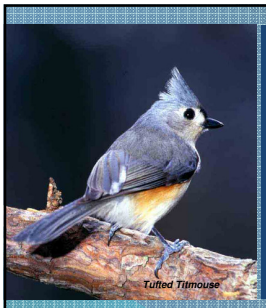
Tufted Titmouse

When there are No Polar Bears or Glaciers to Talk About…

The Policy, Planning and Management Implications of Climate Change for Biodiversity Conservation in the Carolinian Canada Life Zone

By:
Chris Lemieux
Carolinian Canada Forum, London, ON

October 26, 2007

Presentation Overview

- **Some conclusions first**
- **The story behind the conclusions**
  - Climate change in context
  - Examples of ecological consequences of climate change
  - Policy, planning and management implications
  - Recommended Adaptations
- **A few questions (no answers provided)**

Some Conclusions First

1. Biodiversity is currently being affected by 'recent' climate change
2. Future climate change will have predominantly negative consequences for biodiversity
3. Climate change will also present opportunities for socio-economic and ecological systems, but current management and planning approaches may not be flexible enough to accommodate or to take advantage of those opportunities (i.e., unprepared)
4. Climate change will be an unprecedented challenge for the jurisdictions, agencies and civic organizations involved in biodiversity conservation (including stewardship programs, land owners, etc.)
   - No historical analogue to base decisions/uncertain future
   - Long planning horizons compared to other sectors
   - Current socio-economic, land-use and political context
5. Socially acceptable, planned (anticipatory, conscious) adaptation will be key under changing climatic and ecological conditions

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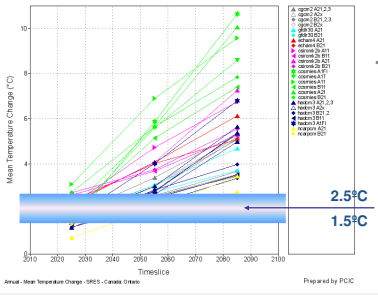
Climate Change in Context

Projected Temperature Change in Ontario:



- Globally, the IPCC projects a +1.8 to 4.0ºC over the next 100 years
- In Canada, these projections in many cases are more than double the projected global average increase

IPCC (2007): "major changes in ecosystem structure and function, with predominantly negative consequences… 20-30% of species are at increased risk of extinction"

The "Range" of Expected CC Impacts

Freshwater Systems

- lower average Great Lake water levels and summer stream flow
- increased lake and stream water temperatures
- reduced lake ice-cover and earlier spring freshet
- loss of cold-water fish habitat and altered breeding/spawning and migration patterns

Terrestrial Systems

- changes in species phenologies, distributions and abundances
- reduction of significant wetland areas
- loss of mature forest habitat
- loss of boreal forest to temperate forest
- in and out migration of Carolinian Canada species
- expansion of southern exotics/invasive species

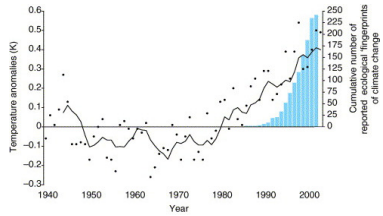
Other Changes/Stresses

- increased forest fire frequency and intensity
- exacerbated acid rain stress
- increased forest disease outbreak and insect infestations
- change in "natural tourism/recreation" supply and demand

Scott and Suffling (2000)
Lemieux et al. (2007)

Effects on Phenology & Distributions

What's Happening to Species Globally?



