



**Science Atlantic
Environment
Conference**

Virtual Conference
March 13, 2021

Cape Breton
University and
University of New Brunswick (Fredericton)



**Conférences en
environnement de
Science Atlantique**

Conférence virtuelle
mars 13, 2021

Université du Cap Breton
Université du Nouveau-Brunswick (Fredericton)

Dear students and faculty

Welcome to the 2021 Science Atlantic Environment Conference, jointly hosted by Cape Breton University and the University of New Brunswick Fredericton located in the unceded territory of the Mi'kmaw, Wolastoqiyik (Maliseet) and Passamaquoddy people. This is a great opportunity for everyone to hear about some of the wonderful research going on in universities all over Atlantic Canada. It is also an opportunity to connect with students and faculty who are passionate about research and knowledge in many fields, and spend time with like-minded new friends. We would love for you to use this event to get to know people you would otherwise not run into in a regular day!

We're particularly excited about this year's conferences because we did not get to have a conference last year. The 2020 SAEC was cancelled on very short notice when Canadian institutions began closing their doors as a result of the rapid spread of Coronavirus. This year has been extremely challenging in so many ways, and we are really happy to welcome you to this virtual event to come together and celebrate all the work being done in the Atlantic provinces. While an in-person event would have been everyone's first choice this virtual event is a testament to adaptability in our universities and enthusiasm for the Science Atlantic mission of engaging students and faculty throughout Atlantic Canada in the exchange of ideas. We're also excited because this is the first time CBU has hosted the Environment Conference. We have a brand new Bachelor of Arts and Science in Environment program (the BASE program) which is in its fourth year with its first graduating class. We look forward to a long relationship with Science Atlantic and all the environmental programs represented here.

We'd like to thank Science Atlantic, Cape Breton University, and the University of New Brunswick (Fredericton) for their financial and logistical support for this conference. Thank you to our excellent student interns Sarah Cusack, Emilie Noel, Jennifer Campbell and Gracie MacKinnon, your work has been invaluable! Thank you to all the faculty members at the regional universities who work with students and encourage them to come to events like these. We'd also like to thank every student presenter and attendee – without you there would be no Science Atlantic, and no conferences. The depth and breadth of the work presented at events like these speaks well for the future professionals who are here with us this week.

Have a great conference!

Michelle Gray

(Acting Dean and Associate Professor, Forestry & Environmental Management UNB)

Deanne van Rooyen

(Associate Professor of Geology, co-director of BASE program CBU)

Dear Undergraduates, Graduate Students and Colleagues,

On behalf of the faculty, staff and students of Cape Breton University, it is my pleasure to welcome you to the virtual 2021 Science Atlantic Environment Conference. The organizing committees have worked tirelessly to bring you what promises to be an excellent scientific program and significant collaboration and networking opportunities. We wish you the best luck at the conferences and with your presentations.

Sincerely,

Rick Pierrynowski and Stephanie MacQuarrie

Dean and Associate Dean of the School of Science and Technology

Andy Parnaby

Dean of the School of Arts and Social Sciences

Cape Breton University

**Thank you to our Sponsors for helping to make
this conference a success!**



Science Atlantic | Science
Atlantique



CONFERENCE SCHEDULE

Friday March 12th 9:00am to 2:30pm

Check-in and dress rehearsal day – see instructions under Conference Logistics.

Saturday March 13th

- | | |
|-------------|---|
| 8:40-8:55 | Welcome and logistics <i>Main MS Teams Channel</i> |
| 9:00-10:40 | Presentations in two concurrent sessions <i>MS Teams channel 1 and Channel 2</i> |
| 10:40-11:00 | Coffee break and Networking <i>Main MS Teams channel</i> |
| 11:00-13:00 | Presentations in two concurrent sessions <i>MS Teams Channel 1 and Channel 2</i> |
| 13:00-14:20 | Poster session <i>Dedicated Poster Channels</i> |
| 13:00-13:20 | Coffee break and Networking <i>Main MS Teams Channel</i> |
| 14:25-14:30 | Introduction to pecha kucha presentations <i>Main MS Teams Channel</i> |
| 14:30-15:30 | pecha kucha presentations <i>Main MS Teams Channel</i> |
| 15:30-15:40 | Quick coffee break <i>Main MS Teams Channel</i> |
| 15:40-16:20 | Plenary Speaker – Maureen Cameron MacMillan <i>Main MS Teams Channel</i> |
| 16:20-16:40 | Awards presentation <i>Main MS Teams Channel</i> |
| 16:40-17:00 | Coffee break and Networking <i>Main MS Teams Channel</i> |

CONFERENCE LOGISTICS

This conference is being hosted on MS Teams.

NOTE: All registrants will be added to the MS Teams using the email submitted during the registration process - please check your email/junk mail on March 11th 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:

- One for the main channel starting at 8:40am – this meeting will stay open all day so that people can come and go for coffee breaks and talks. This is where the welcome session, the coffee breaks, the pecha kucha presentations, the plenary speaker, and the awards presentation will be hosted.
- Two meetings in each for the two talk channels, one starting at 9am and one starting at 11am.
- Individual scheduled meetings for each poster presenter – to chat with the presenter you simply join their meeting in their channel.

Please do not start your own meetings – just join the ones that are scheduled.

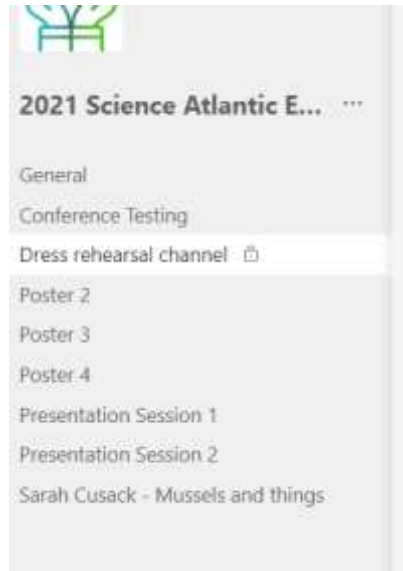
Dress Rehearsal for ALL PRESENTERS: 9:00 am – 2:30 pm Friday, March 12th

All presenters need to access the MS Team set up for the conference during the hours listed above. This is critical for the presenters because we will test your screen-sharing and set-up to make sure your talks go smoothly.

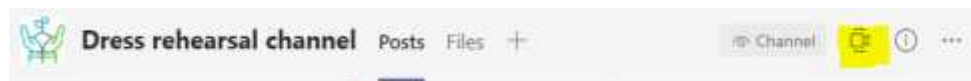
All presenters will be added to the “2021 Science Atlantic Environment Conference” Team in advance of the dress rehearsal. When you are added to the team you will receive an **email notification** (this may go to your junk mail) – access the team page through this email notification. One of the interns will send out an additional confirmation email to let you know that you have been added to the team.

Presenters will be able to go onto the team and access the private “Dress rehearsal channel” – this is where you will practice sharing your screen, accessing the chat function, and asking any pre-presentation questions you may have about the conference. The slot is open from **9:00 am – 2:30 pm** for your convenience. There will be someone available to moderate the practice run with you, anytime between these hours.

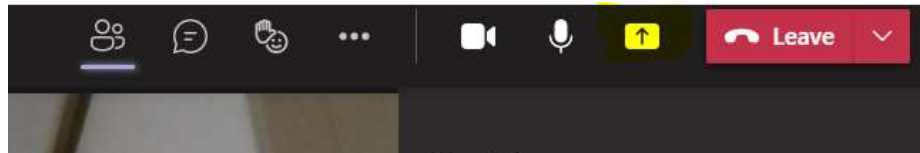
1. Navigate to the Teams homepage for 2021 SAEC conference. Access the private “Dress rehearsal channel”. This is where the practice meeting will be taking place.

