



**CANADA'S ADAPTATION PLATFORM:**  
*Equipping Canadians for a changing climate*

**PROJECTS AND RESULTS**

OCTOBER 2016

# Contents

- COASTAL MANAGEMENT ..... 2
- ECONOMICS ..... 19
- ENERGY ..... 31
- FORESTRY ..... 46
- INFRASTRUCTURE AND BUILDINGS..... 47
- MEASURING PROGRESS..... 49
- MINING ..... 56
- NORTHERN ..... 67
- REGIONAL ADAPTATION COLLABORATIVES AND TOOLS SYNTHESIS..... 72
- SCIENCE ASSESSMENT..... 79
- ENHANCING UPTAKE AND USE OF RESOURCES..... 80

# COASTAL MANAGEMENT

**Title:** Greening Shorelines, Enhancing Resilience: An Evaluation of the Effectiveness of Green Shores Approaches to Coastal Shoreline Development

**Objective:** The objective of this project is to advance coastline protection policy and practices in British Columbia, and more broadly in Canada, by evaluating soft shore armoring measures. The evaluation will compare soft shore armoring with more conventional hard shore approaches with particular attention to the performance and cost-effectiveness of soft shore measures.

**Project Lead:** Stewardship Centre for British Columbia

**Contact:** D.G. Blair, Executive Director, Stewardship for British Columbia, E-mail: dg@stewardshpcentre.bc.ca

**Partner**

**Organizations:** B.C. Ministry of Environment, Emergency Management B.C., District of West Vancouver, Town of Qualicum Beach, West Vancouver Shoreline Preservation Society, University of Victoria, Sea Grant Program University of Washington

**Region:** British Columbia

**NRCan funding:** \$96,160

**Total funding:** \$192,508

**Status:** Complete

**Results:** *Greening Shorelines to Enhance Resilience: An Evaluation of Approaches for Adaptation to Sea Level Rise*

[http://www.stewardshipcentrebc.ca/PDF\\_docs/greenshores/Resources/Greening\\_Shorelines\\_to\\_Enhance\\_Resilience.pdf](http://www.stewardshipcentrebc.ca/PDF_docs/greenshores/Resources/Greening_Shorelines_to_Enhance_Resilience.pdf)

- This report compares the effectiveness and relative cost of several “soft” and “hard” shore armoring options in British Columbia. It considers sea level rise, flooding, and economical resilience. This information will be useful to coastal zone planners, engineers and decision-makers for assessing adaptation options.

## Coastal Management

**Title:** Impacts of Climate Change and Physical Constraints Resulting from Coastal Squeeze in the Gulf of St. Lawrence, and Evaluation of Adaptation Measures

**Objective:** The objective of this project is to evaluate the combined impact of climate change and human activity on the evolution of coastal ecosystems in the Gulf of St. Lawrence and examine possible adaptation solutions.

**Project lead:** Ouranos

**Contact:** Jean Pierre Savard, Oceanographer Email : savard.jean-pierre@ouranos.ca

### **Partner**

**Organizations:** University of Moncton, University of Quebec at Rimouski, New Brunswick Ministry of Natural Resources, Quebec Ministry of Public Safety, Quebec Ministry of Sustainable Development and Parks ,Quebec Ministry of Transportation, Parks Canada

**Region:** Quebec

**NRCan funding:** \$299,725

**Total funding:** \$644,336

**Status:** Complete

**Results:** *Impacts of Climate Change and Physical Constraints on the Readjustment of Coastal Ecosystems (Coastal Squeeze) in the Gulf of Saint Lawrence and Assessment for the Mitigation of these Impacts. (en français seulement)*

<https://ouranos.ca/wp-content/uploads/2016/05/RapportBernatchez2016.pdf>

- This report assesses the combined impact of climate change and human activity on the evolution of coastal ecosystems (coastal squeeze), in the Gulf of St. Lawrence, over the past 50 years. It also analyzes projected future impacts for the years 2060 and 2100, and provides forward-looking recommendations for adaptation.

**Title:** Assessment of the Risk to PEI's Coastal Residences, Infrastructure and Heritage from a Changing Climate

**Objective:** The purpose of this project is to conduct a quantitative assessment of the risk posed by coastal erosion caused by climate change to Prince Edward Island's coastal residences, safety and security, infrastructure and heritage.

**Project Lead:** University of Prince Edward Island

**Contact:** Adam Fenech, Director, Climate Lab, University of Prince Edward Island, E-mail: afenech@upei.ca

## Coastal Management

### Partner

**Organizations:** PEI Environment, Labour and Justice, PEI Office of Public Safety, Mi'kmaq Confederacy of PEI, GeoNet Technologies Inc.

**Region:** Atlantic Provinces

**NRCan funding:** \$66,800

**Total funding:** \$152,910

**Status:** Complete

**Results:** *Risk Assessment to Prince Edward Island's Coastal Residences, Infrastructure and Heritage from Receding Coastlines in 2040, 2070 and 2100*

- The report presents a quantitative risk assessment of future projections for coastal erosion on Prince Edward Island's coastal residences, infrastructure and heritage. Practitioners and decision-makers can utilize this information to increase resilience along PEI's coasts.

*Prince Edward Island Land Area Changes: 1968 - 2010*

- This report, accompanied by a series of maps, provides information on historic land area and coastline change rates on Prince Edward Island from 1968-2010. This information was used to assess risks to Prince Edward Island's coastal residences, infrastructure and heritage from receding coastlines in 2040, 2070 and 2100.

*Methods for Projecting the 2010 Prince Edward Island Coastline into Future Coastlines for 2040, 2070 and 2100*

- This report documents the method developed for quantitatively assessing Prince Edward Island's coastline considering future sea level rise projections. This methodology and lessons learned could inform similar assessments in other regions.

**Title:** Risk Assessment Framework for Coastal Bedrock Aquifers

**Objective:** The purpose of this project is to develop a risk assessment methodology for source-water protection in coastal bedrock aquifers that will inform climate change adaptation decision-making. The outputs are expected to be used for land use planning, directing monitoring efforts, and building community preparedness.

**Project Lead:** Simon Fraser University

**Contact:** Dr. Diana M. Allen, P.Geo., Professor, Department of Earth Sciences, Simon Fraser University Email: [dallen@sfu.ca](mailto:dallen@sfu.ca)

**Region:** British Columbia

## Coastal Management

**NRCan funding:** \$116,610

**Total funding:** \$233,845

**Status:** Complete

**Results:** *Hydrogeological Characterization*

[https://www.sfu.ca/personal/dallen/Chemical%20Indicators%20of%20SWI\\_Final.pdf](https://www.sfu.ca/personal/dallen/Chemical%20Indicators%20of%20SWI_Final.pdf)

[https://www.sfu.ca/personal/dallen/SFU%20Final%20Report%20Research%20Monitoring%20Well%20on%20Salt%20Spring%20Island\\_2015.pdf](https://www.sfu.ca/personal/dallen/SFU%20Final%20Report%20Research%20Monitoring%20Well%20on%20Salt%20Spring%20Island_2015.pdf).

<https://www.sfu.ca/personal/dallen/SFU%20Final%20Report%20the%20Hydrogeology%20of%20Salt%20Spring%20Island.pdf>

- This report documents the hydrogeological characterization of the Gulf Islands' aquifers and builds on previous research. Hydrogeological characterization includes an assessment of: the Geological Framework, the Aquifer Hydraulic Properties, the Groundwater Chemistry and Numerical Modeling.

**Title:** City of Vancouver Coastal Flood Risk Assessment

**Objective:** The results of the project contribute to the implementation of Vancouver's Climate Change Adaptation Strategy and support immediate work on upcoming developments, transportation projects and flood-proofing policies, and will inform long term capital and infrastructure planning.

**Project Lead:** City of Vancouver

**Contact:** Tamsin Mills, Climate Change Adaptation Planner, Sustainability Group, City of Vancouver, E-mail: [Tamsin.mills@vancouver.ca](mailto:Tamsin.mills@vancouver.ca)

**Partner**

**Organizations:** Simon Fraser University; University of British Columbia; City of Vancouver

**Region:** British Columbia

**NRCan funding:** \$145,000

**Total funding:** \$592,500

**Status:** Complete

**Results:** *City of Vancouver Coastal Flood Risk Assessment Report*

[http://vancouver.ca/files/cov/CFRA-Phase-1-Final\\_Report.pdf](http://vancouver.ca/files/cov/CFRA-Phase-1-Final_Report.pdf)

- This report assesses the potential for present and future flooding along four shoreline zones, in view of projected sea level rise . It simulates the base case (2013)

## Coastal Management

and then conditions in 2100 and 2200. Strategic recommendations focus on incorporating adaptation as a consideration or key driver into existing and planned projects.

**Title:** Development of Best Management Practices to Address Extreme High Rainfall Events that Affect Coastal Regions of Canada

**Objective:** This project will fill gaps in existing knowledge of coastal impacts of extreme precipitation events such as atmospheric rivers (high precipitation events that occur over short durations) on transportation infrastructure in British Columbia. The project will also synthesize findings from British Columbia highway case studies and other assessments to develop a cohesive approach to addressing these issues for the entire British Columbia highway system.

**Project Lead:** B.C. Transport/Infrastructure

**Contact:** Dirk Nyland, P.Eng., British Columbia Ministry of Transportation and Infrastructure, E-mail: Dirk.Nyland@gov.bc.ca

**Partner**

**Organizations:** Nodelcorp Consulting Inc., Pacific Climate Impacts Consortium, B.C. Ministry of Environment, Engineers Canada

**Region:** British Columbia

**NRCan funding:** \$96,800

**Total funding:** \$209,269

**Status:** Complete

**Results:** *Considerations for Addressing Climate Change for Water Handling Infrastructure In Highway Management, Design, Operation and Maintenance in British Columbia - Best Practices Document*

[http://www.th.gov.bc.ca/climate\\_action/documents/MoTI-Climate%20Adaptation\\_Best%20Practices.pdf](http://www.th.gov.bc.ca/climate_action/documents/MoTI-Climate%20Adaptation_Best%20Practices.pdf)

- This “Best Practices” document provides guidance to the B.C. Ministry of Transportation and Infrastructure on integrating climate change considerations into highway water handling infrastructure management including planning, engineering, and operations activities. The general approaches that are outlined for adapting practices will be useful to practitioners in other regions of Canada.

## Coastal Management

*Developing Effective Dialogue between Practitioners Of Climate Change Vulnerability--- Risk Assessments: A Primer for Understanding Concepts, Principles and Language Use Across Disciplines*

[http://www.th.gov.bc.ca/climate\\_action/documents/Climate\\_Data\\_Discussion\\_Primer.pdf](http://www.th.gov.bc.ca/climate_action/documents/Climate_Data_Discussion_Primer.pdf)

- This Primer outlines concepts, principles and language used across climate science and engineering disciplines to facilitate effective communication in climate change engineering vulnerability assessments. This report may be of interest to practitioners across Canada.

*Analysis of Climate Change Projections for the Ministry of Transportation and Infrastructure Highways Risk Assessment*

- This report provides climate change projection information for specific infrastructure risk assessments in B.C..

*Engineering Analysis Report for the Climate Change Engineering Vulnerability Assessment*

- This report describes detailed engineering analysis of several water infrastructure examples using climate change projections for extreme precipitation and the PIEVC Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate protocol.

*Review and Analysis of Climate Change Vulnerability Assessments of Canadian Water Management and Drainage Infrastructure*

[http://www.th.gov.bc.ca/climate\\_action/documents/hwy\\_Risk\\_Assessments\\_from\\_Climate\\_Changes\\_Review.pdf](http://www.th.gov.bc.ca/climate_action/documents/hwy_Risk_Assessments_from_Climate_Changes_Review.pdf)

- This report details the findings of a review of climate change vulnerability assessments from across Canada and identifies common risks to water management and drainage infrastructure standards. These assessments used the PIEVC Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate. This information will be of interest to infrastructure owners and engineering professionals.

*Climate Change Engineering Vulnerability Assessment of Three British Columbia Highway Segments: Highway 20 in the Bella Coola Region; Highway 37A in the Stewart Region; Highway 97 in the Pine Pass Region*

[http://www.th.gov.bc.ca/climate\\_action/documents/hwy20\\_bella\\_coola-hwy37A\\_Stewart-hwy97\\_Pine%20Pass.pdf](http://www.th.gov.bc.ca/climate_action/documents/hwy20_bella_coola-hwy37A_Stewart-hwy97_Pine%20Pass.pdf)

- This report details the findings of climate change risk assessments of three highway segments in B.C. that used the PIEVC Engineering Protocol for Infrastructure

## Coastal Management

Vulnerability Assessment and Adaptation to a Changing Climate. This information will be of interest to practitioners and decision-makers conducting similar assessments.

**Title:** Atmospheric Rivers: A Multi-agency Risk Assessment for British Columbia

**Objective:** This project will conduct a high-level risk assessment of atmospheric rivers (meteorological systems associated with intense rainfall events that can lead to flooding and landslides) in British Columbia. The project will also assess options for detection/warning systems in British Columbia, engage flood management professionals, and communicate the results to professional planning and flood management communities.

**Project Lead:** B.C. Ministry of Environment

### **Partner**

**Organizations:** B.C. Ministry of Environment, Pacific Institute for Climate Solutions, B.C. Ministry of Justice, B.C. Ministry of Community, Sport and Cultural Development, B.C. Ministry of Forests, Lands and Natural Resource Operations, B.C. Ministry of Transportation and Infrastructure

**Region:** British Columbia

**NRCan funding:** \$57,000

**Total funding:** \$173,500

**Status:** Complete

**Results:** *Atmospheric Rivers State of Knowledge Report*

<http://www.pacificclimate.org/news-and-events/news/2013/atmospheric-rivers-state-knowledge-report-released>

- This paper summarizes the state of knowledge on risks from and responses to atmospheric rivers (meteorological systems associated with intense rainfall events that can lead to flooding and landslides) in British Columbia. This will be useful to B.C. emergency, flood management, planning, and engineering communities.

*The Future of Atmospheric Rivers & Actions to Reduce Impacts on British Columbians: A Multi-Agency Qualitative Risk Exploration*

[http://www.pacificclimate.org/sites/default/files/publications/Atmospheric\\_Rivers-Final.pdf](http://www.pacificclimate.org/sites/default/files/publications/Atmospheric_Rivers-Final.pdf)

- This report presents a summary of a multi-disciplinary workshop which explored high impact risks from future projections of extreme events. This will be useful to B.C. emergency, flood management, planning, and engineering communities.

## Coastal Management

**Title:** Coastal Sea-Level Rise Risk Assessment

**Objective:** This project will conduct a coastal risk assessment of sea-level rise for the Capital Regional District of British Columbia in order to understand coastal vulnerabilities due to sea-level rise, and explore potential economic risks to government agencies on southern Vancouver Island.

**Project Lead:** Capital Regional District, Victoria

**Contact:** Sarah Webb, Climate Action Program Manager, E-mail: [scwebb@crd.bc.ca](mailto:scwebb@crd.bc.ca)

**Partner**

**Organizations:** City of Victoria, City of Saanich, Tides Canada

**Region:** British Columbia

**NRCan funding:** \$27,500

**Total funding:** \$64,150

**Status:** Complete

**Results:** *Coastal Sea Level Rise Risk Assessment and Planning Approaches Project*

<https://www.crd.bc.ca/docs/default-source/climate-action-pdf/coastal-sea-level-rise-risk-assessment-report.pdf?sfvrsn=0>

- This report documents the results of a literature review and a local government workshop. Policy options and planning tools to address hazards associated with sea-level rise along the southern coast of Vancouver Island are identified and evaluated.

**Title:** Targeted Coastal Archaeological Resources Risk Assessment

**Objective:** This project will contribute to a larger plan to address the impacts of climate change on Newfoundland and Labrador's heritage and archaeological resources which exist in coastal regions of the province. Results are expected to be relevant for coastal archaeological resources in Atlantic Canada, and will be transferable to other regions of Canada.

**Project Lead:** Memorial University of Newfoundland

**Contact:** Trevor Bell, Professor, Departments of Geography and Archaeology, E-mail: [tbell@mun.ca](mailto:tbell@mun.ca)

**Partner**

**Organizations:** Department of Tourism, Culture and Recreation and Department of Environment and Conservation, Government of Newfoundland and Labrador; Heritage Conservation and

## Coastal Management

Commemoration Directorate, Parks Canada; Geological Survey of Newfoundland and Labrador.

**Region:** Atlantic Provinces

**NRCan funding:** \$139,900

**Total funding:** \$472,801

**Status:** On-going

**Title:** Interactive Atlas of the Likelihood of Sea-Ice Hazard for Marine and Coastal infrastructure in a Changing Climate

**Objective:** The objective of this project is to develop an on-line, interactive atlas for Nunavik of the hazards to coastal and marine infrastructure from sea-ice conditions in a changing climate.

**Project Lead:** Institut National de la Recherche Scientifique, Centre Eau Terre Environnement

**Contact:** Dr. Monique Bernier, Ph.D, email : monique\_bernier@ete.inrs.ca

### **Partner**

**Organizations:** Ministère des transports du Québec, Ouranos

**Region:** Quebec

**NRCan funding:** \$133,412

**Total funding:** \$270,237

**Status:** Complete

**Results:** *ICEPAC Interface: An interactive Sea Atlas of the Hudson Bay*

<http://icepac.ete.inrs.ca/#>

- The IcePAC project offers informative maps and data on past, current and future sea ice conditions in the Hudson Bay based on remote sensing and predictive statistical methods. The tools and results will evolve and be regularly updated to match user needs and expectations.

