Relevant Websites:
Geological Survey of Canada:
http://sts.gsc.nrcan.gc.ca/clf/home.asp
Climate change Website:
http://www.nrcan.gc.ca/gcc/english/html/index.html
Natural Resources Canada website:
http://www.nrcan-rncan.gc.ca/home/p2int_e.htm
Permafrost Website:
http://sts.gsc.nrcan.gc.ca/permafrost/

For further information, contact:
Réjean Couture or Margo M. Burgess
Geological Survey of Canada
Terrain Sciences Division
601 Booth Street
Ottawa, Ontario
K1A 0E8
Canada
Telephone: (613) 943-5237 (Couture)
(613) 996-9317 (Burgess)
Fax: (613) 992-0190
E-mail rcouture@NRCan.gc.ca; mburgess@NRCan.gc.ca

References and further reading:

Chartrand, J,. Lysyshyn, K,. Couture, R., Robinson, S.D., Burgess, M.M., (in press). Digital Geotechnical Borehole Databases and Viewers for Norman Wells and Tuktoyaktuk, Northwest Territories. Geological Survey of Canada Open File Report D3912, 1 CD ROM.

Cohen, S. J. (editor) 1997: Mackenzie Basin Impact Study (MBIS)-Final Report, Environment Canada, 1997, 372 p.

Couture, R., Robinson, S.D., Burgess, M.M. (2000). Climate change, permafrost degradation, and infrastructure adaptation : preliminary results from a pilot community case study in the Mackenzie valley. Current Research, 2000-B2, 9 pages
(available at http://www.nrcan.gc.ca/gsc/bookstore).

Couture R., Robinson S.D., and Burgess M.M. (in press). Climate change, permafrost, and community infrastructure: a compilation of background material from a pilot study of Tuktoyaktuk, Northwest Territories; Open File Report D3867, 1 CD-ROM.

Dyke, L.D. and Brooks, G.R. (editors) 2000: The Physical Environment of the Mackenzie Valley: A baseline for the Assessment of Environmental Change, Geological Survey of Canada Bulletin 547, 208 p.

Environment Canada, 1995. The state of Canada's climate: monitoring variability and change. Environment Canada's State of the Environment Report, NO. 95-1.

Etkin, D. 1998: Climate change impacts on permafrost engineering design. Environmental Adaptation Research Group report, Environment Canada, Toronto, 42 p.

Maxwell, B. 1997: Responding to Global Climate Change in Canada's Arctic, Volume II of the Canada Country Study: Climate Impacts and Adaptation, Environment Canada, 82 p.

Robinson S.D., Couture R., Burgess M.M. (2001). Climate change, permafrost, and community infrastructure: a compilation of background material from a pilot study of Norman Wells, Northwest Territories; Open File Report D3913, 1 CD-ROM.

Natural Resources Canada | Ressources naturelles Canada

Climate Change Impacts on Permafrost and Community Infrastructure in the Mackenzie Valley

Canada

Climate Change in the North

The Mackenzie Valley area has undergone greater warming (1.7°C) over the last century than any other region in Canada (Environment Canada, 1995). Average annual air temperatures in 1998 were 3 to 5°C above normal, the warmest year on record for the region (see Figure 1). Sophisticated computer models project that climate warming in the Mackenzie Valley will result in increases in mean annual air temperature of up to 5°C by the year 2050 (see Figure 2). The projected changes are expected to be greatest in the winter and spring, and warming is expected to be amplified in northern regions.

Figure 1. Temperature departures from normal in 1998.

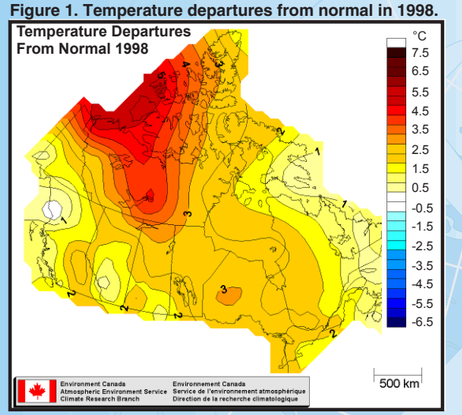
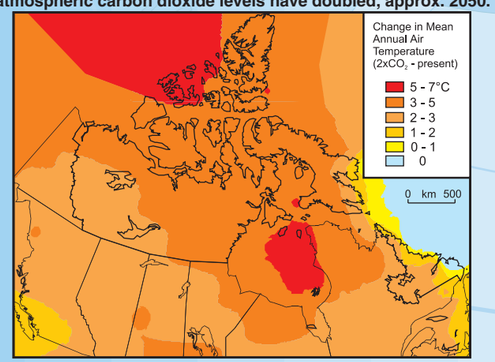


Figure 2. Changes in mean annual air temperature by the time atmospheric carbon dioxide levels have doubled, approx. 2050.



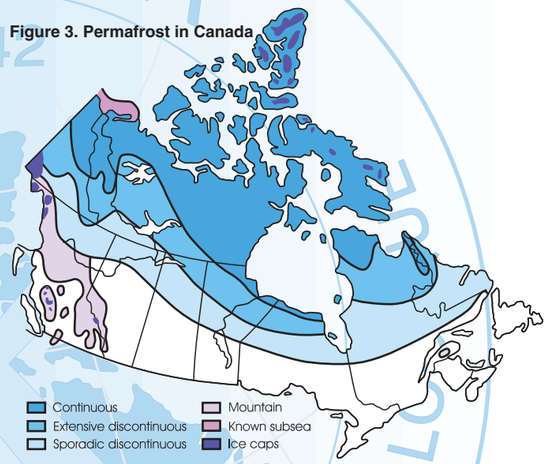
Data from Canadian Centre for Climate Modelling and Analysis, Environment Canada.

Did you know?
Climate warming would extend the shipping season in the Arctic, while rising sea levels and an increase in storminess in the Beaufort Sea areas may endanger coastal infrastructure.

Permafrost and Infrastructure

Permafrost covers approximately 50% of Canada and permafrost is common in the Mackenzie Valley (see Figure 3). In the southern Mackenzie Valley, the distribution of permafrost is sporadic and its thickness is not more than few metres. Towards the north, its occurrence and thickness gradually increase. Ice-rich, thaw-sensitive surface deposits cover large proportions of the Mackenzie Valley, and thus this region is very sensitive to ground warming due to climate change.

Figure 3. Permafrost in Canada



Permafrost presently provides a relatively stable base for many foundations in northern communities. Warming of the ground could affect this stability and performance of existing structures. Changes in ground temperatures associated with climate warming will likely reduce the extent of permafrost, increase the depth of the seasonally thawed layer (active layer) and cause the melting of ground ice. Direct infrastructure-related consequences of permafrost degradation could include the loss of bearing capacity of certain soils and foundation systems, an increase in soil creep, an increase in thaw depth and settlement, and changes in ground permeability.

Based upon climate change scenarios, it is anticipated that geotechnical problems will become more frequent, causing significant and costly problems or increased maintenance for northern communities and infrastructure.

View Next Page

Did you know?
Climate warming is expected to be most pronounced in the winter months. This will likely affect the construction and operation of winter and ice roads, and result in a shorter safe operating season.