TRENT UNIVERSITY

ENVIRONMENTAL & LIFE SCIENCES
GRADUATE PROGRAM

ENLS Graduate Program Conference

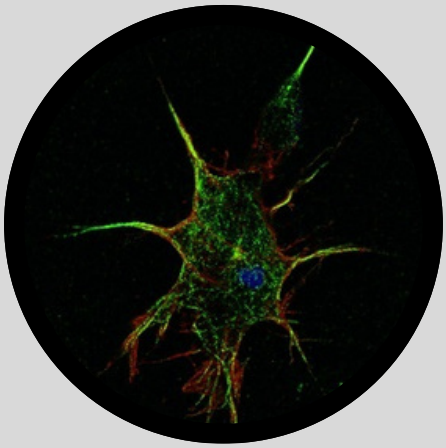
ABSTRACT BOOKLET & SCHEDULE

THURSDAY MAY 1, 2025 |

TRENT UNIVERSITY STUDENT CENTRE

TSC 1.22

trentu.ca/els



Schedule

8:00AM-8:30AM

MORNING REGISTRATION & REFRESHMENTS

8:30AM-9:00AM

WELCOME & OPENING TALK

9:00AM-10:25AM

SESSION 1: EARTH SCIENCES, NATURAL RESOURCES, AND AGRIGULTURE

10:25AM-10:45AM

BREAK

10:45AM-11:55AM

SESSION 2: ECOSYSTEM BIOGEOCHEMISTRY AND TRACE CONTAMINANTS

12:00PM-1:30PM

LUNCH BREAK

1:30PM-2:50PM

SESSION 3: GENES, CELLS, AND PHYSIOLOGICAL SYSTEMS

2:50PM-3:15PM

BREAK

3:15PM-4:25PM

SESSION 4: ECOLOGY, EVOLUTION, AND CONSERVATION

4:30PM-7:00PM

AWARDS CEREMONY (5:30PM) & SOCIAL

A message from the Director

We are very pleased to be hosting the 1st Environmental & Life Sciences Graduate Program Conference, showcasing several of our outstanding students. Today, as a Program, we can further foster collaboration and celebrate the phenomenal research conducted by our students and faculty. We hope that this conference spurs more research ideas and partnerships.

Regards,

Invited Speaker

Erin Bennett

Adjunct Faculty, School of the Environment, Trent University
WEGS Alumni '98 - M.Sc. - Trent University

Prof. Erin Bennett is an Environmental Chemist who manages Research-into-Practice programs tackling a spectrum of innovative project types that span preliminary investigation through full-scale implementation. He has over twenty-five years of international experience, including the Caribbean, in the subfield of environmental analytical chemistry, with emphasis on determining environmental levels of contaminants and developing green strategies to reduce toxicological effects and environmental loadings. Currently, Prof. Bennett is the Editor-in-Chief of the peer-reviewed scientific journal Bulletin of Environmental Contamination and Toxicology.

Environmental & Life Sciences Graduate Program Student Society

The EnLS Society is a student-led society for graduate students in the Environmental and Life Sciences graduate program. Our goal is to provide students with opportunities to engage in fun activities while fostering a sense of community. In addition, the Society organizes events which promote the dissemination of graduate student research and provide opportunities to network with the larger community.

Schedule

Registration: 8:00 am - 8:30 am

Refreshments served in TSC 1.07

Welcome: 8:30 am - 9:00 am

TSC 1.22

	Presenter	
Welcome 8:30 AM - 8:40 AM	**Barbara Moktthewenkwe Wall** **Holger Hintelmann**	Associate Professor, Director of Studies, Indigenous Studies PhD Program, Chanie Wenjack School for Indigenous Studies Vice-President Research and Innovation Research Office
Opening Talk 8:40 AM - 9:00 AM	**Erin Bennett**	Title: **Life After Trent: My Story** Adjunct Faculty, School of the Environment, Trent University

Session 1: Earth Sciences, Natural Resources, and Agriculture

Session Chair: Dillon Brian Muldoon

TSC 1.22

Schedule for Session 1: 9:00 am - 10:25 am

Time	Presenter	Title
9:00 AM - 9:12 AM	**Victoria Vanslyke** MSc Student	Why roots matter: belowground approaches to understanding climate change mitigation with cover crops
9:12 AM - 9:24 AM	**Colette Preston** PhD Student	The Effects of Shape on Microplastic Atmospheric Settling Velocity and Dispersion
9:24 AM - 9:36 AM	**Dane Blanchard** PhD Student	Atmospheric deposition of chromophoric dissolved organic matter in the Athabasca Oil Sands Region, Canada, is strongly influenced by industrial sources during the winter months
9:36 AM - 9:48 AM	**Heather Klyn-Hesselink** PhD Student	Carbonate amendments: Benefit or detriment to reducing carbon emissions
9:48 AM- 9:53 AM	**Stephen (Kyle) Landrum** MSc Student	Surficial Geology and Soil Geochemistry: Influences on Carbon Losses in Tile-Drained Fields
9:53 AM - 9:58 AM	**Ana Paula da Silva Faggiani** MSc Student	Mechanisms controlling subsurface water dynamics in the Brazilian Cerrado
9:58 AM- 10:03 AM	**Brandon E. Monteiro** MSc Student	Abundance and Characteristics of Microplastics and Tire Wear in Urban Stormwater Systems

10:03 AM- 10:08 AM	**Kaileigh Wright** MSc Student	Nature-based nutrient additions to reduce Canada's fertilizer GHG emissions
10:08 AM- 10:13 AM	**Jordan Gilder** MSc Student	Ecosystem Responses to Wollastonite in a Hardwood Forest
10:13 AM- 10:25 AM	**Cerra Simmons** MSc Student	Seasonal ecohydrological connectivity of transpiration source water and streamflow sources in the Maimai M8 Catchment

Break: 10:25 am - 10:45 am

Refreshments in TSC 1.07

Session 2: Ecosystem Biogeochemistry and Trace Contaminants

Session Chair: Brittany Welsh
TSC 1.22

Schedule for Session 2: 10:45am - 11:55am

Time	Presenter	Title
10:45 AM - 10:57 AM	**Victor Bewsh** MSc Student	Impact of non-industrial wood ash application on sugar maple seedling regeneration
10:57 AM - 11:02 AM	**Shelby Conquer** PhD Student	Effect of wood ash fertilizer on sugar maple sap in Ontario, Canada
11:02 AM - 11:14 AM	**Minh Duong** PhD Student	The accumulation and translocation of rare earth elements in rice (*Oryza sativa*)
11:14 AM - 11:26 AM	**David Boettcher** PhD Student	Critical Mineral Aquatic Geochemistry Over Four Seasons in Canada
11:26 AM - 11:31 AM	**Hamant E. France** PhD Student	Aquatic Environmental Remediation Applications of Tunable Waste wood-derived Adsorbents
11:31AM - 11:43 AM	**Emily Miceli** MSc Student	Understanding the Relationship Between Land Disturbance, Mercury and Traditional Practices in the Moose Cree Territory: A Foundation for Risk Assessment
11:43 AM - 11:48 PM	**Jacob Wyonch** MSc Student	Long-Term Monitoring of Surface Water Microplastics: Seasonal and Annual Changes Over Two Years
11:48 AM - 11:53 AM	**Shrutika Kadam** MSc Student	Development of a novel technique to study the oxidative potential of air pollutants using passive air sampler – application to study winter air pollution in Toronto

