38th ANNUAL CRRC STUDENT CONFERENCE ABSTRACTS

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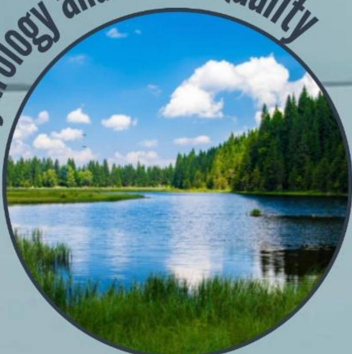
Session Themes

Hydrology and Water Quality



Biologic and Aquatic Ecosystems

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Remote Sensing and Modelling

Wildfires and Disturbances

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Oral Presentations

Assessing timing and drivers of long-term cover change in Van Tat, Yukon

Quinn Nixon-Goebel

Brock University

Arctic regions are undergoing pronounced changes in climate, influencing land cover characteristics. Landscape responses include prolonged change (e.g., gradual increases in shrub coverage) or abrupt transitions in response to disturbances (i.e., thaw slumps, thermokarst lake drainage, fire). Alterations to vegetation composition can have extensive impacts for nutrient cycling, hydrological conditions, fire regimes, and wildlife habitat. We are investigating spatial patterns in vegetation change across Van Tat (VT), located within the traditional territory of the Vuntut Gwitchin First Nation. Mann-Kendall trend analysis of maximum normalized difference vegetation index (NDVI) was used to detect ‘greening’ (positive) or ‘browning’ (negative) trends. Vegetation samples were retrieved across nine greening and two browning sites for dendrochronological analysis for comparing growth rate and remote sensing results. Terrain types of greening sites included south-facing slopes where shrubs have likely gradually encroached, and areas where abrupt change occurred (i.e., thaw slumps, drained lake basins). The samples obtained inside the browning pixels were from dense spruce forest, which burned prior to the documented fire record. Combined NDVI, species data, and tree ring analysis are being used to identify succession patterns associated with gradual versus abrupt change. Drone-acquired imagery at each site was georeferenced using DGPS survey control, providing orthomosaics and digital surface models for high resolution mapping of land cover types and structural characteristics. These will be used to assess spatial distributions of species and estimated biomass among plots. Results are also being incorporated into a long-term study assessing the influence of subcatchment vegetation change on downstream biogeochemistry.

Geophysical insights into permafrost beneath aquatic landscapes

Oliver Conway-White

University of Waterloo

In discontinuous permafrost regions, groundwater–surface water connectivity is strongly influenced by permafrost continuity. Here, we explore permafrost continuity in relation to lakes, streams, and wetlands using an airborne frequency-domain electromagnetic survey (AEM) and terrestrial electrical resistivity tomography (ERT) across a small watershed in the Central Mackenzie Valley, Northwest Territories, Canada. Frozen water is much more electrically resistive than liquid water, so higher resistivity measurements are expected where ice is the predominant water phase within the pore spaces of sediments. Areas of high resistivity are interpreted as permafrost while areas of low resistivity are interpreted as taliks (i.e., unfrozen ground). The AEM results reveal taliks with near vertical sides beneath lakes of various sizes across the watershed. Along streams, permafrost continuity appears variable, with some sections interpreted as taliks while other sections are not. A stream talik was investigated in greater detail using an ERT profile at a location where an open talik was inferred from the AEM data. Results reveal an asymmetrical talik morphology, hypothesized to relate to channel migration due to a meander bend at this location, with the talik extending towards the point bar. ERT measurements collected across three different wetland areas show contrasting permafrost conditions with two locations seen to be underlain by permafrost, while the third location showed an open talik. Characterizing groundwater–surface water interactions across the full diversity of surface water features found in northern areas is critical for understanding hydrological and ecological evolution of these systems as climates warm.

Assessing active layer thickness in ice-rich continuous permafrost using probing and ground-penetrating radar

Tobias Leonhard

Wilfrid Laurier University

Active Layer Thickness (ALT) is one of the most important parameters for the assessment of ice-rich continuous permafrost. The active layer is the main hydrological layer for subsurface flow, and its thickness depends on the surface energy balance that is affected by the vegetation cover and microtopographic features such as mineral earth hummocks or Ice-Wedge Polygons.

This study quantifies the spatial variability of ALT and ice occurrence in the near surface permafrost across distinct microtopographic positions including hummocks, interhummocks, polygon centers, and polygon troughs. High-resolution ground-penetrating radar (GPR) surveys and manual probing of ALT were employed to map vertical and horizontal extents of these features, providing detailed subsurface profiles. Surface imagery helped link topographic patterns to subsurface structures, identifying zones of water storage, restricted drainage, and ice formation.

The findings will address key knowledge gaps in permafrost hydrology, particularly regarding how microtopography governs subsurface flow. Linking surface and subsurface data will support improved predictions of ecosystem responses to climate-driven changes, informing future monitoring and remediation strategies in Arctic landscapes. This baseline characterization is essential for understanding evolving hydrological and geochemical processes in permafrost regions, with implications for scientific research and environmental management.

The impact of permafrost thaw on caribou lichen biomass across the Northwest Territories, Canada

Katerina Coveny

Wilfrid Laurier University

Up to 80% of the boreal biome is found within permafrost regions, and with rapid high latitude warming, widespread thaw is occurring. As the ground warms, permafrost thaws leading to a thickening of the active (seasonally-thawed) layer and an increase in soil resource availability. Caribou lichen (e.g., Cladonia spp.) is a common boreal taxa that forms a critical winter food resource for caribou. Caribou lichens are often found in regions of low productivity, such as soils underlain by permafrost, yet we know little about the impact of thaw on their availability. Permafrost thaw may increase plant productivity, potentially outcompeting established caribou lichen populations, or may directly affect lichen populations through ground surface deformation and/or ponding. Caribou lichen responses to landscape level disturbances may vary regionally, with evidence that lichen recovers faster at lower compared to higher latitudes. Our research investigates how caribou lichen biomass responds to permafrost thaw and how this response is mediated by environmental conditions, with implications for caribou forage availability. We analyzed how caribou lichen biomass varied as a function of active layer thickness and permafrost thaw rates at sites spanning a latitudinal gradient from 61°N to 69°N in the Northwest Territories, Canada. We found that thicker active layers and rapidly thawing permafrost were correlated with decreased lichen biomass. This is examined in the context of co-occurring environmental variables, including fire history, latitude, and forest type. This study advances our knowledge of climate warming-induced disturbances on caribou forage, a research priority identified by Territorial and Indigenous governments.

Monitoring and modelling lake ice for improving ice road safety

Arash Rafat

Wilfrid Laurier University

Increasing air temperatures in the Northwest Territories (NWT) have raised concerns regarding the safety and reliability of frozen lakes for winter transportation. Current climate change and weather variability are altering the formation, growth, and decay of lake ice, presenting challenges in the safe construction, operation, and monitoring of ice roads and winter trails. These seasonal routes connect otherwise isolated communities and link to vital resource development projects. With in-situ data scarce during periods of thin or decaying ice when ice hazards are enhanced, a need exists to 1) monitor the impacts of climate change and variability to ice processes, and 2) translate these results into practical applications for improving safe ice travel. To achieve these objectives, ice processes have been monitored since 2021, and an improved numerical model developed. Our monitoring results showed that freeze-up processes were controlled by variability in early winter air temperatures and snowfall. Break-up processes were governed by variations in radiation and air temperatures. Ice strength showed sensitivity to ice temperature, type (floating/grounded), and loading rates. These insights were incorporated into an improved lake ice model which shows excellent simulation strength against test lakes, directly addressing limitations in existing lake ice models.

Satellite-derived turbidity assessment in Great Slave Lake using a dual-threshold random forest approach

Gifty Attiah

Wilfrid Laurier University

Turbidity is a crucial indicator of water quality and ecosystem health in large northern lakes. However, the scarcity of in-situ observations and the spatial complexity of turbidity drivers hinder long-term monitoring efforts. In this study, we develop a dual-threshold Random Forest (RF) model optimized for low- and high-turbidity regimes to retrieve turbidity from Moderate Resolution Imaging Spectroradiometer (MODIS) and Visible Infrared Imaging Radiometer Suite (VIIRS) reflectance and band ratios over Great Slave Lake (GSL) from 2002 to 2024. Our objectives were to create a turbidity dataset, assess sensor performance against in-situ measurements and among sensors, and investigate the spatial, seasonal, and interannual dynamics of turbidity. Model performance was strong ($R^2 = 0.80$-0.83, $IA > 0.94$) in both low- and high-turbidity conditions around the lake. Spatial analyses identified persistent turbidity hotspots along the southern and southeastern shores of GSL, associated with river inflows from thawing permafrost basins as well as the shallow areas affected by wind-driven resuspension. Seasonal turbidity increased across all months, with the highest rise in June, indicating earlier snowmelt and extended ice-free periods. Interannual turbidity patterns also revealed greater sediment plumes in years with high runoff, such as 2020 and 2022. A lake-wide trend map revealed significant increases in turbidity, up to 2 NTU/yr, across most of the central and western parts of the lake. This study demonstrates how climate-driven landscape change is reshaping turbidity expansion on GSL and is the first harmonized, long-term, multi-sensor turbidity dataset for GSL.

3-Dimensional hydrodynamic modelling of Great Bear Lake

Kirin Lorente

Wilfrid Laurier University

Great Bear Lake (GBL), is the largest lake entirely within Canada's borders, is a vital resource for the community of Délı̨nę and holds significant ecological importance. Despite this, long-term research remains limited, complicating efforts to assess current physical characteristics and understand climate change impacts. To address this gap, we applied the three-dimensional Aquatic Ecosystem Model (AEM3D) to simulate GBL's hydrodynamics and thermal structure from July 2023 to August 2024, focusing on the open-water season. The model has a 1 km × 1 km horizontal resolution and is forced with ERA5-Land atmospheric data. Model performance is evaluated against extensive in-situ observations. Surface temperatures from three lake arms (MBE = –0.04°C, RMSE = 2.95°C) and subsurface profiles in the southwest arm (MBE = 0.4°C, RMSE = 1.45°C) showed strong agreement with simulations. Year-round comparison with a mooring in the southwest arm (MBE = 1.68°C, RMSE = 1.91°C) captured seasonal warming and cooling cycles. Satellite-derived thermal observations further supported the model's spatial and temporal accuracy (MBE = 0.69°C, RMSE = 3.43°C). Simulated transects indicate that thermal stratification develops within the lake's arms, while wind-driven mixing inhibits stratification in the central basin. AEM3D successfully simulates the thermal structure of the lake both spatially and temporally, providing a baseline understanding of GBL's current hydrodynamic state.

Overcoming sparse data in the Arctic: Using SWOT satellite data to improve lake water balance modelling

Arnab Singh

Wilfrid Laurier University

The Arctic region has large areas dominated by vast amounts of thermokarst lakes that cover up to 50% of the area. These lake-rich watershed are difficult to model due the high abundance of lakes and their spatial heterogeneity. Moreover, in-situ hydrological observation data, including lake water levels and subsurface conditions, are sparse in the Arctic. Surface Water and Ocean Topography (SWOT) provide Water Surface Elevation (WSE) and Water Surface Area (WSA) for vast number of lakes. Assimilating SWOT WSE data improves modeled lake water balance estimates by correcting state variables and reduce uncertainty propagation through the model. A Kalman Filtering (KF) approach is used to assimilate summer SWOT WSE data with coupled GEOtop-Canadian Small Lake Model in Big Bear Lake at Trail Valley Creek to better constrain subsurface hydrological processes that are difficult observe directly in the field, and to test whether lake water storage conditions constrained by summer SWOT assimilation persists beneath winter ice cover, providing improved initial conditions for modeling spring freshet.

Prediction of the net ecosystem exchange of carbon dioxide in Canadian peatlands by integrating remote sensing and gridded climate data products

Katie Hettinga

University of Waterloo

Peatlands are globally significant organic carbon reservoirs, yet conventional process-based models of peatland carbon cycling have been constrained to site-specific applications. To enable predicting of carbon dioxide (CO_2) fluxes in peatlands under future scenarios, or to generate real-time estimates where no in-situ measurements exist, machine learning algorithms trained on in-situ CO_2 fluxes from the eddy covariance (EC) technique must be extended across broader geographic domains. In this study, we compiled year-round EC-derived net ecosystem exchange (NEE) measurements with 34 hydroclimatic predictor variables from global remote sensing and climate data products from twenty Canadian peatland sites spanning seven ecoregions. A comprehensive feature selection workflow identified that model performance stabilized at four features, which were: evapotranspiration, burn area index, normalized difference water index, and soil moisture. We trained four algorithms: ElasticNet Regression (EN), Light Gradient-Boosting Machine (LGBM), Random Forest Regression (RF), and Support Vector Regression (SVR) and evaluated their performance using held-out test data. The best performing model was the LGBM model ($R^2 = 0.71$; RMSE = 0.42 μmol CO_2 m^{-2} s^{-1}), which was then assessed for generalizability and transferability via a leave-one-ecoregion-out sensitivity analysis. The LGBM model had the highest generalizability within the Mixed Wood Plains ecoregion and the lowest generalizability within the Marine West Coast Forest ecoregion. Our findings demonstrate that the four-feature model has the potential to be upscaled to broader regions, offering a pathway to improve Canada's spatially explicit CO_2 emission estimates.