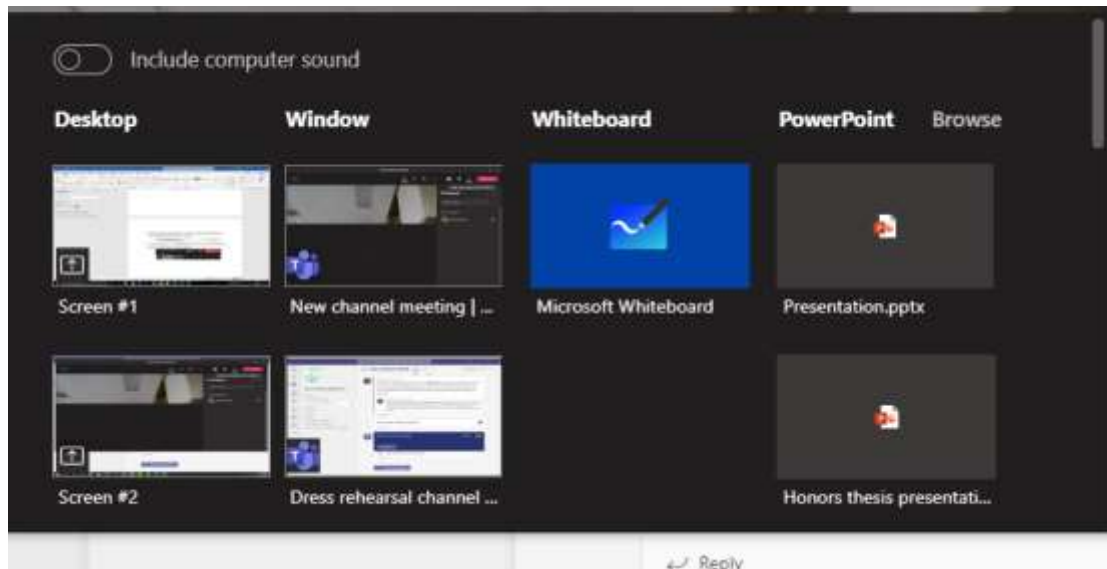


2. Launch a meeting by clicking “Meet now” or, if someone is already in the meeting (i.e. the meeting is already ongoing, simply join the meeting.



3. To share your screen, click on the “share screen” button and select the proper window (that has your presentation open) to share. (See Yellow highlight)





4. Now you should be able to display your presentation in full screen presenter mode and be able to change the slides.

Remember to check in during the dress rehearsal hours 9am – 2:30pm on Friday! Have your presentation ready to test.

After the check-in we ask that you send a copy of your presentation to deanne_vanrooyen@cbu.ca so that we can have a back-up in case your screen-share capacity mysteriously disappears between Friday and Saturday.

Troubleshooting Guest Access in MS Teams

MS Teams can limit access to those outside of the host organization (in this case UNB is the host). Anyone outside of UNB's internal audience will be considered a "Guest" for this conference – therefore 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:

How to become a member of the Team if you are accessing it as a guest:

- The guest receives a welcome email from the team owner, with information about the team and what to expect now that they are a member.

- The guest accepts the invitation (through the email notification). Guests who have a work or school account within the host organization can accept the invitation and authenticate directly. **Other users are sent a one-time passcode to validate their identity (One-time passcode authentication required).**
- After accepting the invitation, the guest can participate in teams and channels (through the App or Browser), receive and respond to channel messages, access files in channels, participate in chats, join meetings, collaborate on documents, and more.

Some issues we have come across in other conferences hosted using MS Teams:

- When the person is added to the team the notification will likely go to their junk mail or “other” mailbox
- To access the Team they need to click on that email notification, and most likely complete the two-factor authentication process (Which almost all universities/companies have now).
- If they choose to use the web browser - Chrome or Edge seems to allow the most functionality. Internet explorer does not work with MS Teams.
- Do not join the meeting directly from the meeting “link” that is generated when a meeting is scheduled (email link). You will not have access to the chat function if you join the meeting that way. Rather, join through the SAEC Team on the **app**.
- When sharing your screen as a guest it sometimes only will allow you to share the “desktop”. Have the presentation/info you want to share open on your desktop screen. If you are using more than one screen that also seems to cause issues for external participants - so while sharing your screen disconnect the second screen.

To bypass the **2-factor authentication** follow the steps provided in this video:

<https://www.loom.com/share/65888b4fb74647849225459cf56a63ac>

PLENARY SPEAKER

Maureen Cameron-MacMillan

Regional Biologist
NS Department of Lands and Forestry

"Sciencing Outside the Box: My Unexpected Career Journey"

Maureen is a biologist and life-long nature lover born and raised in Inverness, NS. She completed a B.Sc. in Biopsychology at Mount Allison University and an M.Sc. in Cognitive and Behavioural Ecology at Memorial University of Newfoundland before returning to her Cape Breton roots. She worked for many years as an environmental consultant in Sydney before joining the Nova Scotia Department of Lands and Forestry as Regional Biologist for Inverness and Victoria Counties.



DETAILED SCHEDULE

This schedule is also available on the MS Teams site under “files” should you need a separate copy.

Saturday March 13th

| | | |
|-------------------------|---|---|
| 8:40 – 8:55 am | Welcome, introductions, logistics in MAIN MS Teams space | |
| | MS Teams Channel 1 | MS Teams Channel 2 |
| 9:00 – 9:20 am | Nina Garrett The effect of call similarity on call discrimination by Tree Swallow (<i>Tachycineta bicolor</i>) nestlings in the presence of noise | Madison Silver Functional connectivity analysis of selected landscapes on Prince Edward Island, Canada |
| 9:20 – 9:40 am | Jenacy Samways Investigating the global drivers of earthworm species diversity on islands | Makadunyiswe Ngulube Wave Dissipation Potential of <i>Spartina alterniflora</i> in the Bay of Fundy |
| 9:40 – 10:00 am | Hannah Kosick Cape Breton Abuzz: Naturalists Amass Data About Bumble Bees | Elise Rogers Spatial and Temporal Variations in Sediment Composition within Restoring Salt Marshes |
| 10:00 – 10:20 am | Andrew Willms Quantifying the Causes of Increased Human-Black Bear Interactions Across Nova Scotia | Brianna Bowes Examination of Mercury and Arsenic Concentrations in Spruce Tree Cores and Soil Samples from Historical Gold Mine Tailing Sites in Nova Scotia |
| 10:20 – 10:40 am | Annie Dysart Cladoceran body size as a metric of environmental change in New Brunswick lakes | Rory MacNeil Greening a Brownfield: An Analysis of the Natural History of Plant Species at Open Hearth Park |
| 10:40 – 11:00 am | Break and networking in MAIN MS Teams space | |
| | MS Teams Channel 1 | MS Teams Channel 2 |
| 11:00 – 11:20 am | Michael Smith Spatial distribution and patterns of airborne mercury and arsenic using epiphytic lichens at a historical gold mine tailings site in Nova Scotia | Leah Crossley Electrochemical Investigation of Microbial Carbon Cycling |

| | | |
|-----------------------|---|--|
| 11:20 – 11:40 am | Hara Saadia Développement d'un outil intégratif d'aide à la décision sur les impacts cumulatifs de l'exploitation des ressources naturelles | Samantha Howard Understanding Resistance to Flood Mapping: a Test of Climax Thinking in Southwestern Nova Scotia |
| 11:40 – 12:00 pm | Rachel Noddle Investigating the Nitrogen Biogeochemistry of Sewage Organic Materials Using Compound-Specific Isotope Analysis | Chiara Ferrero-Wong Examining the Impact of the National Arts Centre Climate Cycle Initiative on the Environmental Knowledge, Attitudes, and Professional Practices of Canadian Theatre Artists |
| 12:00 – 12:20 pm | Meghan Fraser Do brook trout reflect legacy DDT contamination in New Brunswick lakes? | Frejhan Jn Baptiste Assessing coastal vulnerability to sea level rise in St. Lucia and the resiliency of beaches |
| 12:20 – 12:40 pm | Claudio Ignacio Fernández Potato Late blight - Spectral Changes Induced by the Disease | Sage Mosgrove When and where can farm-level Life Cycle Assessments be used to predict aggregate food system contributions to global warming? |
| 12:40 – 1:00 pm | Marika Brown Pollinator response to glyphosate application within managed forests of New Brunswick | Michelle Mann Examining the effectiveness of municipal reuse centers in Nova Scotia as a waste diversion strategy |
| 1:00 – 1:20 pm | Coffee Break and networking in MAIN MS Teams space | |
| 1:00 – 2:20pm | Poster Session in individual poster channels. Go to each channel and chat with the poster presenter! | |
| 1 | Olivia Barry Analysis of trace metal concentrations in relation to water quality and anuran distribution in ponds on Newfoundland's Baie Verte Peninsula | |
| 2 | Molly Bradford The effects of sediment geochemistry on methylmercury production and bioaccumulation in intertidal ecosystems | |
| 3 | Grace Callahan The effects of clearcut harvesting on moss chloroplast lipidome and adaptation to light stress during boreal forest regeneration | |
| 4 | Dan Jewell Identifying Contaminants From Historical Gold Mines Using Satellite Images | |

