# Heading North, virtually
# Vers le Nord, virtuellement

**June 1-2 Juin**
**2020**

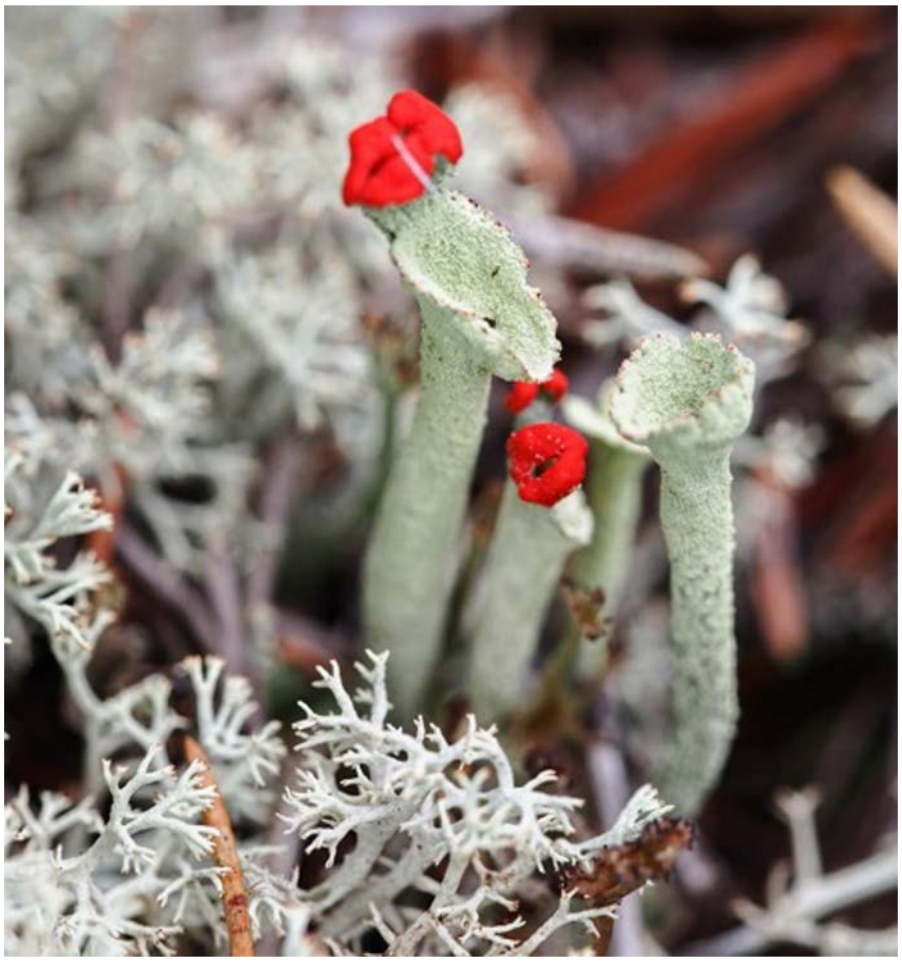
Heading North - Vers le Nord
ABC CBA
~~Bouyn-Norando~~ Web!
2020

*Sharing science during a pandemic*

*Partager la science en temps de pandémie*

**Canadian Botanical Association**

L'Association Botanique du Canada



# WELCOME WORD

The CBA is very pleased to be able to host a virtual version of its annual meeting this year. The organizing committee was of course very disappointed to have to cancel the in person event, having worked hard to offer an interesting scientific program, field visits and socio-cultural activities. We have rolled up our sleeves and used our creativity to prepare a virtual version of the conferences for you. We are particularly pleased with the enthusiasm of CBA members and the broader botanical community for this online version of the meeting. We were thus able to integrate presentations that we could not have had in person and we will have numerous participants from around the world with us.

The 2020 CBA annual meeting is a landmark event in its mission to disseminate and promote knowledge and understanding related to botany, and along with the launch of its new website represents the movement of the association into a new digital era.

We are hoping to welcome all of you in person at the 2022 meeting in our beautiful region of Abitibi-Témiscamingue!

**Nicole Fenton**
CBA President-Elect

# MOT DE BIENVENUE

L'ABC est très heureuse de pouvoir tenir une version virtuelle de sa rencontre annuelle cette année. Le comité organisateur a bien entendu été très déçu de devoir annuler les événements en présentiels, ayant travaillé fort pour une programmation intéressante d'ateliers, de visite sur le terrain et d'activités socio-culturelles. Cependant, nous avons retroussé nos manches et avons usé d'ingéniosité pour vous préparer une version virtuelles des conférences et des sessions d'affiches. Nous sommes particulièrement contents de l'enthousiasme des membres de l'ABC et de la communauté de la recherche et de la pratique en lien avec la botanique face à cette version en ligne de la réunion. Nous avons ainsi pu intégrer des présentations que nous n'aurions pas pu avoir en personne et nous aurons des participants nombreux d'un peu partout dans le monde avec nous.

La rencontre annuelle de l'ABC est un événement phare de sa mission qui est de diffuser et promouvoir le savoir et la connaissance en lien avec la botanique, et, avec la mise en ligne de son nouveau site Web, représente le désir de l'association d'entrer dans une nouvelle ère numérique.

Nous espérons vous accueillir en personne à la rencontre de l'ABC en 2022 dans notre belle région de l'Abitibi-Témiscamingue!

**Nicole Fenton**
Présidente-élue du ABC

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# KEYNOTE SPEAKERS – CONFÉRENCIERS INVITÉS

June 1 Juin - NL-11:45 / Qc-10:15 / BC-07:15

## A shifting foundation – changes in Canada's northern forests in response to permafrost thaw

**Jennifer Baltzer,** Nicola Day, Katherine Dearborn, Ana Sniderhan, Oliver Sonnentag, Katherine Standen
Wilfrid Laurier University

The boreal forest forms a circumpolar belt between 45˚ and 70˚N and is the second largest forested biome globally. It is important in climate regulation and the global carbon cycle and is one of the few remaining terrestrial biomes where large-scale ecological processes are largely unimpeded. The boreal biome is floristically simple but forest dynamics and ecosystem processes arise from complex interactions amongst a range of factors including climate, physiography, permafrost, large natural disturbances, and species ecology. Boreal forests occupy latitudes that are warming 3-4 times faster than the global average; this rapid warming has already been shown to be having marked impacts on permafrost conditions, though the implications of this for forest dynamics remain poorly understood. This is an important shortcoming given that much of the boreal forest occurs in these rapidly changing permafrost zones. Here, I will overview some recent efforts to understand the impacts of permafrost thaw on northern forests. Results will span biological scales of organization from leaf- to landscape-level responses to ongoing thaw. These changes will be discussed in the context of the current and future functioning of high latitude boreal forests.

June 1 Juin - NL-16:30 / Qc-15:00 / BC-12:00

## Boreal Ethnobotany: From Ethics, Research, to Humility

**Alain Cuerrier**
Université de Montréal

Ethnobotany, since its inception in 1895, has been a dynamic field of research in Canada, especially through the work of Nancy Turner. Recently, with Indigenous self-determination and land claims being at the forefront of First Nations, Inuit and Métis people, ethnobotany needs to reflect upon its next steps. What should be the future goals of ethnobotany? Ford, Hunn, Nabhan, Wolverton, and others spoke of the different phases of ethnobiology. Amid those different phases, decolonisation and indigenisation of the field are essential. First, a brief account of two projects done in Eastern Canada will be illustrated, while documenting ethics and what it means from the standpoint of Indigenous and local people. Often, ethics prove to be a Western concept not fully aligned with Indigenous worldviews. We will draw from the diabetes and the traditional medicine project to camp ethics in a more respectful space, and move forward with a new paradigm where Indigenous people play a central role in ethnobotany. The presentation will end with the concept

of biocultural design as an interesting approach to research on biodiversity and conservation. In Nunatsiavut, such a project was co-designed with Inuit people. Although Nunatsiavut is known as a Subarctic region, the southerly community of Rigolet is positioned at the edge of the Boreal forest. Community engagement and leadership came both from the politics in place and from the youth who saw biocultural design as a foundational basis for a regrowth of traditional knowledge.

June 1 Juin - NL-16:30 / Qc-15:00 / BC-12:00

## Clade–specific phylogenetic community structure challenges the assumption of uniform clade responses to assembly processes in an island system

**Julissa Roncal,** Sander Bennett Boisen, Michael Burzynski
Memorial University of Newfoundland

The ability to infer community assembly processes from phylogenetic distance patterns of its taxa is challenging due to strong assumptions such as the binary evolution (convergence or conserved) of all traits of all taxa in a community, and that assembly processes influence all lineages in a similar fashion. We relax these two assumptions by examining clade-specific phylogenetic structure in six plant habitat pools present within the island of Newfoundland, Canada. We hypothesized that the phylogenetic structure of plant habitats is clade-specific and contingent on phylogenetic scale, with clustering at shallow nodes of the habitat phylogenetic tree, and evenness at deep nodes because traits tend to be convergent with time. By studying habitat types, we moved beyond the traditional community plot of phylogenetic community ecology. One habitat showed no significant phylogenetic structuring, two habitats showed contrasting phylogenetic patterns of evenness and clustering according to our expectation, while two others showed the opposite. These results demonstrate that clade-specific patterns of phylogenetic distance can detect shifts in assembly processes across phylogenetic scales, or that different lineages may vary in their response to the same assembly process. Members of a phylogenetically clustered and shallow clade were all stress-tolerant strategists as inferred from three leaf traits, suggesting that environmental filtering is shaping the assembly from the regional into the habitat pool at least for some clades. Pairwise phylogenetic similarity between habitats was not indicative of habitat pairs with shared patterns of clade-specific clustering and evenness, and thus cannot be used to find common assembly forces among communities.

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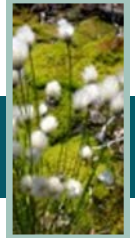
## Adaptation Ecology – Écologie adaptative

NL-12:30-13:15 / Qc-11:00-11:45 / BC-8:00-8:45



NL-12:30 / Qc-11:00 / BC-8:00

### Plant species coexistence in Baie–James, Québec: a hierarchy of community assembly processes

**Marc-Frédéric Etienne Indorf**[1] (marc-frederic.indorf@uqat.ca), Tana Route[1], Yves Bergeron[1], Nicole Fenton[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

Species coexistence and its driving processes – ranging from neutral ones to niche differentiation – have been an important part of ecological research, yet disentangling the different processes is not an easy task. Hierarchical diversity partitioning combined with diversity mesure indexes – alpha, beta, and gamma – is one approach that separates observed biodiversity patterns across spatial scales through comparison with null models of randomised species distributions. Divergence or convergence of the observed data compared with randomised data can highlight different underlying processes of community assembly at each scale. Through the use of an adapted hierarchical partitioning method, this study aims to understand the drivers of observed floristic patterns across 35 boreal peatlands in the James Bay Region of North-Western Québec. Sites were selected from three sectors covering a 1 000 km transect and 3 taxonomical groups were inventoried: bryophytes, tracheophytes, and lichens. Results show that different ecological processes operate at different spatial scales. For example, biogeographical processes are important at the regional scale, neutral processes are particularly important in each sector, and biotic interactions and abiotic factors influence the local community, except in the fens where neutral processes seem to prevail. Niche differentiation does not appear to be an important process for the studied region. Further analysis of the biotic interactions (facilitation and competition) as well as the abiotic factors will help understand how these communities might change in the near future with a growing mining industry and climate changes.

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### Root–microbe interactions—using a collection of *Arabidopsis* genotypes to test intraspecific differences in root microbiome assembly and subsequent plant fitness

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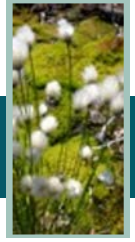
How plants assemble their root microbiome is shown to be affected by plant genotype, soil type, and developmental stage, among other factors. We also know that soil microbes — be they fungi, bacteria, etc. — have consequences for plant fitness. With this information in mind, we aimed to test if (a) root microbiome changes with soil community and (b) plants show fitness differences depending upon soil community. We chose ten diverse *Arabidopsis thaliana* genotypes. We chose four soils that we used as inoculums. The chosen soils came from a fen, a woodland, an ex-arable field, and a grassland. We grew individuals of each genotype on each of the four soil inoculums plus a control. We grew plants on a mix of sand and vermiculite with a 10% soil inoculum, plus a buffered nutrient solution. We harvested the plants at three weeks post-germination. We saved the roots for DNA analyses, and took the width and dry mass of the rosettes. We found a significant interaction between soil inoculum and genotype for both rosette width (Two-way ANOVA, Df = 36, F value = 1.3552, p = 0.01308) and logged dry mass (Two-way ANOVA, Df = 36, F value = 1.6120, p = 0.02166). We will characterize root microbiomes once our lab reopens, post COVID-19 shutdown. Although preliminary, we believe *Arabidopsis* genotypes show fitness differences depending on soil community. We aim to further develop this project into an experiment testing the effects that soil communities have on plant community composition.



## Adaptation Ecology – Écologie adaptative

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### Arctic and red foxes as ecosystem engineers in subarctic woodland and tundra heath communities

**John Markham**[1] (john.markham@umanitoba.ca)

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Ecosystem engineers alter the habitat conditions and communities where they live through non trophic level processes. Terrestrial habitats in the subarctic are nutrient limited. Therefore, the redistribution of nutrients by carnivores can be an important ecosystem engineering activity in this region. Tundra heaths are typically dominated by slow growing prostrate, mostly ericaceous shrubs. On the western shore of Hudson Bay tundra heaths dominate the extensive inland beach ridges composed of limestone sands. We found fox dens in this area had increased levels of soil nitrogen and phosphate and were dominated by grasses (*Leymus molis*) and erect shrub (*Salix athabacensis*) as well as a number of other indicator species not normally found on the heaths. The increased vegetation height alters the microhabitat of the dens by retaining snow in the winter, creating warmer ground conditions, making the dens a preferred habitat for collared lemmings. Further inland, the subarctic woodlands of Western Hudson Bay are dominated by *Picea glauca* on organic cryosolic soils. Red foxes are found in the woodland and their dens also have increased available soil nitrogen, and have a higher abundance grasses and erect shrubs, compared to non den areas. Trees growing on dens show consistently greater radial growth and seed production in non mast years, demonstrating that dens areas have long term increases in productivity. Although fox dens occupy a small portion of the landscape, the conditions they create results in unique habitats and increases regional diversity.

