Northern Research Days

2017



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GREETINGS FROM THE CIRCUMPOLAR STUDENTS' ASSOCIATION!

The Northern Research Days 2017 Organizing committee would like to extend a warm welcome to this year's conference. This year marks our 21st consecutive graduate student conference for students in all disciplines whose work focuses on the North. We appreciate all the effort that you've put into preparing for this day, and we think our line-up for the day won't disappoint!

The goal of Northern Research Day is to provide a friendly environment for graduate students to exchange ideas and provide a stress-free forum to practice presenting your research. Most of all, our mission is to bring together students from across diverse range of disciplines, and backgrounds to stimulate conversation and connect to a new network of peers. We hope to stimulate discussion and help us work together to think about the most complex issues facing the North.

We hope you enjoy all the presentations and posters during this conference, and we look forward to getting to know each of you over the course of the day!

The Circumpolar Students' Association would like to extend a big thank you to UAlberta North for all the support and guidance throughout this year. Especially for the financial support to make Northern Research Day possible!

- The Circumpolars' Student Association

15 MINUTE ORAL PRESENTATIONS (ALPHABETICAL)

Migration dynamics of polar bears (Ursus maritimus) in the Western Hudson Bay
Alyssa Bohart

Migration cycles of animals are often predictable with seasonal changes as they depend on ephemeral resources such as food. Polar bears (Ursus maritimus) migrate onto sea ice as it forms because they depend on ice to hunt their prey. This seasonal feeding ensures their survival during their fasting period when ice and prey are absent. Climate change is altering the seasonal ice within the western Hudson Bay, resulting in the break-up season occurring sooner and the freezing season becoming later, decreasing the overall ice period. The objective of my research is to determine if bears demonstrate different migration strategies and if these patterns have changed with altered ice-periods, as no previous studies have examined these aspects of movement in a migration context in polar bears. I will use satellite-linked collar movement data of female polar bears in the Western Hudson Bay collected between 2004-2017 to determine migration patterns. By comparing the different distance travelled, rates of migration and tortuosity of movements, I anticipate to find groups of bears that exhibit similar strategies. I will use ice cover data collected via remote sensing to investigate the effect of ice dynamics on migration strategies. Determining how ice dynamics have influenced polar bear migration will give insight into future conservation and management strategies to help this species survival.

Polar bear terrestrial movement and habitat selection in western Hudson Bay
Alex Beatty

The western Hudson Bay polar bear population spends ice-free summer months on land. Then bear movements decline as an energy conservation strategy. At the end of this time period, bears migrate from land to newly forming sea-ice. Climate change will continue to increase time polar bears spend on land. Their movement is influenced by numerous biotic factors, such as, availability of resources, age, mates, sex, and reproductive status. Further, abiotic factors such as shelter, air temperature, wind, precipitation, and sea-ice formation affect movements. This study will examine how biotic and abiotic factors influence bear movements. Step-length information, distance travelled by polar bears during specific time intervals, from 2004 – present, obtained from global positioning system (GPS) collars on adult female bears will be used to determine movement patterns. The second component of the study uses resource selection functions to assess habitat selection. Understanding how external variables and habitat selection influences bear terrestrial movement will impact polar bear conservation.

Modelling the response of phytoplankton to storms in the Arctic and Subarctic Oceans.
Laura Castro de la Guardia

Locally, Arctic Ocean primary production controls the abundance and distribution of Arctic fish and marine mammals. Globally, primary production has a major role in carbon sequestration. Recent warming has increased number of storms reaching the Arctic Ocean. Through the enhance of mixing, storms increase the supply of inorganic nutrients to surface waters which may have a significant role enhancing the Arctic Ocean primary productivity. We quantify the contribution of storms by generating two independent experiments using a general circulation model coupled to a biogeochemical model (NEMO-BLING): (a) control simulation with storms, (b) no storms. The results highlight that winds drive up to 45% of the Arctic primary production and carbon export, being more significant in regions such as Baffin Bay, Hudson Bay and the Barents Sea.

