



Executive Summary of the Climate Science Report

For Oxford County, Elgin County, and the City of St.
Thomas

Author

Nermin Abedin

Master of Climate Change Intern, University of Waterloo
Environmental Health
Southwestern Public Health

Acknowledgments

We would like to thank the Environmental Health team for their engagement in this process as well as our reviewers:

Michelle Alvey

Health Promoter
Environmental Health
Southwestern Public Health

Rob Haile

Public Health Planner
Foundational Standards
Southwestern Public Health

Amy Pavletic

Program Manager
Environmental Health
Southwestern Public Health

Susan MacIssac

Program Director
Health Protection
Southwestern Public Health

Cynthia St. John

CEO
Southwestern Public Health

How to cite this document:

Abedin, N. Executive Summary of the Climate Science Report: for Oxford County, Elgin County, and the City of St. Thomas. Woodstock, ON: Southwestern Public Health; 2023.

Introduction

The aim of the climate science report is to provide a summary of climate-related data for the regions of Oxford County, Elgin County, and the City of St. Thomas. The report outlines climate change projections to support the Climate Change and Health Vulnerability Assessment for the Southwestern Public Health (SWPH) region. It is intended to assist in identifying potential risks and vulnerabilities that may affect these areas due to climate change and to inform the public health stakeholders in the region on how to prepare for the projected health effects of climate over time. The report includes the following climate indices for the study area:

- Temperature
- Precipitation
- Air quality
- Ultraviolet radiation

Greenhouse gas emissions scenarios

The report relies on global climate models (GCMs) from the Intergovernmental Panel on Climate Change's Sixth Assessment Report, using data from the Coupled Model Intercomparison Project (CMIP6). These models incorporate socio-economic assumptions such as population, education, energy use, technology, and other relevant factors to generate scenarios that reflect projected greenhouse gas emissions and their corresponding atmospheric concentrations known as the Shared Socioeconomic Pathways (SSPs) (Kriegler et al., 2016; Riahi et al., 2017). This report focuses on projections for SSP1-2.6 (low), SSP2-4.5 (intermediate) and SSP5-8.5 (very high) as they are available in [Climate Data Canada](#) and have levels of Radiative Forcing that are aligned with the three commonly used Representative Concentration Pathways: RCP2.6 (low), RCP4.5 (medium) and RCP8.5 (high).

Data Collection

The [Climate Data Canada](#) portal was used for the majority of the data in this report. Additional qualitative data related to freezing rain, air quality, and UV index was gathered from various reports, as these indices were not available in the Climate Data Canada portal.

Timeframes

The report focuses on two projected future timeframes: the 2050s (2040-2069) and the 2080s (2070-2099). The baseline data is from the period between 1986 and 2014 because, for CMIP6, the transition from historical simulation to future SSP occurred in 2014/2015.

Temperature: Key findings

Extreme heat

- It is expected that the study area encompassing Oxford County, Elgin County, and the City of St. Thomas will experience significant temperature rises of at least 3°C by the 2050s and 5°C by the 2080s across all seasonal measures, including minimum, average, and maximum temperatures under the SSP5-8.5 emissions scenario. These climate projections also indicate an increased frequency and duration of heat warnings.
- In Oxford County, the frequency of extreme heat days (temperature exceeding 30°C) is projected to surge from the baseline of 11 days to 45 days by the 2050s and to 80 days by the 2080s under the SSP5-8.5 scenario. Similarly, in Elgin County, and the City of St. Thomas, the number of extreme heat days is expected to rise from 8 days to 41 days by the 2050s and to 78 days by the 2080s under the SSP5-8.5 scenario.
- The frequency of days with maximum temperatures exceeding 32°C is also expected to increase in the future. Oxford County will have 22 days surpassing 32°C by the 2050s and 55 days by the 2080s, which is 52 days more than the baseline of 3 days. Similarly, Elgin County and the City of St. Thomas will have 17 days surpassing 32°C by the 2050s and 51 days by the 2080s, which is 49 days more than the baseline of 2 days.
- The projected rise in temperature is also expected to result in an increase in the number of tropical nights, defined as nights with temperatures exceeding 20°C. In Oxford County, it is estimated that the number of days with tropical nights will increase from the baseline of 5 days to 25 days by the 2050s, and to 55 days by the 2080s. Similarly, in Elgin County, and the City of St. Thomas, the baseline of 8 days with tropical nights is expected to increase to 32 days by the 2050s, and to 63 days by the 2080s.
- Urban heat islands (UHIs) raise the temperature in urban areas, increasing health risks and exposing residents to the risk of heat-related problems. Ingersoll, Tillsonburg and the City of Woodstock are among the areas slightly more impacted by UHIs. The average annual maximum temperature in these areas can be about 0.5°C higher than it is in the

