INDICATOR: RELEASE OF POLLUTANTS HARMFUL TO BIODIVERSITY

STRATEGIC DIRECTION: Reduce Threats

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

THEME: Pressures on Ontario's Biodiversity

Background Information:

The release of pollutants into the air and water and onto the land can have significant effects on biodiversity. Pollutants can kill organisms outright, change the conditions and processes occurring within an ecosystem, and result in broad changes that degrade habitats and ecosystem services. Biodiversity associated with areas used intensively by humans (e.g., urban areas, agriculture, forestry, mining, and other industries) may be most at risk from pollution; however, non-point-based effects of pollution on biodiversity (e.g., downstream water pollution and downwind air pollution) can also be significant. Currently, a wide range of pollutants interact with natural and other human created factors to alter ecosystems and impact Ontario's biodiversity. Three pollutants in particular - nitrogen oxides, sulphur oxides and mercury - have all been shown to impact on biodiversity in Ontario and were used in this indicator as an index to examine trends in the release of pollutants harmful to biodiversity.

Nitrogen and sulphur oxides are primarily released into the air by fossil fuel combustion and these gases can be transformed in the atmosphere to acidic particles and acidic rain (Driscoll et al., 2001). The effects of nitrogen and sulphur oxides on the environment are generally not caused by direct exposure to the gases themselves, but are related to chronic accumulation in plants and soils and long-term changes in soil and water chemistry (Lovett et al. 2009). Nitrogen and sulphur oxides in the air can damage the leaves of plants, decrease their ability to produce food (photosynthesis) and decrease their growth. In addition, when deposited on land and in estuaries, lakes and streams, nitrogen and sulphur oxides can acidify and over-fertilize sensitive ecosystems resulting in a range of harmful deposition-related effects on plants, soils, water quality and fish and wildlife (e.g., loss of habitat, reduced tree growth, loss of fish species, and harmful algal blooms) (Lee 1998; Bobbink and Lamers 2020). This can result in an overall loss of biodiversity and subsequent reduction in ecosystem services (e.g., water and soil quality) (Aherne and Posch 2013). These impacts are likely to occur where the accumulation of nitrogen and sulphur crosses a threshold known as the critical load. For more than a decade, Canada has worked to reduce nitrogen and sulphur oxides by implementing the Canada-wide Acid Rain Strategy for Post-2000.

Mercury is a highly toxic element released primarily from coal combustion, waste incineration and industrial processes (Lovett et al. 2009). Mercury, primarily methylmercury, is quickly accumulated by aquatic species and causes adverse effects. Biomagnification of mercury up the food chain has been shown, especially in aquatic systems where predators at the top of the food chain accumulate the highest concentrations of mercury (Lovett et al. 2009). There has been increasing recognition that mercury affects fish and wildlife health, in ecosystems both severely and moderately polluted with mercury. In particular, studies have documented diminished reproductive success, behavioural changes and reduced survival of fish, fish-eating birds and mammals due to mercury contamination in aquatic ecosystems (Scheuhammer et al. 2007). There has been effort to reduce the amount of mercury

released into the environment. Most recently, Canada became a signatory to the Minamata Convention on Mercury, a global treaty to protect both human health and the environment from the adverse effects of mercury.

This indicator assesses trends in the release of nitrogen oxides, sulphur oxides and mercury in Ontario as an index of trends in the release of pollutants harmful to biodiversity in Ontario.

Data Analysis:

Data on the release of nitrogen oxides, sulphur oxides and mercury over the period 2002-2015 were obtained from the National Pollutant Release Inventory (NPRI). The NPRI is Canada's legislated, publicly accessible inventory of pollutant releases to air, water and land. It includes information reported by facilities to Environment and Climate Change Canada under the Canadian Environmental Protection Act, 1999, and air pollutant emission estimates compiled for facilities not required to report and non-industrial sources such as motor vehicles, residential heating, forest fires and agriculture. The NPRI database can be accessed at: https://www.canada.ca/en/services/environment/pollution-waste-management/national-pollutant-release-inventory.html. The sudden drops in emissions reported to NPRI for SO_2, NOx and Mercury in 2009 were due to fewer releases from major emitters.

