Science Atlantic Environment Conference 2022

MARCH 12
HOSTED VIRTUALLY BY
DALHOUSIE UNIVERSITY

Conférences en environnement de Science Atlantique 2022

12 MARS
CONFÉRENCE VIRTUELLE ORGANISÉE
PAR L'UNIVERSITÉ DALHOUSIE

Dear Conference Attendees,

Welcome to the 2022 Science Atlantic Environment Conference! This year, the conference is virtually hosted by Dalhousie University, which is in Mi'kma'ki, the ancestral and unceded territory of the Mi'kmaq.

The conference provides a wonderful opportunity for you to learn about some of the impressive research occurring throughout Atlantic Canada. It also enables you to connect with other people interested in environmental science and meet new friends. Presenters representing nine different academic institutions will share their interesting research while developing communication skills.

I am excited about the diversity of research topics presented at the conference this year. The various research projects are helping address environmental issues by contributing to sustainable management and better understandings of our environment.

I would like to thank Science Atlantic and the Faculty of Science at Dalhousie University for their financial contributions. I also thank the Science Atlantic Environment committee for their guidance and support. Thanks to the supervisors who mentor students and encourage their attendance at SAEC. The participation of each student presenter and attendee is greatly appreciated and essential for the success of the event.

Enjoy the conference!

Sincerely,

Caroline Franklin, PhD
Science Atlantic Environment Representative at Dalhousie University
Instructor | Department of Earth and Environmental Sciences, Dalhousie University

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Dear Undergraduate students, Graduate Students, and Colleagues,

It is my distinct pleasure to welcome you to the 2022 Science Atlantic Environment Conference on behalf of the entire Dalhousie University community. I acknowledge and thank the organizers, volunteers, sponsors, and supporters of this conference who have worked hard to make everything work in these unusual times. I wish you the best of luck with your presentations and encourage you to make the most of this valuable opportunity to engage with other scientists. Have a great conference!

Charles Macdonald, PhD
Dean | Faculty of Science, Dalhousie University

Thanks to our sponsors for contributing to the success of SAEC 2022!

Conference Schedule

Thursday, March 10th at 11:00 – 14:00 AT

Drop-in rehearsal for poster presenters (see instructions on page 6 for more details)

Friday, March 11th at 9:00 – 15:00 AT

Drop-in rehearsal for oral presenters (see instructions on page 6 for more details)

Saturday, March 12th at 8:30 – 17:00 AT

8:40 – 9:00	Opening remarks MS Teams General Channel
9:00 – 10:20	Undergraduate student oral presentations in two concurrent sessions MS Teams Channels 1 and 2
10:20 – 10:40	Coffee break and networking MS Teams General Channel
10:40 – 12:00	Undergraduate student oral presentations in two concurrent sessions MS Teams Channels 1 and 2
12:00 – 12:40	Lunch break and networking MS Teams General Channel
12:40 – 13:40	Graduate student oral presentations in two concurrent sessions MS Teams Channels 1 and 2
13:40 – 14:00	Coffee break and networking MS Teams General Channel
14:00 – 15:00	Keynote speaker presentation MS Teams General Channel
15:00 – 16:30	Poster presentation session https://event.fourwaves.com/saec2022/schedule
16:30 – 17:00	Awards ceremony and closing remarks MS Teams General Channel

Conference Logistics

Most of this conference is being hosted on MS Teams. **All registrants will be added to the MS Team using the email submitted for registration. Please check your email/junk mail on March 10th to ensure you gain access to the Team we will be using for the conference. Once you have access to the Team you should have full functionality to join any of the channels throughout the day of the conference.**

There will be meetings within the channels scheduled as follows:
- General channel starting at 8:30 am: this meeting will stay open all day so that people can come and go for coffee breaks and talks. This is where the opening remarks, the keynote speaker presentation, and the awards ceremony will occur.
- Two channels (Channels 1 and 2) for the concurrent student oral presentations

Please do not start your own meetings!

Troubleshooting Guest Access in MS Teams
MS Teams can limit access to those outside of the host organization (i.e., Dalhousie). Anyone outside of Dalhousie's internal audience will be considered a "Guest" for this conference so there is potential for some technical issues when joining the team. The following information may be helpful when you are trying to access the team.

Use the MS Teams app, which can be downloaded from the following website:
https://www.microsoft.com/en-ca/microsoft-teams/download-app

How to become a member of the Team if you are accessing it as a guest:
- The guest receives an email from MS Teams
- The guest accepts the invitation (through the email notification)
- After accepting the invitation, the guest can participate in teams and channels, access files, view and contribute to chats, and join meetings (through the app)

Some potential issues associated with MS Teams:
- When the person is added to the Team the notification may go to their junk mail or "other" mailbox
- A person may need to click on the email notification to access a Team
- Do not join the meeting directly from the meeting "link" that is generated when a meeting is scheduled (email link). You may not have access to the chat function if you join the meeting that way. Join via the SAEC 2022 Team on the **app**.

The poster session will be hosted on the conference website. Please visit the following website for instructions on attending the virtual poster session: https://help.fourwaves.com/how-does-the-virtual-poster-session-platform-work-the-day-of-the-event

Rehearsals for Presenters

All presenters will be added to the "SAEC 2022" Team in advance of the rehearsal. When you are added to the team you will receive an email notification (this may go to your junk mail). Access the team page through this email notification.

Rehearsals are mandatory to test technology, give presenters the opportunity to ask questions, and prepare for a smooth delivery of presentations at the conference. Presenters should join the rehearsal channel any time during the drop-in periods indicated below and someone will help facilitate the practice presentation.