Lunch: 12:00 pm - 1:30 pm

Lunch served in TSC 1.07

Session 3: Genes, Cells, and Physiological Systems

Session Chair: Josephine Esposto
TSC 1.22

Schedule for Session 3: 1:30 pm – 2:50 pm

Time	Presenter	Title of Talk
1:30 PM - 1:42 PM	**Galair Prevost** PhD Student	The efficacy and timing of cytokinin-induced inhibition of frog virus 3 (FV3) replication
1:42 PM - 1:54 PM	**Sean Condie** PhD Student	Exploring the function of the protein-sorting receptor sortilin in *Dictyostelium discoideum*
1:54 PM - 2:06 PM	**Tucker Cambridge** PhD Student	Microbial rescue drives strain-specific disease resistance in the spotted salamander (*Ambystoma maculatum*) during *Batrachochytrium dendrobatidis* infection
2:06 PM - 2:18 PM	**Zeynab Azimychetabi** PhD Student	The relationships among phytohormones and benzylisoquinoline alkaloids in *Papaver rhoeas L.*
2:18 PM - 2:30 PM	**Irina Badell** PhD Student	An exploration of the post-mortem modifications in DNA methylation in the post mortem interval
2:30 PM - 2:35 PM	**Samer Owiar** MSc Student	Investigating the Role of Cln5 in S-palmitoylation Pathway in *Dictyostelium discoideum*
2:35 PM - 2:40 PM	**Tom Burnside** MSc Student	Exploring the Role of Cathepsin B in Neurodegeneration
2:40 PM - 2:45 PM	**Linh Tran** MSc Student	Exploring the relationship between cytokinin and the encystation process in *Giardia intestinalis*
2:45 PM - 2:50 PM	**Ashley Friedenberger** MSc Student	From Grazing to Gut Bugs: Influence of Diet and Disease on the Gut Microbiome of Muskoxen

Break: 2:50 pm - 3:15 pm

Refreshments in TSC 1.07

Session 4: Ecology, Evolution, and Conservation

Session Chair: Mikaella Grant
TSC 1.22

Schedule for Session 4: 3:15 pm - 4:25 pm

Time	Presenter	Title
3:16 PM - 3:28 PM	**Jacob Bowman** MSc Student	Transitions in the thermal habitat use of brook trout during autumnal cooling
3:29 PM - 3:41 PM	**Sophia D'Aurora** MSc Student	Defining home ranges of lake whitefish populations in Lake Huron
3:42 PM - 3:54 PM	**Meghan Ward** PhD Student	Great Lakes coastal wetland biodiversity increases following treatment of invasive Phragmites australis at Point Pelee National Park
3:55 PM - 4:07 PM	**Dorothy Travis** MSc Student	Environmental controls on sub-Arctic arthropod communities in the Hudson Bay Lowlands, Canada
4:08 PM - 4:13 PM	**Mihika Hegde** MSc Student	Density-dependent habitat selection of Meadow Voles (*Microtus pennsylvanicus*) in a sub-arctic ecosystem
4:14 PM - 4:19 PM	**Samantha Howard** MSc Student	The Overwintering Ecology of Northern Map Turtles
4:20 PM - 4:25 PM	**Charlotte Wills** MSc Student	Revegetation following foraging by lesser snow geese in the sub-arctic

Social: 4:30 pm - 7:00 pm

Awards Ceremony: 5:30 pm

Refreshments and cash bar in TSC 1.07

Abstracts

Session 1: Earth Sciences, Natural Resources, and Agriculture

Title: Why roots matter: belowground approaches to understanding climate change mitigation with cover crops
Authors: Victoria D. Vanslyke, Dillon B. Muldoon, Karen A. Thompson and Kira A. Borden
Abstract
Environmental benefits, such as climate change mitigation, are associated with higher functional diversity in agroecosystems. For instance, planting cover crops between the cultivation of primary crops enhances functional diversity on a farm and can increase soil organic matter and reduce soil greenhouse gas (GHG) emissions. Furthermore, greater benefits may be achieved via functionally diverse cover crop mixtures compared to cover crop monocultures. However, little is known about the mechanistic drivers of cover crop diversification effects on GHG emissions or on plant root interactions that regulate carbon dioxide and nitrous oxide fluxes from soil. Therefore, we established a field experiment to evaluate how increased functional diversification of cover crop mixtures alters plant root trait expression and associated impacts on soil GHG emissions. We established a field trial at Trent Research Farm Centre in a randomized complete block design featuring cover crops sorghum sudangrass (Sorghum x drummondii), red clover (Trifolium pratense), and tillage radish (Raphanus sativus), each representing a different functional group, planted in monoculture, and within two- and three-way mixtures, plus a control with no cover crops planted. We measured emission differences from cover cropped plots compared to control plots and related these values to root trait expression and belowground biomass from detailed ex situ and in situ (ground penetrating radar) imaging. Preliminary results of this study will be presented and discussed in relation to climate change mitigation strategies, and the utility of trait-based approaches and novel imaging tools to systematically quantify relationships between plant and ecosystem function.

Title: The Effects of Shape on Microplastic Atmospheric Settling Velocity and Dispersion
Authors: Colette Preston, Cheryl McKenna Neuman, and Julian Aherne
Abstract
Microplastics (MPs) have been found in all terrestrial, marine, and riparian environments, including remote regions, implying that atmospheric transport is an important pathway for MP dispersion. However, limited empirical data exist to aid in the effective development and parameterization of MP atmospheric transport models. This study incorporated two separate experimental designs: (a) the atmospheric settling and horizontal drift velocities of various sizes and shapes of MPs released into two specially designed settling columns were determined using a laser Doppler anemometer, (b) MP particles were released into a wind tunnel to determine the relationship between their geometric shape, settling velocity, wind speed, and dispersion distance. Rather than conforming to well-established, power-law models, each MP shape exhibited a linear but different relationship for the dependency of settling velocity on size, with markedly higher slopes for the spheres and cylinders as compared to the films and fibers. Shape also had a substantial influence on particle drift, with the fibers and films exhibiting the greatest

horizontal motion. MP dispersion in boundary layer flows appear to conform to a power-law relationship based on a dimensionless index of the particle to the fluid stress or friction velocity. This result reinforces the importance of determining accurate settling velocity values for MPs since modelled values are generally higher, which results in significantly lower estimates of the dispersion distance. The results suggest that microplastic particles identified within atmospheric deposits sampled at a single point may derive from entirely different sources representing a wide range in transport distance.

Title: Atmospheric deposition of chromophoric dissolved organic matter in the Athabasca Oil Sands Region, Canada, is strongly influenced by industrial sources during the winter months
Authors: Dane Blanchard, Mark Gordon, Huy Dang, Paul Makar, Jane Kirk, and Julian Aherne
Abstract
There is growing interest in the atmospheric deposition of chromophoric dissolved organic matter (CDOM) owing to its impact on aquatic processes and surface albedo. Industrial operations in the Athabasca Oil Sands Region (AOSR), Canada, are a major source of emissions of organic gases and particulate matter, which likely contribute to regional CDOM deposition. Here we investigated the composition and spatiotemporal variation of CDOM within regional snowpack (45 sites, collected March of 2023) and weekly precipitation samples (three monitoring stations between January 2021–December 2021) using ultraviolet–visible and fluorescence spectroscopy. Spectroscopic analysis identified three distinct fluorescent compounds (fluorophores) in both snowpack and precipitation. Elevated absorbance and fluorescence intensity among near-field samples demonstrated that industrial emissions influenced CDOM deposition in the AOSR. Fluorescent compounds linked to wildfire emissions (indicated by positive associations with pyrogenic indicators) were the dominant source of fluorescence during the summer while an industrial-sourced fluorophore (indicated by high near-field emission intensity and positive associations with continuous air quality monitoring data) was most prominent (absolute and relative emission intensity) during the cold season, possibly due to enhanced atmospheric stability and lower photolysis rates favouring fluorophore formation. Our results suggested that elevated wintertime CDOM deposition associated with oil sands operations will potentially alter snowpack albedo throughout the region.

