A Changing Climate: Primer on Local Science and Initiatives

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With Support From:

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www.climateontario.org
The OCC was established in 2011 as a centre of expertise providing research and analysis services to municipalities, conservation authorities, and the broader public sector.

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Climate Change Trends
Global to Local
A Note on Terminology

Climate Mitigation

- Reducing greenhouse gas emissions (GHGs) through enhancing carbon sinks or reducing sources of GHGs

**Examples:**
- Low Carbon technologies
- Net Zero communities
- Tree planting
- Electric Vehicles

Climate Adaptation

- Reducing our vulnerability and risk to harmful impacts of climate change and building resilience into human systems.

**Examples:**
- Vulnerability and Risk Assessments
- Green Infrastructure
- Incorporating climate risks into Asset Management Planning
Why do we need Climate Information?

To understand the degree of exposure of climate change to hazards to humans, infrastructure, and other systems.

Credit: IPCC(2013)
Globe Continues to Warm

Effect of current pledges and policies

Global greenhouse gas emissions

Projections

Gigatons of carbon dioxide
150
100
50
0

Historical emissions

2000 2020 2040 2060 2080 2100

No climate policies 4.1–4.8°C
Current policies 3.1–3.7°C
Pledges 2.6–3.2°C

2°C pathways
1.5°C pathways

www.climateconnections.ca
North warming ~ 4X Global
Future Climate in York Region (2050s)

- Warmer winters
- More winter precipitation
- Increase in wind extremes
- More ice storms
- More heat waves
- More intense rainfalls
- Extended Spring and Fall

MORE CERTAINTY
- ↑ 200% (95th %)
- ↑ 20 days
- ↑ 3.7°

LESS CERTAINTY
- ↑ 22%
- ↑ 13%

ONTARIO CLIMATE CONSORTIUM
www.climateconnections.ca
Future Climate in York Region (2050)

- Invasive species (Emerald Ash Borer, gypsy moth, Asian longhorn beetle)
- Northward migration of trees
- Heat is amplified by the reflection off of asphalt and pavement
- More watering required
Future Climate in York Region (2050)

- Warmer winters
- More winter precipitation
- Increase in wind extremes
- More ice storms
- More heat waves
- More intense rainfalls

Extended Spring and Fall

More Certainty

- Increase the amount of freeze-thaw cycles, which will increase the amount of salt applied to streets. Road salt will then make their way into tree root systems through increased winter precipitation
- Increase in budbursts in warm spells, but will freeze again and cause damage to new growth
- Increase in pest survival, causing additional stress on trees

Source: Clean Air Partnership, 2007.
Future Climate

- More flooding, erosion, and stormwater runoff
  - More pest outbreaks (insects and diseases)
  - Root damage from waterlogged soils
  - Damage to or uprooting of trees

Source: Clean Air Partnership, 2007.
Future Climate in York Region (2050)

More winter precipitation
Increase in wind extremes
More ice storms
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Extended Spring and Fall

MORE CERTAINTY
LESS CERTAINTY

Future Climate in York Region (2050)

December 2013
Future Climate in York Region (2050)

More winter precipitation
Increase in wind extremes
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Extended Spring and Fall

MORE CERTAINTY

LESS CERTAINTY
Local Climate Initiatives:

Integrating Climate Change Considerations in Policies and Plans in Durham Region
Durham Region

- 9 municipalities
- 5 Conservation Authorities (CLOCA, TRCA, GRCA, LSRCA, KRCA)
- Durham Community Climate Adaptation Plan (2016)
- Natural Environment and Climate Change Working Group
Scope of Work

1. To compile and evaluate policies and plans relevant to natural heritage in Durham Region and inter-jurisdictionally;

2. To develop an evaluation framework for assessing how climate change was incorporated into policies plans;

3. To identify examples of best practice in policy and plans, including how climate information was incorporated for natural heritage.
Methodology

Collect Plans
Develop Review Frameworks
Analyze Plans
Review Other Municipalities (Montreal, Quebec, Vancouver, Peel Region, and the UK)
Make Recommendations

Framework 1: Tiered Approach
Framework 2: Evaluation Criteria
Framework 1: Tiered Approach

- Policies and plans were grouped into three tiers

- Framework developed based on:
  - OURANOS Guidebook on Climate Scenarios (2014)
  - The type of document (i.e. general land use plans, master plans, and technical natural heritage plans)
  - Level of detail in climate information

- Goal: to provide a basis for the types of climate change considerations that should be integrated at different stages of the planning process for natural heritage
Framework 2: Evaluation Criteria

