



[School Name Here]

CLIMATE IMPACT MAP · CLASSROOM EDITION · ONTARIO 🍁

LESSON PLAN · GRADES 4–6 · ONTARIO

Urban Flooding & Infrastructure: A Toronto-Centred Investigation



Grades 4–6 (ages 9–12)



60 minutes



Ontario



theclimateimpactmap.com



[Date]

Required Tool: Climate Impact Map

This lesson is built around hands-on use of Climate Impact Map (theclimateimpactmap.com). Students should spend the majority of class time actively exploring the map. Ensure all students have device access before the lesson begins. Classroom licence unlocks all IPCC AR6 scenarios, storm surge, and infrastructure overlays.

Learning Objectives

By the end of this lesson, students will be able to:

1. Describe the key IPCC AR6 sea level rise scenarios and explain the difference between SSP pathways.
2. Use Climate Impact Map to identify flood risk for communities in Ontario, including Toronto.
3. Explain how urban flooding & infrastructure affects people, infrastructure, and ecosystems differently based on location and socioeconomic status.
4. Connect global climate data to local risk in Ontario using real NASA and IPCC datasets.


5. Reflect on the relationship between climate science and Indigenous knowledge traditions in this region.

Materials & Setup

- **Climate Impact Map** – theclimateimpactmap.com (Classroom licence required for full access)
- Device per student or per pair (tablet, laptop, or desktop)
- Student observation worksheet (create or adapt from this lesson plan)
- Whiteboard or shared digital document for class discussion
- Optional: printed map of Toronto and surrounding region for reference

Teacher prep: Before class, navigate to theclimateimpactmap.com and confirm Classroom access is active. Pre-load the map centred on Toronto and test all scenario buttons referenced in the Main Activity.

Background for Teachers

 **Live NASA Data Integration:** Climate Impact Map displays live Arctic and Antarctic sea ice extent from NSIDC (updated weekly) and active fire detections from NASA FIRMS VIIRS (updated every 24 hours). The Stats panel in the app shows current anomalies versus the 1981–2010 baseline. Reference this data during your introduction to ground the lesson in current conditions.

Cities concentrate risk. The combination of impervious surfaces (roads, parking lots, rooftops) that prevent rainfall absorption, aging stormwater infrastructure designed for historical precipitation patterns, urban heat islands that intensify rainfall events, and dense populations in low-lying areas creates a perfect storm of flood vulnerability. Climate change is intensifying all of these factors simultaneously.

Urban flooding operates differently from coastal flooding – it can occur far from any coast when rainfall exceeds drainage capacity, when rivers overflow, or when combined sewer systems back up. The 2021 flooding of subway systems in New York City and Zhengzhou, China during extreme rainfall events illustrated how quickly modern urban infrastructure can be overwhelmed. In Canada, the Insurance Bureau of Canada reports that water damage from flooding has overtaken fire as the leading cause of property insurance claims.

Climate Impact Map allows students to model sea level rise inundation of coastal urban areas and examine infrastructure at risk. Combined with climate risk scores showing flood frequency projections to 2100, it provides a comprehensive picture of urban climate vulnerability.

Local context – Ontario: Lake Ontario shorelines and the Greater Toronto Area face increasing flood risk from storm surge, extreme rainfall, and changing ice conditions.

Lesson Plan

Introduction (9 min)

Begin by asking students: *"What would happen to Toronto if sea levels rose by 1 metre? By 7 metres?"* Allow 2–3 minutes of discussion. Do not correct or confirm answers yet – capture predictions on the board.

Briefly introduce Climate Impact Map: explain that it uses real GEBCO terrain elevation data, IPCC AR6 projections, and live NASA satellite data. Show the Stats panel briefly to demonstrate that the tool connects to real-time observations.

Frame the lesson: today students will use the same data that climate scientists and emergency managers use to assess flood risk – and they will ground it in the specific geography of Ontario.

Main Activity – Climate Impact Map Exploration (33 min)

Have students open Climate Impact Map on their devices. Walk through the interface briefly (scenario panel, overlays, Cities tab, click-to-explore). Then proceed through the following steps:

1 Baseline urban flood risk

On Climate Impact Map, navigate to the downtown core of your nearest major coastal city. Apply SSP2-4.5 (+0.6 m). What percentage of the downtown area appears to be at risk?

2 Infrastructure overlay

Enable the Airports, UNESCO Sites, and Nuclear Plants overlays simultaneously. Which infrastructure types are most exposed in your city?

