Ministry of Natural Resources

Ontario

Natural. Valued. Protected.

Ontario's Approach to

Climate Change Adaptation

Lake Links Workshop

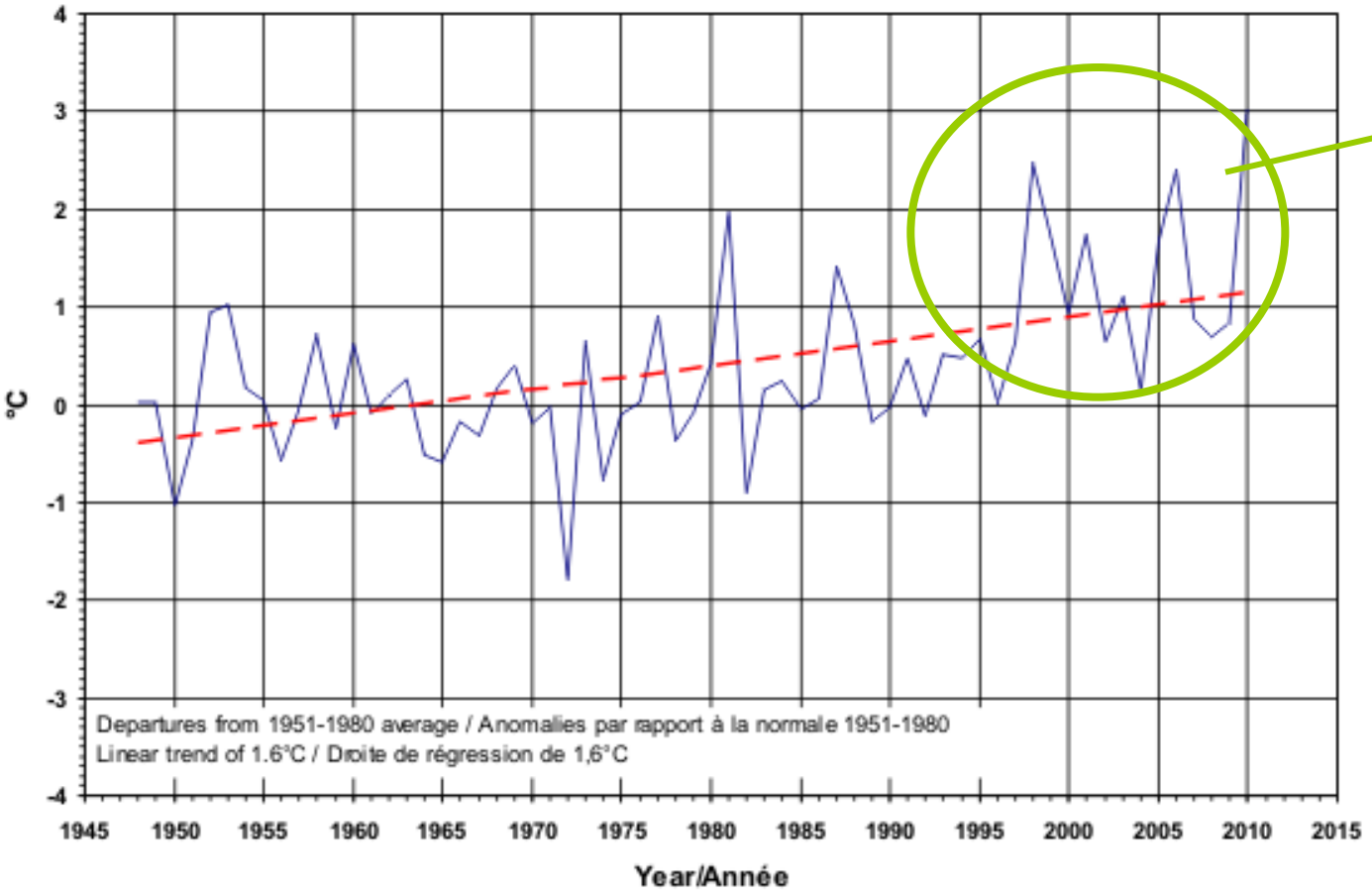
Perth Civitan Hall

October 20, 2012

“Climate change is likely to become one of the most significant drivers of biodiversity loss by the end of the century”

