Breaking Boundaries: Environment and Climate Change Canada's Collaborative Initiatives for the Public and Indigenous Communities, and Analysis of Transboundary Pollution in the Great Lakes

OUTLINE

1.   Communication and Outreach

    –   Educational partnerships and events;

    –   National Pollutant Release Inventory (NPRI) Academic Challenge.

2.   Engagement and Products

    –   Indigenous community engagement;

    –   NPRI Overviews and Data Integrations.

3.   Great Lakes Analysis Summary

    –   Substance risk prioritization;

    –   Pollution burden and demographic data.

Communication and Outreach

Educational partnerships

- Partnering with **Ingenium** and **Science North** for interpretive panels;
- Creating educational activity kits for educators.

Events

- **Eurêka Festival**: Interactive workshops on environmental contaminants, smells associated with pollutants and NPRI data mapping tools;
- **Women and Girls in Science**;
- **Expo-Sciences Outaouais and Ottawa Science Fair**: NPRI booth to promote the program to youth and families.

Eurêka Festival, Montréal, 2019

Women and Girls in Science, 2019

Science North NPRI Booth, 2022

Communication and Outreach

NPRI Academic Challenge

- Engaging the academic community in generating innovative products, activities, recommendations, and research to enhance the understandability, accessibility, awareness and usability of NPRI data;
- Since 2021, we have embarked on 12 projects, with four more planned for Fall and Winter 2023-2024;
- Notable projects:
  - Investigating Environmental Inequities Using NPRI Data – **Université de Sherbrooke**;
  - Analyzing the Impact of GHG Emission Reduction Policies on Related Pollutants, Including Criteria Air Contaminants – **Université du Québec à Montreal**;
  - Assessing the Human Health Implications of Mercury Exposure in Nova Scotia – **Dalhousie University**;
  - Examining Air Pollutants Associated with Oil Sands and Fossil Fuel Electric Power Generation – **Mount Royal University**;
  - Developing a Python Learning Course utilizing NPRI Data – **University of North British Columbia**.

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Top 25 (A)   Top 10 (B)
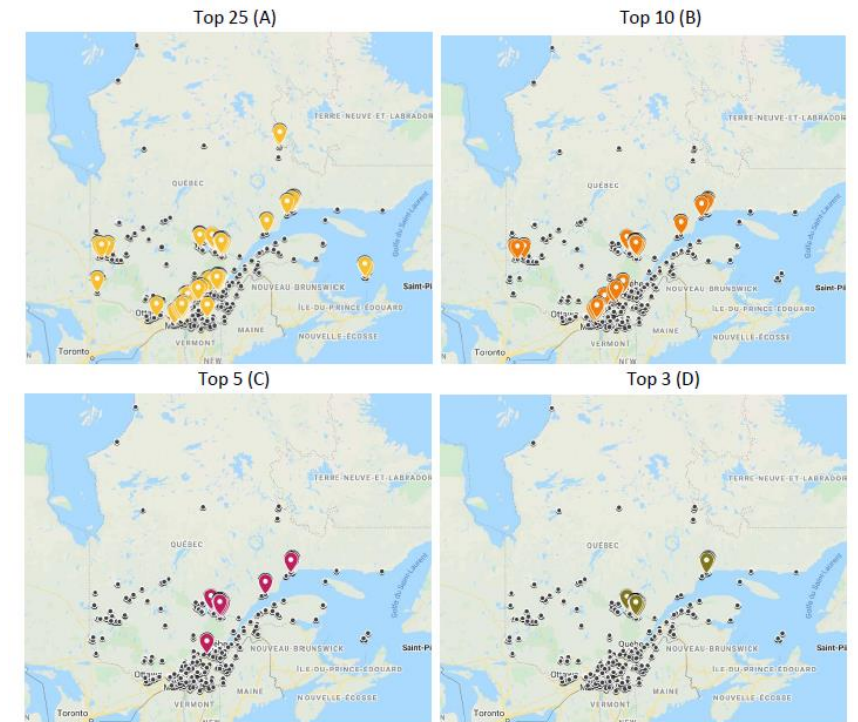
Top 5 (C)   Top 3 (D)

Figure 4.6 A, B, C et D : Répartition des installations déclarantes à l'INRP figurant parmi les 25, 10, 5 et 3 SDR où les volumes de rejets polluants sont les plus élevés au Québec, en 2019.

Engagement and Products

Indigenous community engagement

- Developed the NPRI Indigenous Series to highlight environmental challenges within the communities;
- The inaugural product focuses on Inuit and First Nations communities in Québec near industrial areas. This is the result of ongoing collaboration with the Government du Québec and seven regional Indigenous organizations in Québec;
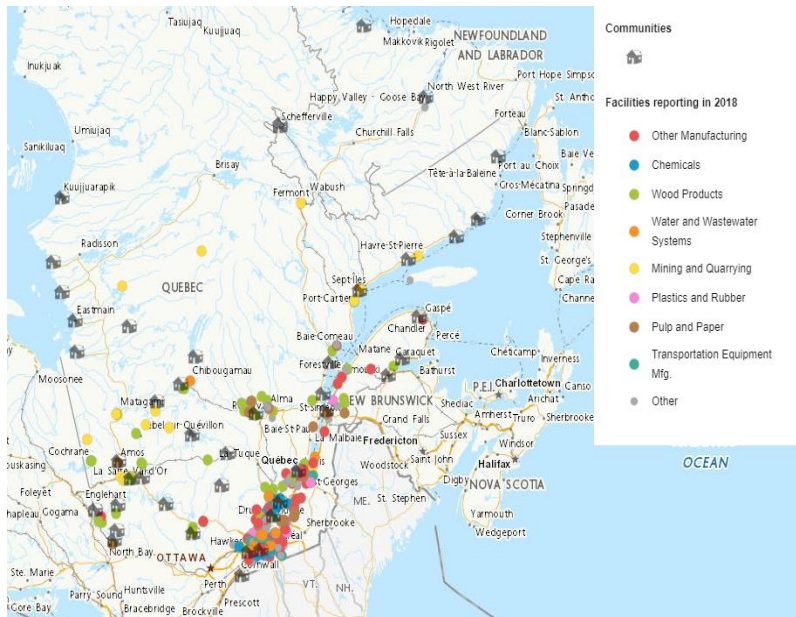
- Crafting a second product addressing pollutants near Indigenous and Métis communities in Ontario;
- Facilitating outreach and engagement activities from the University of Toronto's Technoscience Research Unit, in collaboration with the Aamjiwnaang community, to better understand their perceptions of NPRI data;
- Nurturing an ongoing partnership with Université du Québec en Abitibi-Témiscamingue dedicated to study contaminant exposure among Indigenous communities.

