

# Is climate changing?

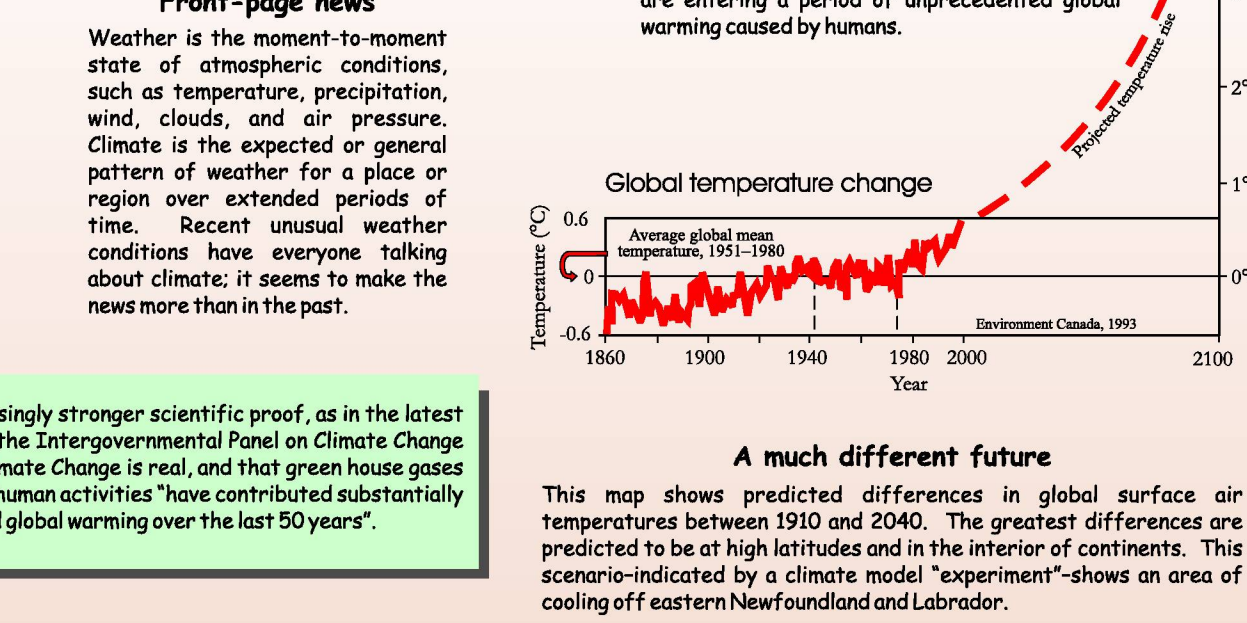
Climate has been an important factor in Canada's history and will influence its future

**Pace of global warming leaves scientists baffled**

Global warming threatens to change the world as we know it. But the pace of global warming has broken records and scientists are baffled. The rate of global warming has increased in the last 10 years, and scientists are not sure why.

**Climate chaos predicted**

Global warming is predicted to cause a range of problems, including sea level rise, drought, and extreme weather. Scientists are predicting that the world will experience a "climate chaos" in the next 100 years.

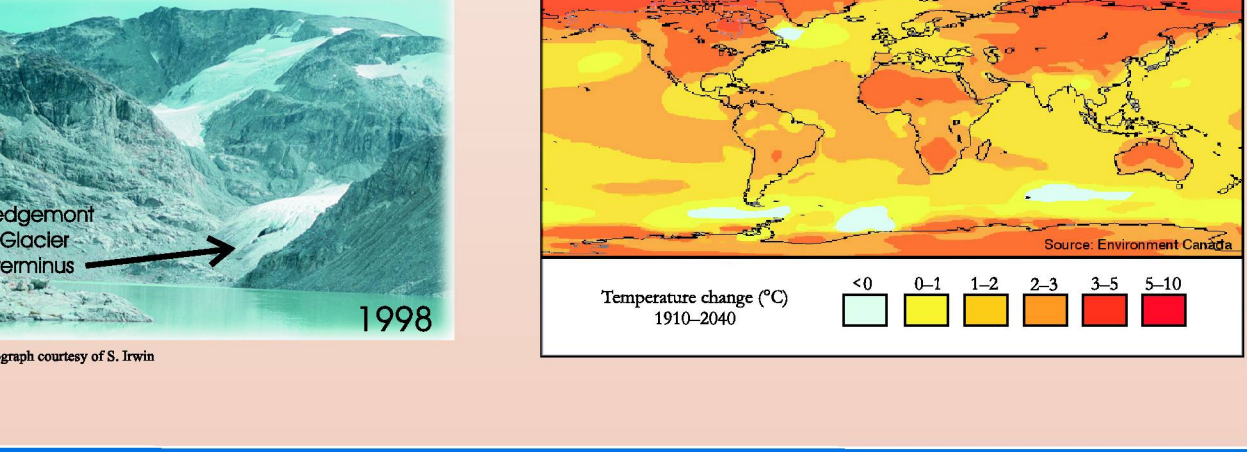


**Nature's thermometers**

Global warming affects climate and they show when it warms. The map shows the location of the thermometers. The thermometers are located in various parts of the world, including the Arctic, the tropics, and the southern oceans.