## Sub–boreal communities and Acadian forests – Communautés sub–boréales / Forêts acadiennes

NL-12:30-13:15 / Qc-11:00-11:45 / BC-8:00-8:45

NL-12:30 / Qc-11:00 / BC-8:00

### The hidden home of rare forest plants: exploring the habitat of *Anemone americana*, *Conopholis americana*, and *Goodyera pubescens* in the Acadian forest ecoregion

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[1]Dalhousie University, [2]Nova Scotia Environment

There are hundreds of rare forest plant species that have been poorly studied within the Acadian Forest Ecoregion (AFE) that dominates the Maritime Provinces of Canada. These plants meet the criteria of conservation concern however, they are not considered rare enough to be formally protected under federal or provincial legislation. This has caused them to be overlooked by the scientific community and prevented many basic features of their physiology, ecology and conservation from being studied. For instance, their population estimates and habitat preferences are often based on little or outdated observation records, undermining their reliability. This also raises serious concerns about the accuracy of their conservation statuses as well as how they may be impacted by human-driven environmental threats. If this knowledge deficit is not addressed these plants may become rarer and face extinction. Our project will directly tackle this challenge by investigating the habitat of three rare forest plants: round-lobed hepatica (*Anemone americana*), American cancer root (*Conopholis americana*) and downy rattlesnake plantain (*Goodyera pubescens*). Our results will reveal the forest successional stage, environmental conditions and plant communities of the areas that these species grow in as well as how these factors may influence their abundances. We will provide essential details about these plants that will directly benefit rare forest plant conservation efforts and develop a more robust understanding of forest communities in the AFE.

NL-13:15 / Qc-11:45 / BC-8:45

### Plant community assembly on the coastal Barrens of Nova Scotia

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The coastal barrens of Nova Scotia are exposed to harsh environmental conditions and dominated by shrubby Ericaceous vegetation. Within this landscape, vegetation varies greatly from sphagnum bogs to small patches of trees to rocky outcrops with sparse plant cover. Recent research shows that at least 595 species of vascular plants, bryophytes, and lichens grow within this landscape. In this study we examine how environmental stress and heterogeneity contribute to the functional diversity of Nova Scotia's coastal barrens. This study analyses 5 coastal barren datasets (n=867 plots), containing information on environmental stress, heterogeneity, and species composition at different spatial scales (whole site vs individual plots). Additionally, functional trait data (plant height, canopy width, leaf thickness, leaf specific area, leaf dry matter content) was collected for the ~200 species present in these datasets. We used multiple linear regression to compare community weighted means, functional dispersion of individual traits, and functional dispersion, with environmental stress and heterogeneity at different spatial scales. Overall, limiting similarity, habitat filtering, and facilitation contribute to the composition of coastal barren plant communities, with scale and soil depth playing a critical role determining which assembly processes are active.

## Sub–boreal communities and Acadian forests – Communautés sub–boréales / Forêts acadiennes

NL-12:30-13:15 / Qc-11:00-11:45 / BC-8:00-8:45

NL-12:30 / Qc-11:00 / BC-8:00

### Towards a new seaweed harvesting industry in eastern Canada: *Vertebrata lanosa*, aka 'Sea Truffle'

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The red seaweed *Vertebrata lanosa* is an epiphyte on *Ascophyllum nodosum*, an abundant seaweed on rocky shores in Nova Scotia. The red alga is marketed in Europe as the 'Sea Truffle', where it is sold online for about CAN$1.50 per gram DW. From May to August 2019 we investigated the population biology and harvest sustainability of *V. lanosa* in the Bay of Fundy at 12 sites on Digby Neck and adjacent islands. At each site, three 30 m transects were established in the central part of the Vertebrata zone. These were randomly assigned one of three conditions: (1) a destructively harvested transect (25 x 25 cm every 2 m along the transect), (2) a harvested sample to mimic a commercial harvester picking the Sea Truffle by hand in a 1-m band along the transect, and (3) an unharvested (control transect). For transect types two and three the following data were gathered at 1 m intervals: cover of *A. nodosum*, depth of *A. nodosum* and cover of *V. lanosa*. The hand-harvested and control transects were re-examined monthly or bimonthly to determine recovery. We estimate that hand-picking removes about 10% of the standing crop of *V. lanosa*, and that monthly harvesting allows for full population recovery. We conclude that the Sea Truffle may provide the basis for a new, economically viable, and ecologically sustainable industry in Nova Scotia.

## Phylogeny and genetics – Phylogénie et génétique

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-13:45 / Qc-12:15 / BC-9:15

### Phylogenetic structure of spectral signatures among Quebec's temperate trees

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[1]Institut de recherche en biologie végétale, [2]Université de Montréal

Biodiversity today faces great threats across every ecosystem. As such, it is necessary to develop new methods allowing for efficient and reproducible data collection and monitoring over large areas. The Canadian airborne biodiversity observatory (CABO; http://www.caboscience.org), from which this project is a part of, attempts this by combining the advantages of remote sensing of vegetation with the detection of their functional traits, a new approach called spectranomics. The interaction of light with foliage can be detected, producing hyperspectral data called spectral signatures. The reflectance measured this way provides information about leaf structure and chemical composition, thanks to different absorbance from the compounds in the leaf. Spectral variation then allows species discrimination, mostly because a major part of this variation appears to be based on species taxonomic identity. However, implication for the evolutionary information potential of these traits remain largely unexplored. My project proposes to investigate the phylogenetic components of spectral signatures, and their potential for revealing evolutionary processes in the underlying foliar traits. This dimension of spectral variation might also prove useful to detect functional convergences, necessary to correctly interpret the ecological meaning and the origin of spectral and functional diversity.

NL-14:00 / Qc-12:30 / BC-9:30

### Phylogeny and evolution of the southern African *Pteronia* L. (Asteraceae)

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[1]University of Johannesburg, [2]University of the Western Cape, [3]South African National Biodiversity Institute (SANBI)

*Pteronia* is a large, often aromatic, shrubby genus comprising 76 species, most of which favour arid habitats within the Greater Cape Floristic Region of South Africa. The genus was last treated by Hutchinson and Phillips (1917), who recognised four sections based exclusively on leaf indumentum. However, this classification is largely artificial and in need of reassessment. A phylogenetic study was carried out to investigate the relationships of the southern African Pteronia using molecular (DNA sequences) data, estimate the divergence times using a relaxed clock dating analysis (Beast) and infer the biogeographic patterns of the genus based on the different Biomes of southern Africa using parsimony- and maximum likelihood-based methods of ancestral area reconstruction (implemented in RASP). The phylogenetic analyses were based on two nuclear (internal and external transcribed spacer: ITS, ETS) and one plastid (trnL-F) DNA sequence data for 60 samples representing 57 taxa. Our phylogeny revealed that *Pteronia* is monophyletic with four main clades recovered. The sections of Hutchinson and Phillips (1917) were not recovered, indicating that their infrageneric classification is unnatural. The divergence time of *Pteronia* was estimated to 7.8 Ma (95 % HPD: 3.9-13.1 Ma), in the late Miocene period. The ancestral distribution of the genus was established to be most likely of Fynbos Biome origin with diversification into the Succulent Karoo, Nama Karoo and other biomes of southern Africa occurring by vicariance or dispersal. The current study has established the hypotheses of species relationships and evolutionary history of the genus as bases for further studies.

## Phylogeny and genetics – Phylogénie et génétique

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-14:15 / Qc-12:45 / BC-9:45

### Fine–scaled molecular and morphological data reveal hidden diversity in common *Navicula* species (Naviculaceae)

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[1]University of Ottawa, [2]Canadian Museum of Nature

*Navicula sensu stricto* is one of the most commonly encountered diatom genera in the northern hemisphere, although it is also widespread across biomes and niches worldwide. Conservatively, the genus comprises more than 200 species, many of which can be found in freshwater environments (ca. 150). *Navicula* presents a long history of taxonomic confusion. This was largely due to the fact that all diatoms with an elliptical-lanceolate valve shape were placed in the genus regardless of other conflicting features. This means that more than 560 often distantly related taxa were once treated within *Navicula*. Recent taxonomic changes to resolve the subgeneric classification of the genus have resolved many obvious problems, and distantly related species have been transferred to existing or newly described genera, but numerous taxonomic problems remain, especially among the many cosmopolitan species of *Navicula*. Recent evidence suggests that these species may be cryptic or pseudo-cryptic species complexes, comprising several taxa with restricted distributions. Such hidden and poorly known diversity not only has enormous implications for conservation of environments and rare species, but also to our understanding of aquatic ecology and biogeography worldwide. Using both molecular (*rbcL*, 18S rRNA, and *atpB* sequences) and morphological (fine-scaled frustule characters and shape analysis) data, we investigated common widespread species within the genus. Phylogenetic trees suggest that unexpected relationships and several new species may exist in what have traditionally been thought of as well-circumscribed taxa.

NL-14:30 / Qc-13:00 / BC-10:00

### Association genetics of acetophenone defence against spruce budworm in mature white spruce

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[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]University of Oxford, [3]Université Laval

Outbreaks of spruce budworm (SBW, *Choristoneura fumiferana* Clem.) cause major recurrent damage in boreal conifers such as white spruce (*Picea glauca* [Moench] Voss) and large losses of forest biomass in North America. Although defensive phenolic compounds have recently been linked to chemical resistance against SBW, their genetic basis remains poorly understood in forest trees, especially in conifers. Here, we used diverse association genetics approaches to discover genes and their variants that may control the accumulation of acetophenones, and dissect the genetic architecture of these defence compounds against SBW in white spruce mature trees. Out of 4747 single nucleotide polymorphisms (SNPs) from 2312 genes genotyped in a population of 211 unrelated individuals, genetic association analyses identified 35 SNPs in 33 different genes that were significantly associated with the defence traits by using single-locus, multi-locus and multi-trait approaches. The multi-locus approach was particularly effective at detecting SNP–trait associations that explained a large fraction of the phenotypic variance (from 20 to 43%). Significant genes were regulatory including the NAC transcription factor, or they were involved in carbohydrate metabolism, falling into the binding, catalytic or transporter activity functional classes. Most of them were highly expressed in foliage. Weak positive phenotypic correlations were observed between defence and growth traits, indicating little or no evidence of defence-growth trade-offs. This study provides new insights on the genetic architecture of tree defence traits, contributing to our understanding of the physiology of resistance mechanisms to biotic factors and providing a basis for the genetic improvement of the constitutive defence of white spruce against SBW.

## Phylogeny and genetics – Phylogénie et génétique

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-14:45 / Qc-13:15 / BC-10:15

### Molecular data support infrageneric nomenclature adjustments in *Crataegus* L. (Maleae, Rosaceae)

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The circumscription and infrageneric classification of *Crataegus* L. (hawthorn) has been a work in progress since the time of Linnaeus. Recent molecular phylogenetic analyses of the genus, as of Rosaceae tribe Maleae to which the genus belongs, have provided support for the infrageneric classification in its most recent iteration. Names at the subgeneric and sectional levels have been proposed to accommodate major clades not previously recognized nomenclaturally. This work sets the stage for further recognition of hybrids at all taxonomic levels, thus clarifying some of the confusion associated with the genus in the past.

NL-15:00 / Qc-13:30 / BC-10:30

### Wide heterogeneity in the nuclear frequency and composition of Arbuscular Mycorrhizal fungal pseudo–dikaryons

**Vasilis Kokkoris**[1,2] (bill.kokkoris@gmail.com), Kelsey Clarke[1], Pierre-Luc Chagnon[3], Gökalp Yildirir[1], Keith Hubbard[2], Franck Stefani[2], Nicolas Corradi[1]

[1]University of Ottawa, [2]Agriculture and Agri-food Canada, [3]University of Montreal

Arbuscular mycorrhizal fungi (AMF) are plant symbionts with a distinct nuclear organization: thousands of nuclei flow simultaneously within their coenocytic hyphae and spores. Recently was revealed that these nuclei are either genetically homogeneous (homokaryons) or heterogeneous (dikaryons), whereby thousands of nuclei of two distinct mating types co-exist at all times. Dikaryotic strains carry higher genetic diversity compared to homokaryotic relatives, yet many questions about this distinct genetic makeup remain unanswered. For example, what is the frequency of AMF dikaryosis, and is there evidence of spatial heterogeneity or inter-nuclear dominance across individual spores of pseudo-dikaryotic strains? Moreover, how do pseudo-dikaryons compare in terms of nuclear counts to homokaryotic relatives? We address these question by combining molecular approaches with advanced microscopy and mathematical modeling. We found that AMF dikaryosis is a rare genetic condition and that dikaryotic strains have higher nuclear counts compared to homokaryotic. We also found that some strains harbor both nucleotypes in exact equal proportions while others appear to have a stable but unequal ratio of their nucleotypes, possibly indicating function dominance or cooperation among nucleotypes. Variation in nuclear counts and nuclear ratios can have important implication in AMF ecology, protein expression and host response.

