation and regulation, and coordination.
Link: <http://www.aeco.no/wp-content/uploads/2013/06/Climate-change-and-adaptation-in-expedition-cruise-tourism-in-Nunavut-pdf.pdf>
- Title:** Case study of community-scale hazard mapping in Clyde River
Agency: Natural Resources Canada
Summary: A case study of community-scale hazard mapping in Clyde River, Nunavut, is available from Natural Resources Canada. This link describes the process of creating hazard maps for the community and its rationale.
Link: <http://geoscan.nrcan.gc.ca/starweb/geoscan/servlet.starweb?path=geoscan/fulle.web&search1=R=224608>

- Title:** Nunavut Economic Forum
Agency: Nunavut Economic Forum
Summary: The Nunavut Economic Forum was developed to identify and share information on economic development activity in Nunavut. It brings together member groups to collaborate on implementing the Nunavut Economic Development Strategy. The website has a resource library as well as news and information on economic development in Nunavut.
Link: <http://www.nunavuteconomicforum.ca/public/index.php>

- Title:** Meeting Nunavut's Energy Needs: Structures and Strategies for Energy and Self-Reliance
Agency: Nunavut Economic Forum
Summary: This report on Nunavut's energy needs and future is to help with understanding Nunavut's energy situation, how to control its costs and develop its resources, and to create tools to manage energy in order to build a comprehensive energy strategy for Nunavut.
Link: http://www.nunavuteconomicforum.ca/public/files/library/ENERGY/lkuma_II.pdf

- Title:** Reducing Vulnerability to Climate Change in the Arctic: The Case of Nunavut, Canada
Agency: Ford, J., Pearce, T., Smit, B., Wandel, J., Allurut, M., Shappa, K., Ittusujurat, H., and Qrunnut, K.
Summary: This report focuses on research conducted with two Nunavut communities, Arctic Bay and Igloolik. The report identifies key areas where policy can help Inuit reduce their vulnerability to climate change, focusing on the renewable resource harvesting sector.
Link: <http://pubs.aina.ucalgary.ca/arctic/Arctic60-2-150.pdf>

- Agency:** Pan-Territorial Adaptation Partnership
Summary: The Pan-Territorial Adaptation Partnership held a Pan-Territorial Permafrost Workshop in November 2013. This workshop brought together front-line decision makers and permafrost researchers from Nunavut, NWT, and Yukon to share knowledge, form connections and look at possibilities for adaptation in the future. Presentations and materials from the workshop are available online.
Link: <http://www.northernadaptation.ca/node/59>

- Title:** Elder's Conference on Climate Change
Agency: Nunavut Tunngavik Inc.
Summary: An Elder's Conference on Climate Change was held in March 2001 with the objective of gathering Inuit Qaujimagatuqangit and experiences of Elders concerning climate change and its effects in Nunavut.
Link: <http://www.polarnet.ca/ntilands/pdfdoc/elders.pdf>



3.2.2 Northern Case Studies & Best Practices

This section includes a list of case studies and best practices specific to the Circumpolar North or produced in the Circumpolar North that provide information on climate change and Nunavut's economy and competitiveness.

- Title:** Case Studies of Adaptation to Climate Change in the Canadian Mining Sector
Agency: ArcticNorth Consulting
Summary: ArcticNorth worked with six mine site case studies in Yukon and Saskatchewan to characterize adaptation actions taken to address climate change and variability. This included documenting the drivers of action, the risks or opportunities addressed, lessons learned, and measurements that are used to track success of the adaptation actions.
Link: <http://www.arctic-north.com/climate-change-impacts-and-adaptation-in-the-canadian-mining-sector/>
- Title:** Climate Change Adaptation: Best Practices for Natural Resource Development in Canada's North
Agency: Navius Research
Summary: This study evaluates climate risk management and adaptation activities in energy and mining developments across the circumpolar north to develop recommendations for best practices in Canada's North.
Link: http://www.nwtclimatechange.ca/sites/default/files/Climate_Change_Adaptation_Best_Practices_Report.pdf
- Title:** Paths to a Renewable North: A Pan-Territorial Renewable Energy Inventory
Agency: A Northern Vision
Summary: This xx is an inventory of current and future renewable energy resources in the three northern territories. It describes the current state of renewable energy use, outlines actions being taken and describes policies under development to increase renewable energy. It highlights the opportunities and challenges faced by each territory in the development of renewable energy.
Link: <http://www.anorthernvision.ca/documents/RenewableEnergyInventoryEN.pdf>
- Title:** Northern Infrastructure Standardization Initiative
Agency: Standards Council of Canada
Summary: The Northern Infrastructure Standardization Initiative (NISI) works to ensure codes, standards, and other related instruments are effective in addressing the climate risks inherent in Northern infrastructure design, planning, and management. Four new standards are being developed by 2017 for northern infrastructure:
- design, maintenance, and installation of thermosyphon foundations;
 - changing snow loads on roofs;
 - managing the effects of permafrost degradation under existing buildings and;
 - climate change informed community drainage plans.
- Link:** www.scc.ca/en/nisi
The *Buildings in Permafrost Supported on Thermosyphon Foundations* standard is available in draft at <http://shop.csa.ca/en/canada/infrastructure-and-public-works/canrsa-s500-14/invt/27036862014>.