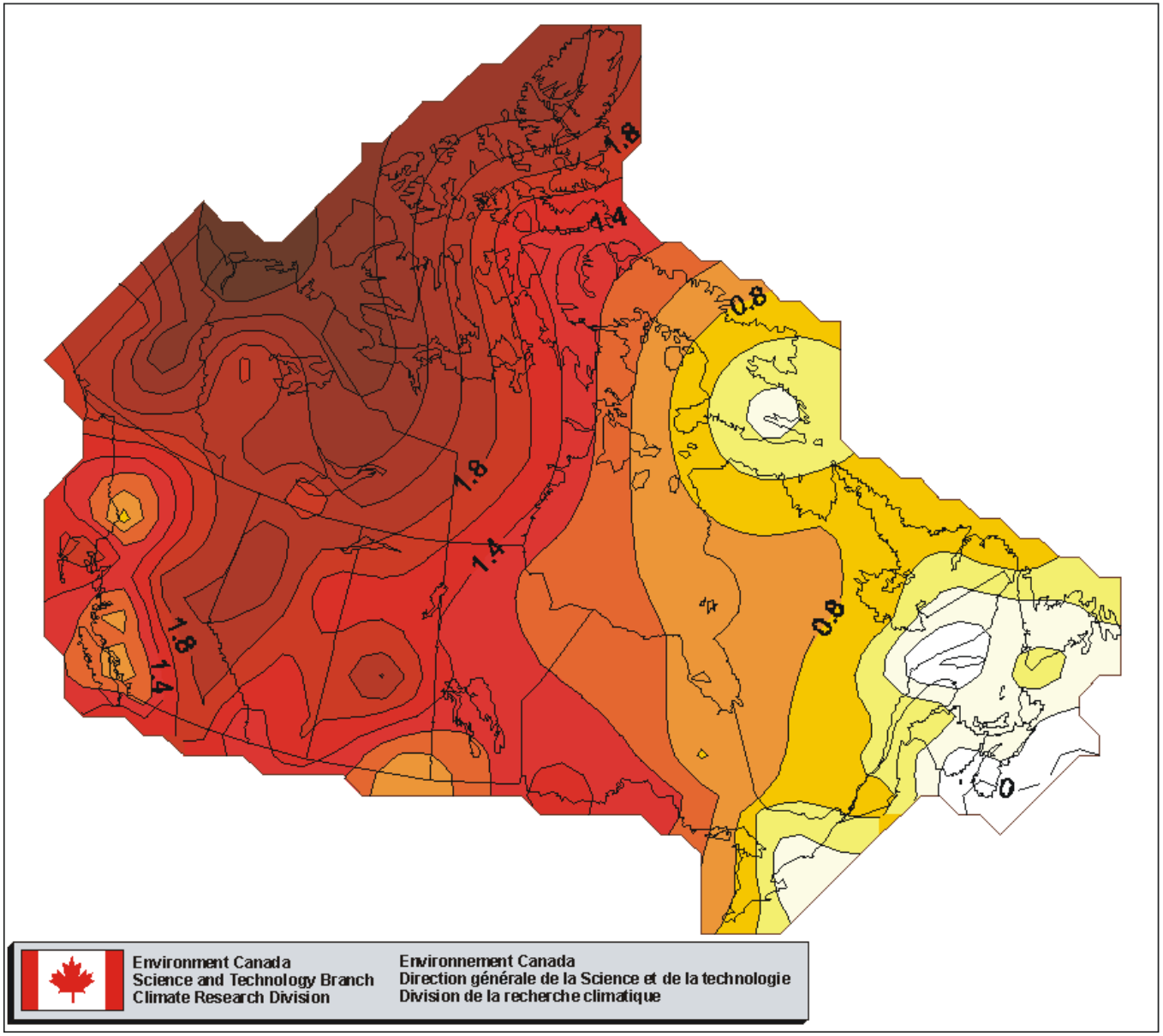
Millennium Ecosystem Assessment, 2005

Observed change in temperature: 1948-2010

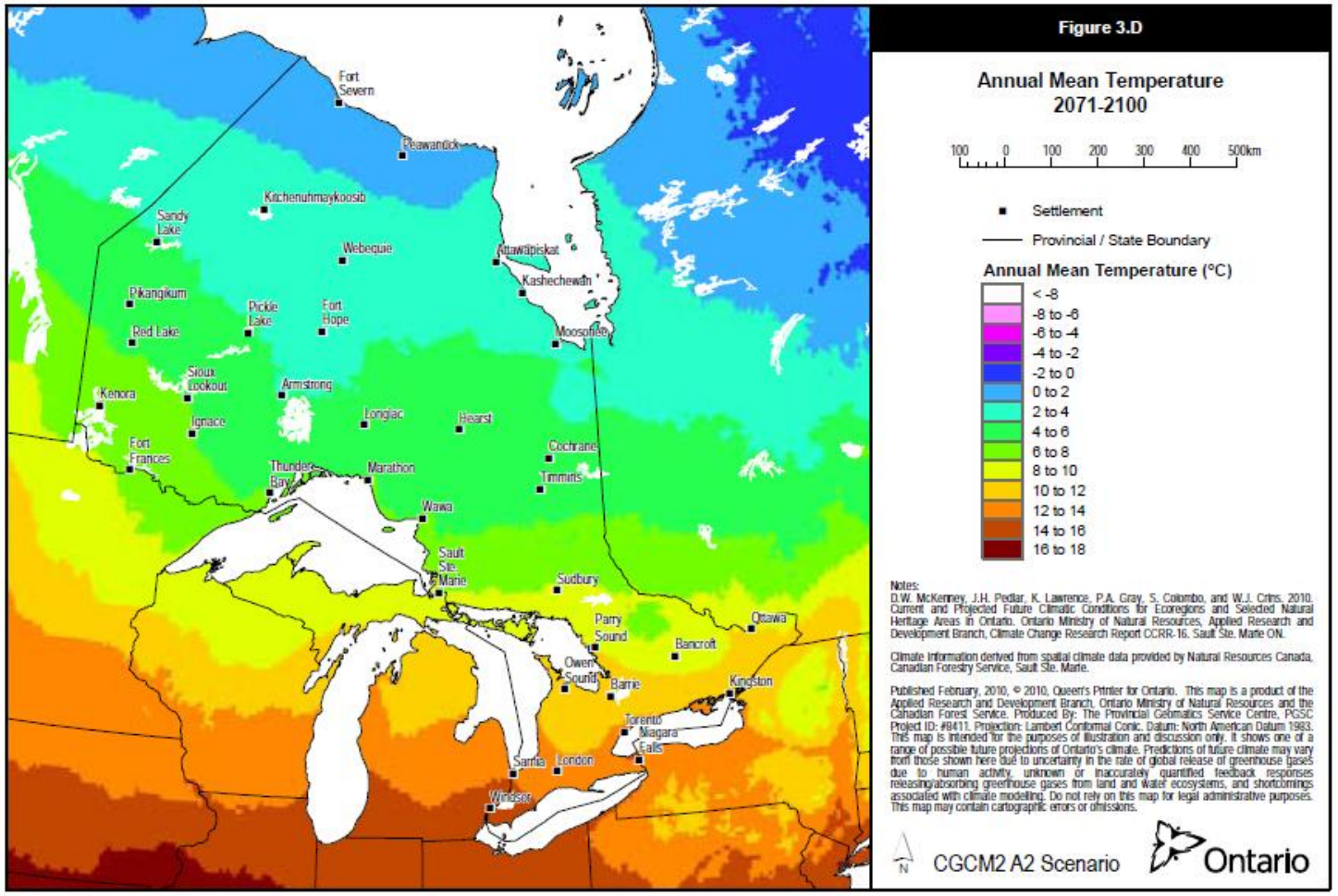


Of the 10 warmest years, 4 have occurred within the last decade

Annual Temperature Trend, 1948-2008



Significant change is projected by the end of the century

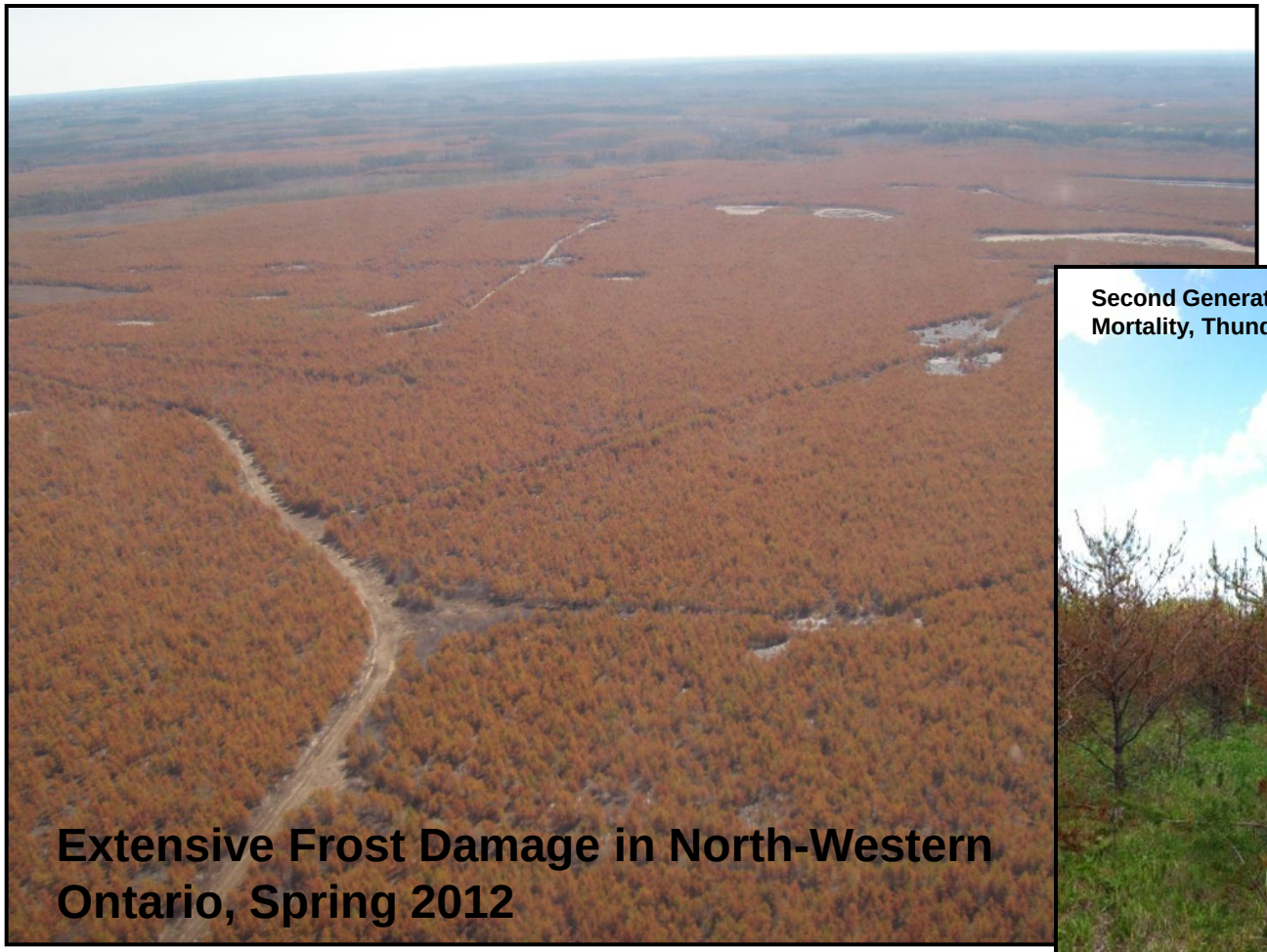


Adaptation: Managing what we cannot avoid!

Confederation Bridge

Constructed 1 metre higher to account for sea level rise under climate change

Mitigation: Avoiding what we cannot manage



Extensive Frost Damage in North-Western Ontario, Spring 2012

Second Generation Jack Pine Seed Orchard Frost Mortality, Thunder Bay 2012

Climate Change Adaptation

- Takes place through adjustments to reduce vulnerability or to enhance resilience in response to observed or expected changes in climate and associated extreme weather events.