Oral Presenters

Drop-in any time between 9:00 am and 3:00 pm on Friday, March 11th

1. Navigate to the MS Teams homepage for SAEC 2022. Access the private "Rehearsal channel for oral presenters". This is where the practice meeting will be taking place.
2. Join the meeting.
3. To share your screen, click on the "share screen" button and select the appropriate window to share. When sharing your screen as a guest it sometimes will only allow you to share the "desktop". In that case, have the presentation you want to share open on your desktop screen. Multiple screens may cause issues, so it is recommended to close screens other than the one with your presentation.
4. Now you should be able to display your presentation in full screen presenter mode and control the slides.

Your presentation slides should be ready to test. After you rehearse, please email a copy of your presentation to Caroline.Franklin@dal.ca as a back-up in case you experience technical issues during the conference.

Poster Presenters

Drop-in any time between 11:00 am and 2:00 pm on Thursday, March 10th

1. Navigate to the MS Teams homepage for SAEC 2022. Access the private "Rehearsal channel for poster presenters". This is where the practice meeting will be taking place.
2. Join the meeting.

Please visit the following website for instructions on presenting your poster: https://help.fourwaves.com/how-do-presenters-join-and-deliver-a-virtual-poster-session

Keynote Speaker

Dr. Stephen Heard

Professor
University of New Brunswick

**"Charles Darwin's barnacle and David Bowie's spider:
What can the names of species tell us about science, and
scientists?"**

Dr. Heard is an evolutionary ecologist and entomologist at the University of New Brunswick. He completed his BSc in Biology at the University of Waterloo and a PhD at the University of Pennsylvania. Dr. Heard's current research is focused on plant-insect interactions and the evolution of biodiversity. He has written *The Scientist's Guide to Writing* (Princeton University Press, 2016; and 2nd edition, 2022) and *Charles Darwin's Barnacle and David Bowie's Spider: How Scientific Names Celebrate Adventurers, Heroes, and Even a Few Scoundrels* (Yale University Press, 2020).

Detailed Schedule

Time (AT)	MS Teams General Channel	MS Teams Channel 1	MS Teams Channel 2
8:40 – 9:00	Opening remarks		
9:00 – 9:20		**Claire Maxwell** Investigating Atlantic Salmon Decline in Qamsipuk River, Eskasoni First Nation, Cape Breton Island	**Erin Nelson** Assessing the suitability of nature-based climate change adaptation techniques for coastal erosion in Prince Edward Island, Canada.
9:20 – 9:40		**Matthew Fraser** Effects of episodic seasonal water quality fluctuations on wild Atlantic Salmon (*Salmo salar*) migration on the northeast Margaree River, Cape Breton Island	**Andrew Howe** The Environmental Impacts of Resource Extraction for Renewable and Nuclear Energy Technologies
9:40 – 10:00		**Cody Penney** Morphological variation in an introduced rodent species on insular Newfoundland	**Rebecca Martino** Modelling How Future Population Growth and Climate Change Effect Food Security in Nigeria
10:00 – 10:20		**Maxwell Locke** Enhanced petroleum hydrocarbon bioremediation in a diesel-contaminated soil using biostimulation and rhizoremediation	**Camryn Gallagher** Evaluating the historic change in consumption of high-impact animal products in Canada
10:20 – 10:40	Coffee break and networking		
10:40 – 11:00		**Ashlynn Fleming** Examining the relationship between marginalization and change in Toronto's urban forest between 2008 and 2018	**Hope Moon** Parental Factors that Affect the Connectedness To Nature of Pre-School Aged Children in Halifax, Nova Scotia
11:00 – 11:20		**Garridan Porter** Impacts of Large-Scale Forest Loss on the Green Water Climate of the Permian-Triassic Extinction	**Emily Lannigan** Evaluating Preschool Children's Environmental Knowledge and Connection to Nature Using a Games Testing Tool
11:20 – 11:40		**Jada Lynch** Quantifying black carbon from biomass burning at an urban and boreal site in Canada	**Emma Kerr** Art, Science and Technology in the production of bird eggs

Time	Column 2	Column 3	Column 4
11:40 – 12:00		**Leila Rashid** Human Influence in the Form of Dam Construction and Agricultural Development in Recent Decades on the Tekes River Alluvial Fan, Xinjiang, China	
12:00 – 12:40	Lunch break and networking		
12:40 – 13:00		**Edward Medeiros** Fluid-preserved museum specimens retain original stable hydrogen isotope signatures	**Hamida Ibrahim** Origine de la matière organique sulfurisée dans la colonne d'eau océanique et sa contribution à la préservation
13:00 – 13:20		**Marzieh Arshian** Geomorphological and Ground penetrating radar survey of a site vulnerable to coastal erosion, SE Newfoundland, Canada	**Alexandre Landry** Les sédiments: un piège efficace et permanent pour le radium?
13:20 – 13:40		**Choyce Chappell** Design of a Mobile App Natural Disaster Preparation, Response and Recovery on Prince Edward Island	**Samuel Banville** Influence de l'âge de l'huître américaine (*crassostrea virginica*) sur les teneurs élémentaires de sa chair
13:40 – 14:00	Coffee break and networking		
14:00 – 15:00	**Keynote speaker: Stephen Heard Charles Darwin's barnacle and David Bowie's spider: What can the names of species tell us about science, and scientists?**		
15:00 – 16:30	Poster presentations on website (https://event.fourwaves.com/saec2022/schedule)		
	Kate Burden, Christopher Dobbin, and Jessica Turner Seed predation in a stand of eastern white pine (*Pinus strobus*) in western Newfoundland		
	Katelyn Corbett Hummock microclimate and substrate preference of the lichen *Ochrolechia frigida* in the province of Newfoundland and Labrador		
	Katrina Cruickshanks and Sean Haughian Arboreal lichens and bryophytes of old growth forest canopies in Nova Scotia: implications for bias and vulnerability		
	Luke Fifield, Shane Taker, and Joshua Ripley Effects of coarse woody debris from white birch (*Betula papyrifera*) harvesting on forest stand nutrient supply, regrowth, structure, and understory composition in central Newfoundland		
16:30 – 17:00	Awards ceremony/Closing remarks		