- Title:** Land Use Planning Tools for Local Adaptation to Climate Change
Agency: Natural Resources Canada
Summary: Natural Resources Canada has produced a report entitled Land Use Planning Tools for Local Adaptation to Climate Change. This website outlines a number of land-use planning tools and decision-support tools for use in the Canadian context, including scenario planning, vulnerability assessment, design guidelines, and more.
Link: <http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/files/landuse-e.pdf>
- Title:** Implications for Economic Development and Adaptation within Key Sectors
Agency: Natural Resources Canada
Summary: Natural Resources Canada's report Implications for Economic Development and Adaptation within Key Sectors focuses on the north and nine sectors: hydroelectric development, mining, oil and gas, infrastructure, transportation, forestry, fisheries, wildlife, biodiversity and protected areas, and tourism. It includes an overview of the current situation, challenges and opportunities, and specific case studies.
Link: <http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2008/10273>

3.2.3 External Case Studies & Best Practices

This section includes a list of relevant case studies and best practices from other areas of Canada or other non-circumpolar countries that provide information on climate change and Nunavut's economy and competitiveness.

- Title:** Climate Change and Canadian Mining: Opportunities for Adaptation
Agency: David Suzuki Foundation
Summary: The David Suzuki Foundation has published a report entitled Climate Change and Canadian Mining: Opportunities for Adaptation. This report describes the vulnerability of the Canadian mining sector to climate change, highlights opportunities for adaptation, and provides recommendations for industry and government.
Link: <http://www.davidsuzuki.org/publications/reports/2009/climate-change-and-canadian-mining-opportunities-for-adaptation/>
- Title:** Partnership Agreements Case Studies
Agency: Natural Resources Canada
Summary: Natural Resources Canada has published several case studies focused on the mining industry in Canada and how they engage with local partners and local Aboriginal peoples. These case studies include mines in Northwest Territories, Ontario, British Columbia, Quebec and Newfoundland and Labrador.
Link: <http://www.nrcan.gc.ca/mining-materials/publications/8826>
- Title:** Adaptation: Linking Research and Practice
Agency: Natural Resources Canada
Summary: This chapter of the Natural Resources Canada report Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, examines the current status of adaptation in Canada with respect to both research and practice, based on scientific and grey literature. It includes a discussion of how we have progressed and overcome barriers, as well as changes in research, engagement, and action. It also includes case studies focused on a range of issues.
Link: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter9-Adaptation_Eng.pdf

4 COURSES & TRAINING

4.1 Economy and Competitiveness Courses & Training

Title: Natural Resources
Agency: Natural Resources Canada
Summary: This chapter of the Natural Resources Canada report Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, focuses on the three natural resource sectors: forestry, mining and energy. It provides an overview of progress made in understanding the impacts of climate change on those sectors, including advancements and research findings on impacts, adaptations, and economic competitiveness.
Link: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter3-Natural-Resources_Eng.pdf

Title: Food Production
Agency: Natural Resources Canada
Summary: This chapter of the Natural Resources Canada report Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, focuses on the implications of climate change for food production from agriculture, fisheries and other non-commercial sources.
Link: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter4-Food-Production_Eng.pdf