A Practitioner's Guide was created

- To help organizations and natural resource practitioners prepare for climate change.
- To demonstrate how a suite of tools (e.g. vulnerability assessments) can be used to inform adaptation efforts.
- To provide a general framework and worksheets that can be used by practitioners from a variety of disciplines.

A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems

Version 1.0

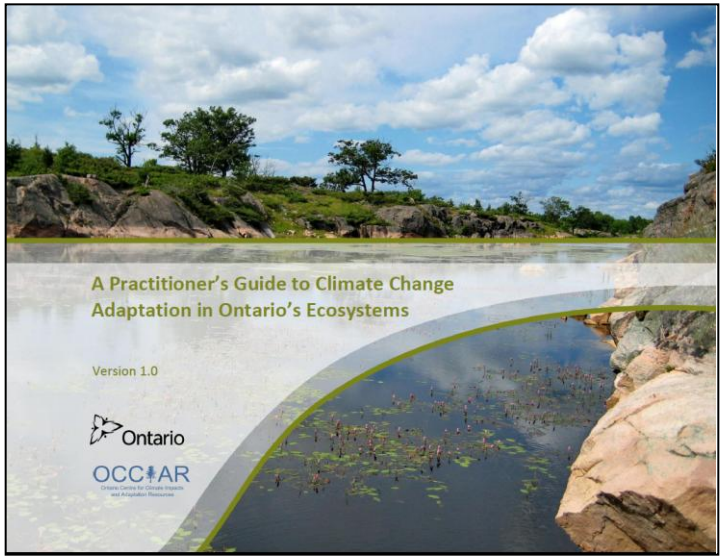
Ontario

OCCIAR

Ontario Centre for Climate Impacts and Adaptation Resources

Key elements of Practitioner's Guide

- Introduces climate change adaptation, vulnerability and risk
- Describes vulnerability and risk assessment tools and techniques that can be used
- Outlines a framework for action
- Provides examples of projects



Examples of vulnerability assessments

Lake Simcoe watershed:

- Vulnerability assessment of wildlife, hydrology, invasive species, species-at-risk, aquatic habitat, tourism
- Development of local adaptation plan with actions to address projected impacts

Northeast Clay Belt:

- Vulnerability assessment of forests (composition, fires, blowdown, insects), wildlife, aquatic habitat, soils, tourism
- Scoping adaptation options to cope with projected impacts

An adaptation framework

Step 1	Set context for assessment and build team
Step 2	Assess current vulnerability
Step 3	Develop and apply future scenarios
Step 4	Estimate future vulnerability and risks
Step 5	Develop adaptation options
Step 6	Implement and mainstream adaptation

Step 1 Set context for assessment and build team

At what level?

- Local assessments
  - Watershed
  - Municipality
  - Forest management unit etc.
- Regional-level assessments
  - Eco-district or Eco-region

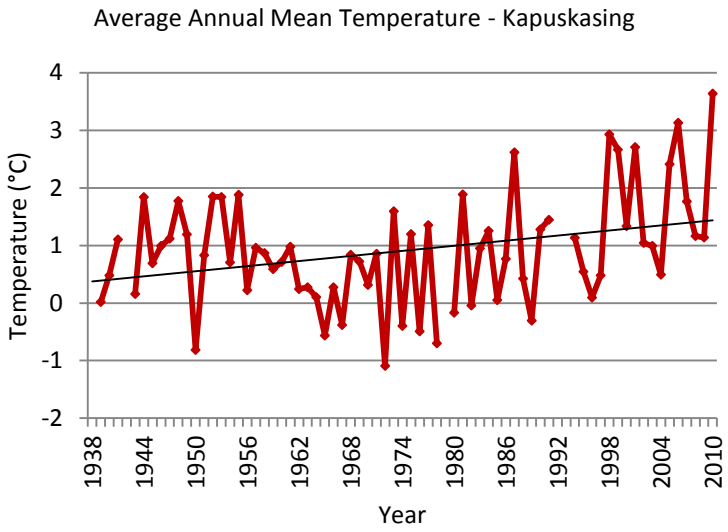
Focused on what?

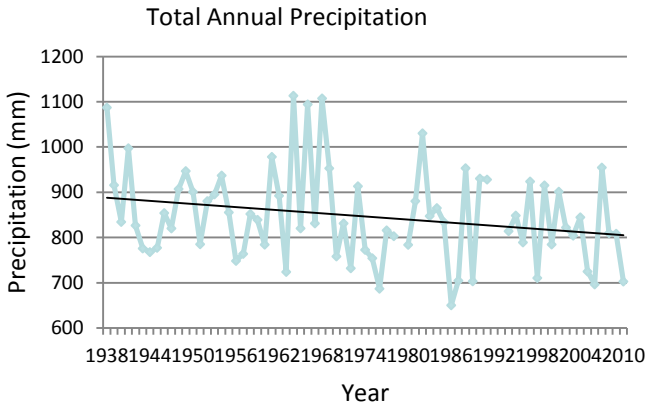
- Ecological and socio-economic themes of interest to resource managers, communities and policy-makers
  - Hydrology
  - Forests
  - Wetlands
  - Invasive species
  - Tourism
  - Aquatic habitat etc.
- Indicators within each theme may help to focus the analysis

Step 2 — Assess current vulnerability

- Understanding the relationship of indicators to climate is a critical foundation to be able to assess future vulnerability to climate change.

- Important to look at observed climatic trends in the area to understand changes that have occurred to date
  - Using information from local weather stations (e.g. temperature and precipitation trends)





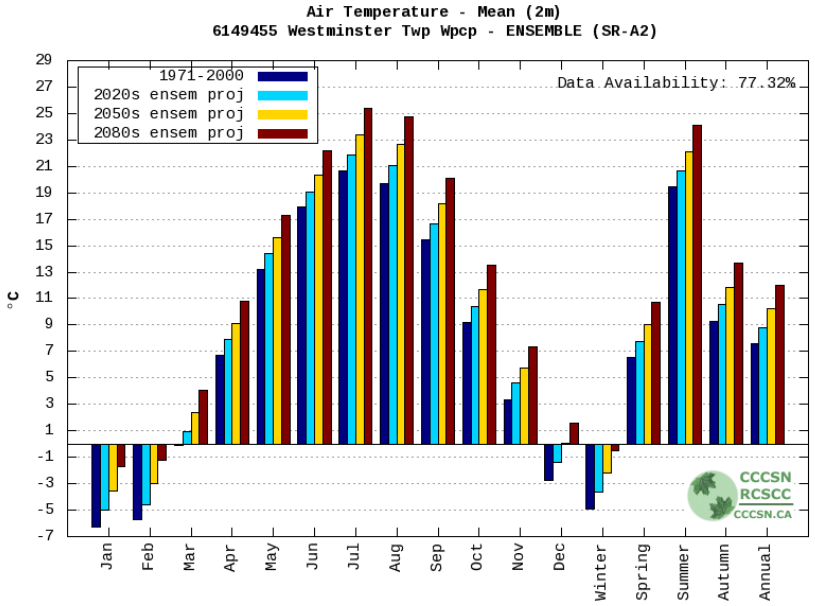
Step 2

Assess current vulnerability (cont'd)

- Climate data that includes both historical trends and future projections is available on a number of websites now easily accessible through the Climate Change Adaptation toolbox.

