



New

Scientific Research

Thursday, June 19, 2025

from 2025-08-05 to 2025-08-31

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ᐅᓄᓇᓂᓴ: Responses to Permafrost Microbial Communities to Climate-Driven Thaw. Researcher's Names and Affiliations: Dr. Eric Bottos, Thompson Rivers University; Gwendolyn Freeze, Thompson Rivers University and Adventure Canada. Project Locations: Monumental Island, Lady Franklin Island, Panniqtuuq, Hoare Bay, Cape Dyer, Dundas Harbour, Powell Inlet, Port Leopold, Beechey Island, Prescott Island, Pasley Bay, Port Epworth. Timeframe: August 5 – September 1, 2025. Research Proposal: In our warming climate, the rate of permafrost thaw (ground that remains frozen for at least two consecutive years) is increasing 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 alter its 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. This August, Gwen will join Adventure Canada on their Baffin Island and Greenland and Into the Northwest Passage trips, travelling by ship throughout northern Nunavut. Permafrost cores and overlying soil samples will be collected from multiple sites representing different Arctic environments. The proposed research will 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? Methodology: In 3x3 meter sampling 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. 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. We expect environmental, wildlife, and community impacts to be minimal. Wildlife habitats and sensitive vegetation will be avoided during sampling, while any disturbance to soil and vegetation will be carefully restored. Soil layers will be kept separate during excavation to ensure accurate filling and restoration post-sampling. Local communities will be consulted prior to sampling to ensure the procedures respect community knowledge and desires, including input on appropriate site selection. Research plans will remain flexible and be adjusted as needed in response to community member feedback and contextual considerations. Data, Reporting, and Community Involvement: All data generated will be securely stored and managed on institutional servers at Thompson Rivers University. Datasets will be made publicly available, and findings are to be published in open-access and peer-reviewed journals. Prior to fieldwork, and in collaboration with Adventure Canada, Nunavut residents in proposed community 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.

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Operations Phase: from 2025-08-05 to 2025-08-31

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Monumental Island	Researching	Crown	Wilderness site. To the extent of our knowledge, there is no history of research within our proposed sampling area.	None to the extent of our knowledge, recognizing that people have likely crossed and utilized these lands prior to our visit. In the event that sites exist, they will remain undisturbed.	Approximately 250 km east of Iqaluit.
Lady Franklin Island	Researching	Crown	Wilderness site. To the extent of our knowledge, there is no history of research within our proposed sampling area.	None to the extent of our knowledge, recognizing that people have likely crossed and utilized these lands prior to our visit. In the event that sites exist, they will remain undisturbed.	Approximately 250 km east of Iqaluit.
Panniqtuuq	Researching	Municipal	Municipal site. To the extent of our knowledge, there is no history of research within our proposed sampling area.	There is archaeological history in this region (Cumberland Sound) with the long-standing presence of Inuit and their predecessors, such as the Thule culture. History at this site also includes the establishment of whaling in the area in the 1800's, as well as a Hudson Bay Company trading post in the 1900's. Sampling will not occur near or disturb any archaeological or paleontological sites.	The proposed sampling site has proximity to the community of Panniqtuuq (Pangnirtung), while Auyuittuq National Park is approximately 40 km away. However, the proposed sampling at this site is to take place in 3 x 3-meter sampling areas and there is flexibility in site selection as to not cause disruption to the community (as described in the Project Document section, where

					we have proposed a 50 km sampling radius around each listed coordinate).
Hoare Bay	Researching	Inuit Owned Surface Lands	Wilderness site. To the extent of our knowledge, there is no history of research within our proposed sampling area.	None to the extent of our knowledge, recognizing that people have likely crossed and utilized these lands prior to our visit. In the event that sites exist, they will remain undisturbed.	Approximately 150 km east of Panniqtuuq.
Powell Inlet	Researching	Crown	Wilderness site. To the extent of our knowledge, there is no history of research within our proposed sampling area.	None to the extent of our knowledge, recognizing that people have likely crossed and utilized these lands prior to our visit. In the event that sites exist, they will remain undisturbed.	Approximately 200 km south of Grise Fiord and 200 km north of Arctic Bay.
Beechey Island	Researching	Crown	Wilderness site and National Historic Site of Canada (1993). To the extent of our knowledge, there is no history of research within our proposed sampling area.	This broader site contains the graves of three of Sir John Franklin's expedition members during the Northwest passage expedition, as well as a fourth grave of a later search party member. It also contains the Northumberland House, which was a shelter used for later search parties, among other archeological aspects (cairns, building ruins). Sampling will not occur near or disturb any archaeological or paleontological sites.	Beechey Island is a National Historic Site of Canada, and is located approximately 80 km east of Resolute.
Prescott Island	Researching	Crown	Wilderness site. To the extent of our knowledge, there is no history of research within our proposed sampling area.	None to the extent of our knowledge, recognizing that people have likely crossed and utilized these lands prior to our visit. In the event that sites exist, they will remain undisturbed.	Approximately 200 km south of Resolute.
Pasley Bay	Researching	Inuit Owned	Wilderness site. To the extent of our knowledge,	None to the extent of our knowledge,	Approximately 150 km

