Ecosystem-based Climate Change Adaptation in the Great Lakes Basin in Ontario

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OCCiAR
Ontario Centre for Climate Impacts and Adaptation Resources

Ontario
Content

• Observations of change
• Managing adaptively
• Adaptation planning and VA process
• Application
• Results
• Research
• Moving adaptation forward
Observations of change in nature

Boreal forest health
• Freezing damage prior to bud break due to spring temp variability
• Bud damage affecting boreal species’ survival and growth

Fish range shifts
• Sportfish shift north by 12-17km / decade in last 30 years
• Coldwater species (e.g. Brook Trout, Lk Trout, Walleye) most vulnerable

N. leopard frog & American toad
• Emerging and calling up to 37 days earlier across Southeastern Ontario

Wood warblers
• Uncoupling of timing with key prey - the eastern spruce budworm
• Not advancing in breeding and migration to match timing
Climate change is projected to accelerate

Projected difference in average summer temperatures in the 2050s compared with 1971-2000

Projected difference in average winter temperatures in the 2050s compared with 1971-2000
What is climate change adaptation?
• Considering possible futures is critical to any robust, long-term natural resource management planning.
  – Common practice is to use at least two future scenarios (e.g. A2, B1)
  – Enables us to ask ‘what if?’ questions during planning.
  – Provides science basis for adopting adaptation-oriented actions.

• Integrating new learning is fundamental to the principles of adaptive management.
Figure 1: A framework to support good decision-making in the face of climate change risk

Climate change → Climate variability → Non-climatic factors & drivers → Exposure → Sensitivity → Adaptive capacity → Climate change impacts on the CHES → Vulnerability to climate change

Source: Based on Füssel and Klein (2006)

Northern Institute of Applied Climate Science (NIACS)

Methodology:

- Vulnerability Assessment Report: Uses a combination of sensitivity attributes and climate factors to assess vulnerability.
- Species Profiles: Uses existing information to create species profiles.
- Multi-Stock Vulnerability Rankings: A vulnerability report for each species will identify key attributes.
- Stock Scores: [low, moderate, high, very high].

NOAA
Why are we assessing climate change vulnerability in Ontario?

Bi-national direction

Provincial direction

Foundation of Strategic Direction
Ecosystem-based adaptation planning in Ontario: 2 case studies

- Peel Region
- Far North (TEK & community-based)
- Thunder Bay
- Mississippi R. & Rideau Valley watersheds
- Durham Region
- Peel Region
- Lake Simcoe watershed & Chippewas of Georgina Island First Nation
- Northeast Clay Belt (Ecodistrict 3E - 1)
Ontario Case Study #1: Lake Simcoe Watershed

- Lake Simcoe Protection Plan called for a watershed Adaptation Plan
- OCCLAR and Ontario government led a process to assess vulnerability in a variety of themes:
  - Wildlife
  - Hydrology
  - Aquatic habitat and wetlands
  - Forest cover
  - Parks and nature-based tourism
  - Species-at-risk
  - etc.
- Vulnerability assessment results were published and used to generate adaptation options to inform the development of an adaptation strategy
An ecosystem-based vulnerability and adaptation process

- Developed by ON Min. Nat. Res. Climate Change Office & OCCIAR
- First Ontario-relevant resource and methodology available focused on ecological vulnerability assessments
- Being used by Ontario Conservation Authorities, municipalities/regions, OMNR
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<tr>
<th>Step 1: Set Context and Build Team</th>
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<tbody>
<tr>
<td>• Define the study area and identify environmental themes and indicators</td>
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<td>• Build team and engage experts, stakeholders and partners</td>
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<th>Step 2: Assess Current Vulnerability</th>
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<tr>
<td>• Describe the current sensitivity and exposure to climate and non-climatic stresses</td>
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<td>• Describe degree of adaptive capacity of the system</td>
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<th>Step 3: Develop and Apply Future Scenarios</th>
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<tr>
<td>• Develop and apply future climate scenarios</td>
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<td>• Consider anticipated non-climatic stresses (e.g. human population growth, land use)</td>
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<th>Step 4: Estimate Future Vulnerability and Risks</th>
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<tr>
<td>• Identify and describe future impacts</td>
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<td>• Determine future vulnerability and categorize uncertainty</td>
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<td>• Describe the likelihood and consequences of vulnerabilities through socio-economic, political, and environmental evaluations</td>
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<td>• Determine areas at highest risk</td>
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<td>• Communicate initial findings to key organizations</td>
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<th>Step 5: Develop Adaptation Options</th>
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<td>• Based on the risk analysis, scope potential adaptation options</td>
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<td>• Prioritize adaptation options considering economic feasibility, social acceptability, ecological suitability, and technical and institutional feasibility (e.g. barriers, opportunities)</td>
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<th>Step 6: Implement and Mainstream Adaptation</th>
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<tr>
<td>• Determine highest priority adaptation actions for implementation</td>
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<td>• Communicate accomplishments</td>
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<td>• Monitor adaptation actions and vulnerabilities over time</td>
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<td>• Acquire new knowledge, learning and insights, and modify adaptation actions as required</td>
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Ontario Case Study #2: Northeast Clay Belt

