OCSNRS 2020 SÉRNOC

Ottawa-Carleton Student
Northern Research Symposium

Symposium Étudiant de Recherche
Nordique D'Ottawa-Carleton

Programme and Abstracts

09:00-16:30
March 20, 2020
CRX C220/C230
Learning Crossroads (CRX)
100 Louis-Pasteur Private
University of Ottawa
Ottawa, Ontario, Canada
K1N 6N5

09 h 00 à 16 h 30
Le 20 mars 2020
CRX C220/C230
Carrefour des apprentissages (CRX)
100 Louis-Pasteur
Université d'Ottawa
Ottawa, Ontario, Canada
K1N 6N5

Welcome to the 2020 edition of the OCSNRS!

The Ottawa-Carleton Student Northern Research Symposium is an annual one-day conference that brings together undergraduate and graduate students from the University of Ottawa and Carleton University who are involved in northern research. It provides an opportunity for students to present their research, network, and to broaden their knowledge of the polar regions. Students from any discipline are welcome, given that their research takes place to the north of the southern limit of discontinuous permafrost.

The University of Ottawa is pleased to host the 2020 edition of the OCSNRS in partnership with the University of Ottawa Library and the Geographic, Statistical and Government Information Centre (GSG).

Light lunch and refreshments will be provided throughout the day.

University of Ottawa Indigenous Affirmation

We pay respect to the Algonquin people, who are the traditional guardians of this land. We acknowledge their longstanding relationship with this territory, which remains unceded. We pay respect to all Indigenous people in this region, from all nations across Canada, who call Ottawa home. We acknowledge the traditional knowledge keepers, both young and old. And we honour their courageous leaders: past, present, and future.

Sponsors

The 2020 OCSNRS organizing committee would like to acknowledge the Geographic, Statistical and Government Information Centre of the University of Ottawa Library (GSG), the University of Ottawa Department of Geography, Environment and Geomatics (GEG), the Geography Graduate Student Association (GGSA), the Geography and Environmental Studies Undergraduate Student Association (GAIA), the University of Ottawa Faculty of Arts Student Experience Fund, and the University of Ottawa Graduate Student Association (GSAED) Academic Project Fund for their generous financial and in-kind support.

OCSNRS 2020 Organizing Committee

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PROGRAMME:

Friday, March 20, 2020. CRX 220/230, Learning Crossroads Building, University of Ottawa.

	08:00-09:00	*Registration and Poster Installation (Coffee and Tea Available)*
Morning	**09:00-09:10**	**Welcome, Opening Remarks, and Land Acknowledgement**
	Plenary	
	09:10-09:50	*Faces in Stone – New Archaeological Research at Qajartalik.* **Dr. Karen Ryan,** Canadian Museum of History
	Session I	**People and Places;** Chaired by Zuzanna Kochanowicz
	09:50-10:05	*Cultural Continuity and Inuit Health in Arctic Canada.* **Sarah Newell,** University of Ottawa
	10:05-10:20	*Informing Colorectal Cancer Screening in Northern Canada Using Participatory Simulation Modeling.* **Heather Smith,** University of Ottawa
	10:20-10:35	*Understanding the Role of Community Energy in Sustainability Transitions: Integrating New Research Contexts from the Canadian North.* **Jessica Leis,** Carleton University
	10:35-10:50	*Leading On-the-Land Science Camps with Indigenous Youth: Towards Reciprocity in Research.* **Stephanie Woodworth & J.F. Lane,** University of Ottawa
	10:50-11:10	**Health Break and Poster Viewing** (Coffee and Tea Available)
	Session II	**Monitoring and Modelling;** Chaired by Abigail Dalton
	11:10-11:25	*Shorebird Breeding Densities Across the North American Arctic: Which Habitat Characteristics are Important at Which Scales?* **Christine Anderson,** Carleton University
	11:25-11:40	*Adiabatic Lapse Rate Modelling in Yukon, Canada.* **Hannah Ackerman,** University of Ottawa
	11:40-11:55	*Using Modelling to Predict Post-Fire Frozen Ground Trajectories near Nain, Nunatsiavut.* **Yifeng Wang,** University of Ottawa
	11:55-12:10	*Spatial Patterns and Textural Characteristics of Surface Disturbances in a High Arctic Environment: Cape Bounty, Melville Island, Nunavut (2013-19).* **Greg Robson,** Queen's University
	12:10-12:25	*Development and Testing of a Streamflow Forecasting Model for the Niaqunguk Watershed, Iqaluit, Nunavut.* **Riley Cormier,** Carleton University

	12:25-14:00	**Lunch and Poster Viewing**
Afternoon	**Session III**	**Snow and Ice;** Chaired by Hannah Ackerman
	14:00-14:15	*Disappearance of a Small Icefield in Expedition Fiord, Axel Heiberg Island, Canada.* **Braden Smeda,** University of Ottawa
	14:15-14:30	*Surface Features of the Cold/Temperate Ice Transition Zone of White Glacier Terminus, Axel Heiberg Island, NU.* **Jeremiah Lee,** Queen's University
	14:30-14:45	*Landfast Sea Ice Break-Up in Admiralty Inlet, NU.* **Ada Loewen,** Carleton University
	14:45-15:00	*Formation and Drainage of Glacier Dammed Donjek Lake, Yukon.* **Moya Painter,** University of Ottawa
	15:00-15:15	*Monitoring of the Polar Regions: The Power and Potential of the Open-Source Cryologger Platform.* **Adam Garbo,** University of Ottawa
	15:15-15:35	**Health Break and Poster Viewing** (Coffee and Tea Available)
	Session IV	**Tracking and Characterizing Chemicals and Contaminants;** Chaired by Kethra Campbell-Heaton
	15:35-15:50	*Characterization of Carbon and Suspended Material in Headwater Streams Across High Arctic Watersheds.* **Evan Koncewicz,** Queen's University
	15:50-16:05	*Paleolimnological Assessment of Wildfire-Derived Atmospheric Deposition of Trace Metal(loid)s to Subarctic Lakes (Northwest Territories, Canada).* **Nicholas Pelletier,** Carleton University
	16:05-16:20	*Giant Mine, Giant Problem: How Mining Emissions Have Affected the Toxicity of Mercury in Yellowknife, NWT.* **Mija Azdajic,** University of Ottawa
	16:20-16:30	**Announcement of Photo Contest Winner and Closing Remarks**
	17:00-19:00	**Social - The Royal Oak (161 Laurier Ave.)**

POSTERS:

- *A Continental Scale Spatial Investigation of Sediment Organic Matter using Sedimentomics.* **Bell, M.A.,** Department of Biology, University of Ottawa; Overy, D., Blais, J.
- *Estimating the Deposition of Microplastics to the Environment Surrounding Arctic Breeding Colonies via Seabird Guano.* **Bourdages, M.P.T.,** Carleton University; Provencher, J.F., Environment and Climate Change Canada; Baak, J., Rochman, C.M., Braune, B., Mallory, M., Geoffroy, C., Vermaire, J.C.
- *Getting Patients to Scopes in the North: A Review of Endoscopy Cancellations in Remote Northern Canada.* **Brunet, N.,** Faculty of Medicine, University of Ottawa; Smith, H., Tessier, A., Kuziemsky, C.
- *Ice Wedge Activity in the Canadian High Arctic.* **Campbell-Heaton, K**., Department of Geography, Environment and Geomatics, University of Ottawa; Lacelle, D.
- *Chironomid-Inferred Environmental Change in Igloolik, Nunavut.* **Cincio, P.,** Department of Geography, Environment, and Geomatics, University of Ottawa; Wesche, S., Medeiros, A., Gajewski, K.
- *Identifying Iceberg Sources, Drift Patterns, and Potential Risk in Canadian Waters.* **Dalton, A.**, Department of Geography, Environment and Geomatics, University of Ottawa; Van Wychen, W., Copland, L.
- *Local Food Initiatives in the Moose Cree First Nation: Understanding Local Food Development.* **Ferreira, C.,** School of Human Kinetics, University of Ottawa; Robidoux, M., Gaudet, C.
- *Characterization of the Light-Harvesting Complex (LHC) Gene Family in the Dark-Adapted Antarctic Alga Chlamydomonas sp. UWO241.* **Fugard, K.**, Department of Biology, University of Ottawa; Possmayer, Cvetkovska, M.
- *Remote Sensing Analysis of Lake Colour Change and Brownification in Northern Canada.* **George, G.,** Department of Geography, Environment and Geomatics, University of Ottawa.
- *Policing in the Northern Communities.* **Hamel-Touchette, S.,** School of Sociological and Anthropological Studies, University of Ottawa.
- *Spatial Variation of River Water Chemistry Due to Permafrost Degradation in Yukon River Basin.* **Kang, M.,** Department of Earth and Environmental Sciences, University of Ottawa; Bataille, C.
- *A History of Human Occupation in the Canadian High Arctic as Recorded in Sediment Cores of Freshwater Ponds.* **Kissinger, J.,** Department of Biology, University of Ottawa; Murchie, T., Kuch, M., Kimpe, L., Eickmeyer, D., Smol, J. P., Savelle, J., Poinar, H., Blais, J.