Engagement and Products

- Improving public understanding of NPRI pollution data through accessible products such as:
  - NPRI Sector Overviews;
  - NPRI Substance Overviews;
  - NPRI Data Integration Reports;
  - NPRI Indigenous Series.

- Objective: Analyzing emissions trends over time.

- Collaborative approach:
  - Developed through collaboration with sector experts at Environment and Climate Change Canada (ECCC), Indigenous organizations and industrial associations, our commitment to objectivity and impartiality ensures the delivery of accurate information to the citizens of Canada, safeguarded from external influence.
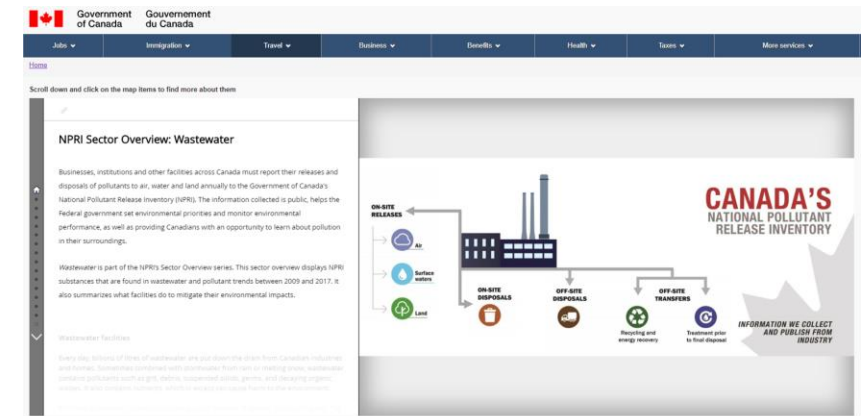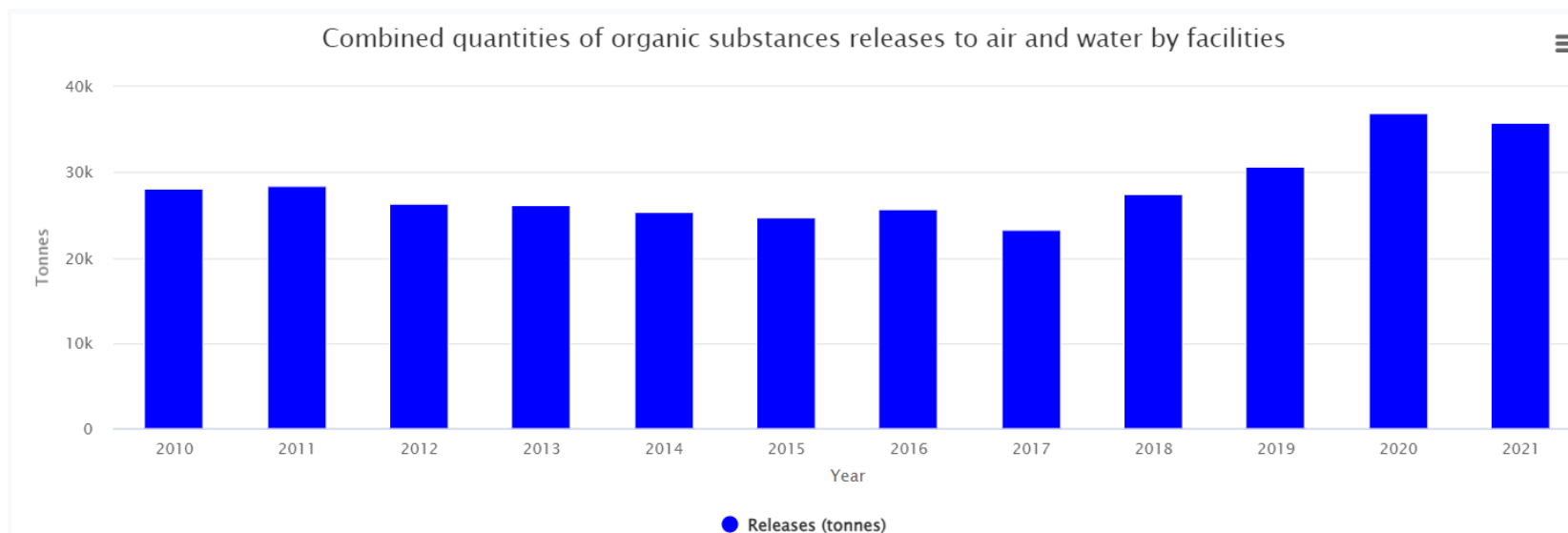
Great Lakes Exploratory Analysis Summary*

- Project highlights Great Lakes pollution impacts, marked by geographical spread and socio-economic burdens, through substance risks prioritization.

- Utilizes the NPRI, the Toxics Release Inventory (TRI) and the National Emissions Inventory (NEI) data to visualize temporal and spatial pollutant risk trends in the Great Lakes watershed from 2010 to 2021:
    - Analyzed 198 substances, categorized by their risk factors, combining exposure and hazard to provide a risk to the most vulnerable ecological receptors;
    - Risk assessment factor were multiplied with demographic variables from census data in both countries to establish a combined environmental impact and socioeconomic score.

- Emphasizes 2017 data for alignment with Canadian census and NEI.

- Presented as a Story Map to offer exploration of spatial data alongside contextual information.