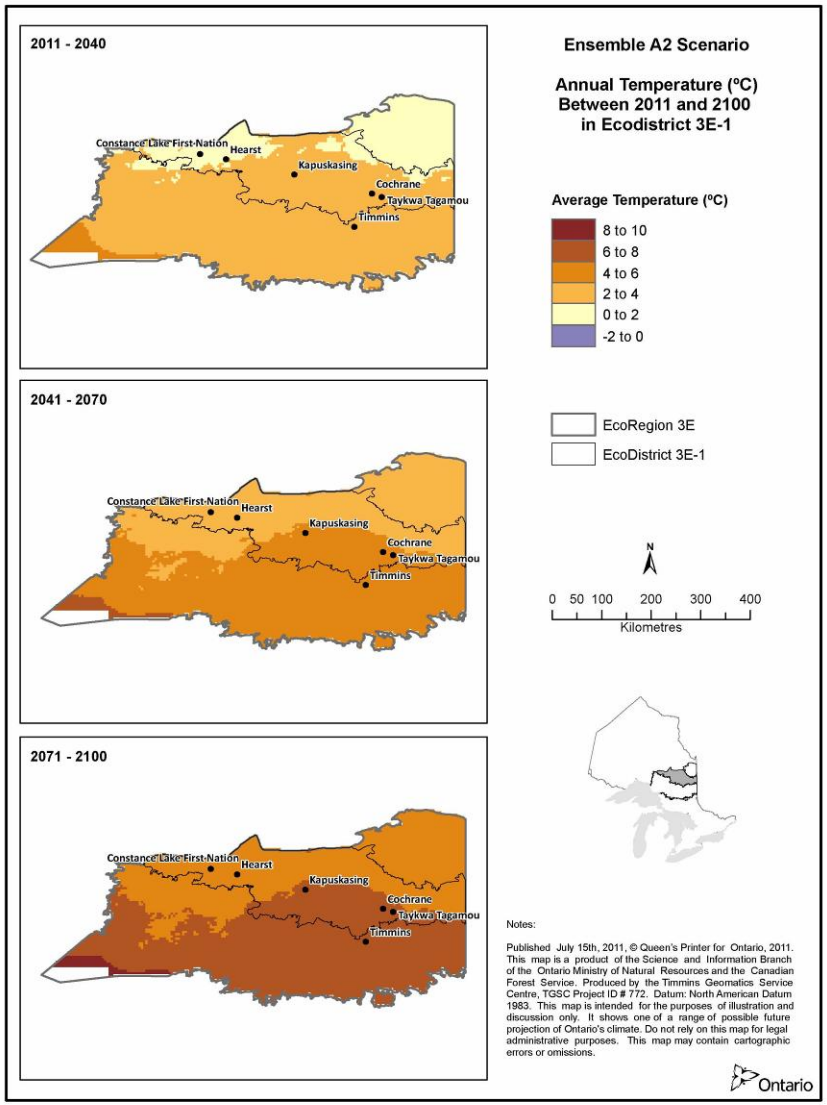
°C	annual	winter	spring	summer	autumn
1971-2000	7.6	-4.9	6.6	19.4	9.3
2020s	8.8 ± 0.3	-3.7 ± 0.5	7.7 ± 0.5	20.7 ± 0.4	10.6 ± 0.3
2050s	10.2 ± 0.6	-2.1 ± 0.7	9.1 ± 0.7	22.1 ± 0.8	11.8 ± 0.5
2080s	12.0 ± 1.0	-0.4 ± 1.0	10.7 ± 1.0	24.1 ± 1.5	13.7 ± 0.9

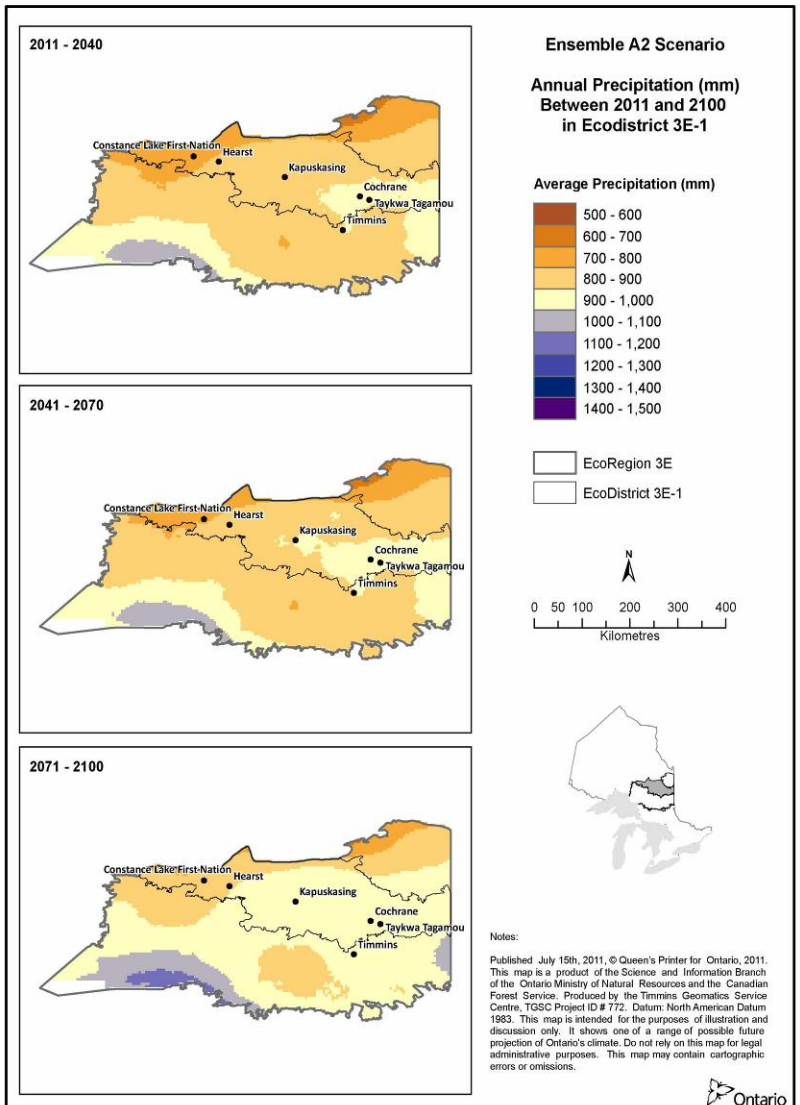
Climate Data for London, ON (Westminster Twsp)
http://ontario.cccsn.ca/



Step 3

Develop and apply future scenarios

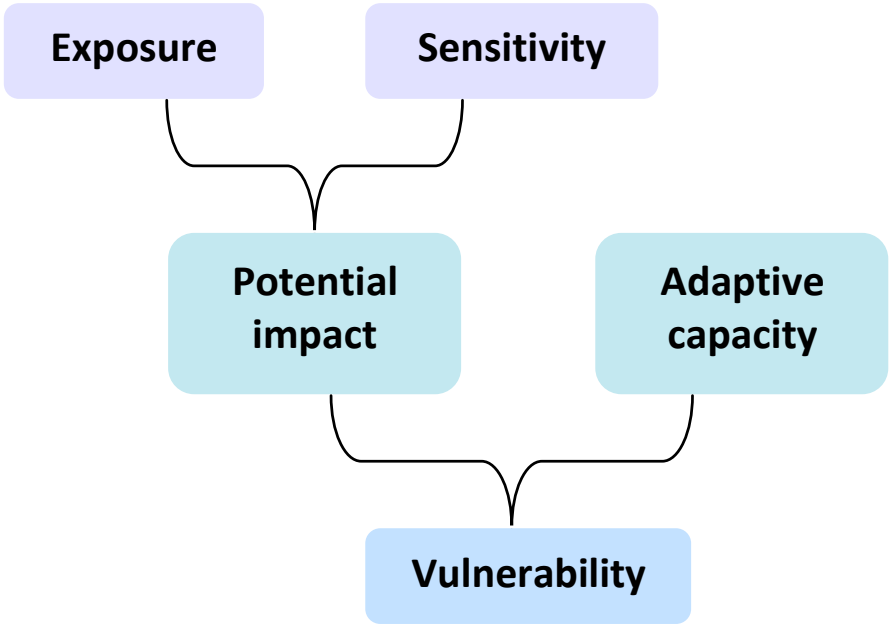




Step 4 — Estimate future vulnerability and risks

- Risk assessment used in many fields to think about future issues.
  - A complimentary approach called 'vulnerability assessment' may provide valuable insights, particularly from an ecosystem perspective.

- "Vulnerability to climate change is the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes."



IPCC, 2007. Fourth Assessment Report: Impacts, Adaptation and Vulnerability.

A sensitive species example of vulnerability: Eastern Hemlock (*Tsuga canadensis*)

Hemlock, an important tree species found in the Great Lakes-St. Lawrence forest ecosystem, can be used as an example of how the components of vulnerability relate to one another. Brief definitions introduce each component.

Exposure: the nature and extent to which the species or system is exposed to significant climate variation. More extreme weather events, including extended droughts and heat waves, are projected with climate change throughout Ontario, including southern and central Ontario where hemlock grows.