| | |
|-----------------------|--|
| 5 | Natalie Parsons The influence of long-term agricultural management practices on red wiggler worm (<i>Lumbricus rubellus</i>) population abundance and activity in Cormack, Newfoundland |
| 6 | Ngoc Dieu Tran Indigenous Medicinal and Ceremonial Plants at the UNB Woodlot |
| 7 | Jodi Young Distribution and abundance of introduced anuran species in ponds on the Baie Verte Peninsula, Newfoundland |
| 2:25 – 3:30 pm | Pecha Kucha session for presentations |
| 2:30 – 2:40 pm | Nikita Popli Consideration of impacts of applying rotenone in aquatic systems: The eradication of Smallmouth bass in the Miramichi River system. |
| 2:40 – 2:50 pm | Kaushalya Rathnayake Is there variation in phenotypic selection on floral traits in bee-pollinated Penstemons? |
| 2:50 – 3:00 pm | Hannah Macdonnell Improving Statistical Downscaling Over Complex Terrain Using GlobSim. |
| 3:00 – 3:10 pm | Damien Mullin Predicting the Effects of Forest Harvest on Wood Turtle Habitat Suitability |
| 3:10 – 3:20 pm | Marwa Jebali Développement des sondes DGT spécifiques à l'échantillonnage du radium dans les eaux naturelles |
| 3:20 – 3:30 pm | Courtney Burk Mapping connectivity in New Brunswick to sustain forest-dwelling vertebrate populations. |
| 3:30 – 3:40 pm | Quick Coffee Break and networking in MAIN MS Teams space |
| 3:40 – 4:20 pm | Plenary speaker - Maureen Cameron MacMillan - Main channel "Sciencing Outside the Box: My Unexpected Career Journey" |
| 4:20 – 4:40 pm | Award Presentations - Main channel |
| 4:40 – 5:00 pm | One last Coffee Break and networking in MAIN MS Teams space |

ONLINE CONFERENCE ETIQUETTE

- Please mute your microphones at all times except when asking a question.
- Use the “raise hand” button to ask questions, or type them into the chat window.
- We encourage keeping your camera on in smaller groups, you may need to turn it off when the groups are larger.
- Speakers should keep their cameras on when presenting.
- Poster presenters should keep their cameras on while hosting the chat in their poster channels. Poster visitors are strongly encouraged to keep their cameras on while chatting to the presenters, this makes it a much more engaging experience.
- Each “meeting” within channels will be started by hosts for that meeting. Please do not start your own “meeting” at any point, you will get lost!
- If in doubt, follow the links from Fourwaves into the channel or meeting you want to be in.

ABSTRACTS

Abstracts are in alphabetical order for first author.

Only the affiliation of the first author is listed.

Analysis of trace metal concentrations in relation to water quality and anuran distribution in ponds on Newfoundland's Baie Verte Peninsula

Olivia Barry and Christine Campbell

Memorial University of Newfoundland - Grenfell Campus

The mining of heavy metals has an extensive history in Newfoundland, particularly in the Baie Verte Peninsula (Slavinski et al. 2010). However, heavy metals pose a serious threat to aquatic ecosystems, and as a result, anurans (frogs and toads) are facing population declines (Lefcort et al. 1998). The aim of this project is to assess the presence and concentrations of trace metals in anuran pond habitats throughout the Baie Verte peninsula. Then secondly, as part of a bigger project assessing anuran populations, to determine if there is any relationship between anuran distribution and the presence of trace metals. Water samples were collected and filtered at 30 ponds throughout the Baie Verte peninsula during July 20-21, 2020. In the laboratory, samples were acidified using trace metal grade nitric acid (Camponelli et al. 2010). Samples were analyzed for a suite of metals using ICP-MS (Inductively Coupled Plasma Mass Spectrometry), which can measure elements at the trace level. (Raja & Barron 2019). A principal component analysis (PCA) was conducted using the program PAST, which found that there is no relationship between anuran distribution and trace metal concentrations. PC1 (Mg) accounts for 88.2% of the variance in the data, while PC2 (Fe) accounts for 11.6% of the variance. Across the 30 ponds, Mg had the highest average concentration (2.14 mg/L), while Cu had the lowest average concentration (0.00885 mg/L). This research is important because it furthers our understanding of the environmental impacts of mining, particularly in aquatic habitats.

Examination of mercury and arsenic concentrations in Spruce Tree cores and soil samples from historical gold mine tailing sites in Nova Scotia

Brianna Bowes, Linda Campbell and Nelson O'Driscoll

Acadia University

Historical gold mine tailing sites in Nova Scotia contain high concentrations of total mercury (THg) and arsenic (TAs). To assess temporal trends in the bioavailability of these contaminants, tree cores and surface soil samples were collected from four gold mine tailing sites near the Halifax Regional Municipality (HRM). Five spruce trees (either *Picea glauca* or *Picea mariana*) were cored from each site, and the year of growth estimated from tree ring counts. We found that average surface soil THg and TAs concentrations from all mine tailing sites exceeded Canadian Health guidelines for acceptable soil Hg (500 µg/kg) and As (12 mg/kg) concentrations in residential areas. We found tree cores were below the method detection limit (MDL) for THg in all analytical runs (MDL ranging 1.26-4.16 µg/kg), with the exception of the Old Stamp Mill site in the Montague Mining District. Tree ring segments for this site ranged from 0.87 to 43.11 µg/kg (MDL=2.01 µg/kg). However, tree ring segments from this site did not show a linear trend in THg content over time (~1945-2019), as indicated by tree ring counts. Additionally, no significant correlation (p-value=0.85, n=26) was found between THg concentrations in tree bark and surface soils. The findings of this study support the need for future research on Hg and As bioaccumulation and effects near historical gold mine tailing sites in Nova Scotia, and that the Old Stamp Mill site merits detailed follow-up studies.

The effects of sediment geochemistry on methylmercury production and bioaccumulation in intertidal ecosystems

Molly Bradford

Acadia University

Due to their natural geochemistry, estuarine ecosystems are vulnerable to bioaccumulation of methylmercury (MeHg), a neurotoxin that readily bioaccumulates in organisms. Determining uptake of MeHg by intertidal invertebrates at the base of the food web is crucial in determining MeHg exposure in higher trophic level organisms like fish and birds. This research will quantify MeHg levels in sediment, porewater and invertebrates, and relate bioaccumulation of MeHg to changes in concentrations of sulfate and dissolved organic matter, in the Minas Basin, Bay of Fundy (UNESCO & Ramsar Sites). The formation of MeHg by sulfate-reducing bacteria during the reduction of sulfate to sulfide suggests that systems with sulfate loading may have increased MeHg concentrations in sediments. Dissolved organic matter (DOM) may reduce the uptake of MeHg by invertebrates, however DOM may also increase MeHg production by acting as an energy source for methylating bacteria. I hypothesize that bioaccumulation of MeHg in invertebrates will be greater in sediments with increased sulfate and DOM. To assess MeHg bioavailability invertebrate MeHg concentrations will be compared to DOM concentration, sulfur speciation, and Hg speciation in porewater and sediment. By identifying areas that are at greater risk for MeHg production and bioaccumulation, this research will help to protect the health of ecosystems critical to migratory birds, coastal fisheries, and many industries in Atlantic Canada.

Pollinator response to glyphosate application within managed forests of New Brunswick

Marika Brown, Chris Edge and Amy Parachnowitsch

University of New Brunswick

Land management activities that are used to promote natural resource outputs influence land dynamics which can have unintentional effects on non-target organisms. In Canadian forestry, the main goal of land management is to promote increases in wood and fiber outputs from managed forests, whilst maintaining social and ecological objectives. To do so, vegetation management is used to improve forest stand conditions for harvestable lumber through the application of silvicultural techniques. One technique that is used to promote softwood production is the application of a herbicide. Herbicides are used in forestry to suppress competitive vegetation (like fast growing hardwood species) to promote optimal growing conditions for planted conifers. The most commonly used herbicide in Canadian forestry are glyphosate-based herbicides (GBH). The suppression of competitive species in regenerating forest stands alters the vegetation community structure and composition, which can indirectly affect other forest stand communities, like pollinators. Of the research that has been conducted on the effects of herbicides on pollinators, a majority of it is dominated by honeybees (*Apis mellifera*) in agricultural settings, resulting in a knowledge gap on the effects of herbicides on non-*Apis* species outside of agroecosystems. The goal of this project is to address the direct and indirect effects of GBH use on pollinators in managed forests. Specifically, I will be looking at what effect GBH use has on the flowering plant community and how this could impact pollinators within managed forests of New Brunswick.