smaller rural municipalities, such as the Township of East Zorra-Tavistock, and the Township of Zorra.

- Heat-vulnerable groups are older adults, infants and young children, people with pre-existing health conditions such as cardiovascular or respiratory illnesses, people taking certain medications that may exacerbate heat sensitivity, socially disadvantaged people such as individuals with low incomes, homelessness, occupational groups, and physically active individuals (Health Canada, 2011).

Extreme cold

- The climate projections suggest that the study area will have fewer extremely cold days, which refers to a day with minimum temperatures below -15°C , in the future, and winters will generally be milder and wetter. By the 2080s, the number of Extreme Cold Days in Oxford County is projected to decrease to zero days from the baseline of 14 days. Likewise, in Elgin County, and the City of St. Thomas, no days with minimum temperatures below -15°C are anticipated in the 2080s under the SSP5-8.5 scenario from the baseline of 10 days.
- Frost Days, characterized by the potential for frost formation and minimum temperatures below 0°C , are expected to decline in Oxford County by up to 70 days by the 2080s under the SSP5-8.5 scenario, in contrast to the 140-day baseline. Similarly, Elgin County and the City of St. Thomas will also experience a decline in Frost Days to 55 days by the 2080s from the baseline of 128 days.
- While the overall warming trend will reduce the frequency of extreme cold events, the effects of climate change could increase the severity of extreme cold events such as freezing rain or ice storms (Cheng, et al. 2011).

Precipitation: Key findings

- It is expected that there will be an increase in total precipitation annually by the 2080s. Most of this increase will take place during the spring, fall and winter seasons and it will decrease in the summer. By the 2080s, it is anticipated that Oxford County's baseline average of 914 mm will increase to 991 mm (SSP2-4.5) or 1018 mm (SSP5-8.5). Elgin County and the City of St. Thomas' baseline average of 915 mm is predicted to rise to approximately 1000 mm (SSP2-4.5) or 1024 mm (SSP5-8.5) by the 2080s, indicating that both regions will see an increase.

- Maximum 1-Day Total Precipitation refers to the highest recorded precipitation in a single day, commonly known as the year's wettest day. Maximum 5-Day Precipitation refers to the cumulative precipitation over five consecutive days. In Oxford County, one-day accumulations are projected to increase from the baseline of 41.1mm to 49.4mm by the 2080s, while five-day accumulations are expected to increase from the baseline of 69.6mm to 83.5mm. Elgin County and the City of St. Thomas are also anticipated to experience an increase in the maximum five-day events from a baseline of 71.3 mm to 77mm in the 2050s and 84.2 mm in the 2080s. The possibility of winter floods, slippery conditions, and flash freeze events is expected to rise due to increased precipitation during the colder months, especially heavy rainfall events.
- Extremely Wet Days refer to the days when total precipitation (rain and snow) is equal to or more than 20 millimeters. It is anticipated that for both regions, extremely wet days will increase from the baseline of 8 days to 11 days by the 2080s.
- Deaths, injuries, and illnesses can result from extreme weather events such as violent storms, floods, and other hazardous conditions. Due to flooding in particular, these heavy downpours can increase the risk of disease outbreaks linked to contaminated drinking water (Gosselin et al., 2022). Extreme weather can have a pronounced impact on the health of older adults, who may be more susceptible to its effects. Falls are a major concern among this population, and the likelihood of falls can further increase during extreme weather conditions (Buse et al., 2022). The likelihood of outbreaks of food and water-borne illnesses is likely to increase as a result of the combination of hotter, drier summers and intense precipitation events (Berry & Schnitter, 2022).