Great Lakes Analysis Summary

Substance risk prioritization
- The Risk Assessment IDentification and Ranking (RAIDAR) model serves as a tool for estimating and comparing potential risks posed by organic chemicals by integrating data on their potential hazards with exposure estimates within a hypothetical environment representative of Canada.
- Considering variances in terminology and reporting requirements between NPRI and TRI, only releases of substances to air and water have been taken into account:
 - Analysis encompassed 198 substances.

Combined quantities of organic substances releases to air and water by facilities



● Releases (tonnes)

Great Lakes Analysis Summary

Releases and risk estimates

- Ethanol dominates risk assessment:
  - Of organic substances released near the Great Lakes, ethanol ranks greatest in risk according to the RAIDAR model;
  - Ethanol emissions to air primarily originate from alcohol storage facilities and is most damaging to plant foliage.
- Risk vs. release discrepancy:
  - Among the top ten substances released in the Great Lakes region in 2017, two (i.e., ethanol, methanol) feature among the top ten substances with the greatest risk.
- Nonylphenol and its ethoxylates emerge as the greatest risk contributors in water discharges. Despite contributing only 22% of the quantities discharged, they account for 89% of the risk. This substance is mainly discharged from water treatment plants.
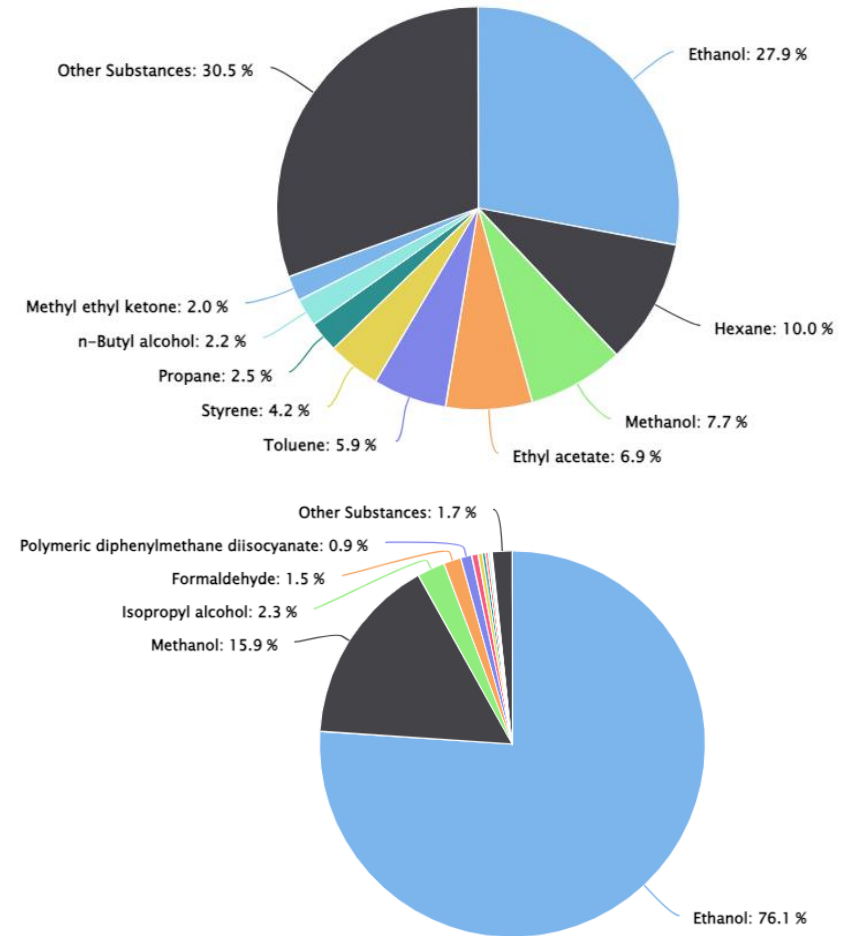
Graph: Total organic substance per discharge and estimated risk in the Great Lakes basin in 2017. The top graph shows discharges, and the bottom graph shows risk estimates.