Title: Seasonal ecohydrological connectivity of transpiration source water and streamflow sources in the Maimai M8 Catchment
Authors: Cerra Simmons, Bruce Dudley, Jeffrey Mcdonnell, and Magali Nehemy
Abstract
Transpiration significantly depletes terrestrial subsurface water stores and plays a crucial role in the hydrological cycle. While extensive research has been conducted in the Maimai M8 catchment (New Zealand) and across many catchments on streamflow generation processes and streamflow sources, we still know little about the sources of transpiration and when transpiration and streamflow sources are hydrologically connected. Here we leverage M8, a long-term studied catchment with well-described streamflow generation mechanisms, to investigate the transpiration source water of Pinus radiata and its connectivity to streamflow sources. We combined monthly observations of isotopic signatures (δ18O and δ2H) of xylem, bulk soil water,

mobile water, subsurface flow, and stream water with continuous monitoring of tree water stress across a hillslope to answer: (1) What is the seasonal source of transpiration at Maimai? And (2) how does transpiration source water interact with streamflow sources? Our data showed that transpiration sources across the hillslope were not distinct but changed seasonally. During summer, when trees showed greater periods of water stress, trees relied on shallow soil water. In contrast, during the winter, trees' isotopic signatures plotted along the local meteoric water line (LMWL), overlapping with mobile soil and stream water. Xylem isotopic signatures were not statistically distinct from stream signatures in the winter, contrasting with distinct isotopic signatures during the summer. Our results showed that transpiration source water in the Maimai M8 catchment changes seasonally, influenced by tree water stress and wetness conditions. Overall, our findings suggest an ecohydrological connectivity between transpiration and streamflow sources during winter months in this wet temperate climate.

Title: Carbonate amendments: Benefit or detriment to reducing carbon emissions
Authors: Heather Klyn-Hesselink and Ian Power
Abstract
Enhanced rock weathering (ERW) aims to accelerate natural carbon dioxide (CO2) removal by applying alkaline rock powders to large land areas (e.g., agricultural fields), raising the alkalinity of soils to draw down atmospheric CO2. Silicate rocks, including basalt and wollastonite skarn, are being investigated for ERW; however, monitoring CO2 removal rates is hampered by inherently slow dissolution rates. Carbonate minerals (e.g. calcite, dolomite) have reaction rates that are orders of magnitude faster than silicates and are commonly used as agricultural lime, which is easily applied and scaled for carbon dioxide removal (CDR). pH levels are a dominant factor affecting mineral dissolution rates, and thus ERW rates. While carbonate amended to acidic soils can increase CO2 emissions, a knowledge gap exists regarding CO2 flux along the complete pH spectrum, and whether differences exist among carbonate varieties. Here, three soils pH ~4, 6 and 7.8 are being tested against their reaction to carbonate amendments. Soils were assembled in drainage columns subdivided into control, calcite- and dolomite-amended systems and exposed to wetting cycles to simulate weathering at the field site. CO2 fluxes, total inorganic carbon and cations were measured to determine CDR. Gas flux results revealed the acidic soil amended with both carbonates increased CO2 emissions from 0.5 - 5.0 kg/m2/yr with wetting, while the alkaline soil suppressed CO2 emissions in both control and amended columns. Future research includes utilizing PHREEQC software to evaluate a wider range of soil pH value for modelling of Canadian soils that may facilitate ERW through carbonate amendments.

Title: Surficial Geology and Soil Geochemistry: Influences on Carbon Losses in Tile-Drained Fields
Authors: Kyle Landrum and Catherine Eimers
Abstract
Tile drainage (TD) is widely used in agricultural systems to improve field conditions, but its effects on soil carbon (C) storage and losses remain underexplored. This study investigates C-losses in TD outlets across three geologically distinct regions in Ontario and examines geochemical controls on soil C stability. Dissolved organic carbon (DOC) and dissolved inorganic carbon (DIC)

concentrations in tile water, combined with flow rates, were used to quantify C-losses (kg C/ha/yr), while soil organic carbon (SOC) and soil inorganic carbon (SIC) stocks were analyzed alongside geochemical properties. Preliminary findings using correlation analysis and multiple linear regression indicate significant differences in C-losses between the three study regions, suggesting that parent material and soil mineralogy strongly influence carbon mobility and stability. Soil Ca concentrations showed a positive relationship with SOC, while Al exhibited a negative correlation, potentially due to its role in SOC stabilization mechanisms. The influence of Fe was more complex, with particle size playing a key role in its interaction with SOC, suggesting that Fe-associated C stabilization depends on mineral form and aggregation.
Further analyses will explore depth-related trends in SOC stability and assess differences between fine and total soil fractions to better understand their role in Fe-associated C stabilization. Additionally, the total and exchangeable portion of elements will be compared with soil carbon concentrations. These findings highlight the importance of regional soil geochemistry in shaping SOC retention and TD-driven carbon fluxes, with implications for improving C-sequestration strategies in agricultural landscapes.

Title: Mechanisms controlling subsurface water dynamics in the Brazilian Cerrado
Authors: Ana Paula da Silva Faggiani, Caio Mattos, Marina Hirota, and Magali F. Nehemy
Abstract
Subsurface water, including soil matrix and groundwater, is a vital water source to the ecosystem, providing drinking water to millions, supporting streamflow generation and sustaining vegetation. In the Brazilian Cerrado, deep, permeable soils facilitate infiltration, making groundwater recharge essential for major South American river basins. However, changes in precipitation alter infiltration patterns, subsurface storage and recharge dynamics. Despite Cerrado's recognized hydrological importance, mechanisms governing subsurface water recharge, particularly infiltration depth during the rainy season and evapotranspiration depth in the dry season, remain poorly understood.
An important tool for understanding subsurface water recharge is isotope tracing using stable isotopes of hydrogen and oxygen. They provide key observation of recharge sources (i.e. specific rainfall events), water movement pathways, soil matrix, preferential flow, and their interactions. In the Cerrado, variations in rainfall frequency and intensity during seasonal transitions influence water infiltration and groundwater replenishment. Here, we present preliminary results of the subsurface storage recharge dynamics during the transition between the wet and dry season.
Our data showed that evaporation influence is observed mostly up to 30cm deep in soil. The data also indicate that the more mobile water differs from bulk water, mainly under the Vellozia Field. Dry season precipitation has a more enriched isotopic composition, while stream signatures still reflect precipitation from the previous wet season. As climate warms and groundwater levels decline globally, reducing subsurface water storage, understanding recharge processes and the impact of evaporation on soil water storage is crucial for managing water resources in regions like the Cerrado.

Title: Abundance and Characteristics of Microplastics and Tire Wear in Urban Stormwater Systems

Authors: Brandon Monteiro and Julian Aherne

Abstract

Microplastics (MPs) and tire wear particles (TWPs) are emerging threats to aquatic ecosystems and can enter the waterways through urban runoff. In urban areas, artificial bodies of water, stormwater ponds (SWP), are designed to mitigate floods, retain pollutants, and collect urban runoff from their surrounding area. This study investigates the MPs and TWPs associated with SWPs (n=12) through surface water and sediment collected from the forebay and main bay during dry events. To understand the influence of land use on the abundance of MP and TWP, the ponds and drains were categorized based on their catchment land use: industrial (n=4), residential (n=4), and commercial (n=4). The concentration of MPs found within SWPs was 4.9 ± 2.6 n/L and 41,739 ± 23,337 n/kg DW, while the concentration of TWP was 6.9 ± 4.6 n/L and 56,529 ± 59,771 n/kg DW. TWPs comprised ~60% of all particles, followed by fragments and fibres. The greatest abundance of MPs found in the water and sediment was in industrial ponds, while the greatest abundance of TWPs found in the water was in commercial ponds. The forebay of the ponds had, on average, fewer MPs and TWPs in the water but more in the sediment compared to the main bay, suggesting the MPs and TWPs are settling in the forebay as intended. These findings suggest that stormwater ponds can help mitigate the transportation of MPs and TWPs from stormwater to waterways.