**1979**

**1998**

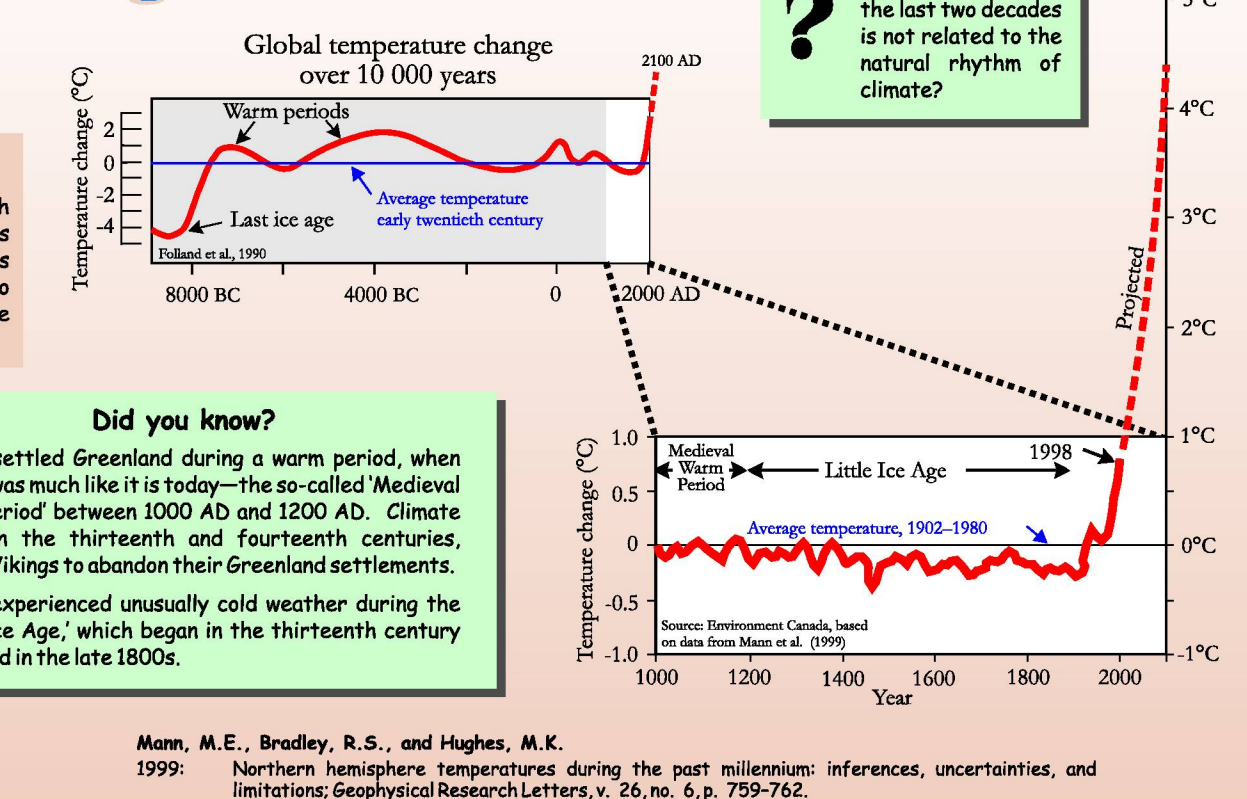


# Climate has always changed

Thousands of years ago, glaciers that formerly extended to the edge of the continental shelf had retreated to the northern shore line. Offshore, several islands existed, but they were small. The map shows the location of the islands. The islands were located in the Gulf of St. Lawrence and the Bay of Fundy.

**10 000 years of stability**

Scientists have found that the climate has been remarkably stable for 10,000 years. This is a period of time when the climate has been stable enough for humans to develop agriculture and civilization.