- *Spatial and Temporal Vessel Trends in the Tallurutiup Imanga National Marine Conservation Area from 2015 to 2018.* **Kochanowicz, Z.**, Department of Geography, Environment and Geomatics, University of Ottawa; Dawson, J.
- *Photos to Elevations: A Photogrammetry Pipeline.* **Kochtitzky, W**., Department of Geography, Environment and Geomatics, University of Ottawa; Medrzycka, D., Smeda, B., Main, B., Copland, L., Culley, A., Vincent, W., Dow, C.
- *Influence of Distance to Water and Vegetation Cover of Spider (Araneae) Microhabitats on Body Size as a Mechanism against Desiccation in Churchill, MB.* **Martin, D.**, Department of Biology, University of Ottawa.
- *The Effect of Growth Conditions on Temperature Stress Resistance in the Antarctic Extremophile Chlamydomonas sp. UWO241.* **Osmers, P.**, Department of Biology, University of Ottawa; Cvetkovska, M.
- *Predicting Land-Fast Sea Ice Breakout Events in Admiralty Inlet, Baffin Island, Nunavut.* **Patterson, C.,** Department of Geography and Environmental Studies, Carleton University; Mueller, D., Tivy, A., Loewen, A., Crocker, G., Bell, T.
- *Examination of Chlorophyll Biosynthesis in the Antarctic Psychrophile Chlamydomonas sp. UWO241.* **Poirier, M.**, Department of Biology, University of Ottawa; Cvetkovska, M.
- *Firn-Pack Evolution on White Glacier, Axel Heiberg Island, Nunavut.* **Stephenson, D.,** Department of Geography and Planning, Queen's University; Copland, L., Thomson, L.
- *Radiocarbon (14C) and Stable Carbon (13C) Isotopic Measurements of Dissolved Inorganic Carbon (DIC) in Baffin Bay Seawater.* **Zeidan, S.**, Department of Earth Sciences, University of Ottawa; Walker, B.

PLENARY PRESENTATION:

Biography (Canadian Museum of History):
Dr. Karen Ryan joined the Canadian Museum of History in 2010, and her curatorial responsibilities touch on the prehistory and history of Canada's North. Dr. Ryan has conducted archeological fieldwork throughout Nunavut, Nunavik and Nunatsiavut, as well as in Newfoundland, and has published articles on the social and cultural prehistory of the Canadian Arctic, traditional ideology and shamanism, hunter-gatherer domestic architecture and the application of contemporary technologies to archaeological practices. Dr. Ryan holds an Honours BA in Anthropology and History from Memorial University of Newfoundland, an MA in Anthropology from McMaster University and a PhD in Anthropology from the University of Toronto.

Faces in Stone – New Archaeological Research at Qajartalik.

Ryan, K., Canadian Museum of History.

In 2017, the Canadian government nominated eight places as candidates for future designation as a UNESCO World Heritage Site. This presentation will introduce one of those locations, Qajartalik, located on a small island off Nunavik's east coast, and talk about new work being done there by researchers from the Canadian Museum of History and Avataq Cultural Institute. As will be discussed, efforts to better understand Qajartalik – a petroglyph site where more than 180 anthropomorphic faces were carved into a series of soapstone outcrops – are being conducted at the behest of community members who recognise the petroglyph's cultural and historical significance. This collaborative and community-initiated research project, operating from field camps at and around Qajartalik, will work to confirm that the petroglyphs were in fact made by a pre-Inuit population called Dorset by archaeologists and Tuniit by Inuit. Understanding why the petroglyphs may have been created and how they fit within their cultural landscape can reveal how Qajartalik was and continues to be experienced by generations of Nunavimmiut.

ORAL PRESENTATIONS:

Cultural Continuity and Inuit Health in Arctic Canada.

Newell, S.L., Department of Geography, Environment and Geomatics, University of Ottawa; Dion, M.L., Department of Political Science, McMaster University; Doubleday, N.C., Department of Philosophy, McMaster University.

Previous research association increased levels of cultural continuity and decreased rates of youth suicide in First Nations communities.

We investigate the relationship between cultural continuity and self-rated health looking specifically at Inuit living in the Canadian Arctic.

The Arctic Supplements of the Aboriginal Peoples Survey from years 2001 and 2006 were appended to explore the relationship between various measures of cultural continuity and self-rated health. Literature related to Inuit social determinants of health and health-related behaviours were used to build the models.

All measures of cultural continuity were shown to have a positive association with self-rated health for Inuit participants. Background and other control variables influenced the strength of the association but not the direction of the association. Access to services in an Aboriginal language, harvesting activities and government satisfaction were all significantly related to the odds of better health outcomes. Finally, the study contributes a baseline from a known data horizon against which future studies can assess changes and understand future impacts of changes.

The Canadian government and other agencies should address health inequalities between Inuit and non-Inuit people through programmes designed to foster cultural continuity at a community level. Providing access to services in an Aboriginal language is a superficial way of promoting cultural alignment of these services; however, more inclusion of Inuit traditional knowledge is needed to have a positive influence on health.

Informing Colorectal Cancer Screening in Northern Canada Using Participatory Simulation Modeling.

Smith, H., Telfer School of Management, University of Ottawa; Yong, J.H.E., Canadian Partnership Against Cancer; Brunet, N., Faculty of Medicine, University of Ottawa; Kandola, K., Office of the Chief Public Health Officer, Northwest Territories Health and Social Services Authority; Boushey, R., Department of General Surgery, University of Ottawa; Kuziemsky, C., Office of Research Services, MacEwan University.

Colorectal cancer (CRC) is the second leading cause of cancer related death in Canada. Northwest Territories (NWT) residents are disproportionately affected: the CRC mortality rate in the NWT has been found to be double that of the rest of the country. Mortality could be reduced with greater adherence to CRC screening. However, screening requires colonoscopy for which access is limited and difficult to predict in the north. OncoSim-CRC is a mathematical simulation model which could help predict the colonoscopy demand.

We will project the impact of CRC screening on colonoscopy demand using OncoSim-CRC and chart-level data from the NWT.

A conceptual model of CRC screening in the NWT was developed with territorial collaborators. This conceptual model informed a retrospective cohort of patients with a positive screening result between Jan. 1, 2015-Mar. 30, 2019. Results were used as input parameters in OncoSim v3.3.1.0 to reflect the NWT population and anticipated increases in screening participation.

The retrospective review identified 7,153 patients age 50-74 who underwent FIT screening in the NWT, and 786 (10.9%) of them had a positive test. The OncoSim-CRC simulation projections are expected to be complete at the time of presentation.

Using OncoSim-CRC and chart-level data, we anticipate our projections will assist with colonoscopy resource planning and ultimately improve CRC outcomes in the NWT.

Understanding the Role of Community Energy in Sustainability Transitions: Integrating New Research Contexts from the Canadian North.

Leis, J., School of Public Policy and Administration, Carleton University.