Title: Nature-based nutrient additions to reduce Canada's fertilizer GHG emissions

Authors: Kaileigh Wright, Karen A. Thompson, and Huy Dang

Abstract

Nitrogen (N) is a macronutrient critical for the growth and development of plants. Nitrogen fertilizers can pose environmental and economic risks due to gas emissions, runoff, and leaching losses. To mitigate these risks, slow-release N fertilizers have been developed. Nature-based mineral fertilizer formulations can potentially slow the release and transformation of N to better match nutrient supply with crop demand, reducing both gaseous and leaching N losses. Moreover, these mineral fertilizer formulations may supply co-benefits to agricultural systems, supporting soil and crop health. The capacity of mineral additions to N fertilizers to reduce nitrogen losses, and their influence on soil health and plant growth require further research. We conducted two controlled environment mesocosm studies using soils from Ontario and Saskatchewan, Canada. Soil fertilizer treatments included synthetic urease-inhibitor, two generations of mineral fertilizer formulations, a conventional N fertilizer, and a zero-fertilizer control. We measured soil gas fluxes (ammonia, nitrous oxide, and carbon dioxide) from treated soils, and measured nitrate, ammonium, and major elements leached using ICP-MS. We characterized the treatment effects on biological, chemical, and physical soil health metrics. Our preliminary findings suggest that the use of mineral N fertilizer formulations has the potential to reduce N losses via soil N fluxes (nitrous oxide, ammonia), with no discernible impacts on soil microbial activity. The use of mineral fertilizer formulations have the potential to reduce N losses from agricultural soils, thereby supporting nutrient management stewardship goals, mitigating economic loss for farmers, and supporting Canadian circular economies.

Title: Ecosystem Responses to Wollastonite in a Hardwood Forest

Authors: Jordan Gilder, Minger Guo, Ian Power, Larissa Wallisch, Victor Bewsh, and Shaun Watmough

Abstract

Wollastonite ($CaSiO_3$), a calcium-rich silicate mineral, is a promising soil amendment for restoring calcium lost from forest soils due to acid rain and logging while enhancing carbon sequestration. When applied to soil, wollastonite undergoes chemical weathering, reacting with carbon dioxide (CO_2) to release Ca^{2+}, increasing pH and base status, although it is unknown if rapid changes in soil chemistry have adverse effects on sensitive ecosystem parameters. This study examines ecosystem responses to wollastonite in a hardwood forest in Haliburton, Ontario, across sixteen plots treated with varying doses (0, 5, 10, 20 Mg/ha across four replicates). Insect community responses and moss health indicators were selected for their sensitivity to environmental changes and key roles in nutrient cycling and soil stability. Insects were monitored before and after application to assess changes in abundance, diversity, and community composition. Moss health was measured by tracking changes in coverage, growth, and sporophyte count. Ground beetles (Carabidae) showed minimal changes in abundance, indicating resilience, while Acari (mites) increased in higher-dose plots, possibly due to improved calcium levels or changes in microhabitat conditions. Ongoing analysis is evaluating shifts in insect community composition and moss health to assess broader ecological effects. This research addresses key gaps in understanding wollastonite's impact on forest ecosystems. The findings could guide forest management by aligning soil recovery efforts with carbon sequestration objectives, supporting sustainable forest restoration and informing climate policy.

Session 2: Ecosystem Biogeochemistry and Trace Contaminants

Title: Impact of non-industrial wood ash application on sugar maple seedling regeneration
Authors: Victor M. Bewsh and Shaun A. Watmough
Abstract
Years of acid rain and timber harvesting have left forest soils in northeastern North America depleted of key nutrients. To accelerate the rate of soil chemical recovery in response to historical reductions in sulphur (S) deposition, researchers have explored using alkaline soil amendments to decrease soil acidity. One amendment that can perform this reduction in soil acidity is residential (non-industrial) wood ash (NIWA). However, much is unknown about its use, including how it affects the regeneration of tree seedlings in forest ecosystems. To test the potential impact of NIWA on sugar maple seedling survival a two-year field study was conducted in Bracebridge, Ontario, in which plots were treated with either 0, 2, 4, 6, or 12 Mg ha-1 of NIWA. Within each plot, smaller 1 m2 observation plots and destructive sampling techniques were used to study sugar maple seedling response by looking at seedling height, diameter, biomass and survivorship. The addition of NIWA increased several key nutrient concentrations in the soil without drastically increasing heavy metal concentrations, and increased soil pH. However, at dosages of 6 Mg ha-1 or more, sugar maple seedling survival was significantly reduced relative to lower dosages over both growing seasons. Ultimately, this research demonstrates that NIWA, when applied at dosages < 4 Mg ha-1, is effective at improving soil base cation status with no effect on sugar maple seedling regeneration. A longer assessment period is needed to determine whether survivorship remains affected at higher NIWA dosages as the ash percolates into deeper mineral soil layers.

Title: Effect of wood ash fertilizer on sugar maple sap in Ontario, Canada
Authors: Shelby M. Conquer, Norman D. Yan, and Shaun A. Watmough
Abstract
Acidic deposition has led to long-term acidification of forest soils and leaching of essential nutrients such as calcium (Ca) that jeopardize the health and productivity of sugar maple trees. Wood ash may be used as an effective nutrient supplement, but it is highly regulated in Canada because of concerns over its metal content and their impact on the environment. Additionally, though sugar maple trees are a substantial economic resource in Canada, and the maple product industry is worth $615 million as of 2023, it is not understood how the application of wood ash would affect sap chemistry or sweetness. To evaluate the effect of wood ash on sugar maple sap yield and chemistry, 6 Mg ha-1 of non-industrial wood ash (NIWA) was applied to surface soil in experimental sugar maple plots in Muskoka, Ontario. One year following application, significant increases were observed in soil pH and nutrient concentrations (Ca, Mg, K) in the upper soil layers and in metal concentrations in the litter layer in the treated plots relative to the controls. Sap yield in the treated plots was twice as high as the control plots in the first year following NIWA addition, but no differences were observed in yield the second year of sampling. Sap sweetness did not significantly differ between the control and treated plots in both years, and differences in nutrient and metal concentrations between treated trees and controls were small. Therefore, NIWA may be used to improve soil conditions with no measurable effect on sap chemistry or sweetness

although the reason behind the increased sap yield immediately post application remains uncertain.

Title: The accumulation and translocation of rare earth elements in rice (Oryza sativa)
Authors: Minh Duong, Karen Thompson, and Huy Dang
Abstract
Rare earth elements (REEs) are classified as priority critical minerals in Canada. In agriculture, commercial REE-based fertilizers, primarily available in Eastern Asia, can positively affect plant development, including rice (Oryza sativa). The distribution of REEs in rice plants is not yet fully understood, and the risk of REE translocation into edible rice parts can lead to food safety issues. This research, therefore, focuses on the bioaccumulation of REEs to evaluate how REE amendments in soil influence the uptake and translocation mechanisms among rice plants. Germinated rice seeds were exposed to a light REE (La). Elemental analyses showed that the highest La concentrations were in roots and husks (up to approximately 10 μg g-1 and 0.04 μg g-1, respectively). The accumulation in roots and husks was also directly related to soil La concentrations. Nevertheless, rice grains had the lowest concentrations (0.001 μg g-1) among the plant parts, which is unresponsive to soil La amendment. Despite a common assumption in the literature of the biochemical analogy between REEs and Ca, given their similar ionic radii, we did not observe the enrichment of Ca and other divalent cations in roots and husks. The differential accumulation of La in different rice tissues suggests specific mechanisms of translocation of REEs into rice tissues and requires further assessment to explore the transport and storage processes. Ultimately, the results highlight the limited transfer of REEs from soils to rice grains, suggesting the limited exposure of REEs to humans from the practice of amending REE in rice paddies.