Oral Presentation Abstracts

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Geomorphological and Ground penetrating radar survey of a site vulnerable to coastal erosion, SE Newfoundland, Canada

Marzieh Arshian and Alison Leitch

Memorial University of Newfoundland

Coastal erosion can be a serious issue requiring accurate observation in order to evaluate vulnerable areas and determine the subsequent actions to address this problem. The Town of Bay Bulls, about 29 km south of St. John's, NL, has coastal areas prone to erosion, and an important aim for the Town municipality is to reinforce these areas to avoid future road collapse. An inspection to describe an areas' geomorphological characteristics and a ground-penetrating radar (GPR) investigation were carried out along the Bay Bulls northern shoreline at the 'Bread and 'Cheese' site. The shoreline at the Bread and Cheese site has steep cliffs subject to erosion by terrestrial and marine processes. The tilted bedrock is mainly light-gray sandstone, locally thinly bedded, greenish-gray to red sandstone, and siltstone. Regarding the cliff face and toe erosion, a noticeable downward dip is apparent in the cliff face due to soil creep or the slumping of the Quaternary cover or glacial diamicton. This occurrence would probably be considered a rotational slump, a common slumping type. The GPR survey was conducted along the road on a clifftop using 250 antennae, providing useful information about the underground structure. GPR result of the Bread and Cheese area depicts the subsurface culverts, bedrocks location, and highly fractured regions corresponding with the geomorphology observations.

Influence de l'âge de l'huître américaine (*crassostrea virginica*) sur les teneurs élémentaires de sa chair

Samuel Banville and Olivier Clarisse

Université de Moncton

L'huître américaine (*crassostrea virginica*) est considérée comme un organisme sentinelle pour les éléments métalliques, c'est-à-dire de refléter en sa chair la contamination de son écosystème. En effet, ces bivalves filtrent sur une base quotidienne une large quantité d'eau pour se nourrir accumulant simultanément les contaminants présents dans l'environnement marin. Cependant, des facteurs biologiques telles la taille ou l'âge des huîtres sont susceptibles d'affecter la teneur des éléments métalliques présents dans leur chair limitant ainsi la portée des études actuelles de surveillance environnementale et de bioaccumulation. Afin de délimiter l'influence de ces paramètres, nous avons récolté auprès de 5 producteurs ostréicoles du Nouveau-Brunswick ~ 160 huîtres âgées de 1 an, ~ 80 de 2 ans, ~ 60 de 3 ans et ~ 40 de 4 ans. Pour chaque producteur et chaque tranche d'âge, la chair des huîtres a été extraite et regroupée afin d'obtenir 6 échantillons avec une masse sèche supérieure à 3 g. La minéralisation acide (HNO_3-HCl, 2 :1) de ces échantillons a permis leurs analyses par spectrométrie de masse couplée à un plasma inductif et la détermination des teneurs de 36 éléments dans la chair des huîtres. Nos résultats démontrent un appauvrissement systématique avec l'âge ou la taille moyenne des huîtres pour les alcalino-terreux (Ca, Mg, Sr et Ba), certains alcalins (Na, Li) et d'autres éléments traces (Mn, V, Ni et Cr). Il est donc primordial de considérer ces facteurs biologiques de cet organisme sentinelle dans les études de surveillance environnementale pour brosser le portrait le plus juste de la contamination des écosystèmes.

Design of a Mobile App Natural Disaster Preparation, Response and Recovery on Prince Edward Island

Choyce Chappell and Chris Power

University of Prince Edward Island

There is an increasing need for citizenry to prepare for, respond to, and recover from natural disaster events due to climate change. There is an opportunity for different types of interactive technology to aid citizenry in how they manage their lives in relation to these disasters. Most research in the area of the design of technology in crisis informatics focuses on the tools that governments and other agencies need, as opposed to that of citizens. There is a gap in the literature of understanding the needs of users of this technology, especially in relation to geographical or cultural contexts. This presentation will describe the research that has been undertaken to design a mobile crisis app that is tailored to the needs of the citizenry of Prince Edward Island. Following a user-centered design lifecycle, semi-structured interviews were undertaken to identify the key goals and needs of users in the island environment and reflect on what that means in terms of design of technology to support them. In additional to traditional preparation goals, thematic analysis of these interviews identified several unexpected themes, including the supportive collaboration of individuals during and after storm, in which island residents need means of communicating who needs or can provide support and help. Personas and user stories were created from this data representing the broad range of goals of island residents. The presentation will relate these design artifacts to a prototype mobile app to support island residents that will be evaluated in the next phase of research.

Examining the relationship between marginalization and change in Toronto's urban forest between 2008 and 2018

Ashlynn Fleming, James Steenberg, and Peter Duinker

Dalhousie University

Urban forests provide a myriad of social, environmental, and economic benefits that help make cities desirable and safe places to live. Understanding the distribution and change of urban forests is key to ensuring their equitable management and development. However, few studies have examined the relationship between urban forest change and populations, and most are limited in the insight they can provide because of the forest metrics they use. This study addresses these gaps by examining the correlation between growth, establishment, and mortality rates of Toronto's urban forest and the four indicators of marginalization described in the Canadian Index of Multiple Deprivation. Bivariate correlation, multiple linear regression, and geographically weighted regression were used to determine if there was a relationship between each change metric and each indicator of marginalization at the dissemination area level. Based on previous studies, it is expected that there will be a negative relationship between urban forest growth and marginalization, indicating areas with less marginalized populations will have experienced higher tree growth and establishment rates, and lower mortality rates. However, since urban forest ecosystems are complex and diverse across cities, there is potential too for unexpected and novel results. This study will provide a further understanding of how and where Toronto's urban forest changed between 2008 and 2018, and whether certain populations benefited more from these changes than others. It will also provide insight into the potential implications of urban forest management plans like Toronto's, in hopes of increasing urban forest equity going forward.

