

## Freshwater Resources of the Eastern Canadian Arctic

## Summary

# Project Leader

Vincent, Warwick

Freshwater lakes and wetlands are abundant in the circumpolar Arctic, and still more freshwater is present in the form of glaciers and ice shelves. These freshwater environments provide many essential services including habitats for aquatic wildlife, drinking water for northern residents, and hydroelectricity. Inuit communities and northern scientists have increasingly observed that these resources are highly vulnerable to ongoing climate change. This project extends our observations on lakes and wetlands at key sites in the eastern Canadian Arctic, to identify and measure aquatic indicators of environmental change in the past and present. These studies are allowing us to make assessments of future changes in northern freshwater ecosystems to help guide the formulation of environmental management and monitoring policies. We are continuing our research on lakes, ice shelves and contaminants along the northern Ellesmere Island coastline based out of Ward Hunt Island Observatory, where we work with Parks Canada to develop facilities, indicators and protocols for long term monitoring. This coastline lies at latitude 83°N, at the northern limit of Nunavut and thus North America, and it is characterized by many climate-sensitive aquatic ecosystems that are highly dependent on ice. Discharge from glaciers also contributes to iceberg flux, which is important for shipping. We are extending our research to wetlands by assessing the snow storage and melt patterns in Polar Bear Pass on Bathurst Island (75°N). This Wildlife Sanctuary is composed of a mosaic of lakes and ponds, and seasonal snowmelt is considered the most important source of water to this wetland. The resultant models and understanding should be of broad application to arctic wetland wildlife habitats that have begun to respond strongly to climate change. Permafrost thaw lakes are a prominent component of northern wetland ecosystems, and we are working at several sites including Bylot Island (73°N) and Kuujjuarapik (55°N), to determine the environmental factors that control their ecosystem metabolism and net production of greenhouse gases in the present and future. This ArcticNet research is in collaboration with the Discovery Frontiers program ADAPT (Arctic Development and Adaptation to Permafrost in Transition), which involves 15 laboratories across Canada. We are analyzing sediment cores from northern waters in the Foxe Basin region (65-70°N), as well as on both sides of Hudson Bay, to assess the natural climate variability in arctic and subarctic Canada, and to identify regional variations in climate sensitivity. Additionally, we are documenting past climate changes in the eastern Canadian subarctic by way of an extensive network of tree-ring analysis sites. Finally we are developing and applying new DNA-based techniques to assess the diversity and function of microscopic life in lakes and wetlands and to develop state-of-the-art molecular indicators of climate responses by northern aquatic ecosystems. We are contributing our findings and expertise on Canadian arctic water resources to the ArcticNet IRISs, Canadian and panArctic climate impact assessments (for example, the SWIPA report), government agencies such as Transport Canada and the Canadian Wildlife Services, and circumpolar initiatives such as the 'Arctic Freshwater Synthesis' under the auspices of the International Arctic Science Committee (IASC). Furthermore, we will document past climate change in the eastern Canadian Subarctic by means of a vast network of millennial dendroclimatic series.

## People

## Network Investigators

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## Project Staff

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## Partners

Aboriginal Affairs and Northern Development Canada - Northern Scientific Training Program  
Aquatic Paleolimnology Lab - CEN  
ArcticNet Aircraft Support Fund  
Campbell Scientific  
Centre d'études nordiques  
Environment Canada - Canadian Ice Service  
FRQNT - Centre d'études nordiques  
Garfield Weston Foundation  
Hydro-Québec  
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Natural Resources Canada - Geological Survey of Canada  
Natural Resources Canada - Polar Continental Shelf Project  
Northern Scientific Training Program  
Parks Canada

Parks Canada - Nunavut Field Unit  
Polar Continental Shelf Program  
Québec-Océan  
Transport Canada

## Publications

## **Articles Published in Refereed Publications**

- Abnizova, A., Miller, E., Young, K.L. and Shakil, S., 2012, Seasonal Variability in Hydrological and Physico-chemical Characteristics of Small Water Bodies Across Polar Bear Pass, a High Arctic Wetland, Bathurst Island, Nunavut, Canada., Arctic, Antarctica and Alpine Research, , Submitted

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Gennaretti, F., Arseneault, D. and Bégin, Y., 2014, Millennial disturbance-driven forest stand dynamics in the Eastern Canadian taiga reconstructed from subfossil logs, *Journal of ecology*, DOI: 10.1111/1365-2745.12315, Published

Gennaretti, F., Arseneault, D., and Bégin, Y., 2014, Millennial stocks and fluxes of large woody debris in lakes of the North American taiga, *Journal of Ecology*, v. 102, no. 2, 367-380, Published

Gennaretti, F., Arseneault, D., Nicault, A., Perreault, L. and Bégin, Y., 2013, Volcano-induced regime shifts in millennial tree ring chronologies from Northeastern North America, *Proceedings of the US National Academy of Science*, , Submitted

Gennaretti, F., Arseneault, D., Nicault, A., Perreault, L. and Bégin, Y., 2014, Volcano-induced regime shifts in millennial tree ring chronologies from Northeastern North America, *Proceedings of the National Academy of Sciences*, v. 111, no. 28, 10077-10082, Published

Guio, J., Boucher, É. and Gea-Izquierdo, G., 2014, Data-model fusion in dendroecology, *Frontiers in Ecology and Evolution*, v. 2, 1-11, Published

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Harding, T., Jungblut, A.D., Lovejoy, C., and Vincent, W.F., 2011, Microbes in High Arctic Snow and Implications for the Cold Biosphere, *Applied and Environmental Microbiology*, v.77, 3234-3243, Published

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Helama, S., Bégin, Y., Vartiainen, M., Peltola, H., Kolström, T. and Meriläinen, J., 2013, Quantifications of dendrochronological information from contrasting microdensitometric measuring circumstances of experimental wood samples.. Applied Radiation and Isotopes.. Accepted

Herdes, E., Copland, L., Danielson, B. and Sharp, M., 2011, Relationships between iceberg plumes and sea-ice conditions on northeast Devon Ice Cap, Nunavut, *Annals of Glaciology*, v. 53, no. 60, Accepted.

Herdes, E., Copland, L., Danielson, B. and Sharp, M., 2012, Relationships between iceberg plumes and sea-ice conditions on northeast Devon Ice Cap, Nunavut, Canada, *Annals of Glaciology*, v. 53, no. 60, 1-9. Published online in 2012.

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