Title: Critical Mineral Aquatic Geochemistry Over Four Seasons in Canada.
Authors: David Boettcher and Huy Dang
Abstract
The critical minerals (CMs) mining sectors are quickly expanding to sustain the CM supply for emerging technology and transitioning to a green economy. To ensure sustainable development of this sector, efficient and effective environmental protection measures are urgently needed but require a more in-depth understanding of the highly variable biogeochemical processes affecting mobility and transport processes of CMs in aquatic environments. However, for many CMs including rare earth elements (REEs) little is known about their geochemistry, environmental behavior and ecotoxicology. This research aims to alleviate these knowledge gaps by investigating CMs over four seasons and transitioning background geology in Ontario. Our investigations aim to differentiate anthropogenic sources of CMs from background concentrations, (ii) determine the major environmental processes governing the geochemistry of CMs, and (iii) the variations in the sources and cycling trends with the annual temperature cycle. We collected water samples along the Otonabee, Trent, and Ottawa Rivers and determined elemental composition using ICP-MS. We report concentrations of 55 elements as well as the distribution between dissolved and particulate fractions in each river over four seasons. Seasonal variation between dissolved and particulate may indicate conditions where CMs are more bioavailable. Preliminary data also

indicate wastewater treatment plants are a current source medical related REE contamination, and the fact that a shift in background geology can increase geochemical weathering, causing concentrations that falsely appear as contamination. Overall, this study aims to aid in future sustainability and protection of environments and communities involved in the CM sector.

Title: Aquatic Environmental Remediation Applications of Tunable Waste wood-derived Adsorbents

Authors: Hamant E. France and Andrew J. Vreugdenhil

Abstract

The remediation of waters polluted by both metallic and organic contaminants continues to attract considerable attention. Here, we report on the removal of the metals lead, aluminum and manganese, and the chlorinated herbicides 2,4-dichlorophenoxy acetic acid (2,4-D) and paraquat, from aquatic matrices. We achieve this by fabricating an activated carbon from a novel waste wood feedstock which is produced from the milling of Chlorocardium rodiei (greenheart); a species widely used in the Guyanese lumber industry. This material has highly tunable surface chemistry properties making it amenable to both oxygen and nitrogen functionalization. Surface oxygen groups were increased by a little explored flash oxidation procedure which resulted in a more than 7-fold increase in surface oxygen. Nitrogen surface functionality was increased by more than 5-fold upon incorporation of shrimp shell, shrimp hydrochar, shrimp chitin and commercially available chitosan into greenheart activated carbon. Oxygen functionalized activated carbons removed 96 ± 1.37% lead, 89 ± 0.72% aluminum and 55 ± 2.59% manganese from model solutions at pH 3 and 303 K. At optimum pH and 303 K, nitrogen functionalized carbons removed 97.5 ± 0.2% 2,4-D and 88.9 ± 0.2% paraquat. These green adsorbents, fabricated from sustainable biopolymers, are promising and versatile environmental remediation materials.

Title: Understanding the Relationship Between Land Disturbance, Mercury and Traditional Practices in the Moose Cree Territory: A Foundation for Risk Assessment

Authors: Emily J. Miceli, S. McGovarin, C. Trapper, W. Tozer, A. Litvinov, and Mary-Claire Buell

Abstract

The Moose Cree First Nation territory located in the James Bay region of Ontario, Canada, has been impacted by hydro, forestry, and mining activities over the past several decades. Concerns from the Moose Cree First Nation, around the impacts of these activities on the mercury burden in culturally significant fish species was raised by community members several years ago. In response to this concern, we used an interdisciplinary approach to our research by quantifying mercury concentrations within three traditionally consumed fish species (walleye [Sander vitreus], northern pike [Esox lucius], lake sturgeon [Acipenser fulvescens]) and through interviewing and surveying several community members. These methods aimed to fully understand the impacts and risks associated with elevated mercury in these fish. Our research methodology centered on community engagement and land relations. To achieve this, we conducted workshops with the Moose Cree community to train harvesters on fish sampling, held frequent meetings, conducted surveys on fish consumption, completed interviews on community land/water/fish relations, and conducted sampling and quantification of mercury in over 200 fish from the Territory. Our results indicated that mercury concentrations were the highest in walleye at

all six sampling locations followed by northern pike and lake sturgeon. The walleye mercury concentrations typically exceed the 0.5ppm Health Canada guideline for mercury in fish greater than fifteen inches at most locations. Walleye fourteen inches or greater also exceeded the 0.2ppm Health Canada guideline for subsistence consumers, women and children at all sample sites. Interviews and surveys stressed the importance of fish as a significant cultural food source that is frequently consumed. Interviewees also indicated that changes are being seen with fish at important fishing locations and that the land and water have been changing, making it difficult to fish and hunt. These changes are often attributed to the hydro activity on the Moose River and its tributaries. Through this research our project sought to support Moose Cree First Nation leadership with land stewardship planning goals and objectives towards maintaining their cultural reliance on traditional foods and land-based relations. Our collaborative project demonstrates an alternative approach to understanding and mitigating the risks of mercury.

Title: Long-Term Monitoring of Surface Water Microplastics: Seasonal and Annual Changes Over Two Years

Authors: Jacob Wyonch, and Julian Aherne

Abstract

Microplastics have become a ubiquitous contaminant across aquatic ecosystems. Freshwater systems can collect microplastics from watershed-scale sources and retain them for years in both surface water and sediment. Despite these factors, literature is scarce on how abundance in freshwater microplastics changes seasonally and annually. This study quantified and characterized surface water microplastics in 17 lakes during Spring and Autumn seasons over two years, in the Haliburton-Muskoka region of Ontario, Canada. Microplastics were isolated through wet peroxide oxidation and vacuum-filtration. Microplastics were characterized by shape, size and color through visual identification using a stereomicroscope. Microplastics were found in all lakes for both seasons and years, besides one lake in Autumn of 2022. Average microplastic concentrations throughout the sampling period was 2.97 mp/L, ranging from 0 – 13.68 mp/L. Fibres were the dominant shape found in all lakes throughout the two years, followed by fragments and other shapes (films, foams, beads). Microplastic concentration (mp/L) increased from 2.64 mp/L in 2022 to 3.29 mp/L in 2023. In 2022, concentration increased from 2.59 in Spring to 2.68 in Autumn but decreased throughout the seasons in 2023 from 3.8 in Spring to 2.82 in Autumn. All changes were not deemed significant, however. Despite changes in direct use of lakes seasonally, variation in microplastics may not be significant due to sustained anthropogenic presence in watersheds, and lake's ability to capture watershed-scale sources. Future work in this project will extend the sampling timeline to 2025 and analyze microplastics in lakes during Winter seasons.

Title: Development of a novel technique to study the oxidative potential of air pollutants using passive air sampler – application to study winter air pollution in Toronto

Authors: Shrutika Kadam and Pourya Shahpoury

Abstract

Air pollution is a major global health concern, with fine particulate matter (PM2.5) significantly contributing to respiratory and cardiovascular diseases. The oxidative potential (OP) of PM, a key measure of its toxicity, is driven by reactive oxygen species (ROS) generated from transition metals

and organic compounds. This study, part of the Science of Winter Air Pollution in Toronto (SWAPIT) project, evaluates the oxidative potential of winter air pollutants using passive air samplers (PUF-PAS) deployed at two locations: a residential area (North York) and a high-traffic urban site (Wallberg Building, University of Toronto). Acellular assays were used to quantify OP by assessing ascorbate depletion and hydroxyl radical formation. Synthetic epithelial lining fluid (SELF) was formulated to mimic lung antioxidants, providing physiologically relevant OP measurements. The findings reveal significant variations in OP between sites, highlighting the role of emission sources, trace metal content, and atmospheric conditions in oxidative stress induction. The kinetic profiles of ascorbate depletion and hydroxyl radical formation provided insights into the time-dependent toxicity of PM. This study underscores the importance of winter air pollution research in understanding the PM toxicity. Future work will expand OP measurements using dithiothreitol (DTT) assays and investigate the oxidative potential of pollutants from tire wear particles. The results contribute to a better understanding of urban air quality and its health impacts, supporting mitigation strategies to reduce exposure to harmful airborne pollutants.