A lateral instability inspired by an idealization of the thermal bar

Nicolas Castro-Folker

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Two regions of fresh water can have the same density but different temperatures; this is a consequence of the approximately quadratic relation between density and temperature of cool water at ambient pressure. Such a configuration can be found in lakes in the form of the thermal bar. We study an idealized version of the thermal bar using two dimensional, high-resolution simulations of two horizontally adjacent, equally dense regions. In our simulations, the interface between the regions attains the temperature of maximum density. That is, the density field attains its greatest value along, and is initially symmetric about, the interface and therefore accelerates downwards shortly after forming. This generates a buoyantly-forced vertical shear layer in the centre of the water column. In turn, the shear layer develops an instability that spreads outward laterally from the interface. We discuss the implications for small scale transport of heat and mass.

Examining seasonality, interannual variability, and the drivers of zooplankton community structure in three Canadian subarctic lakes

Naomi Derksen

Wilfrid Laurier University

Subarctic lakes are facing multiple stressors, including climate change, eutrophication, and impacts from infrastructure development. These stressors can influence water quality and lake food webs, especially invertebrates such as zooplankton. Unfortunately, zooplankton remain severely understudied in subarctic lakes. Most studies lack time-series data on communities and often omit sampling during ice cover. This shortage of multi-season, time-series data limits our ability to reliably quantify zooplankton-environment relationships. It also restricts our ability to predict how environmental changes affect their communities. In this study, we sampled three Canadian subarctic lakes over two years, covering both open-water and ice-covered periods. We observed substantial inter- and intra-annual variability in zooplankton composition and abundance. These changes were linked to specific water quality variables: temperature, dissolved oxygen, conductivity, dissolved organic carbon, and turbidity. In addition, we found that stressors from infrastructure development and fish presence or absence also drove differences between lakes. Studies using only single-date or single-season sampling would not have captured these insights. In addition, the magnitude of interannual variation in zooplankton and the relationships between zooplankton communities and multiple water quality variables underscore the need to study drivers of change in a multivariate context. The year-round drivers of zooplankton community composition and abundance identified as important in this study are expected to be strongly influenced by eutrophication, climate change, and pollution from development; thus, our results highlight the need for ongoing monitoring and mechanistic studies to disentangle the cumulative effects of these stressors.

A new 10,000 year chironomid-based reconstruction of Holocene climate in central Yukon

Albert Tomchyshyn

University of Toronto

Northern high-latitude regions are warming 2-3× faster than the global average. To better understand the probable range of northern climate futures, a long-term perspective on past climate variability is required. Natural climate proxies archived in layers of lake sediments provide an opportunity to refine our knowledge of climatic systems over millennial timescales. Here, we present a new ~10,000-year reconstruction of July air temperatures at Honeymoon Pond (central Yukon) using chitinous insect remains preserved in a ~4m lacustrine sediment core. Paleoclimatic conditions were inferred from Chironomidae subfossil assemblages by utilizing a weighted averaging partial least squares (WA-PLS) model developed from a continental-scale network of modern chironomid assemblages and observed climatic conditions. Analysis of our reconstruction showed notable chironomid assemblage shifts across the Holocene suggesting distinct periods of climatic change, some of which are replicated in other reconstructions across Yukon and Alaska.

Gill bioaccumulation of acute neodymium exposure to juvenile Arctic char (Salvelinus alpinus)

Lauren Best

Wilfrid Laurier University

Rare earth elements (REEs) are a group of metals increasingly used in modern technologies, raising concern over the impacts of their release into the environment. As REEs enter surface waters through industrial activities, increased scientific effort is required to investigate the impacts of these metals on aquatic organisms. In particular, establishing water quality guidelines to protect freshwater species, particularly those residing in sensitive northern ecosystems, is imperative. This research investigates the effects of neodymium (Nd – a critical mineral for electric vehicle batteries) on juvenile Arctic Char (Salvelinus alpinus). Juvenile S. alpinus were randomly assigned to concentrations of Nd (0, 10, 20, 40, 80, 160, 320 µg Nd/L) with 8 organisms per replicate. Exposures were flow-through, in waters of soft hardness (15 mg $CaCO_3$/L), at 10.5˚C, for 15 hours. Measured dissolved concentrations were 50 – 90% of total Nd, indicating complexation is occurring and precipitating Nd out of solution. Gill bioaccumulation analysis reveals maximum accumulation of 3.32 µg/g, with a half gill saturation constant (Km) of 10.22 µg Nd/L. The results show that Nd readily accumulates and reaches equilibrium at 3.32 µg/g. These findings indicate that gills act as a significant site of Nd uptake, which presents the potential for toxicity and behavioral impacts after prolonged exposures. This provides insight into bioaccumulation for northern fish species exposed to Nd deposits, emphasizing the importance of establishing a broader understanding of REEs to establish water quality guidelines.

Venlafaxine, an antidepressant, alters glucose metabolism in fish in low-oxygen conditions

Olena Kuntyj

Wilfrid Laurier University

Northern aquatic environments can experience a combination of concurrent stressors, such as abiotic factors like hypoxia (low oxygen) and wastewater contaminants, including pharmaceuticals. The antidepressant venlafaxine, which targets the neurotransmitter serotonin, is detected in surface waters at up to 3 µg/L. In fish, gill neuroepithelial cells are responsible for eliciting cardiorespiratory reflexes to cope with hypoxia, a process mediated by neurotransmitters, including serotonin; however, investigations into whether venlafaxine alters responses to cope with hypoxia have yet to be carried out. Rainbow trout (Oncorhynchus mykiss) are native to northern Canadian watersheds, where hypoxia often occurs during winter as ice forms and in summer, when stagnant water warms. This study assessed whether short-term venlafaxine altered hypoxia coping mechanisms of juvenile trout exposed to environmental (0, 0.1, 1 µg/L) or supra-environmental (10 µg/L) levels for 24 h, followed by moderate (30% O_2) or severe (10% O_2) hypoxia. Venlafaxine did not alter ventilation or behaviour in hypoxia. In moderate hypoxia, venlafaxine prevented a rise in blood glucose levels when compared to control fish. In severe hypoxia, venlafaxine significantly lowered blood glucose levels despite an increase in several genes involved in the production of glucose compared to control fish, indicating disrupted glucose metabolism and a potential shift to alternative energy sources to maintain behavioural functions. 10 µg/L-venlafaxine exposed trout also potentiated hypoxia-inducible factor gene responses in both hypoxia severities. This study demonstrates that venlafaxine can alter glucose metabolism in low-oxygen conditions, potentially limiting further responses in complex northern aquatic habitats.

Metabolic control of gill neuroepithelial cells in a common freshwater fish, fathead minnow (Pimephales promelas)

Abbeneet Binning Bath

Wilfrid Laurier University

Climate change is imposing considerable stress on aquatic organisms. To maintain homeostasis, animals like fish often adjust ventilation in response to abiotic stress. In mammals, this regulation is multimodal, integrating chemical signals to reflect metabolic status and regulate breathing. Less is known about the multimodal control of ventilation in fish. In fish gills, neuroepithelial cells (NECs) have been proposed to be peripheral chemoreceptors that sense changes in gases. Recent evidence suggests that they can also sense metabolites such as lactate and ammonia; however, the full repertoire of ventilatory control remains unknown. Among these signals, leptin is a key metabolic hormone in mammals that reports energy stores to the brain and has been implicated in the regulation of breathing. Given this, we hypothesize that metabolic hormones, such as leptin, can activate NECs and, in turn, modulate gill ventilation. Primary gill cell cultures from fathead minnows were made, with calcium imaging used to quantify changes in intracellular calcium, a proxy of cellular activity. High CO2, a reliable activator of NECs, was used to confirm their responsiveness. Leptin was then applied with and without calcium blockers to test if its effects rely on the main calcium entry pathways in these cells. Preliminary data show that leptin activates gill NECs, and this response persists in the presence of blockers, suggesting that leptin acts through an alternative calcium pathway. Overall, this work will shed light on how leptin modulates NEC activity and how these changes may help fish adjust gill ventilation in a changing climate.

Biodiversity concerns of researching climate change using satellites

Sara Varón Echeverri

Western University

Although climate change research benefits us all, it may not negatively affect all regions equally. An example of this is the use of satellite constellations for earth observations. A satellite constellation is a group or a network of satellites that have the same purpose and that have shared control. Satellite constellations allow for the better understanding of the interconnection between microenvironments and, therefore, they contribute to the study of climate change (Awange, 2012; Levizzani & Cattani, 2019). There is no other tool capable of gathering the data that these constellations gather. Nonetheless, because of the lack of regulation on the brightness of these satellites, there might be possible negative effects for species who are not adapted to skyglow. The effects that the brightness of these satellites might have disproportionally affect animals that live in the northern part of the globe. More specifically, in the Canadian context, it might affect animals specifically protected by the Species at Risk Act (SARA) like the Ascaphus truei which “is listed because its extreme habitat specialization makes it potentially vulnerable to habitat changes arising from human activities” (Management Plan for the Coastal Tailed Frog (Ascaphus Truei) in Canada, 2018, p. iv). Satellite Constellations, although permit the collection of valuable data, might pose dangers to the biodiversity of northern territories and, therefore, should be adequately regulated to respond to the needs of fauna with extreme habitat specialization.

Effects of temperature on the dispersal of the Rocky Mountain apollo butterfly (Pamassius smintheus)

Evan Bennett

Western University

Much work has been done to provide insight into how alpine insects fare at the lower temperatures commonly seen at high altitudes, and the methods which these insects use to reach the minimum temperature required to initiate movement, however little has been done to investigate the upper temperature thresholds of these insects. The species Parnassius smintheus, or Rocky Mountain Apollo, lives in exposed meadows found along the Rocky Mountains, and are thus subject to direct sunlight and high temperatures for the majority of their flight season. In order to mate, some butterflies will travel between meadows, with distances between meadows ranging between 1 and 10km. Dispersing individuals are relatively uncommon to find, and so my research seeks to determine whether or not individuals who undergo this short distance migration are better equipped to withstand higher temperatures, due to how intense this flight is. Through use of a flight apparatus, a thermal plate, and a thermal camera, two tests were conducted. Firstly, individuals were flown on the apparatus and had their temperatures recorded throughout flight, with performance curves being assembled to compare how internal temperatures changed during flight between dispersers, and non-dispersers. The second test had individuals restrained, and their thoracic temperatures manipulated using a thermal plate. Through preliminary analysis, dispersing individuals appear to show consistently lower body temperatures while flying when compared to non-dispersers. This contrasts results of static tests, where there appears to be little difference in ability to gain or dissipate heat in the absence of physical activity.

Innovating muskox wool for community-led economic resilience in northern Canada

Sarah-Anne Thompson

University of Toronto

This presentation will explore the emerging possibilities of muskox wool (qiviut) as a foundation for community-led, culturally grounded economic development across Arctic Canada. Qiviut is one of the rarest and most valuable fibres in the world, yet Northern communities, who steward muskox populations and supply the raw material, capture only a small share of its global value. This project investigates how that dynamic can shift. In partnership with Makivvik, the Saturviit Inuit Women's Association, and the Avataq Cultural Institute, and in collaboration with hunters, fibre processors, and manufacturers across Canada, Greenland, and Alaska, the research examines how muskox economies function today and how they can be strengthened to support northern innovation, autonomy, and circular economies.

The specific objectives of this study are to: (1) analyze muskox fibre networks across Canada, Greenland, and Alaska; (2) examine how Inuit cultural practices, knowledge, and craft intersect with textile production; and (3) co-design innovation workshops introducing skill-sharing, fibre-processing techniques, and open-source micro-mill technologies suited to Northern regions. The presentation will share the preliminary insights and research plans for this study.

How frequent are desiccation events in the critical aquatic nesting habitat of the endangered whooping crane?

Thenuja Vittanachchi

University of Waterloo

A pond-rich landscape within Wood Buffalo National Park (WBNP), known as the Whooping Crane Summer Range (WCSR), forms critical habitat for the only wild, self-sustaining population of endangered whooping crane (Grus americana). The ponds provide nesting materials, aquatic food, and protection from predators. Their shallow depth makes the ponds vulnerable to desiccation when climatic conditions lead to evaporation rates greater than inflow from precipitation. It has been observed that ~60% of the 63 ponds sampled across the Sass-Klewi Nesting Area (SKNA) dried up between summer 2023 and fall 2025 when weather was arid. In contrast to the widespread desiccation of ponds in recent years, paleolimnological evidence generated at 3 ponds, including one which has dried since 2023, shows little to no evidence of desiccation during the past 150 years. This raises the possibility that widespread recent pond desiccation may be a rare event caused by unusual climatic conditions that pose threats to freshwater availability. In this study, we analyze a sediment core from a pond (“SK 41”) that has been dry since spring 2024 and is strongly influenced by evaporation. To reconstruct the timing and frequency of past desiccation events during the past few centuries. Loss on ignition analyses, radiometric dating (210Pb, 137Cs), carbonate oxygen isotope measurements (d18O), and organic carbon-to-nitrogen ratios will be used to provide insights on past water balance changes and detect past desiccation events. Findings will strengthen understanding of how critical whooping crane nesting habitat may respond to future climate change and inform conservation decisions.

