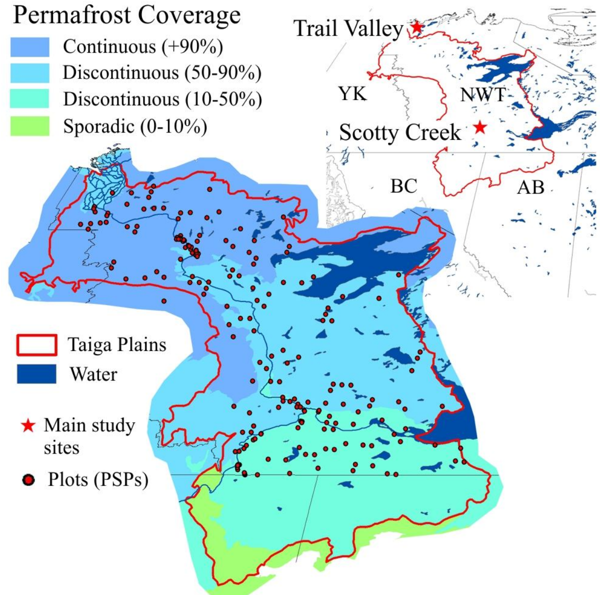
Three graduate positions in hydrology available with the Taiga Plains Research Network

There are three graduate positions available through Wilfrid Laurier University and the Taiga Plains Research Network (www.taigaplains.ca) as part of an ongoing partnership with the Government of the Northwest Territories (http://www.wlu.ca/research/LaurierNWT). We are rapidly expanding our integrated research programme to better understand permafrost ecosystem responses to warming and human disturbance. Our research focusses on the Taiga Plains Ecoregion, which spans the length of the MacKenzie River Valley in the Northwest Territories, Canada. This ecoregion covers a wide latitudinal range encompassing the spectrum of permafrost ecosystem characteristics (see map), including boreal, taiga and tundra systems.



Field Location: Scotty Creek, Northwest Territories

Region-wide warming throughout the Taiga Plains has brought about an unprecedented expansion of permafrost-free terrain over the last several decades along the southern permafrost boundary where ice-rich permafrost in the form of tree-covered peat plateaus occurs as islands within a wetland-dominated terrain. There are strong indications that permafrost thaw and disappearance are changing the region’s hydrology. For example, runoff from rivers and streams throughout the Taiga Plains has increased in recent decades. However, the present ability to account for rising stream flows and capacity to predict flow variations is severely restricted by a limited understanding of the water flow and storage processes at the headwaters, and possible feedback processes during permafrost thaw that may influence them.

The following graduate student projects will contribute to improving the understanding needed for the development of improved predictive methods and mitigation strategies.

1) Vegetation canopy controls on ground thaw

Field observations indicate that disturbances to vegetation canopies from wind, fire, herbivory, disease, and direct human disturbance of the ground surface, can set into motion a sequence of ecosystem feedbacks that can accelerate permafrost thaw and substantially alter local and basin-scale hydrology. Measurements will be made below forests of differing canopy and root network density, insolation, and degrees of disturbance to quantify the relative contributions of long-wave, short-wave, sensible and latent heat contributions to ground thaw.

2) Hydrological interaction among peatland types

Although bogs and channel fens dominate much of the southern margin of permafrost, their hydrological interactions remain poorly understood, and as a result the capacity to predict river flows in this region is limited. Water level records indicate that the expansive areas of bog adjacent to the basin drainage network of channel fens and open channels indicates that such bogs abstract water during high flow periods but contribute runoff during low flows. Smaller bogs (i.e. collapse scars) within permafrost plateaus are often thought to be hydrologically-isolated, however many such bogs drain to channel fens through ephemeral channels, either directly or via downstream bogs. This study will improve the understanding of the mechanisms, rates and patterns of hydrological interaction between bogs and the basin drainage network, and their effect on basin hydrology.

3) Impact of seismic lines on basin runoff generation

Climate-induced permafrost thaw is compounded by that resulting from rapid industrial expansion in the north, particularly in the oil and gas sector. In the past decade, the density of seismic exploration lines have steadily increased, and new gas pipelines, electrical transmission lines and all-weather highways are being planned. These linear disturbances involve removing the tree canopy and much of the underling vegetation, often resulting in substantial changes to the ground thermal regime, and typically resulting in permafrost thaw. At Scotty Creek, the density of seismic lines is more than six-times that of the natural drainage density. This study will examine the impact of seismic lines on the underlying permafrost and on local and basin hydrology.

Funding for the above projects includes a stipend for each graduate student and funds for their field assistants, travel expenses, and field supplies. Ideal candidates should have strong writing and organisational skills.

Students will enroll in the graduate programme of the Department of Geography & Environmental Studies, Wilfrid Laurier University in Waterloo, Ontario in W. Quinton's research group (http://www.wlu.ca/faculty/wquinton). Ideally students will commence their programme on or before September, 2013. Interested students should contact W. Quinton directly (wquinton@wlu.ca).

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