Title: Industry
Agency: Natural Resources Canada
Summary: This chapter of the Natural Resources Canada report Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, assesses the impact of climate change on Canadian industry, and prospects for adaptation to reduce the risks and realize potential for gain. It focuses on property insurance, tourism, residential construction, manufacturing and trade.
Link: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter5-Industry_Eng.pdf

Title: Water and Transportation Infrastructure
Agency: Natural Resources Canada
Summary: This chapter of the Natural Resources Canada report Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, focuses on climate change impacts and adaptation in relation to physical infrastructure related to water (water supply, storm and waste water) and transportation systems. It uses case studies to discuss key sensitivities, impacts and adaptive responses.
Link: http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/earthsciences/pdf/assess/2014/pdf/Chapter8-Infrastructure_Eng.pdf

Title: Greening the Economy: Lessons from Scandinavia
Agency: Coursera
Summary: This course explores greening the economy on four levels: individual, business, city, and nation. It looks at the relationships between these four levels and gives practical examples of challenges and solutions. Throughout the course, Scandinavian examples are used to demonstrate successful and unsuccessful initiatives.
Link: <https://www.coursera.org/course/greeningtheeconomy>

Title: Adapting your Infrastructure to Climate Change
Agency: Canadian Standards Association
Summary: The Canadian Standards Association Learning Institute offers an online course entitled Adapting your Infrastructure to Climate Change. This course is intended for those responsible for or involved in impact assessment, risk evaluation and response planning in support of climate change adaptation of infrastructure, including municipal staff, elected officials and professional service providers.
Link: <http://shop.csa.ca/en/canada/infrastructure-solutions/adapting-your-infrastructure-to-climate-change/invnt/2703207wt>

4.2 Climate Change and Adaptation Courses & Training

Title: Climate Insights 101
Agency: Pacific Institute for Climate Solutions (PICS)
Summary: The Pacific Institute for Climate Solutions (PICS) offers a Climate Insights 101 online short course, intended to provide users with an in-depth understanding of climate science and related issues. Two modules on the science of climate change and mitigation have been produced, and two modules on adaptation and regional climate change impacts are upcoming.
Link: <http://pics.uvic.ca/education/climate-insights-101>

Title: Introductory e-Course on Climate Change
Agency: United Nations Climate Change Learning Partnership
Summary: The United Nations Climate Change Learning Partnership offers an online Introductory e-Course on Climate Change with six modules, including one focused specifically on climate change adaptation. Those who complete the quizzes accompanying each module receive a certificate.
Link: <http://unccelearn.org/>

Title: Various: Climate Change and Climate Literacy
Agency: Coursera
Summary: The online e-Learning platform Coursera presently offers four courses in climate change and climate literacy. These courses are entitled Global Warming: The Science of Climate Change, Climate Literacy: Navigating Climate Conversations, Climate Change, and Climate Change in Four Dimensions, and are offered by the University of Chicago, University of British Columbia, the University of Melbourne, and University of California San Diego, respectively.
Link: <https://www.coursera.org/course/globalwarming>
<https://www.coursera.org/course/climateliteracy>
<https://www.coursera.org/course/climatechange>
<https://www.coursera.org/course/4dimensions>



5 CONTACTS

5.1 Nunavut Contacts

Title: University of Chicago
Agency: Global Warming: Understanding the Forecast
Summary: The University of Chicago offers free online access to course materials to their Global Warming: Understanding the Forecast course. Though all lectures in the course are relevant to climate change science, the lectures of Chapter 12 cover emergency and disaster-related impacts of climate change.
Link: <http://forecast.uchicago.edu/lectures.html>

Title: Climate Change
Agency: Open2Study
Summary: Open2Study offers a free open study course in climate change offered through Macquarie University, which provides information about climate change impacts on food security, the economy, society, and more.
Link: <https://www.open2study.com/courses/climate-change>

Title: Leading Change and Action on Climate Change
Agency: Oxford University
Summary: Oxford University offers an online course entitled Leading Change and Action on Climate Change. This course examines climate change issues, current approaches to leadership at the local, national and global level and supports students in developing their own approach to leading change and innovation on climate change in a personal, local or professional context.
Link: <https://www.conted.ox.ac.uk/courses/details.php?id=L100-11&search=climate%20change&submitbutton=Search&multisearch=single>