The applicability of Kennaugh Decomposition to track the formation of near-surface ice bodies in the firn layer of Devon Ice Cap, Canada
Luisa da Cunda Fernandes

Predictions of future sea-level change suggest that small ice caps and glaciers will be the dominant source of sea-level rise beyond the next century. Over the past three decades, arctic air temperature records show regional warming higher than any seen in the past 2000 years, resulting in pronounced summer melting. The total mass loss from the Devon Ice Cap (DIC), the second largest ice cap in the Canadian Arctic Archipelago, was estimated to be -78 km3 w.e. (Burgess, et al., 2008) with the greatest source of mass loss arising from supraglacial melt and meltwater runoff. At higher elevations, meltwater may drain downwards into snow and/or firn (an intermediate stage between snow and glacier ice), where it may form ice bodies. These ice bodies impede vertical percolation of future meltwater, creating a feedback whereby the meltwater fraction generated in the accumulation area that runs off to the ocean is increased. Here, we demonstrate a new approach to detect the presence of ice bodies in firn using data from spaceborne radar remote sensing (TerraSAR-X) acquired over the DIC in the summers of 2015 and 2016. The technique can separate two important and distinct parameters: the total intensity backscattering strength of the radar return and the polarimetric information. The element that describes the change in polarimetric configuration shows that a switch from odd bounce (related to the surface) to even bounce (from inside the snow/firn) correlates to the presence of ice bodies.

Long term effects of wildfire on permafrost stability and carbon cycling in peatlands
Carolyn Gibson

Permafrost soils in boreal and arctic ecosystems store almost twice as much carbon as is currently present in the atmosphere and are therefore important players in the global carbon cycle. Wildfire can act as an important trigger of permafrost thaw (laterally through thermokarst development and vertically though active layer deepening), and due to increasing fire frequency and more severe fires with a changing climate, rates of permafrost thaw are expected to accelerate in the future. However, there remains much uncertainty about the extent and timing to which wildfire affects permafrost stability. This study aims to assess the role of wildfire on future permafrost stability and carbon storage in permafrost peatlands by exploring the hypothesis that wildfire increases ground heat flux which leads to permafrost destabilization and changes in ecosystem respiration that spans decades until vegetation recovery occurs. Research has been conducted in a series of sites that burned 2-48 years ago in the Northwest Territories, Canada. Thaw depths, soil thermal regimes and ecosystem respiration have been monitored. Satellite imagery has been used to determine the area of recent permafrost thaw within fire scars and adjoining unburned areas. We show that for approximately thirty years sites that experienced fire had deeper active layers than their paired unburned sites. Surprisingly, the effect of fire was most pronounced ~10-15 years following fire with about a doubling of active layer during this time period. With increased active layer deepening we found that permafrost stability along the edges of peat plateaus was drastically affected. Using remote sensing approaches, the rate of new thermokarst development approximately doubled over 30 years following fire. These results suggest that increasing fire frequency and lengthening of the fire season will lead to increased fire-induced permafrost thaw which has long term implications for carbon cycling and land use.

Jocelyn Gregoire

The cumulative impacts of energy sector development in Northern Alberta have resulted in extensive fragmentation of the boreal forest. Linear features associated with Steam Assisted Gravity Drainage (SAGD), such as seismic lines (SL), make up a significant component of this industry. SLs are challenging to environmental managers because their pattern across the landscape does not mimic natural disturbances. The focal species of this study is the Canada Warbler (CAWA), a neotropical migrant songbird that breeds in the boreal forest. The typical habitat association of the CAWA is old growth deciduous or mixedwood stands with a nearby riparian zone. The first objective of this study is to identify if Canada Warblers show use or avoidance behavior of a seismic line and its edge and if this response is influenced by vegetation regeneration. This will be done using two parallel rows of Autonomous Recording Units (ARUs) on either side of the disturbance. The second objective is to determine how observational scale affects our interpretation of song bird response. I will use data collected from the ongoing 'Big Grid' project conducted by the Bayne Lab. Each site consists of a 10x10 grid of ARUs spaced 600m apart. These grids are established on a minimum of 8 sites that represent three levels of SAGD disturbance (undisturbed, developing and active). This research has implications for future reclamation practices and industry standards. It will help to define what is recovered from an ecological perspective and provide industry with an accurate means of evaluating ecological impacts.

Role of the Canadian Arctic in the freshwater transport to the North Atlantic and potential impact on Earth's Climate based on numerical experiments.
Nathan Grivault

The Canadian Arctic Archipelago (CAA) is a complex assemblage of shallow basins inter-connected by narrow and shallow straits. It is a main pathway for liquid freshwater from the Arctic to the North Atlantic and the Labrador Sea. It also receives runoff from several Arctic rivers as well as glaciers localized on the islands that compose the archipelago. During the winter, in the Labrador Sea the surface water is mode dense and sinks to depth. In this process the ocean is ventilated and carbon dioxide is eventually trapped inside the deep ocean. However, this process also depends on the amount of freshwater at the surface of the ocean. This study uses the coupled ocean/sea-ice numerical model NEMO with regional configuration over the Arctic and Atlantic Oceans. We consider a recent-past hindcast reconstruction (2002-2015) forced with high spatial and temporal resolution atmospheric forcing from Environment Canada. We examine the freshwater transport variability through the major gates out of the CAA as well as impact of the local runoff and their potential impact on the the Labrador Sea sinking process.