Results:

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

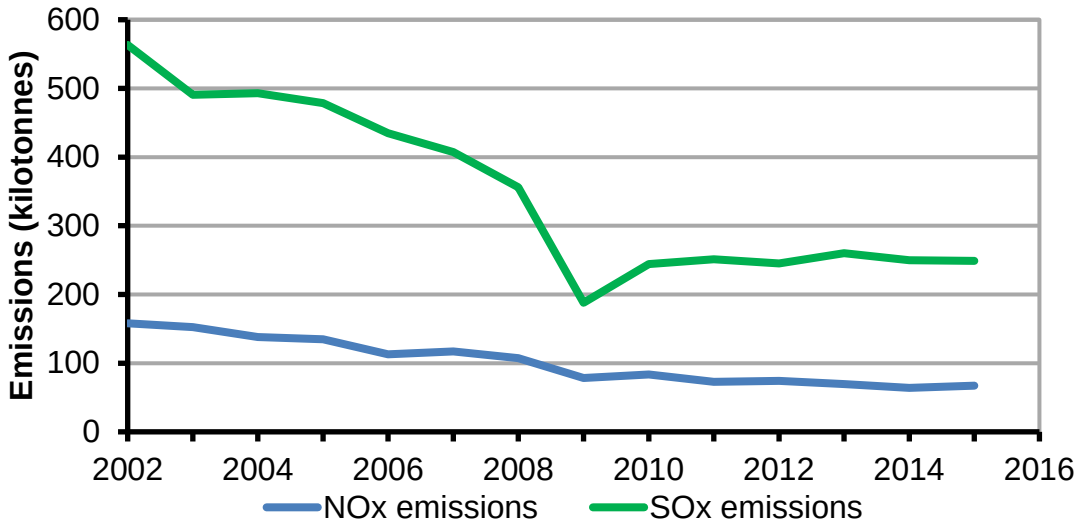

Figure 1. Nitrogen (NO_x) and sulphur oxide (SO_x) emissions in Ontario 2002-2015. Note: Emissions from natural sources and open sources are not included (Source NPRI Database).

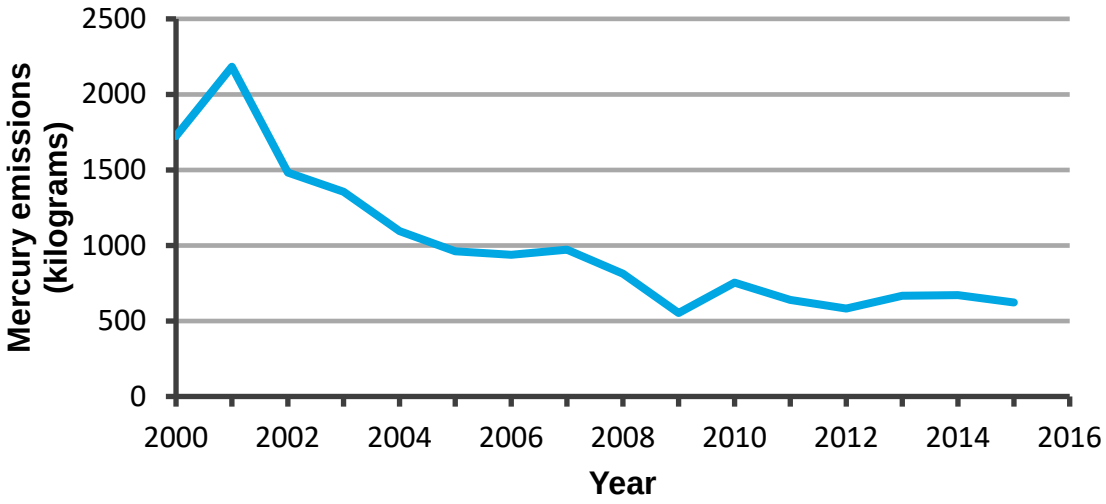

Figure 2. Mercury emissions in Ontario 2000-2015 (Source NPRI Database).

Status:

- Between 2002 and 2015 nitrogen oxide (NO_x) emissions in Ontario decreased by 58%. This decline can be attributed to a reduction in emissions from electricity generation as a result of regulation and domestic and international agreements. Decreases also occurred from industry as a whole.
- Between 2002 and 2015 sulphur oxide (SO_x) emissions in Ontario decreased by 56%. These reductions were largely due to reductions in emissions from fossil-fuel (e.g. coal) fired power-generating utilities, plant closures, as well as a reduction in emissions from the petroleum refining sector.
- Between 2000 and 2015 mercury emissions in Ontario decreased by 64%, mainly due to a reduction of emissions from industrial sources, including metal smelters.

Links:

Related Targets: N/A

Related Themes: N/A

Web Links:

National Pollutant Release Inventory https://www.canada.ca/en/services/environment/pollution-waste-management/national-pollutant-release-inventory.html

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