*ICEPAC Interface: User Guide*

[http://icepac.ete.inrs.ca/ICEPAC\\_USERGUIDE\\_V1.pdf](http://icepac.ete.inrs.ca/ICEPAC_USERGUIDE_V1.pdf)

- This guide presents the functions available in the IcePAC interface.

## Coastal Management

**Title:** Adaptation in the Coastal Zone: From Words to Action

**Objective:** The objective of this project is to contribute to a better understanding of local adaptation practices by assessing interactions between different scales of actors and identifying potential bottlenecks.

**Project Lead:** University of Moncton

**Contact:** Omer Chouinard, Professor, email: omer.chouinard@umoncton.ca

### **Partner**

**Organizations:** Rural Community of Beaubassin-East, Municipality of Cape Pele, District and local services of Cognac and Grande Digue

**Region:** Atlantic

**NRCan funding:** \$27,754

**Total funding:** \$55,254

**Status:** Complete

**Results:** *Adaptation in the Coastal Zone: From Words to Action*

- The objective of this project is to contribute to a better understanding of local adaptation practices by assessing interactions between different scales of actors and identifying potential bottlenecks.

**Title:** Information Accessibility Policy Best Practices for Coastal Adaptation

**Objective:** This project will help advance the adoption of best practices for the collection, management and dissemination of data and information that supports climate change adaptation by providing a comprehensive inventory of present practices, and a benchmark of best practices. Organizations can use the results to modify their policies and operational procedures.

**Project Lead:** Atlantic Coastal Zone Information Steering Committee

**Contact:** Andrew Sherin, Atlantic Coastal Zone Information Steering Committee (ACZISC) Secretariat, Dalhousie University, Email: a.sherin@dal.ca

### **Partner**

**Organizations:** Department of Environment and Conservation, Government of Newfoundland and Labrador; Department of Fisheries and Aquaculture, Government of Newfoundland and Labrador; Department of Environment, Energy and Forestry, Province of Prince Edward Island; Department of Fisheries and Aquaculture, Province of Nova Scotia; Memorial University of Newfoundland; Dalhousie University; University of Prince Edward Island

**Region:** Atlantic Provinces

## Coastal Management

**NRCan funding:** \$35,500

**Total funding:** \$92,015

**Status:** Complete

**Results:** *Data Accessibility Organizational Self-Assessment Tool*

<http://coinatlantic.ca/index.php/coinatlantic/data-accessibility-benchmark-tool>

- This self-assessment tool allows organizations to measure improvement in the effectiveness and ease with which their data and information can be accessed by both internal and external users. The tool first establishes a benchmark, and is then used repetitively to track progress.

**Title:** Evaluation of B.C. Flood Policy Performance for Coastal Areas in a Changing Climate

**Objective:** The purpose of this project is to identify provincial government policies and programs that support, and those that create barriers to, implementation of climate change adaptation measures in coastal areas. The project will also propose alternatives and options for integrating climate change considerations into flood policies and programs to promote mainstreaming of climate change adaptation.

**Project Lead:** B.C. Ministry of Environment

**Contact:** Tina Neale, British Columbia Ministry of Environment E-mail: [tina.neale@gov.bc.ca](mailto:tina.neale@gov.bc.ca)

### **Partner**

**Organizations:** B.C. Ministry of Justice; B.C. Ministry of Community, Sport and Cultural Development; B.C. Ministry of Forests, Lands and Natural Resource Operations; B.C. Ministry of Transportation and Infrastructure

**Region:** British Columbia

**NRCan funding:** \$40,000

**Total funding:** \$109,000

**Status:** Complete

**Results:** *Evaluation of B.C. -Flood Policy for Coastal Areas in a Changing Climate*

[http://www2.gov.bc.ca/assets/gov/environment/climate-change/policy-legislation-and-responses/adaptation/sea-level-rise/evaluation\\_of\\_bc\\_flood\\_policy\\_-\\_final.pdf](http://www2.gov.bc.ca/assets/gov/environment/climate-change/policy-legislation-and-responses/adaptation/sea-level-rise/evaluation_of_bc_flood_policy_-_final.pdf)

- This report evaluates British Columbia flood policies and programs for coastal areas and identifies those that support, and those that create barriers to, implementation of climate change adaptation measures. This will be of interest to water management practitioners, policy-makers and decision-makers.

## Coastal Management

**Title:** Understanding Policy Enablers and Barriers for the Adaptive Management and Resilience of Coastal Communities in the Hudson Bay Inland Sea Region

**Objective:** The objective of this project is to undertake an analysis of existing policies and practices relevant to coastal management in the Hudson Bay Inland Sea region in order to identify enablers and barriers to adaptation at the community and regional level. The project will inform future governance approaches across the region for anticipating and managing risks and opportunities associated with a changing climate.

**Project Lead:** Northern Sustainable Prosperity Initiative

**Contact:** Terry Duguid, Director, Northern and Sustainable Prosperity Initiative, E-mail: tduguid@mymts.net

### **Partner**

**Organizations:** University of Winnipeg; International Institute for Sustainable Development (IISD); Manitoba Conservation and Water Stewardship; Nunavut Tunngavik Incorporated; Government of Nunavut - Department of Executive and Intergovernmental Affairs; Ontario Centre for Climate Impacts and Adaptation Resources OCCIAR  
MIRARCO/Laurentian University.

**Region:** Manitoba, Nunavut

**NRCan funding:** \$65,600

**Total funding:** \$131,200

**Status:** Complete

**Results:** *Understanding Policy Enablers and Barriers for the Adaptive Management and Resilience of Coastal Communities in the Hudson Bay Inland Sea Region*

<https://www.iisd.org/sites/default/files/publications/adaptive-management-resilience-coastal-communities-hudson-bay-region.pdf>

- This report describes the results of using the ADAPTTool to analyse selected policies relevant to the transportation sector along the coast in the Hudson Bay Inland Sea region, in order to identify enablers and barriers to climate change adaptation.

**Title:** Coastal Sea-Level Risk Assessment and Model By-law Development

**Objective:** The purpose of this project is to increase understanding of coastal vulnerabilities of Capital Regional District of British Columbia due to sea-level rise, and to create a tool (a model bylaw) for use in the Capital Regional District and other coastal communities to manage the sea-level rise challenge.

**Project Lead:** Capital Regional District, Victoria

## Coastal Management

**Contact:** Sarah Webb, Climate Action Program Manager, Capital Regional District, E-mail: scwebb@crd.bc.ca

**Partner**

**Organizations:** City of Victoria; District of Saanich; B.C. Ministry of the Environment

**Region:** British Columbia

**NRCan funding:** \$22,500

**Total funding:** \$45,054

**Status:** Complete

**Results:** *Sea Level Rise Planning Approaches Project Report*

<https://www.crd.bc.ca/docs/default-source/climate-action-pdf/sea-level-rise-planning-approaches-project-report.pdf?sfvrsn=0>

- This report outlines a high-level approach to sea level rise (SLR) adaptation along the southern coast of Vancouver Island, including identification and evaluation of policy options related to hazards arising from SLR, and provision of potential adaptation tools.

**Title:** Developing a Decision Key on Planning and Engineering Guidance for the Selection of Sustainable Coastal Adaptation Strategies to Climate Change in Rural Communities

**Objective:** The purpose of the project is to develop a web-based decision tool that will provide planning and engineering guidance for the selection of sustainable coastal adaptation strategies and measures for rural communities in the Atlantic region.

**Project Lead:** University of Prince Edward Island

**Contact:** Adam Fenech, Director, Climate Research Lab, University of Prince Edward Island, E-mail: afenech@upei.ca

**Partner**

**Organizations:** Saint Mary's University; Dalhousie University; Nova Scotia Sustainability and Innovation; PEI Environment, Labour and Justice; PEI Transportation and Infrastructure; PEI Department of Finance, Energy and Municipal Affairs; PEI Transportation and Infrastructure, Land and Environment; Newfoundland and Labrador Environment and Conservation; Service Nova Scotia and Municipal Relations; Nova Scotia Transportation and Infrastructure; Nova Scotia Department of Natural Resources; New Brunswick Environment; Newfoundland and Labrador Municipalities; NEXUS Coastal Resource Management; Engineers PEI; Risk Sciences International; CBCL Limited; Ecology Action Centre; Union of Nova Scotia Municipalities; Municipality of Shelbourne

**Region:** Atlantic Provinces

## Coastal Management

**NRCan funding:** \$360,387

**Total funding:** \$866,707

**Status:** Complete

**Results:** *Atlantic Climate Adaptation Solutions Association (ACASA) Decision Tools*

URL (Login required):

<https://wet.researchspaces.ca/en/islandora/object/islandora%3A224>

- The Atlantic Decision Tree is a suite of tools designed to provide guidance and strategies to manage climate change driven sea level rise, coastal flooding and erosion. It consists of guidance documents, two dozen engineering tools, and over 50 land use planning tools. A log-in ID is required to access the product. Contact Don Jardine < dejardine[AT]upei.ca >, ACASA Project Manager, UPEI Climate Research Lab for a user name and password.

**Title:** Development of Best Management Practices to Address Extreme High Rainfall Events that Affect Coastal Regions of Canada

**Objective:** The purpose of this Project is to fill gaps in existing knowledge regarding coastal impacts of extreme precipitation events on transportation infrastructure in British Columbia caused by incidents such as atmospheric rivers ("Pineapple Express", etc.) (essentially high precipitation events that occur over short durations) and to synthesize findings from British Columbia highway case studies and other assessments to develop a cohesive approach to addressing issues from these events for the entire British Columbia highway system.

**Project Lead:** British Columbia Ministry of Transportation & Infrastructure

**Contact:** Dirk Nyland, Chief Engineer, British Columbia Ministry of Transportation & Infrastructure, E-mail: Dirk.Nyland@gov.bc.ca

### **Partner**

**Organizations:** Pacific Climate Impacts Consortium, Nodelcorp Consulting Inc., Engineers Canada, British Columbia Ministry of Environment, British Columbia Ministry of Transportation & Infrastructure

**Region:** British Columbia

**NRCan funding:** \$96,800

**Total funding:** \$209,269

**Status:** Complete

## Coastal Management

**Results:** *Developing Effective Dialogue between Practitioners Of Climate Change Vulnerability--- Risk Assessments: A Primer for Understanding Concepts, Principles and Language Use Across Disciplines*

[http://www.th.gov.bc.ca/climate\\_action/documents/Climate\\_Data\\_Discussion\\_Primer.pdf](http://www.th.gov.bc.ca/climate_action/documents/Climate_Data_Discussion_Primer.pdf)

- This Primer outlines concepts, principles and language used across climate science and engineering disciplines to facilitate effective communication in climate change engineering vulnerability assessments. This report may be of interest to practitioners across Canada

*Review and Analysis of Climate Change Vulnerability Assessments of Canadian Water Management and Drainage Infrastructure*

[http://www.th.gov.bc.ca/climate\\_action/documents/hwy\\_Risk\\_Assessments\\_from\\_Climate\\_Changes\\_Review.pdf](http://www.th.gov.bc.ca/climate_action/documents/hwy_Risk_Assessments_from_Climate_Changes_Review.pdf)

- This report details the findings of a review of climate change vulnerability assessments from across Canada and identifies common risks to water management and drainage infrastructure standards. These assessments used the PIEVC Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate. This information will be of interest to infrastructure owners and engineering professionals

*Climate Change Engineering Vulnerability Assessment of Three British Columbia Highway Segments: Highway 20 in the Bella Coola Region; Highway 37A in the Stewart Region; Highway 97 in the Pine Pass Region*

[http://www.th.gov.bc.ca/climate\\_action/documents/hwy20\\_bella\\_coola-hwy37A\\_Stewart-hwy97\\_Pine%20Pass.pdf](http://www.th.gov.bc.ca/climate_action/documents/hwy20_bella_coola-hwy37A_Stewart-hwy97_Pine%20Pass.pdf)

- This report details the findings of climate change risk assessments of three highway segments in B.C. that used the PIEVC Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate. This information will be of interest to practitioners and decision-makers conducting similar assessments

*Considerations for Addressing Climate Change for Water Handling Infrastructure In Highway Management, Design, Operation and Maintenance in British Columbia - Best Practices Document*

[http://www.th.gov.bc.ca/climate\\_action/documents/MoTI-Climate%20Adaptation\\_Best%20Practices.pdf](http://www.th.gov.bc.ca/climate_action/documents/MoTI-Climate%20Adaptation_Best%20Practices.pdf)

- This “Best Practices” document provides guidance to the B.C. Ministry of Transportation and Infrastructure on integrating climate change considerations

## Coastal Management

into highway water handling infrastructure management including planning, engineering, and operations activities. The general approaches that are outlined for adapting practices will be useful to practitioners in other regions of Canada.

### *Engineering Analysis Report for the Climate Change Engineering Vulnerability Assessment*

- This report describes detailed engineering analysis of several water infrastructure examples using climate change projections for extreme precipitation and the PIEVC Engineering Protocol for Infrastructure Vulnerability Assessment and Adaptation to a Changing Climate protocol

### *Analysis of Climate Change Projections for the Ministry of Transportation and Infrastructure Highways Risk Assessment*

- This report provides climate change projection information for specific infrastructure risk assessments in B.C.

**Title:** Greening Shorelines, Enhancing Resilience in a Changing Climate: Development and Delivery of Green Shores™ Education and Training for Shoreline Decision-makers

**Objective:** The purpose of this project is to advance softer edge (green) shoreline protection practices by providing training and guidance material. The available tools and resources are targeted at decision makers.

**Project Lead:** Stewardship Centre for B.C. (SCBC)

**Contact:** D.G. Blair, Executive Director, E-mail: dg@stewardshpcentre.bc.ca

#### **Partner**

**Organizations:** Powell River Regional District; Thetis Island Trust Committee; Cowichan Valley Regional District; Capital Regional District; British Columbia Institute of Technology (BCIT); University of Victoria; Modus Consulting; Powell River Regional District; Thetis Island Trust Committee; Cowichan Valley Regional District; Capital Regional District; British Columbia Ministry of Environment, Climate Action Secretariat

**Region:** British Colombia

**NRCan funding:** \$52,200

**Total funding:** \$106,570

**Status:** Complete

## Coastal Management

**Results:** *Development and Delivery of Green Shores™ Education and Training: Formative Evaluation and Training Results*

[http://stewardshipcentrebc.ca/Green\\_shores/training/](http://stewardshipcentrebc.ca/Green_shores/training/)

- This report used a participatory evaluation process when designing and implementing the Green Shores training formative evaluation. The evaluation was completed using a three step process: 1) identifying bench mark indicators with the assistance of a Curriculum Advisory Committee; 2) measuring progress against these indicators; and, 3) completing recommendations for future course delivery.

**Title:** Climate Change Adaptation on the British Columbia Coast: A Video/Workshop Series to Engage the Local Government and Development Community

**Objective:** This project strives to increase understanding, motivation and engagement within the local government and development community on climate change adaptation by creating an informative video series outlining the why and how of adaptation.

**Project Lead:** Golder Associates Ltd.

**Contact:** David Reid, FCSLA, Principal, Environmental Planning /Design Practice Lead, E-mail: David\_Reid2@golder.com

### **Partner**

**Organizations:** British Columbia Ministry of Environment; Metro Vancouver; City of Vancouver; City of Burnaby; City of Nanaimo / Regional District of Nanaimo; British Columbia Ministry of Environment; Capital Regional District

**Region:** British Columbia

**NRCan funding:** \$79,000

**Total funding:** \$160,000

**Status:** Complete

**Results:** *Adapting to Climate Change on the British Columbia Coast: Video Series*

<https://www.youtube.com/playlist?list=PLbER4Sxdn0R4RkKJN5sKGzM0CdkOjUQs1>

- This video series provides an introduction to living with climate change on the B.C. Coast, with special attention to three subject areas: Coastal Flood Management - examples of adaptation to sea level rise; Rainwater Management - examples of adaptation to changed precipitation and stormwater patterns; and, Water Conservation - examples of adaptation to seasonal droughts.

# ECONOMICS

**Title:** Communicating Economic Instruments for Adaptation

**Objective:** The objective of this project is to communicate research findings on economic instruments for adaptation in a broader climate change policy framework to a policy and thought leader audience. This work is being undertaken to support use of economic instruments in an adaptation context.

**Project Lead:** Sustainable Prosperity

**Contact:** Michelle Brownlee, Senior Manager, Policy, E-mail:  
mbrownlee@sustainableprosperity.ca

**Partner**

**Organizations:** Ontario Ministry of the Environment and Climate Change

**Region:** National

**NRCan funding:** \$74,000

**Total funding:** \$157,550

**Status:** Complete

**Results:** *Tooling-up for Climate Change: Economic Instruments for Adaptation*

<http://www.sustainableprosperity.ca/adaptation/>

- This website communicates research findings and policy implications on economic instruments for adaptation, based on four Adaptation Platform projects. It hosts a suite of papers and communication products that explore how different levels of government, as well as other decision-makers, can use economic instruments to support the uptake of adaptation actions in four sectors: forestry, infrastructure, real estate, and ecosystem services.

