

Climate Change Impacts & Adaptation in Ontario: The Forestry Sector

Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)

2015

Observed Impacts

Ontario forests have experienced climate change impacts in recent decades with effects ranging from severe to subtle. Severe impacts are characterized as direct, widespread and damaging, and examples include increases in the frequency and severity of forest fires, the northward spread of pests and diseases such as the spruce budworm, and damage from extreme weather events (Williamson et al., 2009; Lemmen et al., 2014). Extreme events such as drought and wind events have also damaged Ontario's forests. Re-occurring drought events have combined with the cumulative effect of acid rain deposition, contributing to forest decline in some parts of the province (Brydges et al., 2002). More subtle impacts have also been observed: temperature-driven events, such as flowering or bud burst occurring earlier in the year; lengthening of the growing season; and changing forest composition (Williamson et al., 2009; Lemmen et al., 2014). Although these changes have not yet dramatically altered the composition and health of Ontario's forests, they will continue to influence Ontario's forest sector and related industries (Parker and Craig, 2005).



Figure 1: A Ministry of Natural Resources fire ranger looks back as a camp protected by sprinklers is threatened by a forest fire near the town of Red Lake, Ontario on August 4, 2011 (The Canadian Press, 2011).

Expected Impacts

Studies agree that Ontario will gradually become 'warmer and wetter' (IPCC, 2007). Average annual surface air temperatures in Ontario are expected to increase between 2.5 and 3.7°C by 2050 (from baseline average 1961-1990) (CCDS, 2009; MOE, 2011). Furthermore, projections suggest that annual precipitation is expected to increase in Ontario, with the largest changes in the northeast and the lowest changes in the western part of the province (CCDS, 2009).

Long-term changes in temperature and precipitation patterns (both rain and snow) will affect evapotranspiration rates, water availability, length of growing season, and changes in the seasonality of wildland fire (Murphy, Chretien and Brown, 2012). In some regions the warmer, wetter climate will improve growing conditions, while other regions will experience higher evaporation rates and changing soil conditions due to drought, which could lead to early stand dieback and breakup (Murphy, Chretien and Brown, 2012; Williamson et al., 2009; Lemmen et al., 2014). Warming will permit the expansion of the northern range limit of many species however actual species migration will not keep pace with the rate at which climatically suitable niches expand (Williamson et al., 2009). As a result, the extirpation of some vulnerable species is likely to occur due to less favourable climatic conditions.

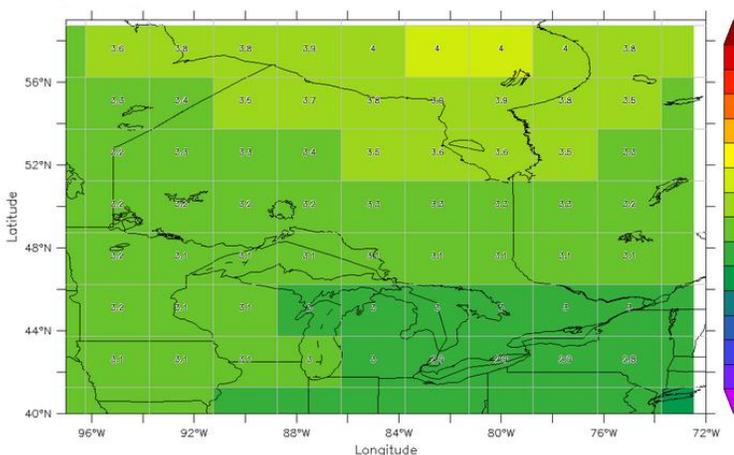


Figure 2: Projected increases in average annual temperature in the 2050s compared with 1961-1990 using HIGH GHG emissions (A1B emission scenario) (CCDS, 2009).

In addition to long-term trends, extreme weather events are expected to increase in magnitude and frequency (IPCC, 2007). More frequent flooding, extreme temperature, and wind events will damage trees as well as infrastructure and equipment required for forest management and related industries (e.g. mills, maple syrup production, transportation routes). Projections also indicate that fires are likely to occur more frequently, requiring current provincial suppression resource levels to be significantly increased to manage this risk, and limiting access to the forest and forest resources (Wotton et al., 2010). Overall area burned is also projected to increase, with most of the increase occurring in the remote northwestern portions of the province (Williamson et al., 2009). Cumulative impacts pose a significant threat to Ontario's forests. For example, damage caused by increasing pest and disease occurrence may increase vulnerability to forest fires and extreme events. This combination of impacts has a multiplying effect on climate risk and can complicate forest resource management adaptation efforts.