Title: Certificate in Decision Making for Climate Change
Agency: Northwestern University
Summary: Northwestern University offers a Certificate in Decision Making for Climate Change in a 100% online format. This course teaches student to understand the impact of climate change and to make educated decisions about adapting to and minimizing its effects. It is intended for municipal, regional, and federal officials, environmental planners and managers, corporate and utility managers, and consultants. The course is offered in partnership with the University of Washington, University of California – Irvine, and the University of British Columbia.
Link: <http://sps.northwestern.edu/program-areas/professional-development/climate-change/>

Title: Assessing the Hydrologic Impacts of Climate Change
Agency: Toronto and Region Conservation
Summary: The website Water and Climate Change Adaptation by Toronto and Region Conservation provides an e-Learning course entitled Assessing the Hydrologic Impacts of Climate Change.
Link: <http://waterandclimate.ca/WP/index.php/technical-training/web-based-elearning-course/>

Agency: Government of Nunavut, Climate Change Section
Summary: The Climate Change Section of the Government of Nunavut Department of Environment coordinates the online Nunavut Climate Change Centre, and provides information about climate change adaptation programs and initiatives occurring in Nunavut. The Nunavut Climate Change Centre is a web-based climate change resource centre intended to provide current climate change information relevant to Nunavummiut. It shares and distributes climate change knowledge in Nunavut and makes information more accessible to the public.

Address: PO Box 1000 Stn 1360
Iqaluit, NU X0A 0H0
Phone: 867-975-7700
Email: climatechange@gov.nu.ca
Website: www.climatechangenunavut.ca/
www.env.gov.nu.ca/node/93

Agency: Canada-Nunavut Geoscience Office (CNGO)
Summary: The Canada-Nunavut Geoscience Office (CNGO) is mandated to supply geoscience information and expertise in Nunavut in support of responsible exploration and development of mineral and energy resources, to build and maintain geoscience capacity and expertise in Nunavut, and to provide geoscience training opportunities, public outreach, and communicate awareness of earth science to Nunavummiut.

Address: PO Box 2319, 1106 Ikaluktuutiak Drive
Iqaluit, NU X0A 0H0
Phone: 867-975-4529
Email: serge.basso@nrcan-rncan.gc.ca
Website: <http://cngo.ca/>

Agency: City of Iqaluit Department of Community Economic Development
Summary: The City of Iqaluit Department of Community Economic Development is responsible for assisting the community by spearheading various community and economic development projects. The department also takes part in business development, proposal development, community-based planning, monitoring and evaluation, and organizational development.

Address: PO Box 460
Iqaluit, NU X0A 0H0
Phone: 867-979-6363 ext. 230
Email: info@city.iqaluit.nu.ca
Website: <http://www.city.iqaluit.nu.ca/i18n/english/economicdev.html>

Agency: Government of Nunavut, Department of Economic Development and Transportation
Summary: The Government of Nunavut Department of Economic Development and Transportation (ED&T) is responsible for supporting the participation of Nunavummiut in the development and growth of the territory, to strengthen the economy, and to ensure the safe and effective transportation system. Among other divisions, this department includes the Transportation Policy and Planning Division and the Airport Divisions.

Address: PO Box 1000 Stn 1500
Iqaluit, NU X0A 0H0
Phone: 867-975-7800 or 1-888-975-5999
Email: edt@gov.nu.ca
Website: <http://www.gov.nu.ca/edt/>

Agency: Nunavut Economic Forum
Summary: The Nunavut Economic Forum is a broad group of member organizations which was developed to identify and share information on economic development activity in Nunavut.
Phone: 867-975-4967
Email: neforum@qiniq.com
Website: <http://www.nunavuteconomicforum.ca/public/index.php>

Agency: Nunavut Housing Corporation
Summary: The Nunavut Housing Corporation (NHC) delivers a number of services to Nunavummiut, including education, support and training to local housing organizations, homeowner services, property management services, and the coordination of housing lobbying efforts.
Address: PO Box 1000 Stn 1400
Iqaluit, NU X0A 0H0
Website: <http://www.nunavuthousing.ca/apps/authoring/dspPage.aspx?page=about>