Session 3: Genes, Cells, and Physiological Systems

Title: The efficacy and timing of cytokinin-induced inhibition of frog virus 3 (FV3) replication
Authors: Galair Prevost, RJ Neil Emery, and Craig Brunetti
Abstract
Cytokinins (CKs) are signaling molecules that are present in all kingdoms of life. These N6-adenine derivative molecules are vital in the development and differentiation of cells. In vertebrate systems, there are still gaps of knowledge in our understanding of what these molecules can do and the mechanisms behind their documented activity. Recently, we observed that specific CKs can significantly inhibit viral replication. To examine these effects we employed frog virus 3 (FV3), a double-stranded virus that primarily affects ectothermic vertebrates. Expanding on previous work and are testing the antiviral activity of two aromatic CKs, kinetin and kinetin riboside (KR). We investigated the timing of antiviral CK effects and determined their optimal concentrations for activity. Our results show that, at 15 μM of kinetin and KR, there is a significant decrease in FV3 replication. We then compared a 1-hour pre-treatment to a concurrent treatment of the CKs and our results show that both timing treatments inhibited FV3 replication, although concurrent treatments showed a greater magnitude of decreased viral activity ($p<0.05$). These results confirm the ability of CK to inhibit viral replication and further demonstrate that concurrent application with infection give the clearest effects. This will help future work that will delve further into the mechanisms behind CK inhibition of viral infection.

Title: Exploring the function of the protein-sorting receptor sortilin in Dictyostelium discoideum
Authors: Sean Condie and Robert Huber
Abstract
Intracellular protein sorting is essential for supplying resources needed by the organelles of a cell. For example, lysosomes require enzymes that break down bulk material like food sources and defective cellular components. How these enzymes get to the lysosome is well studied in mammals and begins with sorting receptors in the Golgi apparatus. Sorting receptors bind to an enzyme in the Golgi apparatus and allow the enzyme-receptor conjugate to be packaged into a vesicle and sent into the cytosol. One of these sorting receptors is sortilin (SORT1), which also participates in the trafficking of other non-enzymatic proteins. In our work, we use the social amoeba Dictyostelium discoideum to study sortilin-mediated protein sorting. D. discoideum has been used for close to a century to better understand conserved cellular and developmental processes and encodes a homolog of sortilin (Sort1). Unlike mammalian cells, D. discoideum has a unique life cycle comprised of both unicellular and multicellular phases. Cells lacking sort1 display reduced proliferation in liquid culture but grow normally on solid agar containing their bacterial food source. Immunofluorescence imaging revealed a cytokinesis defect, smaller and less distinct secretory vesicles, and poor actin recruitment to the cell membrane. Western blots revealed reduced intracellular autocrine proliferation repressing factors and reduced intracellular density sensing factors. We also generated a custom antibody against Sort1, enabling a significant advantage in future assay designs. Together, this research lays the foundation for establishing D. discoideum as a model organism for studying sortilin-mediated protein trafficking.

Title: Host-associated microbiome responses to Batrachochytrium dendrobatidis infection in the spotted salamander (Ambystoma maculatum) reveal microbial rescue as a mechanism of disease resistance.

Authors: Tucker Cambridge and Dennis Murray

Abstract

The global spread of animal disease has altered our understanding of the impacts of pathogens on populations, communities, and ecosystems. As disease epizootics progress to enzootic states, understanding emerging mechanisms of disease resistance within enzootic populations can better inform our understanding of infection dynamics in susceptible populations. Host-associated microbiomes are a mechanism of disease resistance and can provide a protective function during infection through microbial rescue. The fungal pathogen Batrachochytrium dendrobatidis (Bd), has contributed to the decline and extinction of amphibian species worldwide. The amphibian skin microbiome can inhibit Bd growth through production of anti-fungal secondary metabolites. We assessed the cutaneous microbiome response of a disease-tolerant amphibian host, the spotted salamander, Ambystoma maculatum, by inoculating salamanders with enzootic and epizootic strains of Bd-GPL and comparing microbial responses from before infection to recovery with 16S rRNA sequencing. Our results demonstrate microbial rescue by known Bd-inhibitory microbes through their increasing abundance, richness, and dominance in microbiomes. Salamander microbiomes also responded to infection by decreasing intra-host variation in beta diversity during recovery, indicating a shared functional response across individuals. Microbial responses differed by pathogen strain, and salamanders exposed to enzootic Bd had greater pathogen loads over time. This implies a commensal response to enzootic infection in a disease-resistant host, and strain-specific mechanisms of resistance to Bd infection. Microbiome dynamics are governed by the same drivers of community dynamics in macroscopic communities, and this work reinforces community ecology can better describe the functional significance of host-associated microbiomes.

Title: The relationships among phytohormones and benzylisoquinoline alkaloids in Papaver rhoeas L.

Authors: Zeynab Azimychetabi, Erin N. Morrison, Anna B. Kisiala, Scott C. Farrow, and R. J. Neil Emery

Abstract

Benzylisoquinoline alkaloids (BIAs) are widely distributed in the plant kingdom, playing essential roles in defense against pathogens and herbivores. These compounds are of great interest for both ecological and pharmaceutical research. The biosynthetic pathways of several BIAs in opium poppy (Papaver somniferum) have been well-characterized, however, how individual genes within these pathways are regulated remains largely unknown. Phytohormones are a class of naturally occurring, small organic molecules that coordinate a comprehensive suite of physiological processes in plants at very low concentrations. Because phytohormones may alter production of secondary metabolite defense compounds, I hypothesize that phytohormones regulate BIA metabolism. To date, phytohormones and BIA profiles have not been investigated simultaneously during ontogenesis in any member of the Papaveraceae family. Therefore, I investigated phytohormone and BIA profiles of Field poppy (Papaver rhoeas L.) during the first 5-days of in vitro culture. My data clearly showed that the production of BIAs depends on the developmental stage

and starts between days three and four at shoot emergence. Phytohormone profiles changed during this time simultaneously, and directly correlated with changes observed in BIA levels. In addition, for the functional investigation of phytohormones that control the BIA pathway, silencing their biosynthesis, degradation, and response factor genes will help confirm their function. To knock down the genes related to phytohormones and BIA biosynthesis and/or regulation, I used virus-induced gene silencing (VIGS). The results from the VIGS experiment demonstrated that modifying the expression of genes associated with a class of phytohormones, Cytokinins, leads to variations in the production of compounds across various branches of the BIA pathway.

Title: An exploration of the post-mortem modifications in DNA methylation in the post mortem interval

Authors: Irina Badell, Shari Forbes, and Aaron Shafer

Abstract

DNA methylation (DNAm) has been used as a marker of age and sex, due to age correlating with a general decrease in 5-methylcytosine throughout the genome and differential methylation patterns between sexes. Thus, methylation can be used to estimate an individual's biological age and sex from samples obtained in forensic investigations. DNAm changes also show potential as a marker of time post-mortem, or the Post-Mortem Interval (PMI). Consequently, the purpose of this study is to monitor the post-mortem changes in DNAm from pig and human remains to determine how long after death, age and sex can be accurately estimated, and whether there are predictable post-mortem changes. Decomposition was monitored with photos, weather data was collected, and DNA methylation was quantified from soft tissue samples in 930k CpG sites with the MethylationEPIC microarray. Here we show how age and sex can be predicted using methylation data post-mortem, and build a machine-learning model to predict the PMI from the methylation data.