Maternal transfer of contaminants of emerging Arctic concern

Aaron McQuaid

Toronto Metropolitan University

Organophosphate esters and ultraviolet stabilizers are found in seabirds in the Arctic at increasing levels. These chemicals are used in a plethora of industrial applications and household products. They act as plasticizers, flame retardants, lubricants, processing aids, household furniture, clothing, food packaging materials and makeup. Liver, eggs and plasma from Thick-billed Murres on Coats Island, Nunavut over a three-year period were collected by Indigenous hunters and Environment and Climate Change Canada. Solvent extraction, solid-Phase Extraction (SPE) and nitrogen evaporation steps were utilized in lab to create concentrated solutions of egg, liver and plasma. 36 tri-OPEs, 6 di-OPEs and 9 UV stabilizers were analyzed using APCI (+) and ESI (-) ion sources under Agilent’s Quant-my-way for peak areas of each compound against calibration curves. to be analyzed by HPLC. Chemicals that are more hydrophobic were found in liver and hydrophilic in plasma. Egg concentrations were paid to mother and looking at compounds found in eggs can determine which compounds are more likely to be transferred to chicks. While most of these chemicals have detrimental neurological, genotoxic or endocrine disruption – data from this experiment can inform policy on chemicals that are of highest concern that to be addressed by production restrictions and industry regulations.

Examining snow water equivalent and runoff changes across ecoregions in the Northwest Territories, Canada

Elaine Cota

Wilfrid Laurier University

The mean annual air temperature in northwestern Canada is rising rapidly, impacting hydrological processes. This study addresses how basin runoff and snow water equivalent (SWE) are changing across ecoregions in the Northwest Territories (NWT) with climate change. This project aims to expand upon existing understanding of hydrological change in the NWT. Runoff data taken from streamflow stations were acquired from the Water Survey of Canada. Streamflow sites included in the dataset have a twenty year period of record and have data spanning from 1960 to 2025. End of season SWE data were acquired from the ERA5-Land reanalysis dataset. The SWE data were clipped and averaged to the upstream contributing area above the Water Survey of Canada hydrometric gauge at each location. Basins were then classified by ecoregion, where governing hydrological processes could be assigned according to literature. Streamflow sites were paired with SWE sites. Sites within the same ecoregion and were close together were paired. For each group of two paired sites, the trends in SWE changes and runoff changes can be compared and contrasted. Analysis was conducted through R software. A Mann-Kendall trend analysis was completed. Preliminary results suggest that ecoregions in the NWT have differing hydrological responses to climate change. The causal factors driving these changes warrant further meteorological and hydrological investigation. The next step in this research project to further analyze the SWE and runoff data. This research project will expand knowledge of how hydrological systems are changing in response to climate change in the NWT.

Climate change impact on nuclear infrastructure proliferation in the Canadian north

Khaled Emam

McMaster University

Climate change is anticipated to significantly impact the development of northern regions. A recent United Nations assessment report highlights that observed changes in weather and climate, including heat waves, heavy precipitation, acid rain, intense hail, abrupt shifts in freezing and thawing cycles, and rising sea levels, are reaching extreme levels. Canada aims to achieve a zero-carbon environment by 2050, with plans to supply power to remote and off-grid areas, particularly in the north, to connect them to southern regions. To achieve this, Small Modular Reactors (SMRs) are being proposed, as they can generate up to 300 megawatts per unit, which is sufficient to provide clean electricity to approximately 300,000 homes. However, climate change presents additional challenges for constructing these units in northern areas, primarily due to anticipated changes in soil geotechnical properties. Increased rainfall may lead to higher pore-water pressure and infiltration rates, which, in turn, can reduce soil shear strength. Additionally, the melting of permafrost could affect the propagation of seismic waves if the soil becomes softer as it thaws. Constructing auxiliary buildings associated with the SMR units may pose difficulties, given that they will rest on previously frozen soil that could become saturated or near-saturated due to climate change. This research aims to examine the seismic effects on SMRs in these frozen northern regions, accounting for seismic soil-structure interactions and changes in soil properties driven by climate change, using numerical methods and 3D OPENSEES analyses.

Trends and analysis of temperature and turbidity at the Slave River mouth region using Google Earth Engine

Andy Sekoh

Wilfrid Laurier University

Northern freshwater systems are undergoing rapid environmental and climatic change, requiring comprehensive long-term monitoring to understand how these ecosystems are evolving. Lake surface temperature (LST) and turbidity are critical indicators of water quality and ecosystem response to climate change in northern lakes. This study employs multi-sensor satellite observations processed in Google Earth Engine (GEE) to assess 40-year (1984–2024) trends in LST and turbidity in the Slave River-Great Slave Lake (GSL) confluence zone, Northwest Territories, Canada. LST was retrieved from Landsat (5 TM, 7 ETM+, 8 OLI/TIRS) and MODIS Aqua thermal bands. Turbidity was assessed using the Normalized Difference Turbidity Index (NDTI) calculated from MODIS Aqua, Landsat, and Sentinel-2 MSI surface reflectance products. Slave River discharge records were integrated to evaluate hydrological controls on water quality. Results indicate statistically significant warming at 0.07°C/year ($p < 0.001$) across both platforms. Multi-decadal turbidity analysis revealed long-term variability over 40 years (Landsat: slope = -0.0005 NDTI/year), reflecting post-dam equilibration, with recent intensification during 2002-2024 (MODIS: slope = +0.0017 NDTI/year). All platforms detected the exceptional 2020 turbidity maximum, followed by sharp decline through 2024. Strong positive correlations between discharge and NDTI (r = 0.70–0.97) confirm hydrological forcing as the primary driver of turbidity variability. Per-pixel regression analysis revealed a localized increase in turbidity near the river mouth. The spatial pattern indicates eastward transport of suspended sediments over time. This multi-platform approach within GEE provides a robust framework for monitoring water quality in large, remote northern lakes under changing climatic and hydrological conditions

Arsenic, antimony and phosphorus cycling varies across subarctic lakes with diverse municipal and mining impacts

Madeline Patenall

Wilfrid Laurier University

Lakes within Yellowknife, Northwest Territories, have experienced multiple anthropogenic pressures since the 1930s, including the deposition of urban (phosphorus (P)) and mining (arsenic (As) and antimony (Sb)) related redox sensitive elements. The remobilization of these elements influences their concentrations and long-term fate in lakes. In this study, we sampled lakes within Yellowknife city limits with varying physical properties (size, depth, morphology) and urban pressures to explore their influence on element cycling. We demonstrate that the cycling and long-term fate of As, Sb, and P is influenced by both internal and external processes. All shallow lakes (<6 m) exhibited anoxia in winter corresponding with under-ice enrichment of As, Sb, iron (Fe), and manganese (Mn). The deepest lake did not experience winter anoxia or under ice enrichment of redox sensitive elements. In contrast, this lake thermally stratified in summer, likely the result of a recurring algae bloom, resulting in the release of As and P, but little Sb. These findings show that lake processing and recovery from legacy mining contamination is not uniform. In lakes where the deposition of redox sensitive elements has occurred, decision makers should consider the influence of catchment development on lake recovery when evaluating future infrastructure.

Changing wildfire resilience of boreal conifer forests through time

Brian Newton

Wilfrid Laurier University

Throughout the circumpolar boreal forest, climate change is driving increasingly intense wildfire activity. Specifically, the severity, frequency, and extent of wildfire events are all increasing. Wildfire is not a new disturbance, regular stand-replacing wildfires have been a defining feature of the boreal forest for millennia. As a result, the boreal forest is historically resilient to wildfire, meaning that following wildfire disturbance, forests are able to recover their fundamental function and structure. However, increasingly extreme modern fire regimes threaten to overwhelm forest resilience, triggering post-fire transitions to alternate forest states. These alternate outcomes have been observed recently; however, little is known about whether they have become increasingly common over time. My research aims to determine: 1) Are alternate post-fire recovery trajectories becoming more common with time? And 2) Are there any consistent drivers that can predict alternate outcomes on a landscape scale? To determine changes in post-fire trajectories, I used a combination of aerial flyover photographs and satellite imagery to identify pre- and post-fire forest composition throughout Central Yukon in wildfires dating to the 1960s. My results show that for conifer forests, non-resilient post-fire outcomes of broadleaved, mixed-wood, or non-forested regeneration have become significantly more common with time. Post-fire outcomes were compared against remotely sensed climatic and landscape conditions using random forest analysis, which found that in addition to historical period, slope and elevation influence the degree of resilience loss following fire. The results from this study highlight the increasing vulnerability of conifer dominated boreal forests under modern climate change.

Aspen running canker in central Yukon forests

Mackenzie Mihorean

Wilfrid Laurier University

Across the boreal biome, temperatures are increasing 3-4 times faster than the global average favouring the habitat, dispersal, and overall survival of pests and pathogens. Aspen in central Yukon face drought, insect outbreaks, and a novel pathogen, Aspen Running Canker (ARC) caused by the fungus Neodothiora populina (Np). ARC first described in 2015 in Interior Boreal Alaska and can kill a tree in 1-2 years. Since then, it has been found in Yukon and Northwest Territories. It has the potential to follow trends similar to the historic destructive outbreaks of Dutch Elm Disease, Chestnut Blight, and White Pine Blister Rust. Despite ARC's widespread occurrence much of the epidemiology is unknown. I aim to (1) evaluate the frequency of ARC in aspen across central Yukon; (2) investigate the presence of asymptomatic Np infections; and (3) determine the environmental conditions that influence incidences of Np infection and outcomes. Stands of various ages and types were sampled extensively across the central Yukon and later tested using standard molecular methods for the presence of Np. Asymptomatic cases were confirmed throughout the central Yukon along with the presence of Np. Uncovering the differences between environments of symptomatic versus asymptomatic infections will help to identify the most susceptible areas and individuals. Given a warming climate we could expect a continuation of the prevalence of this disease as dry conditions become more common. Understanding the dynamics of this pathogen is crucial to anticipating future changes in the boreal forest as the disease spreads.

Assessing distribution and controls on slope stability in the southern Dehcho, NWT

Will Bender

Wilfrid Laurier University

In the southern Taiga Plains of the Northwest Territories (NWT), Canada, the patchy discontinuous permafrost is rapidly thawing, making frozen, ice-rich slopes susceptible to thaw-driven failure. Communities expressed concern over recent intensification of landsliding along the Mackenzie River. However, specific drivers of recent slope failures are not well understood. Our study aims to investigate how permafrost characteristics, slope aspect, and glacial lake sediment properties influence distribution and nature of recent intensification of landsliding in this region. Of 83 documented landslides along a 260 km reach of the Mackenzie River, most are rotational failures with subsequent retrogressive thaw slumping occurring on northward-facing aspects in glacial lake sediments. Coupled observations of ground ice and frozen material in headwalls suggest permafrost may be a primary control in slope stability. Electrical resistivity tomography (ERT) surveys of glacial lake sediments above active failures were conducted to measure permafrost thicknesses. To address the question of whether landslide activity has intensified, we will use GEE to automatically detect the year of initiation by recording the year of maximum shift in NDVI value and validate this with the manual recordings from Google Timelapse. If successful, other fluvial networks beyond the Mackenzie River will be selected based on similar surficial geology characteristics to apply this process and examine if temporal patterns of initiation and disturbance types are consistent across broader regions. This research will improve understanding of slope failure mechanisms in relatively warm and thin permafrost riverbanks, furthering hazard assessment and adaptation strategies.

Bridging data gaps: Characterizing and predicting multi-hazard events in Canada using public datasets

Sarah Hoyos-Hoyos

Wilfrid Laurier University

The incidence of natural hazards is on the rise globally due to factors such as population growth, urbanization, and the impact of climate change; with Canada being no exception. Natural hazard events and their associated climate conditions and underlying mechanisms have already been studied in Canada, yet little is still known about characterizing multi-hazard events in the same way. This gap in knowledge can lead to omitting multi-hazard events from risk assessments and planning which may generate in inaccurate estimations of potential risks

In this paper I will utilize publicly available datasets recording natural hazard events in Canada, to identify regions likely to experience multi-hazard events and discuss the utility of different data repositories and reports. This analysis highlights current gaps in publicly available data and the limitations still facing multi-hazard research such as categorizing hazard type combinations and defining spatial and temporal patterns. Analysis underscores the occurrence of cascading multi-hazard events across Canada, particularly landslides triggered by other natural processes such as floods. Comparing datasets helps quantify and characterize these limitations and provides a baseline for better understanding the climate conditions and mechanisms of multi-hazards in Canada.