In recent years, the notion of "community energy" (CE) has gained prominence in both academic and policy circles, as a potential mechanism to advance the clean energy transition. In transitions studies, CE is regarded as an area of both technological and social innovation, with the potential to further both environmental and social objectives. In the Canadian context, remote, northern, and largely Indigenous communities are increasingly looking to CE as an avenue to reduce diesel consumption while advancing ongoing struggles for self-determination. Yet, understanding of what constitutes CE in both the policy world and academia is wide ranging. Boundaries with respect to energy practices, project scale, ownership model, etc., can vary from jurisdiction to jurisdiction, and within the academic literature. Therefore, this research seeks to: 1) contribute a better understanding of CE to inform wider policy discussions in the context of the clean-energy transition; and 2) integrate CE perspectives from an under-represented research context in transitions: remote Indigenous communities in NWT. Using a systematic literature review methodology, this research turns to scrutinize existing research on CE in transitions studies specifically, focusing on the range of technologies/practices, actors involved, geographical context, and institutional/policy contexts. Second, it will link literature review results to preliminary findings from interviews that took place in NWT in Fall 2019.

Leading On-the-Land Science Camps with Indigenous Youth: Towards Reciprocity in Research.

Reid, J. A., Department of Biology, Carleton University; **Lane, J.F.**, Department of Geography and Environmental Studies, Carleton University; **Woodworth, S.**, Department of Geography, Environment and Geomatics, University of Ottawa; Spring, A., Department of Geography and Environmental Studies, Wilfrid Laurier University; Garner, R., Education Department, Gingolx Village Government; Tanche, K., Resource Management, Dehcho First Nations.

Land-based learning and knowledge systems form the foundation for many Indigenous education systems. However, colonial power systems embedded in educational institutions, schools and disciplines in Canada have historically worked to disconnect Indigenous youth and families from the lands and waters. Hence, for many Indigenous communities, there is distrust in the education system and an ongoing movement towards self-determination in education. Alongside these colonial legacies, the effects of climate change are disproportionately impacting Indigenous communities. Changes in the landscape alter local knowledge and disrupts generational knowledge transfer. Today, there is great concern that youth are not learning the necessary skills and knowledge for the continuation and well-being of both the culture and the surrounding natural world. It is thus imperative that youth are educated about ongoing changes, through both Indigenous and dominant knowledge systems, to be empowered to respond to ongoing impacts for the continuity of Indigenous cultures and knowledges. Here, we detail two distinct but highly parallel approaches to land-based education, annual science and culture camps in the Nisga'a Village of Gingolx in northern British Columbia and the Dehcho region of the Northwest Territories. Drawing from two experiences, we highlight the shared motivations, challenges, successes, and lessons learned from leading on-the-land science and culture camps with Indigenous youth.

Shorebird Breeding Densities across the North American Arctic: Which Habitat Characteristics are Important at Which Scales?

Anderson, C., Department of Biology, Carleton University; Fahrig, L., Department of Biology, Carleton University; Rausch, J., Environment and Climate Change Canada; Smith, P., Environment and Climate Change Canada.

To conserve the most productive and resilient Arctic breeding habitats for shorebirds, we first need a more comprehensive range-wide understanding of where shorebirds are distributed and which habitats support them. Current understanding of shorebird breeding habitat in the Arctic is patchy, limited to local or regional studies. Our goal was to understand the key habitat characteristics that predict shorebird nest densities at a continental scale. The Program for Regional and International Shorebird Monitoring (PRISM) has surveyed 3000+ plots covering the extent of tundra habitats in Canada and Alaska. We assessed the relative influence of abiotic variables (climate, snow melt, surface water, geology) and biotic variables (vegetation, heterospecifics) on nest density for ~20 shorebird species. Because species may respond to different ecological conditions at different spatial scales, we used a hierarchical modelling approach with several nested spatial scales. We present detailed contemporary distribution maps, highlighting important arctic breeding areas in North America. Identifying these habitat relationships is a valuable step towards predicting how breeding shorebirds will be influenced by rapid climate change occurring in the Arctic.

Adiabatic Lapse Rate Modelling in Yukon, Canada.

Ackerman, H., Department of Geography, Environment and Geomatics, University of Ottawa.

The global average adiabatic lapse rate is -6.5 ºC/km; however, variations from the global average may occur, sometimes resulting in inverted lapse rates. This is known to occur within mountain ranges in the southern Yukon where vertical mixing of air is not as strong during the winter months as it is during the summer months.

Keno and Dawson cities within Yukon are regions with similar degrees of continentality, meaning the difference between the average temperature of the coldest month and the average temperature of the warmest month. Thirteen temperature monitoring systems were deployed in each region at varying elevations and recorded bi-hourly air temperatures between 2006-2007 and 2018. Air temperatures (°C) collected from the 26 sites were used to create linear models of monthly lapse rates for each area and were compared on a monthly basis using a student's t-test.

Inverted adiabatic lapse rates occur between November and February in the Dawson City region and between December and February at the Keno City region. The adiabatic lapse rates were shown to be the most similar during the winter months (December-February). Only sites with 6 or more years of data were used whereas previous studies of adiabatic lapse rates in Yukon were based on three or fewer years of data. These results combined with lapse rate models for other regions in the southern Yukon will help to improve our understanding of regional climate characteristics with respect to degree of continentality.

Using Modelling to Predict Post-Fire Frozen Ground Trajectories near Nain, Nunatsiavut.

Wang, Y., Department of Geography, Environment and Geomatics, University of Ottawa; Lewkowicz, A., Department of Geography, Environment and Geomatics, University of Ottawa; Holloway, J., Department of Geography, Environment and Geomatics, University of Ottawa; Way, R., Department of Geography and Planning, Queen's University.

Forest fires are a significant natural disturbance to permafrost landscapes. Following fire, forests undergo succession, with progressive stages of vegetation establishment and abundance. In these areas, the thermal state of the ground responds to changes in the surface vegetation as the forest recovers, either resulting in vertical degradation of permafrost or recovery as ecosystem-driven permafrost. This project examines the thermal state of the ground and explores the likelihood of post-fire permafrost recovery at the Webb Bay forest fire site, which burned in 2004 near the coastal Nunatsiavut community of Nain.

In situ field data are incorporated as inputs and validation for our ground temperature modelling process, which is being performed in TEMP/W (Geoslope). Thermal modelling is being used to identify the recovery or degradation trajectory of frozen ground at the Webb Bay site, in response to both past and future climate change and to the impacts of fire. In conjunction with a warming climate, post-fire landscape succession and associated shrub regeneration and organic material reduction are expected to promote the thaw and vertical degradation of existing frozen ground. These results, combined with collaborative studies on post-fire vegetation community composition and tree regeneration, will provide insight into fire-associated ecosystem change in Nunatsiavut.

Spatial Patterns and Textural Characteristics of Surface Disturbances in a High Arctic Environment: Cape Bounty, Melville Island, Nunavut (2013-19).

Robson, G. S., Department of Geography and Planning, Queen's University; Treitz, P., Department of Geography and Planning, Queen's University; Lamoureux, S. F., Department of Geography and Planning, Queen's University; Murnaghan, K., Canada Centre for Remote Sensing; Brisco, B., Canada Centre for Remote Sensing.

Processes such as subsidence and thermokarst formation are associated with permafrost thaw and changes to the active layer in tundra environments. These have significant hydrological and environmental consequences, but can also cause damage to Northern infrastructure. It is therefore imperative to be able to track such change and to understand the local disturbance risk factors.

We first aim to examine long-term (2013-19) spatial patterns of landscape disturbances around our study site at Cape Bounty, Melville Island, Nunavut, and how they relate to local vegetation and terrain conditions; and second to investigate the utility of multi-scale surface roughness as a predictor or indicator of landscape disturbance.

We generated intraseasonal and interannual surface displacement maps with sub-centimetre precision using a differential interferometry technique in GAMMA with ultrafine-beam RadarSat-2 images. Patterns of subsidence and uplift on seasonal and annual timeframes were analysed in a GIS environment. First- and second-order texture metrics were derived from optical and SAR backscatter scenes, and from extremely high resolution DEMs constructed from UAV images taken during the 2019 field season.