**Title:** Economic Tools to Incent Climate Change Adaptation in Land Use Decisions by Private Actors

**Objective:** The purpose of the project is to identify decision points by private actors in land use that could lead to outcomes well adapted to climate change hazards, and assess how

## Economics

provincial policies interact with these decisions. Recommendations on economic tools that can incentivize (not finance) adaptation choices will be developed.

**Project Lead:** B.C. Ministry of Environment

**Contact:** Jenny Fraser, Senior Policy Analyst - Adaptation, Climate Action Secretariat, British Columbia Ministry of Environment, E-mail: [jenny.fraser@gov.bc.ca](mailto:jenny.fraser@gov.bc.ca)

### **Partner**

**organisations:** Western University; Insurance Bureau of Canada

**Region:** National

**NRCan funding:** \$35,000

**Total funding:** \$70,200

**Status:** Complete

**Results:** *Economic Tools for Climate Change Adaptation: Private Real Estate Decisions*

[http://www2.gov.bc.ca/assets/gov/environment/climate-change/policy-legislation-and-responses/adaptation/aos\\_economic\\_tools\\_adaptation.pdf](http://www2.gov.bc.ca/assets/gov/environment/climate-change/policy-legislation-and-responses/adaptation/aos_economic_tools_adaptation.pdf)

- This report identifies economic instruments that provincial and local governments could potentially use to overcome barriers to adaptation in real estate decision-making. Instruments studied include: modified development cost charges to incent climate resilient design at the planning stage, property-level upgrade programs to incent climate-resilient upgrades, and transferable development credits to incent development away from high-risk flood zones. Recommendations are provided for provincial and local governments.

**Title:** Economic Instruments to Advance Adaptation in Natural Resource Management: Applications in Forestry

**Objective:** The purpose of this project is to identify economic instruments (financial, behavioural, informational and governmental) currently in use in agriculture, forestry, and land use that have shown success/promise for facilitating adaptation. The project will develop criteria to evaluate their potential for addressing adaptation within forestry, use case studies to show how selected instruments can advance adaptation, and propose where new instruments could be introduced and implemented.

**Project Lead:** University of British Columbia

**Contact:** Dr. Harry Nelson, Faculty of Forestry, University of British Columbia, E-mail: [harry.nelson@ubc.ca](mailto:harry.nelson@ubc.ca)

## Economics

### **Partner**

**Organizations:** B.C. Ministry of Forests, Lands and Natural Resource Operations; B.C. Ministry of Environment

**Region:** National

**NRCan funding:** \$69,978

**Total funding:** \$171,378

**Status:** Complete

**Results:** *Economic Instruments for Adaptation to Climate Change in Forestry: Final Report*

<http://harry-w-nelson-forestry.sites.olt.ubc.ca/files/2015/06/Final-Report-Economic-Instruments-for-Adaptation-to-Climate-Change-June-2-2015.pdf>

- This report assesses how a variety of instruments could be adopted to support forest managers, licensees and communities to address the risks of climate change to Canada's forests. Three case studies oriented around specific climate-change related risks were conducted: 1) looking at wildfire risk on the landscape; 2) fire and the wildland-urban interface; and 3) the effect of maladaptation and less resilient future forests. Recommendations are provided for various levels of government, with specific attention to the provincial level.

**Title:** Analysis of Existing and Potential Economic Instruments Designed to Facilitate Adaptation Actions in Canada

**Objective:** The purpose of the project is to explore existing economic instruments currently in use in the Canadian and international public, private, and/or non-profit sectors and explore how these instruments might be modified and applied to finance adaptation measures in Canada, especially in the local government context. The project will undertake applied analysis for the City of Vancouver, to help this city adopt economic instruments that promote adaptation.

**Project Lead:** Simon Fraser University

**Contact:** Deborah Harford, Executive Director, ACT (Adaptation to Climate Change Team) Association, E-mail: [adapt@sfu.ca](mailto:adapt@sfu.ca)

### **Partner**

**Organizations:** West Coast Environmental Law; City of Vancouver

**Region:** National

**NRCan funding:** \$60,000

## Economics

**Total funding:** \$120,000

**Status:** Complete

**Results:** *Paying for Urban Infrastructure Adaptation in Canada: An Analysis of Existing and Potential Economic Instruments for Local Governments*

<http://act-adapt.org/paying-for-urban-infrastructure-adaptation-in-canada-an-analysis-of-existing-and-potential-economic-instruments-for-local-gove/>

- This report analyzes financial instruments that may assist Canadian municipalities to pay for urban infrastructure investments necessary to adapt to a changing climate. The instruments are assessed based on several criteria, including effectiveness, ease of implementation, public acceptance, equity and flexibility. Recommendations are provided for municipal and higher levels of government.

**Title:** A Comparative Evaluation of Payments for Ecosystem Services and Other Economic Incentives to Encourage Adaptation to Climate Change - Case Studies in OECD Countries

**Objective:** The objective of this project is to analyze the advantages and disadvantages of various economic incentives related to two issues: 1) floodproofing in urban areas; and (2) maintaining wetland / floodplain environments in rural and urban areas. This analysis will help to increase the skills and capacity of the City of Montreal (and other municipalities) and the Government of Quebec to Utilizer economic incentives for Addresser adaptation to climate change.

**Project Lead:** Groupe AGÉCO

**Contact:** Jean-Pierre Revéret, Groupe AGÉCO Courriel : jean-pierre.reveret@groupeageco.ca

### **Partner**

**Organizations:** Ouranos

**Region:** National

**NRCan funding:** \$51,800

**Total funding:** \$107,100

**Status:** Complete

**Results:** *Comparative Evaluation of Payments for Ecosystem Services and Other Economic Incentives to Encourage Climate Change Adaptation (en français seulement)*

<http://www.groupeageco.ca/IncitatifsEconAdaptChgmentsClimatiques.pdf>

## Economics

- This report assesses economic incentives to support adaptation in the management of rural and urban ecosystem services, such as wetlands, floodplains, stormwater, and ‘heat islands’ in urban areas. The paper assesses ten case studies based on effectiveness, efficiency, and equity criteria, and provides considerations for future policy and program design. The case studies come from Canada, the United States, and France.

**Title:** Enabling Canadian Chartered Professional Accountants to Adapt to a Changing Climate and Emerging Operating Environment

**Objective:** The purpose of this project is to integrate climate change adaptation into the professional certification process of the Canadian Chartered Professional Accountants, continuing professional education requirements, higher education programs and professional communities of practice. This will increase the capacity of accountants and their business clients to manage the risks and opportunities of climate change and provide an additional lens through which they can identify risk management and value-protecting and value-creating opportunities. By enabling the mainstreaming of adaptation in the financial sector, the project will help reduce the costs of climate change to Canadian business and to increase economic competitiveness.

**Project Lead:** Chartered Professional Accountants of Canada

**Contact:** Todd Scaletta, Chartered Professional Accountants of Canada, E-mail: [tscaletta@cpacanada.ca](mailto:tscaletta@cpacanada.ca)

**Region:** National

**NRCan funding:** \$374,375

**Total funding:** \$803,750

**Status:** Complete

**Results:** Three briefs were created to provide information on climate change for accountants:

*A Primer on Climate Change Mitigation and Adaptation (Brief 1)*

<https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/climate-change-and-business-three-truths>

*Four Ways Climate Change is Affecting Your Organization...And What You Can Do (Brief 2)*

<https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/four-ways-climate-change-affects-organizations>

## Economics

*The Five Stages of Climate Change Adaptation and Roles for Accountants (Brief 3)*

<https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/climate-change-adaptation-and-accountants-roles>

Five case studies were also written to demonstrate adaptation in action for accountants:

*Adaptation Case Study #1: Frontiers North Adventures (Case study report and video)*

<https://cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/frontiers-north-adventures-long-case-study-1>

- Frontiers North Adventures is a tourism company located in Churchill Manitoba. This case study shows how their business, is being impacted by and responding to climate change. Accountants have supported the company's planning and decision-making process as it adapts to the effects of climate change. Areas accountants have contributed to include, scenario planning, cost-benefit analyses, and, interpreting the return on investment of different options. This case study report is available in video and written format.

*Adaptation Case Study #2: TransLink (Case study report and video)*

<https://cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/translink-climate-change-case-study-2>

- This case study shows how Translink, Metro Vancouver's public transportation and transportation infrastructure provider, sees climate change impacting service delivery, and infrastructure maintenance and development. The case study also discusses how accountants at TransLink contribute to adaptation decisions through risk management, capital planning and reporting. This case study report is available in video and written format.

*Adaptation Case Study #3: MEC (Case study report and video)*

<https://cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/mountain-equipment-coop-adapting-to-climate-change>

- This case study shows how Mountain Equipment Coop (MEC), as a national retail organization, is responding to the impacts of climate change on its sales and supply chain. MEC's accountants support the company's decision-making processes as it adapts to the effects of climate change. This case study report is available in video and written format.

## Economics

*Adaptation Case Study #4: The Cooperators (Case study report and video)*

<https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/the-cooperators-adapting-to-climate-change>

- This case study shows how The Co-operators, a national insurance company, is responding to the risk of increased extreme weather events in Canada, and helping Canadians and communities to better prepare. The case study explains how accountants support the company's efforts to identify the risks and look for opportunities in the face of climate change. This case study report is available in video and written format.

*Adaptation Case Study #5: The Horizon Utilities (Case study report and video)*

<https://www.cpacanada.ca/en/business-and-accounting-resources/other-general-business-topics/sustainability/publications/horizon-utilities-climate-change-case-study>

- Horizon Utilities Corporation is an electricity distributor in southern Ontario. This case study shows how, this company is responding to the physical impacts of climate change. It explains how Horizon's accountants use their objectivity and broad business background to support the company's risk management process to mitigate impacts and carry out their forward planning, taking climate change into account. This case study report is available in video and written format.

**Title:** Atlantic Coastal Infrastructure and Property in the Atlantic Provinces

**Objective:** This project will address climate change impacts on sectors and industries critical to Atlantic Canada's economy. It will reflect existing knowledge and bring sector specific insights into an integrated regional framework. Project will provide economic estimates of climate change damage to coastal infrastructure/property and cost-benefit analysis of adaptation options for six case study sites:

1. Chigneticum Isthmus (NB/NS) – A strategic land bridge and transport corridor with road, rail, electricity and gas infrastructure;
2. Halifax Harbour – Shipping, road and rail infrastructure;
3. Tracadie Harbour, PEI – Fishing fleet and mussel aquaculture;
4. North Cape Coastal Drive, PEI – Key tourist attraction;
5. Bay Bulls – Witless Bay, NFLD – Harbour for cargo and offshore petroleum service industry;
6. Marystown, NFLD – Ship-building facility; one of deepest ice-free sheltered ports.

**Project Lead:** University of Prince Edward Island

**Contact:** Adam Fenech, Director, Climate Research Lab, E-mail: [afenech@upe.ca](mailto:afenech@upe.ca)

## Economics

### **Partner**

**Organizations:** Nova Scotia Department of Environment, New Brunswick Department of Environment and Local Government, New Brunswick Department of Transportation and Infrastructure, New Brunswick Power Corp, Newfoundland Environment and Conservation, Newfoundland and Labrador Office of Climate Change and Energy Efficiency, Halifax Regional Municipality, Prince Edward Island Department of Environment, Labour and Justice, Prince Edward Island Department of Transportation and Infrastructure Renewal, Prince Edward Island Department of Fisheries, Aquaculture and Rural Development, Prince Edward Island Department of Tourism and Culture, St. Francis Xavier University, Northeast Avalon Atlantic Coastal Action Program, Town of Marystown, Newfoundland

**Region:** Atlantic Provinces

**NRCan funding:** \$473,160

**Total funding:** \$1,025,160

**Status:** Complete

**Results:** *Using Cost-Benefit Analysis to Evaluate Climate Change Options in Atlantic Canada – Land Use Planning and Engineering and Natural Approaches*

<http://wet.researchspaces.ca/en/islandora/object/acasa%3A779>

- This report presents the costs of impacts associated with sea level rise and coastal flooding, and the benefit-to-cost ratios for selected adaptation options at six sites in Atlantic Canada: Chignecto Isthmus, Halifax Harbour, North Cape Coastal Drive, Tracadie Harbour, Bay Bulls–Witless Bay, and Marystown. It contains details of the costing methodology, detailed analysis for each site, integrated findings, and lessons learned from applying cost benefit analysis in the context of climate change in Atlantic Canada.

*Atlantic-Quebec Cost-Benefit Analysis of Adaptation Options in Coastal Areas – Synthesis Report*

<https://www.ouranos.ca/publication-scientifique/Synthesis-Report-Qc.pdf>

- A synthesis combining results from this project and a related project on coastal areas in Quebec was also produced.

**Title:** Economic Assessment of Climate Change Impacts and Cost-benefit Analysis of Adaptation Options in Coastal Areas in Quebec

**Objective:** The overall aim is to achieve three main objectives:

## Economics

1. A comprehensive economic assessment of climate change impacts on the coastal region of Quebec;
2. Five cost-benefit analysis associated with the implementation of adaptation options to climate change in representative locations in coastal areas in Quebec; and
3. The integration of results obtained under the different cost-benefit analyzes conducted in Quebec and those of economic evaluations in the Atlantic provinces.

**Project Lead:** Ouranos

**Contact:** Claude Desjarlais, Directeur de l'analyse économique, Ouranos Inc., Courriel : desjarlais.claude@ouranos.ca

**Partner**

**Organizations:** Université du Québec à Rimouski; Gouvernement du Québec; Carleton-sur-mer; Ville de Percé; Îles-de-la-Madeleine; et municipalités de la MRC de la Mitis.

**Region:** Québec

**NRCan funding:** \$841,159

**Total funding:** \$1,682,342

**Status:** Complete

**Results:** *Economic Evaluation of the Potential Impacts of the Erosion of Quebec's Maritime Coasts in a Context of Climate Change*

<https://www.ouranos.ca/en/programs/economic-evaluation/>

- This study provides the first assessment of the potential costs of the impacts of coastal erosion on Quebec maritime property and infrastructure in the context of climate change. The area under study covers 3220 km of coastline and includes 16 regional county municipalities (RCM), spread out between the Bas-Saint-Laurent, the Côte-Nord, the Gaspésie and the Îles-de-la-Madeleine. The results of this study highlight the importance of preventive management of coastal risks that would significantly limit the costs associated with coastal erosion. The potential economic loss for the next 50 years, is estimated at \$1.5 billion.
- The individual regional case studies and technical report are also available at: <https://www.ouranos.ca/en/programs/economic-evaluation/>

*Atlantic-Quebec Cost-Benefit Analysis of Adaptation Options in Coastal Areas – Synthesis Report*

<https://www.ouranos.ca/publication-scientifique/Synthesis-Report-Qc.pdf>

## Economics

- A synthesis combining results from this project and a related project on coastal areas in Atlantic Canada was also produced.

**Title:** Adaptation Strategies to Climate Change Induced Low Water Levels in the Great Lakes Basin: a Cost Benefit Analysis

**Objective:** The objectives of this project are to:

1. Provide a detailed analysis of the economic costs (regionally, sub-regionally, and by sector) of the decline in water levels in the Great Lakes-St. Lawrence system;
2. Analyze the economic costs and benefits of proposed adaptation and mitigation options to respond to this decline; and
3. Provide public and private decision-makers with the economic analysis needed to make better policy decisions and efficient investment choices in responding to the basin's declining water levels.

The project will undertake case studies of the following sectors: commercial shipping and harbours, tourism and recreation, waterfront properties, hydroelectric generation, commercial fishing, and domestic, municipal and industrial water use.

**Project Lead:** Council of the Great Lakes Region

**Contact:** Mark Fisher, Chief Executive Officer, Council of the Great Lakes Region, E-mail: [info@councilgreatlakesregion.org](mailto:info@councilgreatlakesregion.org)

### **Partner**

**Organizations:** Georgian Bay Forever

**Region:** Ontario

**NRCan funding:** \$244,995

**Total funding:** \$500,035

**Status:** Complete

**Results:** *Restoring Water Levels on Lake Michigan-Huron - A Cost-Benefit Analysis*

<https://councilgreatlakesregion.org/restoring-water-levels-on-lake-michigan-huron/>

- This report proposes adaptation strategies for climate change induced low water levels in the Great Lakes basin. It also presents a cost benefit analysis of economic impacts of fluctuating water levels on Lake Michigan-Huron, and economic implications of multi-lake regulation and adaptation management. The study examines the effects of low water levels of four sectors: 1) commercial shipping and

## Economics

harbours; 2) tourism and recreational water activities; 3) waterfront properties; and, 4) hydroelectric generation.

**Title:** Regional Economic Impact Studies and Adaptation to Climate Change: The St. Lawrence River

**Objective:** The Project is aimed to achieve three main objectives:

1. Produce an economic assessment of the cost of climate change impacts, especially those related to low water levels for key areas related to the St. Lawrence River;
2. Conduct an analysis of the costs and benefits of adaptation options for different sectors studied; and
3. Perform integrated analysis of economic sector work.

