Climate Change Impacts & Adaptation in Ontario: Food Production

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

Overview of Climate Change Impacts on Ontario's Food Production System

The food production sector, comprising agriculture, aquaculture, fisheries as well as food processing and storage systems, is a significant economic driver for Canada and the province of Ontario. In 2012, food production contributed $103.5B to Canada's national GDP (AAFC, 2014). In Ontario, agriculture and food processing constitutes 32 percent of agriculture's share of Canada's GDP; the highest of any province (Figure 1).

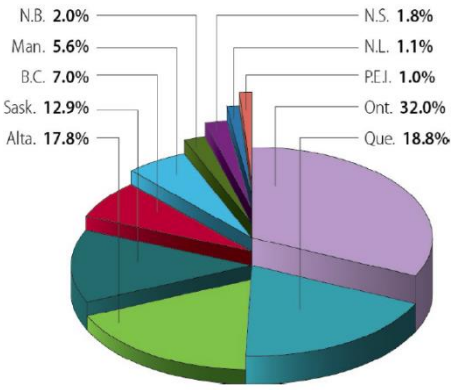

Figure 1: Distribution of agriculture and food processing contribution to the Canadian agriculture GDP (Campbell et al., 2014).

Studies agree that Ontario will gradually become 'warmer and wetter' (IPCC, 2007). Average annual surface air temperature is expected to increase between 2.5 and 3.7°C by 2050 (from the baseline average 1961-1990) (CCDS, 2009; MOE, 2011). Annual precipitation is also expected to increase, with the largest changes to occur in the northeast and lesser change in the western part of the province (CCDS, 2009). The food production sector is particularly vulnerable to climate change because many of its component industries are directly tied to weather in the production process (Table 1).

Agriculture

Increasing spring runoff, increasing summer temperatures, and variable weather patterns are a few of the key challenges that Ontario's agriculture sector will continue to face. Spring runoff can cause flooding, which could lead to infrastructure damage, loss of nutrients from soils, contamination of groundwater tables, increased erosion, and decreased water quality. In 2013, high water levels on Lake Simcoe and the Holland River, combined with heavy rains and high winds resulted in the rupture of a dyke near Bradford West Gwillimbury, Ontario. The resulting flood damaged over 190 acres of prime farmland, prompting the mayor to declare the farms a disaster area (Bradford Times, 2013). Some elements of natural adaptation exist, such as genetic adaptation that can accommodate changes in temperature and precipitation. However, natural adaptation is typically a long-term process that may not occur quickly enough to keep pace with the projected rate of climate change.

Table 1: Summary of potential climate change impacts on food production

Aspect of food production system	Climate impacts
Crop productivity	Crop growth depends on heat, light and water. Warmer, wetter weather may increase productivity. Crop locations will change as regional climate shifts.
Pollinators	Pollinators face easier winters, but may suffer from increased pest and disease activity.
Animal production	Animal production may be affected by changes in temperature, water availability, and feed crop and forage production. Animals may require additional heating or cooling.
Water supply	Changes in water supply will affect farm operations, potentially requiring irrigation or drainage. Water quality may also be impacted.
Food processing	Food processing may be challenged by reduced or variable water availability, transportation or energy failures. Increased storage may be required to account for higher yields.
Fish stocks	Fish stocks may be affected by water temperature and chemistry, algal blooms, and food supply.
Pests, diseases and invasive species	Pests, diseases and invasive species may increase in number due to warming winters and longer breeding seasons.
Northern/remote food production and availability	Northern/remote locations may be able to increase local food production with adaptation. Longer shipping seasons would allow more items to be brought into northern coastal ports. Species distribution shifts may require adapting to new food sources.
International trade	International trade may be affected by change in traditional geographic distribution of food production and by the opening of the Northwest Passage.

Increasing summer temperatures may generate benefits through additional heat units and longer growing seasons, but the heat may also contribute to increased evaporation and water stress, increased number of pests, invasive species and disease, and livestock illness. Variable weather patterns may increase the likelihood of winter bud kill or frost impacts during growing season, which may significantly impact crop production. For example, in 2012, 85 percent of the Ontario apple crop was lost due to late frosts, resulting in a $60M loss (Scallan, 2012). A longer growing season, characterized by warmer weather, enriched CO_2 levels and increased precipitation, may increase agricultural yields. Projections of suitable land show that several regions within Ontario will become more arable (Figure 2). Livestock may thrive due to longer grazing seasons and

the increased availability of quality feed throughout the year. Finally, the opening of the Northwest Passage may provide added opportunity to export food to other parts of the world thus increasing the economic contribution of the food production sector.

Fisheries

In the Great Lakes region, decadal-scale observations of shorter winters, warmer river and lake temperatures, intensified rain and snow events, and decreased ice cover on lakes all reflect changing climate. Climate models suggest future climate change impacts in the Great Lakes area will lead to changes to aquatic thermal regimes with negative consequences for cold- and cool-water species. However, climate change could be advantageous to expansions of warm-water species at the northern end of their range, and to existing or new waves of invasions by alien species. Thus, the history of highly unstable species composition in the Great Lakes area is likely to persist or even accelerate under the influence of climate change; affecting ecosystems, fish, fisheries and economies (Campbell et al., 2014).

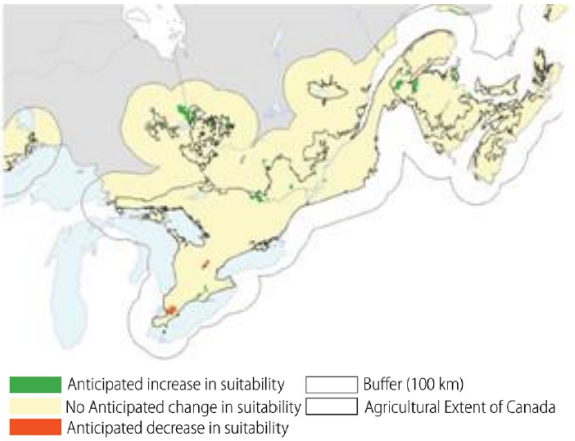

Figure 2: Improvement and decline in land suitability for spring seeded and small-grained crops (AAFC, 2011).

Adaptation Opportunities

Examples of adaptation and beneficial management practices can be observed in the increased use of sustainable food production techniques including no-till farming, controlled tile drainage, riparian buffer zones, and controlling livestock access to natural surface waters. These techniques protect soil and water resources and reduce vulnerability to climate change impacts. Selecting crops, practices, infrastructure and equipment to suit the range of expected conditions, may reduce climate risk in the agriculture industries. The Ontario government has formed a partnership with the University of Guelph to promote early detection and surveillance of animal disease to reduce their impact on livestock. Further institutional support will be required to facilitate the development and use of new technologies and to test solutions to local problems in all food production industries. Furthermore, in a warmer climate, Ontario producers could grow higher-profit niche crops that are currently only grown in countries with longer, warmer seasons. This will allow Ontario to increase its capacity to compete in international markets for higher-end goods. Producers raising livestock will have longer seasons to grow the feed/forage that they require for their animals, potentially decreasing the amount that they may have to buy to get through winters. In the fishing industry, adjusting license availability and regulations can help to maintain sustainable fisheries and control the risk of species population declines. Ongoing monitoring and evaluation work will be critical to adaptive management and fish management systems.

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The information presented is based on Chapter 4 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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