High levels of displacement were generally found within areas (i) classified as wet sedge, which typically carry higher soil moisture levels and (ii) on slopes. Areas which show displacement in one season were found to be more likely to show change in subsequent years. Long-term climate records allowed us to track the recovery of the landscape following the extremely warm summer of 2007. Analysis of the displacement maps in relation to texture is ongoing.

Development and Testing of a Streamflow Forecasting Model for the Niaqunguk Watershed, Iqaluit, Nunavut.

Cormier, R., Department of Geography and Environmental Studies, Carleton University; Richardson, M., Department of Geography and Environmental Studies, Carleton University.

Iqaluit, Nunavut's capital city, is a rapidly growing city and is nearing the limit of its municipal water supply. Freshwater resources are sourced from rain and snowmelt runoff flowing into Lake Geraldine. Snowfall measurements collected from gauges are unable to accurately reflect snowfall due to high winds. Ground measurements of snow depth are subject to sampling bias due to the high spatial variability of snow depth caused by blowing winds. This variability has implications on the runoff regime, local energy balance and snow water equivalence (SWE) used to model snowmelt. The spatial variability of snow needs to be accounted for in hydrological models to get accurate simulated flows. The objectives of my MSc research are to 1) evaluate how the spatial distribution of snow regulates streamflow and 2) evaluate how different representations of the spatial distribution of SWE impacts model performance.

SWE will be derived from a combination of density measurements and remote sensing imagery. An Unmanned Aerial Vehicle will be used to gather imagery to derive snow depth at a high spatial resolution using structure from motion. Fully distributed models can handle small scale measurements while semi distributed models require some form of aggregation. Currently, there is no agreed upon method of aggregation to account for the spatial variability of snow depth in semi distributed hydrological models. The model will be built using the Raven hydrological modeling framework. Inputs into the model will be collected from three micro meteorological towers and will include snow, rain, evapotranspiration, sublimation and surface flow. The model will be calibrated using streamflow discharge records from the Water Survey of Canada.

Disappearance of a Small Icefield in Expedition Fiord, Axel Heiberg Island, Canada.

Smeda, B., Department of Geography, Environment and Geomatics, University of Ottawa; Medrzycka, D., Department of Geography, Environment and Geomatics, University of Ottawa; Copland, L., Department of Geography, Environment and Geomatics, University of Ottawa; Thomson, L., Department of Geography and Planning, Queen's University.

There has been a marked increase in melt season length over the past two decades (2003-2015) on glaciers and ice caps within Canada's Queen Elizabeth Islands (QEI) as recent GRACE measurements suggest that mass losses averaged -33 +/- 5 Gt yr^-1. These losses have primarily been attributed to meltwater runoff, which makes the QEI one of the largest recent contributors to sea level rise outside of the ice sheets. Despite these losses, there is a paucity of information concerning how a warming climate is affecting small (<1 km^2) ice bodies, which are likely sensitive indicators of climate change due to their short response time.

In this study, we describe the use of historical and contemporary aerial photographs, high-resolution optical satellite imagery, and ground penetrating radar surveys to determine the area and volume changes of Adams Icefield within Expedition Fiord, Axel Heiberg Island, from 1959 to 2019. Digital elevation models (DEMs) were created via aerial photo surveys using Structure from Motion photogrammetry, which were accurately co-registered by combining direct measurements of camera positions using an aircraft-mounted dual-frequency GPS system, and multiple ground control points situated around the study region. Volume changes derived from DEM differencing were validated using 36 years of in-situ mass balance measurements from Baby Glacier collected intermittently between 1959 and 2019, together with a 2014 GPR survey. The results from this study indicate that small ice masses are rapidly declining within the QEI, and support future projections of the life expectancy of these small ice bodies.

Surface Features of the Cold/Temperate Ice Transition Zone of White Glacier Terminus, Axel Heiberg Island, NU.

Lee, J., Department of Geography and Planning, Queen's University; Thomson, L., Department of Geography and Planning, Queen's University.

White Glacier is polythermal, having basal ice temperatures that vary between -15 °C, controlling how it flows. The ~350 m thick upglacier trunk has a temperate base near pressure melting point (0°C) due to the overlying mass where sliding can occur, while the thinner, cold ice at the terminus freezes to the bed. We hypothesize that the resulting flow discontinuities in the thermal transition zone (TTZ) influence the terminus surface structures, e.g. thrust faulting between ice units. To characterize how surface features at the terminus are changing, surface elevation of the terminus in 1960 will be compared to digital elevation models (DEMs) from 2014, 2018 and 2019. We are producing the modern DEMs using Structure from Motion, pairing air photo surveys and GPS ground control on stable ground. Spatial analysis of the ice surface change over time will determine which structures are indicative of the TTZ. Field measurements will be used to link en/subglacial processes and observed surface structures. Analysis of ground-penetrating radar profiles will be used to identify how bed topography controls observed surface features. Repeat total station surveys of prism networks drilled into the ice will allow us to infer the strain rates that are linked to the features of interest. Considering the abundance of polythermal glaciers found in the Arctic, understanding how terminus structures are changing could help to infer evolving ice dynamics and potential melt feedbacks.

Landfast Sea Ice Break-Up in Admiralty Inlet, NU.

Loewen, A., Department of Geography and Environmental Studies, Carleton University; Crocker, G., Department of Geography and Environmental Studies, Carleton University; Mueller, D., Department of Geography and Environmental Studies, Carleton University; McKenna, R., R.F. McKenna Associates.

Changes in the Arctic climate have caused changes in sea ice break-up patterns. Oceanic conditions can be highly variable during the break-up season, posing a risk for ship navigation and using sea ice as a transportation platform. Traditional knowledge of sea ice patterns has become less reliable, making assessment of travel safety on sea ice more difficult. In addition, there are currently few resources available for short-term predictions of ice and ocean conditions.

This research uses a combination of oceanographic and meteorological field observations in Admiralty Inlet, NU and finite element modelling to study the dynamic processes causing sea ice break-up. Admiralty Inlet is located on the northern tip of Baffin Island, and extends south from Lancaster Sound. Sea ice in Admiralty Inlet is landfast, and a receding floe edge forms annually at the interface between Admiralty Inlet and Lancaster Sound. Wind and ocean current stresses are thought to be the two main dynamic forces acting on sea ice to initiate break-up in this region.

Preliminary results have suggested that attachment points of sea ice at the shoreline may produce important forces counteracting the action of wind and current stresses, preventing break-out events until the shoreline attachment deteriorates. Modelling studies will quantify these contrasting forces to increase our understanding of the dynamic mechanisms of sea ice break-up and our capacity to predict future break-out events.

Formation and Drainage of Glacier Dammed Donjek Lake, Yukon.

Painter, M., Department of Geography, Environment and Geomatics, University of Ottawa; Kochtitzky, W., Department of Geography, Environment and Geomatics, University of Ottawa; Copland, L., Department of Geography, Environment and Geomatics, University of Ottawa; Dow, C., Department of Geography and Environmental Management, University of Waterloo.

Donjek Glacier, located in the St Elias Mountains, Yukon, is a surge-type glacier with a repeat surge interval of approximately 12 years since the 1930s. Donjek River runs perpendicular to the terminus of the glacier from its headwaters on the Kluane Glacier and surrounding ice bodies. Past surges have at times caused the terminus to advance enough to block the river, leading to the formation of an ice dammed lake. The glacier most recently surged in 2014, and since then Donjek Lake has experienced annual filling and draining episodes.

The most recent drainage event occurred in mid-July 2019, when the ~2.2 km^2 lake drained in less than two days and created a canyon through the glacier terminus. Time-lapse cameras, satellite imagery and a water pressure logger provide details of the drainage event. A dense series of air photos were also taken before and after the lake drained (in May, July and September 2019), from which high-resolution digital elevation models have been produced using the Structure from Motion technique. These data provide information concerning the amount of glacier ice lost through the formation of the canyon, as well as the volume of water lost during the drainage event. These data provide new insights into glacier dammed lake dynamics, the mechanisms of flood release, and downstream hazards caused by the floods.

Monitoring of the Polar Regions: The Power and Potential of the Open-Source Cryologger Platform.