Assessing polar bears (Ursus maritimus) use of the Western Hudson Bay and Beaufort Sea flaw lead polynyas
Erin Henderson

Adult female polar bears select for different sea ice features throughout the winter, but optimize prime foraging features and sea ice conditions for energy conservation and safety. Reproductive status affects habitat selection due to differences in the energy expenditures and movement capabilities of the groups. Polynyas are areas of open water within sea ice and are important for a large number of species, including polar bears prey. The importance of polynyas to polar bears has not been examined. Sea ice in the Arctic is significantly declining due to climate change. This study assesses polar bears use of the polynya in Western Hudson Bay and the Cape Bathurst polynya in the Beaufort Sea by measuring the time polar bears spend near the polynyas, and how polynya size affects polar bears movements. These trends will then be compared between study sites, throughout the winter, between years, and between reproductive groups. Global positioning system collars deployed on adult female polar bears from 2004-present measure polar bears locations. The polar bears locations, when compared to the locations of the polynyas, measure the amount of time polar bears spend near the polynyas, their movements relative to the polynyas, and how these vary between study sites, throughout the winter, between years, and between reproductive groups. This research is important for preserving biodiversity in the Canadian Arctic by testing whether changes in polynya size or abundance due to melting sea ice will affect polar bear habitat selection or inhibit polar bears movements through the Arctic.

Monitoring temporal trends in polar bear (Ursus maritimus) foraging ecology using stable isotope analysis
Amy Johnson

Arctic sea ice decline is associated with reduced polar bear body condition, reproductive success, survival, and population abundance. Further sea ice declines are predicted for the future, which will reduce access to prey and affect the persistence of polar bear populations. This indicates the importance of monitoring the influence of climate change on polar bear ecology to understand population responses to changing habitat conditions. The objectives of this project are to: 1) Determine temporal trends in foraging ecology of the Western Hudson Bay population; 2) Analyze variation in foraging ecology within the population; and 3) Examine the relationship between foraging trends and climate over the past two decades. Stable isotope analysis will be used to examine foraging ecology dynamics. Temporal trends will be determined by examining dietary composition from long-term data (1993-1994 and 2004-2017). Preliminary results indicate differences among recent years in dietary composition and future analysis will determine longer-term trends in foraging ecology. Secondly, variation in foraging ecology within the population will be investigated by examining the relationship between individual polar bear characteristics (age, sex, reproductive status, body condition) and diet. Lastly, the relationship between long-term foraging trends and climate (sea ice and climate indices) will be examined. This project will describe how polar bear foraging ecology is responding to changing climate conditions over time and how this may vary within the population. This research will be useful for monitoring the influence of climate change on polar bear ecology in the rapidly changing Arctic ecosystem.

Effect of wildfire on passerines in the northern boreal forest
Michelle Knaggs,

The boreal forest provides breeding habitat for the majority of migrant passerine species in North America. Wildfire is the most important natural disturbance in the boreal forest but there is limited knowledge of how passerines respond to burn severity across northern boreal habitats. Although peatlands make up between 20 – 60% of the boreal forest of Western Canada, upland habitats have been the focus of similar previous studies. This study is investigating how passerine communities respond to burn severity across all habitats in the northern boreal forest using two large (110,000 and 750,000 ha) naturally caused fires that occurred in 2014 in the Northwest Territories. Passerine abundance was collected one and two years after fire using autonomous recordings units (ARUs). Preliminary results showed that species richness decreased with increasing burn severity in peatlands but not uplands. Results of community analysis and single species habitat models will be discussed. This research will contribute to knowledge of passerines' responses to wildfire for conservation planning.

Health Perceptions of Dene First Nations Youth in a Community Context
Laurie-Ann Lines

In Canada, First Nations are combating 'severe' health outcomes in almost every social determinant of health through decolonizing solutions using Indigenous healing knowledge. Understanding the perspective from First Nations on health meaning and issues is a necessary step to effective program planning across the health field. To accentuate community strengths and Indigenous knowledge, this research used a community-based participatory research methodology, where researchers and community participants collaborated through sharing knowledge and relevant lived experiences to promote social change. The research was conducted with the Yellowknives Dene First Nation across their two communities in the Northwest Territories, Canada. We explored the youth's perceptions of health and their idea of agency in health research, contextualized by community members, during a week-long on-the-land workshop. The primary sources of data collection were: 1) a short survey on health research interests; 2) a longer survey on health issues, priorities, and information; 3) research sharing circles with youth discussing health issues, youth involvement in health research, and their role in addressing community health issues; 4) community mural art and PhotoVoice projects where youth depicted health meaning/priorities; and 5) storytelling interviews with Elders/community members to understand their added cultural perspective of youth's perceptions. Capturing a relevant and appropriate understanding of health meaning and current issues is being used to design more effective health programming in these communities. The results of these assessments provide a sound basis for designing programs for youth participation in health messaging, and increase our overall understanding of Indigenous concepts of health and wellbeing.

