Vulnerability Assessment in Climate Change Adaptation

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity to climate change, and its adaptive capacity.[1]

In Ontario, the average annual temperature has increased by **1.4°C** over the last 60 years, and scientists project that by 2050 the average annual temperature in Ontario could increase by **2.5°C to 3.7°C**.[2] Extreme weather events, prolonged heatwaves and wind storms have also become more common.[2] The projected changes could have major implications for natural[3, 4, 5] and built systems[5] in Ontario.

Adaptation actions are needed to eliminate or reduce the vulnerability of systems to the impacts of climate change.

This requires an understanding of the **known** and **potential** impacts of climate change and the corresponding vulnerability[5] of the systems in question.

Vulnerability Assessments can support adaptation planning in several ways:[5]

- Identify areas most likely to be impacted by projected changes in climate;
- Build an understanding of why these areas are vulnerable, including the interaction between climate change, non-climatic stressors, and cumulative impacts;
- Assess the effectiveness of previous coping strategies in the context of historic and current changes in climate; and
- Identify and target adaptation measures to systems with the greatest vulnerability.

The **Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems**[5] lists six steps in its adaptation planning process. Note that ***steps 1 through 4*** represent the steps involved in the vulnerability assessment process, whereas ***steps 5 and 6*** complete the adaptation process.

Step 1 involves building the project team, engaging stakeholders and partners, and defining the study area, environmental themes, and indicators that will be the focus of the vulnerability assessment.

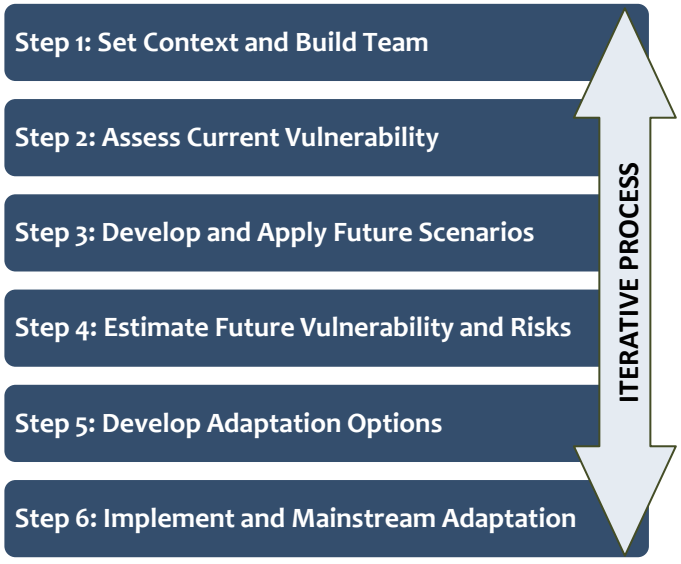
Step 2 involves building an understanding of the study area, including current exposure and sensitivity to climate, adaptive capacity of the species or system, and other contextual information. This information will allow a comparison to future vulnerabilities later in the process.

Step 3 involves incorporating future climate, and where possible, projections of other non-climatic factors (e.g. population growth and development).

Step 4 builds on earlier steps during which current vulnerability was assessed and climate scenarios were applied. It combines the results of those analyses to develop estimates of future vulnerability.

Step 5 identifies potential adaptation options to help reduce or eliminate vulnerabilities and risks.

Steps 1 through 4 represent the Vulnerability Assessment process[5]



Step 6 involves implementing the adaptation measures that were evaluated and selected in the previous step. While this is a final step in the process, the elements of this step form a critical part of a broader adaptive management process that has no end point. Over time, as measures are implemented and adaptation is mainstreamed into policies and programs, monitoring, acquisition of new knowledge and periodic re-assessments will be required.

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Examples of Vulnerability Assessments in Ontario:

- The ***Public Infrastructure Engineering Vulnerability Committee*** (PIEVC) was established to oversee the planning and execution of a broad-based national engineering assessment of the vulnerability of Canadian public infrastructure to changing climatic conditions.[3]

- To inform the development of an adaptation strategy for the Lake Simcoe watershed, ***a Lake Simcoe Vulnerability Assessment***[6] was undertaken to assess the vulnerability of system components (both natural and built) to the impacts of climate variability and climate change in the context of current system stresses. ***System components included:***

  - Hydrology
  - Vegetative cover
  - Natural heritage
  - Species at Risk
  - Invasive Species
  - Infrastructure
  - Wildlife
  - Aquatic habitat
  - Parks and protected areas
  - Insects
  - Agriculture

- ***Climate Change Vulnerability Assessment and Adaptation Options for the Northeast Clay Belt***[7], being conducted by the MNR and partners, aims to establish where and how the Clay Belt is vulnerable to climate change impacts, and identify potential support for forest resource management plans and activities by examining multiple environmental themes. ***Environmental themes include:***

  - Wildlife
  - Soils
  - Socio-economics
  - Hydrology
  - Aquatic habitat

References

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3. Public Infrastructure Engineering Vulnerability Committee. *National Engineering Assessment of the Vulnerability of Public Infrastructure to Climate Change*. Accessed from: http://pievc.ca
4. Varrin, Bowman, and Gray, 2007, as cited in Gleeson, J., Gray, P., Douglas, A., Lemieux, C.J., and Nielsen, G. 2011. *A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems*. Ontario Centre for Climate Impacts and Adaptation Resources, Sudbury, Ontario. 74 p. Accessed from: http://www.climateontario.ca
5. Gleeson, J., Gray, P., Douglas, A., Lemieux, C.J., and Nielsen, G. 2011. *A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems*. Ontario Centre for Climate Impacts and Adaptation Resources, Sudbury, Ontario. 74 p. Accessed from: http://www.climateontario.ca
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