

Climate Change Vulnerability Assessment of the Urban Forest - A Workshop

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Today's agenda

Part I: Introductory Presentations:

- Vulnerability Assessments
- Climate Change Scenarios
- Description of urban forest – London

BREAK

Part II: Discussions

- Exposure, sensitivities, impacts

LUNCH

Part III: Discussions

- Adaptive capacities, vulnerabilities

BREAK

Part IV: Overview of results

Part I - 1

Climate Change Vulnerability Assessments

Basic Concepts

Climate change will affect cities the most:

- Demographics
- Heat islands & landscape transformations

Adaptation:

- Adjustment in natural/human systems to cope with consequences of climate change



Vulnerability Assessments (VAs)

Tool for informing adaptation planning and management

Contributes by:

1. Helping us identify which elements of the urban forest are likely to be most strongly affected by projected changes;
2. Helping us understand **why** these elements are likely to be vulnerable; and
3. Identifying areas of **future research** of climate change and urban forests.



Vulnerability Assessments (VAs)

Goal:

- Critical information about the susceptibility of the urban forest
- Where to put adaptive efforts

VAs tell us if we should:

1. Build *resistance* to climate stressors, or
2. Enhance *resilience* , or
3. Anticipate and facilitate ecological *transitions* that reflect changing environmental conditions... ?



Vulnerability Assessments (VAs)

Uncertainty:

→ There's a lot we don't know, but we have ways to address this, and learn by doing

Limitations:

- No priorities for management (only values do this)
- Not sole basis for special status
- Adaptation goes beyond VAs

Our Approach

- Focus on susceptibility (not just impacts and mitigation)
- Method: collaborative assessment
- Development of adaptation strategy

Considerations

1. Temperature & precipitation → mal-adaptation
2. Individual and ecological sensitivities → ecosystem as a whole
3. Informed and limited by urban forest structure
4. Natural vs. fabricated adaptation

Part I - 2

Climate Change Scenarios

Understanding Climate Change

Changes in:

- ☐ Temperature
- Precipitation & Evapotranspiration
- Sea-level rise
- Extreme weather events (variability)



Impacts:

- Air pollution
- Higher temperatures
- Mal-adaptation & new additions to tree species
- Precipitation changes
- Soils
- Fire
- Wind-throw
- Pests & diseases
- Ecosystem dynamics



Understanding Climate Change

Climate Change in Canada

Table 1: A modest climate change scenario for some urbanized Canadian Provinces

		Region of Canada					
		BC Coast	BC Interior	Prairies	ON & QC	Maritimes	NL
Climate Variables	Mean January temperature	+2°C	+3°C	+3°C	+3°C	+2°C	+2°C
	Mean July temperature	+ 1°C	+2°C	+2°C	+2°C	+1°C	+1°C
	Days over 35°C max T	+ 50%	+ 50%	+ 50%	+ 50%	+ 50%	+ 50%
	Total precipitation	+ 10%	no change	+ 10%	no change	+ 10%	+ 10%
	Prop. precipitation as snow	- 10%	+ 20%	+ 20%	+ 45%	+ 40%	+ 40%
	Large precipitation events	+ 50%	+ 50%	+ 50%	+ 50%	+ 50%	+ 50%
	Wind-storm Events	+ 20%	+ 20%	+ 20%	+ 20%	+ 40%	+ 40%

Abbreviations:

BC=British Columbia; Prairies = Alberta, Saskatchewan & Manitoba; ON = Ontario; QC = Quebec; Maritimes = New Brunswick, Prince Edward Island, Nova Scotia; NL = New Foundland & Labrador.

Legend: + = Increase, - = Decrease

(Based on Meehl et al., 2007; Parmesan & Yohe, 2003)

Understanding Climate Change

Climate Change in Southern Ontario

Table 2: A modest climate change scenario for southern Ontario

		Model		
		GCM - Canada		Hadley
		A2 scenario	B2 scenario	
Climate Variables	Mean Winter temperature	+6°C	+4-5°C	+6°C
	Mean Summer temperature	+ 5°C	+ 3-5°C	+4°C
	Total Winter precipitation	- 10-20%	- 20%	n.a.
	Total Summer precipitation	- 10%	- 20%	n.a.
	Total Precipitation	n.a.	n.a.	+ 2-13%

Legend: + = Increase, - = Decrease

(Based on Colombo et al, 2007; CNR, 2006; OME, 2007)

Understanding Climate Change

Climate Change Impacts in Forests

Table 2: Selected stressors and impacts of climate change on forest ecosystems

		CLIMATE VARIABLE				
		Temperature		Precipitation		
		Higher average	More extremes	Lower average	Fewer, larger events	Less as snow
Forest Ecosystems	Soil (Stability, Nutrients, Water content)	Lower water levels.		Rates of erosion and leaching changed	Increased overflows	Higher filtration rate
	Community Relationships	Altered competitive dynamics among tree species; altered herbivore patterns and predator-prey dynamics.				
Disturbances	Insects and Diseases	Increased range extensions and widespread outbreaks		Uncertain or undefined		
	Fires	Increased number and size of fires				
	Wind	With higher energy storage, more precipitation intensity (with wind), thus higher damage				
Individual Tree Variables	Growth (Productivity)	Increases where temperature is growth-limiting	Lowered growth response	Lower growth	Lower growth	Uncertain or undefined
	Tree phenology	Longer growing seasons, earlier spring events, later fall events	More frequent frost damage	Uncertain or undefined		
	Regeneration	Higher seedling mortality	Higher seedling mortality	Higher seedling mortality	Uncertain or undefined	
	Tree Mortality	Uncertain or undefined	Increased	Increased	Uncertain or undefined	
(Based on Williamson et al., 2009 and authors)						

Understanding Climate Change

Climate Change and Urban Forests

Table 3: Factors of climate exposure for urban forests

Elements	Characterization by factor
Direct Climate	Temperature; maximum & minimum
	Quality and quantity of precipitation
	Solar radiation
	Wind
	Humidity
Climate Extremes	Frequency and intensity of droughts
	Frequency and intensity of flooding
	Frequency and intensity of storms
Hydrology	Evapotranspiration
CO ₂	Atmospheric concentrations
Salinity	Concentrations in water and soil
Vegetation & species responses	Vegetation distribution, new species
Air pollution	Particulate matter, sulphur and nitrogen oxides, ozone, etc.
(Based on BC-MCSCD, 2010; Glick et al., 2011; Ligeti, 2007)	