Yukon Ice Patches: Role of Ice-entombed Bryophytes in Alpine Environments
Brittney Miller

Yukon alpine glacial ice patches are rapidly disappearing, exhuming 8000 year old (BP) plant populations preserved in pristine condition. A major component of the ice patch flora are bryophytes, which are critical to alpine ecosystems. Bryophytes have the incredible ability to generate a new organism from any viable cell (totipotency), allowing them to persist through extreme conditions. The regeneration of formerly ice-entombed vegetation would indicate that ice patches function as reservoirs of genetic diversity in alpine ecosystems. The objectives of this study are to: 1) demonstrate the age (14C), composition, and regrowth potential of emergent ancient bryophytes from two ice patches: Mount Granger and Mount Gladstone, 2) investigate the plant successional pattern following ice patch retreat and whether ancient plant communities are represented. Subfossil tissue collected at the margin (<0.5m) of each ice patch was cultured in vitro showing the potential regeneration capacity. Sampling within the vicinity of each ice margin has documented the extant diversity, and the plant succession with ice margin retreat. Non-metric multidimensional scaling (NMDS) was used to determine the successional gradient and if the plant modern composition is analogous to the ancient communities. Cultured subfossil samples showed remarkable regrowth of propagules (spores and plant tissue), emphasizing the viability of ancient ice patch vegetation. NMDS analysis demonstrated a clear successional pattern that is closely associated with the subfossil species composition. These results reveal a cyclical role of bryophytes from exhumed assemblages that contribute to the establishment, revegetation, and maintenance of diversity in alpine ecosystems.

Habitat selection of Arctic Grayling (Thymallus arcticus) across life stages in pristine northern mountain streams
Morag McPherson

Northern aquatic ecosystems face increasing pressures from climate change and natural resource development, raising conservation concerns for species in these understudied regions. The Arctic Grayling (Thymallus arcticus) is a widely distributed but sensitive freshwater fish that is a good indicator of general aquatic health. Our research objectives are to delineate Arctic Grayling distribution among mountain streams in the Northwest Territories, and to determine habitat characteristics and ecological factors that influence Arctic Grayling habitat use. Sampling sites (n=180) were selected in four sub-basins within the Little Nahanni River watershed. A step-wise logistic regression was used to explore the relationship between the occurrence of Arctic Grayling and stream habitat characteristics. Redundancy analysis (RDA) was used to determine potential size-specific habitat relationships and multivariate regression tree (MRT) analysis was used to identify environmental thresholds and habitat-based size-class segregation. Results show that adult Arctic Grayling used habitats with higher mean elevation (>1200 m) and lower mean temperature (7oC) than juveniles (<1050 m and >10oC). Habitat selection by juvenile Arctic Grayling changed with increasing length, showing larger juveniles (100-150mm) utilized wider, riffle-dominated downstream habitats. These results demonstrate important ontogenetic shifts in Arctic Grayling habitat use. The dynamic nature of Arctic Grayling habitat use in mountain streams highlights the need to consider habitat complexes at the watershed scale when defining species life-stage requirements and assessing potential impacts. Improved understanding of the distribution, habitat requirements and ecology of Arctic Grayling is crucial for the effective management of this species and monitoring of aquatic health in northern regions.

Amendments And Substrates To Develop Anthroposols For Reclamation At Northern Diamond Mines
Valerie Miller

Expansion of diamond mining in the Canadian North has created large areas of disturbance and large volumes of waste materials, necessitating innovative reclamation techniques and approaches. Arctic climate and site conditions can be challenging, making disturbances long lasting and difficult to reclaim; arctic soils have many inherent limitations and disturbances introduce more. This research is focused on development of anthroposols (human built soils) to support native plant establishment and growth in various diamond mine wastes from Diavik Diamond Mine. The experimental design consisted of 6 substrates x 7 organic amendments plus a control x 2 nutrient treatments. Substrates included waste materials like crushed rock, lake sediment, processed kimberlite and various combinations. Amendments included materials available on and off site, including sewage, soil, peat, Black Earth, biochar and various combinations. Northern soils tend to be low in nutrients so inorganic fertilizer provided initial nutrients. Substrates and amendments were mixed in determined ratios and seeded with three grass species selected for their native range and reclamation suitability. Vegetation was assessed to determine responses to anthroposols. Results show that plants will grow in these amended substrates. Plant growth and density were greatest in crushed rock, followed by 25% processed kimberlite with 75% lakebed sediment and 100% lakebed sediment. Substrates amended with peat and/or soil had greatest plant density and below ground biomass, whereas substrates amended with sewage and sewage/soil had greatest above ground biomass. Fertilizer had a limited effect. Results will provide recommendations for enhanced reclamation protocols for industry and government.