## Climate change – Changements climatiques

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-13:45 / Qc-12:15 / BC-9:15

### Biodiversity gradients and trophic interactions in the Western Canadian subarctic

**Kirsten Reid**[1] (kirsten.reid@mun.ca), Carissa Brown[1]

[1]Memorial University of Newfoundland

Climate change is occurring at globally unprecedented rates in the arctic, where annual air temperatures are warming at 2.4x the North American average. As a result, landscape changes and altered climatic processes are common across arctic regions. Furthermore, large-scale disturbances are increasing in frequency, leaving landscapes increasingly vulnerable to biome shifts and further stressors (e.g., insect herbivory). As biotic and abiotic environmental conditions change, species' assemblages will be dictated by novel constraints, resulting in environments and communities with no present-day equivalents (no-analogue communities). Recent analyses have demonstrated that relationships between species richness and latitude within the Canadian arctic are not as definitive as in most areas of the world. An accurate understanding of arctic biodiversity is therefore crucial before we can estimate its response to continued rapid change. Through this research, we aim to describe latitudinal biodiversity patterns and interactions across the western Canadian subarctic and to understand how they may be impacted by future warming. We have established a latitudinal network of 12 study sites (60°60'N to 68°97'N), spanning the range of regional ecological conditions. Within these sites, we are characterizing biodiversity of five distinct taxa (soil microbes, invertebrates, understory vegetation, small mammals, large mammals) and determining the abiotic and biotic processes that drive these patterns. Naturally occurring, partially overlapping wildfires in the study region have set the stage to understand how biodiversity will recover from increasingly frequent disturbances. Here we present initial diversity patterns from this extensive study system, the results of which will provide context for potential rapid change under ongoing warming.

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### Reproductive failures of High–Arctic plants experiencing climate extremes

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The increase in frequency and severity of climate extremes are now recognised as part of contemporary climate change. On Ellesmere Island, Nunavut, temperatures in July, the principal month for plant growth and reproduction, have experienced a significant increase in the magnitude of positive and negative temperature anomalies. Climate extremes have implications for Arctic plant reproductive success where the growing season is short and the reproductive cycle spans multiple years. As the climate warms, Arctic plant reproductive success is predicted to increase from currently low levels. However, the increase in climate extremes and the subsequent carry over effects from year to year may temper the predicted increases in tundra plant reproductive success. An International Tundra Experiment site to study plant responses to warmed environments has been operating at Alexandra Fiord, Ellesmere Island since 1993, where open top chambers (OTCs) passively warm plots by 1-3 °C. Periodically, germination rates of species in the OTC and control plots are tested. In 2018 the Canadian High-Arctic experienced an atypical year with growing season temperatures 2 °C below normal, resulting in late flowering and delayed fruit maturation. Woody species showed almost complete germination failure of seeds collected from control plots with germination rates of seeds from OTCs significantly higher than from control plots, while forbs species exhibited the opposite. Many species exhibited lower germination rates than in past years. Our results highlight the complexity of Arctic plant reproductive success and some unexpected effects of climate change.

## Climate change – Changements climatiques

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### Probability of spring frosts, not growing degree–days, drives onset of spruce bud burst in plantations at the boreal–temperate forest ecotone

**Benjamin Marquis**[1] (benjamin.marquis@uqat.ca), Yves Bergeron[1], Francine Tremblay[1], Martin Simard[2]

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Tree dormancy results from the evolutionary pressure imposed by freezing temperatures in winter. However, eco-physiological models predicting the timing of bud break and bud set are based upon temperature (growing degree-days and chilling units) instead of frost variables. We hypothesized that probability of spring frost could outperform growing degree-days to predict the timing of bud break. During 2016 and 2017, we monitored bud break phenology of various seed sources of white spruce (*Picea glauca* [Moench] Voss), black spruce (*Picea mariana* [Mill.] B.S.P.) and Norway spruce (*Picea abies* [L.] Karst.) in two plantations located on both sides of the boreal-temperate forest ecotone. Mixed binomial regressions and AICc model selection were used to determine the best environmental variables predicting the transition from one bud phenology stage to the next. Onset of bud break was best predicted by frost probability and photoperiod whereas intermediate to last phenological stages (bud swelling to expanded needles) were best predicted by growing degree-days. White spruce was the most sensitive species to both spring frost and photoperiod, which triggered earlier bud break. Seed sources from the temperate forest were more sensitive to photoperiod whereas seed sources from the boreal forest were more sensitive to frost probability suggesting that buds respond to photoperiod in sites where damage from spring frost is rare but respond to frost probability in sites where damage from spring frost is likely. Models predicting bud break should include frost variables and consider the change in sensitivity to climate along the bud break sequence.

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### Inconsistent adaptation despite strong genetic differentiation across a steep elevational gradient in growing season length

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When species experience shifts in climate and growing season length, natural selection should promote adaptation in reproductive timing. In the Canadian Rocky Mountains, the annual *Rhinanthus minor* exhibits steep phenotypic clines in phenology across elevational gradients in growing season length due, in part, to seemingly adaptive genetic differentiation in the timing of flowering and fruit maturation. However, the species also responds to season length variation with striking co-gradient plasticity that could erode local adaptation by facilitating gene flow. In each of two generations, we quantified local adaptation by reciprocally transplanting seeds among nine sites spanning ~1000m elevation and 2-fold variation in season length. Based on lifetime fitness, local adaptation was inconsistent, varying from strong local adaptation to strong local maladaptation. The hypothesis that rampant gene flow eroded adaptation among *R. minor* populations is inconsistent with substantial variation in fitness among source populations when planted at common sites, and with strong genetic differentiation (Fst = 0.31) at genome-wide SNPs. Although local adaptation is widely viewed as common, especially in sessile organisms, our results join growing evidence of inconsistent adaptation to variation in climate. What constrains climatic adaptation is emerging as a key question in this era of rapid global change.

## Climate change – Changements climatiques

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NL-14:45 / Qc-13:15 / BC-10:15

### Climate change effects on floral traits and carbon dynamics of cucumber: Potential consequences for a plant–pollinator mutualism

**Sarah J. McDonald**[1] (smcdon83@uwo.ca), Danielle A. Way[1,2]

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Animal pollination, and in particular pollination by insects, is an important ecosystem service that contributes to the reproduction of over 85% of angiosperms. In recent years, there have been reports of declining insect populations, including declines in insect pollinators. Climate change may contribute to pollinator declines, but research on this topic has largely focused on how climate change affects the phenology and distributions of plants and their pollinators. However, climate change may also affect fine-scale aspects of the plant-pollinator mutualism, such as floral attractiveness or nutritional rewards. Using *Cucumis sativus* (cucumber), we examined the effects of elevated temperature and $CO_2$ on flowering onset, flower size, flower number, sexual expression, and nectar rewards. Additionally, to better understand plant carbon balance and carbon investment in reproduction, we measured biomass partitioning and leaf carbon fluxes of plants under their growth conditions. Carbon uptake and loss rates were largely similar across treatments, and plants grown under combined high $CO_2$ and temperatures showed similar biomass and allocation patterns as plants grown at current conditions. However, despite this, future climate scenarios negatively impacted flower size and floral rewards, while simultaneously advancing flowering time. These changes in floral displays will likely decrease pollination efficiency and plant attractiveness to pollinators, while decreases in nectar rewards could increase the cost of foraging. Taken together, our results indicate that *C. sativus* may experience reduced pollination in future climates, while their pollinators may experience increased nutritional stress.

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### Do species need to adapt to persist outside their ranges for multiple generations?

**Regan L. Cross**[1] (17rc28@queensu.ca), Christopher G. Eckert[1]

[1]Queen's University

Biologists often infer long-term ecological and evolutionary processes from short-term experiments. For instance, many species exhibit stable limits to their geographic ranges and the most direct way to test mechanisms causing these limits is to experimentally plant species within and beyond their ranges. However, most experimental populations are only followed for a single generation, preventing insight into long-term demography and potential for local adaptation beyond the range. In 2005, we transplanted individuals of coastal dune plant *Camissoniopsis cheiranthifolia* into four sites within and one beyond its northern range limit. Fitness of beyond-range transplants was often greater than within-range populations, suggesting that this range edge is limited by dispersal rather than niche constraints. More than 10 generations later, plant density and individual fitness remain high in descendent populations beyond the range. To determine whether experimental populations adapted to the extreme environment beyond the range, we performed a second transplant experiment in 2018 using individuals from all original source and transplant sites, including the beyond-range site. All populations were planted at two within-range sites, one range edge, the original beyond-range site, and a site further beyond range. Lifetime fitness at both beyond-range sites was again high, but recruitment into the following generation was low at the far-beyond site. Individuals sourced from beyond range populations did not outperform within-range individuals when planted beyond the range, suggesting a lack of local adaptation to conditions beyond the range. Taken together, our results provide strong evidence that dispersal limits the northern range of this species.

## Collections and citizen science – Collections et science citoyenne

NL-17:30-19:00 / Qc-16:00-17:30 / BC-13:00-14:30

NL-17:30 / Qc-16:00 / BC-13:00

### Heading North at the National Herbarium of Canada

**Jennifer Doubt**[1] (jdoubt@nature.ca), Christopher Deduke[1], Kimberly Madge[1], Cassandra Robillard[1], Evan Seed[1], Lyndsey Sharp[1], Paul Sokoloff[1]

[1]Canadian Museum of Nature

The National Herbarium of Canada (a.k.a. CAN, CANM, CANL, and CANA), at the Canadian Museum of Nature (CMN), is the world's best archive of plant specimens from the Canadian north. With an estimated 150 000 vascular plant, bryophyte, lichen and algal specimens from Canada's northern territories alone, and many more from circumpolar jurisdictions, the collection offers a 200+ year time series with which to elucidate questions in systematics, taxonomy, floristics, phytogeography, environmental change, history and more. Contemporary CMN botanists continue to focus northward, building on this unique strength. Meanwhile, the Gatineau-based herbarium team works to make the collection increasingly useful and accessible to more people and projects. With support from the Sitka Foundation, all vascular plant and lichen specimens from Yukon Territory, Northwest Territories and Nunavut have been imaged and shared on-line via the Global Biodiversity Information Facility (GBIF). Citizen science initiatives such as "Expedition Arctic Botany", on the Zooniverse platform, accelerate data entry while also engaging an ever-wider, ever more diverse stakeholder community, substantially boosting active in-person outreach programs. In 2020, the physical capacity of the National Herbarium of Canada will increase by about 15%, kicking off a long-overdue reorganization of vascular plant specimens according to modern concepts, and assuring room for future growth of this busy, outward-facing, northern botanical resource.

NL-17:45 / Qc-16:15 / BC-13:15

### Archival fieldwork: new Arctic plant biodiversity data from backlogged herbarium specimens

**Paul Sokoloff**[1] (psokoloff@nature.ca), Jeffery Saarela[1], Jennifer Doubt[1], Lyndsey Sharp[1], R. Troy McMullin[1]

[1]Canadian Museum of Nature

Plant and lichen collections deposited in herbaria around the world underpin our knowledge on species distribution and taxonomy, but time and resource constraints often limit the ability of herbaria to identify, prepare, and/or digitize these specimens. As a result, backlogs of material not yet part of the active collection can accumulate. While these lots may be safely stored and preserved, the biodiversity data represented by the specimens remains locked away and invisible to users of both physical and virtual (on-line) collections. Botany staff at the Canadian Museum of Nature's National Herbarium of Canada have been working to process the backlogged collections of three prominent Arctic botanists: Dr. Sylvia Edlund, Margaret Oldenburg, and Dr. Nicholas Polunin. Together these three lots of over 10 000 specimens represent a combined 28 years of collecting effort between 1933 and 1991. These specimens, collected across the Canadian Arctic ecozone, include species occurrence information from locations not visited since; and specimens from well-botanized sites where repeatedly-collected species can support temporal understanding of species distribution and phenology. We conducted archival searches, interpreted field notes, and communicated with collectors' relatives to fill in missing label data, and identified or confirmed each specimen. Completed batches were then mounted and digitized by co-op students and herbarium volunteers, with help from project funding earmarked for backlog reduction. We will present this project and the floristic results from these efforts and place these important collections in historical context.

## Collections and citizen science – Collections et science citoyenne

NL-17:30-19:00 / Qc-16:00-17:30 / BC-13:00-14:30

NL-18:00 / Qc-16:30 / BC-13:30

### Vascular plant biodiversity of Victoria Island (Northwest Territories/Nunavut, Canada): a new collections–based baseline based on 100+ years of floristic exploration

**Jeffery M. Saarela**[1] (jsaarela@nature.ca), Paul C. Sokoloff[1], Lynn J. Gillespie[1], Roger D. Bull[1], Bruce A. Bennett[2], Serguei Ponomarenko[1]

[1]Canadian Museum of Nature, [2]Independant researcher, Whitehorse, Yukon

The flora of an area refers to all plant species and taxa at other ranks occurring in the area; it is a principal measure of biodiversity. Exploration and documentation of the vascular plant flora of the Canadian Arctic Archipelago has been ongoing for nearly two centuries, yet many areas remain poorly known. Here, we report the results of a collections-based floristic study of vascular plant diversity of Victoria Island, which is the eighth largest island in the world and the second largest in Canada. Our study synthesizes existing published and unpublished information, including new results from five field seasons of botanical collecting across the island. We have reviewed some 7000 collections gathered on the island. A total of 289 taxa in 109 genera are recorded from the island. Thirty-six taxa are known on the island from a single collection. Twenty-three taxa in ten families are newly recorded for the flora of Victoria Island, and nine of these are newly recorded for the flora of the Canadian Arctic Archipelago. Of the eight general areas on Victoria Island that have been botanically explored the most, the greatest diversity of vascular plants is recorded in Ulukhaktok (187 species), followed by the Cambridge Bay area (176 species). We have generated new distribution maps for all species on the island and taxonomic keys to facilitate identification of all vascular plant taxa. Our results represent a new, up to date baseline of knowledge on which continued exploration of the flora of the island can build.