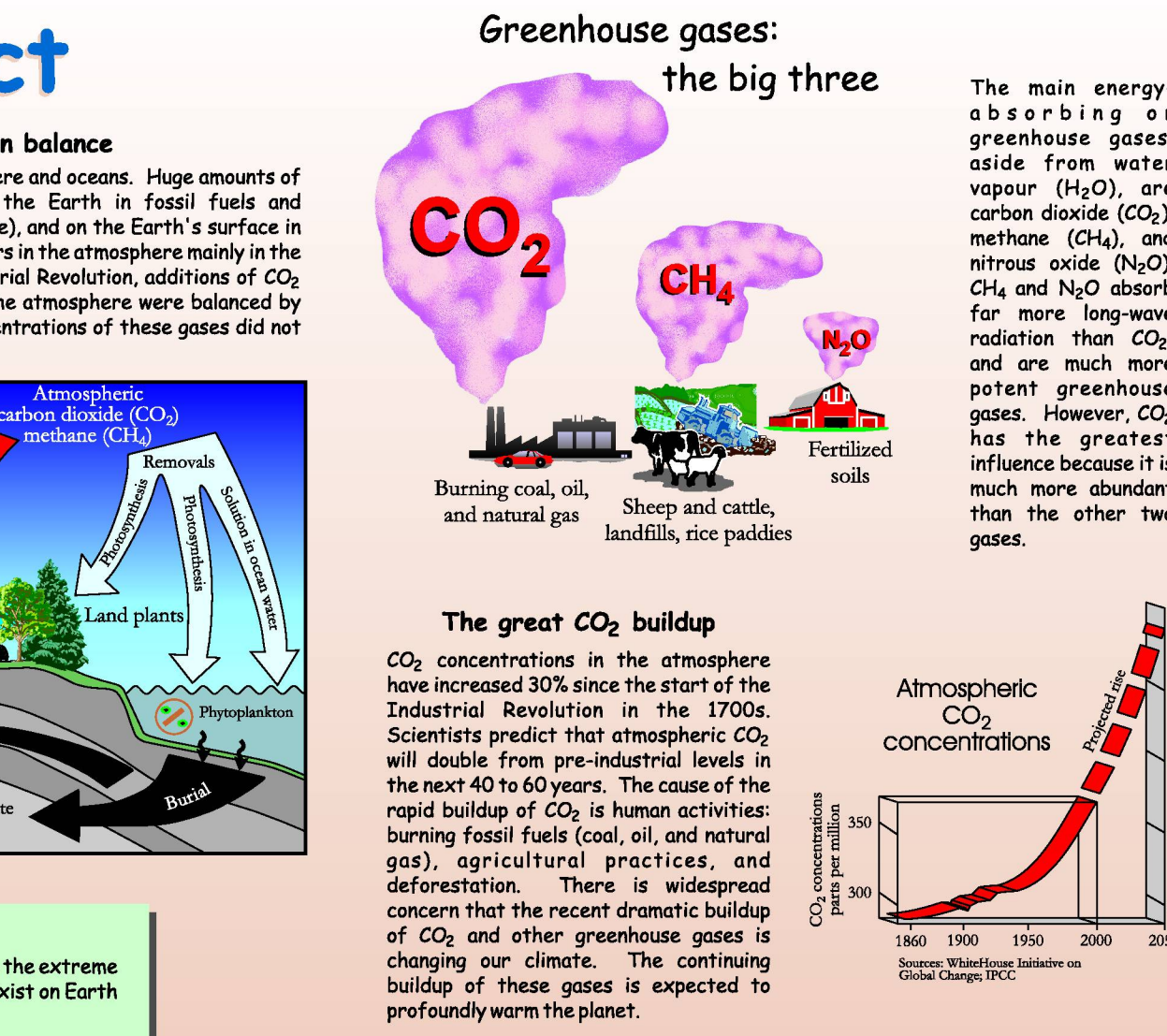
# The greenhouse effect

**The carbon balance**

Carbon is present in the atmosphere and in the ground. The carbon cycle shows how carbon moves between the atmosphere, the ground, and living organisms. The diagram shows the flow of carbon between these different reservoirs.

**The Earth's solar energy budget**

The Earth receives energy from the Sun. Some of this energy is reflected back into space, while some is absorbed by the Earth and its atmosphere. The diagram shows the balance of energy entering and leaving the Earth.