		Surface Lands	there is no history of research within our proposed sampling area.	recognizing that people have likely crossed and utilized these lands prior to our visit. In the event that sites exist, they will remain undisturbed.	northwest of Taloyoak.
Port Epworth	Researching	Inuit Owned Surface Lands	Wilderness site. To the extent of our knowledge, there is no history of research within our proposed sampling area. In the event that sites exist, they will be undisturbed.	The archeological significance at this site includes the presence of Copper Inuit bands. Sampling will not occur near or disturb any archaeological or paleontological sites.	Approximately 130 km east of Kugluktuk.
Cape Dyer	Researching	Crown	Wilderness site. Although research has been conducted in Cape Dyer, no work has been conducted at our proposed sampling site that would lead to any cumulative effects, to the extent of our knowledge. If so, we will alter our sampling site to ensure this is not the result.	None to the extent of our knowledge, recognizing that people have likely crossed and utilized these lands prior to our visit. In the event that sites exist, they will be undisturbed.	Approximately 200 km northeast of Panniqtuuq. Akpait National Wildlife Area is situated approximately 20 km from our proposed sampling site. Sampling will not occur in this area, nor will it have any effect on this area.
Dundas Harbour	Researching	Crown	Wilderness site and abandoned settlement. To the extent of our knowledge, there is no history of research within our proposed sampling area.	Archeological history includes long-standing Inuit land use, as well as a Hudson Bay Company trading post, an RCMP detachment and a small graveyard. Sampling will not occur near or disturb any archaeological or paleontological sites.	Approximately 200 km south of Grise Fiord and 200 km north of Arctic Bay.
Port Leopold	Researching	Inuit Owned Surface Lands	Wilderness site and abandoned trading post. To the extent of our knowledge, there is no history of research within our proposed sampling area.	Archeological significance includes an abandoned Hudson Bay Company trading post. Sampling will not occur near or disturb any archaeological or paleontological sites.	Approximately 150 km southeast of Resolute. Prince Leopold Island is a Migratory Bird Sanctuary, located approximately 15 km north of Port Leopold.

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Project transportation types

Transportation Type	Access Method	Length of Use
Water	Travelling with Adventure Canada on their vessel and following their expedition itinerary. Land will be accessed from the vessel by small 10-passenger inflatable zodiacs as per the Adventure Canada staff.	
Land	Sampling sites will be accessed from landing sites by foot.	

Project accomodation types

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At each site, a small quantity of overlying soil and a small permafrost core will be collected from sampling areas no larger than 3 x 3 meters. While small-scale localized soil and vegetation disturbance may result from this work, dug plots will be narrow to minimize environmental impact, and all sensitive vegetation and wildlife habitats will be avoided during sampling. Any disturbance to the environment will be carefully restored. Soil layers and any vegetation will be kept separate during sampling using various tarps and carefully returned to their original positions post-sampling. All equipment will be cleaned between each site to prevent the introduction of non-native species or microorganisms into new sampling areas. Our sole community sampling location is in Panniqtuuq. If granted permission to sample here, site selection and sampling methods will be chosen as to not cause disruption, and we will work with community members to ensure local knowledge is respected.