NL-18:15 / Qc-16:45 / BC-13:45

### Unravelling major phylogenetic relationships in *Schoenus* (Cyperaceae, tribe Schoeneae)

**Tammy L. Elliott**[1] (tammy.elliott@mail.mcgill.ca), A. Muthama Muasya[2], Ruan van Mazijk[2]

[1]Université de Montréal, [2]University of Cape Town

*Schoenus* L. (Cyperaceae, tribe Schoeneae) is a predominately austral genus having about 140 species, with the highest species richness in Australia, New Zealand, South-east Asia and southern Africa. Our focus in recent years has been the southern African clade of *Schoenus*, whose high species richness can be attributed to the region's highly heterogeneous ecology. The region has varied geological patterns that have resulted in distinct soil types that differ greatly in nutrient-status, as well as varying topography that affects regional climatic patterns. Before our detailed taxonomic studies, the southern African *Schoenus* were determined to be a taxonomic priority by the South African National Biodiversity Institute (SANBI). We began updating the taxonomy of this group in 2017 by transferring 24 species of Southern African *Tetraria* P. Beauv. and *Epischoenus* C.B. Clarke into the genus based on the results of previous molecular studies focusing on tribe Schoeneae. More recently, we have described 20 new species and revised the taxonomy of the major southern African clades. Here, we combine our expanded taxonomic knowledge of the genus with Sanger sequencing data based on expanded taxon sampling to determine: 1) the ancestral area of *Schoenus* and 2) whether the southern African *Schoenus* species are monophyletic. We also examine diversification patterns of the southern African taxa relative to the other *Schoenus* species and evaluate existing species concepts in the group. This study combined with further studies using next-generation RAD-seq data will be used to gain a better understanding of the evolution of this complex group of sedges.

## Collections and citizen science – Collections et science citoyenne

NL-17:30-19:00 / Qc-16:00-17:30 / BC-13:00-14:30

NL-18:30 / Qc-17:00 / BC-14:00

### Canadensys: where are we now?

**Carole Sinou**[1,2] (carole.sinou@umontreal.ca), Anne Bruneau[1]

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Canadensys is a pan-canadian initiative that publishes biodiversity data curated by Canadian institutions. Established in 2009, this initiative has allowed the publications of nearly 3M occurrences (published on both Canadensys and GBIF) and has facilitated the discovery of 6M occurrences through the Canadensys Explorer. These occurrences are mostly specimens curated in Canadian universities and museums, but also observations collected during citizen science events or for inventories. The occurrences represent different types of collections but a wider range of data (for example ecological or phylogenetic datasets) could be published on Canadensys, which would lead to a more complete representation and understanding of the biodiversity of Canada. Since the first publication of datasets, Canadensys has evolved and is involved in several national and international initiatives that range from training workshops to mentoring of GBIF-hosted portals in other countries. In the last two years, Canadensys has launched a new platform based on the Atlas of Living Australia, which has been optimized for an international usage by the Living Atlases Community, and to which the Canadensys team has contributed. In parallel to this new platform, Candensys has moved data and applications to the Compute Canada Cloud to provide more secure and responsive services to users and to facilitate future deployment of exploration and analytical tools. With these tools, Canadensys will offer concrete solutions for scientists, citizens and organizations to better understand and use the data available, and is developing expertise outside its initial mandate to publish Canadian biodiversity data.

NL-18:45 / Qc-17:15 / BC-14:15

### Exploring phytobiomes in our rapidly changing world: data, synthesis and new questions

**Laura Super**[1] (leslaura@gmail.com), Melody Fu[1], Santokh Singh[1], Robert Guy[1]

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A phytobiome is a plant, its environment, and associated communities of organisms. Understanding the phytobiome has implications for basic and applied research as well as in potential practical implications in land conservation, agriculture, and forestry. How does plant health and performance relate to the phytobiome and its associated organisms? How do phytobiomes shift with anthropogenic change? We are investigating the impact of simulated nitrogen deposition and/or climate warming on conifer seedling growth parameters, and associated fungal (phyllosphere and rhizosphere mycobiomes) and rhizosphere nematode communities, under both lab and field conditions. Early results from factorial growth chamber experiments with Douglas-fir (*Pseudotsuga menziesii* (Mirb) Franco) indicate that plant growth and the phytobiome are affected by moderate anthropogenic change (low nitrogen deposition, 10 kg per ha per year; three degrees of warming for temperatures relative to reference period, 1961-1990). Douglas-fir height increased and soil nematode abundance decreased with the warming treatment. Fungal species diversity differed between shoots and roots and with some treatments. To stimulate discussion and a more general synthesis, we will discuss current trends, gaps, and new questions in phytobiome research, including results from a systematic literature search of the Web of Science Core database, more broadly (e.g., plant traits, phenotypic plasticity, microhabitats of multiple plant parts, communities of bacteria, protists, etc.) and in the context of anthropogenic change research (e.g., climate change impacts on associated plant-pollinator networks, etc.).

## Socio–Ecology and landscape – Socio–écologie et paysages

NL-17:30-19:00 / Qc-16:00-17:30 / BC-13:00-14:30

Cancelled - Annulé

### Les communautés Autochtones face aux saisons de feux extrêmes, Canada

**Julia Morarin**[1] (julia.morarin@uqat.ca), Hugo Asselin[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

En forêt boréale, les changements climatiques entraînent une augmentation de la sévérité, de la fréquence, de la taille et de la durée de la saison des incendies forestiers. Les communautés Autochtones sont affectées par les saisons de feux extrêmes qui modifient l'utilisation du territoire et l'accès aux ressources pour des activités culturelles et de subsistances. En 2014, plus de 380 incendies ont brûlé 3.4 millions d'hectares de forêts dans les Territoires du Nord-Ouest, incluant le territoire (Tłı̨chǫ nèèk'e) de la Première Nation Tłı̨chǫ. Les savoirs traditionnels détenus par les utilisateur.trice.s du territoire, couplé aux concepts de système socio-écologique et de services écosystémiques, ont permis de révéler de nombreux impacts dans le temps et l'espace, tant sur l'écosystème boréal que sur les communautés Tłı̨chǫ. 10 femmes et 10 hommes (17 à 82 ans), ont décrit leurs expériences et ressenti vécus pendant les incendies de 2014. Plus de la moitié du Tłı̨chǫ nèèk'e a été brûlé en 2014, et il faudra attendre au moins 80 ans pour que les arbres soient à nouveau prêts à être utilisé dans les activités quotidiennes. Le caribou et le bouleau se placent comme des espèces clé du mode de vie traditionnel Tłı̨chǫ, et leur diminution, conséquente, impacte de nombreux domaines d'activités allant de la pratique de la médecine à la transmission des savoirs et de la langue, en passant par la fabrique de canoës. Cette collaboration complète nos connaissances sur les régimes des feux passés et à venir, et ouvre la voie vers de nouvelles solutions d'adaptations.

NL-17:45 / Qc-16:15 / BC-13:15

### Reproduction and fire interact to constrain tree range expansion in subarctic treeline forests

**Carissa Brown**[1] (carissa.brown@mun.ca), Kirsten Reid[2]

[1]Memorial University, [2]Wilfrid Laurier University

Across the northern boreal forest, stands are structured by landscape-scale fires, where species present have adapted to the historic disturbance regime. With climate warming, fire activity is increasing in many areas of the boreal forest, altering disturbance regimes. In concert, we expect tree populations at the northernmost edge of the boreal forest to increase in density and advance into uncolonized tundra ecosystems as environmental constraints on tree growth lessen. Yet, forest advance has only been observed in approximately half of studied systems. What role does fire play in these processes, and how does increasing fire activity interact with reproductive processes and regeneration under climate change? We explore these questions across two scales: i) black spruce populations in subarctic Yukon, where recent fires have occurred more frequently than historically experienced; and ii) circumpolar boreal treeline. Tree colonization was drastically reduced following two closely timed fires. On-site germination experiments demonstrated that black spruce recruitment was limited by seed availability, not substrate, and sites have shifted to shrub-dominated tundra. Across the circumpolar treeline, the production of viable seed was insufficient for range expansion, including in sites dominated by fire-adapted species. If these marginal stands burn under increased fire activity, we are likely to observe a regeneration failure due to low seed availability. Thus, we have found that seed availability can constrain stand regeneration and population expansion via (at least) two processes: i) increased fire activity can interrupt reproduction; and ii) reproductive bottlenecks can limit increases in range-edge populations.

## Socio–Ecology and landscape – Socio–écologie et paysages

NL-17:30-19:00 / Qc-16:00-17:30 / BC-13:00-14:30

NL-18:00 / Qc-16:30 / BC-13:30

### A broad–scale test of whether constraints on dispersal contribute to the northern range limit of a Pacific coastal dune plant

**Michael Dungey**[1] (13md73@queensu.ca), Chris Eckert[1]

[1]Queen's University

Species are expected to occur where environments allow for population self-replacement, and be limited where biotic and abiotic conditions shift outside their recognized niche. However, many systems lack the declines in fitness towards their range edges expected under niche limitation and even show persistence beyond them, suggesting a role of dispersal limitation in maintaining species? ranges. For species that exist within patchy environments, dispersal limitation can occur through increases in heterogeneity of suitable habitat, as opposed to absolute dispersal barriers. Reductions in habitat patch size and greater patch isolation can increase the cost of dispersal along a gradient, with a range limit forming where colonization can no longer match stochastic patch extinction. We tested this hypothesis across the northern range of two Pacific coastal dune endemics, *Camissoniopsis cheiranthifolia* (Onagraceae) and *Abronia umbellata* (Nyctaginaceae). Both species occur in patchy dune habitat, and previous studies of beyond-range transplants strongly suggest that dispersal may limit the northern range. By surveying all coastal dune habitat in the northern half of the species? ranges and quantifying habitat suitability and occupancy and at > 7000 random 5x5 m plots, we tested the predictions that towards the northern range limit: (1) availability of suitable habitat decreases, (2) inter-patch distance increases, and (3) occupancy of suitable habitat patches decreases. Initial results suggest greater variation in patch isolation than habitat availability, and future work weighting distances with habitat resistance metrics may yield further conclusions on dispersal constraints across the northern range.

NL-18:15 / Qc-16:45 / BC-13:45

### No place to hide: Rare plant detection through remote sensing

**Carlos Cerrejón**[1] (carlos.cerrejonlozano@uqat.ca), Osvaldo Valeria[1], Philippe Marchand[1], Richard T. Caners[2], Nicole J. Fenton[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]Royal Alberta Museum

Rare species detection is greatly limited by their intrinsic nature and by the constraints associated with traditional field surveys. This results in important knowledge gaps that hinder the implementation of effective conservation measures. Remote sensing (RS) provides a powerful alternative to traditional surveys through the increasing availability of RS data and resources. Here we assess the capacity for RS at high and medium resolution to detect rare plants through direct and indirect approaches, and how RS performance can be influenced by species? Characteristics. While direct detection is often limited, it may be possible with very high spatial resolution data for rare plants with distinctive traits. RS can also capture biophysical conditions driving rare plant distributions, increasing predictive performance for plants (indirect detection). Both approaches have the potential to discover new populations of rare plants. Furthermore, RS can feed into species abundance models, which combined with species distribution models (SDMs) are a valuable approach for indirect rare plant detection. While direct detection is limited by the space occupied by a species within its habitat and a species? morphological and phenological characteristics, the predictive performance of RS-based SDMs is influenced by habitat size, habitat specificity, and phenological features of rare plants. Similarly, model predictive performance can be influenced by the form of rarity for a target species based on rarity classification criteria. This synthesis demonstrates the strong potential of RS for the detection and prediction of rare plants.

## Socio–Ecology and landscape – Socio–écologie et paysages

NL-17:30-19:00 / Qc-16:00-17:30 / BC-13:00-14:30

NL-18:30 / Qc-17:00 / BC-14:00

### Boreal sentinels: Forest biodiversity early warning system/So nipukt kelo't keliket nipuket mimajuaqn

**André Arsenault**[1] (andre.arsenault2@canada.ca), Gregory Jedorre[2], Janet Feltham[3], Tegan Padgett[3], Yngvar Gauslaa[4], Michele Piercey-Normore[5]

[1]Canadian Forest Service, [2]Miawpukek First Nations, [3]Parks Canada, [4]Norwegian University of Life Sciences, [5]Memorial University of Newfoundland

In Canada, we are facing three significant challenges in the protection of biodiversity: 1. incomplete survey of biodiversity especially for certain taxa and in remote regions. 2. inadequate monitoring for species at risk, which make the re-assessment of these organisms difficult, and 3. lack of a process for the integration of indigenous knowledge and science to assist guide conservation of biodiversity efforts in the context of reconciliation and natural resource management. Here we present the boreal sentinels projects which attempts to address these three challenges in Newfoundland and Labrador using lichens as indicators of biodiversity. This project is a partnership involving the Canadian Forest Service, Miawpukek First Nations, Parks Canada, MUN, and NMBU. We have two main objectives; 1. develop an effective and respectful communication approach to foster integration of indigenous knowledge and science on biodiversity; and 2. develop an early warning system for lichen biodiversity using a combination of field-surveys, monitoring, time-lapse cameras and innovative field and lab experiments. This collaborative project has been very successful thus far and has included engagement of youth on boreal ecology, field campaigns with all of our partners and a workshop focused on conservation efforts by Parks Canada and Miawpukek First Nation. The result of our surveys have identified new locations for species at risk as well as the discovery of a new lichen species for the province, which is listed by COSEWIC. Time-lapse cameras, and field and lab experiments are providing new insight into threats to lichens in the province such as herbivory.

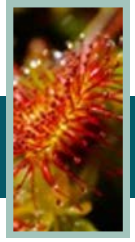
NL-18:45 / Qc-17:15 / BC-14:15

### Hierarchies of Habitat: *Diapensia lapponica* on the Avalon Peninsula

**Heather Baehre**[1] (hbaehre@mun.ca), Carissa Brown[1]

[1]Memorial University of Newfoundland

Alpine flora are known for their resilience to the selective pressures of their associated climate, glacial history, and geology. While some alpine community characteristics are ubiquitous, there are broad variations in alpine ecosystem characteristics, providing an opportunity to compare regions with similar alpine flora. The coastal barrens of the Avalon Peninsula of Newfoundland are a unique region with alpine flora, best demonstrated by the persistence of arctic-alpine species, *Diapensia lapponica*, yet occur at low elevation (maximum of 300 m) within a temperate climate. These populations are the farthest east recorded in North America, and are located near the southern edge of the species? range. *D. lapponica* plays a key role as a nurse plant and maintains diversity in barren landscapes through their role as facilitators. Given the species? isolation to arctic-alpine microclimates, climate change may pose challenges for their persistence. Here, we aim to identify biotic and abiotic conditions associated with the occurrence and structure of *D. lapponica* on the Avalon Peninsula. We assessed vegetation community assemblages and microclimate where *D. lapponica* occurs within the Hawke Hill Ecological Reserve and the Avalon Wilderness Reserve. We present associations between the surrounding plant species and structural characteristics of *D. lapponica*, and summarize natural history observations potentially unique to these coastal barrens communities. Results will provide an improved understanding of conditions in which *D. lapponica* occurs on the coastal barrens of the Avalon Peninsula, informing future conservation and management of these populations within protected areas on the island.



