

Climate Change Impacts & Adaptation in Ontario: Human Health

Overview of Climate Change Risks to Human Health in Ontario

Climate change poses significant risks to human health and well-being. In Ontario, the main health risks related to climate change include greater morbidity and mortality related to an increase in the frequency and severity of extreme weather events (e.g. extreme heat, floods, wildfires, ice storms and droughts), increases in illness and deaths due to poor air quality, food- and water-borne illnesses and the expansion of vector-borne and zoonotic diseases. Vulnerability to the health risks associated with climate change are influenced by exposure to the hazards, sensitivity to the effect, and the level of adaptive capacity of individuals and the public health system.

Air Quality: Air quality issues, such as smog, can have widespread health impacts (e.g. asthma, cardiovascular disease, lung cancer, birth defects, etc.). The Ontario Medical Association (OMA) estimates that in 2005, air pollution cost Ontarians almost \$7B due to premature deaths, emergency room visits, hospital admissions and absenteeism (OMA, 2005). In 2005, Windsor, Ontario experienced approximately 260 premature deaths, 900 hospital admissions and 2,750 emergency visits associated with air quality issues (Windsor, 2014). Recent studies suggest that climate change will exacerbate existing health risks associated with poor air quality through heat and other meteorologically-related increases in ambient air pollutants, aeroallergens, and biological contaminants and pathogens (Berry et al., 2014).

Food and Water Quality: Climate change is expected to increase risks from food-borne diseases as temperatures rise and extreme precipitation events increase. In Canada, human cases of salmonellosis have been associated with higher temperatures, and occurrences of acute gastrointestinal illness have been shown to increase with both high and low precipitation levels (Berry et al., 2014). Water-borne diseases have also been associated with extreme rains, drought and rising temperatures. Over the past fifteen years, filamentous green algae and cyanobacteria blooms have increased in Ontario due to favourable environmental factors (i.e. warmer temperatures, sunlight). Cyanobacteria in freshwater can cause drinking water to have unacceptable taste and odours and some can produce various toxins that taint freshwater and contaminate fish and shellfish (Berry et al., 2014). These trends are expected to increase as temperatures continue to rise.

Vector-Borne Diseases: Climate change has been associated with increasing the length of transmission seasons for certain vector-borne diseases (i.e. Lyme disease) and expanding their geographic range. In Canada, Lyme disease has increased from approximately 128 cases in 2009 to 682 in 2013 (317 of which were in Ontario) (Government of Canada, 2015; PHO, 2013). Ontario has seen a sharp increase in the incidence of Lyme disease, and risks from the disease are projected to continue to grow in part due to a warming climate (Berry et al., 2014). Figure 1 shows the projected expansion of the Lyme disease vector into the 2050s and 2080s. In Ontario, warming temperatures have also resulted in the spread of other vector-borne diseases such as Eastern Equine Encephalitis, a mosquito-borne arbovirus (Berry et al., 2014).

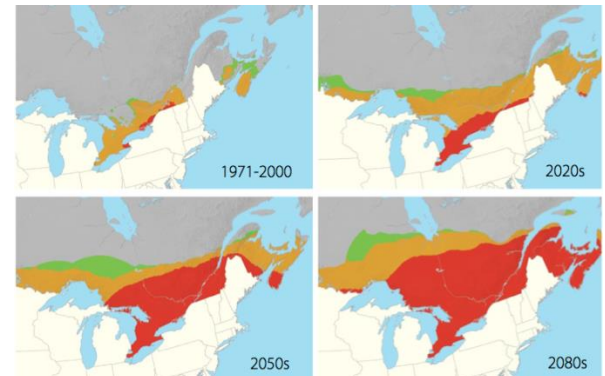


Figure 1: Risk maps for establishment and spread of the Lyme disease vector *Ixodes scapularis* under past (1971-2000) and projected future climate (2020s to 2080s) (Ogden et al., 2008).

Natural Hazards: Between 2003 and 2009, Ontario experienced 203 deaths due to extreme weather (PHO, 2015). This number does not include deaths from extreme heat and would likely be much higher if it were included. Climate change is expected to increase the variability of weather, increasing the frequency, duration and intensity of many extreme weather events. These changes may cause illness, injury or death in Ontario communities.