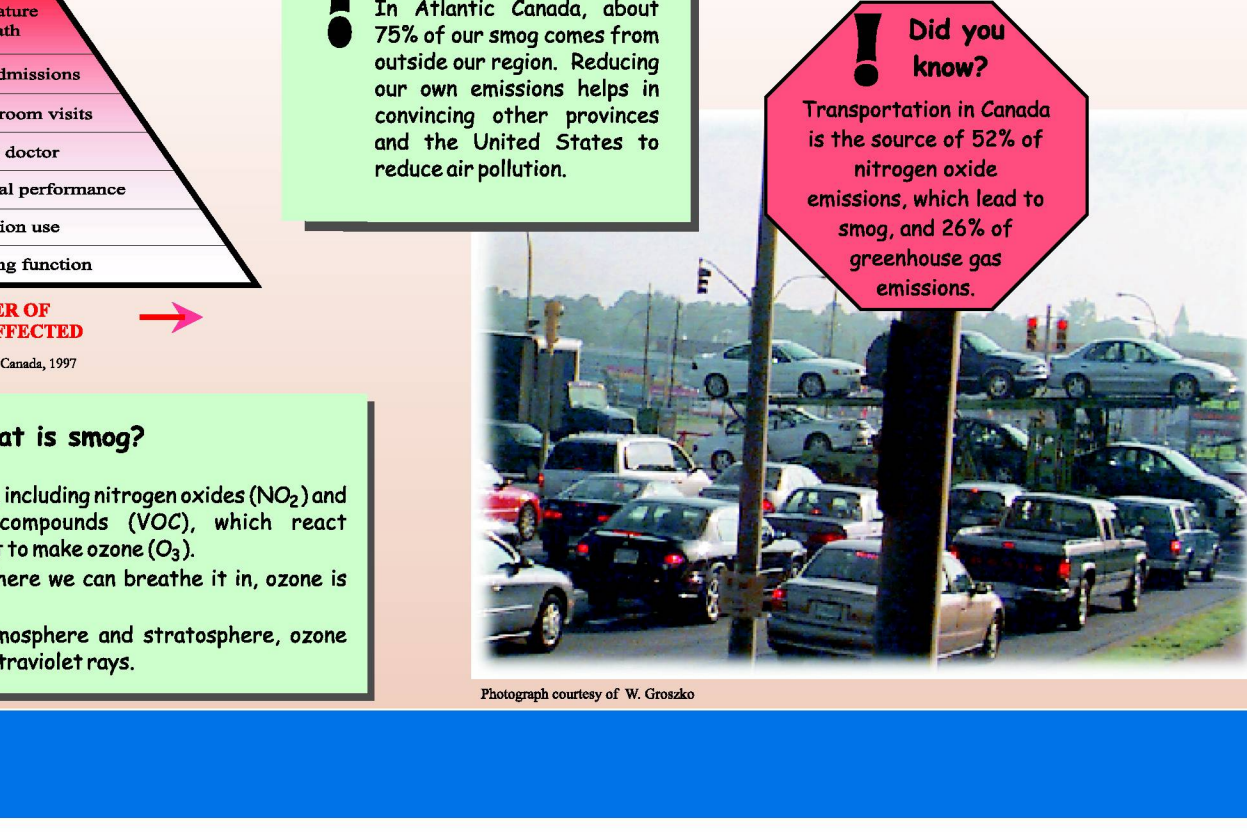
# The air we breathe

**AIR POLLUTION HEALTH EFFECTS PYRAMID**

How our health can be harmed. The pyramid shows the different levels of air pollution and their effects on human health. The levels are: Good, Moderate, Unhealthy for Sensitive Groups, Unhealthy, Very Unhealthy, and Hazardous.

**What is smog?**

Smog is a mixture of air pollutants, including nitrogen oxides (NOx) and volatile organic compounds (VOCs), which react together in sunlight to form a thick, brown haze. The diagram shows the chemical reactions that form smog.