## Evolution – Évolution

NL-12:15-13:15 / Qc-10:45-11:45 / BC-7:45-8:45

NL-12:15 / Qc-10:45 / BC-7:45

### Micro– and macroevolutionary patterns in colour variation in a wind–pollinated plant lineage

**Dylan Longert**[1] (dlong010@uottawa.ca), Étienne Léveillé-Bourret[2], Hong Cui[3], Khaled Himmat[1], Audrey N. Paquette[1], Simon Piché-Mongeon[1], Erin Johnson[1], Xiaohao Wu[1], Julian R. Starr[1]

[1]University of Ottawa, [2]University of Zürich, [3]University of Arizona

Although the selective value of inflorescence pigmentation in animal-pollinated plants has been well studied, little research has been conducted on the role of colour in wind-pollinated plants. The genus *Carex* (Cyperaceae) provides an ideal model to study whether pigmentation evolution could be an adaptation in wind-pollinated plants because of its exceptional diversity (ca. 2000 spp.), cosmopolitan distribution, and high ecological disparity (rain forests to deserts). We hypothesize that darker pigments absorb solar energy thus accelerating floral and fruit development in plants with shorter growing seasons. This would be most advantageous in arctic and alpine regions but could also be important for species with broad latitudinal distributions where growing season length (GSL) may differ significantly. To assess whether there is a correlation between darkness and GSL, we measured the darkness of bracts (scales) and prophylls (perigynia) associated with flowers on digital herbarium specimens and we gathered WorldClim variable BIO10 (Mean Temperature of Warmest Quarter) for the same specimens as a proxy for GSL. We then performed two sets of regression analyses: (1) darkness against BIO10 within three latitudinally widespread species, and (2) darkness against BIO10 across the entire genus in North America, north of Mexico. Results demonstrate that both within and between species, *Carex* with darker bracts and prophylls are found in habitats with shorter growing seasons, whereas *Carex* with lighter parts are found in habitats with longer growing seasons. Consequently, darkness variation within and among *Carex* species may represent a significant adaptation to GSL in this overwhelmingly temperate genus.

NL-12:30 / Qc-11:00 / BC-8:00

### Recent advances in the phylogeny and genomics of subfamily Cercidoideae (Leguminosae)

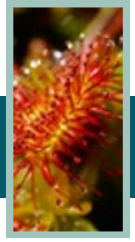
**Warren Cardinal-McTeague**[1] (warren.cardinal-mcteague@umontreal.ca), Carole Sinou[1], Esra Kaymak[2], Jérémy Migliore[2], Olivier J. Hardy[2], Anne Bruneau[1]

[1]Université de Montréal, [2]Université Libre de Bruxelles

Cercidoideae (Leguminosae) is a diverse pantropical, and sometimes warm temperate, lineage of ~400 species of trees, shrubs, and lianas. Members of this subfamily are easily recognized by their bilobed leaves and noted for their frequent shifts among rainforest, savanna, and succulent biomes (compared to general trends of niche conservatism in some legume subfamilies). Recent classifications have settled on recognizing 14 genera in Cercidoideae, supported by their diversity in growth form, floral morphology, and geographic distribution. However, until recently, phylogenetic studies were based largely on a single marker (cpDNA *trnL-F)* and more work was needed to resolve the relationships in Cercidoideae and test the revised generic circumscriptions with improved molecular data (e.g., from both nuclear and plastid genomes; using high throughput methods). Here, we present a summary of recent and upcoming phylogenetic research on Cercidoideae based on three methods: (1) concatenation of duplicated nuclear (Legcyc, Leafy) and single copy plastid (*matK*, *trnL-F*) loci; (2) preliminary Hyb-Seq high throughput data using the Detarioid baitset of 289 nuclear loci (producing ~1000 contigs); and (3) an outline of upcoming Hyb-Seq research that combines the Angiosperm353 baitset with a custom baitset of 90 functional genes that will examine the evolution of functional genes and traits associated with biome shifts.

## Evolution – Évolution

NL-12:15-13:15 / Qc-10:45-11:45 / BC-7:45-8:45



NL-12:45 / Qc-11:15 / BC-8:15

### Conservation on the periphery: genetic diversity of the Endangered sedge, *Trichophorum planifolium*

**Tyler Smith**[1] (tyler@plantarum.ca), Victoria Nowell[2], Song Wang[1]

[1]Agriculture and Agri-Food Canada, [2]Independent researcher

The majority of species at risk in Canada reach the northern extent of their distribution in this country, and most are common and abundant in the southern portion of their range in the USA. This has lead some to question the merit of devoting scarce resources to protecting rare local representatives of globally common species. However, these peripheral populations may be disproportionately important for the long-term persistence of these species, as their isolation in unique environments may generate distinct genetic diversity. We evaluated the divergence of the last remaining Canadian population of *Trichophorum planifolium* relative to populations across the American range of the species. We assessed four different aspects of their diversity: genetic variation (microsatellites), spatial disjunction, microhabitat conditions, and climatic variation. The genetic data reveal extraordinarily low diversity, with very few individuals displaying any heterozygous loci, and half of the populations, including the Canadian one, possessing fewer than three multi-locus genotypes. This is surprising for a sexual wind-pollinated species. It suggests populations are characterized by strong founder effect and high levels of inbreeding. There is some evidence of the divergence of western disjunct populations in Missouri, but not for those on the northern periphery. However, the spatial and environmental data indicate there may have been adaptive divergence not captured by neutral genetic markers.

NL-13:00 / Qc-11:30 / BC-8:30

### Ecology trumps phylogeny in the rapid radiation of Trichophoreae (Cyperaceae)

**Étienne Léveillé-Bourret**[1] (etienne.leveille-bourret@uzh.ch), Chen Bing-Hua[2], Marie-Ève Garon-Labrecque[3], Bruce A. Ford[4], Julian R. Starr[5]

[1]University of Zürich, [2]Fujian Normal University, [3]Independent, Québec, [4]University of Manitoba, [5]University of Ottawa

Cyperaceae tribe Trichophoreae is a subcosmopolitan clade of ~17 species that differ markedly in their size, inflorescence complexity, and perianth morphology. Although its three genera (*Cypringlea*, *Oreobolopsis* and *Trichophorum*) can be morphologically defined, their status is controversial because recent phylogenetic studies have suggested they may not be reciprocally monophyletic. However, a reclassification of Trichophoreae has not been possible due to conflicting topologies and poorly supported nodes following rapid diversification. We analysed restriction-site associated DNA sequencing (RADseq) data from nearly all Trichophoreae, and five Sanger-based markers (*matK*, *ndhF*, *rps16*, ETS-1f, ITS) sampled extensively within species. This approach allowed us to resolve deep and shallow relationships within the tribe, despite an anomaly zone spanning several successive short branches that produced considerable gene tree incongruence. Analyses reveal a major phylogenetic split roughly corresponding to an East Asian-North American disjunction that dates back to the Mid-Miocene with both clades comprised of reduced unispicate species and larger taxa with highly compound inflorescences. Morphological characters traditionally used to circumscribe Trichophoreae genera are shown to be homoplasious. Several of these characters correlate best with climatic conditions, with the most reduced species occurring in open habitats at high latitudes and altitudes. Close relatives with highly compound inflorescences are found in temperate or subtropical forest understories. *Cypringlea* and *Oreobolopsis* are deeply nested within *Trichophorum*, and we merge all three genera within a more broadly circumscribed *Trichophorum*. Moreover, we demonstrate that *Scirpus filipes*, an East Asian subtropical forest species with highly compound inflorescences, is also a species of *Trichophorum*.

## Ecological monitoring – Suivis écologiques

NL-12:15-13:15 / Qc-10:45-11:45 / BC-7:45-8:45

NL-12:15 / Qc-10:45 / BC-7:45

### Tree–related microhabitats and deadwood dynamics in boreal old–growth forests

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Tree-related microhabitats (TreMs) and deadwood, downed or standing, are important substrates for vegetal and fungal species, as well as precious life sites for many animal species. Old-growth forests generally have a higher richness and diversity in TreMs or deadwood than younger stands. However, old-growth forests are also defined by a wide variety of structures and life histories. Moreover, TreMs have so far been little studied in North America, and even less in boreal forest. In this context, it is necessary to better understand how TreMs and deadwood changes within old-growth massifs. Thus, we surveyed TreMs and deadwood in 71 boreal old-growth forests dominated by black spruce in Québec. Our results indicated that the dynamics of TreMs and deadwood follow non-linear and occasionally divergent paths. TreMs density and diversity reached their peaks at the beginning of the old-growth stage (i.e., after canopy break-up) and decreased after. In contrast, deadwood volume and diversity in decay stages reached their peaks at the true old-growth stage (i.e., when almost all the first cohort trees have disappeared). Old-growth forests mixing black spruce and balsam fir were also defined by a higher TreMs density and diversity, as well as a higher deadwood volume, than those dominated by black spruce. Forest succession, tree species composition and secondary disturbances were therefore the main drivers explaining differences in TreMs and deadwood from one old-growth stand to another. Hence, these results underline that the diversity in old-growth forests structures also imply a diversity in habitats that are necessary to many vegetal, fungal and animal species.

NL-12:30 / Qc-11:00 / BC-8:00

### The offsite impacts of mining on plant diversity in boreal areas

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Mining provides minerals and metals for social and economic development. However, it is also one of main anthropogenic disturbance on biodiversity and ecological services, especially in Québec boreal forests. Little is known about those impacts that occur away from the immediate locality of the disturbance. Could these offsite ecological impacts permeate far into apparently undisturbed areas and affect surrounding plant diversity? To answer this question, six gold mines from different stages of the mining lifecycle and six control transects were selected in Abitibi-Témiscamingue and Nord-du-Québec regions (Québec) and plant species inside plots along the transects (6-8 per mine) at increasing distance (0, 20, 50, 100, 200, 500 and 1000 m form mine periphery) were collected. Preliminary results: 1) the presence of offsite impacts of mines is confirmed on the plant community. Data from three mines have been analyzed and indicated that shrubs and bryophytes were favored by mining, but the abundance of fern-allies and trees was reduced compared with undisturbed areas; 2) some common herbaceous species have been identified as potential indicators to monitor offsite impacts of mining. Indeed, we found that *Coptis trifolia* and *Maianthemum canadense* were negatively affected by mines, suggesting that they might be sensitive to the loss of forest cover, soil disturbance and particle deposition induced by mining. Conversely, *Cornus canadensis* was favored by mining activity, which indicates its resilience to the stresses caused by mines. The project is still ongoing, further data will be analyzed to develop our understanding of the ecological footprint of mining activities.

## Ecological monitoring – Suivis écologiques

NL-12:15-13:15 / Qc-10:45-11:45 / BC-7:45-8:45

NL-12:45 / Qc-11:15 / BC-8:15

### Assessing atmospheric deposition of pollutants across the nation using moss: Canada's first Bryomonitoring survey

**Phaedra Cowden**[1] (phaedra.cowden@usask.ca), Hazel Cathcart[2], Karen Golinski[3], Tanner Liang[2], Kayla Wilkins[2], Julian Aherne[2]

[1]University of Saskatchewan, [2]Trent University, [3]Smithsonian National Museum of Natural History

Atmospheric pollutants emitted from anthropogenic activities are eventually deposited onto the landscape as either wet or dry deposition. Monitoring the deposition of these pollutants is important, as an increased input of nutrients and metals can pose a threat to ecosystem and human health. Traditional methods to monitor atmospheric deposition require the installation of monitoring stations, which in remote and rugged regions, typical to the Canadian landscape, can be expensive and logistically challenging to install and maintain. Biomonitoring with moss (bryomonitoring) offers a low cost and efficient method to monitor atmospheric deposition. The use of moss as a biomonitor has been widely adopted in Europe where large-scale country-wide repeat surveys have been carried out every 5 years since the 1990s. Successful bryomonitoring studies have been conducted in Canada, although only at a regional or local scale. The Canadian Bryomonitoring Project is an initiative aimed at carrying out Canada's first country-wide moss survey (URL: bryomonitoring.ca). This project calls on the participation of people from all backgrounds to help gather data by collecting moss during the 2020/2021 field seasons. We hope to engage citizen scientists, academics, field researchers and students to participate in this innovative cross-Canada initiative.

NL-13:00 / Qc-11:30 / BC-8:30

### Addressing knowledge gaps on carbon deposition to tree–rings in Silver fir using intra–annual d13C and xylogenesis data and ecophysiological modelling

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Tree functioning from the cellular to the structural levels is rather well documented. However, knowledge gaps on carbon (C) allocation (tree carbon investment on specific tissues) and xylogenesis (formation of wood cells in tree-rings) still exist. We explored whether our current understanding of C deposition to wood could be improved using: (1) intensive monitoring of wood cell formation during the growing season, (2) intra-annual data of $\delta^{13}C$ in tree-ring cellulose and (3) ecophysiological modelling. We collected wood micro-cores to monitor wood cell formation of six Silver fir trees at two forest sites in the Vosges mountains (France) during three growing seasons in order to detect the periods of cell enlargement and cell wall thickening of 10 tree-ring subsections. The same trees were subsequently sampled to measure $\delta^{13}C$ of tree-ring cellulose ($\delta^{13}Ccell$) over similar 10 tree-ring subsections of the same three years (2007-2009). We then used an ecosystem model, integrating a model for sugar availability and C isotope fractionation, to identify periods of C deposition in each tree-ring subsection based on the agreement between simulated and observed $\delta^{13}Ccell$ values. Our results suggest that the sugar pool used by wood cells during cellulose deposition integrate C that starts to be assimilated some weeks before cell enlargement, with a continuous income of more recent assimilates until the end of cell formation. This study provides useful insights on C allocation to wood in Silver fir that can be used to improve the projections of the C budget and sequestration potential of these forest stands.