Mapping connectivity in New Brunswick to sustain forest-dwelling vertebrate populations.

Courtney Burk

University of New Brunswick

Connectivity is the unimpeded movement of species and the flow of natural processes that sustain life on Earth (CMS, 2020). A functional corridor facilitates metapopulation structure and viable populations, potentially mitigating climate change impacts by allowing movement of species and genes from southern to northern regions. Connectivity and corridor design is the most recommended method for mitigating climate change, biodiversity loss, and habitat fragmentation, yet only select regions of New Brunswick have had connectivity plans completed. Using a suite of 29 forest-dwelling species as a proxy for broader vertebrate diversity, I have assessed the present-day connectivity in New Brunswick's forests. The species used represent one or more of (i) indicator species, (ii) climate susceptible species, (iii) large mammal, (iv) game species, (v) small or medium mammal, or (vi) species listed under the Species at Risk Act (SARA) to encompass as many ecological life history stages as possible. I have used Circuitscape to create a series of maps representing the wall-to-wall current density (flow and resistance) provinces based on each species' habitat preferences. Most corridor plans are developed with graph theory or least-cost path models; however, these methods cannot account for multiple movement paths. My method identified pinch-points for the best remaining habitat in the province where movement is funnelled, which, if lost, would have a significant impact on species' movement now and into the future.

The effects of clearcut harvesting on moss chloroplast lipidome and adaptation to light stress during boreal forest regeneration.

Grace Callahan and Raymond Thomas

Memorial University of Newfoundland - Grenfell Campus

Moss plays an important role in regulating environmental conditions in the boreal forest. *Sphagnum* and feathermoss are the two main groups of bryophytes within boreal black spruce forests. Clearcut harvesting is a common method of regeneration of boreal forests and may expose understory vegetation to environmental stress. Lipidomics has been used as a tool to assess abiotic stress of plants. As a response to abiotic stress, plants may alter or remodel their membrane lipid composition to adapt to the stressor. *Sphagnum* moss and three feathermoss species were studied to assess the application of moss chloroplast lipids as an indicator of moss response to light stress during boreal forest regeneration. The moss species were collected from boreal forest regions of two treatments (clearcut and forest) from months June to November. Moss lipids were assessed using ultra-high performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS). Data analysis included redundancy analysis (RDA) and correlations with photosynthetic data. The RDA indicated that the forest treatment was associated with many lipid species, as well as with *Sphagnum*. It also indicated that some feathermoss species were associated with lipid species under the clearcut treatment. The photosynthesis correlation for lipid species specific to *Sphagnum* indicated that, under the clearcut treatment, certain chloroplast lipids have a positive correlation with P_nmax (net maximum photosynthetic rate). The moss chloroplast lipidome is a useful indicator of species response to light stress following clearcut harvesting, as there appears to be an effect on photosynthetic parameters through the remodelling of chloroplast lipids.

Electrochemical investigation of microbial carbon cycling

Leah Crowley and Allison Enright

University of New Brunswick

Anthropogenic activities are impacting the earth in ways we cannot see with the naked eye. Microbes are impacted by any change in environmental conditions, positive or negative. As a result, biogeochemical processes, such as the carbon cycle, depend on microbial activity. This research will look at the impacts of a carbon influx on microbial carbon cycling. In-situ electrochemical data was collected from inside a mesocosm that simulates a flooded wetland. This research aims to understand how the native microbial community will react, physically, to an influx of carbon. Many of the current analytical processes surrounding microbes analyze one of the biogeochemical processes in isolation, rather than looking at the interaction and influence between processes. This research is important as we currently lack effective methods of evaluating microbial and biogeochemical processes in-situ. The research being done for this project uses a detrended fluctuation analysis on a set of related time series. The time series data was collected from a set of vertical electrode arrays. A DOC slug was introduced shortly after the experiment began. When analyzing the electrode signals before the influx of carbon, the alpha values ranged from 0.82-1.76, showing a range of positively correlated to non-stationary processes. After the influx of carbon, the alpha values ranged from 1.38-2.01 showing non-stationary processes. Abiotic, non-catalyzed processes would have an alpha value of 1; therefore, as the observed alphas are greater than 1, the processes demonstrate the surficial influence of the soil matrix and microbially-mediated reactions. This research is to be continued.

Cladoceran body size as a metric of environmental change in New Brunswick lakes

Annie Dysart, Andrew Labaj and Joshua Kurek

Mount Allison University

Cladocerans are zooplankton used as bioindicators of aquatic conditions and environmental change. A shift toward smaller-bodied individuals often accompanies the onset of stressful conditions such as increased predation pressure or increasing temperatures induced by climate change. A standardized body size metric was created for select cladoceran taxa commonly found in eastern Canada. The metric was applied to cladoceran assemblages from sediment records of five New Brunswick lakes that experienced DDT spraying in the mid-20th century. Body sizes of *Bosmina* and *Daphnia* were measured over the same timeframe to observe whether assemblage trends based on the metric were also occurring at a species-level. Lakes that experienced the highest DDT levels demonstrated a stronger shift towards decreased body sizes, whereas less impacted lakes showed a more muted difference in size between the impact and non-impacted periods. A delayed recovery in three of the lakes suggests that modern-day cladoceran assemblages are now responding to environmental stressors separate from the historic DDT contamination, such as climate change. The shift towards smaller body sizes during the DDT impact period was reflected at both the assemblage (via the size metric) and individual species levels. The similar trends suggest that the metric accurately tracks body size changes. Overall, the body size metric provides a tool to further assess the impact of environmental stressors on cladocerans and the resulting implications for nutrient transfer in food webs.

Examining the impact of the National Arts Centre climate cycle initiative on the environmental knowledge, attitudes, and professional practices of Canadian theatre artists.

Chiara Ferrero-Wong

Dalhousie University

The current literature on the role of the arts in sustainability suggests that incorporating environmental themes into different forms of art can change the way people feel about environmental issues. For this project, we worked with the National Arts Centre (NAC) English Theatre to assess the impact of their event “The Cycle: Climate Change” on the practices and policies of Canadian theatre artists and the organizations they represent. The Climate Cycle had two meetings: The Summit in Banff in 2018, and The Green Rooms in 2019. This study used a mixed methods approach, surveying and interviewing participants who attended these events to determine how these events influenced their practices. The first survey was sent out to The Summit participants before The Green Rooms. A second survey was sent to the same group 6 months after The Green Rooms to gain insight into how the events compared. A similar survey was sent to participants who only attended The Green Rooms. Additionally, 6 participants were interviewed. The qualitative results from the surveys and interviews were analyzed using *a posteriori* coding techniques, and the quantitative results were analysed for measures of central tendency and dispersion. Preliminary analysis of the data suggest that the majority of the participants felt that attending these events was beneficial to their own work. These results will be helpful for organizations like the NAC who are looking to plan environmental-themed programming for artists. With more artists pursuing environmental-based art, the scope and impact of these would be increased.

Potato Late blight - Spectral Changes Induced by the Disease

Claudio Ignacio Fernández, Brigitte Leblo, Ata Haddad, Keri Wang and Jinfei Wang

University of New Brunswick

This study aims to assess which spectral variables and at which time late blight can be detected over potato crops. To determine the time when the disease can be detected, the reflectance spectra were plotted as a function of the day post-inoculation (DPI), then a principal component analysis was applied and followed by a computation of the Jeffries-Matusita distance between healthy and infected leaf or canopy spectra. The spectra were used to compute reflectances and associated vegetation indices for the five Micasense® RedEdge bands. Additionally, we also focused on the red-edge region parameters and specific wavelengths of the Micasense® RedEdge-MX dual system. Finally, a Partial Least Square-Discriminant Analysis (PLS-DA) was applied to the leaf or canopy reflectance spectra and a Support Vector Machines (SVM) to specific red-edge region wavelengths to assess how well the infected leaves or plants can be separated from the healthy ones. The leaf level spectra gave a better separability between infected and healthy cases than the canopy level spectra. A good separability was achieved at 2 and 5 DPI at the leaf and canopy levels, respectively. The best vegetation indices were SR, Clgreen, RI, TCARI, TCARI/OSAVI-2, ClRed-Edge, and Red-Edge NDVI. The maximum overall accuracy for the PLS-DA was observed at 4 DPI (91.11%) and at 5 DPI (85.93%) at the leaf and canopy level, respectively. The SVM applied to specific wavelengths of the red-edge region improved the overall accuracy at the plant level by 15% at 4 DPI.