Air Quality: Key Findings

- The common air pollutants for the study area are nitrogen dioxide, particulate matter, and ground-level ozone. The Port Stanley air quality monitoring site serves as the monitoring station for assessing air quality in Elgin County, and the City of St. Thomas. The Kitchener/London air quality monitoring site is responsible for evaluating the air quality in Oxford County. For this report, the data from the Kitchener station has been used for assessing air quality in Oxford County.
- According to the [Air Quality in Ontario 2020 Report](#), there is a decreasing trend of 18.4% in particulate matter (PM_{2.5}) levels in Port Stanley station. Likewise, Kitchener station

reported a significant 20.8% PM_{2.5} reduction over the 2011-2020 period, though its 2020 annual mean of 6.6 µg/m³ is slightly above Ontario's 6.2 µg/m³.

- In Port Stanley station, there is a decreasing trend of 19.1% in ground-level ozone 1-hour maximum over the 2011-2020 period, while Kitchener station shows a slight 5.2% decline, indicating no significant trend in ozone concentrations over the same period.
- There has been a significant decrease of 22% in the average annual levels of nitrogen dioxide recorded in the Kitchener station between the years 2011 and 2020.
- It is predicted that ozone concentrations in southwestern Ontario will increase by four to five parts per billion by the year 2050 if anthropogenic emissions remain unchanged (Berry et al., 2014).
- In Oxford County, Elgin County, and the City of St. Thomas, the baseline period from 1971 to 2000 witnessed 2 and 12 days where the 80 ppb of ozone concentration limit was exceeded. However, for the 2050s, Elgin County and the City of St. Thomas are projected to exceed the limit for 14 days and Oxford County is projected to exceed the limit for 3 days. By the 2080s, Elgin County, and the City of St. Thomas are projected to exceed the limit of 15 days of the year, while the count for Oxford County remains unchanged from the 2050s (Gough et al., 2016).
- Older adults are at increased risk for health problems due to poor air quality, especially if they suffer from respiratory or cardiovascular conditions. Short- and long-term exposure to air pollution can have negative effects on children. People who already have cardiovascular (such as heart disease) and respiratory (such as chronic obstructive pulmonary disease and asthma) conditions are more vulnerable to having their pre-existing health conditions aggravated by poor air quality (Buse et al., 2022; Health Canada, 2021).

Ultraviolet Radiation: Key findings

- The impact of climate change will not have a worsening effect on the relationship between ozone depletion and exposure to ultraviolet radiation (UVR), and there is currently limited certainty that climate change will significantly affect the factors that influence UVR exposure (Bais et al., 2019).
- However, high UV index during the summer, spring, and autumn seasons can be a significant concern, as people continue to spend more time outdoors in projected warmer than average temperatures across all seasons.

- Infants and children have vulnerable skin and eyes that make them highly susceptible to long-term UVR exposure. People who work outdoors or individuals engaged in physical activities outdoors may experience higher UVR exposure, increasing the risk of adverse health effects (Gosselin et al., 2022).

Vulnerable populations

Certain populations are more susceptible to the adverse effects of climate change. The following populations are deemed vulnerable by [Health Canada](#) (Health Canada, 2022):

- Seniors
- Individuals with chronic diseases and/or weakened immune systems
- Children and infants
- People facing social or economic disadvantages, such as those with low income or housing insecurity
- People who are pregnant
- People with disabilities
- Frontline emergency responders
- People who are immunocompromised and those living with pre-existing illness
- Indigenous Peoples
- Residents of remote communities

Vulnerable populations in the study area include people who are physiologically sensitive to the effects of climate change, people who may be more exposed to these effects because of their occupation or where they live, and people who lack the means to adequately adapt to these changes because of various factors.

Conclusion

An overview of the current and future effects of climate change on population health in Oxford County, Elgin County, and the City of St. Thomas is provided in the Climate Science report. Rising temperatures, higher UV radiation levels, more precipitation, and more frequent and severe weather events are some of the effects of climate change that are expected to have a significant short- and long-term impact on the health of the local population.

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