**Project Lead:** Ouranos

**Contact:** Claude Desjarlais, Directeur de l'analyse économique , Ouranos Inc., Courriel : [desjarlais.claude@ouranos.ca](mailto:desjarlais.claude@ouranos.ca)

### **Partner**

**Organizations:** Centre interuniversitaire de recherche sur les réseaux d'entreprise, la logistique et le transport (CIRRELT) ; Université de Sherbrooke; AECOM; Chaire en tourisme Transat-Université du Québec à Montréal; Gouvernement du Québec; Hydro-Québec

**Region:** Québec

**NRCan funding:** \$530,059

**Total funding:** \$1,081,197

**Status:** Complete

**Results:** *Regional Economic Study on the Potential Impacts of Climate-Change Induced Low Water Levels on the Saint-Laurent River and Adaptation Options - Synthesis of the Findings from Six Sector-specific Studies*

<https://www.ouranos.ca/programme/gestion-de-leau/> (Scroll to bottom of page)

- This report provides an integrated analysis of economic costs for the potential impacts of climate-change-induced low water levels, and cost-benefit analyses of various adaptation options for six sectors of activity directly related to the Saint-Laurent River: 1) maritime transport; 2) municipal water supply and wastewater treatment; 3) ecological services and fishing; 4) recreational boating and tourism; 5) hydropower generation; and, 6) waterfront property values. The study area covered the Saint-Laurent River between the Québec-Ontario border and Trois-Rivières.

The individual case studies are also available at the same link (above).

## Economics

**Title:** A Study of Economic Impacts on the Weather Effects of Climate Change on Vulnerable Communities

**Objective:** The purpose of the project is to conduct an economic analysis of the impacts of climate change at the community level. The project will provide:

1. Economic analysis of the net costs of climate change at the local level on case study communities (Halifax and Mississauga),
2. Analysis to help make the business case to governments, business and property owners that investments in adaptation measures reduce costs over the long-term, and
3. A practical methodology for projecting economic impact of weather effects of climate change that can be adapted for use by communities.

**Project Lead:** Insurance Bureau of Canada

**Contact:** Chris Rol, Senior Policy Advisor, Insurance Bureau of Canada (IBC), E-mail: [crol@ibc.ca](mailto:crol@ibc.ca)

**Region:** National

**NRCan funding:** \$200,000

**Total funding:** \$425,587

**Status:** Complete

**Results** *The Economic Impacts of the Weather Effects of Climate Change on Communities*

<http://assets.ibc.ca/Documents/Studies/IBC-The-Economic-Impacts.pdf>

- The report provides estimates of some of the future costs to the cities of Halifax and Mississauga from severe weather events. For Halifax, the team studied extreme winds and storm surge flooding. For Mississauga, they considered ice storms and stormwater flooding. The estimates include the economic costs to the city as a result of these weather events in 2020 and in 2040, and the added effect of moderate and high scenarios of climate change. Details of the methodology are also included.

# ENERGY

**Title:** Impacts of Climate Change on Regional Energy Demand

**Objective:** This project will update a 2006 study in light of new climate forecasts and considering the most recent socio-economic data and assessment methodologies. Particular focus will be put on climate change impacts on peak demand.

**Project Lead:** Ouranos

**Contact:** M. Gaétan Lafrance, PH. D, professeur honoraire, INRS-ÉMT, email : lafrance@emt.inrs.ca; M. Claude Desjarlais, M.A., Directeur de l'analyse économique, Ouranos, email : desjarlais.claude@ouranos.ca

**Region:** Quebec

**NRCan funding:** \$30,000

**Total funding:** \$101,025

**Status:** Complete

**Results:** *The Impacts of Climate Change on Energy Demand (en français seulement)*

[https://www.ouranos.ca/publication-scientifique/RapportLafrance2015\\_FR.pdf](https://www.ouranos.ca/publication-scientifique/RapportLafrance2015_FR.pdf)

- This study provides estimates of the impacts that various climate change scenarios will have on energy demand in Quebec through 2030 and 2050. It analyzes every form of energy demand and all groups of energy consumers over these time horizons.

**Title:** Manitoba Assessment of Potential Temperature Trends under Climate Change Scenarios and the Impact on Energy Demand

**Objective:** The purpose of this project is to study the potential impacts of climate change on energy demand in Manitoba.

**Project Lead:** Manitoba Hydro

**Contact:** Michael J.F. Vieira, Water Resources Engineering Department, E-mail: mvieira@hydro.mb.ca

**Region:** Manitoba

## Energy

**NRCan funding:** \$30,000

**Total funding:** \$67,730

**Status:** Complete

**Results:** *Projected Climate Impacts on Energy and Peak Demand in Manitoba*

[https://www.hydro.mb.ca/corporate/research\\_and\\_development/projected\\_climate\\_change\\_impacts.pdf](https://www.hydro.mb.ca/corporate/research_and_development/projected_climate_change_impacts.pdf)

- This report summarizes current forecasting practices and projections of the future effect of weather on energy (electric and natural gas), and peak electricity demand in Manitoba. Results from this report will be useful in future adaptation efforts, resource planning and for the identification of opportunities and risks.

**Title:** Risk and Opportunities Assessment: B.C. Electricity Demand in a Changing Climate

**Objective:** The goal of this project is to explore the risks and opportunities posed by projected climate change temperature scenarios for electricity demand in British Columbia.

**Project Lead:** B.C. Ministry of Environment

### **Partner**

**Organizations:** Pacific Climate Impacts Consortium; Government of B.C.; B.C. Hydro

**Region:** British Columbia

**NRCan funding:** \$30,000

**Total funding:** \$65,230

**Status:** Complete

**Results:** *Forecasted Impacts of Climate Change on B.C. Hydro Electricity Demand*

<http://www.env.gov.bc.ca/soe/indicators/climate-change/heating-cooling-days.html>

- This report is the result of collaboration between B.C. Hydro and the Pacific Climate Impacts Consortium to identify indicators of change in the B.C. climate that could impact the electrical sector. It also assesses how peak demand may change with estimates of future temperature from climate change scenarios.

## Energy

**Title:** Yukon Assessment of Potential Temperature Trends under Climate Change Scenarios and the Impact on Energy Demand

**Objective:** The goal of this project is to explore the potential of climate change to affect the management of energy demand in order to identify potential risks and opportunities for the Yukon energy sector.

**Project Lead:** Government of Yukon

**Contact:** Ryan Hennessey, Energy Mines and Resources, E-mail: ryan.hennessey@gov.yk.ca

**Partner**

**Organizations:** Energy Solutions Centre; Yukon Energy Corporation

**Region:** Yukon

**NRCan funding:** \$6,700

**Total funding:** \$17,845

**Status:** Complete

**Results:** *Embracing Energy Efficiency: Ensuring Yukon Benefits from Climate Moderated Heating Demand*

<http://www.energy.gov.yk.ca/pdf/Embracing-Energy-Efficiency-Climate-Moderated-Heating-Demand-Assessment.pdf>

- This report outlines the testing of three net saving assumptions in Yukon to assess their validity, and to determine what risks and opportunities may result from climate moderated energy demand. It examines specific effects of such demand on Yukon's energy market. This report would be useful for governments and energy planners.

**Title:** Climate Change Risk Assessment of Electrical Distribution Infrastructure

**Objective:** The objective of this project is to assess climate change risks to electrical distribution infrastructure through a case study of Toronto Hydro.

**Project Lead:** Clean Air Partnership

**Contact:** Kevin Behan, Deputy Director, E-mail: kbehan@cleanairpartnership.org

**Partner**

**Organizations:** Toronto Hydro; Hydro One; Ontario Power Generation; Engineers Canada; City of Toronto; Ontario Power Authority

**Region:** Ontario

## Energy

**NRCan funding:** \$142,610

**Total funding:** \$286,870

**Status:** Complete

**Results:** *Toronto Hydro-Electric System Limited Climate Change Vulnerability Assessment*

<http://www.pievc.ca/enhancing-resilience-severe-weather-and-climate-change-distribution-sector>

- This report evaluates the vulnerability of Toronto-Hydro's electricity distribution system to climate change. It presents a high level screening analysis to determine where infrastructure vulnerabilities are, suggests avenues for adapting infrastructure, and identifies potential areas for further study. These findings can prove useful for energy planning, and infrastructure research and planning.

**Title:** Watershed Perspective

**Objective:** This project will conduct a climate change risk and opportunity assessment for small waterpower facilities, identify and assess adaptation options and provide recommendations.

**Project Lead:** Mississippi Valley Conservation Authority

**Contact:** Paul Lehman, P. Eng., General Manager, E-mail: plehman@mvc.on.ca

**Partner**

**Organizations:** Bonnechere River Watershed Project; TransAlta; Mississippi River Power Corporation; Ontario Power Generation; Ontario Ministry of Natural Resources

**Region:** Ontario

**NRCan funding:** \$102,390

**Total funding:** \$267,537

**Status:** Complete

**Results:** *Climate Change Implications for Small Waterpower Facilities – A Watershed Perspective*

<http://mvc.on.ca/wp-content/uploads/2015/07/Climate-Change-Implications-for-Small-Waterpower-Facilities.pdf>

- This report examines runoff patterns for the Mississippi River resulting from future climate projections over 90 years. It outlines four adaptation options and details how projected changes in climate in the watershed may affect hydrological

## Energy

processes. Recommendations highlight areas for future study and propose consideration within a broader planning context involving multiple stakeholders.

*Future Water Budget Projections in Mississippi Rideau Watershed Region*

<http://mvc.on.ca/wp-content/uploads/2015/07/Future-Water-Budget-Projections-in-Mississippi-Rideau-Watershed-Region.pdf>

- This report is a subproject of “The Mississippi Rideau Climate Change Vulnerability Assessment Project.” It studies Global Climate Model scenarios and projects future water budgets in the region. It aims to understand adaptation decision-making uncertainties under a range of future climate change projections.

**Title:** Risk and Opportunities for the Oil and Gas Sector in a Changing Climate in Northeast B.C.

**Objective:** The purpose of this project is to increase the awareness of the potential impacts of climate change to the energy sector in Northeast British Columbia and identify the vulnerabilities, adaptive capacities, risks and opportunities.

**Project Lead:** Fraser Basin Council

**Contact:** Jim Vanderwal, Senior Manager, E-mail: [jvanderwal@fraserbasin.bc.ca](mailto:jvanderwal@fraserbasin.bc.ca)

### **Partner**

**Organizations:** Treaty 8 Tribal Association; Resources North Association; B.C. Government; B.C. Oil and Gas Commission; Peace River Regional District; Northern Rockies Regional District

**Region:** British Columbia

**NRCan funding:** \$129,850

**Total funding:** \$259,740

**Status:** Complete

**Results:** *Climate Risk Assessment for the Oil & Gas Sector - Northeastern British Columbia*

[http://www.retooling.ca/Library/docs/Climate\\_Assessment\\_NEBC\\_2015\\_web.pdf](http://www.retooling.ca/Library/docs/Climate_Assessment_NEBC_2015_web.pdf)

- Project results present a high-level inventory of the implications of climate change for the oil and gas sector in northeastern British Columbia and the associated, potential adaptive actions. This work is based on targeted climate projections and engaged consultation with stakeholders.

## Energy

**Title:** Enhancing Resilience to Severe Weather and Climate Change: Assessing Risks and Opportunities for Key Elements of Ontario's Electrical Transmission Grid

**Objective:** The purpose of this project is to conduct a climate change risk and opportunity assessment and develop adaptation options for the electricity transmission sector in Ontario to support adaptation planning and strengthening the resilience of the electricity system.

**Project Lead:** Toronto Region Conservation Authority

**Contact:** Chandra Sharma, Watershed Specialist & Senior Manager, E-mail: csharma@trca.on.ca

**Partner**

**Organizations:** Risk Sciences International; Nodelcorp Consulting Inc.; Engineers Canada; Consulting Engineers of Canada; Western University; York University; Public Infrastructure Engineering Vulnerability Committee; Ontario Ministry of Energy

**Region:** Ontario

**NRCan funding:** \$130,000

**Total funding:** \$260,582

**Status:** Complete

**Results:** *Climate Change Vulnerability Assessment of Ontario's Electrical Transmission Sector*

<http://www.pievc.ca/ontarios-electrical-transmission-sector-climate-change-vulnerability-assessment>

- This report, useful for planners and for capacity-building, discusses the implications of climate change for the electrical system in Ontario. Proposed adaptation measures focus on high voltage transmission systems.

**Title:** A Tool for Adaptation Decision-making in Oil Sands Reclamation under Risk of Climate Change

**Objective:** This Project will develop a regionally applicable tool and methodology that incorporates climate change considerations for use in oil sands reclamation which will improve consistency among operators, and provide a means of assessing current best management practices.

**Project Lead:** University of British Columbia

**Contact:** Dr. Harry Nelson, Assistant Professor, Forestry Economics, Faculty of Forestry, E-mail: harry.nelson@ubc.ca

## Energy

### **Partner**

**Organizations:** Oil Sands Research Information Network; Cumulative Environmental Management Association; Canadian Natural Resources Ltd.; Fort McKay First Nation; Alberta Environment and Sustainable Resource Development

**Region:** Alberta

**NRCan funding:** \$193,019

**Total funding:** \$493,719

**Status:** Complete

**Results:** *A Tool for Adaptation Decision-Making in Oil Sands Reclamation Under Risk of Climate Change - Final Report*

<http://library.cemaonline.ca/ckan/dataset/2013-0031/resource/89a7b1bd-6f43-4b94-8131-a43d7e4ec431>

- This report discusses how risk and uncertainty from climate change can be incorporated into reclamation planning. It outlines two approaches to reclamation and emphasizes a need in the energy sector to understand how organizations handle risks and adapt to current climate conditions. This report may be useful to operators in the energy sector for assessing adaptation decision-making options.

**Title:** A Testbed for an Advanced Decision Making Protocol, From Climate Change Scenarios to Decisions on Hydropower Investments

**Objective:** The objective of this project is to address the emerging adaptation needs in Canada's energy sector in order to improve resilience to climate change impacts by identifying risks and opportunities, and developing case studies of adaptation planning and decision-making tools to assess adaptation options.

**Project Lead:** Ouranos

**Contact:** René Roy, Ph.D. Hydro-Québec Research Institute / Ouranos, email: roy.rene@ouranos.ca / roy.rene@ireq.ca

### **Partner**

**Organizations:** Concordia University, University of British Columbia, Hydro Quebec, Manitoba Hydro

**Region:** Quebec

**NRCan funding:** \$150,225

**Total funding:** \$336,300

**Status:** Complete

## Energy

**Results:** *A Testbed for an Advanced Decision Making Protocol, from Climate Change Scenarios to Decisions on Hydropower Investments*

[scenarios-decision.ouranos.ca/fr](http://scenarios-decision.ouranos.ca/fr)

- This project experiments with two large-scale sensitivity studies that mix climatic and economic variables. These studies look at two scenarios, one where a utility plans to upgrade the equipment of an existing station, and another where it studies options for a new generating station.

**Title:** Probable Maximum Precipitation and Probable Maximum Flood under Changing Climate Conditions: Climate-Change Proof Dam Safety Assessments

**Objective:** This project aims to provide Canadian dam managers with credible estimates of maximized precipitations using numerical climate simulations that account for climate change.

**Project Lead:** Ouranos

**Contact:** Anne Frigon, M.Sc., Climate Simulation and Analysis Head; Email: [frigon.anne@ouranos.ca](mailto:frigon.anne@ouranos.ca)

### Partner

**Organizations:** Hydro Quebec, Manitoba Hydro, Rio Tinto Alcan, Ontario Power Generation

**Region:** National

**NRCan funding:** \$150,000

**Total funding:** \$465,725

**Status:** Complete

**Results:** *Probable Maximum Floods and Dam Safety in the 21<sup>st</sup> Century*

[https://www.ouranos.ca/publication-scientifique/RapportFrigonKoenig2015\\_EN.pdf](https://www.ouranos.ca/publication-scientifique/RapportFrigonKoenig2015_EN.pdf)

- This report examines the methods used to estimate flood risk for dam design, and applies a method to incorporate projected climate change impacts to flood risk. It also identifies potential adaptation options for five watersheds across Canada.

**Title:** Risks to the Energy Sector related to Extreme Climate Events: Case Studies of Adaptation Actions Focusing on the Upper and Lower Souris River Watersheds

**Objective:** The objective of this project is to increase understanding of energy sector risks and adaptation actions to extreme wet and dry climate events using the Souris River watershed as a case study area.

## Energy

**Project Lead:** Environmental Systems Assessment Canada Ltd.

**Contact:** Dennis Sherratt, Environmental Systems Assessment Canada Ltd, E-mail: sherratt@sasktel.net

### **Partner**

**Organizations:** Government of Manitoba; Saskatchewan Research Council; International Institute for Sustainable Development; Saskatchewan Ministry of the Environment; Saskatchewan Ministry of Economy; Government of Manitoba; SaskPower

**Region:** Saskatchewan, Manitoba

**NRCan funding:** \$84,000

**Total funding:** \$168,300

**Status:** Complete

**Results:** *Climatic Extremes and the Energy Sector's Vulnerability: Now and in the Future – Focus on Canadian Portion of the Souris River Watershed: A Literature Review*

<http://www.src.sk.ca/resource%20files/2016%20souris%20river%20watershed%20fact%20sheet.pdf>

<http://www.src.sk.ca/resource%20files/future%20flood%20and%20drought%20risk%20assessment%20-%20souris%20river%20watershed.pdf>

- This report sets out possible future adaptation actions the energy sector can take both locally and nationally to capitalize on potential opportunities and reduce risk in a changing climate. Using previously published literature, it examines future climate and projected extremes, and is useful for planning and risk reduction.