Do brook trout reflect legacy DDT contamination in New Brunswick lakes?

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The organochlorine pesticide DDT is recognized as a legacy contaminant due to its persistence in the environment, bioaccumulation and biomagnification in wildlife, and chronic toxic effects. DDT was applied aerially to conifer forests in north-central New Brunswick, Canada between ~1950 and 1970, and a previous study found that DDT in lake surface sediments in the sprayed region exceed probable effect levels expected to impact aquatic life by ~16 times. Herein, we sampled brook trout, aquatic invertebrates from gut contents, zooplankton, and surface sediments from five impact lakes in the sprayed, north-central region and two reference lakes in the unsprayed southern region to better understand potential effects of legacy DDT on lake food webs. Preliminary results show that concentrations of DDT breakdown products, DDE and DDD, are up to ~14 times higher in brook trout from impact lakes compared to brook trout from reference lakes. Our findings suggest that DDT breakdown products are present in the modern food web, even after more than 50 years. Future efforts will use stable isotopes of carbon and nitrogen to assess and contrast food web structures among lakes and further our understanding of legacy DDT impacts on these ecosystems.

The effect of call similarity on call discrimination by Tree Swallow (*Tachycineta bicolor*) nestlings in the presence of noise

Nina Garrett

Dalhousie University

As the extent of noise expands with urbanization, so does the extent of its impacts on wildlife. The impact of noise is of particular concern when it comes to the disruption of avian communication. Birds, which are especially vulnerable during the nestling stage of their life, rely heavily on acoustic communication. While they can recognize calls in noisy environments, little is known about how call similarity impacts nestlings' call recognition in such environments. My study attempts to answer the question: How does call similarity impact the call discrimination of nestling Tree Swallows (*Tachycineta bicolor*) in the presence of noise? Using data collected in 2016 as part of a larger study, my study used Raven Pro and RStudio to calculate the spectrogram correlation and Euclidean distance of 37 call pairings (one parent call and one unfamiliar adult). The nestling response data, rearing treatment (quiet vs. noise), playback condition (quiet vs. noise) and call similarity measures were then used to generate four mixed linear models. Neither call similarity nor noise had a significant impact on the nestlings' call discrimination, suggesting that even when calls are similar and conditions noisy, nestlings can access the call elements necessary for recognition. While this study found no impact of noise on call recognition, noise cannot be ignored especially given its other, more detrimental impacts (eg., cochlea damage). Further research into the exact mechanism used by nestlings and the impacts of inconsistent noise is needed to better understand how nestlings discriminate between similar calls in noisy environments.

Understanding resistance to flood mapping: a test of climax thinking in Southwestern Nova Scotia

Samantha Howard

Dalhousie University

As a result of climate change, flooding is projected to become more severe and frequent. Flood mapping demonstrates areas of past and potential future flooding, and allows for informed decision-making regarding personal and community planning. However, there has been resistance to flood mapping, with opponents citing potential decline of property values. This thesis explores resistance to flood mapping through the lens of climax thinking. Climax thinking considers why, when faced with proposed land changes, people exhibit resistance, allowing for better understanding of the prevalence and nature of resistance to change. The questions guiding this research were: (1) What are the major concerns of residents regarding the rollout of floodplain mapping? and, (2) How can climax thinking be used to understand these concerns? To address these questions, surveys were administered in Liverpool and Bridgewater. The focus of the survey was to understand flood experiences and opinions in these regions. This presentation will focus on a preliminary analysis of the data, which shows that approximately 1/3 of the respondents in these communities have experienced flooding, yet the majority have not seen a flood map, nor are they concerned about the impact of flooding in the near future. It is anticipated that the final analysis of the data, using the lens of climax thinking, will address the underlying reasons for resistance to publicly available flood mapping in the region. These results will be beneficial when rolling out provincial flood mapping in a manner that will be accepted by individuals and communities.

Développement des sondes DGT spécifiques à l'échantillonnage du radium dans les eaux naturelles

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Le radium est souvent considéré comme un indicateur d'impact environnemental des industries minières, gazières et nucléaire. L'intérêt pour cet élément radioactif porte également sur sa toxicité et sa capacité à être accumulé par les organismes vivants en se substituant au calcium. Les défis de la surveillance environnementale de ce radionucléide dans les eaux naturelles résident dans sa faible concentration et la détermination de sa spéciation, c'est à dire sa fraction biodisponible. C'est dans ce contexte que nous souhaitons développer des sondes DGT (Diffusive Gradient in Thin film) spécifiques au radium : ces échantillonneurs passifs dont le principe repose sur la diffusion contrôlée de l'élément à travers un gel jusqu'à une résine accumulatrice imitent la bioconcentration des contaminants par des organismes sentinelles. Nous avons testé la rétention et l'élution du radium par des gels de polyacrylamide et d'agarose à base des résines TK100, AG50W-X8, Chelex-100 et MnO₂ avant de les intégrer dans des sondes DGT. Les résultats démontrent l'efficacité de la rétention du radium dans l'eau Milli-Q par les résines. Néanmoins, dans l'eau de rivière, les ions compétiteurs affectent la rétention du radium par les DGT mais favorise sa désorption lors de l'élution. Seule la TK100 préconcentre efficacement le radium dans les eaux naturelles. Cependant, son intégration au sein des sondes DGT n'est pas recommandée car les mêmes ions compétiteurs affectent les mécanismes et la vitesse d'échange du radium à la surface de la résine.

Assessing coastal vulnerability to sea level rise in St. Lucia and the resiliency of beaches

Frejhan Jn Baptiste

Saint Mary's University

Saint Lucia, like many other Caribbean islands have not had consistent coastal monitoring programs. This research looks into coastal risk and vulnerability associated with sea level rise and anthropogenic climate change on previously assessed beaches in Saint Lucia. Coastal resources such as mangrove forests, coral reefs and beaches in particular, are critical aspects of the tourism industry, and in turn, Saint Lucia's economy. Using the Emery method, a field assessment of six beaches previously monitored in 2002 was conducted. Factors such as coastal erosion, sediment type and various other backshore and foreshore characteristics were identified for each beach. Beaches were assessed before the hurricane season, two weeks after a storm and one month after the previous assessment to compare variations in shoreline erosion, and profile structure. Profile results displayed anthropogenic backshore infrastructure such as gabion baskets did not recovery by the second assessment unlike that of dune or vegetated backshores. The data collected will be used to conduct a comparative analysis of suitable beach stabilization methods and create a basis for proactive mitigation responses for particular beaches assessed.

Identifying contaminants from historical gold mines using satellite images

Dan Jewell, Linda Campbell and Peter White

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From the late 19th to the early 20th century, arsenopyrite-rich gold ore in Nova Scotia was mined and subsequently extracted using a mercury amalgamation process. Ore-bearing rock was crushed into a fine sand before being washed over mercury-coated plates. This dissolved gold and left the waste rock behind. This waste rock, which was now contaminated with mercury in addition to being naturally high in arsenic, was typically dumped into the nearest wetland, stream, or depression with no regard for the impact on the environment or the health and well-being of people and ecosystems. Remediation or reclamation plans were very rare or nonexistent during this period, and much of this waste, known as tailings, is still present where it was dumped so many years ago. The province of Nova Scotia has committed to cleaning several tailings sites, but assessing their contamination via field work is a lengthy and expensive process. Remote sensing analysis of satellite images has been used at mines around the world to perform rapid and economical assessment of waste materials at regional or local scales. In this study, multispectral data available freely from the European Space Agency's Sentinel-2 satellite is used to create maps of secondary iron minerals diagnostic of acid mine drainage (a product of sulphide mineral oxidation) to locate contaminants and provide information about the state of individual tailings areas.