Effects of episodic seasonal water quality fluctuations on wild Atlantic Salmon (*Salmo salar*) migration on the northeast Margaree River, Cape Breton Island

Matthew Fraser[1, 2]

[1]Cape Breton University, [2]Cheticamp River Salmon Association

Wild Atlantic salmon (*Salmo salar*) are declining throughout Atlantic Canada. Numerous factors are likely at play such as overfishing, climate change, and competition with escaped aquaculture-reared salmon. My research focuses on identifying whether there are increasing episodic changes in water chemistry (i.e., dissolved oxygen and pH) within salmon spawning habitat in the northeast Margaree River, Cape Breton Island. By using historic water chemistry data provided by Environment and Climate Change Canada, we have been able to highlight fluctuations in dissolved oxygen and pH due to seasonal high-water events in the Northeast Margaree, that coincide with salmonid migration. Preliminary findings show that due to the stagnant nature of the highland headwaters during low flow periods (i.e.. hotter, drier summer months), the flushing action of fall rainfalls causes notable drops in pH that may affect migratory actions of salmon during this period. Acquiring a better understanding of the fluctuations (frequency and intensity) of high-water events will play a crucial role in informing conservation efforts.

Evaluating the historic change in consumption of high-impact animal products in Canada

Camryn Gallagher

Dalhousie University

Since the early 1960s, the global anthropogenic food systems have become incredibly resource-intensive and have caused a global increase in greenhouse gas (GHG) emissions, freshwater scarcity, land cover conversion, and biodiversity loss. The balance of scholarly evidence demonstrates that of all food products available for consumption, animal products are the most environmentally impactful foods to produce and consume. Within the Canadian context, three-quarters of food-related emissions are derived from the high consumption of animal products. Due to the impactful environmental footprint of animal products, reducing meat consumption on a population level is critical to planetary health. This research investigates how historical trajectories of Canadian per capita consumption of high-impact animal products have changed over time. Per capita consumption of beef, pork, chicken, turkey, eggs, and milk is calculated using Statistics Canada data to examine changes in consumption over time. The results indicate that poultry currently dominates the livestock consumption in Canada, and there have been significant increases in poultry consumption over time. Beef, pork, milk, and egg consumption have decreased over time, although, the total meat consumption has remained high throughout time with no significant variation. The study adds to the evolving body of literature on agriculture and the environment by examining historic consumption trajectories of high-impact products which can be used to inform modeling scenarios of future Canadian consumption. In turn, this can help better inform decision-makers to better understand the impact that potential interventions for influencing the changes in the Canadian diet could have on the Canadian environment.

The Environmental Impacts of Resource Extraction for Renewable and Nuclear Energy Technologies

Andrew Howe

St Thomas University

A global increase in energy consumption coinciding with a shift to carbon-neutral energy sources has led to an increased concern in how we are extracting raw materials for this development. Frequently, mining companies fail to properly handle their waste or engage in exploitative extraction techniques. These dangerous practices are exacerbated when hazardous materials are mined and local communities face the long term consequences of their effects. Research methods include evaluating the common practices in the extraction industry in comparison to best available technologies, and case studies of issues relating to mining impacts on the local environment and community. Digging deeper, this presentation will disclose my findings on the environmental impacts of extracting resources for renewable and nuclear technologies.

Origine de la matière organique sulfurisée dans la colonne d'eau océanique et sa contribution à la preservation

Hamida Ibrahim

Université de Montréal

Les changements climatiques renforcent la nécessité de mieux comprendre le cycle du carbone et les rôles joués par la matière organique (MO) dans ce cycle. La préservation de la MO s'oppose à l'augmentation des teneurs en CO_2 et donc aux changements climatiques. Les milieux marins possèdent deux énormes réservoirs de MO préservée pour des millions d'années : la MO dissoute (MOD) et de la MO sédimentaire. La préservation de la MOD dans les océans peut être expliquée par le mécanisme de sulfurisation abiotique provenant de la réaction entre du soufre (S) réduit et la MO. Cependant, la contribution de cette réaction à la MOD soufrée (MOD-S) des océans et à sa stabilité demeurent largement inconnus. Dans cette étude, nous avons évalué la source de la MOD-S des eaux marines et la contribution de la sulfurisation à sa préservation. Les résultats des traceurs isotopiques suggèrent que la MOD-S provient principalement de la réduction biotique des sulfates. La comparaison de la composition isotopique de la MOD-S de l'eau de mer avec celle des eaux interstitielles a confirmé que la sulfurisation abiotique n'est pas une source importante de MOD-S pour la colonne d'eau. Des expériences de dégradation supportent cette conclusion en montrant une dégradation préférentielle des molécules sulfurisées abiotiquement par rapport aux molécules non sulfurisées. En conclusion, tous les résultats indiquent une faible contribution de la sulfurisation abiotique à la MOD-S de la colonne d'eau. Cette étude apporte une contribution importante aux connaissances sur les mécanismes de formation et de préservation de la MOD-S.