**Title:** Adaptation Case Studies in the Energy Sector, Overcoming Barriers to Adaptation

**Objective:** The primary objective of the project is to document successful climate change adaptation efforts across the energy sector on a global level to highlight the barriers to adaptation and how they can be overcome.

**Project Lead:** Ouranos

**Contact:** Marco Braun, PhD – Hydrology specialist, Email: Braun.Marco@ouranos.ca

### **Partner**

**Organizations:** Deloitte Canada, Rio Tinto Alcan

**Region:** Various

**NRCan funding:** \$99,400

## Energy

**Total funding:** \$266,275

**Status:** Complete

**Results:** *Adaptation Case Studies in the Energy Sector*

<https://www.ouranos.ca/en/programs/energy-adaptation-case-studies/>

- This project collects 11 case studies from around the world to highlight barriers to adaptation in the energy sector and how they can be overcome.

**Title:** Resilient Pipes and Wires: Assessing policies as Drivers and Barriers to Integration of Adaptation in the Planning and Operation of the Energy Distribution Sub-sector

**Objective:** The objective of this project is to identify policies relevant to the integration of climate change adaptation into planning and operations in the Canadian energy distribution sector, to document how these policies are acting as barriers or drivers to adaptation actions, and to provide recommendations on how to address the identified barriers and leverage drivers.

**Project Lead:** QUEST

**Contact:** Richard Laszlo, Director of Research and Education, E-mail: rlaszlo@questcanada.org

### **Partner**

**Organizations:** Canadian Gas Association; Canadian Electricity Association; International District Energy Association

**Region:** National

**NRCan funding:** \$75,000

**Total funding:** \$150,000

**Status:** Complete

**Results:** *Resilient Pipes and Wires—Adaptation Awareness, Actions and Policies in the Energy Distribution Sector*

<http://www.questcanada.org/events-projects/research/rpw> (landing page)

<http://www.questcanada.org/files/download/f0d858d953eda43> (PDF)

- This report is a summary of research findings examining the level of awareness among electric, natural gas and thermal energy distributors about adaptation. It also summarizes policy drivers and barriers to the integration of adaptation actions into the planning and operations of the energy distribution sector.

## Energy

**Title:** In-depth Review of Policy Drivers and Barriers to Oil and Gas Adaptation in Alberta Region

**Objective:** The objective of the project is to assess policies impacting Canadian oil and gas sector operations for their relevance as drivers or barriers to climate change adaptation. The research and analysis will provide information and recommendations relevant for private and public sector policy-makers.

**Project Lead:** MIRARCO, Laurentian University

**Contact:** Al Douglas, E-mail: [adouglas@mirarco.org](mailto:adouglas@mirarco.org)

**Partner**

**Organizations:** Dr. John Stone; JE & M Consulting; Canadian Association of Petroleum Producers; Government of Alberta

**Region:** Alberta

**NRCan funding:** \$78,600

**Total funding:** \$157,200

**Status:** Complete

**Results:** *Role of Policy in Climate Change Adaptation - An Analysis of Policy Drivers and Barriers in the Alberta Oil and Gas Sector*

<http://www.climateontario.ca/reports.php>

- This report provides a general understanding of policies as drivers, or barriers impacting oil and gas production in Alberta. It offers additional context to policymakers and industry experts working on climate risk and adaptation in the Canadian oil and gas sector, with a focus on policies governing exploration and production activities in Alberta.

**Title:** Evaluating Opportunities and Implications of Integrating Adaptation and Mitigation Programs within the Energy Sector: Lessons from the Energy Sector in British Columbia, Alberta, Saskatchewan, Ontario and the Yukon

**Objective:** The objective of this project is to assess synergies between mitigation and adaptation in the Canadian energy sector in order to maximize the benefits from investments in responding to climate change and enhance the competitiveness of the energy sector.

**Project Lead:** MIRARCO, Laurentian University

**Contact:** Al Douglas, E-mail: [adouglas@mirarco.org](mailto:adouglas@mirarco.org)

## Energy

### **Partner**

**Organizations:** Government of Yukon; Government of Saskatchewan; Government of B.C.

**Region:** Various

**NRCan funding:** \$80,110

**Total funding:** \$160,910

**Status:** Complete

**Results:** *Linking Mitigation and Adaptation Goals in the Energy Sector – A Case Study Synthesis Report*

<http://www.climateontario.ca/doc/reports/Adaptation-MitigationSynthesisReport-FINAL.pdf>

- This report introduces climate change impacts on the Canadian energy sector, and explains adaptation/mitigation synergies and actions. It aims to improve the sector's ability to maximize the benefits of investments and competitiveness in responding to climate change. The results will be useful for sector planners, engineers, and policy-makers.

**Title:** Understanding the Current State of Awareness and Action on Adaptation in the Electricity Generation, Transmission and Local Distribution Sector

**Objective:** The objective of the project is to determine the current state of information, planning and action on adaptation to climate change in the electricity generation and transmission sectors in Canada, to inform decision-making, and reduce risks from a changing climate.

**Project Lead:** Zizzo Allan Professional Corporation

**Contact:** Laura Zizzo, E-mail: [laura@zizzostrategy.com](mailto:laura@zizzostrategy.com)

### **Partner**

**Organizations:** University of Waterloo; Horizon Utilities; New Brunswick Power Holding Corporation

**Region:** National

**NRCan funding:** \$60,000

**Total funding:** \$144,500

**Status:** Complete

## Energy

**Results:** *Understanding Canadian Electricity Generation and Transmission Sectors' Action and Awareness on Climate Change and the Need to Adapt*

<http://zizzostrategy.com/1361/understanding-canadian-electricity-generation-and-transmission-sectors-action-and-awareness-on-climate-change-and-the-need-to-adapt/>

- This report summarizes research conducted with energy transmission and generation sector representatives at the executive and manager level to determine the current status of climate change adaptation in their sector. Its aim is to help inform the best approach to developing adaptation policy and practices in the sector.

**Title:** Climate Change Impacts to the Oil and Gas Sector – Are we Prepared?

**Objective:** This project will determine the current state of information, planning and action on adaptation to climate change among oil and gas companies operating in Western Canada. The focus will be on both the upstream and transmission oil and gas industries in British Columbia, Alberta, and Saskatchewan who have an existing commitment to improve coordination of oil and gas economic development.

**Project Lead:** Resources North Association

**Contact:** Melanie Karjala, Business Development Strategist, E-mail: [Melanie@resourcesnorth.org](mailto:Melanie@resourcesnorth.org)

### **Partner**

**Organizations:** Science and Community Environmental Knowledge; Canadian Association of Petroleum Producers; B.C. Ministry of Environment; Saskatchewan Ministry of Environment; Canadian Energy Pipeline Association; Alberta Environment and Sustainable Resource Development; B.C. Oil and Gas Commission.

**Region:** National

**NRCan funding:** \$50,000

**Total funding:** \$100,750

**Status:** Complete

**Results:** *Climate Change Impacts to the Oil and Gas Sector in Western Canada – How are we Preparing?*

<http://www.bcogris.ca/sites/default/files/cc-2014-01-climate-change-impacts-oil-and-gas-sector-british-columbia-final-report-revised-mar-1715.pdf>

- This report describes the results of an examination of the current state of information, planning and action on adaptation to climate change among oil and gas companies operating in Western Canada. The focus of the research was on the upstream and transmission oil and gas industries in British Columbia, Alberta, and

## Energy

Saskatchewan. This report can be useful to government agencies, producers, associations and other stakeholders.

**Title:** Resilient Pipes and Wires: A Survey of Adaptation Awareness and Action in the Energy Distribution Sub-sector

**Objective:** The objective of the project is to determine the current state of information, planning and action on adaptation to climate change in the electricity distribution sector in Canada to inform decision-making and reduce risks from a changing climate.

**Project Lead:** Quest

**Contact:** Richard Laszlo, Director of Research and Education, E-mail: rlaszlo@questcanada.org

### **Partner**

**Organizations:** Canadian Gas Association; Canadian Electricity Association; International District Energy Association; International Council for Local Environment Initiatives - Canada

**Region:** National

**NRCan funding:** \$50,000

**Total funding:** \$100,000

**Status:** Complete

**Results:** *Resilient Pipes and Wires – Adaptation Awareness, Actions and Policies in the Energy Distribution Sector*

<http://www.questcanada.org/rpw> (landing page)

<http://www.questcanada.org/files/download/f0d858d953eda43> (PDF)

- This report focuses on energy distributors, including electricity, natural gas and thermal energy. It looks at how distributors can enhance the resilience of services in responding to climate change risks. The influence of federal, provincial and local policymakers in driving resilience throughout the distribution sector is also examined.

**Title:** The Impact of Climate Change on Electricity Infrastructure Investments: A National Perspective

**Objective:** The purpose of this project is to identify ways to improve planned electricity infrastructure investments in order to incorporate climate change adaptation considerations into investment projections.

**Project Lead:** Canadian Electricity Association

**Contact:** Michelle Turner, Director, Generation and Environment, E-mail: turner@electricity.ca

## Energy

**Partner**

**Organizations:** Conference Board of Canada; University of Waterloo; Ouranos; Toronto Hydro; New Brunswick Power Corporation; Manitoba Hydro; Ontario Power Generation

**Region:** National

**NRCan funding:** \$163,500

**Total funding:** \$354,200

**Status:** Complete

**Results:** *Adapting to Climate Change: State of Play and Recommendations for the Electricity Sector in Canada*

[http://www.electricity.ca/media/ReportsPublications/Adapting\\_to\\_Climate\\_Change-State\\_of\\_Play\\_and\\_Recommendations\\_for\\_the\\_Electricity\\_Sector\\_in\\_Canada.pdf](http://www.electricity.ca/media/ReportsPublications/Adapting_to_Climate_Change-State_of_Play_and_Recommendations_for_the_Electricity_Sector_in_Canada.pdf)

- This report is Canada's first national-level discussion related to adaptation for electricity generation, transmission and distribution. It addresses risks and opportunities in the electricity sector under a range of climate scenarios, and provides recommendations to help integrate climate change considerations into investment and management decisions.

# FORESTRY

**Title:** Compendium of Forest Adaptation Initiatives across Canada

<https://www.ccadaptation.ca/en/facop-root/facop-root/library/item/3247-compendium-of-forestry-adaptation-initiatives-across-canada-forestry-adaptation-working-group-2014>

- This report provides a centralized collection of information on current or recent forestry adaptation initiatives across Canada. It outlines projects, policy initiatives, and forestry management practices that have attempted to deal with future climate change. This compendium is intended to be a first step in cataloguing current or recently completed forestry adaptation initiatives.

# INFRASTRUCTURE AND BUILDINGS

**Title:** Cities Adapt to Extreme Rainfall

**Objective:** Provision of funding to social science researchers to study immediate after effects of disasters in Canada.

**Project Lead:** Paul Kovacs, Executive Director, Institute for Catastrophic Loss Reduction (ICLR)

**Contact:** Sophie Guilbault, Research Coordinator, Institute for Catastrophic Loss Reduction: sguilbault@iclr.org.

**Partner**

**Organizations:** Institute for Catastrophic Loss Reduction, Natural Hazards Center, University of Colorado  
**Region:** Canada

**NRCan funding:** \$0

**Total funding:** \$125,000

**Status:** Complete

**Results:** *Cities Adapt to Extreme Rainfall*

<http://www.iclr.org/citiesadaptrain.html>

- Cities Adapt to Extreme Rainfall is a book that provides 20 highly accessible best practice case studies of practical measures applied by municipalities across Canada for adapting homes and infrastructure to the impacts of extreme rainfall.

**Title:** Best Practices for Management of Inflow/Infiltration in New Urban Developments

**Status:** Complete

**Results:** *Best Practices Guide: Management of Inflow and infiltration in new urban developments*

[http://www.iclr.org/images/I\\_1\\_Best\\_Practices\\_Guidelines.pdf](http://www.iclr.org/images/I_1_Best_Practices_Guidelines.pdf)

- A best practices guide aimed at municipalities, and the development and home building industries. The guide will outline approaches that can be applied during the planning and construction phases to limit the occurrence of inflow/infiltration in wastewater systems over the lifespan of wastewater infrastructure servicing new developments at the subdivision scale.

## Infrastructure and Buildings

**Title:** IDFCC TOOL: UPDATING IDF CURVES TO ACCOUNT FOR CLIMATE CHANGE IMPACTS

<http://www.idf-cc-uwo.ca/>

- The IDFCC Tool is a publicly accessible, online tool that allows for local water managers and other interested stakeholders to apply GCM outputs to local IDF curves to generate updated IDF curves that account for climate change impacts. The Tool provides access to outputs from 22 Global Climate Models (GCMs), and is pre-loaded with rain monitoring data (e.g., annual maximum precipitation events) from roughly 700 Environment Canada rain monitoring stations. Users can also create and enter data for their own rain monitoring stations.

# MEASURING PROGRESS

**Title:** Measuring Progress on Climate Change Adaptation: Lessons from the Community Well-being Analogue

**Objective:** The objective of this project is to evaluate approaches to measurement of community well-being to identify lessons that may be applicable for the measurement of adaptation to climate change.

**Project Lead:** Wilfrid Laurier University

**Contact:** Dr. Brenda L. Murphy, Associate Professor, E-mail: bmurphy@wlu.ca

**Partner**

**Organizations:** Ontario Ministry of Agriculture, Food and Rural Affairs

**Region:** National

**NRCan funding:** \$17,137

**Total funding:** \$78,387

**Status:** Complete

**Results:** *Measuring Progress on Climate Change Adaptation: Lessons from the Community Well-Being Analogue*

- The paper examines the measurement of community well-being to provide insights for the measurement of adaptation. It includes a brief overview of the roots and indicators of the community well-being concept, results from interviews with leaders in community well-being initiatives, and the lessons learned that would be useful for the development of measurement approaches in the adaptation context.

**Title:** Learning Through Similar Approaches for Measuring the Progress of Climate Change Adaptation

**Objective:** The objective of this project is to describe the Monitoring and Evaluation approaches through these two case studies and to draw observations and comparisons that may be insightful to monitoring and evaluation of adaptation to climate change.

**Project Lead:** Ouranos

**Contact:** Caroline Larrivée Larrivee.Caroline@ouranos.ca

## Measuring Progress

### Partner

**Organizations:** Hydro-Québec; Direction de la santé publique de Montérégie

**Region:** National

**NRCan funding:** \$61,250

**Total funding:** \$134,175

**Status:** Complete

**Results:** *Developing Knowledge on Monitoring and Evaluation Through the Study of Analogues for Climate Change Adaptation Measurement*

<https://www.ouranos.ca/publications/> (Search keyword: analogue)

- This report reviews the monitoring and evaluation of a public health and an energy initiative to identify lessons that can be applied to the measurement of adaptation to climate change. The information will be useful to people who are planning to monitor and evaluate adaptation programs and actions.

**Title:** Research and Analysis of Measuring and Evaluation Programs in Climate Change Adaptation Analogues

**Objective:** The objective of this project is to evaluate approaches to measurement of progress and success in other policy issues to identify lessons that may be applicable for the measurement of adaptation to climate change.

**Project Lead:** MIRARCO

**Contact:** Al Douglas, E-mail: [adouglas@mirarco.org](mailto:adouglas@mirarco.org)

### Partner

**Organizations:** Risk Sciences International

**Region:** National

**NRCan funding:** \$140,366

**Total funding:** \$281,045

**Status:** Complete

**Results:** *Research and Analysis of Monitoring and Evaluation Programs as Analogues for Climate Change Adaptation Measurement*

[http://www.climateontario.ca/doc/p\\_ECCC/AP048-Report\\_FINAL-MIRARCO.pdf](http://www.climateontario.ca/doc/p_ECCC/AP048-Report_FINAL-MIRARCO.pdf)

## Measuring Progress

- This report pulls out lessons on monitoring and evaluation that are relevant to the measurement of climate change adaptation from two diverse programs: British Columbia’s Forest and Range Evaluation Program; and, the School Health Action, Planning and Evaluation System program.

*Research and Analysis of Monitoring and Evaluation Programs as Analogues for Climate Change Adaptation Measurement – Executive Summary*

[http://www.climateontario.ca/doc/p\\_ECCC/AP048-Executive\\_Summary\\_FINAL-MIRARCO.pdf](http://www.climateontario.ca/doc/p_ECCC/AP048-Executive_Summary_FINAL-MIRARCO.pdf)

**Title:** Transferability of the Adaptation Indicators Selected and Reported in the United Kingdom to the Canadian Context

**Objective:** The objective of this project is to review United Kingdom’s selection and use of indicators to measure progress and effectiveness of climate change adaptation and identify lessons that may be applicable for measurement of adaptation in Canada.

**Project Lead:** Ernst & Young LLP

**Contact:** Cathy Cobey, Associate Partner, E-mail: [cathy.r.cobey@ca.ey.com](mailto:cathy.r.cobey@ca.ey.com)

### **Partner**

**Organizations:** United Kingdom Adaptation Sub-committee

**Region:** National

**NRCan funding:** \$75,000

**Total funding:** \$150,000

**Status:** Complete

**Results:** *An Assessment of the Transferability of the UK’s Approach to Monitoring and Evaluating Climate Adaptation Progress to the Canadian Context*

[http://www.ey.com/Publication/vwLUAssets/EY-Research-Study\\_UK-approach-to-adaptation-measurement-May2015/\\$FILE/EY-Research-Study\\_UK-approach-to-adaptation-measurement-May2015.pdf](http://www.ey.com/Publication/vwLUAssets/EY-Research-Study_UK-approach-to-adaptation-measurement-May2015/$FILE/EY-Research-Study_UK-approach-to-adaptation-measurement-May2015.pdf)

- This study reviewed the United Kingdom’s past and current approach to measuring adaptation and provided recommendations for adopting its approach in Canada.