Title: Investigating the Role of Cln5 in S-palmitoylation Pathway in Dictyostelium discoideum

Authors: Samer Owiar, William D. Kim, and Robert J. Huber

Abstract

S-palmitoylation is a post-translational modification that adds palmitic acid onto a protein to regulate its trafficking and impacts a protein's function. S-palmitoylation is a subcategory of lipidation and what makes it unique is that it is the only form of lipid modification that is reversible. Previous work suggested that the lysosomal enzyme CLN5 may function as a depalmitoylase, which is a protein that removes palmitate from palmitoylated proteins. Mutations in CLN5 cause a rare form of neurodegeneration called CLN5 disease, which is a subtype of neuronal ceroid lipofuscinosis. In my research, I am investigating the potential depalmitoylase activity of Cln5 in the eukaryotic microbe Dictyostelium discoideum, which is an established model system for studying CLN5 disease. There are two main objectives of my research project. First, I am using acyl-Resin Assisted Capture (acyl-RAC) to capture palmitoylated proteins from wild-type and cln5- cells. Based on the potential depalmitoylase activity of CLN5, I predict that cln5- cells will contain a greater number and/or amount of palmitoylated proteins compared to WT cells. In my second objective, I am assessing the effect of a palmitoylation inhibitor on the growth and multicellular development of D. discoideum, which will lead to a better understanding of the role

of palmitoylation in regulating conserved cellular and developmental processes. Overall, this work will provide insight into the molecular function of CLN5 and the importance of palmitoylation during the D. discoideum life cycle.

Title: Exploring the Role of Cathepsin B in Neurodegeneration
Authors: Tom Burnside and Robert Huber
Abstract
The lysosome is responsible for breaking down cellular materials through the action of hydrolytic enzymes. Deficiencies in these enzymes can result in the abnormal accumulation of substrates within lysosomes causing lysosomal storage diseases. One such disease, neuronal ceroid lipofuscinosis (NCL, commonly known as Batten disease), is a rare form of neurodegeneration associated with mutations in CLN genes: CLN1-8 and CLN10-14. Each gene is linked to a specific subtype of the disease (e.g., mutations in CLN3 cause the CLN3 disease subtype). Mutations in CLN genes cause progressive neurodegeneration with clinical symptoms ranging from vision loss and cognitive decline to premature death. The cysteine protease, cathepsin B, has been identified as a protein of interest in NCL as well as other forms of neurodegeneration. Cathepsin B is involved in the proteolytic cleavage of proteins within lysosomes as well as in the extracellular matrix (ECM). In various NCL subtypes, the expression, activity, and trafficking of cathepsin B is altered, making it both a potential target for therapeutic intervention and a biomarker for the neurodegenerative process. My research focuses on characterizing cathepsin B function in the model organism Dictyostelium discoideum, and then assessing the expression, activity, and trafficking of the protein in NCL knockout models. Overall, my objective is to establish D. discoideum as a model system for examining the role of cathepsin B in NCL pathology.

Title: Exploring the relationship between cytokinin and the encystation process in Giardia intestinalis
Authors: Linh Tran, Neil Emery, and Janet Yee
Abstract
Giardia intestinalis is a protist that causes diarrheal disease in humans. The infection initiates when a host ingests infectious cysts in contaminated water. Once inside the host, the cyst hatches in the stomach to release the trophozoite form, which swims down and proliferates within the intestinal tract. In the small lower intestine, some trophozoites develop back into cysts, which are released in the feces where they become a source of new infections. The conversion of the trophozoite into the infectious cyst form is called encystation and this can be induced in laboratory cultures. Cytokinins (CKs) are signaling molecules that are well-studied in plants for their important roles in the growth and developmental processes. Recently, CK metabolites have been found to be present in all kingdoms of life. Preliminary work done suggested that Giardia can metabolize CKs during encystation, and N6-benzyladenosine (BAR), a synthetic form of CK, may have inhibitory effect on the Giardia encystation process. My research is to investigate the roles BAR has on encystation. Efficiency of encystation of the Giardia cultures was monitored by the appearance and localization of a cyst wall protein (CWP1) by using immunofluorescence microscopy, and by quantifying the increase of this protein by using immunoblotting. Those experiments were performed in parallel with endogenous measurements of relevant metabolites

inside Giardia cells during encystation using liquid chromatography-high resolution mass spectrometry. Lastly, flow cytometry was used to analyze and monitor the G2 phase of the cell cycle that is the entry point to the encystation pathway.

Title: From Grazing to Gut Bugs: Influence of Diet and Disease on the Gut Microbiome of Muskoxen

Authors: Ashley Friedenberger, F. Mavrot, S. Kutz, and C.J. Kyle

Abstract

The Arctic is experiencing rapid environmental changes in temperature, landcover, and disease prevalence, all of which influence species abundance and distributions. A growing concern for Northern communities is the declining population of muskoxen on Victoria Island, a species of cultural and ecological significance. Muskox play critical roles in the Arctic food web and nutrient cycling, but factors such as low genetic diversity, extreme weather patterns, and infectious diseases threaten their survival. Past bottleneck and extinction events have resulted in low genetic diversity, limiting their ability to adapt to drastic environmental changes. Extreme weather can increase snow accumulation and ice crust formation, reducing forage accessibility, leading to higher mortality in adults and calves. Additionally, outbreaks of Erysipelothrix rhusiopathiae, Orf virus, and brucellosis have caused poor body condition, lameness, reduced fertility, and death. Diet analysis paired with gut microbiome research can provide insight into how a species are responding these environmental pressures in their habitat. Here, we explore dietary shifts in 360 muskoxen on Victoria Island between 2007-2023, examining potential correlations between diet, the gut microbiome, and disease. We will utilize 16S rRNA and TRNL gene sequencing to characterize microbial communities, diet composition, and disease presence through a combination of 16S rRNA sequencing and serology. Understanding these adaptive responses will help inform targeted conservation strategies and management practices for muskoxen. Ultimately, our findings will contribute to understanding broader implications of climate change on the iconic Arctic species, guiding efforts to preserve biodiversity in the Northern Canada.

Session 4: Ecology, Evolution, and Conservation

Title: Transitions in the thermal habitat use of brook trout during autumnal cooling
Authors: Jacob C. Bowman, Dak. T. de Kerckhove, Trevor Middel, and Mark S. Ridgway
Abstract
Climate change is altering the seasonal timing of ecological events, having consequences for aquatic biodiversity. In freshwater lakes, autumn cooling has been delayed dramatically in recent decades and the implications of this shift are largely unappreciated. The brook trout is one of the most iconic fish species in Ontario, yet it has declined across its range due to habitat loss and other threats. Brook trout need cold water (< 20°C) to survive and reproduce; therefore, a delay in autumnal cooling may negatively affect brook trout. For my M.Sc. work, I am studying the habitat use and thermoregulation of brook trout during the autumnal cooling period. Using an acoustic telemetry array in Algonquin Park, Ontario, I tracked the fine-scale movement patterns, depth-use, and body temperature of brook trout in relation to lake environmental temperature in the autumn of 2023. Using changepoint analysis, I have identified transitions in brook trout depth, body temperature, and use of littoral habitats during the cooling period. Indices of thermal habitat selection also describe how brook trout alter their thermoregulation strategy from a summer mode to an autumn mode. Autumn is an important period of transition for brook trout to capitalize on favourable thermal environments before the onset of winter. This work will improve our ability to predict the effects of climate change brook trout habitat use and inform conservation efforts.

Title: Defining home ranges of lake whitefish populations in Lake Huron
Authors: Sophia D'Aurora, Camilla Ryther, Justin Trumpickas, Warren Zeinstra, Chris Davis, Ryan Lauzon, Calvan Harpur, and Erin S. Dunlop
Abstract
The native lake whitefish (Coregonus clupeaformis) is experiencing population declines in Lake Huron from reduced recruitment. Lake whitefish commercial harvest is managed in Lake Huron using a quota system with little understanding about lake whitefish home ranges and the extent to which populations move between management zones, basins, or across international boundaries. To better understand the ecology and movement of lake whitefish (known as dikameg in Anishinaabemowin) in Lake Huron, a collaborative Two-Eyed Seeing research study, named Together with Giigoonyag, was initiated between the Saugeen Ojibway Nation, Ontario Ministry of Natural Resources, and Parks Canada. An acoustic telemetry array was established throughout the Ontario waters of Lake Huron to track the movements of acoustically tagged lake whitefish. Here, we describe estimated seasonal home ranges of lake whitefish that were tagged at two spawning shoals of local importance to the Chippewas of Nawash Unceded First Nation and Chief's Point. In 2020 – 2021, 59 lake whitefish were surgically implanted with acoustic telemetry transmitters at Nawash, followed by 69 lake whitefish at Chief's Point in 2021 – 2022. Results show that lake whitefish moved between management zones but stayed within their respective basins. Additionally, at least half of the populations exhibited spawning site fidelity and the lake whitefish at Chief's Point travelled greater distances than those at Nawash. These results highlight the home range variability among different spawning populations that can help improve our

understanding of the ecology of this species and better inform stewardship options for population rehabilitation.