Art, Science and Technology in the production of bird eggs

Emma Kerr

Cape Breton University

Experiential, hands-on learning about wildlife is one of the best ways to increase environmental stewardship. An alternative to handling wildlife is to create exceptionally realistic replicas. Allowing students and community members to handle bird eggs, thus providing them with a sensory learning experience, will likely inspire them to learn more about bird species. Artificial models safeguard the specimen's diversity by eliminating the need to handle actual specimens. Three-dimensional printing has revolutionized our ability to reproduce models that accurately represent the size, shape, and mass of a bird species' egg by using computer software that computes mathematical formulae generated from photographs of real eggs. Encompassing all three attributes: experiential learning, the biology of bird egg production, and colour theory, the purpose of my research is to employ three-dimensional printing and printing technologies and precision hand painting to produce the most realistic, resilient, and relevant bird egg replicas. Sixteen different bird species are included in the project. The species were selected based on ecological interest and importance to Indigenous culture, supporting a traditional Mi'kmaq sky story passed down through the generations - *Muin and the Seven Bird Hunters*. The models have educational value for use in Cape Breton University's Cameron Zoological Museum Collection, Natural Sciences and Engineering Research Council of Canada (NSERC), Let's Talk Science Kits and CBU's ornithology course and community outreach events.

Les sédiments: un piège efficace et permanent pour le radium?

Alexandre Landry and Olivier Clarisse

Université de Moncton

Lors de l'extraction des ressources naturelles, le radium présent naturellement dans les roches du sous-sol est mobilisé vers les environnements de surface où il se concentre dans les sédiments des rivières avoisinantes. Les teneurs sédimentaires de cet élément radioactif servent alors d'indicateur de contamination des activités anthropiques et permettent de délimiter sa dispersion au sein des écosystèmes. Cependant, la diagénèse précoce des sédiments modifie grandement les équilibres géochimiques de ce milieu favorisant ainsi la remobilisation du radium de la phase solide vers la phase dissoute. Les sédiments puits initiaux de radium peuvent alors se comporter comme une source de cet élément pour la colonne d'eau. Pour illustrer ce propos, nous nous sommes intéressés aux sédiments de la rivière Kennebecasis au Nouveau Brunswick où se concentre actuellement dans son bassin versant tous les puits de gaz de schiste de la province. Quatre carottes sédimentaires de 15 à 25 cm ont été prélevées, découpées en tranches au laboratoire sous atmosphère inerte pour permettre l'extraction des eaux interstitielles par centrifugation. Le radium a été mesuré tant dans la phase particulaire que la phase dissoute des sédiments et la colonne d'eau subjacente. Nos résultats devraient permettre de i) dresser l'historique des dépôts de radium au sein des sédiments de la rivière Kennebecasis, ii) délimiter spatialement toute contamination éventuelle et iii) préciser le rôle actuel des sédiments en tant que puit ou source de radium pour la colonne d'eau.

Evaluating Preschool Children's Environmental Knowledge and Connection to Nature Using a Games Testing Tool

Emily Lannigan and Dr. Tarah Wright

Dalhousie University

Environmental education among preschool-aged children focuses on increasing children's connection to nature, environmental knowledge, and developing their environmental attitudes and beliefs. Barriers such as the Coronavirus pandemic and increases in technology limit the opportunities of children to expand their experiences within nature. With these barriers increasing, measuring this relationship is pivotal in determining the importance of nature connectedness and nature experiences among preschool aged children. To measure this relationship, a modified psychological games testing tool was applied to a sample of 3-5 year old preschool children in Halifax, Nova Scotia. This study analyzed the environmental knowledge and connection to nature of the preschool children through measuring the extent to which the children in the study demonstrated environmental sensitivity, environmental awareness, and environmental preferences with nature. The games testing tool was tested on a cohort of 30 preschool aged children and included six games ranging from a child's feelings towards certain behaviours to a goods and services matching game. This presentation will explore preliminary results including an analysis of each game to determine the relationship of the children in the study and their connection with nature. The analyses will then further investigate these results to determine whether attendance to nature based versus non-nature based preschools or the age of the children impact the level of their environmental knowledge and connection to nature. The results showcase meaningful contribution to measuring nature connectedness using the tool, although future research is necessary to conduct the study on a larger sample size.

Enhanced petroleum hydrocarbon bioremediation in a diesel-contaminated soil using biostimulation and rhizoremediation

Maxwell Locke and Mano Krishnapillai

Grenfell Campus, Memorial University of Newfoundland

Conventional methods for cleaning up hydrocarbon-contaminated sites can be damaging and are expensive. Bioremediation techniques use the hydrocarbon-degrading capacity of some soil microbes to transform hydrocarbons into non-toxic products, mitigating the adverse effects they may impose upon the environment. Biostimulation is the addition of nutrients or bulking agents to hydrocarbon-contaminated soil to stimulate microbe activity, thus enhancing bioremediation efficiency. Also, plants release exudates from their roots, enhancing hydrocarbon biodegradation, a technique known as rhizoremediation. These strategies have gained interest amongst scientists as they represent environmentally friendly and cost-effective means of cleaning up hydrocarbon-contaminated sites. In this work, an outdoor pot experiment was conducted to study the effectiveness of two bioremediation techniques, biostimulation and rhizoremediation, on the removal of hydrocarbons from a diesel fuel-contaminated soil under cold climate conditions. Six treatments were used, including control, grass, compost, manure, compost+grass and manure+grass, each prepared in triplicate. Amendments were added at a rate of 10% on a dry mass basis. Samples were taken every 15 days, and transient changes in hydrocarbon concentration were assessed by measuring the gravimetric oil and grease content using a Soxtec® extraction apparatus. Interestingly, after 60 days, the control had the lowest final oil and grease content of approximately 344 mg/kg (90% reduction), followed by grass, manure, manure+grass, compost and compost+grass treatments. Although data are still being generated, these early results suggest that enhanced contaminant adsorption in the amended treatments may be inhibiting bioavailability and thus bioremediation highlighting the importance of optimizing all factors for bioremediation success.

