INDICATOR: Ground-level ozone

Startegic Direction: Reduce Threats

Target: N/A

Theme: Pressures on Ontario's Biodiversity — Climate Change

Previous version: Ground-level ozone 2017

Background Information

Ground-level ozone is a secondary pollutant, formed by chemical reactions between nitrogen oxides and volatile organic compounds in the presence of heat and sunlight. Nitrogen oxides are emitted by natural sources and by human sources such as cars, trucks, and industrial plants. Volatile organic compounds may be emitted by natural sources, such as plants and trees, or by human activities. In addition to having impacts on human health, there is substantial evidence that ground-level ozone can have significant impacts on biodiversity. The most important and well documented impacts are reported for terrestrial vegetation with reductions in crop production, tree growth, and changes in species composition observed (Hayes et al. 2007; Wittig et al. 2009), all of which have downstream consequences for ecosystem services (Royal Society 2008). Evidence suggests that these impacts are likely to occur where ozone concentrations are above a threshold of 40 ppb, a limit which is currently exceeded in most countries around the world, including Canada (Royal Society 2008; Environment and Climate Change Canada 2014).

This indicator is used to assess trends in the seasonal means of ground-level ozone at sites across Ontario, as well as the annual peak (4th highest) daily maximum 8-hour concentration, following Canadian standards and methodology.

Data Analysis

Data to assess trends in the seasonal means of ground-level ozone concentrations in Ontario from 1987 to 2017 (Fig. 1) were obtained from the Air Quality in Ontario Reports 2007 and 2018 (OMOE 2008; OMECP 2019). Seasonal means were based on data from ozone monitoring stations operated across Ontario. A 75% data completeness criterion was used to derive trends. Long-term trends in ground-level ozone were derived using data from 19 monitoring stations for the period 1987 to 2007 (OMOE 2008) and from 39 monitoring stations for the years 2008 to 2017 (MECP 2019). These stations are dispersed across the province, though most are concentrated in metropolitan areas in southern Ontario.

Data used to assess annual peaks (fourth-highest) for daily maximum 8-hour average ground-level ozone concentrations from 2002 to 2016 (Fig. 2) were obtained from the Canadian Environmental Sustainability Indicators Air Quality Report 2018 (Environment and Climate Change Canada 2018) which includes data from the National Air Pollution Surveillance Program (NAPS) and the Canadian Air and Precipitation Monitoring Network (CAPMoN). The annual peaks for ground-level ozone are calculated using an approach that is aligned with the Canadian Ambient Air Quality Standards (CAAQS). Annual peaks for Ontario are based on data collected from 38 monitoring stations in southern Ontario. Peaks are based on the fourth-highest of the daily maximum 8-hour average concentrations measured over a given year.