Machine learning models present the possibility for improving multi-hazard analysis, while addressing the technical challenges revealed by this data-driven analysis. By acknowledging and addressing these technical barriers, modeling can be completed to enhance the understanding of multi-hazard dynamics and contribute to improved risk assessment and planning across the country.

Impacts of burn severity on the physical, hydrological and thermal properties of sub-Arctic peat soils

Joshua Meyer

Wilfrid Laurier University

Peatlands are one of the world's largest carbon sinks and serve as an abundant fuel source for wildfires within the boreal forest. While much research has been focused on the effects of wildfire on peat properties, these investigations have predominantly operated along a burned-unburned binary, excluding the potential effects of varying fire severity. Scotty Creek, NWT, Canada (61°17'N, 121°17'W) is a peatland-dominated basin underlain by discontinuous permafrost, which experienced a fast-moving wildfire in October 2022, resulting in varying degrees of burn severity across both wetlands and peat plateaus. In this study, we sought to determine if changes to burn severity produced any significant differences in the physical, hydrological and thermal properties of underlying peat. Selected sites were first assessed using the visually based composite burn index system and classified each as either unburned, partially burned or severely burned. Peat core samples were collected from each site and analyzed to determine several different physical and hydrological parameters. Field measurements were collected at both plateau and wetland sites to determine soil moisture values, thermal properties and thaw depths. The results showed that increases in burn severity on the plateaus were correlated with significant increases in volumetric soil moisture, while decreases in solute transport rates indicated a reduction in active porosity. Significant increases in thermal conductivity were also observed at burned plateau sites. By the month of June, increased rates of active layer thaw were observed with increasing burn severity, with the severely burned sites also possessing a more uniform depth of thaw.

3-Minute Theses

Estimating the distribution of forage quality for caribou and willow ptarmigan in Tongait KakKasuangita SilakKijapvinga, Nunatsiavut, Labrador

Nhu Le

University of Waterloo

Changes in temperature, soil disturbances, and herbivory intensity are linked to widespread changes in tundra plant communities and shrubification (the increase of shrub abundance, height, and cover). Tundra ecosystems are the preferred habitats for northern wildlife species, such as tuttuk (caribou (Rangifer tarandus)) and aKiggik (ptarmigan (Lagopus spp.)). Tongait KakKasuangita SilakKijapvinga (Torngat Mountains National Park; TMNP) is home to the Torngat Mountains caribou herd and willow ptarmigan (L.lagopus), cultural keystone species for Inuit in this region and important indicator species for tundra ecosystem health. Recent studies have indicated widespread shrubification across TMNP, resulting in an increase of shrub-dominated tundra and a decrease in lichen-dominated tundra. These changes may reduce the availability of lichen, the primary winter forage for caribou while simultaneously increasing the availability of shrubs, such as willow (Salix spp.), which are important forage for willow ptarmigan.

To identify potential areas of preferred habitats in the TMNP, we estimated the local distribution of forage quality for both wildlife species using plot-scale ground photography and uncrewed aerial vehicle surveys at one long-term study site within southern TMNP and one study site just south of the TMNP boundary. We plan to upscale the local forage maps into regional TMNP forage maps, which could be used to inform long-term management of preferred habitats by local (Nunatsiavut and Nunavik) and federal (Parks Canada) governments.

Using novel technologies to understand landscape change in culturally significant places across coastal Labrador

Lili Paradi

Queen's University

Recently, there has been an underestimation of discontinuous permafrost in coastal Labrador leading to an underappreciation of thaw sensitive areas prone to change (Wang et al., 2022). This has implications for physical systems including carbon exchange but also for Inuit and Innu who live near these thawing permafrost landscapes who rely on them for hunting, foraging and creating communities. Located across these permafrost regions are important peatlands, as well as geomorphologically unique landforms like palsas and peat plateaus, ripe with flora and fauna who survive best in these environments.

It is important to assess landscape change across these peatlands, spanning the southernmost coast of Labrador to the northernmost communities. Modelling variability in vegetation across peatlands which experience varying levels of thaw will help researchers and communities better understand how culturally significant species like tuttuk (boreal caribou) forage and use these northern ecosystems.

Exploring different methods of analyzing change will allow for a deeper understanding of how to adapt to it. Vegetation plots, hand-held LiDAR, uncrewed aerial aircrafts, all the way up to historic air photo use and to satellite imagery, allow for a bottom-up view of Labrador's coastline and unique peatland ecosystems. This presentation will immerse the listener into the dynamics of landscape change, interconnected methodologies and how to connect responsiveness of places to the responsiveness of culturally significant species.

Decoding knowledge: A comprehensive look at Ontario's far north wildlife

Emilie Knighton

Wilfrid Laurier University

Ontario's Far North has some of the most intact landscapes in the world and is home to a rich diversity of vertebrate species. It is a highly heterogeneous environment of socioeconomic and cultural importance. However, the remote nature of this region has greatly limited data collection; travel is costly, and many species occur at low densities, making adequate sampling difficult. This raises an important question: how much of what we know about Ontario's Far North comes from local knowledge and how much is inferred from other, partially comparable, landscapes? To evaluate the distribution and history of existing knowledge, I will conduct a literature review of scientific publications, government reports and data repositories (e.g., GeoHub, iNaturalist) from the last 100 years. This review will help identify knowledge gaps by ecoregion, habitat types, and species, and will guide the prioritization of key research questions for Ontario's Far North moving forward. Much of the existing scientific literature focuses on large mammals and relies heavily on aerial surveys or collaring methods, with relatively little integration of Indigenous knowledge. Understanding the extent of these knowledge extrapolations will help clarify species-specific gaps and improve both local and regional assessments of current and future impacts.

Characterizing vegetation community changes following permafrost thaw in the North Slave and Sahtú regions of the Northwest Territories

Karelia Del Piero

Wilfrid Laurier University

Permafrost is ground that remains below 0°C for at least two consecutive years. It affects roughly 11% of the Earth's terrestrial surface and permafrost soils store about twice the carbon currently held in our atmosphere. Climate warming-induced permafrost thaw is rapidly altering northern landcover, which impacts the people and wildlife that use the landscape. Ice-rich permafrost features are particularly sensitive, and those that have experienced or are undergoing collapse are called thermokarst. Understanding changes in thermokarst vegetation communities is critical to predicting climate warming-induced landcover change. The first systematic inventory of thermokarst was conducted in the Northwest Territories (NT), Canada, by the NT Thermokarst Mapping Collective (TMC). This effort mapped all thermokarst features for the NT. However, landcover changes associated with the inventoried features have yet to be characterized. My project aims to characterize the vegetative communities associated with commonly occurring ice-rich permafrost features in the North Slave and Sahtú regions of the NT before and after thermokarst, using aerial imagery available through the TMC. I also aim to assess the vegetative biodiversity implications of these changes on a subset of features in each study region. Comparing pre- and post-thermokarst vegetation communities will contribute to the TMC's existing framework that is mapping and predicting thaw-driven landcover change across the NT. The mapping generated by the TMC will inform territorial, municipal, and private land use planning decisions, wildlife management and conservation policy, and subsistence land-users.

Lichen regeneration rate responses to post-fire conditions in central Yukon

Claire Bandet

Wilfrid Laurier University

Boreal fires are burning at higher frequency and greater severity, triggering changes in boreal forest composition and function. These changes may be an emerging threat to Canada's caribou because fire eliminates critical food stocks until enough time has passed for them to grow back. Terrestrial lichen, which represents 70% of caribou's winter diet, can take anywhere from 30 to 80 years to recover after fire, and even then, only if the forest composition regenerates as open, conifer-dominated stands that supports high lichen biomass. Shifts from spruce to deciduous dominance after fire therefore inhibit lichen recovery and affect caribou habitat and food resources. Here we present new data on the post-fire recovery of caribou forage lichens in central Yukon. We conducted surveys of forest cover type, lichen cover, and lichen biomass on sites that burned between 1950 and 2002 (n=200). We found that lichen cover is more than 30x higher in conifer and unforested stands than in broadleaf or mixed stands, consistent with other boreal regions. Additionally, we found that lichen grew more rapidly after wildfire when stands regenerate as conifer or unforested. We are also constructing lichen biomass allometries of the target morphological groups by modeling the relationship between biomass, height, and percent cover of samples collected from 80 plots in 2024. This work is intended to test whether the more generalist species are allometrically similar between Yukon, Northwest Territories, and Saskatchewan, and to fill in an allometry library for species more common in Yukon. This new understanding of lichen in central Yukon will be used to support forecasts of the recovery and availability of critical caribou forage under climate warming.

Investigating the toxicity, bioaccumulation and mechanisms of action of platinum (Pt) in freshwater invertebrates

Maddy Kim

Wilfrid Laurier University

Technology-critical Elements (TCEs) such as platinum (Pt) are being extracted to satisfy the growing demand due to their usage in renewable energy and technology. Although TCEs reduce greenhouse gas emissions, they are released into the environment through vehicle abrasion and mining extraction activities, ultimately reaching aquatic ecosystems via road runoff and wastewater pathways. Freshwater gastropods Planorbella pilsbryi are an important group of invertebrates that plays a critical role as bioindicators of freshwater ecosystem health due to their role in nutrient cycling and food source to higher trophic organisms. Freshwater planktonic crustaceans, Daphnia magna are filter feeders, playing an important role in aquatic food chains as food source for higher trophic levels. This thesis will examine the toxicity, bioaccumulation, bioavailability and mechanism of platinum on P. pilsbryi and D. magna. Chronic exposure tests will be conducted across a gradient of platinum concentrations to assess impacts on survival, development, reproduction, and tissue accumulation. Both species will be exposed in two different water hardness to understand how hardness affects toxicity of Pt. Snail tissues will be analyzed to identify pathways disrupted by Pt. Species threshold values such as LC50 and EC10 will be derived for both species and incorporated into species sensitivity distribution to support the development environmental quality guidelines for Pt. The purpose of this project is to address the critical data gap of Pt by generating toxicity data, which will contribute to the development of threshold guideline for TCEs in freshwater ecosystem and informing environmental quality guidelines for Canada’s Chemicals Management Plan.

Quantifying controls on climate-driven landslides in British Columbia using probabilistic rainfall thresholds and explainable AI

G. Shaila Afroz

Wilfrid Laurier University

Although landslides are becoming more frequent and destructive across western Canada as extreme rainfall, snowmelt, and human-driven landscape impacts intensify under a warming climate, there remains large data and modelling gaps across Canada for characterizing landslide conditions across large landscapes. To address this gap, this project identifies the key climatic and landscape factors that likely shaped the widespread landslides (over 1,300) that occurred during the climate-change induced November 2021 atmospheric event that devastatingly impacted the Fraser Valley, Coquihalla, and Lillooet corridor in British Columbia. The research will be done by integrating the 2021 landslide inventory of the event with gridded ERA5-Land and ANUSPLIN rainfall datasets, climate-station observations, terrain derivatives, wildfire burn-severity layers, and road-network information within a unified spatial grid. Probabilistic rainfall thresholds will be estimated using a Bayesian modeling approach and assess nonlinear and seasonal controls on slope failure using generalized additive models. To represent complex interactions among climatic and environmental predictors, interpretable machine-learning techniques will be applied using gradient-boosted decision trees combined with SHAP-based explanations, which will highlight influential drivers and illustrate their spatial variability. The analysis will support the development of transparent rainfall-trigger thresholds, interpretable susceptibility maps, and openly accessible geospatial tools that can strengthen early-warning systems, guide climate-resilient infrastructure planning, and inform adaptation strategies for communities across British Columbia and other regions facing increasing landslide risk under climate change.

The importance of mathematical modelling and data in environmental science

Christian Cameron

Wilfrid Laurier University

Mathematical modelling and data are essential to modern environmental science. Models use a combination of data and physics to fill gaps in incomplete datasets and estimate future environmental conditions. When paired with measurements from fieldwork and remote sensing, they help us separate natural variability from human impact and see patterns that are not obvious from raw data alone. Modelling lets us explore future scenarios for climate, lake and river dynamics, and water quality without having to experiment on the real world. This is crucial for communities that depend on ice cover, fisheries, or safe drinking water. By combining models with uncertainty, we can show not just a single prediction, but a range of possible outcomes and how confident we are in them. Ultimately, mathematical models and data provide a quantitative language for scientists, policymakers, and local communities to understand environmental change, and make informed decisions for the future.

What makes a patch a good patch? Bakeapple quality and nutritional value across NunatuKavut, Labrador, Canada

Tara Ryan

University of Waterloo

Climate change-induced shifts in Canada's subarctic regions pose a risk to many facets of Indigenous livelihoods, including bakeapple/appik (Rubus chamemorus L.) yield and quality. This berry, beloved by many Inuit communities, serves as an important source of traditional food and sustenance during both late summer and winter months. In this study, 26 Inuk participants were recruited between 2024 and 2025 to collect bakeapple berries, bakeapple leaves, and soil in Labrador. Berries were analyzed for vitamin C content, while leaves were analyzed for the presence of endophytes, and soil was analyzed for pH, organic matter and nutrients.