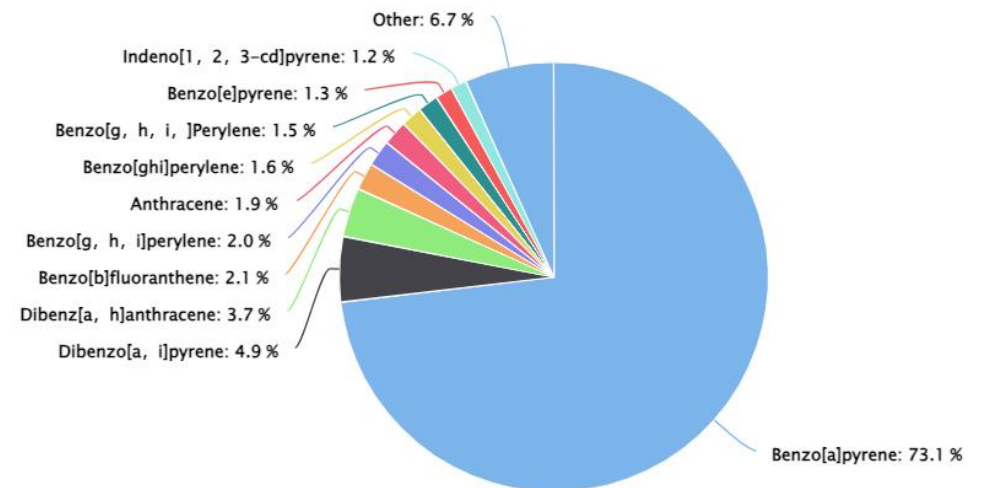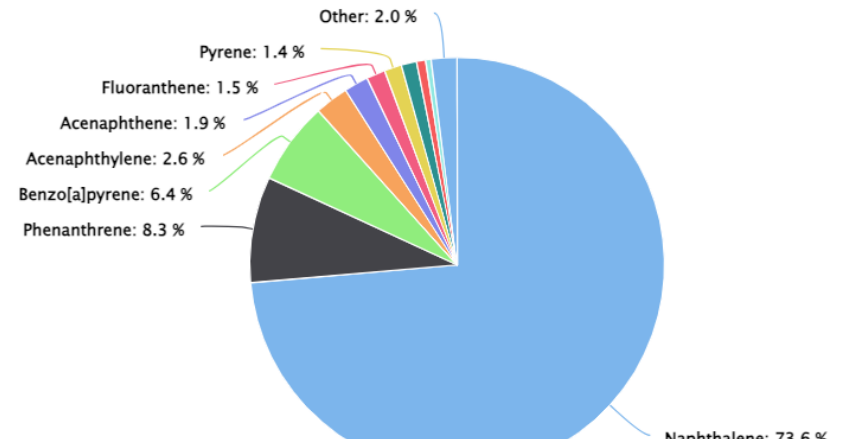**Release quantity and risk estimates of pollutant releases in 2017**
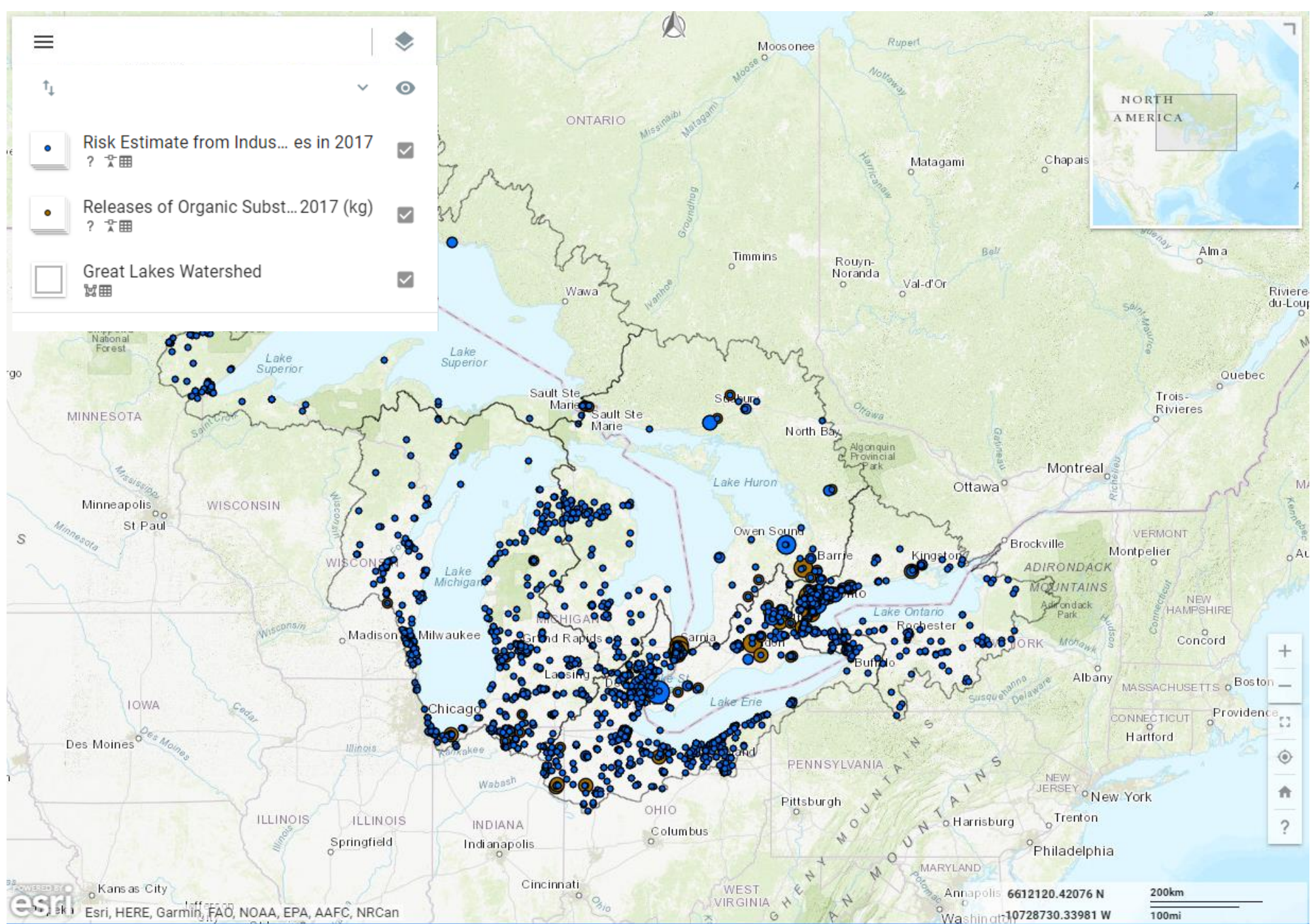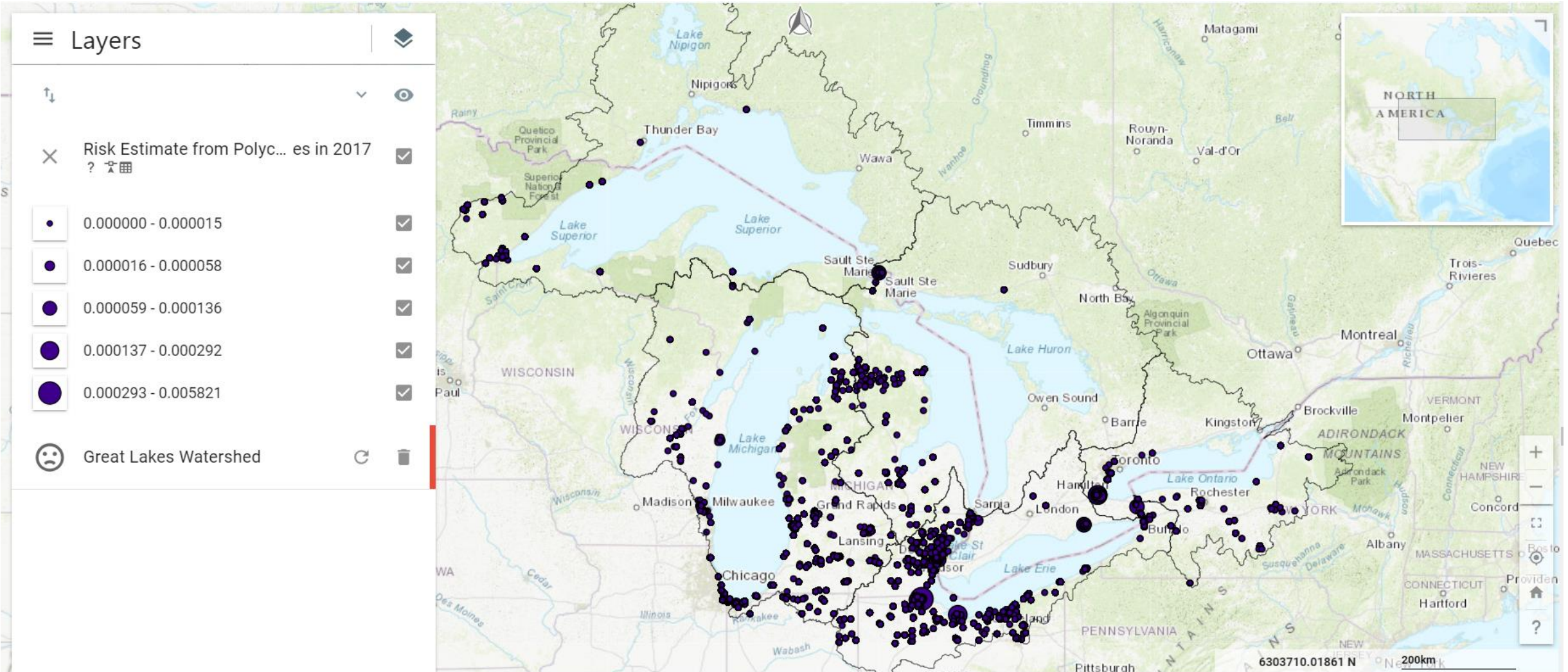
Great Lakes Analysis Summary