Agency: Nunavut Research Institute (NRI)
Summary: The Nunavut Research Institute, a part of Nunavut Arctic College, acts as a gateway to research and technology development initiatives in Nunavut. NRI develops and promotes traditional knowledge, science, and technology as key local resources. It also shares information on research projects, provides advice on research funding programs, and assists in the development of proposals to research funding agencies.
Address: PO Box 1720 Building 959
Iqaluit, NU X0A 0H0
Phone: 867-979-7280
Website: www.nri.nu.ca

Agency: NWT & Nunavut Chamber of Mines
Summary: The NWT & Nunavut Chamber of Mines acts as the voice of the northern mining and exploration industry. Its mission is to advocate for responsible and sustainable mineral exploration in Nunavut and NWT.
Address: PO Box 2818 Suite 103, 5102 50 Ave.
Yellowknife, NT X1A 2R1
Phone: 867-873-5281
Website: <http://www.miningnorth.com/>

5.2 Government Agencies

Agency: Aboriginal Affairs and Northern Development Canada (AANDC)
Summary: Aboriginal Affairs and Northern Development Canada (AANDC) support Aboriginal and northern communities to address risks and challenges associated with climate change and to become more resilient through its Climate Change Adaptation Program (CCAP). In its first three years, this program funded more than 90 projects in 80 communities.
Address: Climate Change Adaptation Program
25 Eddy Street, 10th floor
Gatineau, QC K1A 0H4
Phone: 819-953-2590
Email: adaptation@aandc-aadnc.gc.ca
Website: www.aadnc-aandc.gc.ca/eng/1329158189051/1329158264671

Agency: Canadian Northern Economic Development Agency (CanNor)
Summary: The Canadian Northern Economic Development Agency (CanNor) fosters growth and development in the north by delivering economic development programs and by collaborating with and aligning the effort of partners in northern and southern Canada to respond to economic challenges and opportunities in the North.
Address: PO Box 40, 2nd Floor, 1106 Allavik Building
Iqaluit, NU X0A 0H0
Phone: 867-975-3746
Email: ecdevnunavut@cannor.gc.ca
Website: <http://www.cannor.gc.ca/>

Agency: Government of the Northwest Territories, Climate Change Unit
Summary: The Climate Change Unit of the Government of the Northwest Territories Department of the Environment and Natural Resources provides information and coordinates action on climate change. They provide the Northwest Territories Climate Change Network, a web-based tool that provides a resource for members to share information, make contacts, and promote action on climate change in the Northwest Territories.
Address: PO Box 1320
Yellowknife, NT X1A 2L9
Phone: 867-873-7654
Email: climatechange@gov.nt.ca
Website: www.nwtclimatechange.ca/nwt-climate-change-network

Agency: Government of Yukon, Climate Change Secretariat
Summary: The Climate Change Secretariat is a branch of Environment Yukon, Government of Yukon. They coordinate the Yukon's government-wide response to climate change, form partnerships, coordinate activities and develop climate change policies and strategies.
Address: PO Box 2703 (V-205)
Whitehorse, YT Y1A 2C6
Phone: 867-456-5543 or 1-800-661-0408 ext. 5544
Email: climatechange@gov.yk.ca
Website: <http://www.env.gov.yk.ca/air-water-waste/climatechange.php>



Agency: Natural Resources Canada
Summary: Natural Resources Canada (NRCan) is the federal department responsible for natural resources, energy, minerals and metals, forests, earth sciences, mapping, and remote sensing. It works to ensure the responsible development of Canada's natural resources and builds and maintains an up-to-date knowledge base of the Canadian land mass and resources. The Impacts and Adaptation program at Natural Resources Canada includes programs such as the Adaptation Platform and the Regional Adaptation Collaboratives (RACs) program. Within the RACs, areas of focus for the individual collaboratives include flood protection (British Columbia), drought and flood planning (Prairies), extreme weather risk management (Ontario), and many more. The role of the collaborative is to develop knowledge, tools and networks to support practitioners and decision-makers in addressing climate change issues now and in the future.
Email: adaptation@nrcan.gc.ca
Website: www.nrcan.gc.ca/environment/impacts-adaptation
www.nrcan.gc.ca/environment/impacts-adaptation/regional-initiatives/collaboratives/10633