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The development of low-cost, open-source instrumentation can greatly reduce the cost of cryospheric research, improve the spatial and temporal resolution of collected data, and produce new ways to observe and monitor the cryosphere. Here, we describe the design of the Cryologger - an inexpensive, modular, and user-friendly data logger and telemeter based on the open-source electronics Arduino platform. Two design configurations are highlighted to demonstrate the flexible nature of this sensor platform. The first configuration is intended for use as a tracking beacon to monitor the drift patterns of icebergs and ice islands in the Canadian Arctic. A total of 16 tracking beacons were successfully deployed between 2018-2019 from the CCGS Amundsen along the coasts of Ellesmere Island and Baffin Bay. Deployed beacons have provided long-term measurements of GPS position, temperature, pressure, and orientation and travelled a combined distance of over 9000 km. The second configuration is an automatic weather station intended to provide near real-time measurements of temperature, humidity, pressure, and wind speed and direction. In 2019, a weather station successfully deployed near the community of Nain, NL provided valuable information on local sea-ice conditions to community members. The success of these diverse applications has demonstrated that low-cost, open-source hardware can provide a reliable, and cost-effective alternative to commercially available equipment for use in cryospheric research.

Characterization of Carbon and Suspended Material in Headwater Streams across High Arctic Watersheds.

Koncewicz, E., Department of Geography and Planning, Queen's University; Thomson, L., Department of Geography and Planning, Queen's University; Lafrenière, M., Department of Geography and Planning, Queen's University.

Freshwater discharge and weathering-derived solutes play an important role as hydrological outputs in carbon budgets in Canadian High Arctic watersheds. Currently, dissolved carbon export from streams in the Canadian Arctic Archipelago is poorly characterized, as are the understanding of geochemistry and weathering rates in snowmelt dominated or proglacial freshwaters. More research behind connections between landscape heterogeneity and stream carbon chemistry is needed to better estimate carbon export to the Arctic Ocean. Our objective is to characterize the total dissolved and particulate fluvial carbon (organic and inorganic) across an Arctic headwater stream to begin understanding the roles of glacier processes, geologic setting, and vegetation on carbon transfer from watersheds to the ocean. We hypothesize that weathering rates and export of carbon will be regulated by geochemical composition of substrate and presence of vegetation.

Paleolimnological Assessment of Wildfire-Derived Atmospheric Deposition of Trace Metal(loid)s to Subarctic Lakes (Northwest Territories, Canada).

Pelletier, N., Department of Geography and Environmental Studies, Carleton University; Chételat, J., National Wildlife Research Center, Environment and Climate Change Canada; Blarquez, O., Département de Géographie, Université de Montréal; Vermaire, J.C., Department of Environmental Science, Department of Geography and Environmental Studies, Carleton University.

We quantified the impact of atmospheric deposition from wildfires on lake metal(loid) fluxes using macroscopic charcoal accumulation rates, historical fire mapping, and element concentrations in 210Pb-dated lake sediment cores from five small subarctic lakes with limited catchments. Time series of element fluxes were compared to fire history using Superposed Epoch Analyses. Fluxes showed a limited but significant increase (median = 5 - 25%) for all analyzed trace metals (Hg, Pb, Cd, Cu, Co, Ni), metalloids (As, Sb) and major ions (Ca, K, Mg, Mn) in the sediment following fire events. The impact of wildfires on metal fluxes lasted for 0-6 years, depending on the element, and were due to short-term increases in sedimentation rate (19 Â± 52% increase) and increasing concentrations of some elements. Wildfire deposition was mainly composed of Ca, Al, Fe, Mg, K, Mn, and Na but changes in sediment flux were greatest for Mn, V, Zn and Sr compared to pre-disturbance conditions. These flux estimates provide a basis for predicting future changes in lake contamination and remobilization of anthropogenic metal(loid) contaminants under more severe fire regimes.

Giant Mine, Giant Problem: How Mining Emissions Have Affected the Toxicity of Mercury in Yellowknife, NWT.

Azdajic, M., Department of Biology, University of Ottawa; Yumvihoze, E. Department of Biology, University of Ottawa; Poulain, A., Department of Biology, University of Ottawa; Blais, J., Department of Biology, University of Ottawa.

Mercury (Hg) is a global pollutant and potent neurotoxin that accumulates in animal tissues as monomethylmercury (MMHg). Populations that depend on local food sources, such as Canada's northern communities, are exposed to MMHg via fish consumption. Therefore, it is important to identify environmental variables that favour MMHg production. The extraction of gold from arsenopyrite at Giant Mine in Yellowknife, NWT has created strong environmental gradients of sulfate concentrations in lakes surrounding the mine. Whereas total Hg levels remain constant with increasing distance from the mine, the ratio of MMHg relative to total Hg increases with proximity to the stack. Microbial activity is the main source MMHg production, with sulfate reducing bacteria being important contributors. Therefore, we hypothesized that the sulfate reducing bacteria in lake sediments are responsible for the pattern of Hg concentrations around Giant Mine. To test our hypothesis, we sampled water and sediments from lakes spanning a range of distance to Giant Mine. We determine simultaneous methylation and demethylation rates using stable isotope analysis and characterized the microbial community using high throughput sequencing of 16S rRNA genes. By analyzing MMHg production, we have identified sulfate as being the main driver of both final concentrations of MMHg and the production of MMHg in the lake sediments. The strong environmental gradients formed by mining activities are affecting the toxicity of mercury in the lakes surrounding Yellowknife, NWT.

POSTER PRESENTATIONS:

A Continental Scale Spatial Investigation of Sediment Organic Matter using Sedimentomics.

Bell, M.A., Department of Biology, University of Ottawa; Overy, D., Ottawa Research and Development Centre, Agriculture and Agrifood Canada; Blais, J., Department of Biology, University of Ottawa.

Lake sediments are a natural record of biodiversity because they are archives of natural organic materials derived from plants, animals, microbes, and geological processes in the catchment. We used lake sediments to examine the composition of natural organic materials from across northern Canada. This information can be used to define regional lake districts, and to overlay current spatial classification systems (i.e. ecozones). Our work represents a first-of-its-kind analysis of the composition of organic carbon molecules in lake sediments across a large geographical extent using a new sedimentomics technique. This presentation highlights the power of sedimentomics to define regional and ecological boundaries, to investigate climate change, and it can be integrated with other research fields like metagenomics to build more informative models on carbon cycling.

Estimating the Deposition of Microplastics to the Environment Surrounding Arctic Breeding Colonies via Seabird Guano.

Bourdages, M.P.T, Carleton University; Provencher, J.F., Environment and Climate Change Canada; Baak, J., Acadia University; Hamilton, B.M., University of Toronto; Rochman, C.M., University of Toronto; Braune, B., Environment and Climate Change Canada; Mallory, M., Acadia University; Geoffroy, C., Environment and Climate Change Canada; Vermaire, J.C., Carleton University.

Although microplastics have been established as being persistent in the environment, the ways in which they are distributed throughout environmental systems requires further understanding. Seabirds have been identified as vectors of contaminants from marine to terrestrial environments, and studies have recently identified seabirds as possible vectors of plastic pollution in the marine environment, however, their role in the distribution of microplastic pollution in the environment has yet to be fully examined. We examined two species of seabirds known to ingest plastics (Northern fulmars [Fulmarus glacialis] and thick-billed murres [Uria lomvia]) as potential significant vectors for the transport of microplastics in and around breeding colonies. With the guidance of local Inuit hunters from Qikiqtarjuaq, Nunavut, biotic and environmental samples were collected in August 2018 from two bird colonies, one in the Qaqulluit National Wildlife Area and one in the Akpait National Wildlife Area. Using the quantification of microplastics found in the guano and last 10 cm of intestines of sampled seabirds from the colonies, along with bird population surveys from these colonies, we are able to estimate how many microplastics these birds are likely depositing into the environment during their breeding period. This data will help examine whether migratory seabirds are contributing to the concentration of microplastics in the coastal environment, and by how much.

Getting Patients to Scopes in the North: A Review of Endoscopy Cancellations in Remote Northern Canada.