Polycyclic aromatic hydrocarbons (PAHs)

- PAHs are chemicals of interest assessed under the Canada-United States Great Lakes Water Quality Agreement (GLWQA).

- Among PAHs released into the Great Lakes region, naphthalene is the most prevalent, constituting a significant portion. However, in terms of risk estimation within the PAH group, naphthalene accounts for a mere 0.85%.

- Benzo[a]pyrene represents only 6% of the total releases but has a considerably higher risk score.

- The risk assessment factor associated with this substance is relatively low for different ecological receptors, including aquatic mammals, small rodents and passerine birds.

Top pie chart labels:
- Other: 2.0 %
- Pyrene: 1.4 %
- Fluoranthene: 1.5 %
- Acenaphthene: 1.9 %
- Acenaphthylene: 2.6 %
- Benzo[a]pyrene: 6.4 %
- Phenanthrene: 8.3 %
- Naphthalene: 73.6 %

Bottom pie chart labels:
- Other: 6.7 %
- Indeno[1, 2, 3-cd]pyrene: 1.2 %
- Benzo[e]pyrene: 1.3 %
- Benzo[g, h, i,]Perylene: 1.5 %
- Benzo[ghi]perylene: 1.6 %
- Anthracene: 1.9 %
- Benzo[g, h, i]perylene: 2.0 %
- Benzo[b]fluoranthene: 2.1 %
- Dibenz[a, h]anthracene: 3.7 %
- Dibenzo[a, i]pyrene: 4.9 %
- Benzo[a]pyrene: 73.1 %

Graph: PAHs by release and estimated risk in the Great Lakes basin in 2017. The top graph shows releases, and the bottom graph shows risk estimates.

# Risk assessment factor from PAHs in the Great Lakes basin in 2017

Great Lakes Analysis Summary

Pollution and demographic data

- Risk assessment scores for organic discharges from Canadian and American facilities were multiplied with the following demographic variables:
  - Indigenous identity;
  - Immigrant status;
  - Educational attainment;
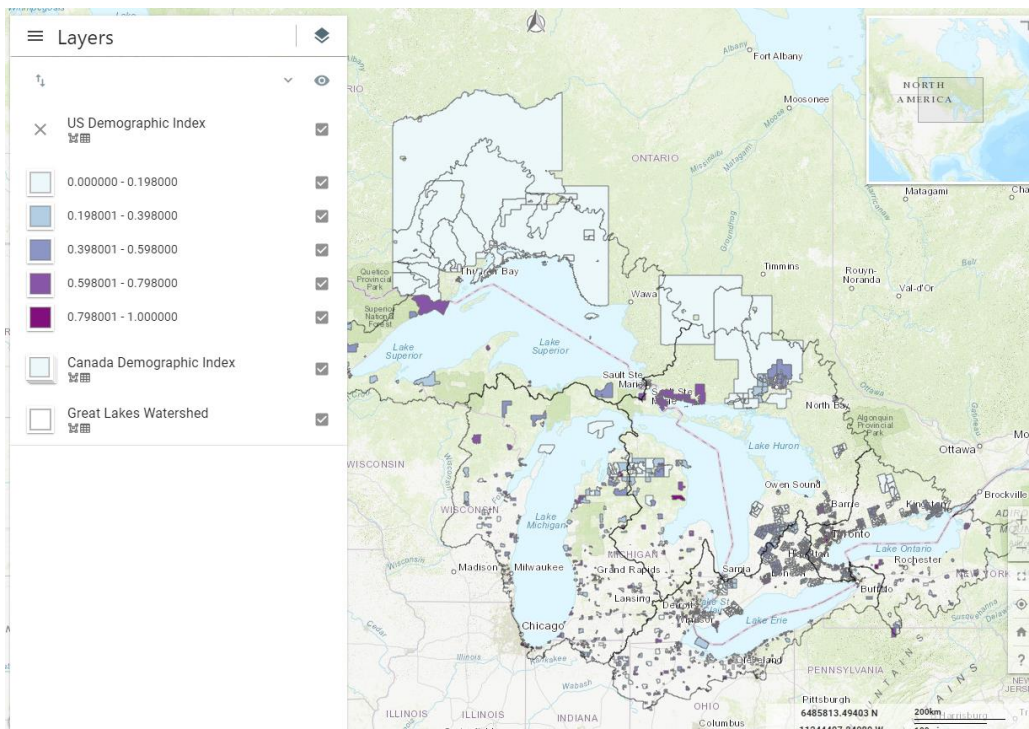 - Presence of visible minorities;
  - Low income.