Cape Breton abuzz: naturalists amass data about Bumble Bees

Hannah Kosick

Cape Breton University

Keen amateur naturalists can identify bumble bees (genus *Bombus*) and provide valuable data. An open, online learning guide to educate youth and eager naturalists about Cape Breton bumble bees is used to increase the effectiveness of citizen science data collection. This guide provides educational supports and fosters a passion for environmental stewardship. The effectiveness of citizen science iNaturalist data on bumble bees is compared to data collected by experienced naturalists (those who study *Bombus*) in Cape Breton. A higher proportion of citizen scientist observations were research grade than those from experienced naturalists throughout the same time period. More than 90% of citizen scientist observations were identified to at least bumble bee by the observer. Researchers can look to citizen science data collection as a cost-effective means of gathering quality data from large areas in a short amount of time. Future research could test how successful the online educational guide is in further increasing the effectiveness of citizen science data collection. Research could also examine how education increases the value of iNaturalist observations and how that influences conservation efforts.

Improving statistical downscaling over complex terrain using *globsim*.

Hannah Macdonnell

St Francis Xavier University

Many environmental models require both well-resolved parameterizations of surface phenomena and continuous driving time-series meteorological data. Unfortunately, there exists a large gap in available observational data at many sites of interest. One approach to solving this data gap is to downscale coarse-grid global reanalysis products to point-scale observations. This method has proved successful in some northern tundra regions of Canada, however, the method proves unreliable in mountainous terrain with extreme lateral variability. Using the software *GlobSim*, ensemble simulations incorporating the ERA-5, JRA-55 and MERRA-2 reanalysis products were used to statistically downscale ground-surface temperature across a five site transect of British Columbia. Pressure and temperature are linearly interpolated to point-scale elevations retrieved from an open source 30-m resolution digital elevation model (DEM). Observational data was pulled from the British Columbia Pacific Climate Impacts Consortium spanning 1990 to 2020 for comparison. The simulated time-series data was also compared to an adiabatic lapse rate of $-9.6 \text{ }^\circ\text{C km}^{-1}$. Results indicate that the method was able to reproduce seasonal temperature cycles and mimic observed local climate. This proves its ability to serve as driving time-series data for land-surface models in data-poor mountainous regions.

The effects of cholecystokinin and leptin on glutamate synaptic transmission in the dorsomedial nucleus of the hypothalamus

Kelsey MacKinnon

Mount Allison University

Obesity, an epidemic in many developed countries, is largely caused by an imbalance in food intake and energy expenditure. In the brain, the dorsomedial hypothalamic nucleus (DMH) plays an important role in the regulation of appetite. Cholecystokinin (CCK), a key satiety hormone, acts in the DMH to suppress food intake, but the underlying mechanisms of this effect are not understood. There is evidence that CCK alters neurotransmitter release onto DMH neurons in rats. Specifically, CCK increases the release of the inhibitory neurotransmitter, GABA, onto putative appetite-stimulating DMH neurons. It remains unknown, however, whether CCK affects the release of glutamate, an excitatory neurotransmitter, onto these neurons, despite reports of CCK modulating glutamate release elsewhere in the brain. We hypothesized that CCK decreases glutamate release onto rat DMH neurons. To test this, we used young male Sprague Dawley rats and performed patch clamp electrophysiology to record glutamate-mediated currents in living DMH neurons. Surprisingly, CCK had no effect on glutamate release onto DMH neurons. Another satiety hormone, leptin, has been reported to act with CCK to reduce appetite in other brain regions. We therefore co-administered CCK and leptin onto DMH brain slices and observed a significant depression in glutamate release onto DMH neurons. When leptin was administered alone, however, no effect was observed. These results suggest that CCK and leptin act synergistically in the DMH to reduce glutamate release onto DMH neurons. This research could aid in developing therapeutics for humans living with obesity.

Greening a brownfield: An analysis of the natural history of plant species at Open Hearth Park

Rory MacNeil

Cape Breton University

Brownfields are sites which have been contaminated from commercial or industrial operations, but still retain value in the form of redevelopment through remediation. The goal of this project was to examine the composition and characteristics of plant communities used as part of the brownfield remediation of the former Steel Plant and Coke Ovens sites in Sydney, NS and the creation of a 39-hectare public green space called Open Hearth Park in 2013. I examined temporal changes in species richness by comparing lists of plants installed during the creation of Open Hearth Park to plant lists from current day. Current plant lists were compiled during a BioBlitz which took place at Open Hearth Park in the fall of 2020, with the results documented on the citizen science app iNaturalist. I observed a 14% decrease in tree species richness, a 55% increase in shrub species richness, and a 150% increase in herbaceous species richness over an 8-year period at Open Hearth Park. Of the species currently present at the park, 84% of trees, 71% of shrubs, and 43% of herbaceous species were native. A literature review was conducted to identify shade tolerance, drought tolerance, seedbank presence, capacity for nitrogen fixation, pH tolerance, salinity tolerance, and heavy metal tolerance of plant species used during remediation and those found on site today. The results of this project may help to guide plant selection for the remediation of future brownfield sites.

Examining the effectiveness of municipal reuse centers in Nova Scotia as a waste diversion strategy

Michelle Mann

Dalhousie University

One of the major environmental challenges of today is the overconsumption of resources and excessive waste. Municipal reuse centers offer a potential solution, as they work to extend the lifespan of objects otherwise destined for landfill. There are 3 municipal reuse centers in Nova Scotia, however their impact has yet to be determined. In this study, the impacts of municipal reuse centers on the total annual waste quantities and operation costs of waste management in Nova Scotia were explored. Consultative interviews took place with waste managers in both regions with and without reuse centres to gain an understanding of the current waste management practices, as well as the most recent waste tonnages and operational costs. A literature review was also completed to compare strategies at reuse centers in other jurisdictions. The results of this study were inconclusive. Compared to other regions, a significant difference was found in at least one region with a reuse center. However, due to a lack of available data, it has not been determined if this difference is a result of the reuse center. Several potential strategies that would generate measurable impacts for reuse centers that could be implemented in Nova Scotia have been established. This study identified the need for further investigation of bulky waste management in Nova Scotia, as there is currently a lack of available data to accurately measure the impacts of reuse centers.

When and where can farm-level Life Cycle Assessments be used to predict aggregate food system contributions to global warming?

Sage Mosgrove

Dalhousie University

Food production is one of the key anthropogenic systems driving global warming, biodiversity loss, land use change, and biogeochemical imbalances. Food system sustainability is a field of research dedicated to addressing these issues, ultimately motivated to meet human needs within biophysical planetary boundaries. One of the many tools that have emerged in food system sustainability research is the Life Cycle Assessment (LCA). LCA is a biophysical accounting framework used to measure the material and energy flows involved in a product's life cycle, which are then converted to measures of contribution to global-scale resource depletion challenges (e.g. water depletion) and environmental concerns (e.g. greenhouse gas emissions). In a broader context, food LCAs can be synthesized to answer questions of aggregate production and consumption impact contributions, as well as inform policymaking and consumer behaviours. Though individual LCAs and the works that synthesize them are extremely valuable, they are not without limitation. This exploratory research investigates the degree to which geography influences the associated GHG emissions of grape cultivation, as well as how emission differences across geographies may relate to aggregate food system impact assessments. For this purpose, the results of published wine LCAs are compared within and across different production locales with a focus on GHG emission patterns. As well, the underlying sampling patterns of wine LCA research are investigated at a global scale. The conclusions of this research will help inform future food system sustainability research methods, thus contributing to the sustainable development of our food systems.

Using Science to Inform Species at Risk Management: Predicting the Effects of Forest Harvest on Wood Turtle Habitat Suitability

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University of New Brunswick

Sustainable forest management includes protecting species-at-risk, including the endangered Wood Turtle (*Glyptemys insculpta*). The Wood Turtle is a challenging species for forest management because females often travel 500+ meters perpendicular to rivers into forested habitats. Forestry occurs in approximately 40% of the Wood Turtles Canadian range making it a widespread threat to the species, however the magnitude of the threat is unknown. Our research objective is to determine the effects of commercial forest harvest on Wood Turtle habitat suitability to better delineate critical habitat. We outfitted 25 female Wood Turtles with VHF transmitters and GPS loggers and are tracking them from 2019-2021 to collect multi-year fine resolution Wood Turtle spatial data. We will then combine this occurrence data with environmental predictor variables collect both on-site and via remote sensing (LiDAR) in a resource selection function to quantitatively inform a habitat suitability model. We will then apply our habitat suitability model to chronosequence forest harvest blocks aged 1, 5, 10, 15, and 25 years, and old-growth forests, to predict the effects of forest harvest on Wood Turtle habitat suitability. To date, we have collected a total of 7,341 active season spatial points from the GPS loggers between June 2019 and September 2020. Preliminary results will be presented as the research is still on-going. This study will provide important data to better delineate critical habitat which has range-wide implications for Wood Turtle conservation.