# Freshwater issues

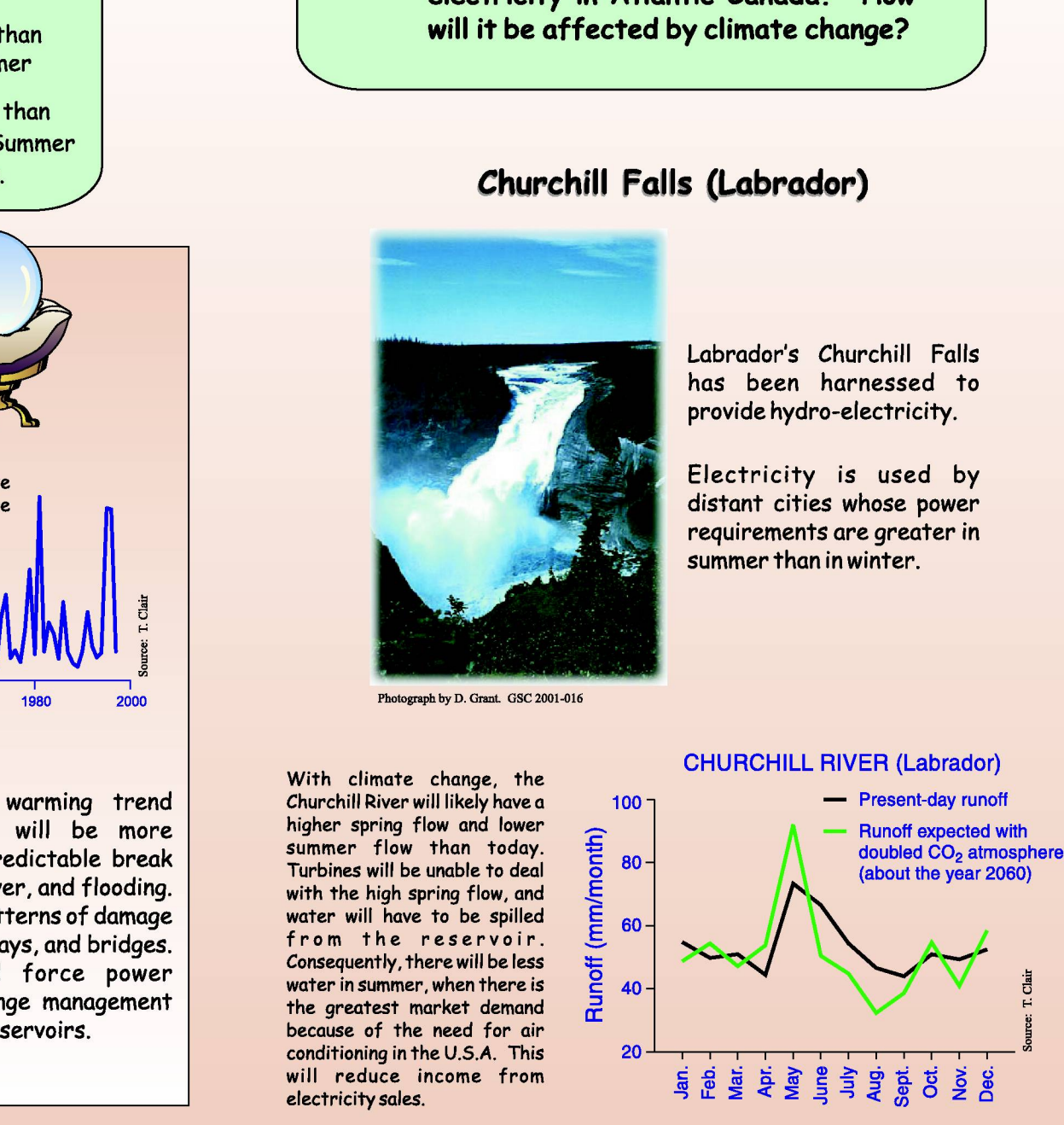
**PREDICTED CHANGES IN HYDROLOGY**

Labrador: Less runoff, higher flows earlier than present, reduced flows in the summer.

Prince Edward Island, Nova Scotia, New Brunswick: More runoff, higher flows earlier than present (April rather than May). Summer flows less than present and earlier.