Results

Trend: Mixed	**Data Confidence:** High	**Geographic Extent:** Provincial

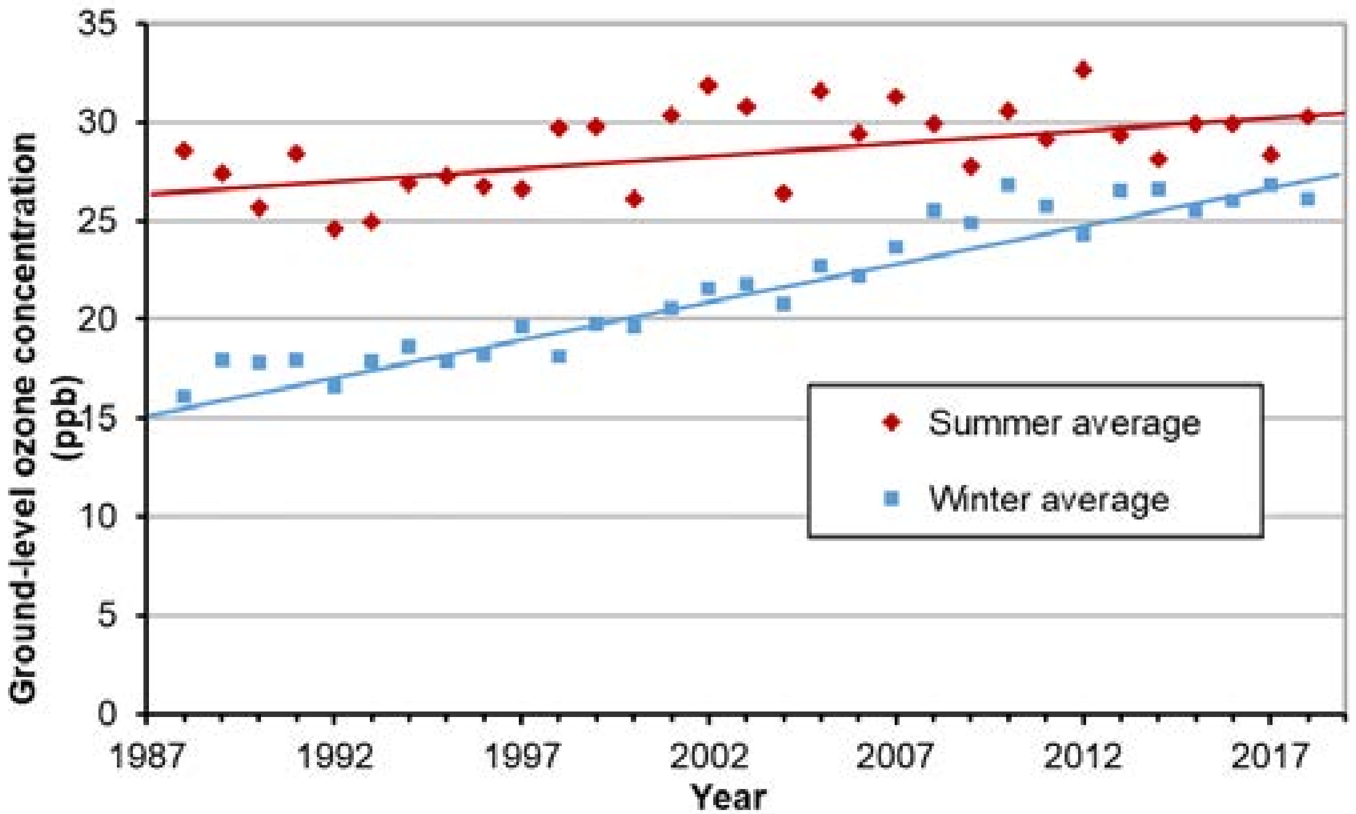

Figure 1. Seasonal means and 30-year trendlines of ground-level ozone at monitoring sites across Ontario for the period 1987–2017 (Source: OMOECC 2008 and OMECP 2019).