Agency: Public Health Agency of Canada
Summary: Health portfolio coordination for emergency preparedness and response in Nunavut is coordinated by the Public Health Agency of Canada and carried out by Health Canada.
Address: 180 Queen Street West, 11th floor
 Toronto, ON M5V 3L7
Phone: 416-973-0003
Website: www.phac-aspc.gc.ca/canada/on-nu/index-eng.php

Agency: Public Safety Canada, Emergency Management
Summary: Public Safety Canada, through the Emergency Management branch, works in collaboration to strengthen national emergency preparedness including planning, training, exercises, risk assessment, and shared lessons learned.
Address: 269 Laurier Avenue West
 Ottawa, ON K1A 0P8
Phone: 613-944-4875 or 1-800-830-3118
Website: www.publicsafety.gc.ca/cnt/mrgnc-mngmnt/index-eng.aspx

5.3 Climate Change Organizations

Agency: Adaptation to Climate Change Team (ACT), Simon Fraser University
Summary: The Adaptation to Climate Change Team (ACT) is the only think tank initiative on the topic of climate change adaptation in Canada. Among other roles, it publishes research reports identifying policy and resource opportunities to bridge theory and action in support of sustainable adaptation.
Address: Simon Fraser University
 #3551, 515 West Hastings Street
 Vancouver, BC V6B 5K3
Phone: 604-671-2449
Email: adapt@sfu.ca
Website: <http://act-adapt.org/about/>

Agency: Arctic Institute of Community-Based Research
Summary: The Arctic Institute of Community-Based Research (AICBR) facilitates and promotes community-based, northern-led health research activities aimed at improving the health of indigenous and non-indigenous Northerners.
Address: 308 Hanson Street
 Whitehorse, YT Y1A 1Y6
Phone: 867-668-3393
Email: info@aicbr.ca
Website: www.aicbr.ca

Agency: Arctic Institute of North America, University of Calgary
Summary: The Arctic Institute of North America works to advance the study of the North American and circumpolar Arctic through the natural and social sciences, the arts and humanities. They also acquire, preserve and disseminate information on physical, environmental and social conditions in the North. Their website is home to the Arctic Science and Technology Information System (ASTIS) database, which contains records describing publications and research projects about northern Canada and the circumpolar Arctic.
Address: 2500 University Drive NW, ES-1040
 Calgary, AB T2N 1N4
Phone: 403-220-7515
Email: arctic@ucalgary.ca
Website: www.arctic.ucalgary.ca

Agency: ArcticNet
Summary: ArcticNet is a Network of Centers of Excellence of Canada that brings together scientists and managers in the natural, human health, and social sciences with their partners from Inuit organizations, northern communities, federal and provincial agencies, and the private sector. The central objective of ArcticNet is to contribute to the development and dissemination of the knowledge needed to formulate adaptation strategies and national policies to help Canadians face the impacts and opportunities of climate change and modernization in the Arctic.
Address: Pavillon Alexandre-Vachon, Room 4081
 1045, avenue de la Médecine, Université Laval
 Québec, QC G1V 0A6
Phone: 418-656-5830
Email: arcticnet@arcticnet.ulaval.ca
Website: <http://www.arcticnet.ulaval.ca/aboutus/rationale.php>



Agency: Canadian High Arctic Research Station
Summary: The Canadian High Arctic Research Station (CHARS) will be a research station in Canada's Arctic with the goal of advancing Canada's knowledge of the Arctic in order to improve economic opportunities, environmental stewardship, and quality of life.
Phone: 819-953-1160
Email: chars-srcea@aandc-aadnc.gc.ca
Website: www.science.gc.ca/default.asp?lang=En&n=74E65368-1

Agency: Canadian Institute of Planners
Summary: The Canadian Institute of Planners is a federation that accredits, represents, and communicates with planners across Canada. They have developed a climate change adaptation website, which includes specific case studies, and also offers a course on climate change adaptation for professional planners.
Address: 141 Laurier Avenue West, Suite 1112
Ottawa, ON K1P 5J3
Phone: 613-237-7526 or 1-800-207-2138
Website: www.cip-icu.ca