## Biotic interactions – Interactions biologiques

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-13:45 / Qc-12:15 / BC-9:15

### Examining anthocyanin localization in relation to the endoplasmic reticulum during programmed cell death in lace plant (*Aponogeton madagascariensis*) leaves

**Georgia Denbigh**[1] (g.denbigh@dal.ca), Christian Lacroix[2], Arunika Gunawardena[1]

[1]Dalhousie University, [2]University of Prince Edward Island

Lace plant (*Aponogeton madagascariensis*) forms perforations throughout its leaves via developmental programmed cell death (PCD). Newly emerged 'pre-perforated' lace plant leaves are filled with anthocyanin pigmentation, and the first visible sign of cell death is the disappearance of anthocyanin in 'window' leaves, which generates a unique gradient of non-PCD, early-PCD and late-PCD cells. Although previous research has recognized the presence of anthocyanin vacuolar inclusions (AVIs) in lace plant, their function in leaf development and PCD remains elusive. Further, the intracellular transport of anthocyanin from the endoplasmic reticulum (ER; biosynthesis site) to the vacuole (accumulation site) is unknown. Two models are proposed: vesicular or ligandin transport. Even though the involvement of the ER is well-documented in animal PCD, little is known about ER dynamics in lace plant PCD. Therefore, the objectives of the study are: (i) to investigate AVI structure and localization, and (ii) to examine ER dynamics across the PCD gradient in lace plant. A combination of long-term live-cell imaging and transmission electron microscopy (TEM) were used to determine the localization of AVIs in lace plant leaves. A protocol was optimized for 3,3'-Dihexyloxacarbocyanine Iodide, a fluorescent dye, to observe ER changes across the PCD gradient using confocal laser scanning microscopy (CLSM). Microscopic observations indicated that AVIs are more concentrated in the apex of window leaves. Transmission electron microscopy revealed that AVIs are engulfed in ER-derived vesicles for transportation to the vacuole, which supports the vesicular transport model. Both TEM and CLSM provide evidence of ER changes across the PCD gradient.

NL-14:00 / Qc-12:30 / BC-9:30

### Investigating the inhibitory effects of anthocyanin extracts from *Aponogeton madagascariensis* leaves on human ovarian cancer cells

**Alice Rollini**[1] (alice.rollini@dal.ca), Wasundara Fernando[1], David Hoskin[1], Arunika Gunawardena[1]

[1]Dalhousie University

The lace plant (*Aponogeton madagascariensis*) is an aquatic monocot with unique perforations across the lamina of its leaves. It is a novel model system to study programmed cell death (PCD) because of the predictability of perforation formation, the ability to perform live cell imaging due to semi-transparent leaves and an established protocol for sterile propagation. Perforation formation is divided into five developmental stages: pre-perforation, window, perforation formation, perforation expansion and mature. Window leaves are pink because of a water-soluble component, anthocyanin. As leaves mature, they lose the pink coloration and turn green. Anthocyanins are natural polyphenolic compounds with cytotoxic and anti-proliferative activities against cancer cells. Although several aponogeton species have medicinal properties, including anti-cancer activities, little is known about the lace plant anthocyanin. This research investigated the anti-cancer activity of crude anthocyanin extracts from window and mature stages of lace plant leaves on OVCAR-8 and SKOV-3 human ovarian cancer cell lines. Normal human mammary epithelial cells (MCF-10A) were the control. A tetrazolium-based (MTT) assay, used to measure the metabolic activity of the cells, showed significant reduction in metabolic activity of anthocyanin-treated ovarian cancer cells in a time- and dose- dependent manner. Annexin V- 488/propidium iodide and Crystal violet staining showed characteristics of apoptosis in anthocyanin-treated cells compared to control cells. This study showed that lace plant crude anthocyanin extracts of window and mature stage leaves have anti-cancer effects on OVCAR-8 and SKOV-3 ovarian cancer cells; however, more study is needed to confirm the mechanisms and cell death pathways involved.

## Biotic interactions – Interactions biologiques

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-14:15 / Qc-12:45 / BC-9:45

### Sexual fluids in *Cycas revoluta*, sago palm

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During pollination and fertilization, ovules of *Cycas revoluta* release secretions. We collected these sexual fluids from wild and cultivated female plants found on Iriomote Island, Okinawa, Japan. Pollination drops were found to have a rich proteome of approximately 30 proteins, including defense and carbohydrate-modifying proteins. By comparison fluids released prior to and during fertilization by the megagametophyte and archegonia were very complex. Megagametophyte fluids are released from apical cells surrounding the archegonial chamber. These fluids flow into the chamber triggering pollen tube release of sperm and neck cell separation of archegonia. The latter release a flocculent emission rich in proteins and other materials that attracts and entangles sperm seeking the archegonium. The pH and the osmotic potential of the megagametophtye fluid alone and supplemented with archegonial fluids differ significantly. We analyzed sugars and amino acids using high pressure liquid chromatography. For proteins we used label-free quantitation, as well as gel separation and liquid-liquid extraction processing prior to mass spectrometry. Both fluids had hundreds of proteins and were rich in glucose and various amino acids. This is the first report of chemical composition of fluids involved in fertilization in living members of this ancient clade of gymnosperms.

NL-14:30 / Qc-13:00 / BC-10:00

### Nitrogen in *Pinus ponderosa* and *Pinus contorta* germinants in the first growing season after wildfire or clearcutting: the effect of mycorrhization

**Naomi Yamaoka**[1] (naomi.k.yamaoka@ubc.ca), Melanie D. Jones[1]

[1]University of British Columbia, Okanagan campus

Ectomycorrhizal fungi are below-ground, symbiotic microorganisms that promote plant survival primarily by providing limiting nutrients, such as nitrogen, to their partner. Although the importance of this relationship is generally well recognized, little is known about the early stages of the symbiosis in the field. The aim of this study is to determine how colonization with ectomycorrhizal fungi affects the nutrient status of first year pine germinants establishing in the field and whether this differs with disturbance type. *Pinus ponderosa* and *Pinus contorta* seeds were sown in the interior of British Columbia in the spring of 2019 in areas affected by wildfires or clearcutting the previous year. Seedlings were collected every four weeks over the 2019 growing season. Seedling colonization rates were consistent among tree species and disturbance type, and were first observed 51 days after sowing. At each sampling time, there were no differences in the percent of root tips colonized between species or disturbance types. Timing of increases in seedling nitrogen content and changes in $\delta^{15}N$ will be used as indicators of mycorrhizal contributions to N uptake. This information will give insight into how initial colonization affects plant nutrient status. The results of this study will contribute to our limited knowledge about regenerating pine seedlings and the early stages of the ectomycorrhizal symbiosis. This is especially important in forest ecosystems that are recovering following the major removal of trees, which is an increasing concern given reduced rates of pine forest regeneration in changing climate and weather regimes.

## Biotic interactions – Interactions biologiques

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-14:45 / Qc-13:15 / BC-10:15

### Effects of nutrient addition and herbivory on plant communities depend on severity of degradation

**Tara Mulloy**[1] (tmulloy@sfu.ca), Isabel C Barrio[2], David Hik[1], Ingibjörg Jónsdóttir[3]

[1]Simon Fraser University, [2]Agricultural University of Iceland, [3]University of Iceland

Fertilization has been used in rangeland restoration to promote plant growth in degraded areas. However, the effects of grazing and nutrient addition can differ between habitats at varying stages of degradation and with different nutrient limitations. In this way habitats may respond differently to combinations of nitrogen (N), phosphorus (P) and potassium (K), with and without grazing. We conducted a field experiment in a northern tundra rangeland system in the highlands of Iceland and measured the effects of factorial combinations of N, P and K and sheep grazing exclusion on plant biomass and species composition, in a vegetated and a highly degraded habitat. After 4 years of nutrient application, we found both habitats to be limited by a combination of NPK. We found that NPK and grazing exclusion consistently produced the greatest amount of above-ground biomass, but the combined effects of NPK and grazing on species richness differed between habitats. In the vegetated fertilized plots where grazing was excluded above-ground biomass increased but corresponded to a loss of species richness, whereas species richness was higher when grazing was present. In contrast, in fertilized plots in the degraded habitat, grazing reduced above-ground biomass but had no effect on species richness. Our results suggest that in this rangeland system nutrient addition can rapidly increase above-ground plant biomass, but habitat-specific effects of grazing can ultimately determine the effects of nutrient applications on the composition of the plant community.

NL-15:00 / Qc-13:30 / BC-10:30

### Effects of smooth pigweed (*Amaranthus hybridus*) on five different cover crop species used in Southern Ontario vineyards.

**Heather VanVolkenburg**[1] (hvanvolkenburg@brocku.ca), Frédérique C. Guinel[2], Liette Vasseur[1]

[1]Brock University, [2]Wilfrid Laurier University

*Amaranthus hybridus* is classified as a noxious weed in Ontario, with possible allelopathic properties that can lead to decreased agricultural production. We tested the germination and growth of five cover crop species commonly used in vineyards when exposed to the following treatments: 1) germination in Petri dishes and *A. hybridus* aqueous extracts, 2) in soil with dried material and 3) fresh materials in soil. Results were analyzed using either a germination index for seed germination response, as well as dry weight of plant shoots and roots after 65 days in growth experiments. All species had reduced germination in 100% extract. *Trifolium pratense* had significant root weight reductions in extract and dried treatments, whereas shoot weight only decreased in dried treatment. *Medicago sativa* shoot weight decreased in 20g fresh treatment, while root weight decreased in dried treatment. Shoot weight of *Raphanus sativus* increased at 50% extract solution, while root weight increased only with dried treatment; however, its shoot and root weights decreased in fresh treatment. Only the shoot weight of *Lolium multiflorum* increased, and only in extract or dried treatment. Both *Cichorium intybus* shoot and root weights decreased in fresh treatment. Our findings indicate that crop responses to *A. hybridus* are complex, depending on the type of material and species. Further testing *in situ* is recommended to increase our understanding of crops and *A. hybridus* interactions.

## Lichen Ecology – Écologie des lichens

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-13:45 / Qc-12:15 / BC-9:15

### Thriving at the edge of life: how do chlorolichens produce biomass in a world of nitrogen limitation?

**Carmen Allen**[1] (ccallen@ualberta.ca), Toby Spribille[1]

[1]University of Alberta

Nitrogen (N) is an essential resource in the biological production of macromolecules such as DNA and protein. Its unavailability can place hard limits on the growth of life. Many organisms circumvent these limits by forming symbioses with N-fixing bacteria. Fungal-algal symbioses "chlorolichens" colonize some of the harshest and most N-limited terrestrial surfaces on our planet. Their ability to thrive under extreme conditions at the Earth's poles has made them models for the study of early life. While some lichenoid symbioses have overcome N-limitation by associating with conspicuous, N-fixing cyanobacteria ("cyanolichens"), the large majority do not have known N-fixers and nonetheless achieve levels of biomass far greater than would be predicted by N-availability. How they do this is unknown, but two possibilities have been posited. First, recent studies have revealed associations of bacteria related to those involved in root nodule symbiosis in chlorolichens; however, whether these bacteria fix N, are sufficiently abundant to influence N-budgets, and are stably associated, is unknown. Second, evidence for concentration of N along growing edges suggests that some chlorolichens may internally upcycle N as they deposit biomass. I will present the current understanding of N acquisition and cycling in chlorolichens and our future research directions.

NL-14:00 / Qc-12:30 / BC-9:30

### Marketplaces of microbial dealmaking: symbiont give–and–take in lichens

**Toby Spribille**[1] (toby.spribille@ualberta.ca),

[1]University of Alberta

Lichens are often characterized as a symbiosis between two parties involving an exchange of sugar alcohols for the fungus for a safe haven for the alga. However, sugar alcohols are far from the only valuable currency in the symbiont interaction marketplace. Furthermore, the fungus and alga are seldom, if ever, alone in this marketplace: few, if any, lichens have been certifiably shown to lack additional, stably associated unicellular organisms. All of these organisms are alive at some point and what they take up from, and secrete into, intercellular space is knowable. I will discuss a range of hypotheses for the kind of interactions, and minimal components, required to achieve specific symbiotic outcomes, and contrast them to the null model of fungus and alga that has dominated lichenology for decades. I will also discuss the potential and observed range of goods and services exchanged between partners and the toolboxes that can be brought to bear on understanding them.

## Lichen Ecology – Écologie des lichens

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-14:15 / Qc-12:45 / BC-9:45

### Fertility metrics and genetic variability of the boreal felt lichen in Newfoundland and Labrador

**Katherine Flores**[1] (krf848@mun.ca), Andre Arsenault[2], Michele Piercey-Normore[1]

[1]Memorial University of Newfoundland, [2]Natural Resources Canada

Globally, the boreal felt lichen (*Erioderma pedicellatum*) is considered rare, but within Newfoundland & Labrador, it is locally abundant. Although population declines have been attributed to factors such as reduction in suitable habitat and acid rain, essential information on the life history strategy of the lichen is still uncertain. It is known that the lichen reproduces sexually, but the details of the reproductive cycle are not well understood. The lichen may possess a complicated life cycle that acts as a barrier to efficient reproduction. The objective of this study was to identify differences and similarities in fertility metrics, species assemblages, and genetic makeup in the boreal felt lichen between two regions of Newfoundland. Methods included field surveys as well as genetic sequencing lab work. Three main discoveries resulted from this study. 1) Significant differences in fertility metrics including thallus size in cm2 ($p=0.021$), the number of apothecia ($p=0.001$), and the number of spores ($p=0.038$) as well as species assemblages, were identified between regions that indicate that the Avalon Peninsula of Newfoundland may be a hotspot of lichen diversity. 2) No significant differences were identified between lichen thalli inhabiting different regions of the tree host indicating that microhabitats on the tree scale do not strongly influence the examined fertility metrics. And finally, 3) Based on genetic sequencing, boreal felt lichen found in Newfoundland has a high level of genetic variability. This is a positive indication that there is good gene flow between isolated populations.