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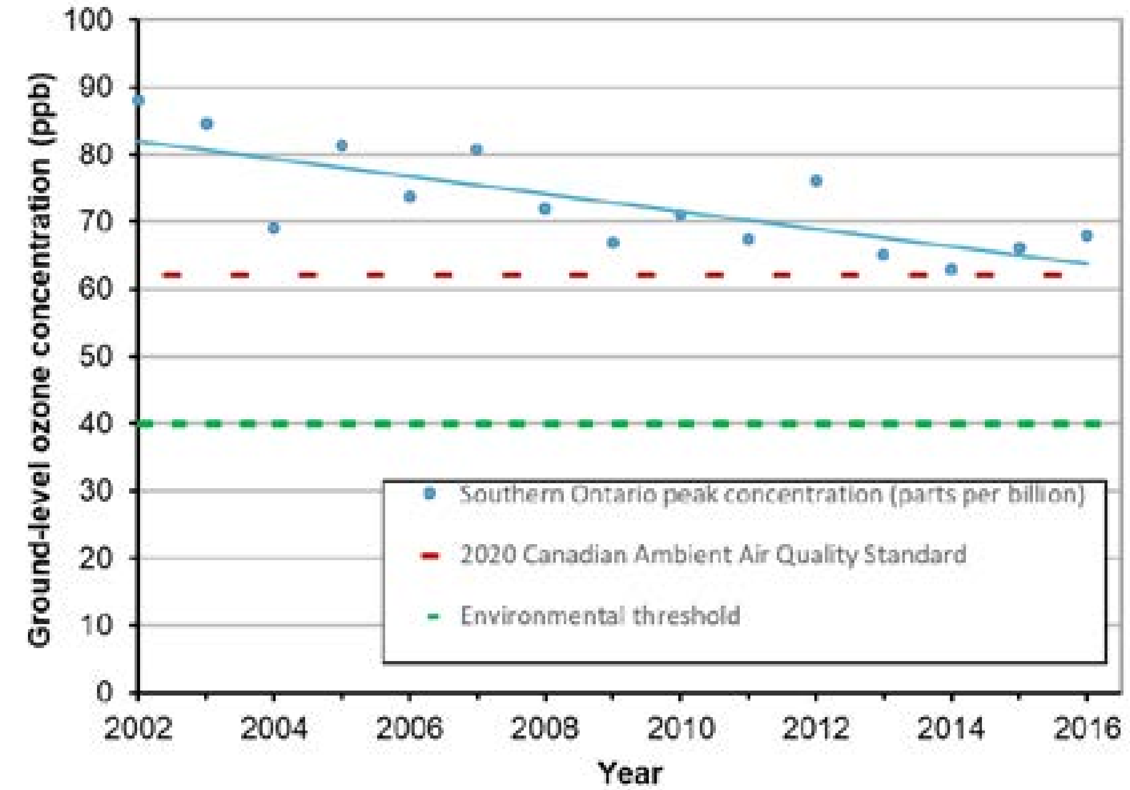

Figure 2. Annual peak (fourth-highest) daily maximum 8-hour average ground-level ozone concentration at sites across southern Ontario 2002–2016 (n = 38) (Source: Environment and Climate Change Canada 2018) (Note: The red widely spaced horizontal dashed line represents the value of the Canadian Ambient Air Quality Standards (CAAQS) for 2020 and is shown for indicative purposes only, and not for evaluation of the achievement status of the standard. The green more closely spaced horizontal dashed line represents the environmental threshold above which impacts are likely on vegetation (Royal Society 2008).

Status

- Between 1987 and 2017, there was an increasing trend in seasonal means of ground-level ozone in Ontario, with summer average concentrations consistently higher than winter average concentrations. Over the 30-year period, average summer concentrations increased by approximately 12% while average winter concentrations increased by nearly 68%. However, more recently—between 2007–2017—average summer ground-level ozone concentrations in Ontario have been declining while concentrations in winter have been increasing at a much lower rate than in previous 10-year periods. The continued increase in winter ozone averages are mainly attributed to rising global background concentrations.

- A decreasing trend was detected in the annual peak concentrations of ground-level ozone from 2002 to 2016, representing a decrease of 23% (or an average of 1.6% per year) over that period. A reduction in emissions of ground-level ozone precursor gases (nitrogen oxides and volatile organic carbons) from Canada and the United States is likely an important factor in this downward trend. The annual peak ground-level ozone concentrations were above both the 2020 Canadian Ambient Air Quality Standard and the environmental threshold for all years.

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Links

Related Targets

8. By 2015, the release of pollutants harmful to biodiversity is reduced.

Related Themes: N/A

Web links

Canadian Environmental Sustainability Indicators http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=En

Ontario Ministry of Environment, Conservation and Parks Air Quality Reports http://www.airqualityontario.com/press/publications.php

National Air Pollution Surveillance Program (NAPS) http://www.ec.gc.ca/rnspa-naps/

Canadian Air and Precipitation Monitoring Network (CAPMoN) https://www.ec.gc.ca/rs-mn/default.asp?lang=En&n=752CE271-1

Canadian Ambient Air Quality Standards (CAAQS) http://www.ec.gc.ca/default.asp?lang=En&n=56D4043B-1&news=A4B2C28A-2DFB-4BF4-8777-ADF29B4360BD

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