Brunet, N., Faculty of Medicine, University of Ottawa; **Smith, H**., Telfer School of Management, University of Ottawa & Division of General Surgery, The Ottawa Hospital, Ottawa, ON; Tessier, A., Stanton Territorial Hospital, Yellowknife, NT; Kuziemsky, C., School of Business, MacEwan University, Edmonton, AB.

Intro: Colonoscopy is a diagnostic and therapeutic tool for colorectal cancer (CRC), and is challenging to access in northern Canada. Timely access is important; CRC guidelines recommend screening within 60 days of positive FIT (Sey et al., 2012). Northern Canadians face challenges in accessing timely colonoscopy, in part due to frequent cancellations, for which reasons remain poorly understood.

Objective: Understand trends and reasons for colonoscopy cancellation at a NWT hospital.

Methods: Conducted a retrospective review of colonoscopies cancelled from January 2018, May 2019 at the Medical Daycare Unit at the Stanton Territorial Hospital (Yellowknife, NWT), identified in MDCU cancellation logs. Community of residence, reason, and timing of cancellation were recorded by clerk staff. Thematic analysis was conducted to group cancellation reasons. Descriptive statistics were generated using Microsoft Excel V16.16.13.

Results: Of scheduled colonoscopies 370 (27.72%) were cancelled during the data period and occurred on average 28 days post-booking. Cancellation reasons were grouped into 20 themes, covering personal to geographic factors. The most cited theme was work/family commitments (indicated by 70 respondents (24.3%)). Others frequently cited being away from home and physician-initiated cancellation.

Discussion: Further analysis of cancellation reasons required. Collaborative efforts needed between employers, travel agencies, and homecare supports to mitigate access delays.

Ice Wedge Activity in the Canadian High Arctic.

Campbell-Heaton, K., Department of Geography, Environment and Geomatics, University of Ottawa; Lacelle, D., Department of Geography, Environment and Geomatics, University of Ottawa.

Ice wedges are a near-ubiquitous continuous permafrost feature that make up 20-80%vol of ground ice in the upper few meters of permafrost. Despite the numerous contemporary studies examining factors that control ice wedge cracking, their development and degradation, relatively few have explored ice wedge activity in relation with past climate and vegetation conditions. In the Eureka Sound region, ice wedge polygons dominate the permafrost terrain and their degradation has started to occur and is leading to the growth of thaw slumps. The objective of this study is to determine the timing of ice wedge growth in the Eureka Sound region over the Holocene. This is reached by: 1) describing the cryostratigraphy of sedimentary units exposed in the headwall of the slump; 2) determining the moisture source of the ice wedges from measurements of δD-δ18O of the ice; 3) determining the age of the ice wedges from 14C measurements of the dissolved organic carbon (DOC). Preliminary results from three ice wedges show that DOC concentration in the ice range between 2-5 ppm with 14CDOC ages clustering during cold intervals in the Holocene. This contrasts with ice wedge activity in central Yukon where ice wedges were active during the late Pleistocene to late Holocene.

Chironomid-Inferred Environmental Change in Igloolik, Nunavut.

Cincio, P., Department of Geography, Environment, and Geomatics, University of Ottawa; Wesche, S., Department of Geography, Environment, and Geomatics, University of Ottawa; Medeiros, A., School for Resource and Environmental Studies, Dalhousie University; Gajewski, K., Department of Geography, Environment, and Geomatics, University of Ottawa.

The sustainability of freshwater resources is of increased uncertainty in remote Arctic communities, where cultural practices, access to drinking water, and ecosystem health are deteriorating in response to recent climate warming. Aquatic biota such as chironomids respond rapidly to changes in their environment and are well preserved in the sediment archive, making them effective agents for detecting and inferring past ecological conditions. Here, we apply a paleolimnological approach to examine past lake productivity and regional climate variability of Small Fish Lake, Igloolik to quantify its ecological trajectory. A sediment core spanning 40 cm in length was stratigraphically analysed by extracting and identifying the fossilized remains of chironomids at 0.5 cm intervals. The upper 0-10 cm of the core representing the period ~ 1876 to 2018 CE demonstrated the greatest compositional shift from cold stenothermic taxa to warm-water indicators, which intensified after 1980. A northern North America chironomid paleo-temperature model produced a summer surface water reconstruction inferring a 4 °C increase over the record. The recent shift towards warm-water taxa illustrates the effects of climate warming on aquatic ecosystems, while emphasizing the susceptibility of Small Fish Lake to water level fluctuations. This will inform the long-term sustainability of Igloolik's drinking water resource in the aftermath of a water security crisis.

Identifying Iceberg Sources, Drift Patterns, and Potential Risk in Canadian Waters.

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In recent years, rapid warming has been observed in the Arctic, resulting from anthropogenically driven climate change. Since 2000, Trinity and Wykeham glaciers on SE Ellesmere Island have consistently accelerated and, as of 2016, contribute ~66% of total iceberg discharge from the Canadian Arctic Archipelago, compared to ~22% in 2000. However, we currently have a limited understanding of the processes driving iceberg production from these glaciers and the potential risk that icebergs, once calved, may pose along primary shopping routes in the Canadian Arctic. To address these knowledge gaps, my thesis will first use a ~20 year record of surface velocities mapped for Trinity, Wykeham, Cadogan, and Ekblaw glaciers on SE Ellesmere Island combined with terminus retreat rates derived from optical imagery, and surface/bed topography from NASA Operation IceBridge data to determine the relative importance of ice loss through iceberg production vs. terminus retreat over time. Second, understanding iceberg drift patterns will be improved using a database developed during previous field seasons in Baffin Bay aboard the CCGS Amundsen from 2016-2019, when ~50 icebergs were visited and characteristics such as size, thickness, and source were identified. Once calved, iceberg drift patterns will be identified through analysis of hourly positional data transmitted by helicopter-deployed GPS tracking satellite beacons deployed on icebergs and ice islands within Baffin Bay. Lastly, shipping risk will be assessed using a comprehensive database of ship tracks derived from NORDREG data. Known ship and iceberg locations will be used to create risk maps focusing on communities that are close to regions of high iceberg and shipping traffic.

Local Food Initiatives in the Moose Cree First Nation: Understanding Local Food Development.

Ferreira, C., School of Human Kinetics, University of Ottawa; Robidoux, M., School of Human Kinetics, University of Ottawa; Gaudet, C., Faculty of Arts, University of Alberta.

This presentation builds on the Indigenous Health Research Group`s work with northern remote Indigenous communities addressing food security challenges through local food initiatives. The research takes place in Moose Cree First Nation in northern Ontario (MCFN). The focus will be on the efforts of MCFN's to build local food capacity by introducing food initiatives like community gardening. Through an action based participatory research approach, we worked with the Economic Development Group and a Local Food Developer to determine the steps needed to develop two community gardens and work with individual families to assist in creating personal gardens. The presentation will describe the planning that was involved during the creation of the gardens, the laborious efforts to build the gardens, the incorporation of community partners throughout the process, the yields that were harvested and the decisions made around food distribution. While harvested yields were modest, the project highlights the successes and limitations that were encountered during this project, and promising best techniques and practices that are being planned for continued garden development in the spring of 2020 with the addition of a greenhouse.

Characterization of the Light-Harvesting Complex (LHC) Gene Family in the Dark-Adapted Antarctic Alga Chlamydomonas sp. UWO241.

Fugard, K., Department of Biology, University of Ottawa; Possmayer, M., Department of Biology, University of Ottawa; Cvetkovska, M., Department of Biology, University of Ottawa.

Chlamydomonas sp. UWO241 (UWO241) is a psychrophilic green alga which has been isolated from the permanently iced-covered Lake Bonney in Antarctica. It is within this extreme environment in which UWO241 must optimize light harvesting efficiency in order to survive in such low light conditions and a prolonged 6-month period of darkness. Using computational tools this project aims to provide insight towards how variations, such as gene duplication, within the genomic sequence of UWO241 have adapted to increase photosynthetic activity. Methods in bioinformatics include BLAST, sequence alignment analysis, genome annotations and construction of phylogenetic trees. Analysis of sequence alignments have indicated high homology between UWO241 and the mesophilic control, Chlamydomonas reinhardtii. Results have revealed conserved amino acid sequences, as well as noteworthy variations both between the algal species and within UWO241. Results have also shown that UWO241 has undergone duplication events within LHCII which can be linked to variations at the molecular level which function to increase protein accumulation of these essential genes. Further analysis of the phylogenetic relationship of UWO241 will be carried out in order to provide support to the hypothesis that LHC gene family in UWO241 has undergone gene expansion. The findings from this study will provide a deeper understanding of how photosynthetic algae have adapted to low-light conditions.