Interviews were conducted with 12 participants in the summer of 2025, where people who had been going to the same berry picking spot for decades spoke about their experiences picking bakeapples, what has changed at their patch, and what their patch used to look like, highlighting their traditional knowledge. Satellite images over the last few decades, coupled with this qualitative data, will be used to paint a picture of how Inuit berry picking patches are changing, and what that feels like for the people who frequent these patches. Threats to bakeapples identified by berry pickers include the increased presence of shrubs, such as dwarf birch (Betula nana and Betula glandulosa) around bakeapple picking spots, and in some cases, changing the landscape entirely. This study aims to highlight the importance of TEK and citizen science in environmental studies research and document the changes that Inuit observe when they are on the land.

Exploring and understanding youth's active transportation use in a northern context

Alexandra Sbrocchi

McMaster University

Transportation is an essential facet of daily life; it is necessary for people to reach their required destinations. However, how individuals get to and from destinations varies. This reality is a result of factors such as age, geography, access, and mode choice. The use of active transportation, human-power such as walking and biking for transportation, should be urged across all age groups for both utilitarian and recreational purposes because of its myriad of benefits.

Arguably, youth are the age group most reliant on active transportation because of both age and financial constraints. Current research on youth's active transportation use within Canada is typically situated in major urban areas, neglecting to consider northern communities, and often collaborates with individuals on youth's behalf instead of directly with youth. The purpose of this presentation is to therefore explore and understand youth's active transportation experiences directly from youth who reside within the City of Yellowknife, a northern Canadian community.

Exploring the impact of Arctic climate change in the defence of Canada's geopolitical sovereignty

Isabella Bigioni

York University

The study of Canadian Arctic climate change and its implications for geopolitical sovereignty sits at the intersection of environmental science, international geo-political relations, and Indigenous governance. As the Arctic warms up faster than the global average, scholars have emphasized both the urgency of ecological change and the complex political issues it reveals. This dual focus showcases broader academic conversations that link Arctic climate systems with global governance frameworks, positioning the Arctic as both an environmental and geopolitical frontier. These changes are no longer confined to the circumpolar North but reverberate abroad and extend through other global climate systems, biodiversity, and trade routes, making the Arctic both a regional and international concern. Critically exploring how accelerated climate change in the Arctic challenges the ecological stability of the ecosystem, redefines international relations between Arctic and non-Arctic nations, and raises questions of sound governance strategies that involve Arctic Nations, Indigenous communities, and global institutions. Exploring this concentration will help deepen our understanding of the Arctic as a space where climate change, conservation, and sovereignty are highly interconnected, and to critically evaluate how these forces shape both regional resilience of the Arctic ecosystem and larger global environmental governance.

Linking disease probability to growth history in aspen forests of central Yukon Territory

Nicola Rammell

Wilfrid Laurier University

Trembling aspen (Populus tremuloides) is the most widely distributed tree species in North America. In recent decades, a widespread decline in aspen health – particularly within the warmer and drier portions of its range – has been attributed to temperature-induced drought stress under climate warming. Such stress can reduce host resistance to insect pests and fungal pathogens, which may further induce water and carbon stress and negatively impact tree health. Recently, a novel ‘aspen running canker’ (ARC) disease caused by a previously undescribed fungal pathogen (Neodothiora populina) was identified in Alaska, Yukon, and Northwest Territories, where it has been linked to rapid aspen mortality. To date, the factors driving aspen vulnerability to ARC are unknown. We conducted health assessments and collected tree ring samples from 600+ aspen trees throughout central Yukon Territory, testing each tree for the presence of N. populina using molecular methods. Using dendroecological methods and stable isotope analyses, we are working to reconstruct aspen growth histories from annual tree rings and historical pest data. We predict that disease incidence will be influenced by the growth history of the host tree, with greater susceptibility in trees experiencing high drought stress in the warmest, driest landscape positions. Under continued climate warming, these dynamics could substantially alter forest stand trajectories, with far-reaching implications for wildlife habitat and ecosystem functioning across northern forests.

Maintaining vision at temperature extremes: the effects of temperature acclimation on the Arctic char (Salvelinus alpinus) retina

Alexis Dimitropoulos

Wilfrid Laurier University

The Arctic is undergoing rapid environmental change, exposing cold-adapted fish like Arctic char to increasingly variable temperatures. Visual function is central to survival in these fish, yet almost nothing is known about how their retina maintains performance across ecologically relevant temperature extremes. This project thesis investigates how retinal cells in juvenile Arctic char adjust key molecular pathways to support vision in acclimation scenarios above and below their optimal temperature. Retinal tissue has been collected from individuals held at three temperature treatments, and quantitative PCR (qPCR) will be used to quantify the expression of phototransduction-related genes like opsins, stress-response markers, and metabolic or maintenance-related genes that together reflect retinal health and resilience. Preliminary observations suggest that warmer waters can reduce survivability, with cold-acclimated fish exhibiting functional changes in the refractive index of the lens, indicating that the visual system has adjusted to at least colder waters. By comparing gene expression profiles across temperatures, this will provide the first molecular-level assessment of how the Arctic char retina responds to temperature stress. These results will improve our understanding of how visual systems in cold-tolerant fish are maintained under changing climatic conditions and will help identify molecular indicators of retinal resilience or vulnerability in a warming Arctic.

Applying a bacterial lipid paleothermometer proxy to strengthen understandings of past climate variability in northwestern North America

Danielle Martin

University of Toronto

Knowledge of Holocene climate variability and sensitivity to changing boundary conditions can advance climate system understanding and ameliorate models that estimate future climate change and related impacts. Over the last four decades, research in northwestern North America (NWNA) generated (often qualitative) paleoclimate inferences based on fossil pollen or midge assemblages from lake sediment archives. Additional paleotemperature data are needed to refine NWNA paleoclimate knowledge. My NWNA-based research involves applying the bacterial-derived branched glycerol dialkyl glycerol tetraether (brGDGT) proxy to develop quantitative Holocene summer temperature estimates. Lake sediment cores were collected from three lakes in NWNA spanning ~8° of latitude, including Spindly Pine Lake (southern Yukon Territory), Honeymoon Pond (central Yukon Territory), and M Lake (western Northwest Territories). Preliminary quantitative July temperature reconstructions using previously published pollen data (and Modern Analogue technique) from Honeymoon Pond and M Lake provide reconstructions for comparing brGDGT-derived estimates. Organic geochemistry methods extract brGDGTs from lake sediments, where downcore brGDGTs from all sites will be quantified using ultra-high-performance liquid chromatography-mass spectrometry. Preliminary analysis of surface-sediment samples from anoxic M Lake has revealed high amounts of the 6-methyl brGDGT isomer and an IR6Me greater than 0.4, indicating M Lake-based brGDGTs may be a better proxy for pH than temperature; additional downcore results are needed. These preliminary results highlight importance of pre-screening samples (especially anoxic lakes) to identify ideal lakes for temperature reconstruction. Results from this study (including pollen proxy data) will provide a more complete understanding of paleoclimate history of this region and timing/magnitude of climatic events.

Assessing the effects of Cu contamination in the Canadian Arctic to the Arctic char (Salvelinus alpinus)

Natalie Nykamp

Wilfrid Laurier University

The Canadian Arctic is a complex region, inhabited by organisms adapted to extreme conditions. Copper (Cu) contamination can be found in Canadian waterways, predominantly due to mining and industrial activities. The Canadian Government's new Critical Minerals Strategy is expected to drive increased mining activity in northern Canada. This expansion raises concerns about Cu contamination, underscoring the need to evaluate its effects on Arctic ecosystems. Water Quality Guidelines (WQGs) that are aimed at protecting organisms from contaminants are based on temperate species, with limited information pertaining to Arctic species. Arctic organisms have slower uptake, metabolisms, and growth, possibly causing differential responses to contaminants. This project aims to assess the toxicity of Cu to Arctic char (Salvelinus alpinus) and rainbow trout (Oncorhynchus mykiss) at two temperatures (15ºC, 5ºC) to represent current Arctic temperatures and predicted future temperatures from climate change. Preliminary results show that the 7-day LC50 for larval Arctic char is 176 +/- 8.48 µg/L Cu. Preliminary results for the chronic experiment on Arctic char show that 250 µg/L Cu significantly increased mortality across both temperatures, and 160 µg/L Cu significantly reduced the weight of the juveniles, compared to controls. The 15ºC fish also weighed significantly less than the 5ºC fish, following the 60-day exposure. Next steps include looking at bioaccumulation of Cu in critical tissues, assessing behaviour, and looking at gill morphology following the chronic experiment. Overall, this work will provide important evidence of the toxicity of Cu to Arctic fish, and work towards the derivation of Arctic-relevant WQGs.

Characterizing snow depth break events and associated trends in the Great Slave Lake region

Albert Jiang

University of Waterloo

Climate change related anomalous winter phenomena are on the rise, with examples including delayed first snowfall, extended accumulation periods to achieve a specific ground snow depth (GSD), loss of prolonged deep GSD periods, and early snowmelt. Among these scenarios, abnormal mid-winter warm-up events that cause snowmelt or loss of GSD remain relatively unknown and unexplored. Numerous studies focus on rain-on-snow and rain-on-ice events. However, there is generally less emphasis on the impact on GSD. A prior study revealed that the likelihood of experiencing uninterrupted and prolonged deep snow periods is reduced in the Great Slave Lake (GSL) region when comparing pre-1980s with post-1980s observations. This study aims to explore snow depth break (SDB) events characterization methods and perform frequency analyses. SDB events are defined as GSD decreases that occur before the maximum GSD in any given year, and irregular, sudden increases in the period between the maximum GSD and the complete loss of ground snow. This study proposes using frequency analysis to evaluate general trends of SDB events using data from the GSL region. During this process, various methods for properly capturing true SDB events will be explored, such as how to consider an event with data showing a snow depth decrease as a SDB event. Expected results include long-term trends of SDB events and trend characterization, as well as generalizable methodologies for characterizing SDB events. The results of this study will fill the gap by expanding the current knowledge about the impact of climate change on GSD.

Improving bias corrections of snowfall measurements in the western Canada Arctic

Robin Thorne

Wilfrid Laurier University

As the Arctic climate changes, there is a growing need for an increased understanding of the Arctic snow environment. Total snowfall measurements are challenging as frequent periods of trace amounts of snow are often difficult to measure. Periods of light precipitation, which can significantly contribute to the snowpack throughout the winter, can be missed by conventional weighing precipitation gauges. Underestimated snowfall can be adjusted using transfer functions that include wind speed and temperature, but even these adjustments fall short.

This study utilizes measurements of solid precipitation using a weighing precipitation gauge, a laser-optical disdrometer, and micro rain radar, that took place over the winter of 2023-24 and presents a potential solution for the detection and measurement of low-rate snowfall in order to improve total snowfall measurements. This study takes place at the Laurier Trail Valley Creek Research Station, north of Inuvik, NWT, in the low-Arctic tundra. The Laurier Trail Valley Creek site has a unique multi-decadal data set with snow, discharge and climate data that began in 1979. These data sets include snowfall, snow on the ground at the end of winter, distribution of snow over different terrain and vegetation types, and hydrometeorological data.

Correcting for wind and snowfall intensity significantly increased the measured snow fall amount, with additional snowfall accounted for by compensating for trace amounts of precipitation. While more work is required to confirm these methods, this study contributes to a better understanding of current measurement systems and can be used to enhance snowfall estimations.

The influence of lake morphometry on ice-off timing across Arctic lakes

Riley Forth

University of Toronto

Understanding the mechanisms driving ice break-up processes is a critical step for improving the accuracy of Arctic lake ice models, which are needed to understand the cryospheric implications on climate variability, ecological health, and human activities in the region. While ice-off timing is largely a product of temperature, lakes facing similar climatic conditions still differ in their melt phenology. Lake morphometry is recognized as a potential control for this phenomenon, but prior research on this relationship has mostly focused on temperate regions. This research aims to investigate the impact of lake morphometry on the ice-off phenology of lakes across the Canadian Arctic Archipelago. The timing and duration of ice break-up processes will be largely assessed through time lapse imagery captured by a network of remote digital trail cameras, and supplemented with satellite observations to expand the temporal scale. The duration of ice melt can be obtained through fieldwork measurements of ice thickness, using an acoustic instrument for full-season estimates and ice drilling for near-maximum measurements. Lake morphometry will be evaluated through sonar bathymetry data when available, while lakes without sonar coverage will have satellite-derived bathymetry developed through optical imagery from Landsat products. A predictive regression-based model will then be created to evaluate the correlation between each morphometric variable and break-up phenology, establishing lake morphometry's relationship with ice-off. These findings can advance the accuracy of modelled Arctic lake ice phenology, which then contribute back to validating climate projections and understanding the ecological and anthropogenic ramifications of the changing ice cover.