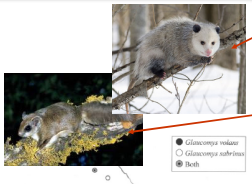
IPCC (2007) found that of 29,000 observational data series, 89% are consistent with the direction of change expected "signal switching"

Parmesan *et al.* (2003) examined 1,700 species and found:

- 6.1km northern range boundary advancement
- 2.3 day per decade advancement in phenological events

Walther *et al.* (2002) similarly found a 1.2 to 2.0 advancement in phenological events and 1.3-4.4 days per decade earlier migration in NA

Effects Phenology & Distributions (in the Carolinian Canada Life Zone)



- Virginia Opossum: non existent in Ontario in the 1980s, now found as far north as Georgian Bay (CCME, 2003)
- Southern Flying Squirrel: expanded its northern range margin by approx. 200 km since the mid-80s.
- While expansion was possible through the contiguous forests of central Ontario and Quebec, expansion did not occur through the fragmented forests of southwestern Ontario (Carolinian Life Zone region)
- As a result, due to "confinement", squirrel populations have become rare or even absent in previously suitable habitats (Bownman *et al.*, 2005)

A Recent Example in Ontario

WHERE'S WINTER?

Migration plans go south

Plentiful food supply keeps birds at home

Insects at root of tree danger

Effects in Canada's PA Network?

CCEA/UW PACC Survey

Are any types of protected areas within your agency currently affected by climate change related impacts?

NO	YES	NOT SURE
6%	71%	13%

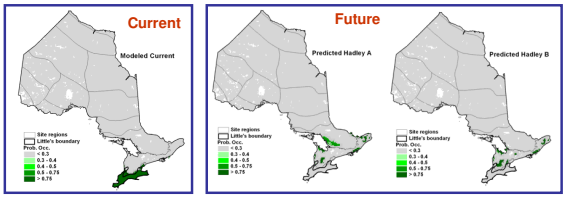
- All Fed/Provincial Jurisdictions
- NGOs: Carolinian Canada, Ont. Nat. Federation, Nature Conservancy, Long Pt. Biosphere Reserve
- 34 total

Types of Impacts Being Observed:
Species range shifts: 53%
Species composition: 29%
Disturbance regimes: 29%
Physiography: 50%
Tourism/recreation: 15%
Other: 6%

Lemieux et al. (in prep)

Effects on Future Distributions

Tulip tree (*Liriodendron tulipifera*)

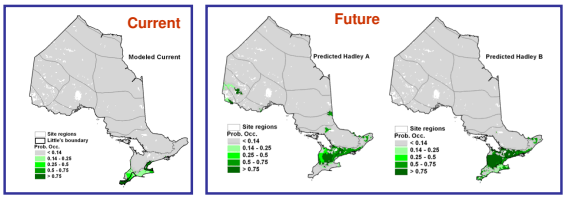


Malcolm *et al.* (2004)

Possible Loss of Carolinian Canada's Most Iconic Flora?

Effects on Future Distributions

Red mulberry (*Morus rubra*)



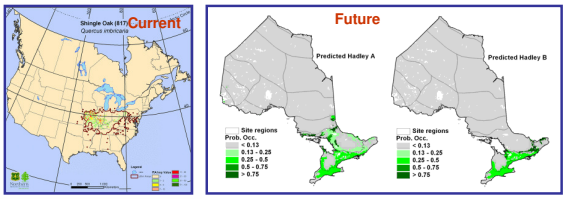
Malcolm *et al.* (2004)

Opportunities for Species at Risk?

Red mulberry (endangered, 2000) is listed in regulation under Ontario's Endangered Species Act (E.S.A.), which protects regulated species and their habitats. Additionally, the federal *Species at Risk Act* (SARA) protects Red Mulberry on the federal lands on which it occurs.

Effects on Future Distributions

Shingle Oak (*Quercus imbricaria*)



Malcolm *et al.* (2004)

Opportunity for new species not "native" to the region?

CC Opportunities?