NL-14:30 / Qc-13:00 / BC-10:00

### Does bacterial community structure shift across host lichen species?

**Marta Alonso-García**[1] (marta.alonso-garcia.1@ulaval.ca), Juan Carlos Villarreal Aguilar[1]

[1]Université Laval

Lichens are commonly described as a mutualistic symbiosis between fungi and a photobiont (Chlorophyta or Cyanobacteria). In recent years, the classical view of the lichen has been expanded to include bacteria as an integral component of the lichen holobiont. In boreal and arctic ecosystems, reindeer lichens are critical components of the ecosystem. They contain an important portion of the total lichen woodlands biomass (ca. 20%) and, they act as an extremely efficient mulch, maintaining the soil at field capacity. In addition, they are the main food source for reindeer and caribou during winter, accounting for three-quarters of their diet to face the energetic costs of predator avoidance and migration. Regarding their microbiome, we still lack the knowledge on the diversity of bacteria associated with lichens, their host-specificity, the variability across different environmental conditions or their phylogenetic structure. Here, we characterized, for the first time, the microbiome of four typical reindeer lichens such as *Cladonia mitis*, *C. rangiferina*, *C. stellaris* and *C. stygia*. We performed a study to (i) assess the abundance and diversity of the bacterial community of four species of reindeer lichens, and (ii) verify the host-specificity. We collected 170 samples throughout the province of Quebec. Approximately 10 mg of lichen thalli were used for DNA extraction and amplicon sequencing of the 16S ribosomal gene. Our results will lay the foundation to delve into the phylogenetic structure of the lichen microbiome or its relationship with environmental conditions.

## Lichen Ecology – Écologie des lichens

NL-13:45-15:15 / Qc-12:15-13:45 / BC-9:15-10:45

NL-14:45 / Qc-13:15 / BC-10:15

### Metagenome–derived predictions of the input of three fungal symbionts to a lichen symbiosis

**Gulnara Tagirdzhanova**[1] (tagirdzh@ualberta.ca), Paul Saary[2], Robert D. Finn[2], D. Wade Abbott[3], Jeffrey P. Tingley[3], David Díaz Escandón[1], Toby Spribille[1]

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Most organisms, such as animals and plants, consist of genetically identical cells which undergo cell fate determination and subsequent tissue development resulting in the formation of large, complex organisms. Lichens present a major exception to this rule. They are symbiotic assemblages built by multiple lineages of fungi, algae, and bacteria that together create a macroscopic, three-dimensional architecture resembling that of a plant. These architectures are achieved by extracellular polymeric substances (EPS) gluing together cells of the symbiotic partners. The roles different symbiotic partners play in creating lichen architecture remain largely unknown. Using a combination of wet lab techniques and bioinformatics analyses, we were able to reconstruct genomes of three fungal members of a lichen symbiosis from a metagenome. From annotated symbiont genomes, we predict the molecules they secrete into the extracellular space in order to identify give-and-take of different symbionts into the lichen EPS and predict their contribution to the lichen symbiosis.

NL-15:00 / Qc-13:30 / BC-10:30

### Cleistogamy and zygomorphy: revisiting Darwin's hypothesis

**Simon Joly**[1] (simon.joly@montreal.ca), Daniel Schoen[2]

[1]Montreal Botanical Garden, [2]McGill University

Charles Darwin noted in 1877 that cleistogamous species tend to be more common in bilaterally symmetric (zygomorphic) flowers than in those with radially symmetric (actinomorphic) flowers. Because cleistogamy ensures pollination, he suggested that this is because pollination is less certain in zygomorphic species that rely on a more specialized guild of pollinators. We gathered a large dataset of 2,523 species on floral symmetry and cleistogamy and reconstructed a phylogeny for these species. We then tested Darwin's hypothesis using a phylogenetic logistic regression and models of evolution for correlated characters.

# ABSTRACTS
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## Genetics and biological interactions – Génétique et interactions biologiques

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:15 / Qc-13:45 / BC-10:45

### Antibacterial and Phytochemical Screening of Indigenous Herbal Chewing Sticks

**Olusola Helen Adekanmbi**[1] (oadekanmbi@unilag.edu.ng), Nwaiwu Stephnie Ogechi[1], Bolanle Akinboboye[1]

[1]University of Lagos

The antibacterial activities of five commonly used chewing sticks such as *Zanthozylum zantholoides*, *Mascularia acuminata*, *Anogeissus schimperi*, *Terminalia glauscens*, and *Azadirachta indica* were tested against three bacterial species (*Staphlococcus aureus*, *Candida* sp., *Staphylococcus* sp.) using agar well diffusion method and zones of inhibition were measured for each of the extracts. Extraction was done using distilled water and ethanol. The methods used were soxhlet extraction method and maceration. The chewing sticks were all screened for their phytochemical components. They all showed different antibacterial activities against test organisms with zones of inhibition running from 0.009mm- 0.7mm. The ethanol extracts showed higher activities than the aqueous extracts. *Azadirachta indica* was the most active of all the chewing sticks (0.175mm- 0.2mm), while *Mascularia acuminata* showed the least activity. Staphylococcus aureus was least sensitive of all the test organisms and it showed a high sensitivity to *Azadirachta indica*. The photochemical screening showed that tannins, reducing compounds, alkaloids, phenols, terpenoids, flavonoid, saponin, cardiac glycoside were the active compounds. This study has justified the use of these chewing sticks for the maintenance of oral hygiene in rural and urban communities. Research is ongoing to produce user friendly chewing stick as well as mouthwash from the plant extracts.

NL-15:18 / Qc-13:48 / BC-10:48

### Are the friends of my friends also my friends? Synthesizing co–occurrence data on bryophytes, lichens and vascular plants to prioritize host–cyanobacteria research

**Mélanie Jean**[1] (melanie.jean@uqat.ca), Nicole Fenton[1], Pierre-Luc Chagnon[2], André Arsenault[3], Ermias Azeria[4], Guillaume Blanchet[5], Carissa Brown[6], Phil Burton[7], Romain Darnajoux[8], David Garbary[9], Steven Harris[10], Diane Haughland[11], François Lutzoni[12], Michelle Mack[13], Nicolas Magain[14], Philippe Marchand[1], John Markham[10], Jolanta Miadlikowska[12], Carlos Pardo-De la Hoz[12], Carlos J. Pasiche-Lisboa[10], Kirsten Reid[6], Juanita Rodríguez[1], Julia Stuart[13], Laura Super[15], Krista Williams[11]

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Nitrogen (N) is the primary growth-limiting nutrient in boreal forests and many vascular plants, bryophytes and lichens have consequently developed symbiotic interactions with N-fixing bacteria. These beneficial bacterial symbionts (often cyanobacteria) are key drivers of primary productivity, feedback dynamics and community assembly in boreal forests. The microbiome of lichens, bryophytes and vascular plants are often host-specific. It has been hypothesized that lichens sharing cyanobacterial partners may facilitate each other. In addition, how this might apply to bryophytes and vascular plants is unknown. Information on N-fixing symbionts for bryophytes and lichens is sparse and dispersed through the literature. Our main objectives are twofold: 1) synthesize the best available data on N-fixing symbionts in bryophytes and lichens and 2) evidence co-occurrence patterns among vascular plants, bryophytes, and lichenized fungi associating with N-fixing bacteria. We use data from the Alberta Biodiversity Monitoring Initiative, which includes the presence of vascular plant, bryophyte, and lichen species, and environmental covariates (e.g. canopy dominance, disturbance) in ~500 boreal forest plots (1 ha). We use recent statistical techniques (Hierarchical Modelling of Species Communities) to identify species that co-occur more frequently than expected by chance: these patterns could indicate facilitation through shared cyanobacterial partners. Thus, this project will allow us to: gain novel insights into boreal community assembly processes such as facilitation and N-fixation; publish a N-fixation trait database for bryophytes and lichens; test some long-standing hypotheses on species co-occurrence patterns; and kick start the development of research projects generating critically missing data on host-cyanobacteria interactions.

## Genetics and biological interactions – Génétique et interactions biologiques

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:21 / Qc-13:51 / BC-10:51

### Rhizosphere microbiome and potential of range expansion of exotic invasive guinea grass, *Megathyrsus maximus* in the Lower Rio Grande Valley

**Vanessa Elizabeth Thomas**[1] (vanessa.thomas01@utrgv.edu), Pushpa Soti[1]

[1]University of Texas Rio Grande Valley

Rhizosphere microbiota play an important role in plant growth, nutrient cycling and directly influences the functioning plant communities in natural ecosystems as well as control the resources plants need for health and physiology of the plant manifested in the production of chlorophyll through its own metabolic mechanisms. These microbes influence the plant soil feedback in multiple ways: accumulation of antagonistic microbes (fungal pathogens, nematodes, bacteria) negative feedback or accumulation of beneficial microbes (arbuscular mycorrhizal fungi, beneficial endophytes, nitrogen fixing bacteria) a positive feedback. Recently there has been increased attention paid to the role of plant soil feedback and how soil microbes might promote plant invasions. Recent studies have revealed that the bacterial communities in rhizospheres are diverse with more than 104 species per gram of soil. Plant growth promoting rhizobacteria (PGPR), a group of beneficial microbes are known to promote plant growth by asymbiotic $N_2$ fixation, phosphate, mineral solubilization, production of siderophores, ammonia ($NH_3$) and phytohormones such as indoleacetic acid (IAA) which increase seed germination rate and seedling emergence in plants and plant growth. The goal of this study is to explore the distribution of Guinea grass, *Megathyrsus maximus*, in the Lower Rio Grande Valley (LRGV) region analyze develop a distribution model to predict future invasion patterns. We will also explore the plant-PGPR feedback in guinea grass and native grass species. To determine the rhizosphere microbiota, we will collect and analyze the rhizosphere soil samples from coexisting native plants and guinea grass from 5 different locations representing different environmental conditions in LRGV. Soil samples will undergo DNA extraction, then analysis of qPCR using nif and 16s genes to understand the possible PGPR population and distribution in the LRGV. We conduct further community evaluation through next generation sequencing to recognize the endosymbiotic bacteria in exotic invasive guinea grass and native grass species.

NL-15:24 / Qc-13:54 / BC-10:54

### Belowground biotic and abiotic heterogeneity and above ground growth in agricultural fields

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[1]University of Texas Rio Grande Valley

The rhizosphere microbial communities are highly influenced by soil properties (such as pH and texture) and land use (such as cropping and soil tillage). Soil management practices change the physical and chemical properties of the soil creating fluctuating environments for the soil microbial community. Intensive farming practices tend to reduce the species diversity of the soil microbes in agricultural fields. In semi-arid dryland farming systems, crop patches are generally common because of multiple factors such as variation in soil moisture, herbivory, the redistribution of soil sediments, nutrients and propagules from the bare areas towards the plant clumps, where they contribute to improve soil properties, in turn favoring plant growth. This study investigates the patchy growth of cover crops in a dryland grain system in South Texas to determine the relationship between the difference in the microclimate resulting from the crop patches and the soil microbial community. An aerial image of a 40-acre field was collected with a UAV during October 2019 and the field was divided into multiple blocks based on the canopy cover of the plants. Soil samples from these blocks were collected by stratified sampling method and analyzed for the soil nematode community, mycorrhizal fungi spores, PLFA content, and soil organic matter. Currently, we are in the process of isolating, screening, and characterizing *Pseudomonas fluorescens* and analyzing their plant growth-promoting traits and disease protection abilities. This is an ongoing project and the results will be presented at the meeting.

## Genetics and biological interactions – Génétique et interactions biologiques

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:27 / Qc-13:57 / BC-10:57

### Genetics and conservation significance of geographically disjunct populations of *Abronia umbellata* (Nyctaginaceae)

**Alyson Van Natto**[1] (17avn2@queensu.ca), Christopher G. Eckert[1]

[1]Queen's University

A species' genetic structure results from interactions between genetic drift, natural selection and gene flow and, therefore, strongly depends on the species' spatial distribution. Approximately 90% of "at-risk" species in Canada are peripheral isolates of otherwise common species and there is currently no consensus on the conservation value of these geographically disjunct populations. On one hand, they may be low in genetic variation and prone to extinction due to low fitness and demographic stochasticity. Alternatively, they could be adapted to extreme range-edge environments and well-poised for range expansion during climate change. *Abronia umbellata* is endemic to coastal dune habitats from Baja California, Mexico to Oregon, U.S.A. but also has several disjunct populations in Washington, U.S.A. and on Vancouver Island in British Columbia, Canada, where it is designated "at risk". We compared sequence variation at 9 single-copy genes for 95 individuals from 25 populations across the species range and found that disjunct populations of *A. umbellata* are not genetically unique from northern populations in the contiguous range. However, populations in Baja are genetically unique and are in a steep demographic decline. Overall, our study highlights the importance of looking at the entire range when considering the management of species "at-risk".

NL-15:30 / Qc-14:00 / BC-11:00

### Investigating the impact of asexuality on species' range limits using de novo transcriptome assembly with a wetland plant

**Hana C. Thompson**[1] (15hct@queensu.ca), Christopher G. Eckert[1]

[1]Queen's University

All species have limits to their geographic distributions, thought to reflect a failure of adaptation to conditions beyond the range. Because the reproductive system strongly affects genetic diversity within populations, a shift in reproductive mode may influence adaptation at range limits. Shifts from sexual to asexual reproduction at range limits have been observed in a variety of plants, but whether this impedes or promotes range expansion is unknown. *Decodon verticillatus* is a wetland plant native to eastern North America that reproduces sexually in the southern portion of its range but exhibits a dramatic genetic shift to exclusive asexual reproduction at its northern limit. Previous studies suggest that this shift to asexuality has facilitated range expansion: asexuality appears to have arisen independently multiple times at the range limit and is associated with better survival in colder climates. We will be more directly testing this hypothesis through de novo transcriptome assembly and genome-wide analysis of genetic variation. If asexuality is promoting range expansion, we expect signatures of long-term asexuality (e.g. increased heterozygosity and deleterious mutations) and broad genetic differentiation of northern populations from southern populations. A better understanding of the factors that impose range limits is becoming increasingly important to better anticipate the capacity of species to adapt and potentially shift their ranges in response to anthropogenic environmental changes.

