Climate Change Impacts & Adaptation in Ontario: Biodiversity and Protected Areas

Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR) 2015

Overview of Climate Change Impacts on Biodiversity in Ontario's Ecosystems

Ontario encompasses a variety of ecosystems, including prairies, forests, tundra, wetlands, lakes, rivers, and the coastal regions of Hudson Bay (Ontario Biodiversity Council, 2015). Climate affects many components of each ecosystem including soil composition and structure, the water cycle, species distribution, the timing of life-cycle events such as egg laying, and plant and animal health (Bush et al., 2014; Nantel et al., 2014). As climate change continues to cascade through each ecosystem (Figure 1), there will be significant social and economic implications for Ontarians. For example, warming temperatures and changing precipitation patterns will affect biodiversity, agriculture, aquaculture, hunting and fishing opportunities, recreation and tourism, pharmacology, flood regulation, and clean air and water, amongst others (Nantel et al., 2014).

Figure 1: Illustration of the complex interactions among documented or projected responses of species and ecosystem processes to climate change. Such complexities make the outcome for any given species difficult to predict (Nantel et al., 2014).

Climate change will affect biodiversity in many ways by altering species relationships and changing the distribution and configuration of habitats, which could result in community reassembly in ecosystems throughout Ontario. There will be winners and losers. For example, mobile species with relatively large geographic ranges with northern range boundaries in Ontario likely will benefit from climate change, while habitat availability for less mobile species with southern range boundaries in the province may contract as a result increased threat from parasitism, competition and other biotic stresses.

Life cycle changes resulting from warmer winter and spring temperatures are occurring across Ontario. Shifts include earlier onset of breeding by amphibians (e.g. wood frog, northern leopard frog and spring peeper) and earlier occupation of breeding habitat and emergence of hatchlings by bird species (Varrin et al., 2007; Walpole and Bowman, 2011). For example, eastern bluebird migration and egg-laying occur earlier in the season and coincidentally correspond to climate-induced changes in insect population distribution and abundance (Varrin et al., 2007). In the long term, this shift may increase bluebird reproduction. Conversely, the southern range boundary for some species is contracting or projected to contract as a result of hybridization (e.g. black-capped chickadee) and habitat loss (e.g. the gray jay where warmer fall temperatures could result in increased rotting of stored food, which in turn will negatively influence reproduction) (Waite and Strickland, 2006). Warming water temperatures continue to change the distribution and volume of thermal aquatic habitat. Habitat for coldwater species such as lake trout is decreasing while habitat for warmwater species such as smallmouth bass is increasing. Sharma et al. (2009) project that by 2050 the number of lakes with vulnerable lake trout populations could increase from 118 to 1,612.

Warmer water temperatures will enable invasive species like smallmouth bass and algal blooms to significantly influence community reassembly in lakes, rivers and wetlands throughout Ontario (Chiotti and Lavender, 2008). Many invasives represent a significant threat to the health and well-being of indigenous species and people who live and work in these ecosystems. For example, the winter range of the black-legged tick responsible for the spread of Lyme disease has expanded from southern Ontario and the northeastern USA into central Ontario and is projected to reach northern Ontario by the 2080s (Ogden et al., 2006).

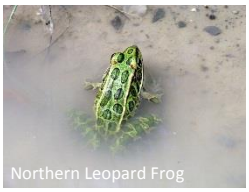
At the landscape and waterscape scale, increased extreme weather events such as heavy precipitation, extreme winds and drought will affect ecosystem-level responses through forest fires, blowdowns and flooding. For example, climate model projections suggest that the average area affected by forest fires across Canada could increase up to 120% by the end of the century (Flannigan et al., 2005). In addition, it is important to note that climate change works with other cumulative effects to modify ecosystem composition, structure and function. When combined with human-induced stressors such as habitat fragmentation, water pollution, deforestation and wetland drainage, these changes can significantly affect survival and adaptation ability of species throughout Ontario.


Eastern Bluebird


Lake Trout


Black-capped Chickadee


Black-legged Tick


Northern Leopard Frog

Adaptation Opportunities

As the climate warms and ecosystems change, adaptation will become increasingly more important to Ontarians as they work to cope with these new challenges. Many adaptation options are available, including but not limited to:

1) Protecting intact ecosystems.
2) Connecting protected areas through sustainably managed landscapes and waterscapes. Mechanisms for this may include new approaches to habitat protection on intervening landscapes and waterscapes, and increased participation of landowners. For example, the Ontario Ministry of Natural Resources and Forestry's 50 Million Tree program creates corridors between natural areas in order to enhance and diversify southern Ontario's landscape and increase adaptive capacity to withstand climate change (Nantel et al., 2014).
3) Supporting species recovery with ecological restoration of degraded ecosystems.
4) Encouraging active habitat management, such as the establishment of nest boxes and the protection of cavity trees to facilitate the colonization of sites by species expanding their ranges.
5) Sponsoring programs that subscribe to an adaptive approach to managing for the effects of climate change. This can include improved institutional coordination, and training and education programs.
6) Employing knowledge management systems to support research, inventory and monitoring, as well as communication and education.
7) Undertaking species vulnerability assessments to identify species and populations that require active human intervention to mitigate losses. A study of the vulnerability of Ontario's Lake Simcoe watershed to climate change led to the development of *A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems* (Gleeson et al. 2011), a guide to help natural resource managers integrate climate change vulnerabilities and adaptation planning into decision-making processes.
8) Acquiring longer-term data sets to assess species responses, and develop models to better understand the complex potential outcomes of climate change on species and their interactions.
9) Engaging communities in adaptation programs (Nantel et al., 2014).

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The information presented is based on Chapter 6 of NRCan's 2014 National Climate Assessment titled **Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation** with additional Ontario-specific information. For more information on the National Assessment, please visit: www.nrcan.gc.ca/environment/resources/publications/10766

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