## Measuring Progress

**Title:** Analysis of Indicators in Climate Change Adaptation Used in Countries of the Organisation for Economic Cooperation and Development (OECD): The Case of Coastal Management

**Objective:** The objective of this project is to conduct a review of international initiatives that use indicators to measure progress on adaptation in coastal areas.

**Project Lead:** École nationale d'administration publique (ÉNAP)

**Contact:** Moktar Lamari, Ph. D., Professeur et Directeur, Centre de recherche et d'expertise en évaluation (CREXE), Courriel : moktar.lamari@enap.ca

### **Partner**

**Organizations:** Ouranos

**Region:** National

**NRCan funding:** \$92,943

**Total funding:** \$227,987

**Status:** Complete

**Results:** *Adapting to Climate Change, Acclimatizing Public Policies: Measures and Excesses of Adaptation to Climate Change in Coastal Zones in Principal OECD Countries.*

<http://archives.enap.ca/bibliotheques/2016/05/031118381.pdf>

- The report discusses the indicators used by Australia, Canada, USA, France, New Zealand, the Netherlands and the United Kingdom to measure adaptation. Examples of the indicators are included in annexes.

**Title:** Using Columbia Basin “State of the Basin” Indicators to Measure Climate Adaptation

**Objective:** The objective of this project is to review existing State of the Basin indicators in the Columbia Basin to assess their ability to measure the effectiveness of climate change adaptation.

**Project Lead:** Columbia Basin Trust

**Contact:** Tim Hicks, Manager, Water and Environment, E-mail: thicks@cbt.org

### **Partner**

**Organizations:** West Coast Environmental Law, Rural Development Institute – Selkirk College, Engineers Canada, British Columbia Ministry of Environment, British Columbia Ministry of Communities, Sport and Culture, Emergency Management British Columbia, Pacific Climate Impacts Consortium

## Measuring Progress

**Region:** National

**NRCan funding:** \$74,600

**Total funding:** \$150,129

**Status:** Complete

**Results:** *Indicators of Climate Adaptation in the Columbia Basin. How “State of the Basin” Indicators can be used to Measure Climate Change*

<http://adaptationresourcekit.squarespace.com/storage/Final%20Report%2015-03-15%20Web%20.pdf>

- This report analyses how the current Columbia Basin “State of the Basin” indicators could be used to measure adaptation to climate change, and identifies new indicators that would be useful.

*Climate Resilience Indicator Literature Review.*

<http://adaptationresourcekit.squarespace.com/storage/Review%2015-03-15%20Web%20.pdf>

- This literature review documents and describes the types of indicators that are currently in use or that have been proposed for tracking climate change, impacts and adaptation.

*Measuring progress on climate adaptation in the Columbia Basin. Indicators and pathways to chart the course – a summary report.*

<http://adaptationresourcekit.squarespace.com/storage/Summary%2011-03-15%20Web.pdf>

- This report provides an overview of the process taken to review and develop indicators for measuring progress on adaptation, including the development of adaptation pathways for five key topics (agriculture, extreme weather and emergency preparedness, flooding, water supply and wildfire).

*Introducing State of Climate Adaptation and Resilience Indicators in the Basin: Using indicators to measure progress on adaptation in the basin*

<https://www.youtube.com/watch?v=hDp6orvPkRo&feature=youtu.be>

- This whiteboard-style video introduces the use of indicators to measure adaptation and resilience in the Canadian Columbia Basin.

## Measuring Progress

**Title:** Best Practices in Surveying for the Measurement of Climate Change Adaptation.

**Objective:** The objective of the work is to provide guidance on the use of surveys for the measurement of both progress in implementation of adaptation and effectiveness of actions taken to adapt to climate change. Surveying includes survey design, survey population identification and access, survey delivery, analysis and interpretation.

**Project Lead:** Natural Resources Canada

**Region:** National

**NRCan funding:** \$30,744

**Status:** Complete

**Results:** *Best practices in surveying for the measurement of climate change adaptation – Guidance document*

- This document provides guidance on the use of surveys for measurement of progress and effectiveness of adaptation.

**Title:** Measuring Progress: An Analysis of Indicators Used in Four Canadian Sectors and their Transferability to Adaptation

**Objective:** The objective of this Project is to review indicators of sustainability to determine their usefulness for measurement of adaptation in Canada.

**Project Lead:** Clean Air Partnership

**Contact:** Kevin Behan, Deputy Director, E-mail: [kbehan@cleanairpartnership.org](mailto:kbehan@cleanairpartnership.org)

### **Partner**

**Organisations:** ICLEI Canada, Institute for Catastrophic Loss Reductions, Mining Innovation Rehabilitation and Applied Research Corporation, University of Prince Edward Island, Greater Toronto Area Clean Air Council

**Region:** National, International

**NRCan funding:** \$126,350

**Total funding:** \$253,800

**Status:** Complete

**Results:** *Are we there yet? Applying Sustainability Indicators to Measure Adaptation*

<http://www.icleicanada.org/programs/adaptation/item/233-are-we-there-yet-applying-sustainability-indicators-to-measure-progress-on-adaptation>

## Measuring Progress

- This report lists forty indicators used in four sectors (coastal management, flood management, infrastructure and health) that can be used to measure adaptation. The report discusses context, limitations and potential data sources for each indicator.

**Title:** Research into the Use of Climate Change Adaptation Indicators in OECD Countries Lessons for Public Agencies

**Objective:** The purpose of this Project is to review the selection and use of indicators to measure progress and effectiveness of climate change adaptation in selected OECD countries and identify lessons for measurement of adaptation in Canada

**Project Lead:** International Council for Local Environment Initiatives – Canada

**Contact:** Ewa Jackson, E-mail: [ewa.jackson@iclei.org](mailto:ewa.jackson@iclei.org)

### **Partner**

**Organizations:** Simon Fraser University, ICLEI – USA, ICLEI – Korea, ICLEI – Europe, ICLEI World Secretariat

**Region:** National

**NRCan funding:** \$100,350

**Total funding:** \$210,150

**Status:** Complete

**Results:** *Research into the Use of Climate Change Adaptation Indicators in OECD Countries: Lessons for Canada*

<http://www.icleicanada.org/resources/item/234-climate-change-adaptation-indicators-in-oecd-countries-lessons-for-canada>

- This document a “matrix” of three hundred and fifty five adaptation indicators from nine countries.

# MINING

**Title:** Understanding Policy Enablers and Barriers for Adaptation Mainstreaming in the Mining Sector in the Prairies

**Objective:** The purpose of the project is to assess Saskatchewan and Manitoba's provincial government policies and programs in identified priority areas related to the mining sector for their ability to support or hinder adaptation under a changing climate.

**Project Lead:** Saskatchewan Watershed Authority

**Contact:** Tom Harrison, Director, E-mail: Tom.Harrison@wsask.ca

**Partner**

**Organizations:** Government of Saskatchewan; Government of Manitoba

**Region:** Manitoba, Saskatchewan

**NRCan funding:** \$52,000

**Total funding:** \$104,000

**Status:** Complete

**Results:** *Adaptive Policy Analysis of Mining Policies in Manitoba*

[http://www.iisd.org/sites/default/files/publications/adapttool\\_manitoba\\_mining.pdf](http://www.iisd.org/sites/default/files/publications/adapttool_manitoba_mining.pdf)

- This report summarizes the results of a review of six provincial policies related to the mining sector. The review examined their ability to enable or hinder adaptation actions in the sector. Policies examined included the Manitoba Mines Act and Mine closure regulations.

*Adaptive Policy Analysis of Mining Policies in Saskatchewan*

[http://www.iisd.org/sites/default/files/publications/adapttool\\_saskatchewan\\_mining.pdf](http://www.iisd.org/sites/default/files/publications/adapttool_saskatchewan_mining.pdf)

- This report summarizes the results of a review of nine provincial policies and programs related to the mining sector. The review examined their ability to enable or hinder adaptation actions in the sector. Policies examined included the Guidelines for Northern Mine Decommissioning and the Drainage Approval Process.

## Mining

*Strengthening Adaptive Capacity in Two Canadian Provinces : ADAPTool Analysis of Selected Mining Policies in Manitoba and Saskatchewan : A Synthesis Report*

[http://www.iisd.org/sites/default/files/publications/adapttool\\_mining\\_synthesis.pdf](http://www.iisd.org/sites/default/files/publications/adapttool_mining_synthesis.pdf)

**Title:** Policy Drivers and Barriers to Adaptation for the Mining Sector in British Columbia

**Objective:** The purpose of the project is to assess B.C. Government provincial policies and programs related to the mining sector for their ability to support adaptation under current climate risks, extreme weather events and future climate change.

**Project Lead:** B.C. Ministry of Environment

**Region:** British Columbia

**NRCan funding:** \$40,000

**Total funding:** \$91,500

**Status:** Complete

**Results:** *Policy Issues and Barriers to Climate Change Adaptation for the B.C. Mining Sector*

- This report is an analysis of government policies and programs affecting climate change adaptation in B.C.'s mining sector. It examined their ability to enable or hinder adaptation. The report includes detailed information regarding specific government acts, how they relate to adaptation, and recommendations for future action.

**Title:** Understanding Mining Policy Drivers and Barriers in the Context of Climate Change Impacts and Adaptation

**Objective:** The purpose of the project is to analyze Ontario Government provincial policies and programs related to the mining sector for their ability to support or hinder adaptation to climate change.

**Project Lead:** MIRARCO

**Contact:** Al Douglas, E-mail: [adouglas@mirarco.org](mailto:adouglas@mirarco.org)

**Partner**

**Organizations:** Centre of Excellence in Mining Innovation

**Region:** Ontario

**NRCan funding:** \$70,000

**Total funding:** \$140,400

## Mining

**Status:** Complete

**Results:** *Understanding Mining Policy Drivers and Barriers in the Context of Climate Change Impacts and Adaptation*

[http://www.climateontario.ca/doc/p\\_ECCC/AP049\\_MIRARCO\\_RSI\\_Mining\\_Policy\\_Report-Final.pdf](http://www.climateontario.ca/doc/p_ECCC/AP049_MIRARCO_RSI_Mining_Policy_Report-Final.pdf)

- This study assesses the ability of 10 of Ontario's existing mining policy tools to support climate change adaptation. It focuses on policy instruments relating to tailings facility design and management, and mine closure planning.

**Title:** Incorporation of Climate Change in Environmental Assessments of Mining Projects

**Objective:** The purpose of the project is to provide insights about actions recommended and/or taken to address the risks related to a changing climate based on a review of past environmental assessments.

**Project Lead:** MIRARCO

**Contact:** Al Douglas, E-mail: [adouglas@mirarco.org](mailto:adouglas@mirarco.org)

### **Partner**

**Organizations:** Centre for Excellence in Mining Innovation; Golder Associates; Risk Sciences International

**Region:** National

**NRCan funding:** \$103,000

**Total funding:** \$206,000

**Status:** Complete

**Results:** *Economic Impacts of a Changing Climate on Mine Sites in Canada: Assessing Proactive Adaptation Investments against Estimated Reactive Costs*

- A modelling tool was developed to assess the costs and benefits of making proactive investments in adaptation measures at mine sites compared with responding to climate change impacts when effects are realized. The report provides the results of applying the tool to do this assessment for four mine sites in Ontario and Quebec. The results demonstrate that the modelling tool can assist managers to identify those mine sites with greater risk of climate change impacts, and to determine the financial viability of potential investments in adaptation measures.

## Mining

**Title:** Case Studies of Adaptation to Climate Change in the Canadian Mining Sector

**Objective:** The objective of this project is to undertake case studies of adaptation to climate change by mining companies from across Canada and share this information with Canada's mining sector.

**Project Lead:** Arctic North Consulting

**Contact:** Dr. Tristan Pearce, Partner, E-mail: [tristanpearce@gmail.com](mailto:tristanpearce@gmail.com)

**Partner**

**Organizations:** Northern Climate ExChange; Pittman Sustainability Consulting; Frank Duerden Consulting

**Region:** Saskatchewan, Yukon

**NRCan funding:** \$80,600

**Total funding:** \$167,910

**Status:** Complete

**Results:** *Adaptation to Climate Change and Potash Mining in Saskatchewan*

[http://testing.arctic-north.com/wp-content/uploads/2012/09/saskatchewan\\_web.pdf](http://testing.arctic-north.com/wp-content/uploads/2012/09/saskatchewan_web.pdf)

- This case study documents how six mines in the Qu'Appelle River Watershed are adapting to risks related to water scarcity, flooding and extreme weather by investing in infrastructure, innovative sourcing of water, water reuse, and proactive planning. The lessons from this case study may be useful to the practitioners in the mining sector.

*Case Studies of Adaptation to Climate Change in the Yukon Mining Sector*

<http://testing.arctic-north.com/wp-content/uploads/2012/09/yukon-web.pdf>

- This report examines climate change risks and adaptive strategies in Yukon mines that can be applied to manage these risks in three stages in the life of a mine: planning, operation, and remediation. The lessons from this case study may be useful to the practitioners in the mining sector.

**Title:** Risks to Mining Companies Related to Extreme Climate Events: Case Studies of Adaptation Actions Focusing on the Qu'Appelle River Watersheds

**Objective:** The objective of this project is to undertake case studies of adaptation to climate change by mining companies of the Qu'Appelle River watershed and share this information with Canada's mining sector.

## Mining

**Project Lead:** Saskatchewan Water Authority

**Contact:** Tom Harrison, Director, Partnerships and Plan Implementation, E-mail:  
Tom.harrison@swa.ca

**Partner**

**Organizations:** Saskatchewan Research Council; Watershed Implementation Fund; WUQWATR; Lower Qu'Appelle Watershed Stewardship; Saskatchewan Mining Association; Elaine Wheaton (consultant); Government of Saskatchewan

**Region:** Saskatchewan

**NRCan funding:** \$80,000

**Total funding:** \$179,200

**Status:** Complete

**Results:** *Past, Present and Future Vulnerability and Risk Assessment to Climate Extremes for Potash Mines in the Qu'Appelle River Watershed: Literature Review*

- This report examines historic climate risks to the potash industry, estimates future impacts due to climate change, proposes potential solutions, and includes a preliminary cost-benefit analysis for the adaptation strategies.

*Characterization of Historical Drought and Excess Moisture in the Qu'Appelle River Watershed*

<http://www.parc.ca/rac/fileManagement/upload/1TLandofExtremesDEM%20report%202011-12%20v2.pdf>

- This study provides an overview of the climate of the Qu'Appelle River Watershed over the last 110 years, including temperature, precipitation, drought, and evapo-transpiration. Knowledge of historical climate extremes can help inform adaptation decisions to reduce the impact of future events.

*Risks of Dry and Wet Extremes in Southeast Saskatchewan: From the Past into the Future*

- This short overview covers the basics of climate change and climate impacts due to extreme weather in southern Saskatchewan, a region which holds the records for some of the greatest wet and hot extremes in Canada.

*Future Possible Dry and Wet Extremes in Saskatchewan*

- This literature review characterizes projections of future severe weather events and identifies worst-case scenarios for drought and precipitation for the Upper and Lower Qu'Appelle Valley in Saskatchewan. Although prepared to support case studies in the mining sector, the report will be useful for those planning for future climate change in the region.

## Mining

### *What Risks to Potash Mining are Posed by Droughts?*

- This presentation communicates the risks to potash mining in Saskatchewan posed by climate change. Information on different types of droughts and the impacts they have on industrial mining activity is included.

**Title:** Adaptation in the Mining Sector in Canada: A Compilation of Case Studies

**Objective:** The objective of this project is to undertake case studies of adaptation to climate change by mining companies from across Canada to provide information about what companies are already doing about adaptation and share this information with Canada's mining sector.

**Project Lead:** Fraser Basin Council

**Contact:** Bob Purdy, Director, External Relations & Corporate Development, Email: [bpurdy@fraserbasin.bc.ca](mailto:bpurdy@fraserbasin.bc.ca)

#### **Partner**

**Organizations:** Mining Innovations Rehabilitation and Applied Research Corporation; Centre for Excellence in Mining Innovation; Golder Associates

**Region:** British Columbia, Ontario

**NRCan funding:** \$100,000

**Total funding:** \$244,508

**Status:** Complete

**Results:** *Climate Change Planning at Glencore in Sudbury, Ontario*

[http://www.retooling.ca/Library/Mining\\_Essentials/mining\\_case\\_study\\_glencore.pdf](http://www.retooling.ca/Library/Mining_Essentials/mining_case_study_glencore.pdf)

- This case study outlines the climate change adaptation planning and action currently underway at Glencore's integrated nickel mining operations in Sudbury. It is intended to be a source of information for other mining operations in Canada seeking to understand how their business will be impacted by climate change.