Sensitivity: how affected a species or system is by being exposed to a stress. Eastern hemlock requires cool, moist sites to regenerate and thrive. It is quite sensitive to dry and hot conditions and experiences significant stress under these conditions. In addition, hemlock is a preferred browse species of white-tailed deer; since warmer winters result in less snow cover, hemlock seedlings would be exposed to more browsing pressure.

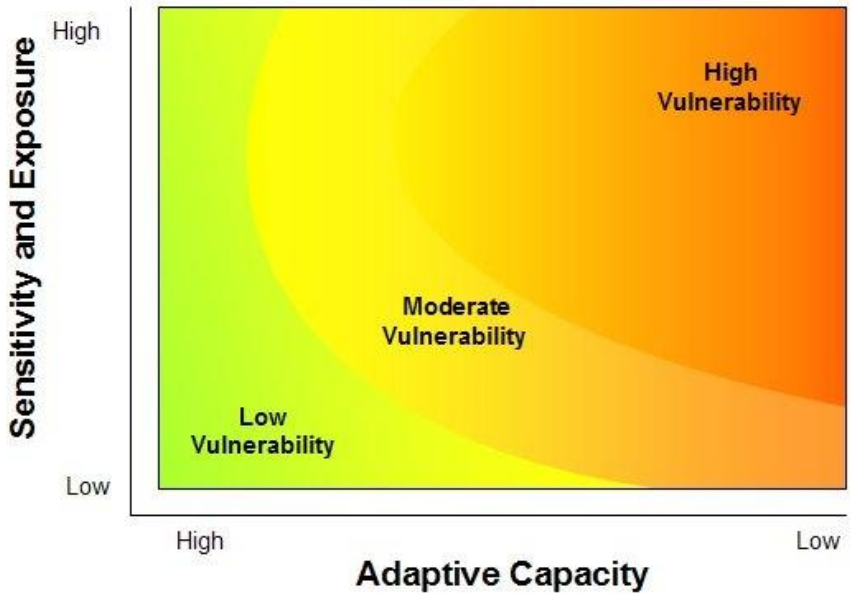
Adaptive Capacity: the ability or potential of a species or system to respond successfully to climate variability and change. Hemlock's natural ability to adapt to climate change stresses is limited. Its slow growth rate as a seedling makes it less adaptable to heat and drought conditions that would limit its growth, cause significant mortality, and make it less competitive than other Great Lakes-St Laurence tree species. Strategies to keep hemlock in the Great Lakes-St. Lawrence forest ecosystem could include management techniques such as seeding and planting of hemlock on suitable sites around water bodies and assisted migration to appropriate sites further north.

Hemlock [Stan Vasiliauskas, MNR]

Step 4

Estimate future vulnerability and risks

- Using results of analysis, identify and describe future vulnerabilities
  - Rank each indicator's future vulnerability High, Medium, or Low using information about sensitivity, exposure and adaptive capacity



(adapted from Alberta Sustainable Resource Development, 2010)

- Consider the consequences and likelihood of the vulnerabilities from different risk perspectives (financial, safety, operational etc.)

Vulnerability Assessment Results

Environmental Theme	Impacts
• Aquatic Habitat	Smallmouth bass distribution may increase in lakes while Walleye productivity may increase in some lakes and decrease in others.
• Forest Blowdown	Increases in potential incidences of severe forest blowdown, as well as building and infrastructure damage due to wind.
• Forest Fire	The fire season length is projected to increase by roughly 11 days by 2041 but total number of fires (includes human caused fires and lightning caused fires) is decreasing minimally.
• Forest productivity and composition	Ecodistrict 3E-1 may become more favourable climatically to Great Lakes – St Lawrence forest tree species
• Hydrology	• Soils in the western portion of Ecodistrict 3E-1 will be extremely dry in summers by 2100





Vulnerability Assessment Results

Environmental Theme	Impacts
• Peatlands	Increase bog and decreased fen areas leading to enhanced carbon dioxide sequestration because of higher tree/shrub growth.
• Paludification	Interaction of climate change on fire severity and paludification may result in less paludified forests which could result in increased productivity of the forests over the long term.
• Socio-economics	Walleye's increased productivity may increase revenues at remote tourism establishments. But, snowmobiling and ice fishing season could decrease.
• Wildlife	Moose not highly vulnerable to climate change in 3E-1, but if moose density increases this could increase risk for caribou due to likely higher associated wolf densities.
	Sensitivity to wetland availability, spring snow cover, and loss of forest habitat will affect waterfowl.
	Introduction of southern competitors and pathogens as well as increased extinction risk of cold-adapted species.

Step 5 Develop adaptation options

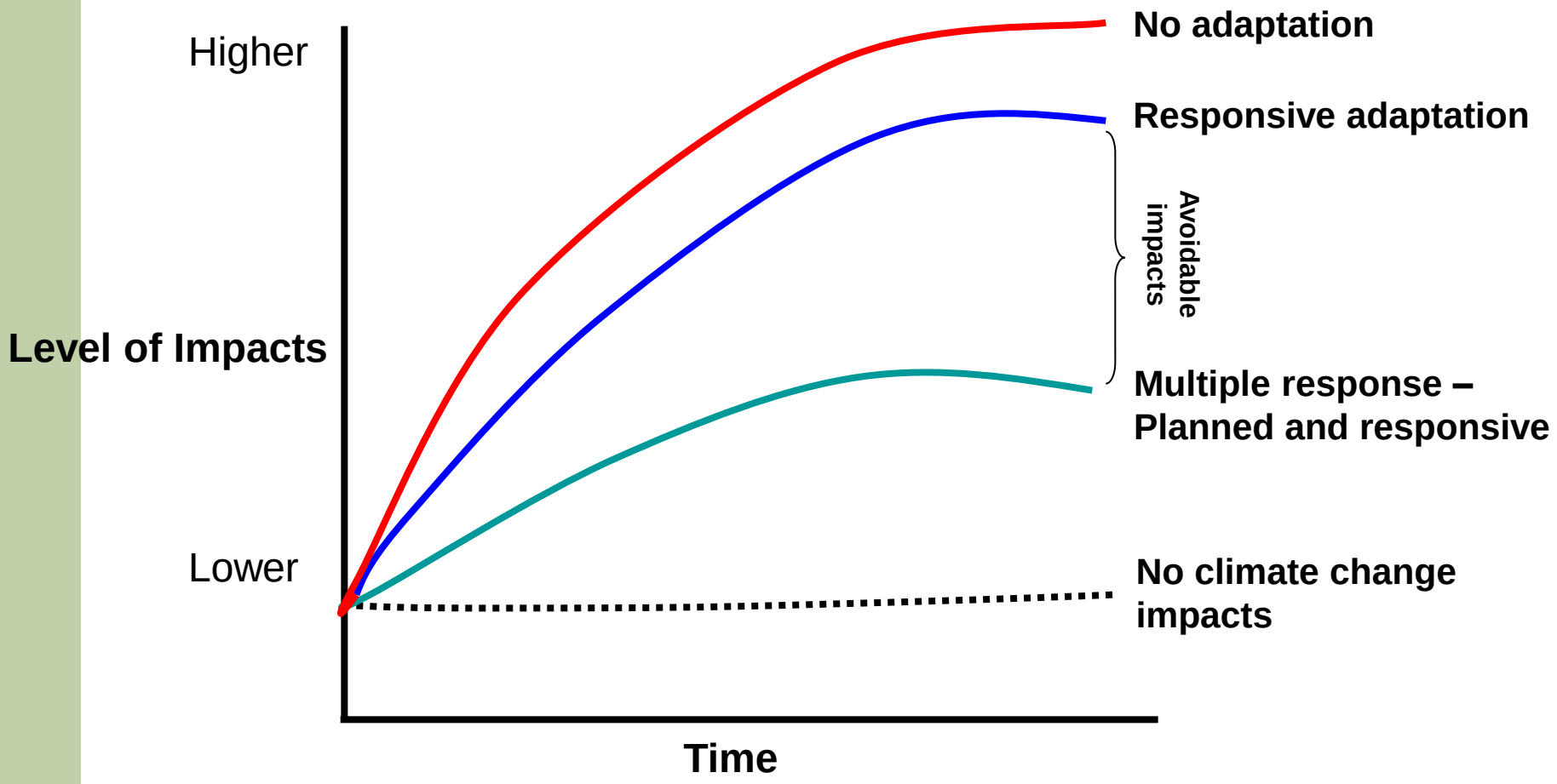
- Climate change adaptation actions helps to reduce or eliminate vulnerabilities and risks