Quantifying black carbon from biomass burning at an urban and boreal site in Canada

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Black carbon (BC) aerosol is created via incomplete combustion of fossil fuels and biomass. It is important to study sources of BC emissions because it is one of the major short-lived climate forcers, and it can also cause severe health issues. However, it is difficult to constrain sources due to limitations in measurements, models, and emission inventories. This study uses BC measurements conducted at an urban and boreal site in Canada, Toronto and East Trout Lake, respectively. Although emission inventories suggest that BC in Toronto should be highest in the winter, the observations show an opposite trend, with the highest BC concentrations in the summer. To explore the sources contributing to these trends, we use the Lagrangian particle dispersion model FLEXPART (FLEXible PARTicle dispersion model) with the Global Fire Emissions Database (v4.1s) to simulate biomass burning emissions of BC and the Community Emissions Data System to represent anthropogenic emissions. The influence of these different sectors and their contribution to the observed BC concentrations will be presented for the two sites and annual and seasonal variations will be explored.

Modelling How Future Population Growth and Climate Change Effect Food Security in Nigeria

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Population growth leads to a greater demand for energy and production, thus increasing anthropogenic emissions worldwide. Increased atmospheric carbon dioxide concentrations lead to radiative forcing and an enhanced greenhouse effect. Climate change, as result, has serious consequences such as extreme events like droughts, heat waves, and heavy precipitation. These consequences have devastating effects on agricultural productivity. How can understanding and modelling these consequences of climate change give insight to the state of food security in Nigeria? To answer this question, I used Stella, a system dynamics modelling software, to model the effects of climate change on agriculture in Nigeria. In Stella, I focused on five main components in the environmental system; the Human population, CO_2 concentrations, temperature anomalies, Nigeria's population, and Nigeria's crop production. Through sensitivity analyses, I projected three future scenarios for each component in the model. The main sensitivity analysis performed was on the carrying capacity of Earth's population. In result, it was found that temperature anomalies have large effects on the frequency of the three extreme events. As anomalies increased passed 1.5°C, the frequency of events occurred unprecedentedly. This result had large consequences on Nigeria's crop production, in the sense that it created chaos in the system when the frequency of extreme events changed. This consequently fluctuated crop production and caused a severe decrease in Nigeria's food security by 2050. Overall, it can be determined from this model that food security will be substantially effected by the consequences of climate change in the future.

Investigating Atlantic Salmon Decline in Qamsipuk River, Eskasoni First Nation, Cape Breton Island

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Atlantic salmon decline has been a serious concern across Atlantic Canada since the early 1990s. In Eskasoni First Nation, Qamsipuk River is a migrating site for salmon which is among dozens of streams in Cape Breton that are plagued with population decline. Additionally, Qamsipuk River has faced river degradation and loss of salmon habitat. My project uses an interdisciplinary approach to investigating salmon population decline and habitat degradation in Qamsipuk River. Information has been gathered from published scientific articles, unpublished information from Eskasoni Fish and Wildlife Commission (Qamsipuk River's primary monitoring organization), government documents, and historic documents, combined with professional interviews with scientists, foresters, and fisheries management professionals, and elder oral tradition seminars in collaboration with Eskasoni Fish and Wildlife Commission. Overfishing, at-sea poaching, and poor land-use practices are among general causes for salmon decline. In Qamsipuk River, the unique presence of an Indian Agency implemented sawmill which operated along the riverbank during Mi'kmaq centralization in the 1940s is hypothesized to have caused downstream effects on river condition. The sawmill's clearcutting and associated log transportation using the stream may have contributed to habitat degradation and subsequent salmon population decline. I am currently using historic documentation combined with the elder oral tradition seminars and professional interviews to compare the conditions of Qamsipuk River pre- and post-centralization and examine the potential effects of centralization and the sawmill on river habitat and salmon decline.

Fluid-preserved museum specimens retain original stable hydrogen isotope signatures

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Stable hydrogen isotope techniques are widely used to assign probable areas of origin to migratory animals. Latitudinal gradients in the stable hydrogen isotope composition (d^2H) of meteoric water make this system well-suited to studies of long-distance aerial migrations, such as those undertaken by some birds, insects and bats. Such studies commonly include analyses of keratinous tissues, including feathers and fur. These samples may be taken from museum specimens and the specimens selected are usually dry study skins. Many museum specimens, however, are stored in fluid preservative and the effects of fluid preservation on the stable carbon and nitrogen isotope compositions of various tissues are well-studied. We know of no similar investigations on the effects of fluid preservation on the d^2H of keratinous tissues. We hypothesized that preservation in fluid does not alter the d^2H of bat fur and investigated using a two-pronged approach. We accessed bat specimens held by the Natural Sciences Research Laboratory at Museum of Texas Tech University. We (i) placed 5 *Perimyotis subflavus* carcasses in each of three common preservatives (formalin, ethanol, and isopropyl alcohol), sub-sampling fur over the following six months and (ii) compared the d^2H_{fur} of dry and fluid-preserved *Sturnira lilium, Dermanura tolteca,* and *Carollia sowelli* that had been collected at matched locations between 50 to 30 years previously. We found no differences in the d^2H_{fur} following fluid preservation over the short or longer term. We conclude that fluid-preserved museum specimens are a useful source of samples for future stable isotope investigation of bat migration.

Parental Factors that Affect the Connectedness To Nature of Pre-School Aged Children in Halifax, Nova Scotia

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Time spent in nature has been found to promote a connectedness to nature (CTN) in both children and adults. However, it has been found that people are spending increasingly less time outside, thus jeopardizing establishing a degree of a CTN. For children especially, it has been found that developing CTN can lead to pro-environmental attitudes and behaviours as adults. However, access to time in nature can largely depend upon the child's parental situation. Parental factors that may affect a child's time spent outside can include attitude such as safety concerns ecological outlook, level of income and education, or whether they have enrolled their child in a nature-based school. This study aimed to explore these parental factors that may impact the time spent outside, and therefore indirectly impact a child's degree of CTN. Participating parents were given a survey to complete, asking them questions regarding time spent outside, associated safety concerns with given environments, their ecological outlook, and their material and social welfare levels. Different factors were then compared with the time spent outside, or likelihood of placement in a nature-based school. Preliminary analysis shows little significance of the different factors on the time spent outside. Further, the results seem to indicate that the study sample was biased due to the proportion of high incomes and education levels, and therefore potentially skewing the data. This study helps to inform future studies to ensure a more robust sampling method for better recognition of potential patterns and effects of parental factors on CTN.