Scores = (percentile rank of environmental indicator) X (demographic variable for census group – demographic variable for country)
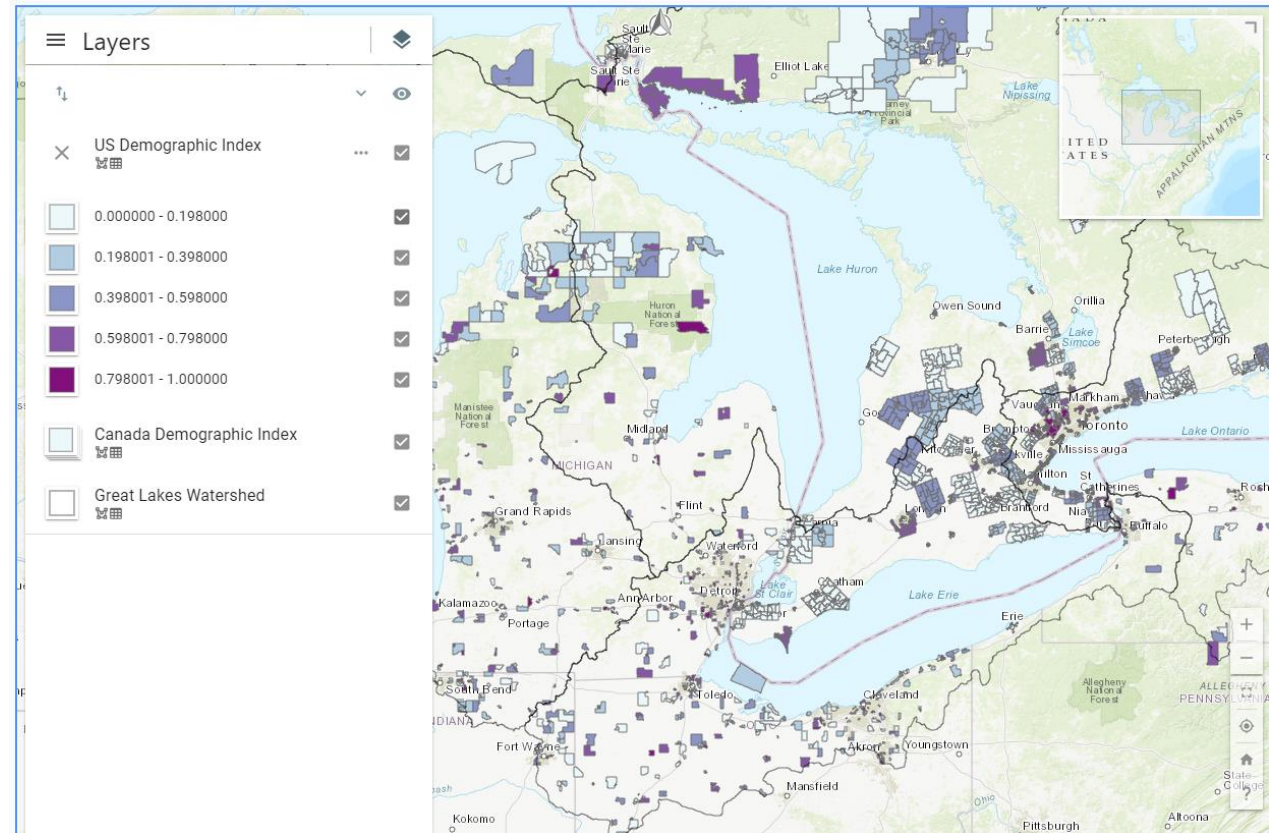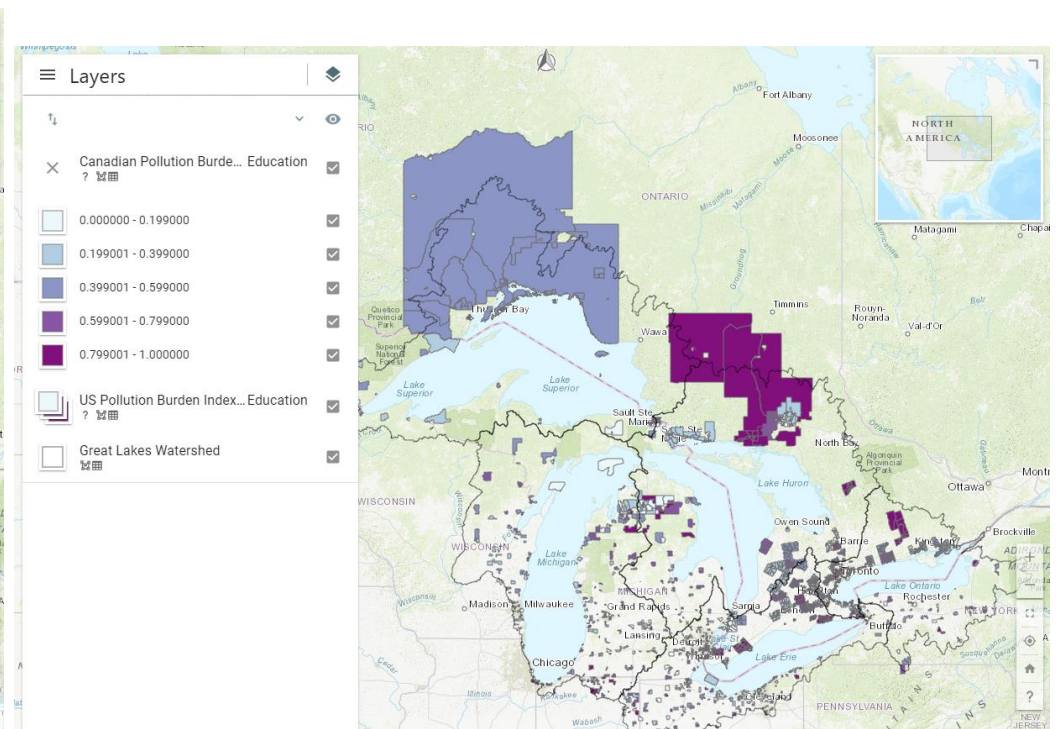