Microclimatic influences on lake ice formation and decay in Resolute Bay, Nu

Ernest Steele

University of Toronto Mississauga

Climate change continues to alter lake ice formation mechanisms on a global scale, requiring an updated understanding of the mechanisms that drive ice formation, given the importance of ice in the cryosphere and global climate. Based on observations of changing snow and ice regimes in the Arctic, this talk highlights increased white ice presence and the thickness/decay rates of ice on a High Arctic lake near Resolute Bay, Nunavut. Typically, little to no white ice forms on these lakes; with changing snow cover, white ice may become the new standard. White ice in warmer regions forms through snow-mass-related cracking and mid-winter thaws that flood the snowpack, which then refreezes. Yet in the High Arctic, thermodynamic cracking of the ice layer causes floodwater to mix with snow (if present on the ice surface). Rates of thickening/decay will be studied through in situ observations and time-lapse imagery to connect fall seasonal weather influences on lake ice formation and ice/snow depths. Using data collected by a Shallow Water Ice Profiler and manually measured in situ thicknesses, comparisons between ice thickening rates and climate variables will provide insight into the factors driving phenological shifts in ice cover on small lakes around Resolute Bay, which are representative of typical small High Arctic lakes. As the Arctic continues to warm and experience the impacts of Arctic Amplification, weather patterns depart from historic norms, highlighting the need to update our understanding of how these alterations to the cryosphere will impact the numerous High Arctic lakes.

Decoding Lake Superior winter dynamics through high-frequency decadal data

Leonard Korreshi

University of Waterloo

Lake Superior is the largest, least human-impacted of the Laurentian Great Lakes. It alternates between years of ice-covered and ice-free conditions that creates a varying environment for the lake water to mix and stratify as it moves through the winter season. Due to a negative relationship between the temperature and density of cold water between 0°C and 4°C, lake winters see a period of inverse stratification, with a layer of colder water resting on relatively warmer water. Through high-frequency hourly temperature and velocity data collected by the Large Lakes Observatory (LLO) over the last 15 years, the dynamics of this period can be examined in incredible detail. Using data techniques like empirically orthogonal functions (EOFs), the continuous wavelet transform (CWT), and wavelet coherence, relationships between drivers like wind and solar radiation and the lake surface and thermocline can be expressed, providing clear visual intuition for how a deep lake develops through the winter. In particular, it is shown that winds drive the late fall stratification onset while it is solar radiation that drives the end of stratification in the early spring.

Radioactivity in the Arctic: Radionuclide transport in the hydrologic-permafrost systems under a changing climate

Erik Young

Wilfrid Laurier University

Many Arctic communities and remote mine sites rely on diesel generators for electricity production. A roadmap for the implementation of small modular reactors (SMR) has been created to address negative impacts of diesel power generation. The desire for SMR implementation underscores the need to understand baseline radionuclide levels and their potential mobilization mechanisms under a warming climate, an issue recognized by the Arctic Council. Arctic permafrost and lake sediments store radionuclides from natural sources and legacy fallout, but the effect of climate change on the transport and fate of these radionuclides remains poorly quantified. This research aims to assess climate-driven radionuclide release and transport using an integrated hydrological and geochemical reactive transport modeling framework, parameterized and validated with field data from the Laurier Trail Valley Creek Research Station located in the Trail Valley Creek Watershed (TVC) north of Inuvik, NWT and remote sensing products. Field sampling will include water, soil, and sediment analyses, complemented by hydrological measurements. The modeling approach will combine the Canadian Hydrological Model (CHM) and Advanced Terrain Simulator (ATS) to simulate permafrost dynamics, supra-permafrost water flow, and radionuclide fluxes under current, historical, and projected climate scenarios. Outputs will identify landforms at risk of radionuclide accumulation and inform SMR site selection. This work will provide critical insights into radionuclide behavior in Arctic hydrologic-permafrost systems, supporting safe SMR deployment and long-term environmental stewardship.

Poster Presentations

Boreal peatlands surface radiation changes in response to climate-induced permafrost thaw and wildfire disturbances

Amber Buston-White

Wilfrid Laurier University

Northwestern Canada is warming at twice the global average, driving a persistent thaw of permafrost, while increasing the frequency and magnitude of wildfires. Both rising temperatures and wildfires alter forest canopy structure, ground surface radiation regimes, and subsurface energy balances. These ecosystem responses to disturbances strongly influence whether a peatland plateau recovers or transitions towards a new state, however, these responses remain inadequately quantified. This gap limits our ability to understand and accurately predict how peatlands will continue to transition under increasing warming-induced disturbances, as the partitioning of energy is a fundamental control on environmental stability and functioning. To investigate these responses, we examined seven peat plateaus with various degrees of permafrost thaw, and five of which were burnt in wildfires in 2014 or 2022. Six sites are in the southern Dehcho region of the Northwest Territories and one is in northeastern British Columbia. The BC site allows us to assess a latitude-for-time comparison of advanced permafrost thaw in historically similar environments. Using the Composite Burn Index, two sites are classified as low (0.25-1.49), two as moderate (1.50-2.49), and one as high (2.50-3.00) burn severity. All sites have multi-year records of incoming and outgoing short-and-longwave radiation. Using these datasets, we (a) quantified annual radiation regimes at each site, (b) compared regimes across different disturbance phases, identifying shifts in flux densities and patterns, and (c) synthesised the variation in radiation responses relative to plateau thaw progression, dominant disturbance type, and burn severity.

Spatial and Temporal Variability of Snow and its Effects on Lake Ice in Yellowknife, NT

Alicia Pouw

Wilfrid Laurier University

Ice roads and winter trails are critical transportation routes in northern Canada, yet their reliability is increasingly challenged by changes in snowfall. While ice thickness is a key indicator of ice road safety, ice composition is equally important. Snow ice, formed when the weight of accumulated snow depresses the ice surface, causing overflow and slush at the snow-ice interface, generally has a lower load-bearing capacity than congelation ice. Thus, variability in snowfall timing and frequency can influence lake ice development and the operational capacity of ice roads.

This study examines the effects of snowfall timing on lake ice development across three sub-Arctic lakes near Yellowknife, Northwest Territories (Ryan, Landing, and Rater Lakes). Ground-penetrating radar and in-situ observations were collected during the winters of 2023–2024 and 2024–2025. Early snow accumulation in 2023–2024 led to snow ice comprising 24–36% of total ice thickness by March, while a single late-season storm (18.3 cm in three days) nearly doubled snow-ice proportions across all lakes. In contrast, the 2024–2025 season experienced comparable total snowfall but greater variability in its timing. This produced snow-ice proportions of 0-26%, except on the wind-limited lake, where snow-ice reached 40%. Despite differences in snow-ice composition, average snow depth and total ice thickness remained relatively consistent across the lakes over both seasons. These findings highlight the critical role of snowfall timing and lake-specific conditions in ice growth and underscore the implications for winter travel safety and infrastructure resilience in a changing climate.

Leveraging artificial intelligence and IoT for predictive quality control in production systems

Emmanuel Oyediran

University of Ibadan

Ensuring consistent product quality remains a major challenge in many modern production systems, where quality checks are often reactive and conducted only after defects have occurred. This reactive approach results in material waste, production delays, and customer dissatisfaction. The integration of

Artificial Intelligence (AI) and the Internet of Things (IoT) offers a promising pathway toward predictive quality control, allowing machines and sensors to detect and prevent irregularities before they lead to faults. This study explores how AI-driven IoT frameworks can transform traditional inspection methods into proactive, data-based processes that enhance continuous improvement and operational efficiency.

The research adopts a hybrid model that integrates IoT-enabled sensors to collect real-time data on process parameters such as temperature, vibration, and product dimensions. These data are analyzed using AI algorithms, particularly machine learning models like Random Forest and Support Vector Machines, to predict deviations and recommend corrective actions. A pilot simulation within a small-scale manufacturing environment tests the framework's predictive accuracy and responsiveness.

Preliminary results indicate improved detection of quality deviations, reduction in scrap rates, and greater stability in process control. The findings demonstrate that AI-assisted IoT systems not only minimize waste and downtime but also promote smart manufacturing and sustainable innovation. Ultimately, this research provides a foundation for advancing continuous improvement practices in production systems globally.

Using the SWOT KaRIn Sensor to Retrieve Lake Ice and Overlying Snow

Hayley Kavanagh

University of Waterloo

This research focuses on exploring the capabilities of the SWOT satellite mission's Ka-band Interferometric Radar (KaRIn) sensor for retrieving lake ice and overlying snow properties. SWOT KaRIn Version D Pixel Cloud Data Products are compared to in-situ snow and ice measurements on Łù'àn Män (Kluane Lake) during the Calibration and Validation phase that took place over a three month period in 2023. The Snow Microwave Radiative Transfer (SMRT) model is used to simulate backscatter for varying snow and ice scenarios to better understand variances in observed backscatter across the lake. Optical satellite acquisitions are also utilized to extract and compare backscatter to surface reflectance to analyze seasonal lake ice phenology trends. Preliminary results indicate that KaRIn-retrieved heights are inconsistent during the winter season. Additionally, the contrast in backscatter for ice and open water allow for effective ice cover mapping. During the winter season, backscatter values exhibit a general negative pattern, with SMRT simulations indicating a correlation to snow cover variability.

Understanding under-ice light availability in MacDonald Lake: A multi-year assessment of PAR, snow and ice conditions

Imran Smlatic

University of Toronto Mississauga

Under-ice light availability is a critical but under-characterized driver of winter limnological and ecological processes, particularly within small, seasonally frozen lakes of Central Ontario. This study focuses on MacDonald Lake in Haliburton Forest and Wild Life Reserve, and aims to develop a detailed understanding of photosynthetically active radiation (PAR) transmission through ice and snow during the winter season. A MiniPAR Logger was deployed beneath the ice to collect continuous, high-frequency PAR measurements, providing a robust time series of under-ice light conditions. Additionally, weekly manual measurements were made using a LiCOR underwater pyranometer deployed under the ice during the 2023-24 and 2024-25 season. Ice-on and ice-off periods were identified using field images and visual assessments to ensure accurate delineation of seasonal transitions. To characterize the physical controls on light penetration, weekly in situ snow-depth measurements were collected using a MagnaProbe or manual measurements. Ice-thickness measurements acquired along lake transects using auger and probing methods were used to capture spatial variability in ice structure, while near-continuous ice-thickness records from an ASL Environmental Sciences Shallow-Water Ice Profiler (SWIP) provided high-resolution temporal variability in ice growth and decay. This project synthesizes datasets spanning 2018–2024 to evaluate how snow accumulation, ice structure, and seasonal transitions interact to shape the winter light environment. The resulting multi-year, multi-method observational framework enhances understanding of winter PAR dynamics and supports future investigations into under-ice ecological and biogeochemical processes.

Investigation of mercury bioaccessibility in subsistence fishes from the Canadian subarctic

Kiran Sharma

Wilfrid Laurier University

In the Canadian subarctic, remote Indigenous communities rely on subsistence fishing practices for food security and cultural well being. Fish consumption is the primary route of methylmercury exposure in humans, a global contaminant of concern. General consumption guidelines suggest decreasing consumption frequency and meal size, this may not be feasible in remote indigenous communities. Working with Fort Albany First Nation, we investigated the effects of cooking methods (pan-frying and smoking) on total and bioaccessible mercury from commonly consumed fish (Lake Whitefish, Longnose Sucker, Walleye, and Northern Pike) from the Albany River. Total mercury concentrations varied significantly among fish species but not among treatments (raw, pan-fried and smoked). Walleye had the highest total mercury concentrations and Lake Whitefish had the lowest. Using in vitro gastrointestinal models, smoking and pan-frying significantly reduced bioaccessible mercury. The raw treatment had an average of 76% bioaccessible mercury, the pan-fried treatment had 31% and smoked had 26%. In the Lake Whitefish and Longnose Sucker, there was no significant difference in percent bioaccessible mercury between pan-fried and smoked treatments. In the Walleye and Northern Pike, there was a significant difference in percent bioaccessible mercury between pan-fried and smoked treatments. These findings contribute to a more precise risk assessment to the exposure of mercury in the Albany River. Furthermore, this project is part of a bigger project that aims to combine research of the health of the environment with the research of human health, specifically in remote indigenous communities.

Exploring early Earth: Characterization of Banded Iron Formation (BIF) and associated organic matter from the Gunflint Formation, northern Ontario

Jawad Khan

Western University

This study examines microbially influenced mineral structures preserved in the Gunflint Formation BIF, a system often used as an analog for microbe-dominated, low-temperature environments similar to those found in modern cold regions. By characterizing mineralogical and elemental signatures within microfossil-bearing horizons, the findings provide insight into Precambrian environmental conditions that no longer exist today, while highlighting northern Canada as one of the few modern landscapes that can serve as a reproducible analogue for these ancient systems.