Title: Great Lakes coastal wetland biodiversity increases following treatment of invasive Phragmites australis at Point Pelee National Park
Authors: Meghan Ward, Tarra Degazio, and Jeff Bowman
Abstract
In North America, the invasive common reed (Phragmites australis) has invaded coastal wetland habitats, resulting in the decline of wetland bird, invertebrate, and vegetation communities. Point Pelee National Park (PPNP) is located on the shores of Lake Erie in Ontario, Canada. Approximately 70% of Point Pelee National Park consists of marshland, making it one of the largest remaining Great Lakes coastal wetlands in Canada. PPNP has been designated an Important Bird Area and a Wetland of International Significance by UNESCO. Unfortunately, the wetlands in PPNP have become dominated by invasive P. australis. To reduce the extent of invasive-dominated areas and increase marsh biodiversity, a 5-year management plan was proposed by Parks Canada to remove five hectares of Phragmites growth from the northern and southern sections of the wetland complex. Using invertebrate traps, anuran and bird acoustic data, vegetation monitoring, and camera deployments, I have assessed the use of P. australis-invaded, treated, and non-invaded wetlands by wetland mammals, birds, anurans, and invertebrates. I have found that biodiversity across all taxa declines in patches heavily invaded by P. australis, but that the treatment of P. australis results in a diverse community reflective of that seen in non-invaded remnant habitat. This is one of the first studies to assess wetland biodiversity (including mammals) following manual Phragmites treatment, and the results of this project should be used to inform small- and large-scale restoration projects across the Great Lakes.

Title: Environmental controls on sub-Arctic arthropod communities in the Hudson Bay Lowlands, Canada
Authors: Dorothy Travis and Glen Brown
Abstract
Climate warming is accelerating at higher latitudes, driving significant shifts in ecosystem processes. Arthropods play vital roles in ecosystem function, particularly as key dietary components in seasonally dependent sub-Arctic food webs. Their growth and emergence during spring and summer are closely tied to temperature, and warming may lead to earlier seasonal availability, potentially causing a mismatch with consumer demand. These effects are pronounced in cold environments, where arthropod abundance is constrained by limited growth opportunities.
Despite their ecological importance, the relationship between habitat heterogeneity and arthropod phenology remains poorly understood. Climate warming may influence arthropod availability through interactions with habitat structure and permafrost thaw, which alters below-ground environments. Permafrost thaw dynamics vary across habitat types, introducing microtopographic unpredictability, particularly in wetlands and other sub-Arctic landscapes.
To investigate the environmental and microtopographic factors influencing arthropod availability, we analyzed biomass, abundance, and phenology of invertebrates collected using emergence and

modified Malaise-pitfall traps over two summers at 20 sites within Polar Bear Provincial Park, Hudson Bay Lowlands, Ontario. Our fine-scale spatial analysis considered accumulated air and soil degree-days, key weather variables, and microtopographic variation across four distinct sub-Arctic habitat types. Preliminary results indicate that soft-bodied, flighted taxa, particularly Diptera, exhibit strong dependence on climatic variables, while ground-dwelling taxa such as Carabidae demonstrate reduced climatic sensitivity but increased phenological dependence on fine-scale landscape habitat features. These findings highlight the complexity of arthropod responses to environmental change and underscore the importance of microhabitat variability in shaping phenological patterns in sub-Arctic ecosystems under rapid warming conditions.

Title: Density-dependent habitat selection of Meadow Voles (Microtus pennsylvanicus) in a sub-arctic ecosystem

Authors: Mihika Hegde and Glen Brown

Abstract

Arctic and sub-arctic wetland ecosystems are susceptible to anthropogenic climate warming, and its impacts on lower trophic levels can have cascading effects. For example, shrubification or the shrinkage or expansion of wetlands may alter habitat for wildlife and species distributions. Here, highly abundant and fluctuating populations of small mammals serve important functional roles, affecting vegetation through herbivory, as well as predators and other prey through food availability. Better understanding of small mammal distribution dynamics in northern ecosystems, like habitat selection and dispersal, is needed. In the Hudson Bay Lowlands, a large sub-arctic wetland region, meadow voles are the dominant prey, and their habitat suitability can be affected by shrub-cover and subnivean habitat characteristics. If small mammal populations follow an ideal free distribution (IFD), individuals should occupy freely available patches to maximize fitness and show density-dependent habitat selection. While such dynamics have been well-documented in the literature, site-specific factors can affect the amount of density-dependence, and the cost and direction of dispersal. Isodar theory has been proposed as a practical way of studying density-dependent selection, where, under an IFD, the linear regression of the relative densities for a given pair of habitat patches (isodar), where one habitat is typically more suitable than the other, can be analyzed to understand the factors affected by site-specificity. However, this approach has mostly been done in experimental set ups. My thesis attempts to assess meadow vole habitat selection dynamics in a vulnerable ecosystem and demonstrate the applicability of isodars in natural systems.

Title: The Overwintering Ecology of Northern Map Turtles

Authors: Samantha Howard, Michelle DiLeo, and Christina Davy

Abstract

Northern map turtles are a freshwater turtle species that aggregates in the winter at communal overwintering sites, where they remain active for the season . This species occurs in the Trent Severn Waterway, which spans from Georgian Bay to Lake Ontario and consists of 42 locks and more than 100 dams. With increased shoreline development and climate change, water levels across the system vary significantly throughout the year, particularly in fragmented areas between control structures where access to ideal overwintering habitat may be limited. Using a

combination of VFH and GPS tags, we will compare habitat selection by turtles in sites fragmented by locks and dams where access to deep water is limited to control sites where turtles have access to larger bodies of water with more habitat variability. This information will help us understand if turtles in fragmented sites select different overwintering habitats, potentially due to limited choice. Throughout the winter, we will also monitor changes in water level, flow, temperature, substrate composition, and macrophyte density at overwintering sites. We expect selected overwintering sites in fragmented areas to be significantly shallower, with higher water flow and more dissolved oxygen than control sites. Our results will better understand how water level management may impact northern map turtles.

Title: Revegetation following foraging by lesser snow geese in the sub-arctic
Authors: Charlotte Wills and Glen Brown
Abstract
The Mid-Continent population of lesser snow geese (Anser caerulescens caerulescens L.) had a substantial increase in population supported by agricultural developments. This increase led to widespread habitat degradation in their sub-Arctic breeding grounds along the coast of Hudson Bay. Due to their large number, the lesser snow geese's grubbing and foraging strategies resulted in expansive baren land, altering the ecosystem dynamics. The dynamics in the degraded state have now been well studied, particularly at the colony located at La Perouse Bay near Churchill, Manitoba. However, as the population of lesser snow geese began to stabilize, and decades have passed since the initial degradation, the question remains of if there is revegetation at these colony locations, and what the rate of revegetation is. This study employs a multi-temporal remote sensing-based approach to track changes in the landscape. Landsat satellite imagery was analyzed using vegetation indices such as Normalized Difference Vegetation Index (NDVI) and images were classified by plant functional group. Changes were tracked from 1974 to current to assess trends in plant cover and potential recovery time to identify spatial and temporal trends. Preliminary findings indicate that there are areas of recovery in recent years in areas where initial loss in vegetation has been located.