### *Enhancing Weather Resiliency at Nyrstar Myra Falls*

[http://www.retooling.ca/Library/Mining\\_Essentials/mining\\_case\\_study\\_nyrstar.pdf](http://www.retooling.ca/Library/Mining_Essentials/mining_case_study_nyrstar.pdf)

- This case study describes the efforts of Nyrstar to deal with weather-related challenges at its Myra Falls operation on Vancouver Island. It is intended to be a source of information for other mining operations seeking to understand how their business will be impacted by climate change.

## Mining

*Addressing Weather Related Challenges at the Galore Creek Project, Northwestern British Columbia.*

[http://www.retooling.ca/Library/Mining\\_Essentials/fbc\\_mining\\_case\\_study\\_galore\\_creek.pdf](http://www.retooling.ca/Library/Mining_Essentials/fbc_mining_case_study_galore_creek.pdf)

- This case study focuses on work undertaken at Galore Creek Mining Corporation related to an extreme rainfall event in 2011, and to address future weather and climate-related challenges. It is intended to be a source of information for other mining operations seeking to understand how their business will be impacted by climate change.

**Title:** Economic Impacts of a Changing Climate on the Operations and Reclamation of Mines: A Comparison of Proactive and Reactive Approaches

**Objective:** The objective of this project is to prepare four case studies that examine the economic impacts of climate change on the mining sector and the adaptation actions that can be used to address them.

**Project Lead:** Ernst & Young LLP

**Contact:** Cathy Cobey, Associate Partner, E-mail: [cathy.r.cobey@ca.ey.com](mailto:cathy.r.cobey@ca.ey.com)

**Region:** British Columbia, Québec

**NRCan funding:** \$100,000

**Total funding:** \$215,000

**Status:** Complete

**Results:** *Economic Impacts of a Changing Climate on Mine Sites in Canada: Assessing Proactive Adaptation Investments Against Estimated Reactive Costs*

[http://www.ey.com/Publication/vwLUAssets/EY-NRCan-climate-change-adaptation-analysis-report-Mining/\\$File/NRCan%20climate%20change%20adaptation%20analysis%20report\\_mining.pdf](http://www.ey.com/Publication/vwLUAssets/EY-NRCan-climate-change-adaptation-analysis-report-Mining/$File/NRCan%20climate%20change%20adaptation%20analysis%20report_mining.pdf)

- This report describes the impacts of climate change on mining operations, transportation and reclamation in Ontario and Quebec. It includes a modeling tool for decision-makers in the mining sector to assess the net present value of undertaking adaptation actions, versus responding to impacts as they occur.

## Mining

**Title:** Economic Implications of Climate Change Adaptations for Mine Access Roads in Northern Canada

**Objective:** The objective of this project is to prepare a case study that examines the economic impacts of climate change on a seasonal mine access road in northern Canada and of the adaptation actions that can be used to address them.

**Project Lead:** Northern Climate ExChange

**Contact:** Lacia Kinnear, Manager, E-mail: [lkinnear@yukoncollege.yk.ca](mailto:lkinnear@yukoncollege.yk.ca)

### **Partner**

**Organizations:** Risk Sciences International; International Institute for Sustainable Development; Government of Northwest Territories

**Region:** North

**NRCan funding:** \$122,502

**Total funding:** \$287,002

**Status:** Complete

**Results:** *Economic Implications of Climate Change Adaptations for Mine Access Roads in Northern Canada. A Case Study of the Tibbitt to Contwoyto Winter Road*

[http://www.yukoncollege.yk.ca/downloads/Economic\\_Implications\\_TCWR\\_FINAL\\_web3.pdf](http://www.yukoncollege.yk.ca/downloads/Economic_Implications_TCWR_FINAL_web3.pdf)

- This report presents the results of a cost-benefit analysis for a range of adaptation options for the Tibbitt to Contwoyto winter ice road. The Tibbitt to Contwoyto ice road, supports four mines, and is the busiest heavy-haul ice road in the world.

**Title:** Climate Change Impacts and Adaptation Mining Survey

**Objective:** The objective of this Project is to survey mining companies in Canada to identify the current state of adaptation activity.

**Project Lead:** Mining Association of Canada

**Contact:** Ben Chalmers, Vice President, Sustainable Development, E-mail: [bchalmers@mining.ca](mailto:bchalmers@mining.ca)

### **Partner**

**Organizations:** Members of the Mining Association of Canada

**Region:** National

**NRCan funding:** \$20,000

## Mining

**Total funding:** \$42,300

**Status:** Complete

**Results:** *Climate Adaptation in the Canadian Mining Sector*

[http://mining.ca/sites/default/files/documents/Climate\\_Adaptation\\_in\\_the\\_Canadian\\_Mining\\_Sector\\_2014.pdf](http://mining.ca/sites/default/files/documents/Climate_Adaptation_in_the_Canadian_Mining_Sector_2014.pdf)

- This report presents the results of a survey of twenty six Canadian mining companies with operations across Canada about their current adaptation actions.

**Title:** Development of Climate Change Economic Case Analysis for the Mining Sector

**Objective:** The objective of this Project is to prepare four case studies that examine the economic impacts of climate change on the mining sector and the adaptation actions that can be used to address them.

**Project Lead:** Mining Innovation Rehabilitation and Applied Research Corporation

**Contact:** Al Douglas, Project Lead, Ontario Centre for Climate Impacts and Adaptation Resources, E-mail: [adouglas@mirarco.org](mailto:adouglas@mirarco.org)

### **Partner**

**Organizations:** Glencore; Golder Associates; Fraser Basin Council; Manitoba Department of Innovation, Energy and Mines

**Region:** Manitoba, Ontario

**NRCan funding:** \$95,000

**Total funding:** \$190,500

**Status:** Complete

**Results:** *Cost Benefit Analysis of Climate Change Impacts and Adaptation Measures for Canadian Mines – Final Report*

[http://www.climateontario.ca/doc/p\\_ECCC/1-AP261-FinalReport-FINAL.PDF](http://www.climateontario.ca/doc/p_ECCC/1-AP261-FinalReport-FINAL.PDF)

<http://www.climateontario.ca/casestudies.php>

- This report describes the development and application of cost benefit analysis for potential adaptation actions at two Canadian mine sites.

## Mining

*Case Study: Economic Case Analysis of Climate Change Impacts and Adaptation Measures: Sudbury Integrated Nickel Operations*

[http://www.climateontario.ca/doc/p\\_ECCC/4-AP261-SINO-CasesStudy-FINAL.PDF](http://www.climateontario.ca/doc/p_ECCC/4-AP261-SINO-CasesStudy-FINAL.PDF)

- This case study summarizes the results of a cost benefit analysis of climate change impacts and potential adaptation measures related to water management for Glencore's Sudbury Integrated Nickel Operations.

*Cost Benefit Analysis of Climate Change Impacts and Adaptation Measures for Canadian Mines – Literature Review*

[http://www.climateontario.ca/doc/p\\_ECCC/3-AP261-LiteratureReview-FINAL.PDF](http://www.climateontario.ca/doc/p_ECCC/3-AP261-LiteratureReview-FINAL.PDF)

- This literature review, specific to the mining sector, explores existing tools and resources available to assist decision-makers in assessing the costs and benefits of adaptation.

*Developing Climate Change Economic Case Analysis: A Guide to Using the Climate Change Cost-Benefit Analysis Tool*

[http://www.climateontario.ca/doc/p\\_ECCC/2-AP261-Guidebook-FINAL.PDF](http://www.climateontario.ca/doc/p_ECCC/2-AP261-Guidebook-FINAL.PDF)

- This report provides guidance for the use of the cost-benefit analysis approach developed and used to assess potential adaptation actions at two Canadian mine sites.

**Title:** Economic Impacts of a Changing Climate on the Operations and Reclamation of Mines: A Comparison of Proactive and Reactive Approaches

**Objective:** The objective of this Project is to prepare four case studies that examine the economic impacts of climate change on the mining sector and the adaptation actions that can be used to address them.

**Project Lead:** Ernst & Young LLP

**Contact:** Cathy Cobey, Associate Partner, E-mail: [cathy.r.cobey@ca.ey.com](mailto:cathy.r.cobey@ca.ey.com)

**Region:** National

**NRCan funding:** \$100,000

**Total funding:** \$215,000

**Status:** Complete

## **Mining**

**Results:** *Economic Impacts of a Changing Climate on Mine Sites in Canada: Assessing Proactive Adaptation Investments against Estimated Reactive Costs*

[http://www.ey.com/Publication/vwLUAssets/EY-NRCan-climate-change-adaptation-analysis-report-Mining/\\$File/NRCan%20climate%20change%20adaptation%20analysis%20report\\_mining.pdf](http://www.ey.com/Publication/vwLUAssets/EY-NRCan-climate-change-adaptation-analysis-report-Mining/$File/NRCan%20climate%20change%20adaptation%20analysis%20report_mining.pdf)

- This report discusses the results of a study examining the costs and benefits of investing in proactive adaptation measures versus a “do nothing” scenario that included only repair and remediation costs. Data from four Canadian mine sites were used to conduct this study.

# NORTHERN

**Title:** A Systematic Review of Climate Change Hazard-related Mapping Activities and Vulnerability Assessments of the Built Environment in Canada's North to Inform Climate Change Adaptation

**Objective:** The project will identify and evaluate climate hazard mapping and vulnerability assessments of the built environment in Canada's North to inform future hazard mapping and vulnerability assessments relevant to the built environment in Canada's North.

**Project Leads:** McGill University and Risk Sciences International

**Contacts:** Dr James D. Ford, Asst. Professor, Climate Change Adaptation Research Group, Dept. of Geography, Email: james.ford@mcgill.ca; Mr. Erik Sparling, Director, Climate Risk Decision Support, Email: esparling@risksciencesint.com

## **Partner**

**Organizations:** Ouranos; Memorial University

**Region:** North

**NRCan funding:** \$129,490

**Total funding:** \$261,005

**Status:** Complete

**Results:** *Adapting the Built Environment in a Changing Northern Climate*

<http://www.jamesford.ca/archives/2266>

- This report reviews climate-related hazard and vulnerability assessments in Canada's North and their applicability for use in adaptation activities. The document identifies vulnerabilities, evaluates current adaptation activities, identifies priorities, and includes recommendations aimed at advancing hazard identification in the North.

*Adapting the Built Environment in a Changing Northern Climate: Searchable Database*

- This online database provides a searchable listing of climate change adaptation information affecting Canada's North. Reports included were published during 2007-2012, and cover all three territories, Yukon, Northwest Territories and Nunavut.

## Northern

**Title:** Enhancing Knowledge Transfer to Decision-Makers with Respect to Climate Change Impacts on the Cryosphere

**Objective:** This project will assess the evidence of current changes to permafrost and snow conditions as well as information about projected changes, and developed and tested information and communication products for climate change adaptation decision-making in the northern mining and land transportation sectors.

**Project Lead:** Yukon College

**Contact:** Lacia Kinnear, E-mail: lkinnear@yukoncollege.yk.ca

**Partner**

**Organizations:** Risk Sciences International; Mining Innovation Rehabilitation and Applied Research Corporation; Government of Northwest Territories Department of Transportation

**Region:** North

**NRCan funding:** \$99,832

**Total funding:** \$239,952

**Status:** Complete

**Results:** *Enhancing Knowledge Transfer to Decision Makers with Respect to Climate Change Impacts on the Cryosphere: Literature Review Report*

[http://yukoncollege.yk.ca/research/abstracts/Knowledge\\_transfer\\_final\\_report](http://yukoncollege.yk.ca/research/abstracts/Knowledge_transfer_final_report)

[http://www.yukoncollege.yk.ca//downloads/Resilience\\_of\\_Mining\\_and\\_Transportation\\_Sectors\\_Final\\_Report.pdf](http://www.yukoncollege.yk.ca//downloads/Resilience_of_Mining_and_Transportation_Sectors_Final_Report.pdf)

- This literature review focuses on the impacts of changes to snow and permafrost on transportation and mining in the Yukon and Northwest Territories.

**Title:** Baseline Analysis of Mainstreaming Adaptation into Natural Resources Development Activities in the Hudson Bay Inland Sea Region

**Objective:** This project will identify how existing natural resource companies and government sectors operating in Canada's North (specifically within the Hudson Bay Inland Sea region) currently integrate climate change in their operations, identify how risks related to future climate change are being addressed in planned resource development in Canada's North, and develop recommendations for future consideration to support sustainable resource development in a changing climate.

**Project Lead:** International Institute for Sustainable Development

## Northern

**Contact:** Darren Swanson, Deputy Director, Natural and Social Capital Program, E-mail: dswanson@iisd.ca

### **Partner**

**Organizations:** Hydro Quebec; Manitoba Hydro; University of Winnipeg; Centre for the North; Government of Manitoba; Government of Nunavut; Government of Ontario

**Region:** Manitoba, Ontario

**NRCan funding:** \$52,000

**Total funding:** \$104,000

**Status:** Complete

**Results:** *Baseline Analysis of Mainstreaming Adaptation into Natural Resource Development Activities in the Hudson Bay Inland Sea Region*

- This report provide a baseline of how climate adaptation is being incorporated into development planning by government and industry in the context of community level adaptive capacity in the Hudson Bay Inland Sea Region.

**Title:** Climate Risk Assessment of Transportation Requirements for the Manitoba-Nunavut Supply Chain

**Objective:** This project will undertake a climate vulnerability risk assessment of the transportation infrastructure that supports the supply chain between Manitoba and Nunavut. The outcomes of this project will increase awareness of climate related vulnerabilities among policy makers and planners in the Governments of Manitoba and Nunavut, and key private-sector stakeholders who rely on transportation for the development and expansion of their operations in this region.

**Project Lead:** University of Winnipeg

**Contact:** Terry Duguid, Director, Northern Sustainable Prosperity Initiative, E-mail: tduguid@mymts.net

### **Partner**

**Organizations:** Calm Air; Centre Port Canada; Engineers Canada; Gardewine Group; International Institute for Sustainable Development; Kivalliq Inuit Association; Mining Association of Manitoba; North West Company; Omni Trax Inc.; Winnipeg Airport Authority; Stantec Consulting Ltd.; Government of Manitoba; Government of Nunavut; City of Thompson; Town of Churchill

**Region:** North

**NRCan funding:** \$125,000

**Total funding:** \$267,500

## Northern

**Status:** Complete

**Results:** *Climate Risk Assessment of Transportation Infrastructure Requirements Supporting the MB-NU Supply Chain*

- This report focuses on the supply of goods and services between northern Manitoba and the Kivalliq region of Nunavut, improving our understanding of the transportation infrastructure and vulnerabilities in the face of climate change and a growing north.

**Title:** Risk Assessment of Key Buildings and Infrastructure in Ross River, Yukon, Related to Permafrost Degradation

**Objective:** The objective of this project is to assess the risks to public infrastructure managed by Yukon Government's Property Management Division (PMD), and supporting current and future economic development, posed by permafrost degradation in Ross River. The outcome of this project will inform the maintenance and design of existing and new infrastructure in northern communities supporting non-renewable resource extraction, ensuring their continued contribution to Canada's northern economy.

**Project Lead:** Northern Climate ExChange Yukon College

**Contact:** Dr. Fabrice Calmels, Research Associate, Northern Climate ExChange, E-mail: fcalmels@yukoncollege.yk.ca

**Partner**

**Organizations:** Government of Yukon; Yukon Geological Society

**Region:** Yukon

**NRCan funding:** \$186,499

**Total funding:** \$401,546

**Status:** Ongoing

**Title:** Impacts of Change on Storminess and Storm Surges in Hudson Bay and James Bay

**Objective:** The objective of this project is to estimate the impact of climate change on existing and future infrastructure for selected sites along the shores of James Bay sites and Hudson Bay.

**Project Lead:** Ouranos

**Contact:** Jean Pierre Savard, Oceanographer Email : savard.jean-pierre@ouranos.ca

## Northern

### **Partner**

**Organizations:** Ministère de Transport Québec

**Region:** Quebec, Ontario, Manitoba

**NRCan funding:** \$131,400

**Total funding:** \$263,900

**Status:** Complete

**Results:** *Impacts des changements climatiques sur le régime des tempêtes et les niveaux d'eau extrêmes dans la Baie D'Hudson, la Baie Janes et le Détroit D'Hudson (en français)*

<https://www.ouranos.ca/publication-scientifique/RapportSavard2016.pdf>

**Title:** Arctic Council Information Portal

**Objective:** The objective of this project is to develop an online adaptation information portal for the circumpolar Northern region that will enhance adaptive capacity, foster innovation and learning-by-doing, and facilitate the development of best practices in climate change adaptation for governments, industry, and Arctic indigenous peoples.

**Project Lead:** Yukon Government

**Contact:** Stephen Roddick, Adaptation and Outreach Coordinator, Climate Change Secretariat, Department of Environment, E-mail: Stephen.Roddick@gov.yk.ca

### **Partner**

**Organizations:** University of Alaska Fairbanks

**Region:** North

**NRCan funding:** \$113,000

**Total funding:** \$332,000

**Status:** Complete

**Results:** *The Arctic Adaptation Exchange:*

<http://arcticadaptationexchange.com/>

- The Arctic Adaptation Exchange (AAE) facilitates knowledge exchange on climate change adaptation in the circumpolar Arctic, and serves as a central information hub for communities, researchers and decision-makers in the public and private sectors. This project was a deliverable under Canada Arctic Council Chairmanship.