Map illustrating the percentiles of risk assessment scores for pollutant releases and demographic variables. Due to the differences in pollutant registers in the two countries, the data are separated by country and each country represents its own percentiles.
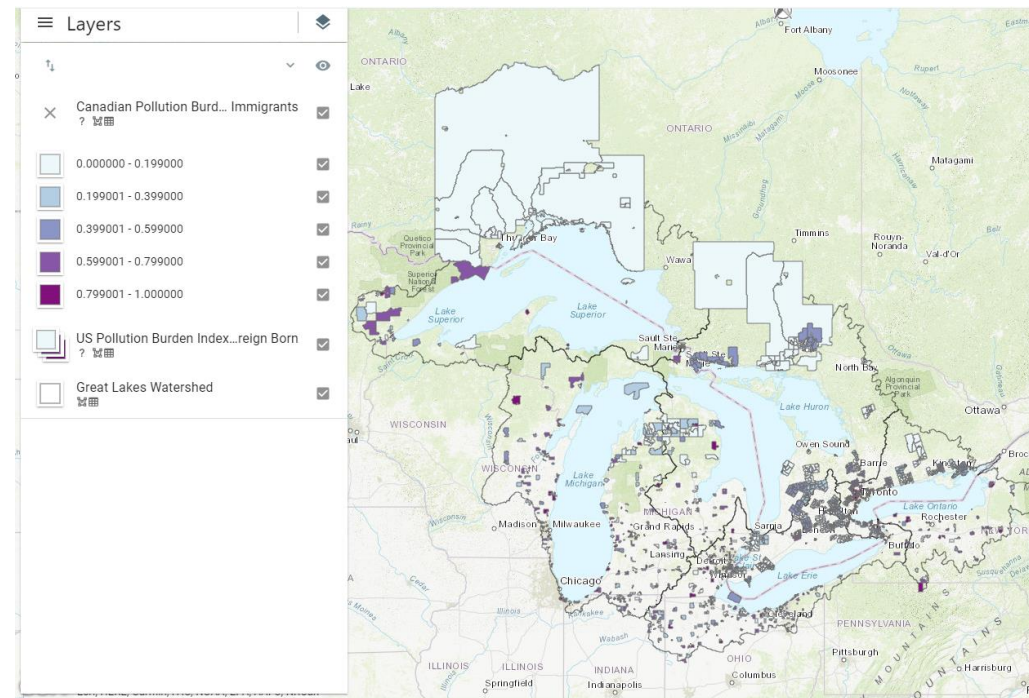
Combined score of pollution and poverty and visible minority populations in 2017
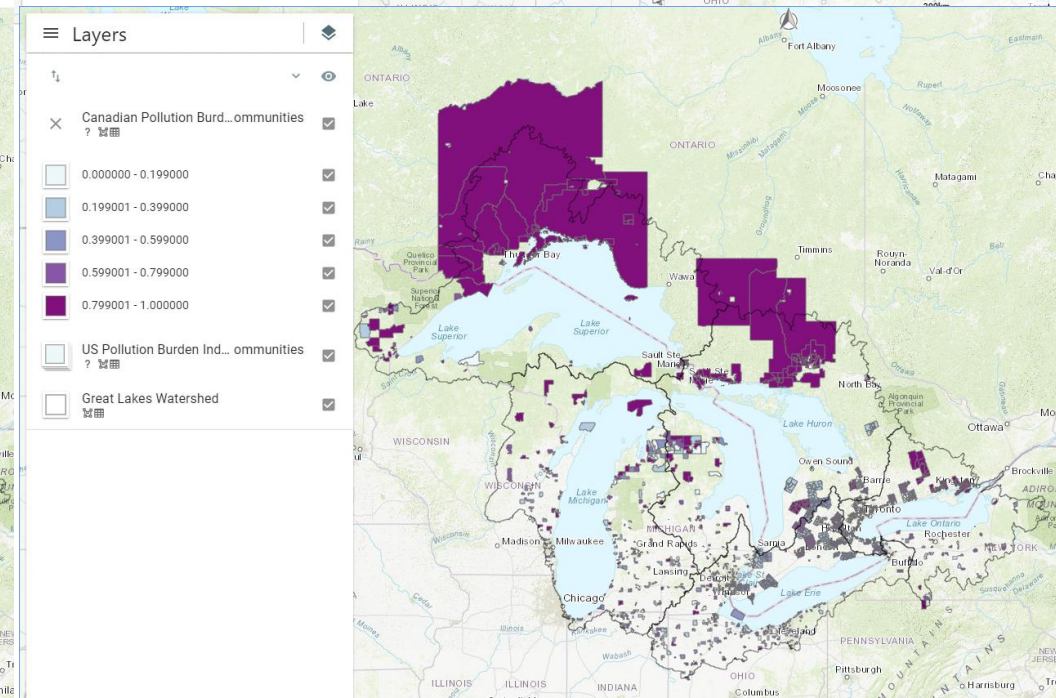
Layers

US Demographic Index

- 0.000000 - 0.198000
- 0.198001 - 0.398000
- 0.398001 - 0.598000
- 0.598001 - 0.798000
- 0.798001 - 1.000000

Canada Demographic Index

Great Lakes Watershed

Combined score of pollution and educational attainment in 2017

Layers

Canadian Pollution Burde... Education

- 0.000000 - 0.199000
- 0.199001 - 0.399000
- 0.399001 - 0.599000
- 0.599001 - 0.799000
- 0.799001 - 1.000000