Early growth in migratory and resident northern form Dolly Varden

Northern Dolly Varden char (Salvelinus malma malma) are listed as special concern by COSEWIC due to their limited distribution, population declines, and concerns over their ability to tolerate climate change. Research focus to date has been on the anadromous (migratory) life history form; information on resident (non-migratory) Dolly Varden and their overall role in populations is unknown, despite the fact that anadromous and resident Dolly Varden are genetically the same within rivers. Therefore, this research aims to compare resident and anadromous life histories and identify factors that contribute to the selection of different life history strategies, specifically looking at early growth rates and associated traits. Research will involve comparison of biological data collected in conjunction with ongoing stock assessment studies. Otoliths (ear-bones) will be analyzed to determine fish age and growth rates. Traits such as juvenile growth will be compared between resident and anadromous Dolly Varden within and among rivers to determine how growth influences life history selection. Preliminary results presented will include comparison of size-at-age of from three river systems. The results of this study will aid in management efforts for Dolly Varden and enhance the overall understanding of life history strategies within this species.

Postglacial human and landscape histories of northeastern Alberta: An analysis of Sharkbite Lake

Christina Poletto

Within the Mineable Oil Sands Region (MOSR) and the northeastern Boreal Forest region of Alberta, rapid industrial development has resulted in intensive archaeological investigations and the discovery of hundreds of sites relating to almost 10,000 years of human. Unfortunately, the archaeological record is usually limited to stone tools situated in poorly stratified sites, and the region lacks a well-defined culture history. With this limited record, the analysis of supplementary records such as lake cores, becomes valuable in understanding past environmental and landscape conditions across the archaeological record. My analysis of a sediment core from Sharkbite Lake, within the MOSR, aims to supplement the current understanding of past human-environment interactions by reconstructing changes (through pollen and charcoal analysis) which rarely can be seen in a traditional archaeological assemblage. Previously conducted studies on lakes within northeastern Alberta are limited in their chronologic control, and highlight primarily broad-scale changes. The opportunity to conduct research in this area, however, can prove to be challenging at times. I discuss these challenges of my fieldwork, and show how these highlights the dynamic Boreal Forest system. I also discuss a critical aspect of the region, bitumen, which presents itself as a valuable teaching opportunity while leaving the potential for problems. I also present preliminary results from the proxy records of Sharkbite Lake and link the tangible (archaeological) and micro-scale (palynological) records to illustrate both the human and natural history of the Boreal Forest.

Insult to injury? The effects of predation on a weak cohort
Jody Reimer

Polar bears (Ursus maritimus) prey predominantly on naïve and vulnerable ringed seal (Phoca hispida) pups during the spring. Approximately once a decade, however, local effects of large scale climate patterns cause temporary but dramatic declines in ringed seal fecundity. A constant number of bears may thus be hunting a reduced number of available seal pups. During these periods of low ringed seal reproductive success, the age composition of seals killed by polar bears necessarily shifts in response to the availability of pups. We explore whether increased pup mortality rates may be a secondary cause of reduced recruitment. Surprisingly, we find that polar bears seem to display a within-species switching behaviour, focusing disproportionately on older seals in years of low pup availability. The resulting increased neonate survival may mitigate the effects of reduced fecundity resulting from unfavourable climatic fluctuations.

Modelling freshwater dynamics in the Hudson Bay Complex using the ANHA configuration
Natasha Ridenour

The Hudson Bay Complex (HBC) is the drainage basin for many rivers in Canada, receiving roughly 900 km^3 of river runoff per year. Hydroelectric regulation and development has modified the temporal and spatial distribution of runoff entering the HBC. To understand the impacts and future of regulation in this region, the numerical ocean model, NEMO, run with the ANHA configuration, is used to model freshwater dynamics associated with river runoff and sea ice melt. The present work establishes the freshwater budget in each subregion of the HBC, in addition to evaluating the impacts of model resolution and different river discharge datasets. It is shown that the freshwater budget is mainly a balance between river discharge and freshwater advected out of the region, while surface fluxes are the dominant term. Quantitative estimates of turbulent, mean, and Ekman components of freshwater exchange between the interior and boundary regions of Hudson Bay are also presented. Through this analysis, we show that the mean summer circulation is not cyclonic, as previously thought, but a double gyre, with anticyclonic circulation in the east, and cyclonic circulation in the west. This flow is largely driven by geostrophic currents, generated by steric height gradients which are induced by increased river discharge in the spring.

