Cost-Benefit Analysis of Adaptation Options
Lessons from recent Canadian Experience

Pamela Kertland, Gerett Rusnak, Don Lemmen
Climate Change Impacts and Adaptation Division
Natural Resources Canada

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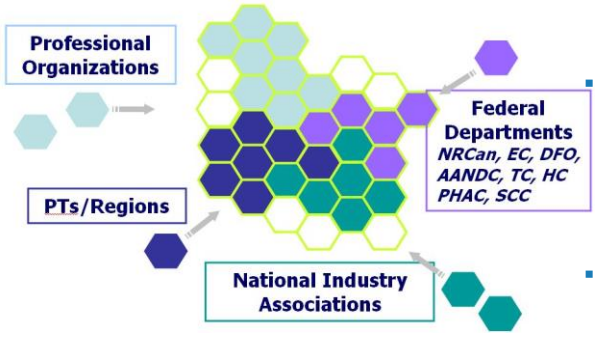
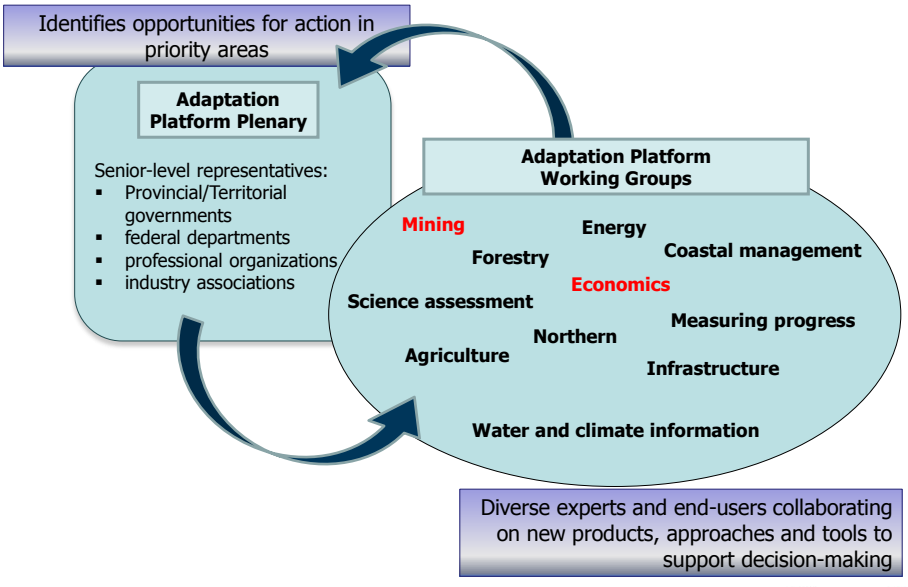
The Adaptation Platform: enhancing collaboration



- Mechanism to bring together knowledge, capacity & resources
- Focus on generating specific, decision-useful information and tools that regions and key industries need to understand and adapt to a changing climate
- Expanding the tent
  - + industry, financial sectors
  - + federal departments
- Each participating organization brings its own resources, priorities and mandate

Canada's Adaptation Platform



Goals for Economic Research

- To expand the information available about the costs of climate change impacts and the costs and benefits of adaptation action
- To help build the business case for action
- To increase awareness of the contribution of this analysis to adaptation decision-making and build capacity to undertake the work.

Mining Sector Results

Key Findings:

- Costs, benefits and appropriate timing of actions are site dependent.
- Some actions worth investing in now such as: increasing tailing pond capacity, upgrading water management systems, and installing dust barriers.
- Other actions only become cost effective in the future.
- Valuable information for developing business cases
- Completion of a risk assessment improves ability to do economic study