# REGIONAL ADAPTATION

## COLLABORATIVES AND TOOLS

### SYNTHESIS

**Title:** Community-related Adaptation Resources Compendium and Guidance based on RAC and Tools Program Products

**Objective:** The purpose of this project is to create an on-line accessible compendium of climate change adaptation resources, focused on community-level issues.

**Project Lead:** ICLEI-Canada

**Contact:** Megan Meaney, Director, E-mail: [megan.meaney@iclei.org](mailto:megan.meaney@iclei.org)

**Region:** National

**NRCan funding:** \$116,840

**Total funding:** \$235,318

**Status:** Complete

**Results:** *Adaptation Library*

<http://www.adaptationlibrary.com/>

- The Adaptation Library is a publicly accessible and searchable collection of community-related products developed through the Natural Resources Canada Regional Adaptation Collaborative (RACs) and Tools for Adaptation Programs. The goal of the Library is to connect community and municipal users with relevant information related to local climate change adaptation.

**Title:** Sea Level Rise Primer Version 2 and Companion Materials

**Objective:** The objectives of this project are to: update the existing “Sea Level Rise Primer” content to include case studies and stakeholder feedback published/gathered since May 2012; prepare an on-line “Sea Level Rise Primer” publication; and develop regionally relevant companion materials to assist decision-makers in demonstrating the benefits of adapting to sea level rise.

**Project Lead:** B.C. Ministry of Environment

## Regional Adaptation Collaboratives and Tools Synthesis

### Partner

**Organizations:** Ouranos; Atlantic Climate Adaptation Solutions Association; B.C. Ministry of Environment; B.C. Ministry of Community, Sport and Cultural Development; B.C. Ministry of Forests, Lands and Natural Resource Operation; Nova Scotia Environment

**Region:** British Columbia

**NRCan funding:** \$60,000

**Total funding:** \$123,250

**Status:** Complete

**Results:** *Sea Level Rise Adaptation Primer: A Toolkit to Build Adaptive Capacity on Canada's South Coasts*

<http://www.env.gov.bc.ca/cas/adaptation/pdf/SLR-Primer.pdf>

- This Primer is a resource for coastal management authorities to help identify and evaluate options for adapting to the impacts of sea level rise and associated hazards. The Primer provides an introduction to past and future sea level, an overview of four adaptation strategies, a recommended framework for decision making and 21 adaptation tools to support local adaptation action. It is relevant for southern coastal regions across Canada.

**Title:** British Columbia Regional Adaptation Collaborative Case Studies

**Objective:** The objective of the project is to produce two case studies that document innovative Regional Adaptation Collaborative projects from British Columbia from which key learning experiences and methods/approaches can be promoted to other targeted adaptation decision-makers and practitioners across Canada.

**Project Lead:** B.C. Ministry of Environment

### Partner

**Organizations:** B.C. Ministry of Forests, Lands and Natural Resource Operations; B.C. Ministry of Community, Sport and Cultural Development

**Region:** British Columbia

**NRCan funding:** \$25,000

**Total funding:** \$50,000

**Status:** Complete

**Results:** *Sea Level Rise in British Columbia: Mobilizing Science into Action*

[http://www.retooling.ca/Library/docs/bc\\_sea\\_level\\_rise\\_en.pdf](http://www.retooling.ca/Library/docs/bc_sea_level_rise_en.pdf)

## Regional Adaptation Collaboratives and Tools Synthesis

- This case study examines the conditions that lead to successful integration of climate change science into B.C. government policy, and in particular, sea level rise studies and how they affected awareness of sea level rise issues in the province.

*Adaptation Planning: The Local Government Experience in B.C.*

[http://www.retooling.ca/Library/docs/bc\\_community\\_adaptation\\_en.pdf](http://www.retooling.ca/Library/docs/bc_community_adaptation_en.pdf)

- This case study looks at the drivers and barriers to action on climate change by local governments. The results provide a better understanding of these factors, and encourage cooperation and collaboration among local government when faced with climate change issues.

**Title:** Policy Analysis for Mainstreaming Adaptation in Four Provinces using the ADAPTool

**Objective:** The objective of this project is to produce an improved version of the *ADAPTool – For Existing Policies* with a guidance manual for users, as well as a beta version of the *ADAPTool – for New Policy Design*.

**Project Lead:** Saskatchewan Watershed Authority

**Contact:** Tom Harrison, Director, E-mail: Tom.Harrison@wsask.ca

### **Partner**

**Organizations:** Government of B.C.; Government of Nova Scotia; Government of Saskatchewan; Government of Manitoba

**Region:** National

**NRCan funding:** \$117,650

**Total funding:** \$236,300

**Status:** Complete

**Results:** *The Adaptive Design and Policy ADAPTool*

- The ADAPTool is a web-based tool developed by the International Institute for Sustainable Development which can be used to assess government policies for their resilience to climate change. There are 2 versions of this tool – one for new policies and one for existing policies:

*The Adaptive Design & Assessment Policy Tool (ADAPTool) for Creating New Policies*

[http://www.iisd.org/pdf/2014/adapttool\\_overview.pdf](http://www.iisd.org/pdf/2014/adapttool_overview.pdf)

## Regional Adaptation Collaboratives and Tools Synthesis

- This fact sheet summarizes a beta version of the ADAPTool which helps decision-makers create new policies that will be more responsive to future changes or stressors that can have an impact on policy performance including climate change.

*The Adaptive Design and Policy Tool (ADAPTool) for Existing Policies and Guide*

[http://www.iisd.org/pdf/2014/adapttool\\_guidebook.pdf](http://www.iisd.org/pdf/2014/adapttool_guidebook.pdf)

- This tool was designed to assess existing programs and policies for their adaptability and resilience to stressors including climate change. This version of the tool was further modified based on pilot assessments in four Provinces as listed below. The pilot results have informed government decision-makers on how policies encourage and do not restrict adaptation measures.

*Strengthening Adaptive Capacity in Four Canadian Provinces: ADAPTool Analysis of Selected Sectoral Policies – a Synthesis Report*

[http://www.iisd.org/pdf/2014/adapttool\\_synthesis.pdf](http://www.iisd.org/pdf/2014/adapttool_synthesis.pdf)

*Adaptive Design & Assessment Policy Tool (ADAPTool), Government of B.C. Agriculture Programs*

[http://www.iisd.org/pdf/2014/adapttool\\_bc\\_ag.pdf](http://www.iisd.org/pdf/2014/adapttool_bc_ag.pdf)

*Adaptive Design & Assessment Policy Tool (ADAPTool), B.C. Ministry of Agriculture, Marine Fisheries and Seafood Program*

[http://www.iisd.org/pdf/2014/adapttool\\_bc\\_fisheries.pdf](http://www.iisd.org/pdf/2014/adapttool_bc_fisheries.pdf)

*Adaptive Policy Analysis of Nova Scotia: Selected Policies and Programs of N.S. Environment (water withdrawal and parks and protected areas)*

[https://www.iisd.org/sites/default/files/publications/adapttool\\_nova\\_scotia.pdf](https://www.iisd.org/sites/default/files/publications/adapttool_nova_scotia.pdf)

*Adaptive Policy Analysis of Saskatchewan's 25-year Water Security Plan*

[http://www.iisd.org/sites/default/files/publications/adapttool\\_saskatchewan\\_water.pdf](http://www.iisd.org/sites/default/files/publications/adapttool_saskatchewan_water.pdf)

**Title:** Enhancing Knowledge and Stakeholder Engagement on Climate Change Adaptation In Atlantic Canada

**Objective:** The objective of the Project is to broaden and connect the Adaptation Platform outcomes by connecting with priority sectors in the Atlantic Region through strategic activities targeting issues such as coastal erosion, coastal and inland flooding, infrastructure design, water management and community assessment. More specifically, the Project will:\* increase adaptation awareness and capacity at the regional level with a focus on the transfer of the Adaptation Platform's products and results; and

## Regional Adaptation Collaboratives and Tools Synthesis

provide support for regional engagement and a focal point for adaptation knowledge, information, resources and expertise.

**Project Lead:** University of Prince Edward Island

**Contact:** Adam Fenech, Director, Climate Research Lab, email: afenech@upeu.ca

**Region:** Atlantic Canada

**NRCan funding:** \$370,000

**Total funding:** \$921,375

**Status:** Complete

**Results:** *Engaging Small Communities of PEI in Assessing their Vulnerability to Climate Change*

<https://atlanticadaptation.ca/en/islandora/object/acasa%3A621>

- This case study describes the various approaches used to engage community members in Prince Edward Island (PEI), and the results. Efforts focused on involving key decision makers in the study team; gathering local knowledge through one-on-one interviews, history circles, storytelling, and community meetings; and using maps and photographs.

*Helping Newfoundland and Labrador Communities Assess Climate Change Vulnerability*

<https://www.atlanticadaptation.ca/en/islandora/object/acasa%3A470>

- This case study provides information on the development of Seven Steps to Assess Climate Change Vulnerability in Your Community with Newfoundland and Labrador” communities.

*The Contribution of the RAC Atlantic Climate Adaptation Solutions Project towards Building Adaptive Capacity in Nova Scotia*

<https://wet.researchspaces.ca/en/islandora/object/acasa%3A574>

- This report outlines the efforts of Atlantic Climate Adaptation Solutions (ACAS) to involve a focused group of Nova Scotian institutions in numerous capacity building activities in order to improve awareness and understanding of climate adaptation in Nova Scotia. This case study provides a short overview of the ACAS program in Nova Scotia (2007-2012), giving some insights regarding the achievement of its objective to develop adaptive capacity in some targeted institutions.

## Regional Adaptation Collaboratives and Tools Synthesis

**Title:** Climate Scenarios: A Guide for Decision-Makers

**Objective:** This project will produce a guide to help various user groups' use of climate information for decision-making in the context of uncertainty.

**Project Lead:** Ouranos

**Contact:** Diane Chaumont, email: chaumont.diane@ouranos.ca

**Partner**

**Organizations:** Hydro Quebec, Pacific Climate Impacts Consortium

**Region:** National

**NRCan funding:** \$92,400

**Total funding:** \$216,265

**Status:** Complete

**Results:** *A Guidebook on Climate Scenarios: Using Climate Information to Guide Adaptation Research and Decisions*

[https://www.ouranos.ca/publication-scientifique/GuideCharron2014\\_EN.pdf](https://www.ouranos.ca/publication-scientifique/GuideCharron2014_EN.pdf)

- This guide provides information on categories and types of products for future climate scenarios. It also describes what type of information may be most appropriate for different types of analysis and decision situations. This guide will be useful to practitioners, researchers and decision-makers across all sectors.

**Title:** Prairies Regional Adaptation Collaborative (RAC) Case Studies

**Objective:** The objective of this work is to produce new Case Studies to document innovative Prairie RAC projects from which key learning experiences and methods/approaches can be promoted to other targeted adaptation decision-makers and practitioners across Canada.

**Project Lead:** NRCan

**Region:** Prairies

**NRCan funding:** \$37,000

**Status:** Complete

## Regional Adaptation Collaboratives and Tools Synthesis

**Results:** *Climate Change Adaptation Framework Manual, 2010 (Alberta)*

<http://aep.alberta.ca/forms-maps-services/publications/documents/ClimateChangeAdaptationManual-Apr1-2010.pdf>

- The Adaptation Framework Manual was developed to provide clear, straightforward instructions for initiating and completing the adaptation planning process using the Adaptation Framework. The manual itself is adaptable and can be modified for any purpose or organization as the Adaptation Framework is based on broadly recognized standards for risk management.

*Drought and Excessive Moisture Preparedness Planning in Saskatchewan Watersheds*

<http://www.parc.ca/rac/index.php?page=droughtButton>

- This case study focuses on the process used by three watershed stewardship groups to assess their watershed's vulnerability to climate change, and to prioritize actions. Each case study provides a unique perspective regarding vulnerabilities to climate change, and stakeholder engagement.

*Provincial Planning on Adaptation for Excessive Moisture in the Manitoba Interlake Region*

[http://www.parc.ca/rac/fileManagement/upload/120329\\_FINAL\\_Manitoba%20InterlakeProvincial%20Strategy%20Recommendations-FINAL.pdf](http://www.parc.ca/rac/fileManagement/upload/120329_FINAL_Manitoba%20InterlakeProvincial%20Strategy%20Recommendations-FINAL.pdf)

- This case study will reviews the methodology, results and lessons learned from the report Provincial Planning on Adaptation for Excessive Moisture in the Manitoba Interlake Region. Guidance for generating this review was largely taken from the Clean Air Partnership.

# SCIENCE ASSESSMENT

**Title:** Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation

**Project Lead:** NRCan

<http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2014/16309>

- This report is an update to the 2008 science assessment report. It assesses advances made in understanding climate change impacts and adaptation from a sectoral perspective, based primarily on literature published up to the end of 2012.

**Title:** Canada's Marine Coasts in a Changing Climate

**Project Lead:** NRCan

<http://www.nrcan.gc.ca/environment/resources/publications/impacts-adaptation/reports/assessments/2016/18388>

- Canada's Marine Coasts in a Changing Climate assesses climate change sensitivity, risks and adaptation along Canada's marine coasts. The report includes overviews of regional climate change impacts, risks and opportunities along Canada's three marine coasts, case studies demonstrating action, and discussion of adaptation approaches. Led by Natural Resources Canada, the development of this report involved over 60 authors and 70 expert reviewers, and synthesized over 1300 recent publications.

# ENHANCING UPTAKE AND USE OF RESOURCES

**Title:** Making Strides on Community Adaptation: Using Existing Resources to Move from Planning to Action on Climate Change

**Objective:** The primary purpose of this project is to increase the uptake and use of existing information and resources related to climate change adaptation in communities. Facilitated, peer-to-peer knowledge exchange of existing resources, decision support tools and other adaptation-relevant information are used.

**Project Lead:** ICLEI-Canada

**Contact:** Ewa Jackson, Manager, E-mail: ewa.jackson@iclei.org

**Partner**

**Organizations:** Adaptation to Climate Change Team (ACT) Simon Fraser University; Toronto Regional Conservation Authority; Registration - Workshop Participants; Adaptation to Climate Change Team (ACT) Simon Fraser University; Advisory Committee Members; Union of Nova Scotia Municipalities; Toronto Regional Conservation Authority;

**Region:** Nova Scotia, Ontario, B.C.

**NRCan funding:** \$78,816

**Total funding:** \$174,872

**Status:** Complete

**Result:** *Making Strides on Community Adaptation: Bridging the Implementation Gap*

<http://www.icleicanada.org/component/k2/item/244-making-strides-on-community-adaptation>

- This report contains 7 recommendations to address common obstacles to implementing climate adaptation actions. Interviews, surveys and case studies from across Canada inform the recommendations. This report is intended for use by Canadian municipalities.

**Title:** The Climate-Resilience Express Action Kit—Kick-starting Adaptation in Smaller Alberta Municipalities

**Objective:** The objective of this project is to develop, pilot, refine and launch a Climate-Resilience Express Action Kit to remove barriers to adaptation and thereby kick-start action by smaller municipalities.

**Project Lead:** Resilient Communities

**Contact:** Dr. Richard Boyd, Senior Fellow, E-mail: [boyd.richard.a@gmail.com](mailto:boyd.richard.a@gmail.com)

**Partner**

**Organizations:** The Calgary Foundation; Municipal Climate Change Action Central (MCCAC)

**Region:** Alberta

**NRCan funding:** \$59,700

**Total funding:** \$169,200

**Status:** Complete

**Result:** *Climate Resilience Training Workshop*

<http://mccac.ca/programs/climate-resilience-express>

- A workshop to train Alberta municipalities on how to use the Climate Resilience Express Action Kit was held in February 2016, in Olds, Alberta. This kit will help these municipalities plan for and manage the local impacts of climate change, build business cases for resilience planning, and support pilot communities in developing their own climate resilience action plans.

**Title:** Mobilizing Decision-relevant Adaptation Knowledge through the Varied Roles of Professional Biologists in Western Canada

**Objective:** The objective of this project is to improve the ability of Professional Biologists and Biology Technologists in western Canada to access climate change adaptation information. This will enable them to consider the effects of a changing climate in professional practices and decision-making.

**Project Lead:** British Columbia College of Applied Biology

**Contact:** Pierre Iachetti, Executive Director, E-mail: [executivedirector@cab-bc.org](mailto:executivedirector@cab-bc.org)

**Partner**

**Organizations:** Alberta Society of Professional Biologists; ESSA Technologies Ltd.; B.C. Ministry of Environment

**Region:** Western Canada

**NRCan funding:** \$50,000

**Total funding:** \$100,000

**Status:** Complete

**Results:** *Climate Adaptation and the Role of Professional Biologists in Western Canada*

- This report provides a technical summary of the approach, findings, and key implications from the project. It presents the results of a survey of members of the two partner organizations.
- The project also prepared three “climate adaptation notes” to disseminate the project’s findings :
  - Note #1: *Perspectives, situations, and needs of professional biologists around climate adaptation in western Canada*, summarized key findings from the survey of members with the College of Applied Biology and the Alberta Society of Professional Biologists;
  - Note #2: *Climate data, information and tools to support climate adaptation of natural resource and environmental management*, provides information about the climate data, information and tools available to support the consideration of climate change effects in natural resource planning and environmental management; and
  - Note #3: *Ecosystem conservation and restoration in a changing climate*, provides information about adaptation knowledge available to support conservation and ecosystem restoration in a changing climate.