That sinking feeling: glacial melt transforms high arctic great lake into a summer CO2 sink
Kyra St.Pierre

In the Canadian Arctic Archipelago, glacial mass loss has accelerated dramatically since 2000. While the characterization of the sub-glacial drainage system and its meltwaters have received considerable attention, we know little about the quality of meltwaters as they exit the glacier and flow into receiving freshwater ecosystems. Due to high rates of coupled physical and chemical weathering of eroded geological material, glacial meltwaters could have important consequences for carbon chemistry in freshwater systems, particularly in determining whether these freshwaters are sources or sinks of carbon dioxide (CO2). At 540 km2 and 267 m deep, Lake Hazen on northern Ellesmere Island (81N, 71W) is the world's largest high arctic lake by volume. Its 7400-km2 watershed is just over a third glaciated and underlain by permafrost. Our objectives were three-fold: 1) to assess temporal variability in pCO2 dynamics during the melt season in glacial rivers; 2) to assess spatial variability in pCO2 in different rivers throughout the watershed; and, 3) to determine the impact of glacial meltwaters on Lake Hazen as a source or sink of CO2 to the atmosphere. During summers 2015 and 2016, we completed detailed surveys of 7 glacial rivers in the Lake Hazen watershed. From 2013-2016, we also completed chemical depth profiles of Lake Hazen itself. Spring under ice profiles of the lake indicate the build-up of CO2 and depletion of O2 at depth; however, dense, turbid glacial rivers form underflow currents upon entering Lake Hazen, transporting waters undersaturated in CO2 to the bottom of the lake.

Thaw Detection Using Remote Sensing and Historical Aerial Imagery
Jessi Steinke

Permafrost in the northern Alberta peatlands underlies raised plateaus that are surrounded by low-lying, moss-dominated bogs. Permafrost plateaus are sensitive to thaw with increasing temperatures, hydrological change, vegetation loss and wildfire disturbance. In this study we aim to quantify rate of thaw in the discontinuous permafrost zone near Zama City, Alberta between 1955 and 2011. Manual digitization of permafrost features found in aerial and satellite imagery in unburned and recently burned areas was completed using ArcGIS mapping platform. Comparison of thaw rate in recently burned and unburned areas was used to assess the impact of fire disturbance on permafrost thaw. Rate of thaw was found to be higher in recently burned areas than unburned areas. Results were compared to supervised classification results from a related study to assess error in manual digitization for future studies.

Uranium, nickel and arsenic geochemistry in meromictic pit lakes of the Cluff Lake uranium mine

Konstantin von Gunten

Uranium (U) is one of the most important energy resources, and Canada is its second largest producer worldwide. Deep open pits often remain after mining operations, and quickly flood with ground- and rainwater to form meromictic water bodies, which create optimal conditions for the containment of dissolved and suspended metals, such as U, nickel (Ni), and arsenic (As). However, the geochemical cycling of metals and the long-term stability of such meromictic systems is not well investigated. In this project, the distribution and speciation of U, Ni, and As in the water column of two meromictic pit lakes was investigated at Cluff Lake, a former U mine in northern Saskatchewan. The pits have very different limnologies and redox conditions. The 28 m deep D-pit has a chemocline at 13 m depth, below which iron (Fe) and As undergo speciation changes from their oxidized to their reduced states, reaching maximal concentrations of 54 ppm and 131 ppb, respectively. Aluminum and iron oxyhydroxide colloids carrying various metals disappear below this zone. The chemocline and the layers below are also linked to the presence of metal-reducing bacteria, as determined by 16S rRNA gene sequencing. In the much deeper (90 m) and larger DJX-pit, two chemoclines are seen at 15 m and 65 m depth. Both are linked to rapidly rising U and Ni concentrations, with maximum concentrations of 1.7 ppm and 2.2 ppm, respectively, near the bottom of the pit. Unlike D-pit, a redox transition was not observed within the water column.