Projected Impact of Demographic and Climatic Changes on Park Visitation to the 2020s

Park Region	Total visitors in 2003	Climate Change Only[1] NCARPCM B21	Climate Change Only[1] CCSRNIES A11	Demographic Change[2]	Climate Change and Demographic Change[3] NCARPCM B21	Climate Change and Demographic Change[3] CCSRNIES A11
Northwest	777,477	842,008	967,181	863,777	935,470	1,074,539
Northeast	816,572	997,851	1,285,284	907,211	1,108,612	1,427,951
Central	3,485,606	3,774,911	4,210,612	3,872,508	4,193,926	4,677,990
Algonquin	886,617	909,669	954,887	985,031	1,010,642	1,060,879
Southeast	1,951,717	2,287,412	2,734,356	2,168,358	2,541,315	3,037,869
Southwest	2,264,129	2,449,788	2,746,388	2,515,447	2,721,714	3,051,238
Total Visitation	10,182,118	11,261,639	12,898,708	11,312,333	12,511,681	14,330,465
% Change in Visitation		+10.6%	+26.7%	+11.1%	+22.9%	+40.7%

Jones & Scott, 2006

+17%

+25%

PAs could benefit economically, communities could also benefit, however, could also result in higher occurrences of recreation conflict among park users, additional stresses, extra operational demands, and requires a change in habits and routines.

Peak +20%
Shoulder +50%

Implications for Carolinian Canada PAs

Protected Areas System Planning and Policy	• PA system planning frameworks (e.g., natural region representation) may not be optimal. [National Parks Plan, Provincial Parks, ESAs (25 of CC's 38 sites) and ANSIs (17 of CC's 38 sites)] • System goals will require interpretation (what to protect? historic-current-future species?). • Because future non-analogue communities are unknown, they are excluded.
Park Management Plans	• Established management objectives will no longer be viable in some parks. • PA objective statements (e.g., to protect a highly valued species) will force protected areas managers to try to "hit a moving target" of ecological representativeness.
Active Management Plans	• Wildfire management plans (utilize to re-establish or maintain current ecological representation) [e.g., Rondeau and Pinery]. • Individual species management plans (commit resources to species re-introduction?, how define invasive species?, exclude southern species from species at risk protection?). • Visitor management plans (how manage for potentially large increases in visitation, possibility of extra stress on operations and ecosystems).
Other ???	• Northward shift of species from the US would be considered an "invasive species" – ethically justified to remove such a species? • Canadian Species at Risk Act: species "native" to Canada for at least 50 years.

Adaptation Recommendations

Planning & Policy	• Expand, link protected areas where possible • Improve natural resource planning & management to focus on preserving and restoring ecosystem functionality and processes across regional landscapes. • Select redundant reserves.
Management	• Implement adaptive management & incorporate climate change into management objectives & strategies • Enhance resiliency of PAs to allow for management of processes and services in addition to "valued" species • Minimize external stresses, create and restore buffer zones (matrix conservation) • Revise PA objectives to reflect dynamic biogeography
Research & Monitoring	• Make resources available to aid research on impacts of future climate change (modeling) • Use PAs as a TOOL to facilitate adaptation (can play an important role as long-term monitoring sites, especially for species at risk) – role of stewardship orgs and land-owners?
Capacity Building & Awareness	• Strengthen professional training and research capacity of PA staff, volunteers, organizations • Capacity building and awareness should proceed with the goal of securing public acceptance • Greater partnerships/collaboration (such as those under CCC) within the greater (regional) park ecosystems • Improved collaboration/stewardship

Insights and Conclusions

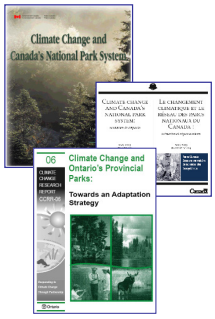
Examples provided here suggest that climate change will be a dominant factor in ecological protection over the 21st century…

What should be the role of Protected Areas under changing climatic and ecological conditions?

What do we value?

How can we take advantage of the opportunities?

Extra Resources…



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- Scott, D.J. and C.J. Lemieux. 2007. Protected areas, climate change and Canada's boreal forest. The Forestry Chronicle, 83(3): 347-357.
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THANK YOU!