- **Storms and flooding:** Thunderstorms, freezing rain, tornadoes and hailstorms can result in injury or death, power outages, disruption to medical care, impacts to critical infrastructure, and contamination of water and food sources. Between 2003 and 2012, Ontario experienced 23 'disaster-level' extreme weather events, including 9 floods, 4 severe thunderstorms, 4 tornadoes and 2 winter storms (PHO, 2015). Climate change is expected to significantly increase risks from extreme weather (IPCC, 2012; McBean and Henstra, 2003). Regional projections for Ontario suggest that freezing rain events will increase by 35 to 100 percent by the 2050s, and 35 to 155 percent by the 2080s (Cheng et al., 2011). Toronto and Windsor are likely to see an increase of between 35 and 55 percent, while communities like Kenora, Thunder Bay and Timmins are likely to see an increase of 70 to 100 percent (Berry et al., 2014).
- **Extreme Heat:** Extreme heat events can cause significant injury and illness, including heat stroke and heat exhaustion. They can also lead to death in vulnerable populations such as older adults, young children, people with chronic diseases and the socially disadvantaged. Since 1950, the number of hot extremes in Canada has increased and this trend will continue due to climate change (Warren and Lemmen, 2014). The Ministry of the Environment and Climate Change reported that the average air temperature in Ontario increased by 1.4°C between

1948 and 2008, and could increase by 3.7°C by 2050. Communities like the City of Toronto anticipate that the number of heat alert days could increase fourfold by 2080 (City of Toronto, 2013).

- **Forest Fires:** Forest fires are a significant danger to Ontario communities. In July of 2011, approximately 120 forest fires were reported in northern Ontario during a 17-day period. These fires caused the evacuation of 3,292 First Nations people from 8 communities due to smoke inhalation, food shortages and a lack of food storage capacity. Projections indicate that an increase in ideal fire conditions due to climate change in Ontario may result in more large burns (Colombo, 2008).

Adaptation Opportunities

There are significant opportunities to adapt to climate change health risks and a number of examples currently at the provincial level and at the community level. The Ontario Ministry of Health and Long-Term Care is developing climate change and health vulnerability assessment guidelines and an Environmental Health Climate Change Framework for Action. The City of Windsor has developed a heat alert and response system to help protect residents during heatwaves and is taking measures to reduce the urban heat island effect (Windsor, 2014). Public Health Ontario is actively monitoring vector-borne diseases to prepare Ontario for future risks (Sider et al., 2012). The City of Greater Sudbury participated in a community climate change vulnerability assessment which informed adaptive capacity gaps and needs in health and other sectors (Paterson et al., 2012). As well, Peel Public Health implemented a West Nile Virus rapid risk factor surveillance system which includes a seasonal questionnaire distributed to residents (Paterson et al., 2012).

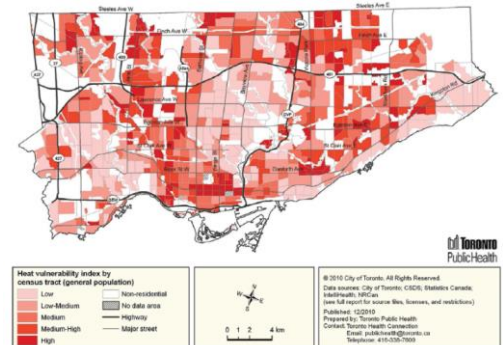


Figure 2: Vulnerability to heat in Toronto (City of Toronto, 2013).

A core requirement for developing effective adaptation measures is knowledge about existing health vulnerabilities and options for reducing risks to Ontarians. To better identify, monitor and protect vulnerable populations from climate change impacts, some municipalities have undertaken vulnerability assessments. The City of Toronto has mapped vulnerable populations to provide more effective and efficient support during extreme heat events (e.g. targeted locations for cooling centres during events) (see Figure 2) (City of Toronto, 2013). Middlesex-London Health Unit conducted a full climate change and health vulnerability assessment (Berry, Paterson and Buse, 2014) using new World Health Organization (WHO) assessment guidelines (Ebi et al., 2012) and is using the results to develop a 10-year health adaptation plan.