US Pollution Burden Index... Education

Great Lakes Watershed

Combined score of pollution for Immigrant and foreign-born populations in 2017

Layers

Canadian Pollution Burd... Immigrants

- 0.000000 - 0.199000
- 0.199001 - 0.399000
- 0.399001 - 0.599000
- 0.599001 - 0.799000
- 0.799001 - 1.000000

US Pollution Burden Index...reign Born

Great Lakes Watershed

Combined score of pollution and Indigenous populations in 2017

Layers

Canadian Pollution Burd...ommunities

- 0.000000 - 0.199000
- 0.199001 - 0.399000
- 0.399001 - 0.599000
- 0.599001 - 0.799000
- 0.799001 - 1.000000

US Pollution Burden Ind... ommunities

Great Lakes Watershed

Great Lakes Analysis Summary

Pollutant releases near First Nations and Tribal communities

- The Great Lakes region is home to approximately 120 First Nations, tribal and Métis communities.

- In 2017, a total of 132 polluting facilities were located within a 15km radius of 31 indigenous communities in the region, releasing a total of 3,762 tonnes of pollutants into the air and 23 tonnes into the water.

- The Indigenous community in the Great Lakes region with the highest score is Fort William First Nation, Ontario. Additionally, Aamjiwnaang First Nation in Sarnia, Ontario, also ranks among the communities with the greatest score.

- In the United States, the highest scored communities include the Saginaw Chippewa Tribal Nation in Isabelle, Michigan, and the Tuscarora Reservation in New York State.
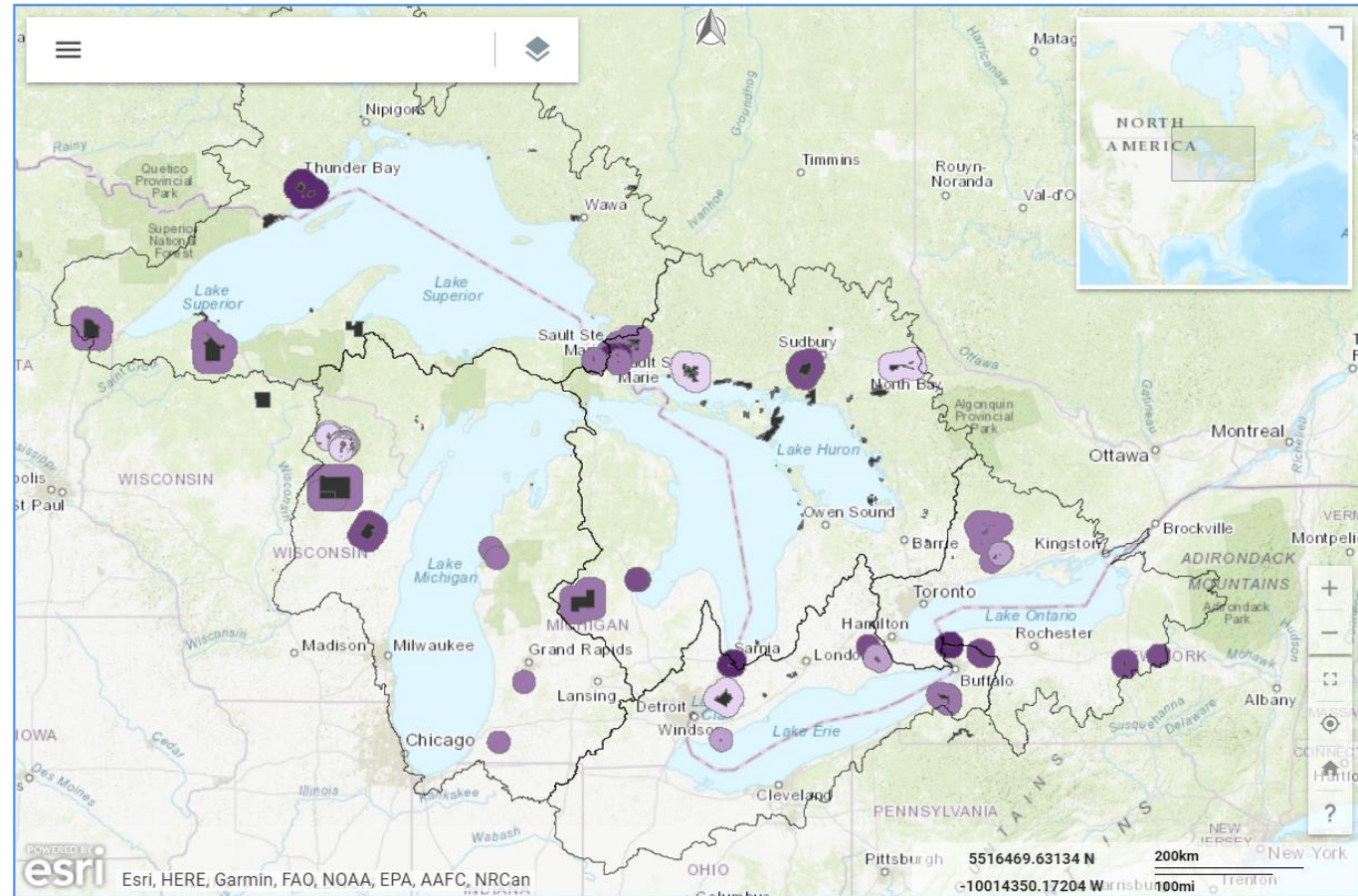
Map illustrating First Nations and Tribal communities with facilities that discharge pollutants within a 15 kilometers radius. The colors represent the percentiles with the highest score (darkest) to the lowest (lighter), separating the two countries.

Conclusion

- Diversifying the ways in which data can be accessed by exploring various avenues it can reach the public;

- Providing users with additional contextual information to facilitate a more comprehensive and nuanced understanding.

ec.inrp-npri.ec@canada.ca

1-877-877-8375

https://www.canada.ca/NPRI