Remote Sensing Analysis of Lake Colour Change and Brownification in Northern Canada.

George, G., Department of Geography, Environment and Geomatics, University of Ottawa.

Thawing permafrost can negatively impact the water quality of nearby lakes by triggering geomorphic activity that releases organic matter into surrounding waterbodies. This increased input of sediment and organic matter results in a phenomenon known as lake brownification. Lake brownification affects water chemistry and trophic system dynamics, which can contribute to increased carbon emissions and affect human activities that depend on clear lake water. Despite being a recognized issue, the extent of brownification across Northern Canada is still unknown.

The objective of my research is to develop a methodology to quantify long term trends in lake water quality and detect lakes that have undergone statistically significant optical change across the Canadian permafrost region from 1984 to 2019. A secondary goal is to map the extent of lake color change in Northern Canada since 1984 and develop a methodology to allow continued monitoring efforts.

This research uses Landsat imagery from 1984 to 2019 to detect colour change in lakes from clear to brown across Northern Canada. Turbidity caused by increased terrestrial matter has a visible effect on lake water colour and can be clearly differentiated from clear water using certain band ratios. Early results show that clear and browning lakes have sufficiently distinct surface reflectance values in the green and red bands to detect temporal change in Landsat imagery around Bank's Island.

Policing in the Northern Communities.

Hamel-Touchette, S., School of Sociological and Anthropological Studies, University of Ottawa.

In 2012, the Government of Canada reached an agreement with the Government of Nunavut and the Government of Northwest Territories to renew the RCMP's Policing Contract in both territories for another 20 years (G.N.T, 2012). In the renewal contract, there was a lack of discourse regarding the societal challenges that police officers face when posted in northern Canadian communities. Police officers in the Arctic are often deployed to a detachment and are to complete a two-year plus 1-year minimum deployment period when placed in northern communities. However, it is reported that many police officers struggle to complete the two-year requirement (Griffiths, 2019). Some authors (Wakeling et al., 2001; Griffiths, 2019) suggest that officers working in northern communities often experience professional and personal challenges because their responsibilities often extend beyond those of policing. There is lack of understanding and sensitivity to Indigenous cultures by non-Indigenous police officers. My research will further explore this phenomenon. The research question for my thesis is to explore the living and working conditions in the Northern communities and how these conditions interplay and impose challenges for operational police officer in the northern communities. The goal is to interview police officers in the Arctic to determine how living and working conditions make policing in the Northern communities difficult to fulfill their mandate. Moreover, I would like to understand why police officers are unable to remain at their detachment for more than 2 years. With this thesis, I will explore the living/working conditions in the Northern communities and how it differs from the rest of Canada.

Spatial Variation of River Water Chemistry Due to Permafrost Degradation in Yukon River Basin.

Kang, M., Department of Earth and Environmental Sciences, University of Ottawa; Bataille, C. Department of Earth and Environmental Sciences, University of Ottawa.

Yukon River Basin is extensively covered by permafrost, where it plays an essential role in northern river hydrochemistry. Permafrost acts as an impermeable barrier between the active layer and aquifers, which limits groundwater and surface water interactions. Degradation of permafrost due to climate change results in increasing hydrological connectivity between aquifers and surface water, which deepens the flow pathways and increases contribution of groundwater. The goal is to investigate how the degrading permafrost influences chemical weathering intensity and water flow paths by studying geochemical signatures of the Yukon River Basin.

The samples had been collected previously across the Yukon River Basin during the summer of 2015, 2016 and 2017. The concentrations of the cations were obtained from the collaborator of this study. After the Li purification through ion chromatography, concentrations of Li and Na were measured using ICP-MS to check the recovery. The ð7Li were measured using Neptune MC-ICP-MS.

The Yukon River Basin was found to have an $^{87}Sr/^{86}Sr$ ranging from 0.70537 to 0.74463, with most values in between 0.7092 and 0.7200, indicating a mixed contribution from weathering of carbonate and silicate rocks. Rivers with High ð7Li are expected in the regions of discontinuous permafrost due to an increased groundwater contribution to the surface water. Whereas, relatively low ð7Li is expected in the areas of continuous permafrost.

A History of Human Occupation in the Canadian High Arctic as Recorded in Sediment Cores of Freshwater Ponds.

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This study proposes to develop new methods for archeological studies using lake sediments as natural archives. I will use a variety of methods applied to freshwater sediment cores to investigate the history of human occupation in the Canadian High Arctic, with a focus on Thule culture: (1) chemical biomarkers (sterols, stanols); (2) stable isotope analysis of δ13C and δ15N; (3) radiometric dating by 137Cs, 226Ra, 210Pb, and 14C; and (4) isolation of sedimentary ancient DNA (sedaDNA) based on targeted enrichment methods. The multi-proxy approach utilizes chemical fossils to measure indicators of species presence related to Thule occupation. SedaDNA from ponds next to the archeological sites may be analyzed for proxies indicative of human occupation including Arctic flora and marine- and terrestrial- animal species hunted by the Thule as staples for sustenance. I propose to test whether data from sterol biomarker and sedaDNA analysis corroborates that of stable isotope analysis and radiometric dating. I plan to test these methods at ponds adjacent to ancient archeological sites of the Thule in the Canadian High Arctic. Pond sediments will be analyzed using the chemical fossils described above. Analysis will be performed from samples collected in 2019 on Cornwallis, Bathurst, and Somerset Islands.

Spatial and Temporal Vessel Trends in the Tallurutiup Imanga National Marine Conservation Area from 2015 to 2018.

Kochanowicz, Z., Department of Geography, Environment and Geomatics, University of Ottawa; Dawson, J., Department of Geography, Environment and Geomatics, University of Ottawa.

Tallurutiup Imanga (Lancaster Sound) is a marine area that was established as a National Marine Conservation Area (NMCA) in the summer of 2019. It spans approximately 110,000 square kilometers and is located at the eastern entrance of the Northwest Passage. The area is rich in ecological and cultural significance and provides key habitat for marine mammals such as narwhals, belugas and bowhead whales. Since 1990 traffic in Tallurutiup Imanga has increased dramatically, with the total distance travelled by all vessels doubling between 1990 (51,584 km) and 2016 (124,693 km). It is expected that the future traffic will also increase due to reductions in sea ice and an expected increase in shipping activities including tourism, fisheries and trade. This poster outlines the spatial and temporal trends in Tallurutiup Imanga NMCA from the years 2015 to 2018, and is the partial analysis for a thesis project evaluating ship-source noise exposure for marine mammals in the NMCA.

Photos to Elevations: A Photogrammetry Pipeline.

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Elevation measurements are fundamental to Earth systems to quantify positions, heights, and volumes. Quantifying change is crucial to understanding the evolution of such systems around the world, particularly those such as glaciers undergoing rapid change due to anthropogenic activities. Here, we present a semi-automated pipeline to create high resolution orthographic mosaic images and digital elevation models (DEM) from aerial photographs. We do this using a Nikon D850 SLR camera attached to a high-precision GPS mounted on a fixed wing aircraft or helicopter. We wrote custom software in R and Python to determine the precise positions of the photos based on the GPS record. We then use high performance supercomputing through Compute Canada to process the data using Agisoft Metashape-Pro. We are able to produce DEMs and orthographic mosaics at a scale of 10 cm - 1 m for tens of square kilometers. Here, we showcase an example from Thores Glacier, Northern Ellesmere Island, Nunavut. We show that we can quantify elevation change over a particularly warm 13-day period in July, 2019. These extremely high-resolution measurements are revolutionizing glacier mass balance and dynamics studies, providing new insights into glacier processes and change. These methods have implications for the Earth sciences and GIS in better quantifying landscape change.