- Adaptation options come in all forms, shapes, sizes and can:
  - Reduce threats
  - Enhance resilience
  - Engage people
  - Improve knowledge

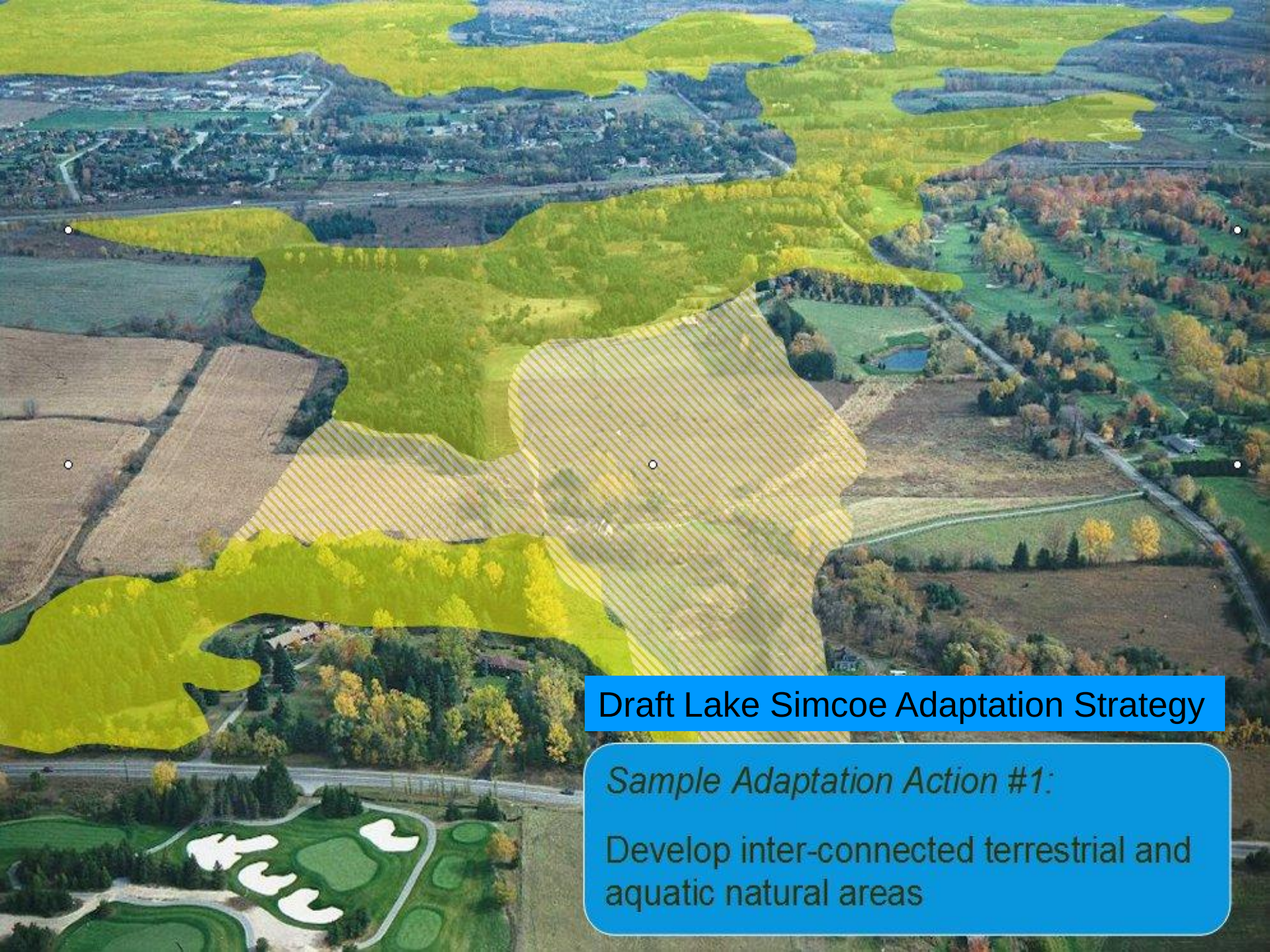
- Recommended to involve partners, stakeholders, public and organizations that will implement the actions in an evaluation of:
  - Implementation costs
  - Technical and institutional feasibility
  - Likely benefits
  - Social acceptability
  - Ecological suitability etc.


Positive proof of global warming.
18th Century
1900
1950
1970
1980
1990
2006

A Case for Proactive Adaptation



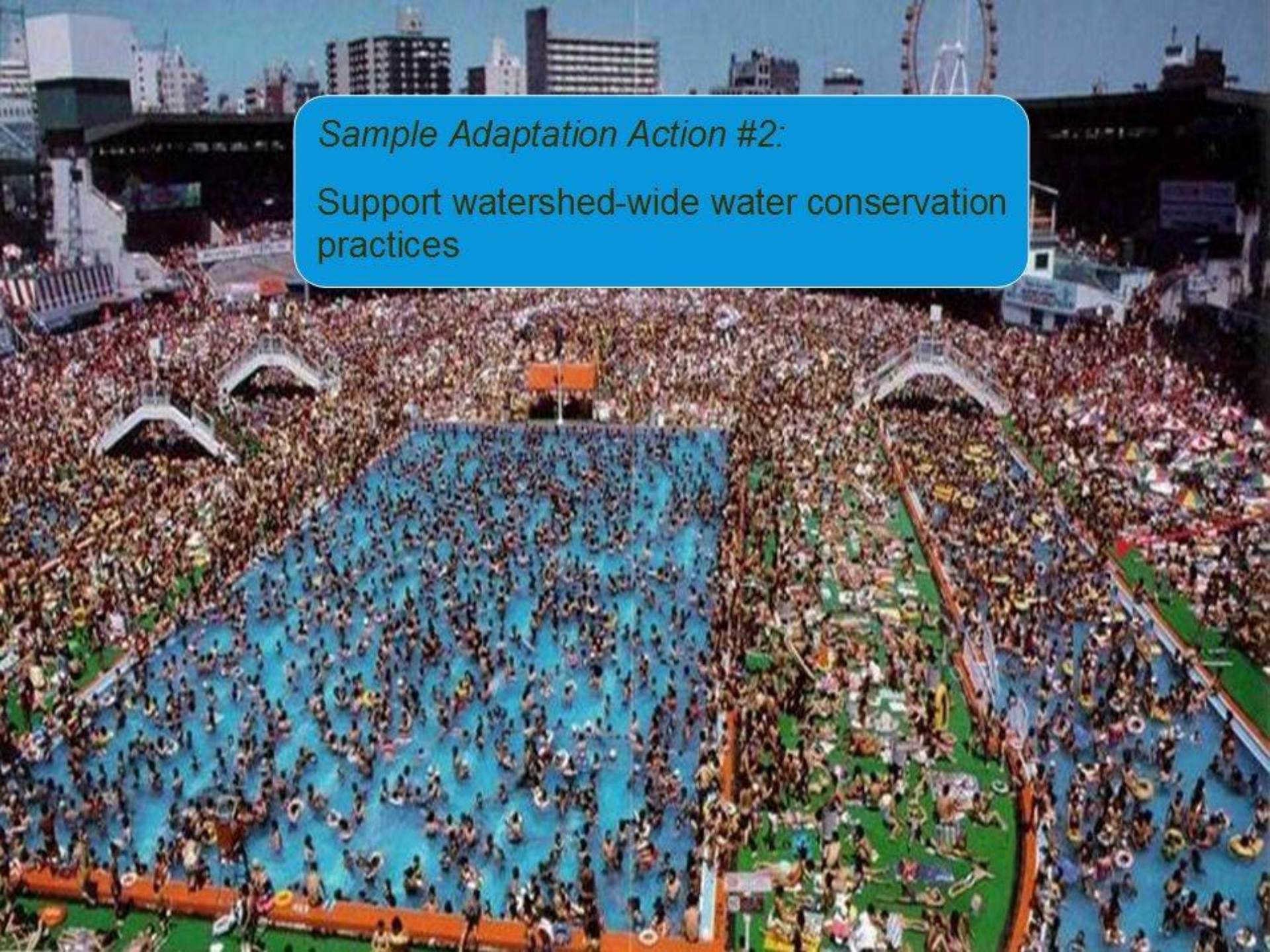
(Adapted from Fussel and Klein, 2006)