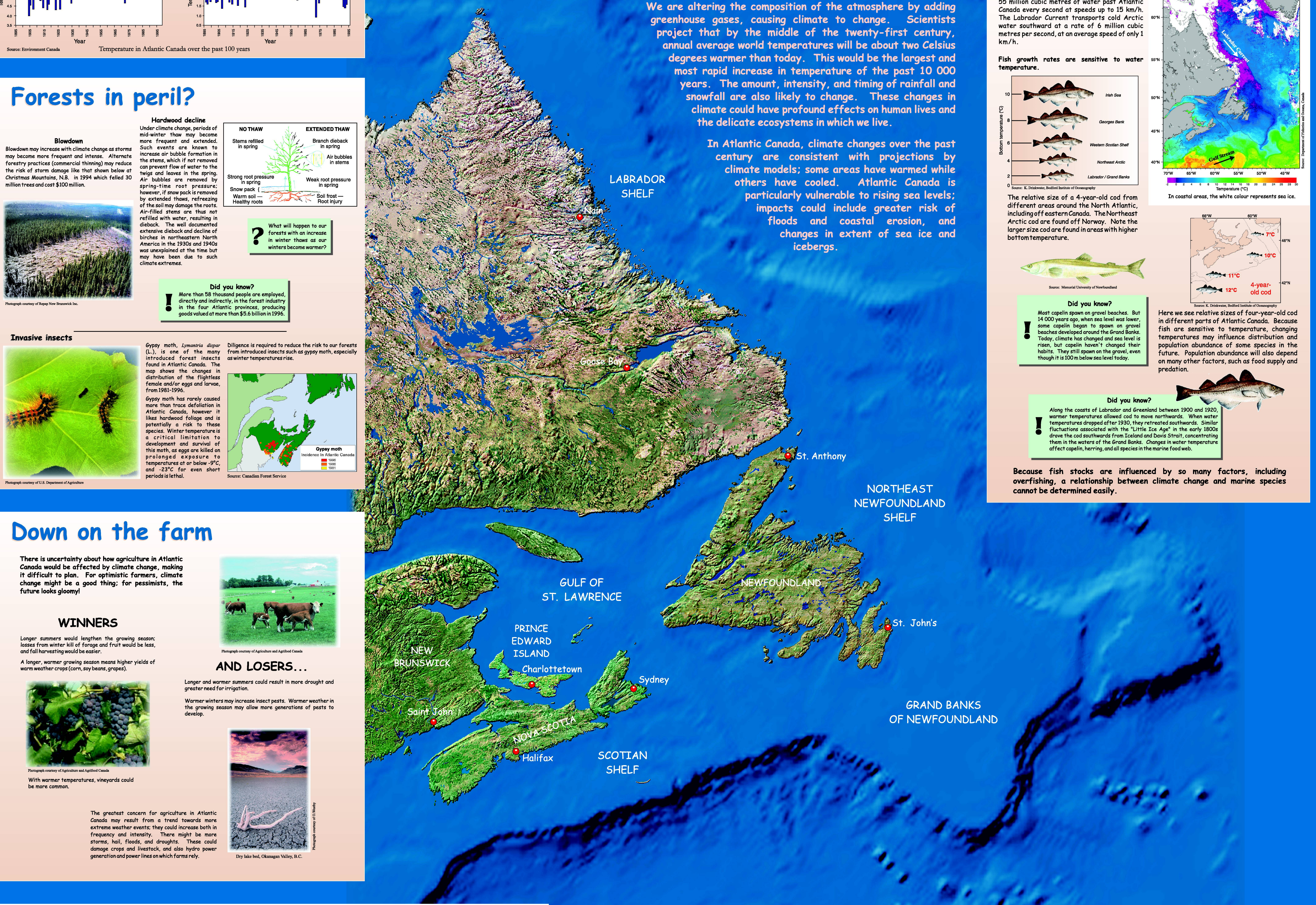
**The Saint John River: a glimpse of the future?**

Because of changing climate, the amount of water in our rivers — the runoff — will change. The example of the Saint John River illustrates the complexity of change in our climate.



# THE TIDES OF CHANGE

## Climate Change in Atlantic Canada



# Forests in peril?

**Blowdown**

Blowdown may increase with climate change as storms may become more frequent and intense. The diagram shows a tree being blown over by a storm.

**Handed decline**

Under climate change, periods of reduced rainfall and increased air-bubble formation in the stems, which if not removed, can prevent flow of water to the top and lower in the stem. The diagram shows a tree with a blocked water pathway.

# Invasive insects

**Gypsy moth, Ips, and other insects**

Along the coast of Labrador and elsewhere between 2000 and 2010, warmer temperatures allowed oak to move northward. The diagram shows the northward movement of the gypsy moth range.

