

Impacts of climate change on northern landscapes

A changing environment will affect many components of northern landscapes. Projections include shrinking glaciers, rising sea levels, erosion of coastlines, melting of permafrost, increasing numbers of landslides, changes in water resources, and a reduction in the thickness and extent of sea ice. The Intergovernmental Panel on Climate Change (IPCC) reports that once these changes are triggered, they may continue for centuries, long after atmospheric concentrations of greenhouse gases are stabilized. Some of the possible impacts of climate change on northern landscapes in the Yukon territory and across northern Canada are described below.

Glaciers

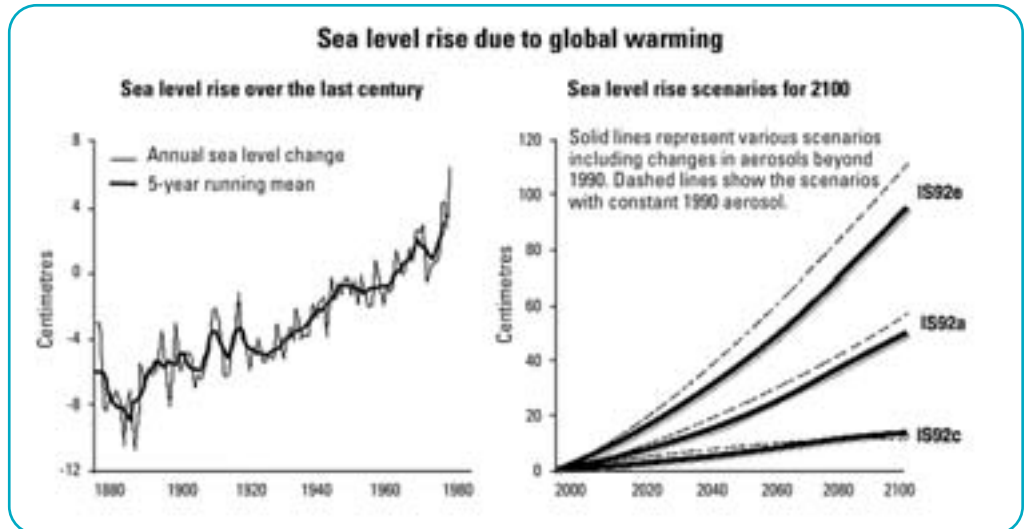
In high-snowfall areas, glaciers will continue to advance. The effect of the warmer summer temperatures will be balanced by the increase in snowfall. Glaciers at lower elevations may begin to retreat or to retreat at a greater rate. Changes in Yukon glaciers affect land stability and the flow of water in streams. Changes in stream flow could impact aquatic habitats and hydroelectricity production.

People noticed more cut banks from ice in the springtime, after the water starts getting low.

Aklavik resident

cited from Arctic Borderlands Ecological Knowledge Co-operative's 2002 *Community Monitoring Report*.

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www.taiga.net/coop



Graph Source: United Nations Environment Programme and GRID-Arendal. Available at Vital Climate Graphics www.climateark.org

Sea level rise

Over the last 100 years, the global sea level has risen by about 10 – 25 cm. The IPCC has projected sea levels to rise by up to 88 cm by 2100, based on a global mean temperature change of 1.4°C – 5.8°C. Along the Yukon's coast the sea is already rising at an abnormally high rate. Depending on the effect of the warming climate on major ice sheets in Greenland and Antarctica, the Yukon's sea level could rise more.

Coastal zones

The entire Yukon coast may be subject to increased erosion and coastal flooding from the predicted increased frequency and magnitude of summer storms, and from the rising Beaufort Sea interacting with melting ice-rich permafrost. These changes would have impacts on birds, fish, and marine mammals.

Permafrost

Perennially frozen ground, or permafrost, can be found in a significant portion of the North. In the southern Yukon and NWT, permafrost is discontinuous and is only present beneath about 10% of the land. The proportion of permanently frozen land increases with increasing latitude and decreasing mean annual temperatures. Areas where the permafrost is only a few degrees below 0°C are considered to be particularly vulnerable to climate change. Already, permafrost areas have been reduced, and a general warming of ground temperatures has been observed in many areas. If the climate warms as projected, seasonal thaw will increase and permafrost will become thinner or disappear altogether in some areas.



Yukon
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The permafrost has been melting at a fast rate in the last five years. We see this when we travel along the rivers – the Crow, Bell, Porcupine, Eagle, and Whitestone. There are a lot of landslides and erosion of the riverbanks and new channels in the rivers.

Old Crow resident

cited from Arctic Borderlands Ecological Knowledge Co-operative's 2002 Community Monitoring Report.