Draft Lake Simcoe Adaptation Strategy

Sample Adaptation Action #1:

Develop inter-connected terrestrial and aquatic natural areas



Sample Adaptation Action #2:

Support watershed-wide water conservation practices

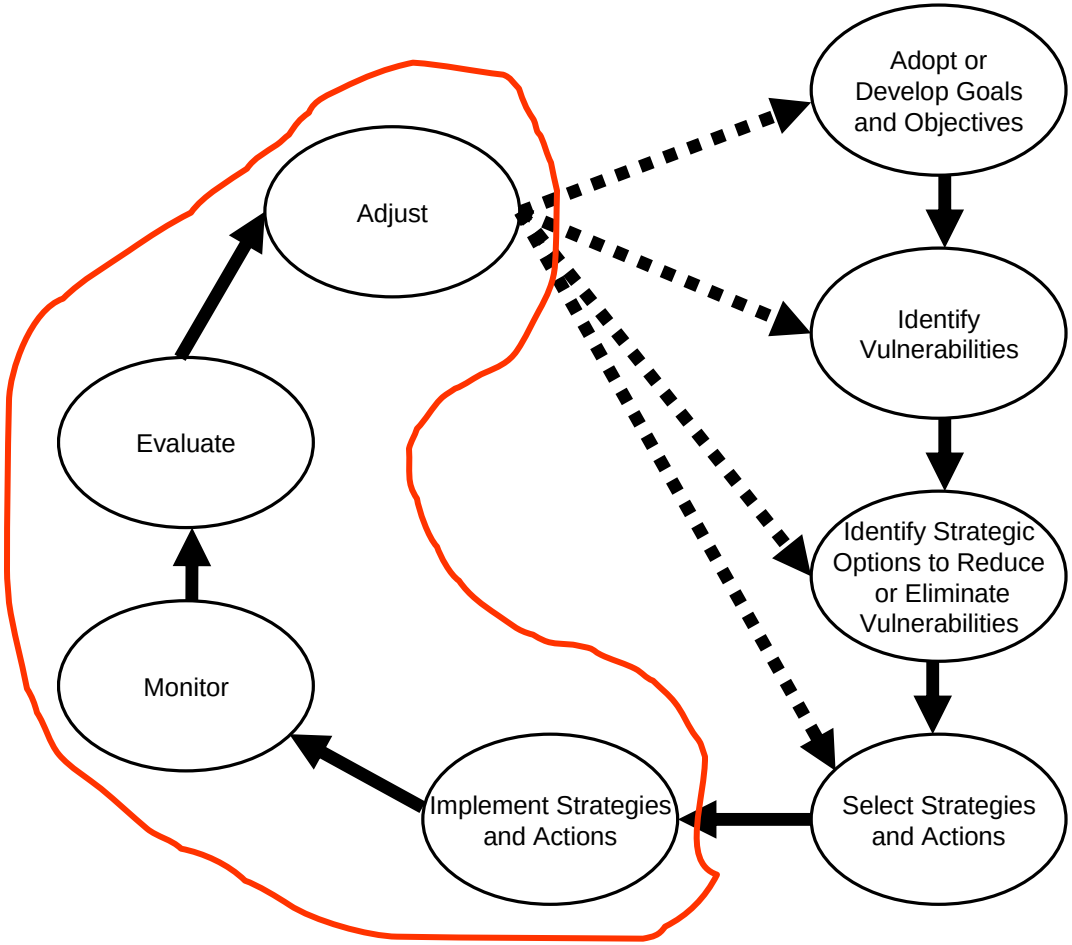
Sample Adaptation Action #3:

Develop and implement early detection techniques and response strategies for invasive species

Step 6

Implement and mainstream adaptation

Implementation of climate change adaptation plans and strategies will require an adaptive management approach



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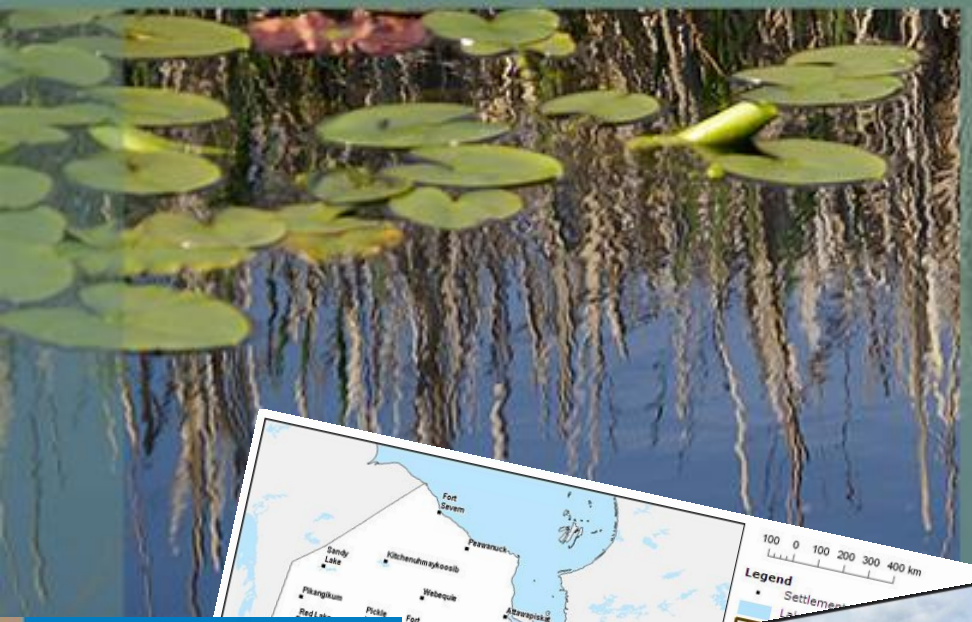
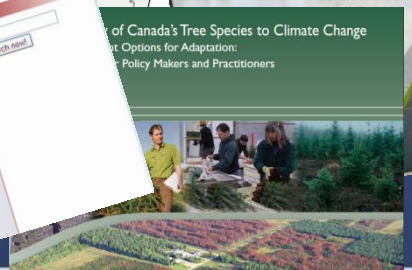
Climate Change Adaptation Toolbox

Cool Tools for a Hot Climate!



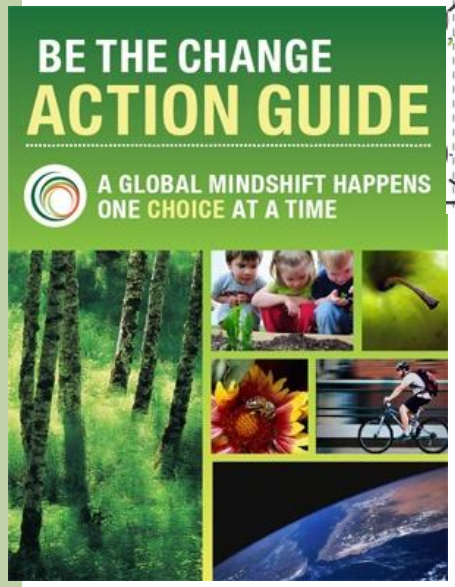


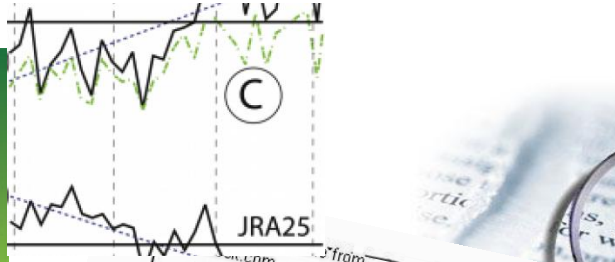
The General Idea…

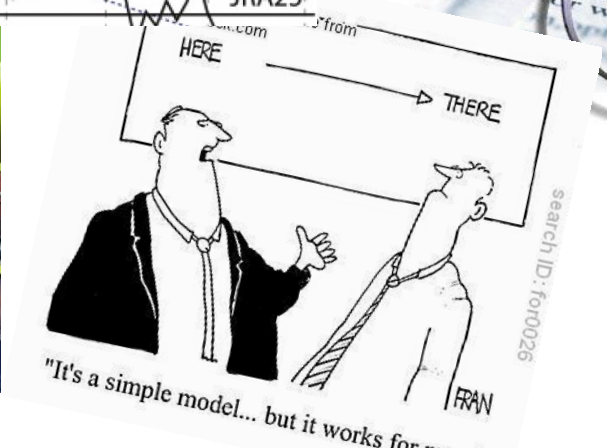
Tool type: models, guides, data sets, case studies and interactive mapping tools

Audience: conservation practitioners, resource managers, planners, policy makers, and Aboriginal communities

Theme: aquatic, terrestrial, general climate or community







Cool Tools for a Hot Climate!