Wave dissipation potential of *Spartina alterniflora* in the Bay of Fundy

Makadunyiswe Ngulube

Saint Mary's University

The purpose of this research is to determine the wave dissipation potential of salt marsh vegetation in a temperate, hypertidal estuary. The study site is Clifton Marsh, Nova Scotia, in the Bay of Fundy. This site was selected in part because it is monospecific, with *Spartina alterniflora*. The research addresses two key questions:

1. How effective is the *Spartina alterniflora* at attenuating wave energy?
2. What is the variability in wave height as the vegetation height increases over time?

A transect was set up with 4 RBRduet³ T.D|wave16 — temperature & pressure loggers extending from the mudflat to the vegetated section dominated by *Spartina alterniflora*. Data were collected from mid June to early December 2020. For each two-week dataset, the data was sorted to include only that with a depth greater than 0.1 m, and events were selected to have a significant wave height that is greater than 0.05 m.

Vegetation surveys were carried out bi-weekly to measure the various parameters such as the stem height, stem diameter and the width of the middle top parts of the leaves. The outcomes show that vegetation has an effect on the wave energy and significant wave height, and affects the attenuation capacity of salt marshes. This research demonstrates that the presence of vegetation on salt marshes plays an important role in wave dissipation and attenuation. There needs to be a better understanding of vegetated intertidal environments and incoming waves, to achieve sustainable coastal management and planning.

Investigating the nitrogen biogeochemistry of sewage organic materials using compound-specific isotope analysis

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Microbial degradation of organic matter plays a critical role in biogeochemical cycling of carbon and nitrogen. Microbes mediate the breakdown of complex particulate organic material (POM) into simpler forms, including degraded particulates and dissolved organic and inorganic molecules. Thus, it is important to characterize the magnitude and pathways of POM degradation. Recently, a geochemical proxy for microbial breakdown of POM, based on the stable nitrogen isotopes of amino acids ($\delta^{15}\text{N}_{\text{AA}}$) has been proposed. Evidence from field samples indicates that $\delta^{15}\text{N}_{\text{AA}}$ can be used to quantify the extent of microbial re-working and distinguish between different microbial metabolisms. However, the approach has rarely been tested or validated under controlled experimental conditions. We are using samples collected from primary, secondary and tertiary wastewater treatment plants (WWTP) as quasi-controlled chemostats to evaluate changes in the $\delta^{15}\text{N}_{\text{AA}}$ associated with microbial degradation of POM. Water samples (1-2 L) are collected at different stages of treatment, pasteurized, and vacuum filtered through GFF filters. The filtered particulates are then freeze-dried for isotopic analysis. Preliminary data from an advanced primary WWTP show that “bulk” $\delta^{15}\text{N}$ results range from -0.66 ‰ to +2.26 ‰ (n=6), with $\delta^{15}\text{N}$ values decreasing through the sewage treatment process. Compound-specific isotope analysis of amino acids will be paired with bulk isotope analysis to elucidate the pathways and extent of microbial alteration of POM during critical steps in the wastewater nitrogen cycle. We anticipate that these results will provide new insights to the interpretation of natural abundance $\delta^{15}\text{N}$ data in biogeochemistry and paleoceanography contexts.

The influence of long-term agricultural management practices on red wiggler worm (*Lumbricus rubellus*) population abundance and activity in Cormack, Newfoundland

Natalie Parsons and Mano Krishnapillai

Memorial University

Earthworms are considered fundamental bioengineers of nearly all earthly ecosystems. The bioturbation carried out by earthworms is known for contributing to improvements in crop yields by enhancing aggregation and alleviating compaction, as well as facilitating nitrogen additions to soils. This in turn, ameliorates root growth capabilities through enhanced aeration, gaseous exchange, water infiltration, and water-holding capacity. Conventional agricultural practices have been designed for maximization of profit and rates of production, without much concern as to the environmental implications of such design. After centuries of unquestioned success, the agricultural sector is now failing due to the severe depletion of soil quality that conventional practices have caused on a global scale. As a result, these environmental concerns are driving food insecurity for the ever-rising human population. Of importance is the universal lack of knowledge of the geographic variability in earthworm populations. Understanding this distribution may provide information that allows for the optimization of management tactics concerning the soil environment. A 10-acre area of farmland in Cormack, Newfoundland, which has been in operation since 1976 was chosen as the location of data collection. The overarching objectives of this study are to compile a history of long-term (>25 years) agricultural activities and management practices performed at this site, to determine how such activities have altered biological and physicochemical properties of the soil environment, to assess how these long-term anthropogenic actions have impacted earthworm distributions and abundance seasonally at this site, and to draw conclusions based on the data collected.

Is there variation in phenotypic selection on floral traits in bee-pollinated Penstemons?

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The selective role of pollinators on plant phenotype has been identified as the major force behind the diversification of flowering plants. Therefore, it has been a long tradition to study the relationship between different plant traits and relative reproduction fitness to understand the evolution of optical characteristics and the selection mediated by pollinators upon them. It is known that the state of one trait can also determine the relevance of another. Therefore, studying multiple traits and their functional correlations among each other may help us to answer the question of whether there are specific combinations of traits that are likely to be correlated and fulfill the functions in maintaining the interactions with pollinators to maintain higher reproduction fitness. Here we examined multiple plants and floral traits of two bee-pollinated species of genus Penstemon; *P. strictus* and *P. mensarum* correlated with reproductive success. Our preliminary analysis shows, among 13 individual plant and floral traits, we examined only eight of them explain the variation observed in reproductive fitness. Stem height and number of flowers showed positive selection on reproductive fitness in both plants while the number of aborted flowers showed a negative selection. However, the relative amount of nectar, length of the corolla tube and the width of the constriction on the floral tube had an opposite selection on reproduction fitness between two species. The study will expand further by including floral scent as an attraction trait and analyzing combined effects of olfactory, visual, nutritional and morphological traits in plant reproductive fitness.

Spatial and Temporal Variations in Sediment Composition within Restoring Salt Marshes

Elise Rogers

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Salt marsh ecosystems are extremely vulnerable to climate change and sea level rise. Various studies support and explain the importance of these ecosystems and the ecosystem services they provide. Adaptation strategies such as managed realignment, or dyke realignment, allow for the growth of new salt marsh in areas where one had previously been destroyed. Dyke realignment has been occurring in many areas around the world, including the Bay of Fundy. Indispensable ecosystem services such as erosion protection, water quality enhancement, and carbon sequestration are provided by salt marshes worldwide. Two restoring salt marshes in the Bay of Fundy, Belcher Street marsh and Converse marsh, were used to complete this study. The spatial variability of water content, organic matter content, organic carbon content, and grain size of sediment were examined across the salt marsh surfaces. The sediment characteristics were plotted against differing elevations within the tidal frame to determine its influence on sediment characteristics. Sampling occurred both in August and in November to determine if the spatial variation observed initially is consistent over time. Finally, these results were compared to the sediment characteristics of reference conditions (other restored salt marshes in Nova Scotia). These examinations were completed through analyses of sediment scrape samples. Results will help inform future salt marsh restoration projects and create a deeper understanding of these important ecosystems.

Développement d'un outil intégratif d'aide à la décision sur les impacts cumulatifs de l'exploitation des ressources naturelles

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Université de Moncton

L'économie du Nouveau-Brunswick est étroitement associée au développement des ressources naturelles. Cependant, ce développement entraîne des impacts sur la santé, l'environnement et les communautés qui sont cumulatifs, complexes et souvent contrastés. C'est pourquoi, nous avons, par le biais du réseau de l'Observatoire pancanadien de la santé, de l'environnement et des communautés, développé un outil interactif, le NB EnviroScreen qui permet d'intégrer des indicateurs de santé, environnementaux et socio-économiques. Cet outil a été développé en se basant sur la méthodologie du CalEnviroScreen, un outil qui a été mis au point par le California Office of Environmental Health Hazard Assessment. Le NB EnviroScreen crée un indice qui fait une comparaison relative entre les différentes zones géographiques en intégrant des indicateurs. Après avoir sélectionné nos indicateurs, nous avons pu développer l'outil pour le Nouveau-Brunswick. Nous voyons apparaître sur les cartes, les régions où se situent (situaient) les industries lourdes. Ces résultats sont dues au fait que les indicateurs que nous avons utilisé permettent de mieux représenter les industries lourdes. Il est donc important de développer des indicateurs qui permettent d'aborder les questions qui sont reliées à la foresterie, l'agriculture et la pêche. Dans les prochaines étapes de ce projet, nous organiserons des groupes de discussion afin de tester et contextualiser le NB EnviroScreen pour arriver à un NB ECHOScreen qui représentera mieux les réalités du Nouveau-Brunswick. Cette recherche permettra de bâtir la capacité intersectorielle à réagir aux impacts cumulatifs du développement des ressources naturelles.