Livin' on the edge: landscape and fire characteristics drive moose presence at the limit of their northern range

Claudia Haas

Wilfrid Laurier University

Species distributions have been shifting dramatically in the past century amplified by the impacts of anthropogenic climate change. Moose (Alces alces) have been documented expanding their northern range onto the tundra, however the drivers of this expansion remain unclear. We modelled moose detection rates from camera trapping data along the transition zone between the taiga boreal forest and tundra in Thaıdene Nëné Indigenous Protected Area, NWT to quantify detailed drivers of an edge population of moose, specifically looking at landcover, fire characteristics, and presence of predators and competitors. In summer, the presence and age of fires were the best predictors of moose occurrence; with moose detected the most in habitat that had burned more than 20 years previously and the least in habitat that had not burned in the past 50 years. The best predictor of moose occurrence in the winter was landcover, with the moose detections highest in areas with mixed forest. Competitors and predators had minimal impact on moose detections, contrasting with previous studies. Moose were detected at three locations on the tundra, with multiple sightings at one location, but only in summer. These results suggest that moose use different habitats on the edge of their range, and climate impacts may continue to cause changes in this species' distribution in the future.

Plant community response to late-lying snowpatch dynamics in the Torngat Mountains National Park

Alyssa Goulet

University of Waterloo

Seasonal snow cover is a defining environmental driver of tundra ecosystems. In areas with favorable topographic characteristics, snow can persist long into the summer, creating late-lying snowpatches with microclimatic conditions affecting soil moisture, decomposition rates, plant phenology and other biological processes. These microhabitats support distinct plant communities with specialized functional traits, but ongoing Arctic warming is likely to affect these restricted ecosystems. However, the specific effects of late-lying snow on plant communities, particularly in the Torngat Mountains National Park (TMNP), remain poorly understood. This research aims to characterize plant community composition and functional traits of late-lying snowpatches and investigate their temporal dynamics within TMNP. Using satellite imagery, we will assess changes in snowpatches size and melt timing over the past 10 years in the southern portion of TMNP. In the field, we will examine community composition and functional traits along snowmelt gradients (zones of earlier and later snowmelt). We predict that late-lying snowbeds will decrease in size over time and experience earlier seasonal melts while species in late-lying snowbeds will exhibit functional traits better suited to wetter conditions and shorter growing seasons, with partial overlap between snowbeds species and the surrounding tundra. This research will improve our understanding of how these highly restricted ecosystems will respond to continued climate change and contribute to broader assessments of vegetation change in the Arctic.

Community-oriented forecasting of ice jam floods: A case study in Sambaa K'e, NWT

Katie Schill

University of Waterloo

Rapid climate change across Northern Canada is leading to greater uncertainty in river-ice dynamics and an increased risk of ice jam floods. Although remote northern communities like Sambaa K'e, NWT face heightened vulnerability due to limited hydrometric monitoring, a lack of baseline data, and changes in river-ice dynamics brought on by climate change, current flood research and forecasting tools are primarily designed around southern, urbanized regions. This vulnerability became evident in May 2022 when an ice jam on the Island River resulted in extensive flooding and property damage across the community, highlighting the need for improved local forecasting capacity.

This project investigates the drivers and hydrological conditions that led to the 2022 flood, using federal hydrometric and climate monitoring datasets, observations by the local Indigenous community, and government field reports to reconstruct pre-flood conditions and examine key climatic drivers and river-ice characteristics. It will also involve developing preliminary stage-discharge rating curves for major inflows to Trout Lake to strengthen baseline monitoring data records for the community. The research will culminate with the presentation of early-warning ice jam flood indicators to the Sambaa K'e community, and the development of a foundational hydrological dataset for Sambaa K'e will support future community-led monitoring and flood preparedness within the community. Ultimately, by improving ice jam flood forecasting capacity in this data-sparse, rapidly warming northern region, this work will contribute to more equitable, climate-resilient flood management across Canada.

Snow-ice interactions and slush development in a changing winter climate: Evidence from 10 years of lake ice data

Sofia Chemeris

University of Toronto Mississauga

Seasonal lake ice in Central Ontario is highly sensitive to winter air temperatures, snowfall patterns, and mid-winter melt events. These factors shape the relative growth of black and white ice and determine when snow becomes waterlogged, forming slush. This process remains understudied in temperate, forested lake systems. In this project, I analyze approximately a decade of weekly ice-thickness, snow-depth, and slush-related observations from Haliburton Forest and Wild Life Reserve (2015–2024) to examine how changing winter conditions affect ice structure and slush development. Using field measurements collected at MacDonald and Clear Lakes, I will quantify total ice thickness, the relative contributions of black and white ice, snow depth and density, and the presence and thickness of slush.

I will combine these records with cleaned daily meteorological data from the on-site weather station to investigate relationships among air temperature, freeze–thaw cycles, precipitation type, and slush occurrence. Particular attention is given to winters with unusual weather patterns, including warm and wet periods that produced widespread slush across multiple weeks. By organizing these partial records into a consistent dataset, this project clarifies how snow loading, variable winter temperatures, and mid-season precipitation contribute to slush formation and evolving lake-ice structure in Central Ontario. The results will contribute to ongoing long-term monitoring in Haliburton Forest and support a broader understanding of lake-ice behaviour under shifting winter climate conditions.

Effects of temperature dynamics on dissolved organic carbon export from permafrost soils

Huong Nguyen

University of Waterloo

Northern permafrost regions are experiencing increased thawing and deepening of the active soil layer due to rising air temperatures driven by global warming. This process can intensify the release of trapped organic carbon, particularly dissolved organic carbon (DOC), from the permafrost into surrounding freshwater lakes, a primary driver of lake browning (colour change), causing direct detrimental effects on aquatic ecosystems and indirect effects on surrounding ecosystems and communities. This project examines the effect of temperature on DOC release and nutrient export from thawing permafrost soils into nearby freshwater bodies and the lake browning trends in Great Bear Lake (GBL), located in the Northwest Territories (NWT), Canada. The permafrost soil cores collected from a field site close to GBL in Deline were incubated in a series of soil column experiments at different temperatures of 1, 5, 10, and 15°C, mimicking spring to summer field temperature conditions and weekly precipitation events. Leachates were collected after simulated rainfall events and analyzed for degree of browning, DOC quantity and quality, dissolved inorganic carbon (DIC), and total nitrogen (TN). While quantity of DOC export did not exhibit a clear dependency on temperature, percent of DOC aromaticity decreased with increasing temperature. Additionally, there were clear positive temperature effects on the export of DIC and TN. The results from this project can be utilized as a baseline to predict large-scale consequence of lake browning in northern cold regions under changing climate scenarios.

Has natural gas development altered sediment metal concentrations in Fisherman Lake, NWT?

Emma Bacchiochi

University of Waterloo

Even long after an oil and gas plant is shut down, a decommissioned site can pose environmental risks from dispersion and deposition of legacy contaminants. Such risks are a concern at Fisherman Lake, near Fort Liard, NWT. The waterbody holds deep cultural importance to the nearby Indigenous community, having supported generations of hunting and fishing. The lake is located 3.5 km downgradient from the Pointed Mountain Gas Plant, which operated from 1971-2001. Past spills and seepage from a former surge pond have elevated concerns and raised an important question “Has the Pointed Mountain Gas Plant caused measurable contamination in the sediments of Fisherman Lake?”. To address this question, metal concentrations are being measured in a radiometrically-dated sediment core collected near the lake center in September 2025. The core will be used to reconstruct historical environmental conditions at Fisherman Lake to determine both the timing and magnitude of changes in metal deposition. This reconstruction will help establish background, reference concentrations from measurements on pre-1900 sediments, well before the operation of the Pointed Mountain Gas Plant and prior to most far-field industrial pollution. Potential enrichment associated with the operation and legacy effects of the Pointed Mountain Gas Plant and far-field pollution will then be assessed by comparing modern sediment concentrations (i.e., post-1900) against the baseline. Currently, the samples are being analyzed for metal concentrations at a commercial lab, and the results will be reported back to the community along with the implications for those who utilize natural resources at Fisherman Lake.

Modularized marine infrastructure for cold-region urban development

Omar Gad

McMaster University

The strategic development of cold regions is becoming increasingly critical; however, the expansion of essential urban infrastructure, particularly small modular reactors (SMRs) required for land reclamation faces substantial logistical and construction challenges. Large-scale urbanization in these remote areas depends heavily on the ability to transport oversized components, for which marine shipping remains the most practical and reliable mode. Yet cold-region coastlines lack the marine infrastructure required to receive such cargo, as conventional port construction is slow, costly, and technically complex under severe climatic and geotechnical conditions. This study presents several alternative solutions for a scalable, modular construction approach aimed at enabling the rapid development of berthing facilities in cold-region environments. The proposed concepts focus on creating structurally robust, modular quay systems capable of providing the required retaining height for safe vessel berthing. These alternatives offer a major advantage by significantly reducing construction time, allowing installation during the limited favourable summer weather window while also minimizing carbon emissions compared to conventional construction methods. A numerical analysis using PLAXIS 2D is conducted to evaluate global stability and to quantify straining actions for different proposed alternatives. Proposed alternatives provide a robust, rapid, and cost-efficient solution by utilizing standardized components. The study further highlights key structural interfaces that govern system performance. Overall, the research concludes that modular based marine structures offer a practical approach for accelerating port development in cold regions. By enabling faster establishment of berthing facilities, this approach supports the transport and deployment of critical infrastructure necessary for sustainable cold-region expansion.

Seismic line restoration in Northeastern B.C.: A look at in-line mounding & hummock transfer

Henry Gibbons

University of Waterloo

Peatlands store approximately one third of the global soil carbon pool. Canada is home to 170 million hectares of peatlands, which can be found in northern areas of the country. Peatlands are home to different types of vegetation that influence their ability to store carbon. Unfortunately, through oil and gas exploration these systems become disturbed by seismic line creation. Seismic lines are linear disturbances which can span many kilometers and are often formed in grid like patterns. Some of which are found in northeastern British Columbia. These disturbances often alter a peatlands innate ability to store carbon. Seismic lines can be restored through active treatment using techniques such as inline mounding and hummock transfer. Therefore, the objectives of this study is (1) Determine the effect of restoration with different techniques such as inline mounding and hummock transfer on northeastern British Columbia peatland seismic lines' carbon cycling and greenhouse gas exchange. (2) Determine the effect of seasonal timing of restoration (fall vs. winter) on northeastern British Columbia seismic lines regarding carbon cycling and sequestration. Potential results of this study could inform operators and government about which forms of active treatment are the most effective regarding carbon dynamics.

Fire regime reconstruction using lake sediment from the Canadian Arctic

Mickey Chen

University of Toronto

In recent years, large areas of northern Canada and the American southwest have experienced record-setting wildfire seasons which have significantly increased airborne pollution, forced community evacuations, and damaged cultural heritage locations. Some research has linked recent changes in fire activity to broader climate trends (e.g., climate warming). To understand future fire trends, it is insufficient to rely solely upon recent historical data. Therefore, we take a paleoclimate perspective to investigate changes to fire regimes in response to climate and ecological forcing since deglaciation to explore potential future changes to the Canadian boreal ecosystem. We reconstruct past fire regimes using Holocene era lake sediment cores located in Yukon and Northwest Territories. Lake sediments represent sequential deposition over time. We extracted fire-related chemical biomarkers (i.e. polycyclic aromatic hydrocarbons) from each sequential layer of sediment to quantify fire events. We expect differences in local ecology at each sediment layer to be reflected in the relative concentrations of these pyro-molecules. This biomarker record enhances our understanding of fire ecology at these selected sites by better characterizing the nature of different fire regimes. Furthermore, we expect the broad aerial distribution of the biomarkers prior to their settling in lakebeds to reflect a more regional fire signal as opposed to existing charcoal-based studies. To refine our interpretation of fire ecology, we link our record to existing pollen-based environmental reconstructions of the same sites. Our findings will contribute to understanding the implications that climate change will have on the Canadian boreal forest ecosystem.

Seasonal patterns in plankton metal(loid) bioaccumulation in subarctic lakes that span a gradient of impact from legacy mining

Trish Rodrigues

York University

The discovery and extraction of gold in Yellowknife played an important role in the economic development of both the city and the Northwest Territories. However, decades of mining activity released substantial quantities of arsenic, antimony, lead, mercury, and other contaminants into the surrounding landscape, leaving behind a legacy of metal(loid) contamination in the environment. Arsenic contamination in Yellowknife lakes has been widely studied, but significant knowledge gaps remain regarding the mobility and biological uptake of other metal(loid)s in these lakes. To address these knowledge gaps, this study analyzed metal(loid)s in plankton tissues across five Yellowknife-area lakes that span a gradient of impact from historic mining pollution, using samples collected in the ice-free and open-water seasons from 2022-2024. We will assess and compare metal(loid) bioaccumulation patterns across lakes and across seasons and investigate the limnological factors that may influence bioaccumulation potential. The results of this research will contribute to a broader understanding of legacy mining contamination in northern lakes and support ongoing research and monitoring efforts in the Yellowknife region.

