Theme 2: Monitoring permafrost change

Theme 2 Co-leads
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Antoni Lewkowicz, University of Ottawa

Objective: Use monitoring to reveal and quantify permafrost change in Canada and understand its varying rates and expressions at the land surface.

Drained Lakes Infrastructure Seismic

Photo: Trevor Bennett

Presentation today

- Introducing the theme
- 2 HQP presentations illustrating the range of monitoring methodologies
  - Usman Iqbal Ahmed
  - Emma Street
- Wrap-up
- Break-out groups

Theme 2: Monitoring permafrost change

Sub-theme objectives

1. To measure or infer permafrost change using geophysical methods, remote sensing and traditional and local knowledge so that spatial patterns and temporal trends can be discerned.
2. To synthesise and reconcile results from differing modes of permafrost monitoring so that they can support local decision making as well as coherent national synthesis

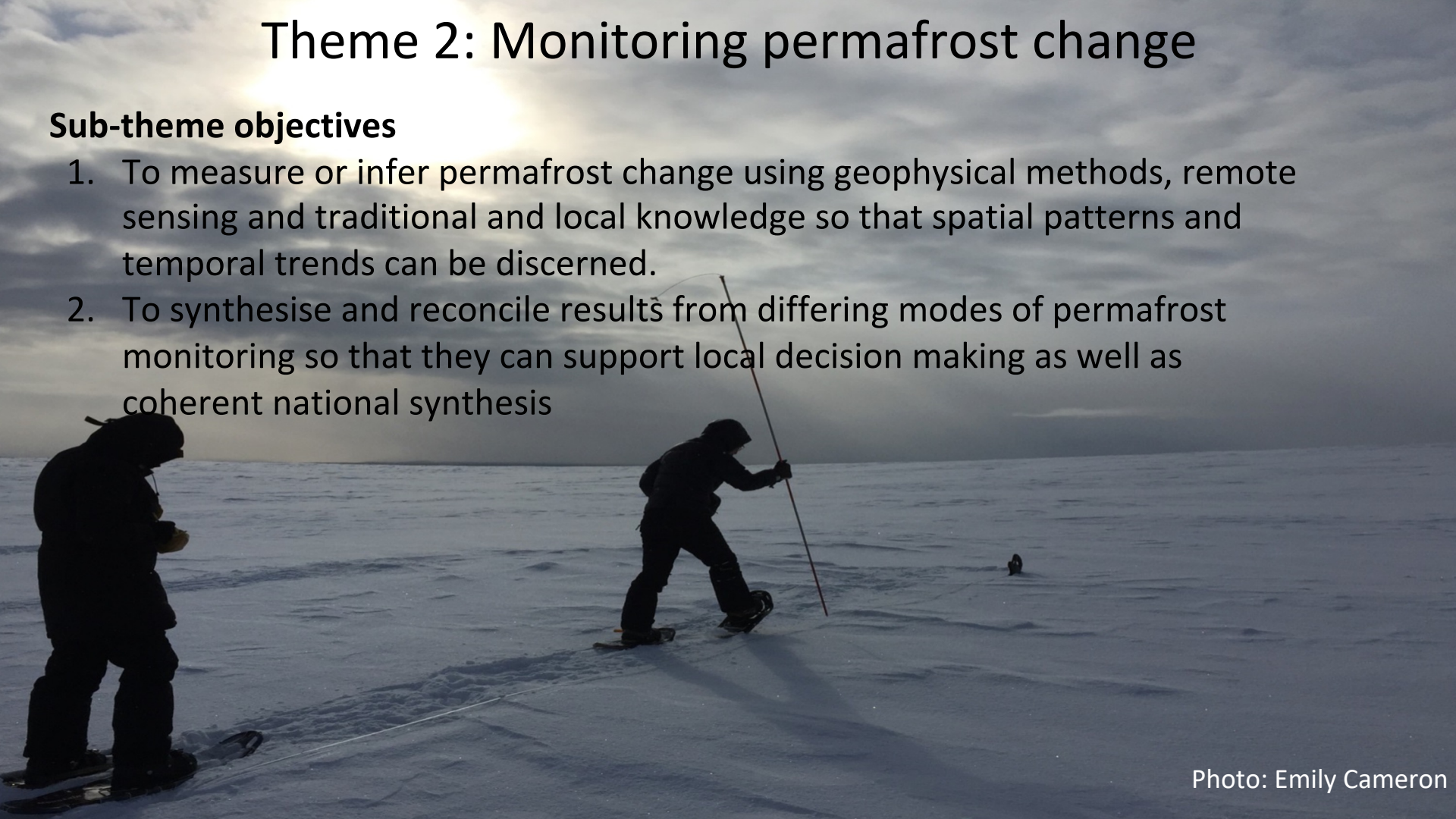


Photo: Emily Cameron

Theme 2. Ongoing Projects

Emma Street. Traditional Knowledge of permafrost in the Gwich'in and Inuvialuit Settlement Regions (PhD2).

Allison Plourde. Measuring surface displacement using winter SAR (MSc1).

Usman Iqbal. Airborne InSAR to monitor permafrost thaw near linear infrastructure (PhD4).

Fereshteh Ghiami. Detecting temporal trends ground temperature data (PhD5).

Pete Castillo. Towards a permafrost observation platform (MSc2).

Lingcao Huang. Thermokarst inventories using remote sensing (PDF).