Land stability

In northern permafrost areas, the further decay of permafrost as a result of continued warming trends is likely to increase the occurrence of thaw-flow slides and other types of landslides. Locally, forest fires could amplify this effect.

Water resources

The hydrology of the North is particularly susceptible to warming because small rises in temperature will result in increased melting of snow and ice. The runoff regime is expected to be driven increasingly by rainfall, with less seasonal variation in runoff. There will be more ponding of water in some areas, but peatlands may dry out because of increased evaporation and plant transpiration. In some areas, thawing of permafrost may affect infiltration. Climate

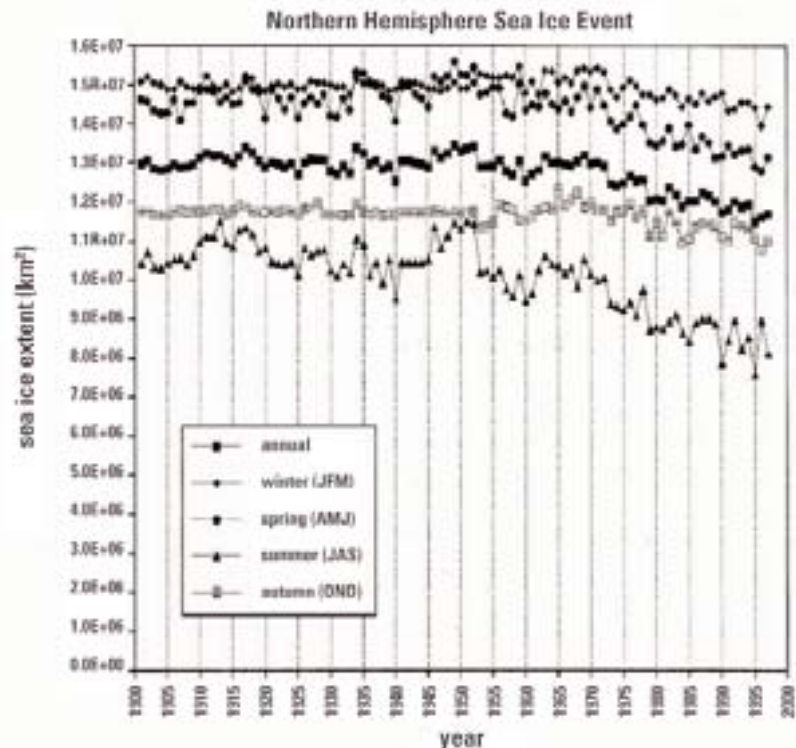
change may affect hydropower generation in the Yukon. While the net effect is uncertain, increases in the amount of water runoff may boost hydropower capacity, while possible heavy storms and sediment loading may reduce its potential. Spring flood damage could be more severe and frequent along rivers and streams.

Sea ice

Arctic sea-ice extent has decreased by 2.9% per decade over the 1978 – 1996 period. Sea ice has thinned, and there are

now more melt days in the summer. Climate change models are projecting major changes in northern sea ice, including a possible reduction in summer ice extent by 60%, for a doubling of carbon dioxide and possibly a complete disappearance of summer ice by 2100. Early ice breakup or complete loss of ice would have a profound effect on northern lifestyles. Already, communities along the Arctic coast are experiencing problems because of lower winter ice levels. Open water in early winter is causing stormy waters to accelerate the erosion of Tuktoyaktuk's coastline.

Graph Source: Environment Canada



Additional reading

Cohen, S (ed). 1997. *The Mackenzie Basin Impact Study*. Environment Canada. Available at <http://yukon.taiga.net/knowledge/resources.html>

Intergovernmental Panel on Climate Change. *Climate Change 2001: Impacts, Adaptation and Vulnerability*. Available at <http://www.ipcc.ch/>

Maxwell, Barrie. 1997. "Responding to global climate change in Canada's Arctic," vol. II of the *Canada Country Study: Climate Impacts and Adaptations*. Environment Canada.

McCoy, V. and C. Burn. 2001. *Climate Change in the Central Yukon*. Carleton University. Available at <http://yukon.taiga.net/knowledge/resources.html>

Taylor E. and B. Taylor. 1997. *Responding to Global Climate Change in British Columbia and Yukon*. Environment Canada.

Research

Research is underway in northern Canada to help understand the impacts of climate change on northern landscapes. The northern office of the Canadian Climate Impacts and Adaptation Research Network tracks projects that are currently underway (<http://www.taiga.net/c-ciarn-north/>). The Northern Climate Change Infosources Database (<http://yukon.taiga.net/infosources/>) contains a listing of available reports and publications.