# Down on the farm

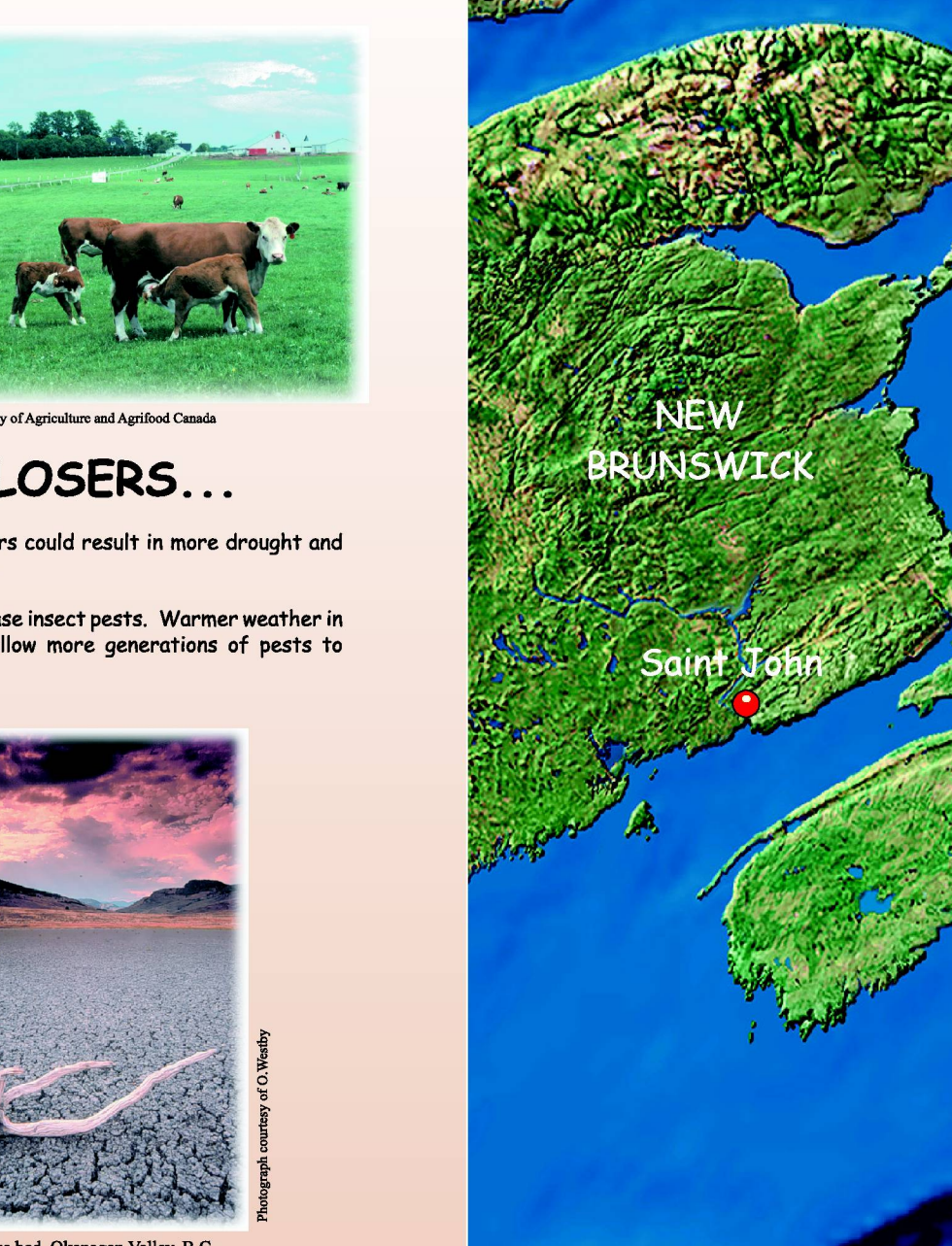
**WINNERS**

Larger harvests would lengthen the growing season. Larger, warmer growing seasons mean higher yields of many summer crops (corn, soybeans, grapes).

**AND LOSERS...**

Larger and warmer growing seasons could result in more drought and greater need for irrigation. Warmer temperatures increase insect pests. Warmer weather may also allow more generations of pests to develop.

# Changing ecosystems



# The ocean

**Sea surface temperature 1-15 May 1999 composite**

The ocean currents (see right) have a major influence on climate. The Gulf Stream carries 55 million cubic metres of water past Atlantic Canada every second at speeds up to 15 km/h.

**Fish stocks are sensitive to water temperature**

The relative size of a 4-year-old cod from different areas around the North Atlantic, including off eastern Canada, the Northeast Arctic and off Newfoundland. The diagram shows the size of cod fish from different regions.

# Storm surges and coastal flooding

**Carrier waves**

Extreme water levels are caused when a storm surge adds to the regular tidal waves that occur twice a day. The diagram shows a storm surge adding to a tidal wave.

**Treated areas: some examples**

Along the coast of Labrador and elsewhere between 2000 and 2010, warmer temperatures allowed oak to move northward. The diagram shows the northward movement of the gypsy moth range.

# Sea ice and... icebergs

**Sea ice limits**

Every year, sea ice forms in Atlantic Canada, reaching maximum extent in February and March. The ice is at its thickest off the coast of Newfoundland and Labrador.

**Iceberg limits**

The iceberg drift south in the Labrador Current and the northern edge of the Grand Banks. In the future, the southern limit may move farther north.