References

- Berry, P., Clarke, K., Fleury, M.D. and Parker, S. (2014): Human Health; 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, pp. 191-232.
- Berry, P., Paterson, J., and Buse, C. (2014): Assessment of Vulnerability to the Health Impacts of Climate Change in Middlesex- London. Report Prepared for the Middlesex-London Health Unit. London. <www.healthunit.com/climate-change>.
- Cheng, C. S., Auld, H., Li, Q., and Li, G. (2011): Possible impacts of climate change on extreme weather events at local scale in south-central Canada; *Climatic Change*, v. 112, no. 3-4, p. 1-17.
- City of Toronto. (2013): Exploring Health and Social Impacts of Climate Change in Toronto. Medical Office of Health, City of Toronto.
- Colombo, S.J. (2008): Ontario's Forests and Forestry in a Changing Climate. Government of Ontario, Ministry of Natural Resources, Science and Information Resources Division, Applied Research and Development Branch. ISBN: 978-1-4249-7494-8.
- Ebi, K.L., Berry, P., Campbell- Lendrum, D., et al., (2012). Protecting Health from Climate Change: Vulnerability and Adaptation Assessment. World Health Organization and Pan American Health Organization, Geneva. <www.who.int/globalchange/publications/Final_Climate_Change.pdf>.
- Government of Canada (2015): Surveillance of Lyme disease. <www.healthycanadians.gc.ca/diseases-conditions-maladies-affectons/disease-maladie/lyme/surveillance-eng.php>
- IPCC [Intergovernmental Panel on Climate Change] (2012): Summary for Policymakers; in Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. Cambridge University Press, Cambridge, United Kingdom.
- McBean, G. and Henstra. D. (2003): Climate Change, Natural Hazards and Cities. Institute for Catastrophic Loss Reduction (ICLR). ICLR Research Paper Series – No. 31, ISBN 0-9732213-9-9.
- Ogden, N.H., St.-Onge, L., Barker, I.K., Brazeau, S., Bigras-Poulin, M., Charron, D.F., Francis, C.M., Heagy, A., Lindsay, L.R., Maarouf, A., Michel, P., Milord, F., O'Callaghan, C.J., Trudel, L., and Thompson, R.A. (2008): Risk maps for range expansion of the Lyme disease vector, Ixodes Scapularis, in Canada now and with climate change; *International Journal of Health Geographics*, v. 7, no. 24.
- OMA [Ontario Medical Association] (2005): The Illness Costs of Air Pollution: 2005-2026 Health & Economic Damage Estimates. ISBN 0-919047-54-8.
- Paterson, J. A., Ford, J.D., Berrang Ford, L., Lesnikowski, A., Berry, P., Henderson, J., and Heymann, J. (2012). Adaptation to climate change in the Ontario public health sector. *BMC Public Health*, doi: 10.1186/1471-2458-12-452.
- PHO [Public Health Ontario] (2013): Vector-Borne Diseases: 2013 Summary Report. Toronto, ON: Queen's Printer for Ontario; 2014.
- PHO [Public Health Ontario] (2015): Extreme Weather: The Fallout after the Storm. Poster by Public Health Ontario <www.publichealthontario.ca/en/eRepository/OHP_infog_ExtremeWeather_2014.pdf>.
- Sider, D., Patel, S., Russell, C., Jain-Sheehan, N., and Moore, S. (2012): Technical Report: Update on Lyme disease Prevention and Control. Public Health Ontario.
- Warren, F.J. and Lemmen, D.S. (2014): Synthesis; 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. 1-18.
- Windsor (2014): Illness Costs of Air Pollution. City of Windsor <www.citywindsor.ca/residents/environment/Environmental-Master-Plan/Goal-B-Create-Healthy-Communities/Pages/Illness-Costs-of-Air-Pollution.aspx>.

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

The information presented is based on Chapter 7 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