

NPC 151157: Responses of Permafrost Microbial Communities to Climate-Driven Thaw

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Proposal Status: Conformity Determination Issued

[Overview Documents](#)

[Project Overview](#)

Type of application: Amendment

Proponent name:

Eric Bottos

Proponent company:

Thompson Rivers University

Project Description:

In our warming climate, the rate of permafrost thaw (ground that remains frozen for at least two consecutive years) is accelerating in the Canadian Arctic. Permafrost stores vast amounts of carbon, which, upon thaw, is released as carbon dioxide and methane into the atmosphere, significantly contributing to rising global temperatures. The microbial communities (groups of microorganisms living together in an environment) within permafrost play a central role in this process, becoming more active as the ground thaws and accelerating the release of carbon. Interestingly, permafrost microbial communities are not all uniform. They can vary across Arctic landscapes, as shaped by local environmental conditions and the characteristics of the overlying soil layers. As permafrost thaws, it mixes with the microorganisms and nutrients from this overlying soil, which can dramatically alter microbial community composition and, in turn, influence how much carbon is released. Despite their importance, the composition of permafrost microbial communities and its overlying soils across Arctic landscapes, as well as how these layers interact during thaw, remain largely understudied. The goal of this research is to study these factors, which could help us better predict the effects of permafrost thaw on future carbon emissions and global climate, as well as help support climate resilience planning and advocacy for northern communities. This August, Gwen Freeze, a member of Dr. Eric Bottos' lab at Thompson Rivers University, will join Adventure Canada on their Baffin Island and Greenland and Into the Northwest Passage trips, travelling by ship throughout northern Nunavut. In coordination with scheduled passenger landings, Gwen will go ashore to collect permafrost cores and overlying soil samples representing a range of Arctic environments. The proposed research will specifically investigate the following questions:

1) How do permafrost microbial communities and overlying soil characteristics vary across different Arctic landscapes? and 2) How do interactions between permafrost and its overlying soil influence microbial community responses to warming? At the proposed sampling sites (see attached map), soil and permafrost samples will be collected within 3 × 3 meter plots. A small quantity of overlying soil will be collected at 10 cm below the soil surface using a spade and shovel, while 30 cm permafrost cores will be collected using a portable gas-powered auger. Samples will be stored at -20 °C onboard until transported to Thompson Rivers University in Kamloops, BC, with Gwen Freeze. DNA sequencing technologies will be used to characterize microbial community compositions, and simulated thaw experiments will be carried out in lab to assess how overlying soils influence permafrost microbial communities during warming events. Environmental, wildlife, and community impacts will be kept to a minimum. Sensitive vegetation and wildlife habitats will be avoided during sampling. Any soil and vegetation disturbance will be carefully restored to its original condition, with soil layers kept separate during excavation and replaced in the correct order post-sampling. Prior to sampling, consultations with local communities will be conducted to ensure the procedures align with and respect community knowledge and priorities, including input on appropriate sampling site selection. Research plans will remain flexible and be adjusted as needed in response to community feedback and contextual considerations. While ashore, the research will not require transportation, infrastructure, or water use, nor will it create waste. All data generated will be securely stored and managed on institutional servers at Thompson Rivers University. Relevant datasets will be made publicly available, and findings published in open-access and peer-reviewed journals. Prior to fieldwork, and in collaboration with Adventure Canada, Nunavut residents in proposed sampling locations will be consulted about the research plans and invited to participate in sampling activities, for which they will be compensated. Within one year of sample collection, results are to be shared with participating communities, territorial organizations, and the Nunavut Research Institute, both as plain-language summaries and a technical report. Throughout the project, we are dedicated to ongoing collaboration with communities and organizations, and for their input to guide how data and findings are best managed and shared. Our goal is to ensure the most accessible and inclusive approach for all Nunavut residents, and we hope this research can benefit northern communities by informing future climate knowledge.

[Project Schedule](#)

Start Date:

2026-08-26

End Date:

2026-09-27

[Project Map](#)

List of project geometries:

Id

Geometry

Location Name

[21402](#)

point

Dundas Harbour

[21403](#)

point

Powell Inlet

[21404](#)

point

Port Leopold

[21405](#)

point

Beechey Island

[21406](#)

point

Prescott Island

[21407](#)

point

Pasley Bay

[21408](#)

point

Port Epworth

[21450](#)

point

Grise Fiord Inlet

[21451](#)

point

Coutts Inlet

[21452](#)

point

Maxwell Bay

[21453](#)

point

Aston Bay

[21454](#)

point

Strzelecki Harbour

[21455](#)

point

Fort Ross

[21456](#)

point

Wrottesley Inlet

[21457](#)

point

Jenny Lind Island

NPC Planning regions:

No Approved Plan

North Baffin

[Project Land Use and Authorizations](#)

Project Land Use:

Scientific Research

Licensing Agencies:

Nunavut Impact Review Board

Nunavut Research Institute

Qikiqtani Inuit Association

Kitikmeot Inuit Association

[Material Use](#)

Equipment:

Type

Quantity

Type

Use

Shovel

1

25 x 150 cm

The shovel will be used for digging to collect soil (overlying the permafrost).

Forceps

2

2 x 12 cm

Forceps will be used to collect small bryophyte samples from sampling sites.

Trowel

1

10 x 35 cm

The trowel will be used for digging to collect soil (overlying the permafrost).

Electric-powered drill (Hilti DD 150-U-22)

1

10 x 37 cm core bit size

The drill will be used to drill permafrost cores where site conditions and circumstances allow. The SPX-A speed core bit has a diameter of 10 cm and length of 37 cm. The drill's overall dimensions will be larger to accommodate the motor and frame. Permafrost depth is expected to range from 1 to 2 meters below the surface. Where necessary, additional 31 cm bit extensions will be used to access deeper permafrost layers.

Fuel Use:

Type

Container

Capacity

Use

No data found

Hazardous Material and Chemical Use:

Type

Container

Capacity

Use

No data found

Water Consumption:

Daily Amount (m²)

Retrieval Method

Retrieval Location

Waste and Impacts

Environmental Impacts:

Environmental impacts will be kept to a minimum through careful planning and execution. Sensitive vegetation and wildlife habitats will be avoided during sampling, and any soil or vegetation disturbance will be carefully restored. Soil layers and plant material will be kept separate during excavation and returned to their original positions post-sampling to ensure proper restoration. Additionally, any equipment used will be cleaned between each sampling site to prevent the introduction of non-native species or microorganisms into new environments. We will also ensure traditional ecological knowledge and conservation priorities are respected. By adhering to these measures we aim to ensure minimal disruption to local ecosystems.

Waste Management:

Waste Type

Quantity Generated

Treatment Method

Disposal Method

No data found