Adaptation Measures

Trees have natural physiological and genetic adaptive abilities that allow adjustment to changes in the environment. Expected climate change impacts will likely surpass this inherent adaptive capacity, therefore Ontario's forest sector will need to adapt. Some of the ways in which forest managers can mobilize adaptation into practice include assisted migration (the human-assisted movement of species in response to climate change) and increased research to better understand Ontario's vulnerability and adaptation requirements. For example, the City of Greater Sudbury considered climate changes when planning forest floor transplants as part of the re-greening program. Species likely to thrive in northerly locations were identified and transplanted with forest floor material in the target area. The City of Toronto Urban Forestry Services has employed new planting techniques that promote street tree health and provide an element of protection for urban forests against climate change impacts. The new planting techniques facilitate root growth and encourage the growth of strong, healthy trees (CAP, 2012).



Figure 3: The Spruce Budworm is the most destructive pest of spruce and fir forests in North America. Climate change is expected to result in increased spruce budworm damage in northern areas of Ontario and decreased budworm damage in southern areas (Williamson et al., 2009; Government of Ontario, 2015).

In 2013, the Canadian Council of Forest Ministers (CCFM) conducted a review of several case studies in which forestry-based climate change vulnerability assessments had been carried out. These included assessments in the Clay Belt region and the Lake Simcoe watershed in Ontario. The case studies identified climate risks, vulnerable regions, and provide data to inform decisions on adaptation in the region. The CCFM has also developed criteria and indicators (C&I) for sustainable forest management across Canada. There is an ongoing discussion on how climate change vulnerability assessment can be incorporated into the C&I. In 2012-2015, CCFM produced a series of reports on *Adapting Sustainable Forest Management to Climate Change* which examines the impact of climate change on sustainable forest management and provides a suite of tools and products that improve the ability of the forest sector to adapt to climate change, and guide forest managers in understanding and carrying out vulnerability assessments. For more information on the CCFM climate change documents, please visit www.ccfm.org/english/coreproducts-cc.asp.

References

- Brydges, T., Hall, P. and Loucks, O. (2002): Forest Health and Decline. A report from the 2000 Muskoka Workshop and Field Tour of Experts, Muskoka, Ontario.
- CAP [Clean Air Partnership] (2012): Accelerating Adaptation in Canadian Communities: Case Studies. <www.cleanairpartnership.org/accelerating_climate_change_adaptation_case_studies>
- CCDS (2009): 2050s Ensemble Scenarios (1961-1990 baseline). Canadian Climate Change Scenarios Network. Editor: N. Comer. Adaptation and Impacts Research Section, Environment Canada. <<http://ccds-dscc.ec.gc.ca/?page=enemblescenarios-2050s>>.
- Government of Ontario (2015). Spruce Budworm. <<http://www.ontario.ca/environment-and-energy/spruce-budworm>>
- IPCC [Intergovernmental Panel on Climate Change] (2007): Summary for Policymakers, in Climate Change 2007: The Physical Science Basis; Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.
- Lemmen, D.S., Johnston, M., Ste-Marie, C. and Pearce, T. (2014): Natural Resources; in Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation, (ed.) F.J. Warren and D.S. Lemmen; Government of Canada, Ottawa, ON, p. 65-98.
- MOE [Ministry of the Environment] (2011): Climate ready: Ontario's Adaptation Strategy and Action Plan 2011-2014. <www.ontario.ca/document/climate-ready-adaptation-strategy-and-action-plan-2011-2014>.
- Murphy, B.L., A.R. Chretien and L.J. Brown (2012): Non-timber forest products, maple syrup and climate change. The Journal of Rural and Community Development, 7(3), p. 42-64.
- Parker, B. and Craig, B. (2005): The Status of Forest Health in Southern Ontario: An Assessment using Tree Mortality Rates. Environment Canada <<http://ec.gc.ca/Publications/default.asp?lang=En&xml=F5DF2B94-B7FD-4C79-92B9-D04F2D33A6CF>>.
- The Canadian Press (2011): Northwestern Ontario breaks 50-year forest fire record. <<http://ottawa.ctvnews.ca/northwestern-ontario-breaks-50-year-forest-fire-record-1.687297>>.
- Williamson, T.B., Colombo, S.J., Duinker, P.N., Gray, P.A., Hennessey, R.J., Houle, D., Johnston, M., Ogden, A. and Spittlehouse, D.L. (2009): Climate change and Canada's forests: From impacts to adaptation. Sustainable Forest Management Network and Natural Resources Canada, Canadian Forest Service, Northern Forest Center, Edmonton, Alberta.
- Wotton, B.M., Nock, C.A., and Flannigan, M.D. (2010): Forest fire occurrence and climate change in Canada; International Journal of Wildland Fire, v. 19, no. 3, p. 253-271.

This information sheet was developed by the **Ontario Centre for Climate Impacts and Adaptation Resources (OCCIAR)** with federal funding support through Natural Resources Canada's Regional Adaptation Collaboratives Program. www.ClimateOntario.ca

The information presented is based on Chapter 3 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