Assessing the suitability of nature-based climate change adaptation techniques for coastal erosion in Prince Edward Island, Canada

Erin Nelson

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Coastal erosion rates on Prince Edward Island (PEI) are increasing due to climate change. Wave action continuously works on the unconsolidated till and sandstone banks, eroding and receding coastlines. This causes intensified risk to properties, infrastructure, and humans. Common hard engineered structures are short-term solutions to coastal erosion. These hard, anthropogenic structures disrupt the natural land-water interaction as wave energy is deflected at the structure and dispersed to adjacent areas, increasing erosion. Nature-based adaptations are used as alternatives to hard structures by incorporating natural materials, such as vegetation, to provide coastal protection. Nature-based adaptations are long-term methods for coastal erosion. These adaptations act as wave energy barriers and sediment traps, slowing erosion rates. Certain characteristics and baseline conditions such as vegetation, geology, geomorphology, sediment, and differing exposure types are required for nature-based adaptation techniques to reap their intended benefits. Tools to assess site suitability for living shorelines, available online or through documents, are critiqued. The critique is based on how well the tool characterizes PEI, signifying how useful it would be if used as an assessment resource for the suitability of nature-based adaptations. A multicriteria evaluation was conducted in ArcGIS Pro to identify segments of shoreline that were suitable, moderately suitable, and unsuitable for implementing living shorelines. This model was tested using 31 field sites surveyed between July-August 2021. With this information, governments and coastal property owners will be able to determine whether or not their property would benefit from installation of nature-based adaptations.

Morphological variation in an introduced rodent species on insular Newfoundland

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Rapid evolutionary change (over a few years or decades) may occur in populations that have been introduced to new areas, particularly islands. Red-backed voles (*Myodes gapperi*) are native to many parts of Canada, but were absent from insular Newfoundland until their introduction around 1999. Changes in rodent morphology are well documented following their introduction to island ecosystems. Here, we assessed geographic and temporal variability in cranial morphology of *M. gapperi* among sites in Atlantic Canada, including between insular Newfoundland and mainland populations. Specifically, we predicted that the cranial morphology of members of the introduced Newfoundland population would be distinct from those in the mainland populations of eastern Canada. We further predicted that there has been an increase in the size of *M. gapperi* through time since the initial introduction to insular Newfoundland. We accessed red-backed vole specimens from eastern Canada that are held by the Royal Ontario Museum, and the Newfoundland and Labrador Fisheries and Wildlife Division. We collected both linear measurements and geomorphometric data from the red-backed vole skulls and performed principal component analysis (PCA) (linear measurements) and Procrustes analysis followed by PCA (geomorphometric measurements) on those data. We found evidence of variation in cranial morphology between the insular Newfoundland and mainland populations, as well as within the insular Newfoundland population since the time of introduction.

Impacts of Large-Scale Forest Loss on the Green Water Climate of the Permian-Triassic Extinction

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Recent studies have shown profound effects of deforestation on precipitation and evapotranspiration. This can be attributed to the concept of green water, which is the volume of water stored in soils and interacting with plants via evapotranspiration. The Permian-Triassic extinction had the most profound impact on plant life of any mass extinction, with many large forests being replaced by herbaceous lycophytes. The aim of this study is to explore a large-scale extreme example of deforestation by analyzing the green water variables of the Permian-Triassic extinction linked to the global loss of Glossopteris and related forests. When exploring this event, two main questions are focused on; how did the global distribution of green water differ after the extinction, and how could these alterations have affected global climate at the time? To answer these questions, variables from various studies are transferred into ArcGIS and used to make first estimates of seasonal evapotranspiration, latent heat flux, and mean residence time before and after the Permian-Triassic extinction. Initial tresults show a general decrease in evapotranspiration across Pangaea, except regions of increase around the 30° latitudes. Similar changes are observable for the latent heat flux across the continent which correlates to an approximate inverse change in sensible heating after the extinction. As for MRT, there is an assumed reduction of almost 100% across Pangaea. When these changes are correlated to known distributions of pre-extinction land cover types the general trends seem to hold true, with the pre-extinction desert and boreal conifer biomes acting as outliers.

Human Influence in the Form of Dam Construction and Agricultural Development in Recent Decades on the Tekes River Alluvial Fan, Xinjiang, China

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An alluvial fan is a fluvial landform with a semi-conical shape formed by sediment deposition by a river that emerges from a confined upland source area. Fans are sensitive landforms that link the erosional upper catchment area with a low-lying depositional area and readily reflect changes to both of these environments. The Tekes River alluvial fan is located in Xinjiang Province in northwestern China and is the fan of interest for this Honours Project. Xinjiang Province has an arid to semi-arid climate as well as a historically unpredictable precipitation rate. With a rapidly growing population, food insecurity is a serious issue. Therefore, making use of available water resources is important. Because of this, the Tekes River fan has had a vast increase in human influence in the form of dam construction and agriculture expansion. Although development on and surrounding the Tekes River alluvial fan is apparent, there is a lack of research on how these human impacts have affected the fan. The primary objective of this project is to use remotely-sensed image analysis to document the human influence that has occurred to the Tekes River alluvial fan. A 31-year time series (1990-2021) was created using Landsat imagery from 1990 – 2021. Image processing techniques such as unsupervised classification were used to describe dam construction, the expansion of agricultural area and an irrigation network over time, and changes in morphology of fan surface river channels.