3 City stats panel

Open the Cities tab and select your study city. Record: current elevation, population at risk, estimated economic damage, and flood depth at each scenario.

4 Storm surge + urban core

Click on the coastline nearest your city centre and apply **Cat 3 surge + SSP2-4.5**. Compare the combined inundation to sea level rise alone. What additional areas are affected?

5 Climate risk score — urban vs suburban

Click on the city centre versus a suburban or rural area nearby. Compare the 5-metric climate risk scores. Is urban flood risk higher or lower than surrounding areas? Why?

6 Future projection

Apply **SSP5-8.5 (+1.0 m)** with Cat 4 surge. This represents a plausible extreme scenario by 2080–2100. Describe what your city's waterfront district would look like.

Discussion & Analysis (12 min)

Bring the class together. Use the following discussion questions to deepen analysis and connect data to broader themes:

- How does urban flooding differ from coastal flooding? Can a city far from the ocean still face serious flood risk?
- Who in a city is most vulnerable to flooding? Is flood risk distributed equally across socioeconomic groups?
- What would it cost to protect your city's downtown from 1 metre of sea level rise? Is this feasible? What are the alternatives?
- What does "managed retreat" mean? When is it the right choice, and who decides?

Closing & Exit Ticket (6 min)

Ask students to complete a brief exit ticket (written or verbal) responding to: *"What is one thing you learned today that surprised you, and one question you still have?"*

Collect responses to inform follow-up instruction. Consider sharing standout observations in the next class as a warm-up.

Indigenous Knowledge & Urban Flooding & Infrastructure

The land on which Toronto stands is the traditional territory of the Mississaugas of the Credit First Nation, Anishinaabe, Haudenosaunee, and Wendat peoples. Climate change is not an abstract future threat to Indigenous peoples — it is a present reality reshaping relationships with land, water, and community that have been sustained for thousands of years.

Traditional ecological knowledge held by Indigenous peoples in this region provides a long-term record of environmental change that predates Western scientific instrumentation by centuries. Changes in seasonal timing, species behaviour, water levels, and weather patterns observed by knowledge keepers offer invaluable context for interpreting Climate Impact Map data.

When using Climate Impact Map to explore urban flooding & infrastructure scenarios, consider: whose land are you mapping? Whose communities appear in the flood zones? How does Indigenous land stewardship — including practices like cultural burning, salmon habitat management, and coastal resource governance — relate to climate resilience?

Reflection Prompt

How can Western scientific data (like IPCC AR6 projections and NASA satellite data) and Indigenous traditional ecological knowledge complement each other in understanding and responding to climate change? What would it look like to genuinely centre Indigenous voices in climate adaptation planning for this region?

Suggested resource: Consult the First Peoples' Cultural Council (BC), Ontario Native Education Counselling Association, or your region's tribal nation websites for climate-related traditional knowledge resources.

Assessment Rubric

Criteria	Beginning (1)	Developing (2)	Applying (3)	Extending (4)
Understands sea level rise scenarios	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.
Can describe local flood risk	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.
Uses Climate Impact Map to find information	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.
Connects science to community	Shows limited understanding; requires significant support to complete tasks.	Shows basic understanding; completes tasks with some guidance and occasional errors.	Demonstrates solid understanding; completes tasks independently with minor errors.	Demonstrates thorough understanding; extends thinking beyond task requirements with insight.

Extension Activities

1. Research your city's stormwater management infrastructure. When was it built? What rainfall intensity was it designed for? How does this compare with current and projected extreme rainfall events?

2. Compare the flood adaptation strategies of two cities facing similar risks (e.g., Rotterdam vs. Miami, or Vancouver vs. Seattle). Which approach is more effective, and why?
3. Calculate the economic value of assets in your city's flood zone under SSP5-8.5 + Cat 3 surge. Research what flood insurance currently costs in that zone, and project how premiums might change by 2050.

Curriculum Connections

Curriculum Standard: Ontario Ministry of Education — Science and Technology, Geography, Environmental Education

This lesson addresses outcomes related to: Earth and environmental science; climate systems and human impact; geographic inquiry and spatial thinking; data literacy and scientific reasoning; social justice and equity in environmental contexts; Indigenous perspectives and land relationships.

Cross-curricular connections: Social Studies (geopolitics of climate change), Mathematics (data interpretation, percentages, scale), Language Arts (persuasive writing, research), Indigenous Education.