Multiscale studies of permafrost degradation and solute fate in discontinuous permafrost

Jiaqi Weng

University of Waterloo

Permafrost degradation is proceeding in Northern Canada due to warming climatic conditions, which is impacting local ecosystems and native communities by affecting water balances, landform transition, and solute/contaminant transport. Due to the geologic and hydrogeologic complexity of the northern landscape, permafrost may respond differently under distinct thawing scenarios. To advance the understanding of freeze-thaw dynamics as related to permafrost degradation, it is essential to investigate the complex interaction between different freeze-thaw processes under various thawing scenarios. The current research focuses on the relative influence of a wide range of freeze-thaw processes that are often considered but sometimes undifferentiated in cryo-hydrogeological studies. These include heat advection, latent heat, cryosuction, freezing-thawing hysteresis, frost heave and thawing settlement, and solute transport processes. The combined influence of these various processes is numerically evaluated under different thawing scenarios including various soil and terrain configurations, subsurface hydraulic boundary conditions, climate variability and solute source type. Numerical testing models (NTMs) developed using COMSOL Multiphysics, incorporate full coupling of thermal, hydraulic, soil mechanical, and chemical (THMC) processes. A 2D synthetic cross section is generated to represent a gravity-driven groundwater basin in discontinuous permafrost terrain. The role of each process is assessed by its inclusion or exclusion in a 3-year simulation under different freeze-thaw scenarios. The most influential processes are then prioritized for incorporation into multi-scale cryo-hydrogeological models to enhance predictive capabilities.

Laurier’s Yellowknife research facilities & amenities

Isabel Hilgendag

Wilfrid Laurier University

Wilfrid Laurier University has a variety of facilities and amenities in Yellowknife, NWT, available to students, staff, faculty, and external researchers. The Yellowknife Research Office, located in downtown Yellowknife, has free desk space available to visiting researchers, a boardroom to host meetings, and satellite communication devices available for rental. Laurier's research facility and researcher house, located on Enterprise Drive in Yellowknife's Kam Lake district, is open year-round to affiliated and non-affiliated students and researchers. The researcher house consists of 12 beds, three bathrooms, a full kitchen, living room, and a rec room with three desks. Bicycles are also available to guests for rental. The research facility consists of a basic lab space, fridges and freezers for temporary sample storage, and warm and cold storage for research gear and equipment. Further amenities consist of a truck and snowmobiles available to Laurier students, staff, and faculty for research purposes. Wilfrid Laurier University's facilities and amenities are uniquely located in Yellowknife to serve students and researchers from a range of disciplines conducting research in the Northwest Territories and beyond.

Assessing Yttrium toxicity in early-life stages of Arctic and temperate fish under altering water chemistry

Mustajab Khalid

Wilfrid Laurier University

Rare earth element (REE) mining is expanding in Canada, raising concerns of contamination in aquatic environments. Yttrium (Y) is a common byproduct of REE mining and is used for screen manufacturing. Current Federal Environmental Quality Guidelines (FEQGs) are supported by the Biotic Ligand Model (BLM), a predictive tool used for site-specific metal toxicity in fish. Furthermore, no FEQGs currently exist for Y, and existing toxicity datasets are based on temperate fish species, without accounting for cold-adapted fish physiology. Additionally, the BLM does not model Y and its interactions with water hardness and dissolved organic matter (DOM). These key modifiers fluctuate in sub-Arctic lakes as snow and permafrost thaw. To address this gap, I will quantify 7-day median lethal concentrations for Arctic char and rainbow trout larvae to compare species-specific sensitivity to Y. I will then conduct a 30-day sublethal exposure in Arctic char larvae to test how fixed hardness and DOM levels modulate Y toxicity. Across experiments, internal and aqueous concentrations of Y, Ca, Mg, and DOM will be measured using inductively coupled plasma spectroscopy and total carbon analyzer, alongside key developmental endpoints such as yolk absorption, growth (length/weight), and survival. This study will be the first to characterize how Y interacts with DOM and hardness during early development in cold-adapted fish. Overall, these findings will fill a critical data gap for Y toxicity, support future FEQG creation, and improve site-specific assessments for REE mining in northern freshwater ecosystems.

Effects of rare earth elements (REE), Nd, Pr, and Y in arctic algae, Chlamydomonas sp.

Celine Do

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Neodymium (Nd), praseodymium (Pr), and Yttrium (Y) are three rare earth elements (REEs) that occur in the mineral ore bastnaesite, the primary ore of Canada's first REE mine on Thor Lake, Nechalacho, NT. REEs were included in the Canadian Critical Minerals List as they are key components in various green energy equipment, particularly wind turbines and electric vehicles. As such, there is a rising concern about environmental risks due to anthropogenic contamination. However, minimal data is currently available regarding REEs and their mixtures. The objective of this study was to investigate the effect of REE mixtures in arctic algae, Chlamydomonas sp. The arctic algae were exposed for 7-d at 12°C with constant light exposure (3000 lux) and a pH of 6.5. For example, the 7-d IC50 for Nd was 1.91 mg/L (95% CI of 1.70-2.15 mg/L), for Pr was 2.09 mg/L (95% CI of 1.54-2.83 mg/L), and for Y was 1.32 mg/L (95% CI of 1.09-1.59 mg/L). Mixture exposures were designed using a toxic unit (TU) approach, based on converting the IC50 concentrations from previously conducted single metal toxicity tests to TUs and applying a matrix isobologram approach. For example, TUs of 0.2 (IC10) and 0.4 (IC20) were prepared to observe whether responses would follow an additive interaction.

When elements compete: How calcium mitigates neodymium toxicity to rainbow trout

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Neodymium (Nd) is a high-demand rare earth element (REE). REE's are a priority on the Canadian Critical Minerals List and there are currently no published federal water quality guidelines for REEs. The goal of my research is to characterize Nd exposure-effect relationships of Nd in freshwater rainbow trout. Exposures were conducted at 12C in soft water (30 mgCaCO3/L, pH 7.0) with sampling at 12, 24, and 48h, as well as 7, 14, 21, and 36d. Responses were hypothesized to demonstrate a damage-repair-acclimation response. Dissolved Nd concentrations in exposure solutions were greater than 90% of total. Initial exposures at 21, 48, 78, and 152 ugNd/L were acutely lethal. Subsequent exposures at 5 and 10 ugNd/L resulted in significant bioaccumulation of Nd in gill, liver, and kidney but not muscle. Plasma Na+, Cl-, K+, and glucose concentrations were largely unaffected by Nd exposure. Trout survived exposure to 5ug Nd/L but experienced an initial and temporary loss of plasma Ca2+. Exposure to 10ug Nd/L resulted in mortalities, associated with disruptions of plasma Ca2+ (loss) and Mg2+ (increase). Exposure to 10ug Nd/L + 18 mgCa/L was protective against trout mortalities (all fish survived), and bioaccumulation was significantly reduced compared to 10 ugNd/L exposure without added Ca. Findings of this study illustrate the acute and chronic effects of Nd exposure to trout, contributing foundational knowledge of Nd toxicity to inform federal water quality guidelines. This research is supported by NSERC (Alliance), Environment and Climate Change Canada, Stantec Inc., and Nechalacho Resources/Vital Metals Inc.

Hydrological modelling to better improve carbon and methane emission estimations

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Hydrological studies in the Western Canadian Arctic are dominated by lakes and wetlands. These systems and their role within the global carbon cycle are poorly understood and results from literature of methane concentrations have large differences between them (Ganesan et al., 2019, Jacob et al., 2016). The dynamics of what we do know though are changing as climate change begins to rapidly shift these northern landscapes at rates unprecedented anywhere else across the globe. This study falls within a larger collaborative effort to better improve estimates for methane emissions from Arctic wetlands and lakes (both modelled and observed). This study specifically is looking at simulating and validating a variety of different watersheds and landscape features across both the Northwest Territories and Sweden test areas to provide the inputs necessary to map methane storage and emissions. In the NWT area three watersheds will be looked at: Hans Creek, a large, tundra lake dominated watershed north of the treeline (300 km2); Trail Valley Creek, a large tundra lake poor watershed north of the treeline (55km2); and Havikpak Creek, a smaller forest dominated watershed (18km2). In the Sweden test area we will look at Abisko Stordalen, a small palsa peat bog (8km2) We will use the cold regions hydrological model, GEOtop, to simulate water table depths, active layer depths, and stream discharge, and validate this with our own discharge data collected in situ alongside data from Water Survey Canada.

Canadian connectivity: Economics of northern transportation networks

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Efficient transportation networks drive quality of life and innovation. In Canada, cities and towns along major transportation networks reap the benefits of this connectivity, while rural areas and northern communities are physically ostracized from the Canadian economy. Without reasonable access to these networks, rural areas are limited in the services, goods, and work available – and thus, they are devoid of purchasing and supplier power in the current late-capitalist model for well-being. As you move further north, the influence of climate change and aging infrastructure becomes increasingly evident as ice road seasons become shorter and road and rail access dwindles. Rural Canadians' opportunities are largely dictated by resource extraction and corporate or military activities for infrastructure improvement, but when these operations cease, they experience disinvestment. The recent Canadian budget has significant promises to support northern infrastructure; however, these investments rely on equivalent private investment and do not directly respond to existing conditions affecting locals and areas without resource extraction. These large-scale investment plans are a barrier to entry for small-scale businesses, government, and communities because of the lack of existing infrastructure. Future investments must respond to existing local concerns through community involvement to support the Canadian and northern economy more effectively.

Seasonal Habitat Use of Muskox (Yutthéjëré; Ovibos moschatus) at the Southern Edge of Their Range

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Canada's north is changing rapidly due to climate change and other anthropogenic disturbances, altering habitat availability and the distribution and abundance of resident species. Whereas most ungulates in North America are predicted to move north with climate-induced habitat change, muskox (Yutthéjëré; Ovibos moschatus) on the mainland of the Northwest Territories (NWT) have been expanding their range south of the tree line into the boreal forest. My research uses photos from camera traps to quantify seasonal muskox-habitat associations across a boreal-tundra transitional region on the East Arm of Great Slave Lake (Tu Nedhé), specifically Thaıdene Nëné Indigenous Protected Area, NWT. I ask whether muskox occurrence varies spatially and temporally across habitats and investigate if muskox select habitat based on predation pressures, land cover classes, or recent burns. I found that predation from grizzly bears and gray wolves are the main driver influencing muskox distribution in TDN. This information will support management and conservation as Muskox begin occupying habitats south of the tree line.

Physiological Stress in Rainbow Trout Across Different Severities of Sea Lamprey–Inflicted Parasitism

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The invasive sea lamprey (Petromyzon marinus) is a major threat to native teleosts in the Great Lakes. Rainbow trout (Oncorhynchus mykiss) experience significant physiological stress and mortality as a result of parasitic feeding. Lamprey feeding involves rasping tissue removal and the secretion of lamphredin, which is a potent anticoagulant. This interaction forces the host to cope with blood loss, osmotic imbalance, and the high metabolic demands of tissue repair and detoxification. Evidence on related salmonids suggests that physiological stress increases when wounds are more severe, but this relationship has not been investigated in rainbow trout. This study examines how wound severity influences the internal stress response in trout following lamprey feeding. Trout will be exposed to natural lamprey attachment for several weeks, along with a non-parasitized control group. Each parasitized fish will be photographed, and wounds will be scored by evaluating features such as puncture depth, tissue loss, and bruising. To understand the internal impact of these wounds, several physiological indicators will be measured. These include plasma cortisol for hormonal stress, protein carbonyls and lipid peroxides for oxidative damage, and total lipid, protein, and glycogen concentrations for tissue energy reserves. By comparing trout with different wound severities, this research will help explain how external injuries reflect the internal challenges faced by trout during parasitism. These insights may also support monitoring efforts, since external wounds could offer a practical way to identify areas with high lamprey pressure and greater physiological risk for affected salmonids.

The influence of fire on lake biogeochemistry, Scotty Creek, NWT, Canada

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The southern Taiga Plains ecoregion in northwestern Canada is one of the most rapidly warming regions on Earth. This shift stemming from climate change has driven high rates of permafrost thaw and wildfires, inducing changes to the structure and hydrological function of the raised peat plateaus, collapsed scar wetlands, and channel fens that dominate the ecoregion. Small, shallow (1-2 m depth) lakes are another prominent feature of the Taiga Plains, serving as sentinels of broader landscape change as reflected in their physical, chemical, and biological characteristics. In 2022, most of the peatland-dominated headwaters of Scotty Creek were burned by a late-season wildfire, resulting in high mortality of tree canopies and understory, blackening a large portion of the catchment areas of the lakes. This study aims to assess how different lakes of the Scotty Creek watershed uniquely reflect landscape transitions driven by wildfire and permafrost thaw through a comparison of three shallow lakes, each connected by channel fens and surrounded by a burned catchment area. This will be achieved by 1) performing surface water sampling of the lakes and surface and pore water sampling of their flow paths; 2) quantifying discharge of channel fen flow and saturated flow from the edges of plateaus; and 3) delineating and identifying the burned severity of adjacent lake catchment areas. This research will enhance the application of lake systems to track environmental change in peatlands affected by thawing permafrost and wildfire.