Poster Presentation Abstracts

Listed in alphabetical order by last name of first author

Seed predation in a stand of eastern white pine (*Pinus strobus*) in western Newfoundland

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Seed production, viability, and seedling survival rates are the main drivers of forest regeneration, which can be severely impacted by herbivores. In the boreal forest of Newfoundland, patterns of seed predation reflect habitat conditions that favour specific groups of granivores. Red squirrels are likely to be active in the thicker forest, while meadow voles can operate in the field around separated trees. Insects are ubiquitous, while slugs prefer humid areas. Seed predation also exhibits strong diurnal and seasonal patterns. Squirrels and birds forage during the day, voles and gastropods are mostly nocturnal, and insects vary in their behaviour. Invertebrates normally operate during the warmer season, while mammals and birds may be active throughout the year. The objectives of this study are to estimate the diversity of seed predators, their spatial and temporal activity patterns, and cumulative rates of seed removal in western Newfoundland. Field data for this project were obtained from a forested area containing a population of eastern white pine (*Pinus strobus*) in the Blow Me Down Mountains on the south shore of the Bay of Islands. Trays containing white pine seeds were placed along a 200 m elevation gradient across the summer and fall seasons. Motion-activated cameras were installed to capture the diversity and activity of seed-predating wildlife. By preliminary estimates, seed removal rates were high across the season, and cameras captured a variety of visitors, from birds to a bear. We discuss the prospective analytical approaches to apply to the datasets, and the expected experimental results.

Hummock microclimate and substrate preference of the lichen *Ochrolechia frigida* in the province of Newfoundland and Labrador

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Ochrolechia frigida (Sw.) Lynge is a parasitic lichen adapted to live in extreme alpine and arctic climates. It has been found growing in bog-covered barrens of the island of Newfoundland wherein preliminary surveys show that its east and west coast populations grow on different species of mosses. Before the lichen fungal partner of *O. frigida* acquires its algal symbiont, it may source nutrients from a living substrate, which may be a moss, a vascular plant, or another lichen, often leading to the death of the host substrate. *O. frigida*'s relatively unusual ability to parasitize living vegetation likely accounts for its ecological success. There is limited research on this lichen, and little is known about the plant community, microclimate, or other environmental parameters that might influence the substrate choice of the lichen. Establishing such connections is important to understand the future of *O. frigida*, as climate change starts to alter ecosystem conditions and slowly shift lichen habitats globally. The geographic isolation of the island of Newfoundland, together with the location of the two sites on the opposite coasts provide an opportunity to study two lichen populations, adapted to uniquely challenging but different growth conditions. Therefore, the objectives of this study are 1) to explore patterns in the plant and lichen community composition that support the growth of *O. frigida*, and 2) to characterize substrate choice in the two Newfoundland populations of *O. frigida*. Observations on the growth habit of *O. frigida* and some preliminary findings will be discussed.

Arboreal lichens and bryophytes of old growth forest canopies in Nova Scotia: implications for bias and vulnerability

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Lichen and bryophyte diversity is highest in old growth rainforests, which occupy only a fraction of their former extent. Old growth forests will likely continue to decline, particularly those at risk of infestation from pests such as hemlock woolly adelgid. Arboreal lichen surveys have traditionally focused on the lower bole of host trees; this likely causes underestimation of biodiversity that could mislead forest managers. We tested how arboreal lichen and bryophyte communities differ between the canopy and lower boles of 27 old growth Eastern hemlock trees at 9 sites across Nova Scotia. Each tree was surveyed using visual percent-cover estimates at the base and in the lower canopy. Single rope ascension was used to access the lower canopy with minimal impact on epiphyte communities or tree cambium health. Habitat properties were also recorded, including bark pH, tree girth and height, and canopy cover. Results showed higher pH, and a greater abundance of macrolichens in the canopy, whereas bryophyte species richness and microlichen abundance were both greater on the lower bole of host trees. Macrolichen diversity was not influenced by height, rather it increased from the North East to the South West region of the province. As the first study of canopy lichens in the province, our results suggest that when research focuses only on those species within reach of the ground, macrolichen biodiversity is underestimated, as is the conservation value of forests.

Effects of coarse woody debris from white birch (*Betula papyrifera*) harvesting on forest stand nutrient supply, regrowth, structure, and understory composition in central Newfoundland

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Commercial clear-cutting in the boreal forests changes the nutrient flow patterns by disrupting the regular supply of litter from the trees. In turn, any woody debris left on site after harvest contribute to the organic and inorganic content of soil. Key nutrients such as phosphorus and nitrogen are deposited into the soil as products of decay, and can be actively absorbed by vegetation. Growth of suppressed saplings present in the understory is released by the removal of the shading canopy, reflected in increased yearly growth increments. Shade-tolerant or moisture-dependent understory components may be suppressed. Growth rate differences between species affect the composition of the regenerating stand community. Our study looks at the stand regeneration patterns after a forest harvest experiment initiated 20 years ago in central Newfoundland. The study area of boreal forest dominated with white birch (*Betula papyrifera*) with some balsam fir (*Abies balsamea*) and black spruce (*Picea mariana*) was divided into three treatments: uncut, birch removal with branches and tops left behind, and birch removal with all branches and tops removed. Recently, the sites were re-assessed for soil parameters, tree growth, and vegetation composition. The objective of this work is to investigate whether the differences in the remaining debris biomass have changed the chemistry of the soil, affected the growth rates of dominant trees as reflected in annual rings and height increments, altered plant community composition, and resulted in different stand structure among the treatments. We present our proposed approaches to data analysis and discuss likely outcomes.