Investigating the global drivers of earthworm species diversity on islands

Jenacy Samways

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Large gaps exist in knowledge of the global patterns and drivers of biodiversity, particularly in belowground systems and island environments. Earthworms are a key group of soil invertebrates in many systems due to their ability to act as ecosystem engineers, yet our understanding of their distributions globally is limited. To investigate the drivers of earthworm species diversity on islands, I conducted literature searches to obtain lists of earthworm species on 379 islands. Earthworm species records were found for 99 of the searched islands, with many of the islands for which no species records were found consisting of entire archipelagos. The relationship between earthworm species richness and each island's underlying geology, latitude, distance from the mainland, temperature, precipitation, area, and plant species richness were analyzed using a zero-truncated negative binomial regression model. As predicted, earthworm species richness was positively correlated with island area and plant species richness, as well as mean annual precipitation, but negatively correlated with distance from the mainland. Less expected was a strong correlation to oceanic island geology and a relatively low occurrence of globally widespread species such as *Lumbricus terrestris*. However, it is clear that earthworm species data on a great number of islands is severely lacking. Future research should also investigate whether drivers differ for the diversity of native versus non-native species of earthworms on islands.

Functional connectivity analysis of selected landscapes on Prince Edward Island, Canada

Madison Silver

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Habitat fragmentation and habitat loss are two of the largest threats to biodiversity in the modern age. Because of this, the study of how animals move between patches of fragmented habitats as well as how genes flow through populations of a species is crucial to being able to plan for the protection of species and habitats. The connectivity between habitat patches has differing effects for different species, so when studying ecological connectivity it is important to look at both the structure of the landscape and the impact it has on species that live in the habitat. I conducted a functional connectivity analysis of barriers to movement for three species - Northern flying squirrel (*Glaucomys sabrinus*), Pickerel frog (*Lithobates palustris*), and Smooth green snake (*Opheodrys vernalis*) - in four different regions across the Canadian province of Prince Edward Island, which has seen a significant reduction in natural areas since the 19th century. Resistance maps were created for each species using critical habitat components and the open-source toolbox Linkage Mapper was utilized to find least-cost paths, barriers, and pinch points between core habitat areas in each region. This analysis can assist landscape planners and environmental managers in making future conservation decisions.

Spatial distribution and patterns of airborne mercury and arsenic using epiphytic lichens at a historical gold mine tailings site in Nova Scotia

Michael Smith, Linda Campbell and Carrie Rickwood

Saint Mary's University

Between the 1860s and 1940s, over 360 gold mines in 64 formal gold districts in Nova Scotia generated approximately three million tonnes of mercury (Hg) and arsenic (As) contaminated waste (tailings) that were released directly into terrestrial and aquatic environments near mining communities. Many of these mines were abandoned and unremediated since the 1940s, leaving a legacy of environmental contamination. Today, under a changing climate and with increasing land use, there is the potential for intensified dust emissions from these tailings deposits, leading to the remobilization and distribution of these historical contaminants to surrounding environments. Monitoring the extent of this wind-borne dust and air contamination is important for management of these tailings sites and to better assess risks to public and ecosystem health. Lichens are widely used in biomonitoring spatial patterns of dust and air quality at contaminated sites due to their ability to accumulate airborne contaminants almost entirely from atmospheric deposition. In the summer of 2019, we sampled epiphytic lichens (*Platismatia* and *Usnea* spp.) over a series of gridded transects over both tailing and reference areas to determine the spatial distribution of airborne Hg and As surrounding the Montague gold mine tailings site near Dartmouth, Nova Scotia. Lichens were analysed for Hg and As. Seasonal dust and elemental levels were also determined using passive air samplers and rain collectors along a stream-based transect through the main sampling grid. We will report the geographical distribution of Hg and As in lichen and their proximity to historical gold mining sites.

Indigenous medicinal and ceremonial plants at the UNB Woodlot.

Ngoc Dieu (Sue) Tran, Emma Gorey, Tia Boyington, Becca Ireland, Maria Hernandez and Kaitie Collingwood

University of New Brunswick

The University of New Brunswick (UNB) Woodlot is a 1500ha lot in Fredericton, New Brunswick with an area designated for conservation and education called the Creighton Conservation Forest (CCF) that is 632 ha. Our project aims to identify Indigenous medicinal, ceremonial, and edible plant species available at the woodlot, focusing on the CCF. We will create an Interactive Map and Data Document from our field work data and use it to provide educational materials (Medicine Walk Trail, Educational Booklet and Website) to educate students and users of the UNB Woodlot on Indigenous knowledge and conservation principles such as Etuaptmumk (Two-Eyed Seeing) and Netukulimk (sustainable harvesting). We are also producing a report on collaborative management to provide recommendations on resource-sharing practices that could be adopted in the management process of the UNB Woodlot. We are conscious of the sensitivity around certain traditional knowledge and will be working closely with our Indigenous clients to ensure that the materials we include are well-informed and appropriate.

Quantifying the causes of increased human-black bear interactions across Nova Scotia

Andrew Willms

Dalhousie University

Nova Scotian residents are seeing an increase in the presence of black bears around their properties and homes. This year, the Nova Scotia Department of Lands and Forestry received a record amount of over 1000 human-black bear conflict reports from residents across the province, nearly doubling the total received in 2017. These interactions are categorized by their potential to harm a resident's property, livestock, crops, personal safety, or pets. While many studies have examined bear ecology, few have quantified the spatial and temporal patterns leading to human-black bear conflict. This study examines the causes for rising human-black bear conflicts within three study areas across Nova Scotia, Canada – Amherst, Waverley and New Glasgow. Through a spatial analysis in ArcMap Pro, Landsat imagery from 2016 and 2019 was examined to uncover whether the presence of crops, berry fields, forest-urban fringe, and urban development play a role in the increasing frequency of human-black bear interactions. Data from the 2016 Census was mapped to highlight whether factors like population density, income and housing type were influential, with ANOVA testing and logistical regression used as statistical analyses for each variable. Preliminary results show that the drivers of increased conflict are unique to each area, with the presence of crops, berries and urban development being most influential. The final results will help inform local communications strategies aimed at curbing human-black bear conflicts by providing the necessary information to contextualize these strategies to each community, helping to reduce the number of human-black bear interactions across Nova Scotia.

Distribution and abundance of introduced anuran species in ponds on the Baie Verte Peninsula, Newfoundland.

Jodi Young and Christine Campbell

Memorial University of Newfoundland - Grenfell Campus

Anurans (frogs and toads) are the most geographically diverse order among all amphibians and play an important role in many ecosystems by increasing productivity through several mechanisms. Insular Newfoundland lacks native anurans; however, four species have been successfully introduced: the American Toad, Green Frog, Wood Frog, and Mink Frog. There is limited knowledge surrounding the dispersal of these amphibians on the island, especially in the central region. Auditory surveys were used to determine the species and abundance at thirty ponds along the Baie Verte Peninsula, Newfoundland and Labrador. Calling codes (0, 1, 2, or 3) were used to estimate abundance, with 0 indicating no calling and 3 indicating many overlapping calls. Habitat parameters such as water pH, temperature, and conductivity were also recorded and compared with previous data collected from the western Newfoundland region in 2001 and 2011. Our findings show the establishment of American Toads and Green Frogs on the Baie Verte peninsula. Percentage of ponds with anurans and mean species calling codes were similar between regions when standardized for sampling date. However, the habitat parameters showed statistically significant differences between regions. This may indicate that pH, temperature, and conductivity were not the primary factors influencing dispersal and habitat selection. This can be used to further map the movement throughout the island, as well as understand the factors that may be influencing the habitat selection of these introduced species.

Thank you to all our presenters, faculty supervisors, organizers, and attendees!

**Here's hoping we gather together
in person next year!**