- OMNR selected northeastern Clay Belt (Ecoregion 3E-1) as 2nd vulnerability assessment pilot area

- Broadened out vulnerability assessment to include themes for Boreal forest:
  - Forest fire
  - Forest blowdown
  - Forest composition and productivity
  - Ungulates

- Currently applying results to integrate climate change adaptation into Forest Management Planning
  - Hearst Forest Management Planning
  - Initiating next 10 year plan
Climate change ecosystem vulnerability and adaptation planning for Great Lakes Basin in Ontario

- **Goal:** To prioritize, support and conduct ecologically-focused, science-based assessments to inform adaptation planning in Basin.

- **Approach:** Undertake research at regional scales with nested local information to feed local adaptation initiatives.

- **Ecological themes currently supported:**
  - Aquatic invasive species
  - Aquatic habitat
  - Water balances and stream flows
  - Forests
  - Migratory and resident forest birds
  - Furbearers
  - Landscape connectivity
  - Biodiversity rapid assessment
Research currently underway

- **Ontario Great Lakes Basin Water Balances Vulnerability Assessment** - Dr. Robert Metcalfe

- **Ontario Great Lakes Basin Tree Species Vulnerability Assessments—White Spruce** - Dr. Bill Parker, Dr. Pengxin Lu, Dr. Steve Colombo

- **Ontario Great Lakes Basin Migratory Birds Vulnerability Assessment** - Dr. Rob Rempel

- **Ontario Great Lakes Basin Furbearer Vulnerability and Landscape Connectivity Assessments** - Dr. Jeff Bowman

- **Ontario Great Lakes Basin Biodiversity Rapid Vulnerability Assessment** - Sam Brinker and Colin Jones
Largest northward shifts of sportfish (>¾° latitude):

Regional Projections of Thermal Habitat Space for Fishes in Stratified Ontario Lakes
Charles K. Minns, Brian J. Shuter, and Simon Fung

Coolwater fish - Habitat space will expand in the north and contract in the south

Regional Projections Ice Cover and Open-Water Duration for Ontario Lakes
Charles K. Minns, Brian J. Shuter, and Simon R. Fung

Ontario Great Lakes Basin Aquatic Ecosystem Vulnerability Assessment
Cindy Chu
Moving Forward
Climate change ecosystem vulnerability and adaptation planning for Great Lakes Basin in Ontario

Current

Growing body of science on climate change impacts on natural resources and ecosystems

Report on State of Knowledge on Ecological Vulnerabilities to Climate Change in Ontario’s Great Lakes Basin

Climate Change Adaptation Network for Ontario’s Ecosystems (under Ontario Biodiversity Council)

A Practitioner’s Guide to Climate Change Adaptation for Ontario’s Ecosystems

2020

Synthesis of Ontario Great Lakes Basin Climate Change Vulnerability Assessment
• Basin-wide
• Lake drainage basin
• Nested local information

Adaptation planning with best available science:
• Local communities
• Natural resource industries
• Conservation Authorities

Climate Change Adaptation Plan of Action guiding future work priorities and management decisions

Integrated climate change monitoring
• Across agencies
• Basin-wide

Great Lakes Basin Climate Change Vulnerability Assessments
(e.g. aquatic habitat, wildlife, hydrology, biodiversity, invasive species)

Adaptation tools and techniques

Accessible and user-friendly climate modeling products and standards

PARTNERSHIPS and COLLABORATION with local and regional conservation organizations
An ecosystem-based vulnerability and adaptation process

Climate change ecosystem vulnerability and adaptation planning for the Great Lakes Basin

Opening ‘Black Box’ of climate modeling

- Goal: remove a significant barrier to public engagement by making climate science accessible to professional and lay audiences across Basin.
- Climate modeling products (maps, accessible databases, training)

Climate Adaptation Network for Ontario’s Ecosystems (CANOE)

- Newly established working group of the Ontario Biodiversity Council comprised of Ontario ecological and climate experts
- Collaborate and coordinate efforts across organizations to promote climate change adaptation
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