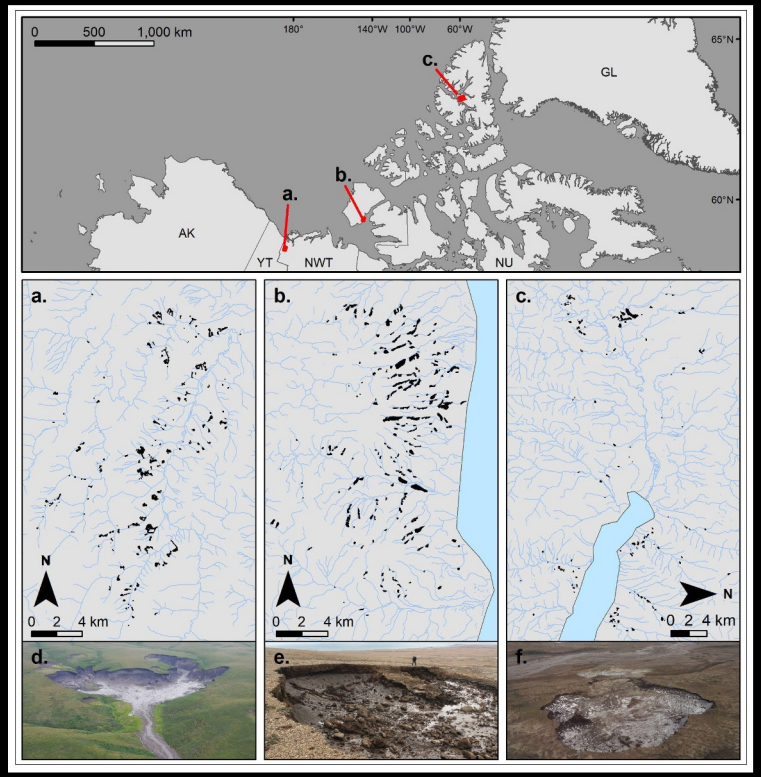







Challenges and Ways Forward

PhD3: Optical Remote Sensing to Monitor Change

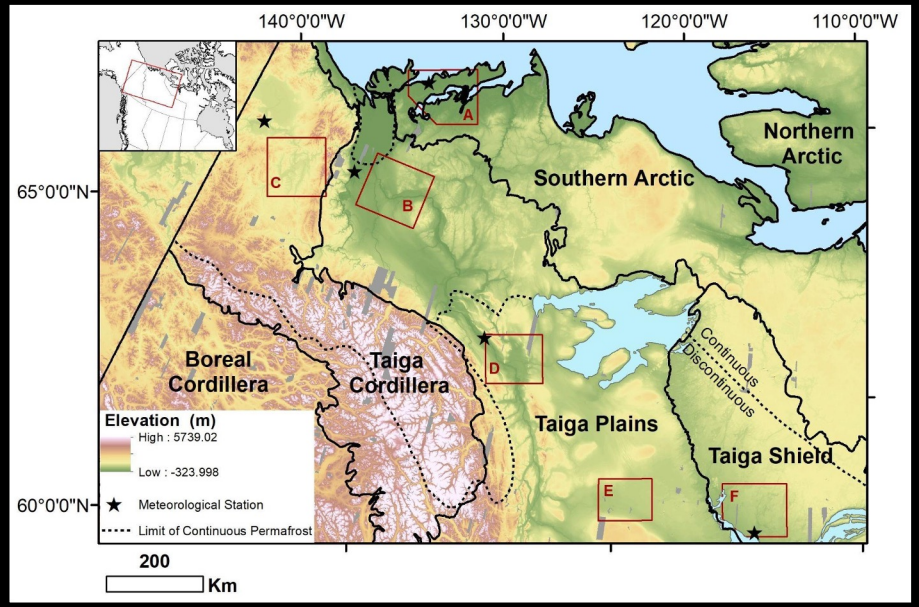


Huang, L., Lantz, T.C. Fraser, R.H., Tiampo, K.F., Willis, M.J. and Schaefer, K. (2022). Accuracy, Efficiency, and Transferability of a Deep Learning Model for Mapping Retrogressive Thaw Slumps across the Canadian Arctic. Remote Sensing 14: 2747.

Lingcao Huang (UC Boulder) completed a project to extend his work using Convolutional Neural Networks (CNN) to map slumps in Tibet to the three region of the Canadian Arctic.

CNNs perform well in areas with training data, but poor transferability limits the potential to scale-up.

PhD3: Optical Remote Sensing to Monitor Change



Hana Travers-Smith (UVic) developed an earth engine workflow to track interannual change in lake area using the Landsat Archive.

Most region are experiencing gains in surface water.

Fire and ground-ice content are important determinants of the direction of change.

Travers-Smith, H*., Lantz, T.C, and Fraser, R.H. Surface Water Dynamics and Rapid Lake Drainage in the Western Canadian Subarctic. (2021). Journal of Geophysical Research. 126, e2021JG006445.

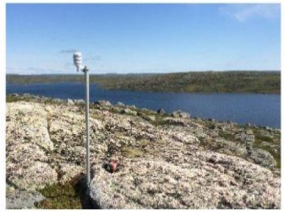
Travers-Smith, H., Lantz, T.C, Kokelj, S.V., and Fraser, R.H. (2022). Changes in surface water dynamics across Northwestern Canada are influenced by wildfire and permafrost thaw. Environmental Research Letters. 17 114021

PhD1: Using Repeat ERT to Monitor Change

- Many of the objectives associated with T2-PhD1 are being met despite not filling the position.
- Repeat ERT is being undertaken by A. Lewkowicz. The PermafrostNet flex-fund permitted participation in fieldwork by Teddi Herring(T1-PDF2) and partners at YGS and Yukon University were also involved.