Name	Organization ▲	Description	Type	Theme
Circuitscape Project (2009)	Circuitscape.org	Circuitscape predicts patterns of movement, gene flow, and genetic differentiation among plant and animal populations, information that can be used to identify and prioritize important areas for activities such as connectivity conservation.	Interactive Tool	Terrestrial
Climatic Atlas (2009)	Environment Canada	Environment Canada's climatic atlas is a five volume series of historic climate data (eg. temperature, precipitation, and solar radiation, etc.) portrayed visually on national maps. The archive provides over 400 maps of climate data!	Data set	Climate
A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems (2011)	Ministry of Natural Resources	This guide introduces the concepts of climate change adaptation, vulnerability and risk. It also provides assessment tools and techniques for these concepts, and a framework to support adaptive management. The guide identifies ways that climate change vulnerabilities and risks can be integrated into decision-making processes.	Guide	Climate
Climate Change Publications (various publication dates)	Ministry of Natural Resources	This link to MNR's climate change publications includes guides, technical papers and the Climate Change Research Report series.	Guide	All

Climate Change in Ontario's Ecoregions - Map Browser

Help | About | Report | Back to Mapping Tools

Present Climate

Ecoregion

Please select an ecoregion...

View Map

Future Climate

Climate Model

Please select a climate model...

Time Period

Please select your future climate period...

Greenhouse Gas Scenario

Please select your climate scenario...

Ecoregion

Please select an ecoregion...

View Map

D.W. McKenney, J.H. Pedlar, K. Lawrence, P.A. Gray, S. Colombo, and W.J. Crins. 2010. Current and Projected Future Climatic Conditions for Ecoregions and Selected Natural Heritage Areas in

Climate Change in Ontario's Ecoregions - Map Browser

Welcome to the Climate Change in Ontario's Ecoregions Map Browser. To view the climate change maps, follow the steps described below.

Step 1

Choose between viewing **Present Climate** or **Future Climate** maps.

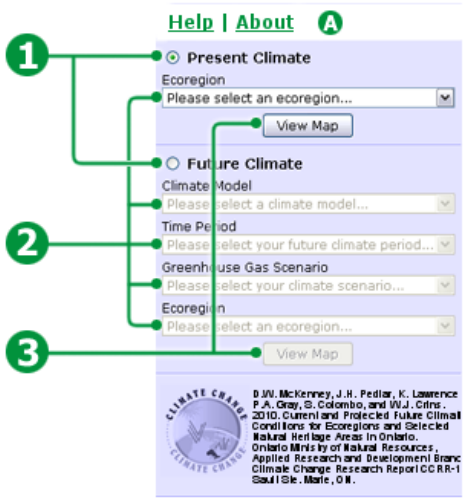
Step 2

Select the desired map details. For present climate maps, you must select an **Ecoregion**; for future climate maps, you must select a **Climate Model**, **Time Period**, **Greenhouse Gas Scenario**, and **Ecoregion**.

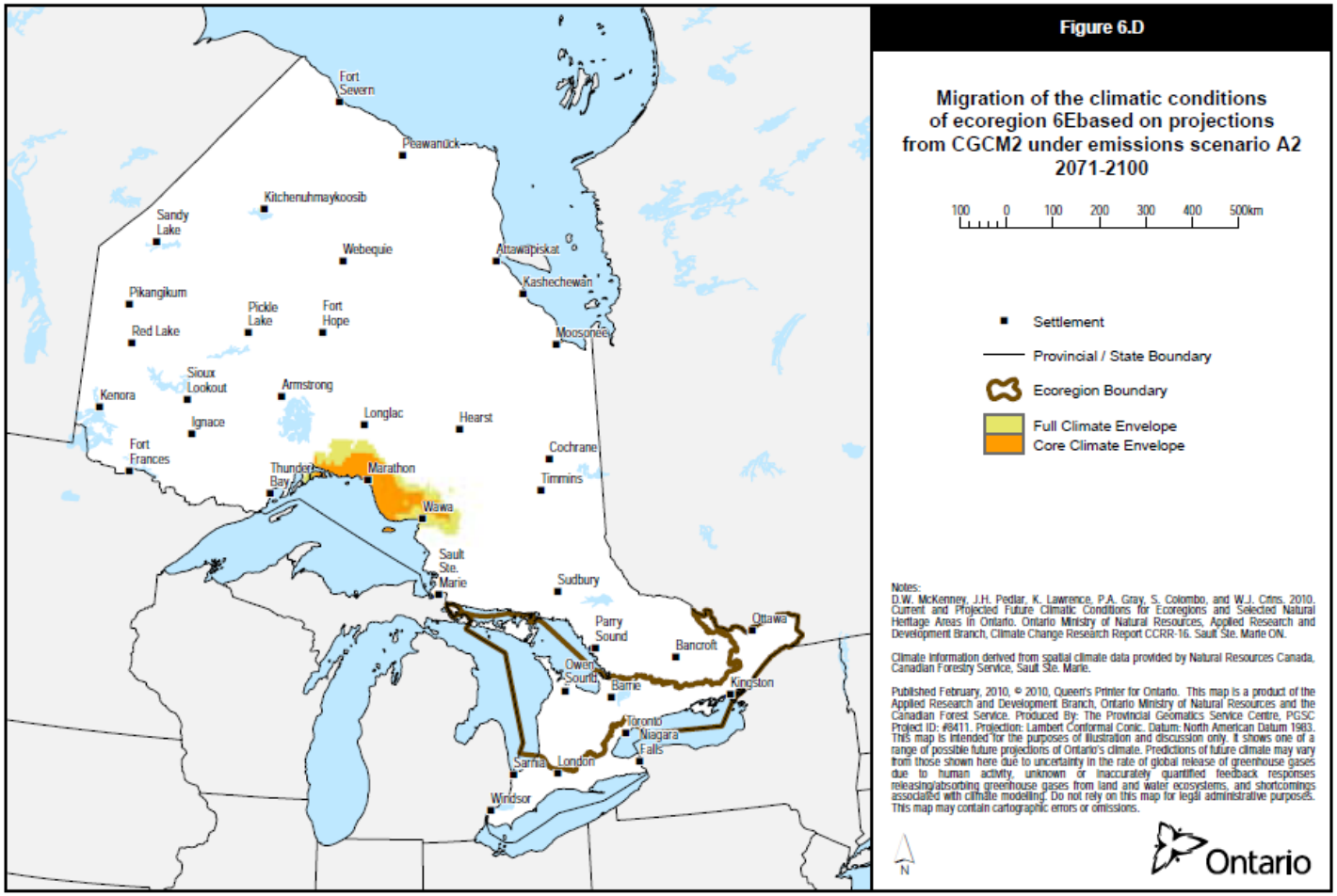
Step 3

Click on the **View Map** button to display the map.

For more information about Climate Change in Ontario, click on the About link (A).



Climate Envelops are predicted to shift having major implications for composition structure and function of ecosystems



Next steps

- Promoting and disseminating the Guide to practitioners, decision-makers and partners.
- Using the Guide and Tool Box to leverage action on adaptation planning.
  - Practitioners are encouraged to design their own approaches based on the questions being asked and the context and focus of their assessment.
- Making linkages to other emerging guidance and tools in Ontario and beyond.
- Navigate to the Tool Box – Ontario Ministry of Natural Resources/Climate Change/Adapt/Adaptation Tool Box
- You can find the Practitioners Guide at http://ontario.ca/s364

Thank you

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Photo taken Oct 7, 2011 Port Dover, Ontario