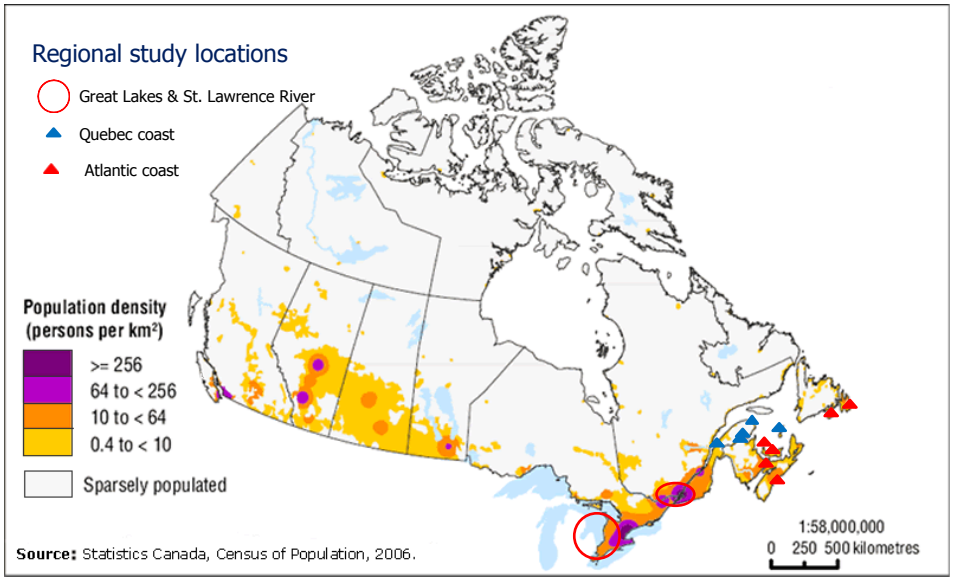
Sample risks modelled

Event	Conditions	Damage	Cost	Preventive Cost	Preventive Measure
Heavy rains	>200 mm over 24 hours in winter or spring	Tailing ponds overflow	$5M	$4M	Increase tailing ponds' maximum capacity
Severely heavy rains	> 250 mm over 24 hours in winter or spring	Failure of safety fail in spillway (overflow) and dyke rupture	$75M	$150M	Definite restoration of tailing ponds
Local road closure	Ice storm, flood or erosion	Storm inhibits staff transportation to the site	$10K/hour	$100K	Training, partnership, shift planning
Regional road closure	Ice storm, flood or erosion	Storm blocks lime supply	$10K/hour	$250K	Increase inventory max capacity
Regional road closure	Ice storm, flood or erosion	Storm blocks supply of other critical ingredients (Cyanide, Oxygen, SO2)	$10K/hour	$750K	Increase inventory max capacity
Forest fire	Forest fire in the surrounding area	Staff is evacuated, equipment is damaged	$10K/hour + $300K	$1M	Brushing, emergency equipment storage plans
Large scale ice storm	Power outage	Ice storm causes power outage	$10K/hour	$2M	Increase power generation capacity at the mine (generators and stock of diesel fuel used for mobile generators)
Severe lightning	Power outage	Power lines are struck down	$10K/hour	$2M	Increase power generation capacity (generators and stock of diesel fuel used for mobile generators)

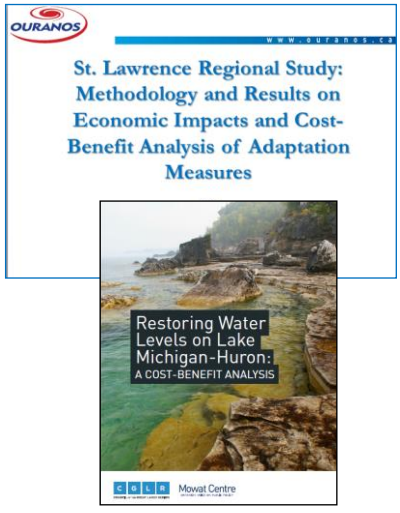
Source Ernst & Young, 2015

Mining Sector – Lessons learned

- Manage uncertainty openly
- Need to fit analysis to the nuances of the industry
- Trust is critical – 2 of 3 study leaders had existing relationships with the companies studied



St. Lawrence & Great Lakes

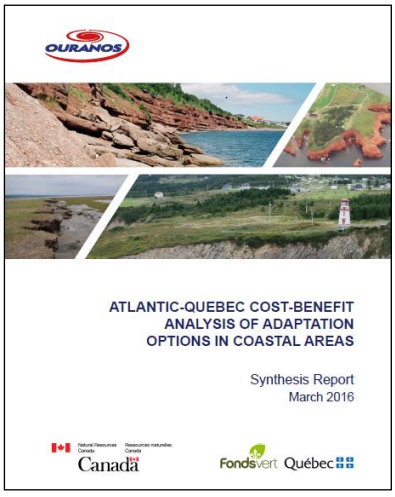


- Focus on low water levels
- Great-Lakes – evaluation of restoration of water levels
- St. Lawrence – studies on waterfront property values, hydroelectricity production, marine transportation, ecological services and fishing, municipal water supply & discharge, recreational boating & tourism
- Reference scenario and 2 what-if scenarios

Findings

- Impacts of climate change vary greatly among sectors – tens to hundreds of millions of dollars
- No hard structures to manage water levels seem economically justified to minimize potential impacts on maritime transportation or tourism
- Adaptation options like restoration of riparian areas and floodplains could be positive economically especially since they also manage other climate risks beyond low water levels
- The clear requirement to adapt may give consideration to options outside infrastructure changes e.g. reducing electricity demand, alternative energy sources