Tier 1
- Fact Base
- Organization and Presentation
- Goals
- Monitoring and Evaluation
- Sectional CC Info
- Inter-Organizational Coordination

Tier 2
- Fact Base
- Organization and Presentation
- Goals
- Monitoring and Evaluation
- Sectional CC Info
- Inter-Organizational Coordination
- Participation

Tier 3
- Fact Base
- Organization and Presentation
- Goals
- Monitoring and Evaluation
- Sectional CC Info
- Inter-Organizational Coordination
- Participation

(Guyadeen, Thistlethwaite & Henstra, n.d.)
### Examples of Evaluated Plans and Policies

<table>
<thead>
<tr>
<th>Tier</th>
<th>Overall Goal</th>
<th>Evaluated Documents</th>
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<tbody>
<tr>
<td>Tier 1</td>
<td>Provide broad vision statements and goals; not solely focused on natural heritage</td>
<td>Official Plans, Strategic Plans, Whitby Asset Management Plan, Township of Brock Recreational Master Plan, Clarington Priority Green</td>
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<tr>
<td>Tier 2</td>
<td>Provide general guidance for natural heritage planning and identify how climate impacts both human and natural environment</td>
<td>GRCA Climate Change Strategy, KRCA Climate Change Strategy, Durham Region DCCAP</td>
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<tr>
<td>Tier 3</td>
<td>Provide technical, sector-specific policies that focus on specific natural heritage features</td>
<td>Watershed Plans, Ajax UFMP, GRCA Terrestrial Natural Heritage Strategy, CLOCA SWM Plan, LSRCA Natural Heritage System for the Lake Simcoe Watershed, TRCA East Duffins Headwater Management Plan</td>
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</tbody>
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Types of Climate Information Needed in Tier 3 Plans

• Future changes in means, absolute values and extremes over finer spatial scales
• Examples:
  – Analysis of extremes
  – Analysis of low-confidence
  – Maps of projected future values
  – Temporal series
  – Evolution of future values
  – Climate normals (i.e., averages)
Analysis of Extremes

Figure 24: Comparison of historical and future trends in extreme temperature variables for the frequency of days when $T_{\text{min}} \leq -10^\circ\text{C}$ and $T_{\text{max}} \geq 30^\circ\text{C}$. The shaded area denotes the uncertainty bounds associated with the model ensemble, representing the 10th and 90th percentile of the ensemble.

(Coulibaly et al., 2016)
Map of Projected Future Values

Climatic Normal: 1971 - 2000

Climatic Scenarios: Horizon 2050
10th percentile 50th percentile 90th percentile

(Logan, 2014)
Climate Sensitive Vegetation:

- **Analysis Results:** 4.1% of natural cover within urban areas contains climate sensitive native vegetation.
- **Climate Change Impacts:** Potential dieback and/or shift to more southern invasive or shrubby vegetation. Could lead to loss of shading and habitat.
- **Recommendation:** Through mapped vulnerabilities and planning priorities, restore or protect key natural features containing climate sensitive native vegetation to promote habitat diversity and regional connectivity.
Overall Findings from other Jurisdictions

• A lack of standardized or ‘official’ methodology exists internationally to integrate climate change considerations within policies and plans – potential barrier to action

• However, there are enough progressive natural heritage policies and plans that exist to develop an approach
  •  *Vulnerability and risk assessment could be a key part of this*

• Important to acknowledge and leverage what portions of policies/plans can be re-framed as climate change considerations (e.g., green infrastructure) – huge opportunity
Overall Findings from Durham Region

• Many of the plans reviewed under this study predate the work of the Durham Community Climate Adaptation Plan.

• As a result, complementary technical studies to inform natural heritage planning (i.e. urban forest management plans, natural heritage strategies, etc.) were not always available.

• Agencies in Durham Region have begun to incorporate climate change within their policies, such as:
  • Tier 1: Oshawa OP (green infrastructure)
  • Tier 2: KRCA Climate Change Strategy
  • Tier 3: Ajax Urban Forest Management Plan
  • Tier 3: LSRCA Carbon Budget
Key Take-Aways

1. Opportunity to prioritize and re-frame natural heritage plans and policies (where relevant) to climate change

2. Prepare complementary technical (or background) assessments that include climate change in support of planning

3. Leverage numerous vulnerability and risk assessment methodologies and results (where applicable) as a tool

4. Consider incorporating advances in climate science and information to Inform natural heritage planning
Thank You!

Any Questions?