POSTER PRESENTATIONS (ALPHABETICAL)

A 10,000-year record of atmospheric mercury deposition in northern Yukon, Canada
Sasiri Bandara

Lake sediments, peatlands, tree rings, and ice cores are often used to estimate the influence of recent human activities such as coal burning and climate change on the biogeochemical cycling of Hg. Over thousands of years, sub-arctic and arctic yedoma and peat permafrost sequestered atmospherically deposited Hg prior to human impacts. However, with continued climate warming, it is hypothesized that these northern cryosols will shift from stable carbon/Hg sinks to carbon/Hg sources through permafrost degradation. Accelerated loss of Hg from yedoma silts and peat bogs to adjacent aquatic environments may pose a threat to both wildlife and humans. Here, we reconstruct natural fluxes of atmospheric Hg deposition during the Holocene (last 10,000 years) through the drilling, recovery, and analysis of permafrost from peatlands along the Dempster Highway and the Old Crow and Bluefish basins in northern Yukon, Canada. Based on our analyses, we quantify the natural variability in atmospherically deposited Hg fluxes in light of millennial-scale climate as derived by pore-ice stable isotope ($\delta 18O$ and δD) trends over the last 10,000 years, from which we will be able to compare current rates of deposition due to human activities and quantify potential fluxes of Hg to downstream freshwater systems.

Assessing ecosystem dynamics in the Beaufort Sea using stable isotopes in polar bears (Ursus maritimus) and ringed seals (Pusa hispida)
Nicole Boucher

The amount of sea ice is declining in the Arctic, which likely will result in changes of abundance and distribution of both polar bears (Ursus maritimus) and their main prey ringed seals (Pusa hispida). Changes in availability and accessibility of prey will result in changes in the diets of both species. I am studying how the diets of both polar bears and ringed seals in the Beaufort Sea may have changed due to climate change using samples collected in April and May from 1985–1987, 1992–1994, 2000, and 2003–2011. I am using nitrogen and carbon stable isotopes in serially sectioned polar bear claws and hair, and ringed seal claws, to quantify diet. The objectives of this study are to 1) determine if seasonal and annual variation in polar bear and ringed seals diets has changed over time from 2003 to 2011, 2) determine whether stable isotope values in sectioned hair and claw samples are associated with polar bear space-use strategies from satellite telemetry data, 3) examine relationships between isotopic values in both species relative to sea ice breakup dates, rate of sea ice breakup and climate indices, and 4) determine if changes to ringed seal diets are associated with changes in polar bear stable isotopes.

Impacts of wildfire and permafrost thaw on source and downstream fate of dissolved organic carbon in subarctic peatland-rich catchments
Katheryn Burd

Warming temperature in subarctic and arctic ecosystems is causing permafrost thaw and degradation; thaw is further exacerbated by an observed increase in both wildfire intensity and severity. The change in dissolved organic carbon (DOC) lability as a function of disturbance (burn, permafrost thaw) was examined through three incubation experiments (Spring, Summer, Fall). Porewater collected from six distinct locations within a burned peatland catchment was subjected to microbial and photodegradation under natural conditions for one week. It was determined that permafrost thaw enhances DOC quantity and quality (observed via C:N ratio, specific UV-absorbance (SUVA)), subsequently enhancing DOC biodegradability (BDOC). In sites of recent permafrost thaw, 26 $\pm$ 2.7% of total exported carbon was biologically available in the spring, 5x more biodegradable than recently burned plateaus. Photodegradation losses were greatest in the summer and were not related to DOC quality, rather loss was a function of incoming photosynthetically available radiation (PAR). Photodegradation significantly enhanced overall DOC losses in the summer and fall.

Unseen and unknown: Characterizing microbial community diversity and metabolic potential in a rapidly changing high Arctic watershed
Maria Cavaco

Microbes are responsible for mediating key local and global biogeochemical processes, such as regulating nutrient and pollutant cycling through ecosystems. Microbial communities and subsequent metabolic functions can shift due to environmental disturbance with unknown consequences. Sensitive areas, like the Canadian High Arctic, are experiencing some of the greatest environmental change, with increases in temperature and precipitation leading to higher volumes of freshwater being released from glacial melt and permafrost thaw. This leads to the release of significant amounts of nutrients and pollutants into downstream freshwater ecosystems. As such, it is likely that established freshwater microbial communities will shift in response to these changes, affecting local and global biogeochemical processes. My overall research project aims to shed light on microbial community composition and their activities in freshwater systems in the high Arctic, using the already rapidly warming Lake Hazen watershed as a sentinel system for change. Research objectives include determining microbial community composition and associated metabolic activities in: i) permafrost streams and the waterbodies they drain into-including small lakes and wetland areas during the summer; ii) glacial rivers; and iii) the Lake Hazen water column in the spring and the same water column in the summer at the height of runoff. Together with environmental data including a wide array of inorganic and organic chemical parameters, the samples obtained from field seasons of 2016 and 2017 will be used to determine microbial community composition and their potential activity by targeting specific microbial markers, such as 16S rRNA genes, with the ultimate goal of determining how these changes might impact freshwater quality and ecosystem services.