Quebec and Atlantic Regional Studies



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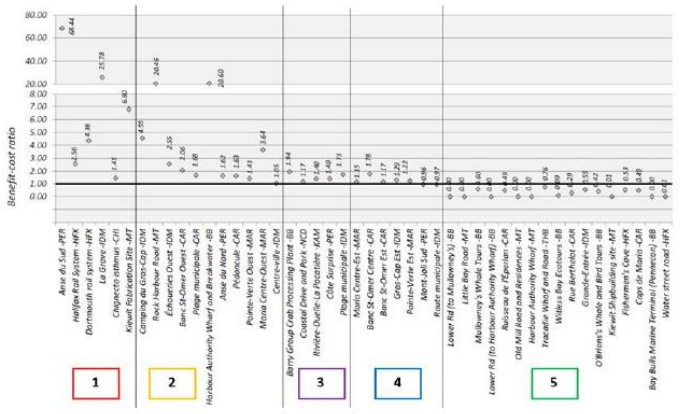
- Quantify & compare net present value of benefit-cost ratio of adaptation options
- 11 case study sites in Quebec and Atlantic Canada
- Common frame – 50y time horizon, 4% discount rate, estimates in 2012 C$
- 3 option categories- hard engineering structures, soft engineering structures, non-structural options
- Included study, construction, & maintenance costs
- QC studies also included impacts on environmental & social assets

Summary across case studies



Note: Segment groups: Red: 1-Not intervening is not an option; Yellow: 2-Net advantage to intervene ($0.5 M-$10 M); Purple: 3-Small advantage (<$0.5 M); Blue: 4-Within a margin of $25,000; Green: 5-No economic advantage to intervene

Figure 4.3 Benefit-Cost Ratio of the Most Advantageous Options

Source: Boyer-Villemaire, U et al 2016

Lessons learned

- Collaboration with stakeholders
  - Increase access to numerical data
  - Understanding and acceptance of results
  - Can be challenging where priorities for adaptation vary
- Breaking coasts into segments allows for highly realistic assessment of damages but may be more efficient to work at larger scales
- Consideration of indirect impacts variable or impacts key in decision-making processes
- Complementary studies may be needed (e.g. on distributive costs)
- Can assist with decision making – e.g. Percé
- Regionally integrated studies are challenging yet offer relevant way to look at multiple interactions and cross-cutting issues.
- Need enough baseline studies to conduct integrated studies efficiently

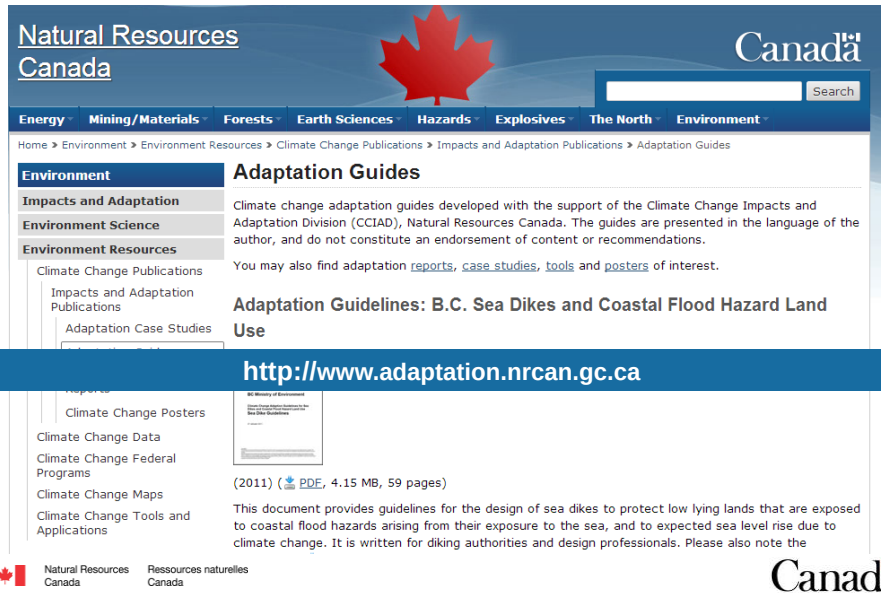
For more information:

Great Lakes study
councilgreatlakes.org

St. Lawrence & Quebec coastal studies
www.ouranos.ca

Atlantic coastal studies
www.upei.ca/climate

For additional information:



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