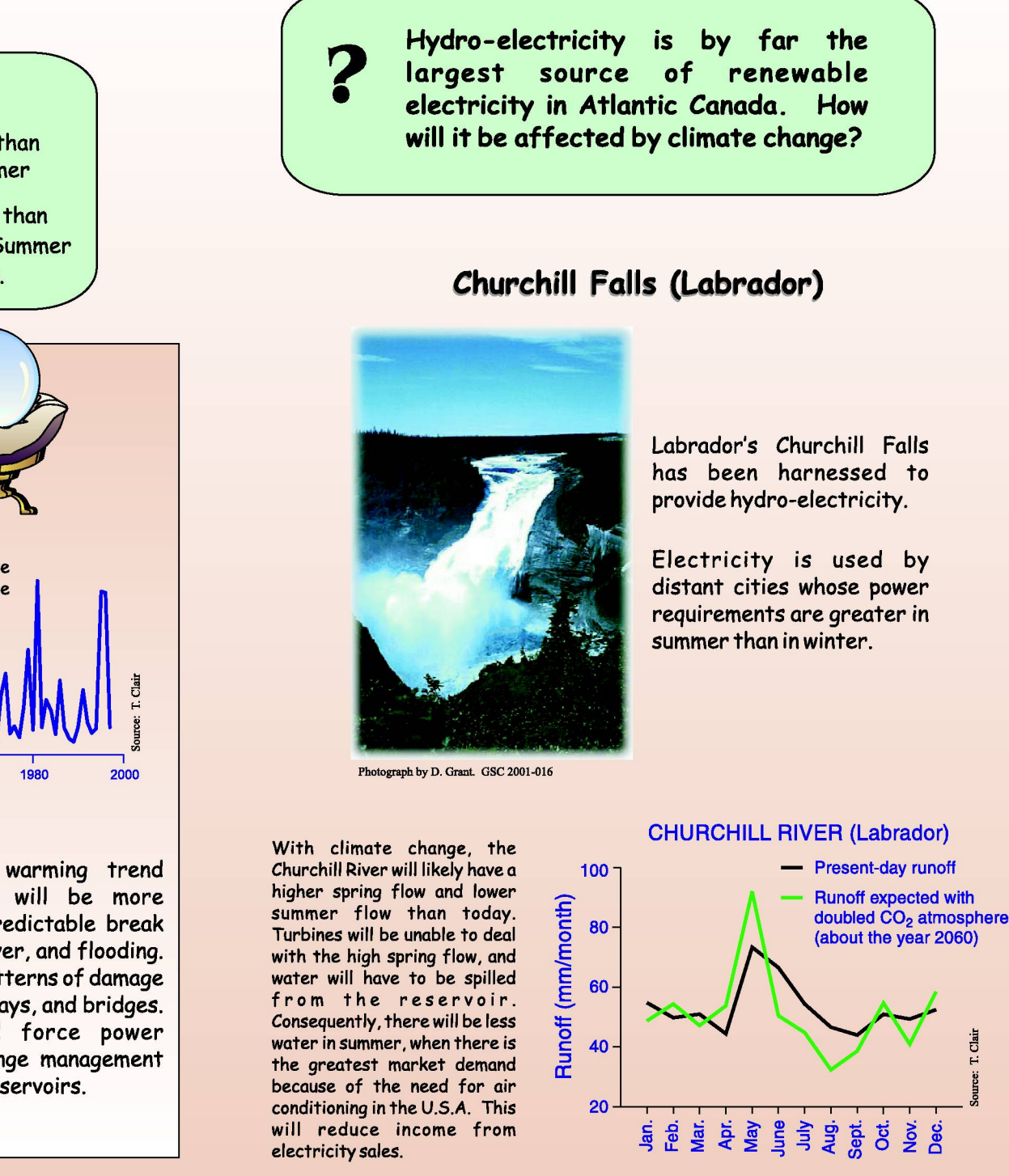
# How do we measure up?

**Atlantic Canada's greenhouse gas emissions**

Total of all sources in Atlantic Canada (2000): 47 million tonnes of CO2 equivalent per year.

**How to reduce greenhouse gas emissions**

Most greenhouse gas emissions come from burning fossil fuels (oil, gas, coal, natural gas, propane, coal). Anything which uses fossil fuels will reduce greenhouse gas emissions.



# Let's meet the challenge

**The risks**

The magnitude and rate of future climate change are not known. However, the risks are high. We may be facing unprecedented changes in climate that will affect how we live. It would seem wise to proceed cautiously after we act, as we may have long-term negative consequences.

**Our choice**

Our choice will be to choose a path that will meet the challenge. The diagram shows a path leading to a sustainable future.

# Let's meet the challenge

**The Tides of Change - Climate Change in Atlantic Canada**

Geological Survey of Canada, Miscellaneous Report 75, 2001

**Lead agency**

Natural Resources Canada, Geological Survey of Canada (Atlantic), Dartmouth, New Scotia

**Participating agencies**

Department of Fisheries and Oceans, Bedford Institute of Oceanography, Dartmouth, New Scotia; Agriculture and Agri-Food Canada, Charlottetown, Prince Edward Island; Environment Canada, Confederation Centre, Fredericton, New Brunswick; Natural Resources Canada, Confederation Centre, Fredericton, New Brunswick; Memorial University of Newfoundland, St. John's; Nova Scotia Department of Environment, Halifax; Environment Canada, Environmental Cooperation, Sackville, New Brunswick; Environment Canada, Meteorological Service of Canada, Atlantic Region

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