Influence of Distance to Water and Vegetation Cover of Spider (Araneae) Microhabitats on Body Size as a Mechanism against Desiccation in Churchill, MB.

Martin, D., Department of Biology, University of Ottawa.

The main purpose of this study was to determine if there is a correlation between different microhabitat conditions and the body size in length of spiders (Araneae). The microhabitats in question are those that are either close or far to water and with high or low vegetation cover. I also investigated the relationship between body size and family, abundance and family as well as family and microhabitat choice. Over the course of 5 days, 120 spiders were collected using yellow pan traps, sorted into their respective families and measured in the lab. I found some research in support of my hypothesis, but after conducting my study I found no significant correlation between the body size and habitat choice. I did see a correlation with respect to abundance and habitat choice; more than half the spiders were found in the habitat that was close to the water and with high vegetation and this number increases when you look at these conditions separately. I also saw a significant correlation between spider body size and what family they belong to. I can conclude that the presence of water, vegetation cover and family may all have an effect on body size but there are most likely other factors contributing to an equal or stronger degree.

The Effect of Growth Conditions on Temperature Stress Resistance in the Antarctic Extremophile Chlamydomonas sp. UWO241.

Osmers, P., Department of Biology, University of Ottawa; Cvetkovska, M., Department of Biology, University of Ottawa.

The polar regions of our planet represent unique and challenging environments for photosynthetic organisms. Chlamydomonas sp. UWO241 provides an excellent opportunity to study how variations in growth conditions enable the alga to better survive in adverse conditions. This psychrophilic extremophile's natural habitat (Lake Bonney, Antarctica) is incredibly stable, it only grows at a depth of 17m below a permanent ice sheet. At this depth the temperature is constantly around 5°C; low levels of light penetrate to this depth, even in the peak of the Antarctic summer; and the light that reaches is enriched in the blue-green wavelengths. Replicating the natural growth conditions of UWO241 in a laboratory condition has allowed for the isolation of characteristics that influence algal growth and its resistance to stresses. This experiment assesses the roles that salinity, light quality, and light intensity have on the health of the algal cultures grown under mimicked natural conditions and under the standard laboratory conditions. Inducing heat stress in the cultures allowed for the isolation of the factors that contribute to UWO241's stress resistance and the factors that are detrimental to the alga, even prior to inducing stress. Climate change has put the long-term stability of UWO241's natural habitat under threat and it is important to know how changes to the environment will affect the species in the future.

Predicting Land-Fast Sea Ice Breakout Events in Admiralty Inlet, Baffin Island, Nunavut.

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Due to Arctic climate warming, sea ice extent and duration is decreasing, seriously impacting traditional Inuit ways of life and their local economies by increasing the risks associated with ice-based activities. The community of Arctic Bay in Nunavut relies on immobile land-fast sea ice in Admiralty Inlet for travel to the northern floe edge where the inlet meets the open ocean. The spring hunting and tourism season is the most important time to travel there, yet it is during this annual period of sea ice breakup when risks are greatest. In the last few decades in Arctic Bay, there have been many incidents where people have become stuck on sea ice floes that broke free of land-fast ice, requiring search and rescue intervention, incurring significant loss of equipment and property.

Our project will examine past breakup events and assess long-term climate-related changes, to develop short-term break up risk prediction prototype toolkit that can be implemented by the Hamlet of Arctic Bay. This research will examine the patterns, timing and mechanisms of land-fast sea ice breakup in Admiralty Inlet through the analysis of archived remote sensing data, meteorological reanalysis data, and in situ data. These analyses will be used to develop and test empirical models that predict land-fast sea ice breakout. We hope to determine if accessible meteorological forecasts, are adequate drivers for an operational empirical model to accurately predict the timing of sea ice breakout events.

Examination of Chlorophyll Biosynthesis in the Antarctic Psychrophile Chlamydomonas sp. UWO241.

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Photosynthetic algae make up the basis of the food web in permanently cold Arctic and Antarctic habitats yet we do not know how they are able to adapt and survive under these extreme conditions. You wouldn't expect to find photosynthetic life 17 meters below the surface of a permanently ice-covered Antarctic lake, where there is only low blue light half the year and darkness the other half. Yet this is exactly where the green algae Chlamydomonas sp. UWO241 thrives. Algae and plants produce chlorophyll pigments allowing them to absorb light from the sun to power photosynthetic reactions and carbon fixation. Despite its low light environment, UWO241 has lost the genes required for chlorophyll biosynthesis in the dark, while a second green algae isolated from the same lake, Chlamydomonas sp. ICE-MDV, has retained the genes for dark-adapted chlorophyll biosynthesis. I am working to determine how UWO241 is producing chlorophyll and surviving in its low light environment. First, we must understand how key steps in chlorophyll biosynthesis are adapting to different light levels. These changes in UWO241 can then be compared to ICE-MDV to determine what effect losing the dark-adapted step has on chlorophyll biosynthesis in low light. Although both Antarctic algae appear to use different strategies to produce chlorophyll, they do share some similarities, including the duplication of a gene involved in the conversion of chlorophyll a to chlorophyll b, a duplication that has not yet been seen in other green algae species. By studying these unique low-light thriving psychrophiles, we will gain insight into photosynthetic adaption under extreme conditions, and their ability to support the food chain in polar environments.

Firn-Pack Evolution on White Glacier, Axel Heiberg Island, Nunavut.

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The Arctic has warmed at a rate more than twice the global average in the last five decades as a result of Arctic amplification. This warming has caused accelerating mass loss of land ice in the Canadian Arctic Archipelago. Understanding glacier response to climate change is imperative for accurate predictions of future hydrological conditions. Densification and meltwater retention in the firn area of glaciers are two processes that occur in the accumulation area that present uncertainty. Observations of increasing firn densities have been observed on Devon and Penny Ice Caps in the Canadian Arctic, but similar investigations have not been made on more northerly glaciers. Additionally, melt extent and spatial patterns of melt have yet to be explored on a Canadian glacier as far north as White Glacier. We used ground penetrating radar measurements of changes in firn-pack extent over the period 2013 to 2019 on White Glacier, Axel Heiberg Island, Nunavut. Our focus is on how the firn-pack changes in extent, depth, and distribution over time in radar surveys along the glacier centreline and across the accumulation area. Radar data interpretations are validated using shallow firn cores. Additionally, a SAR time series analysis will be conducted to examine the spatial patterns of melt extent and distribution. The results from both analyses will be presented. This research will contribute to understandings of firn-pack response to climate forcing potentially impacting meltwater retention, assumptions of glacier density, and thermal conditions of the accumulation area.

Radiocarbon (14C) and Stable Carbon (13C) Isotopic Measurements of Dissolved Inorganic Carbon (DIC) in Baffin Bay Seawater.

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The oceans store around half of the carbon dioxide emitted into the atmosphere from fossil fuels as dissolved inorganic carbon (DIC), holding ~38,000 GtC and making it the largest marine carbon reservoir. The Arctic Ocean is a chemically sensitive region, and little is known about the effects of climate change on the marine carbon cycle of this region. Baffin Bay is an ocean basin that feeds cold, fresh surface water into the Labrador Sea, critical for the global deep ocean circulation. The estimated ventilation times of Baffin Bay range from 77 to 1,450 years. DIC samples collected in Baffin Bay will be measured for 14C and 13C, powerful tools used to constrain physical oceanographic parameters and understand the marine carbon cycle. Based on these measurements we hypothesize that 1) Estimated residence time of deep water in Baffin Bay will be less than 1,450 years 2) Bomb and anthropogenic 14C signatures will have penetrated the deepest waters 3) Dual 14C, 13C tracer approach will quantify Atlantic, Arctic and Pacific water end member contributions to Baffin Bay deep water. Seawater samples were collected by a CTD rosette on the CCGS Amundsen in July 2019 throughout Baffin Bay. Samples will be extracted and analyzed by accelerator mass spectrometry (AMS) at the University of Ottawa. This work will provide a better understanding of the Arctic marine carbon cycle, constrain the physical circulation of Baffin Bay, and quantify the amount of sequestered anthropogenic C.

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