- Other ERT surveys are being undertaken as part of ground ice work in Theme 1.
- Teddi Herring is incorporating repeat ERT surveys into the CPERS database.

We are still searching for a Postdoc to lead synthesis activities

Postdoctoral Research Opportunity with NSERC PermafrostNet




NSERC PermafrostNet (permafrostnet.ca), the Permafrost Partnership Network for Canada, is seeking a postdoctoral researcher to develop a framework for permafrost terrain types that will support the analysis and prediction of permafrost change at multiple scales. The utility of a permafrost terrain type approach will be demonstrated in Canadian permafrost landscapes using a variety of existing data sources (surficial geology, soils, topography, vegetation cover, ground ice, climate, and surface water). The successful applicant will also be encouraged to develop collaborative projects across the network.

We welcome applications from researchers from a range of disciplines including, but not limited to: permafrost science, landscape ecology, geomatics, physical geography, and geology. Preference will be given to candidates with exceptional written and oral communication skills, and a combination of the proficiencies listed below.

- Statistical analysis
- Terrain classification, mapping, and GIS
- Remote sensing
- Observation and/or simulation of permafrost environments and processes

Breakout Group question:

What is changing or needs to change in relation to our permafrost monitoring methods and does this differ by knowledge user group?

1. Field-based approaches
2. Remote sensing tools
3. Community-led monitoring