Additional Information

SECTION A1: Project Info

SECTION A2: Allweather Road

SECTION A3: Winter Road

SECTION B1: Project Info

SECTION B2: Exploration Activity

SECTION B3: Geosciences

SECTION B4: Drilling

SECTION B5: Stripping

SECTION B6: Underground Activity

SECTION B7: Waste Rock

SECTION B8: Stockpiles

SECTION B9: Mine Development

SECTION B10: Geology

SECTION B11: Mine

SECTION B12: Mill

SECTION C1: Pits

SECTION D1: Facility

SECTION D2: Facility Construction

SECTION D3: Facility Operation

SECTION D4: Vessel Use

SECTION E1: Offshore Survey

SECTION E2: Nearshore Survey

SECTION E3: Vessel Use

SECTION F1: Site Cleanup

SECTION G1: Well Authorization

SECTION G2: Onland Exploration

SECTION G3: Offshore Exploration

SECTION G4: Rig

SECTION H1: Vessel Use

SECTION H2: Disposal At Sea

SECTION I1: Municipal Development

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The Project Activities section in this form best describes the proximity of each proposed terrestrial sampling site to protected areas and communities, as well as their linked cultural and historical significance. All proposed sampling sites, apart from the community of Panniqtuuq, are remote and uninhabited. Throughout the duration of sampling there will be no access to roads/trails, nor will the work occur in designated environmental areas, such as parks, in protected areas, heritage areas, cultural areas, sensitive environmental or geological areas (e.g., eskers or unique landscapes), or in disruption with wildlife species and their habitats (including breeding/spawning areas, migration routes, etc.). Sampling will also avoid recreational areas, community use areas, as well as those used for fishing and hunting. This work will not have any contact with water or aquatic ecosystems, and if lakes, streams, etc. are encountered, sampling will not proceed near these areas. Marine use will only apply to accessing land from the ship, for which Adventure Canada has permitting approval. Noise will be very minimal, as the auger is expected to run for no longer than one minute at each site, and will have no effect on air quality. Climate impacts resulting directly from this research will also be very minimal, while this work will generate data to aid in future climate modelling in each area. The topography at each site will vary. Adventure Canada has not yet accessed all these sites, and therefore the exact topography at each location cannot be accurately described at this time. However, sampling is aimed to occur in plains and valleys, where the ground is flat and most conducive to soil and permafrost collection. There may be eskers, wetlands, or other unique landscapes present, although sampling will not occur within these landforms. Permafrost will be accessed, although the exact stability, depth, thickness, and continuity will likely vary across the proposed sites and is to be determined and recorded during field work (depth is expected to range from one to two meters). Exposure of permafrost may have small-scale climate impacts; however, careful restoration of each site will be carried out using the original overlying soils to protect permafrost layers. The active soil layer (above the permafrost) will also be accessed, where solid bedrock, large sediments, and unstable rock will be avoided. Soil quality is expected to reflect that of the Arctic tundra: nutrient-poor and varied in moisture content. It is not expected that there will be thermokarsts or ice lenses, but in the case that there are, these areas will be avoided and undisturbed during sampling, as well as documented. Concerning sampling in the community of Panniqtuuq, we have reached out to Anita Evic at the Hamlet of Pangnirtung regarding employment opportunities for community members on the day of sampling, as well as to work with community members to identify aspects of the physical environment locally and choose the most appropriate sampling site that avoids any environmental and cultural areas of note. Overall, within these proposed locations, there is flexibility in choosing a suitable and appropriate sampling site. All sensitive areas will be cautiously avoided during site selection (i.e., trails, areas of biological interest, natural features such as streams, etc.) and we are looking to take our sample from an area that is representative of the physical environment, and to not disrupt any part of the environment that is unique or fragile. No structures are to be erected in the area, and there will be no use of water or creation of waste. Transportation while on land will be by foot. Sampling conducted by Gwen will take no longer than 2 hours at each site.

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Miscellaneous Project Information

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Impacts are identified in the Impacts tab on this application, and includes both permafrost and vegetation, both as mitigable. Permafrost and vegetation will be disturbed at a very small scale, and these effects will be mitigated through limiting sampling area and resource collection, as well as through careful restoration of each sampling site. Any sensitive vegetation will also be avoided during sampling. The Impacts tab further details our proposed mitigation strategies for any negative effects. There will be no transboundary effects as this research is localized and will not cause greater harm, and there will be no adverse effects to species under the Species at Risk Act and their habitats, as these species and their habitats will be avoided during sampling. There is flexibility in sample site selection, which further allows the avoidance of sensitive areas and enables us to carefully choose the most appropriate sampling site. As stated previously, aboard the Adventure Canada vessel there will also be a resource team of scientists and local Nunavut residents. We will consult with these individuals prior to site selection and sampling regarding any possible environmental concerns in the area. If there are environmental concerns, sampling will not occur. As above, this work is expected to have no negative socioeconomic impacts on the locations visited. Longer term, this data will allow better prediction of greenhouse gas emissions from permafrost, and how local environmental factors may influence carbon flux in different Arctic regions. We hope this will improve climate modelling, and in turn aid in supporting climate resilience planning for northern communities. Furthermore, we will discuss our research with the passengers travelling with Adventure Canada to raise awareness for northern communities experiencing the effects of climate change in their local environments. Our aim is to create increased global advocacy for Nunavut communities navigating the future of climate

warming in the Arctic.

Cumulative Effects

There will be no cumulative effects resulting from this work.

Impacts

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1	point	Monumental Island
2	point	Lady Franklin Island
3	point	Panniqtuuq
4	point	Hoare Bay
5	point	Cape Dyer
6	point	Dundas Harbour
7	point	Powell Inlet
8	point	Port Leopold
9	point	Beechey Island
10	point	Prescott Island

11	point	Pasley Bay
12	point	Port Epworth