The influence of weather, prey abundance and experimental food supplementation on nest delivery rates and nestling outcomes in an arctic predator
Kevin Hawkshaw

Wet weather has been shown to negatively affect the reproductive output of raptor species by increasing nestling mortality. Wet weather also has the potential to indirectly affect raptor productivity by influencing prey abundance and hunting efficiency. My project focuses on these indirect effects in a population of Peregrine Falcons breeding near Rankin Inlet, Nunavut. I will present the first chapter of my doctoral thesis, which describes abundance and habitat preferences for several prey guilds in 2015 and 2016. I conducted distance sampling surveys for avian and mammalian prey species and used density surface modelling to estimate prey abundance spatially and temporally. I also conducted snap trapping in both years to estimate microtine rodent abundance, which indicated abundance in 2016 was significantly greater than in 2015. Weather conditions in 2015 were cool and wet, while 2016 was warm and dry, relative to 30 year climate averages. The effects of both weather and microtine rodent abundance on various prey guilds will be explored. Future directions of my project include estimating prey delivery rates to falcon nests as a function of seasonal weather and prey abundance, and creating growth and survival curves for peregrine nestlings. I will be returning to Rankin Inlet in summer 2017 to collect additional data.

Fish Community Composition in Compensation and Natural Lakes in the Alberta Oil Sands
Karling Roberts

Freshwater ecosystems, their biodiversity, and the ecosystem services they provide are highly threatened worldwide. One of the key threats to freshwater ecosystems is habitat degradation and destruction due to human-caused land use change. In Canada, the Fisheries Act mandates that unavoidable losses to commercial, recreational, and aboriginal (CRA) fisheries productivity due to land use change must be compensated for. One strategy for satisfying this mandate is through the use of habitat offsets, such as human-made lakes called compensation lakes. In the oil sands of Alberta, five compensation lakes have already been constructed and multiple are currently in the planning process. Investigations were carried out to determine if the fish community of the first compensation lake constructed in the oil sands is similar to natural lakes in the region. Based on comparisons between fish community survey data from the compensation lake and nine natural lakes I suggest that the fish community of the compensation lake differs from natural lakes with regards to its species composition, fish abundance, and functional diversity. The history of management actions that led to the compensation lake's unique fish community is discussed and potential future directions for compensation lakes as conservation tools are explored.

Mobilization and degradation of particulate organic carbon from retrogressive thaw slumps in the western Canadian Arctic
Sarah Shakil

Permafrost thaw in northern regions can mobilize large quantities of previously frozen organic carbon causing it to enter the active part of the contemporary carbon cycle. This organic carbon can then be decomposed to CO2 and act as a significant positive feedback to climate change. On the Peel Plateau, NWT, Canada, a warming and wetting climate has intensified the activity of massive retrogressive thaw slumps (RTS), that thaw large amounts of glacigenic sediments, increasing suspended sediment concentrations in streams by several orders of magnitude. This could also substantially increase organic carbon delivery to streams, primarily in the form of particulate organic carbon (POC). However, the delivery of POC in this system has not been examined. Furthermore, no studies have investigated the potential for permafrost-derived POC to decompose in streams. Thus, the potential for this mobilization to act as a feedback to climate change is an important unknown. We examined changes in organic carbon delivery and particulate organic matter composition upstream and downstream of 8 thaw slumps across the Stony Creek watershed on the Peel Plateau. We further assessed the biodegradability of RTS-released POC in this region by conducting biodegradation incubations using water samples collected upstream, at, and downstream of RTS sites. Results of these investigations will be shown.

Using automated call recognition to assess impacts of industry on owls
Julia Shonfield

Noise in an environment can mask acoustic signals used for animal communication. Owls use vocalizations to attract mates and defend territories, and rely on acoustic cues to locate prey. Industrial noise negatively affects owl hunting success by affecting their ability to detect prey, but whether this results in reduced habitat suitability is unknown. To determine if owls avoid industrial noise sources and at what scale, we deployed autonomous recording units (ARUs) in northeastern Alberta to acoustically survey for owls at sites with chronic industrial noise, intermittent traffic noise, or no noise. We extracted detections of owls using automated recognition, and compared the efficiency and performance of recognizers to listening to a subset of recordings. Given the relatively low detection rates of owls by listening and the larger dataset obtained using recognizers, we show that automated recognition is highly useful for monitoring habitat use of owls. We found that barred owls, great horned owls, and boreal owls were equally likely to occupy noisy sites compared to sites with no noise, indicating that occupancy at a home range scale was unaffected by the presence of noise sources on the landscape. However, at a local scale, barred owls showed a decline in seasonal use around stations with higher noise levels, but this was not the case for the other two owl species. This research contributes to growing evidence that anthropogenic noise sources have impacts on wildlife and can degrade otherwise suitable habitat, though some species seem to be more sensitive than others.