Agency: Canadian Polar Commission
Summary: The Canadian Polar Commission is Canada's primary knowledge agency. It is a point of contact with the Canadian and international polar scientific communities. It encourages and facilitates cooperation and collaboration in polar knowledge and works with partners to determine scientific and other priorities.
Address: 2464 Sheffield Road
Ottawa, ON K1B 4E5
Phone: 613-998-8127
Email: mail@polarcom.gc.ca
Website: www.polarcom.gc.ca

Agency: Climate Change Adaptation Research Group, McGill University
Summary: The Climate Change Adaptation Research Group is based in the Department of Geography at McGill University. Most of the research activities carried out by the group focus on climate change vulnerability and adaptation among Indigenous populations and stakeholder engagement in adaptation planning, with several past and present research projects taking place across Nunavut.
Website: <http://www.jamesford.ca/>

Agency: Engineers Canada
Summary: The Public Infrastructure Engineering Vulnerability Committee (PIEVC) of Engineers Canada has the central objective of ensuring that professional engineers and geoscientists, as well as infrastructure owners and managers, always consider climate change as an integral part of planning, designing, construction, operating, maintaining, and rehabilitating civil infrastructure.
Website: www.pievca.ca

Agency: ICLEI Canada – Local Governments for Sustainability
Summary: ICLEI Canada – Local Governments for Sustainability is an international organization of local governments and local government organizations that are committed to sustainable development. They provide a variety of services, including technical consulting, training and information services. They have worked with many Canadian communities to develop adaptation plans.
Address: 401 Richmond Street W., Studio 204
Toronto, ON M5V 3A8
Phone: 647-728-4308
Email: iclei-canada@iclei.org
Website: <http://www.iclei.org>

Agency: International Institute for Sustainable Development (IISD)
Summary: The International Institute for Sustainable Development is an international public policy research institute for sustainable development. The IISD focuses on adaptation, risk reduction, climate change and energy, economics, amongst other diverse topics. They host a number of initiatives, including the Community-based Risk Screening Tool – Adaptation and Livelihoods.
Address: 161 Portage Ave. East, 6th floor
Winnipeg, MN R3B 0Y4
Phone: 204-958-7700
Email: info@iisd.org
Website: www.iisd.org

Agency: Northern Climate ExChange, Yukon Research Centre, Yukon College
Summary: The Northern Climate ExChange (NCE) is a part of the Yukon Research Centre at Yukon College which provides a credible source of information, develops shared understanding, promotes action, and coordinates research on climate change in Yukon and across Northern Canada.
Address: PO Box 2799 500 College Drive
Whitehorse, YT Y1A 5K4
Phone: 867-668-8862
Website: http://www.yukoncollege.yk.ca/research/programs/northern_climate_exchange

GOVERNMENT OF NUNAVUT



GOVERNMENT OF NUNAVUT PARKS



REFERENCES

Agency: Ontario Centre for Climate Impacts and Adaptation Resources, Climate Change Adaptation Community of Practice
Summary: A Climate Change Adaptation Community of Practice, through the Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR), is an interactive online community that provides a space for policymakers, researcher, and practitioners from across the country to share information and communicate with others in the field of climate change adaptation. OCCIAR also has a number of resources available at their website.
Address: 935 Ramsey Lake Road
Sudbury, ON P3E 2C6
Email: amorand@mirarco.org (Climate Change Adaption Community of Practice)
Website: <http://www.climateontario.ca>
<https://www.ccadaptation.ca/en/landing>

Agency: Pacific Institute for Climate Solutions (PICS)
Summary: The Pacific Institute for Climate Solutions (PICS) is a knowledge network hosted and led by the University of Victoria that integrates multi-disciplinary approaches to climate change. Its mandate is to develop innovative climate solutions, seek new opportunities for positive adaptation, and lead the way to a vibrant, low-carbon economy.
Address: PO Box 1700 Stn CSC
Victoria, C V8W 2Y2
Phone: 250-853-3595
Email: pics@uvic.ca
Website: www.pics.uvic.ca

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Government of Nunavut, 2005c. Inuit Qaujimagatuqangit of Climate Change in Nunavut: A sample of Inuit experiences of recent climate and environmental changes in Pangnirtung and Iqaluit, Nunavut. Government of Nunavut, Iqaluit, NU, 33pp., <http://env.gov.nu.ca/sites/default/files/South%20Baffin%20English.pdf>.

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