## Genetics and biological interactions – Génétique et interactions biologiques

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:33 / Qc-14:03 / BC-11:03

### Genetic differentiation and structure of boreal populations of *Crossocalyx hellerianus* (Nees ex Lindenb.) Meyl. in North America

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[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

Population genetic studies of liverworts are few in North America and none have been completed in Canada. *C. hellerianus* is a minute dioecious epixylic liverwort with a circumboreal sub-continental distribution, which primarily reproduces through asexual gemmae. Although it is a rare redlisted and patchily distributed species in Europe, it is a relatively common species in boreal Canada., Here we identify the spatial pattern of genetic variation and structure of *C. hellerianus* from population (site) to regional (100km) to intercontinental scales (10000km) to determine how current distribution and dispersal limitation shape spatial genetic patterns of *C. hellerianus*. Samples were collected from boreal forests in Quebec, Alberta and New Brunswick in Canada. Extracted DNA were analyzed using microsatellite markers developed in Europe for this species. For intercontinental comparisons, published data from Europe were used. Despite the dominant asexual reproduction mode of this species, we observed a high level of genetic diversity within colony and population levels. We observed two different genetic clusters in North America and few barriers against gene flow, which is similar to the genetic structure of boreal tree species in North America. At the intercontinental level, three significant clusters were observed: Canadian, Czech and Finnish. There is a connection to Europe via the Gulf of St-Lawrence region. These results indicate that populations of asexually and sexually reproducing species can be equally genetically diverse. Furthermore, the genetic structure in North America has been shaped by post-glacial dispersal patterns and biogeographic connections between North American and Europe.

NL-15:36 / Qc-14:06 / BC-11:06

### Hybridization in four *Physalis* L. species in Nigeria

**Sekinat Okikiola Azeez**[1] (sekinatokiki@gmail.com), Julius Olaoye Faluyi[1]

[1]Obafemi Awolowo University

Some *Physalis* species have been observed to be growing sympatrically in Nigeria; however, there is no evidence that they exchange genes naturally. Interspecific reciprocal hybridization was therefore carried out among the four *Physalis* species found growing in Nigeria namely: *P. angulata, P. micrantha*, *P. pubescens* and *P. peruviana* to elucidate the phylogenetic relationship that exists among them. The desired pollen grains were transferred to the desired ovulate parents, bagged and labeled accordingly to prevent contamination from undesired pollen grains for proper identification. *Physalis angulata*, *P. pubescens* and *P. peruviana* were able to cross reciprocally among each other even though no matured fruits were harvested except in a cross (*P. angulata X P. pubescens*). The only F1 hybrid obtained produced few flower buds which failed to develop to matured fruits. Its average pollen grains diameter fell within the range of that of the two parents with pollen stainability of less than 50%. The pollen mother cells of the F1 hybrid were characterized by meiotic irregularities. It can therefore be concluded from this study that *P. pubescens* is closely related to *P. peruviana* and *P. angulata* than *P. micrantha*.

## Microorganisms and cryptogams – Micro-organismes et cryptogames

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:15 / Qc-13:45 / BC-10:45

### Widespread infection of the hair lichen genus *Bryoria* by a previously unknown fungal pathogen

**Spencer Goyette**[1] (sgoyette@ualberta.ca), Viacheslav Spirin[2,3], Toby Spribille[1]

[1]University of Alberta, [2]Finnish Museum of Natural History, [3]University of Helsinki

As one of the dominant genera of hair lichens in western North America *Bryoria* is integral to high elevation conifer forest ecosystems. In areas where *Bryoria* is abundant, it is not uncommon that a non-negligible percentage of thalli have become conglutinated forming brittle dead zones. We sampled *Bryoria* thalli across western Canada and the United States monitoring thallus dieback throughout the year. We found that this dieback phenomenon is strongly associated with the aggressive winter growth of a mold-forming basidiomycete not previously known to associate with *Bryoria*. Similar die-off events have been attributed to extreme rain events in British Columbia and Norway, but not in the presence of a necrotrophic mold. We report that this fungus belongs to *Athelia*, a cosmopolitan genus containing economically significant pathogens. We designed *Athelia*-specific primers for EF1-a and ITS, and screened the mold directly along with uninfected lichen specimens to assess its potential latent occurrence. The pathogen appeared to be related to *Athelia acrospora*, a species known only from dead wood, and *A. epiphylla*. Based on phylogenetic placement and morphology, this mold is presented here as a new species. It preferentially infects members of *Bryoria* sect. Implexae, associates with other species in Parmeliaceae, and does not appear to exist within thalli asymptomatically. Whether or not this widespread infection of *Bryoria* in western North America is a recent event or simply an overlooked phenomenon is difficult to determine. This research will serve as a benchmark for documenting the pathogenic outbreak affecting an ecologically significant lichen genus.

NL-15:18 / Qc-13:48 / BC-10:48

### Position of lichen-inhabiting *Tremella* spp. within the phylogeny of Tremellales

**Samantha Katelyn Pedersen**[1] (spederse@ualberta.ca), Gulnara Targirdzhanova[1], Toby Spribille[1]

[1]University of Alberta

The traditional definition of a lichen is a symbiotic relationship between a single fungal species - the mycobiont, and a photobiont - an alga or cyanobacteria. However, studies have found additional basidiomycete fungi inhabiting lichen thalli. Tremellomycetes is a class of basidiomycete fungi that are predominantly dimorphic with a variety of lifestyles ranging from saprotrophic, fungicolous, to lichen-associated. Initially, lichen-associated fungi from Tremellomycetes were labelled parasites, as in their sexual stage they occasionally form gall-like structures on lichens. A recent study, however, showed that a tremellomycete fungus *Tremella lethariae* in its yeast form is present in the vast majority of healthy thalli of wolf lichen, *Letharia*. As new evidence suggests that lichen symbioses may be more complex than traditionally thought, investigating the presence of additional yeasts in lichens has become important to understanding their biology. We extracted *Tremella* rDNA sequences from metagenomic data from several healthy-looking macrolichens - lichens with large thalli appearing bushy or leafy. Using the maximum likelihood approach, we intend to place lichen-associated *Tremella* species within the Tremellomycetes phylogeny.

## Microorganisms and cryptogams – Micro-organismes et cryptogames

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:21 / Qc-13:51 / BC-10:51

### Characterizing grape yeast communities in Nova Scotia vineyards

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Winemaking is a burgeoning industry in Nova Scotia, with many new opportunities for research into biological interactions within its vineyards. While *Saccharomyces cerevisiae* is usually added to grape juice (must) to induce wine fermentation, many native yeasts reside naturally on grape skins and can noticeably influence wine flavour (the "microbial terroir"). However, it is unclear how factors such as the local environment, grape variety, vineyard management practices and the persistence of commercial yeasts contribute to the influence that native yeasts have on wine fermentations in Nova Scotia. We analysed yeast communities before and after the spontaneous fermentation of pressed juices from five Nova Scotia vineyards using next generation ITS sequencing (Illumina MiSeq). Vineyards represented both conventional and organic management practices, and both white and red grape varieties. Regardless of grape variety or vineyard management type, yeast communities harbouring small initial proportions of fermentative Saccharomycetaceae, such as *Saccharomyces uvarum* or *Zygotorulaspora florentina*, generally resulted in vigorous and complete spontaneous fermentations, with these yeasts dominating post-fermentation. Conversely, fermentations by yeast communities lacking Saccharomycetaceae were sluggish, although this did not necessarily correlate with poor wine flavour. These results may allow Nova Scotia winemakers to begin experimenting with native yeast communities in order to highlight the distinctive qualities of their individual vineyards.

NL-15:24 / Qc-13:54 / BC-10:54

### Soil nematode and fungal community response to four different *Brassicas* in a vineyard

**Corynne O'Farrell**[1] (cmofarre@gmail.com), Miranda Hart[1], Tom Forge[2], Melanie Jones[1]

[1]University of British Columbia, [2]Agriculture and Agri-food Canada

*Brassica* cover crops with biofumigant activities have been used to mitigate soil born pathogens in vineyards for years. Although this practice is common, the effect of these crops on soil microbes in the field, including both pathogens and beneficials, is not well understood. This study will compare the response of the soil microbial community to four different cover crops with biofumigant properties, two which are commonly used in Okanagan vineyards (*Sinapis alba* L. and *Raphanus sativus* (L.) Domin) as well as two *Brassicas* which are native to the Okanagan (*Capsella bursa-pastoris* (L.) Medik. and *Boechera holboelli* (Hornem.) Á.Löve & D.Löve). These cover crops will be grown in a vineyard for the full growing season and soil samples taken at the end of the season for DNA and nematode extraction. The fungal community will be analyzed by sequencing of the ITS2 sub-region with Illumina. The nematode community will be analyzed by counting based on trophic groups.

## Microorganisms and cryptogams – Micro-organismes et cryptogames

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:27 / Qc-13:57 / BC-10:57

### Weed be good together: Do arbuscular mycorrhizal fungi form symbiosis with *Cannabis sativa* L.?

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[1]University of British Columbia (UBC) - Okanagan Campus, [2]Canopy Growth Corporation

*Cannabis sativa* L. is an annual flowering plant that has been cultivated and used by humans for at least 12,000 years (Warf et al. 2014). However, the illegal status of cannabis throughout the 20th century led to isolated and private cultivation, resulting in many chemovars with non-standardized traits based on cannabinoid and terpene content (Mudge et al. 2018). However, other plant biology traits have not been established for recreational cannabis chemovars. The mycorrhizal status of recreational cannabis must be addressed, as commercial arbuscular mycorrhizal fungi (AMF) inoculants are developed and marketed towards cannabis cultivators. Approximately 80% of plants form symbiosis with AMF, and experience benefits such as increased growth, yield, and increased secondary metabolite production (Smith and Read 2008). However, mycorrhizal symbiosis and colonization intensity can vary between cultivars, especially in species that have been intensively cultivated. There is evidence of hemp-type cannabis being mycorrhizal (Citterio et al. 2005), however there are no published reports of recreational chemovars forming symbiosis with AMF. A survey of 32 field-grown, recreational cannabis chemovars was conducted in central Saskatchewan in August 2019. Roots and soil were collected from the field, and then analyzed at University of British Columbia - Okanagan Campus in Kelowna, BC. Roots were stained, and colonization was estimated using the Trouvelot (1986) method. Soil and root DNA was extracted, and amplified using polymerase chain reaction to detect AMF. Variation in both mycorrhizal presence and intensity was found in the cannabis chemovars, suggesting a chemovar-dependent response to mycorrhiza fungi.

NL-15:30 / Qc-14:00 / BC-11:00

### Investigating the effect of arbuscular mycorrhizae on *Crocanthemum canadense* (L.) Britt. (Cistaceae) propagated in tissue culture

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*Crocanthemum canadense* (L.) Britt. (Cistaceae), Rockrose, is a small perennial herb found in Eastern North America sand barrens. It is classified as critically imperiled in Nova Scotia; populations continue to decline and recent counts estimate 5000-5500 plants remain in Nova Scotia. To better understand Rockrose biology, we analysed symbiotic mycorrhizal associations among native Nova Scotia populations. Recent research from our group has documented the presence of arbuscular mycorrhizal fungi (AMF) within Rockrose roots of plants in their native habitat; the present study is the first to focus primarily on the benefits of this symbiotic relationship between Rockrose and AMF, and to identify the fungal partner. AMF improve water and nutrient uptake (phosphorus and nitrogen) by the plant. In return, they rely on the plant as a host and carbon source. In our greenhouse trial with varying percentages of AMF inocula, we determined how AMF would affect the growth of Rockrose plants propagated from tissue culture. The 1:25 inoculum had the most significant effect on the height of the shoots (cm) while the 1:50 inoculated plants had the largest root mass (g). A lack of phosphorus in the experimental trial could have had a negative effect on the growth and symbiosis of *C. canadense* and AMF. We identified AMF using rDNA barcoding. A potentially novel species of AMF sister to Funneliformis mosseae was identified. Our research aids in conservation and restoration of this critically imperiled species by further understanding beneficial soil fungi, an understudied component of the declining sand barrens habitat.

## Microorganisms and cryptogams – Micro-organismes et cryptogames

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:33 / Qc-14:03 / BC-11:03

### *Forsstroemia trichomitria* in Canada: overcoming search effort challenges to improve confidence in status assessment

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[1]Canadian Museum of Nature, [2]Independent bryologist

Despite a recent surge of interest in bryophytes, low search effort often hinders understanding of species' distribution and abundance. Even in densely-populated areas with long collection histories, the known size and health of some Canadian populations of bryophyte species (e.g., *Fissidens exilis*, *Bryoandersonia illecebra*) has changed considerably after an initial "at-risk" designation sparked increased attention and targeted research. A new species for assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), *Forsstroemia trichomitria* ("Fan Moss"), offers promising opportunities to avoid this pattern. As a relatively large, distinctive moss that grows on vertical surfaces, *F. trichomitria* can be recognized in the field and identified in good-quality photographs, making it an enticing quarry for botanists with a wide range of experience, and a good candidate for broad collaboration - both informal and facilitated (e.g., iNaturalist) - across the species' potential range. At the same time, some clues beyond the low number of known extant populations already point to possible at-risk status. At least 15 specimens of *F. trichomitria* were collected between London and Prescott, Ontario, in the 1800s, a number comparable to that for now-common moss species such as *Neckera pennata* and *Leucodon sciuroides*. In contrast, however, *F. trichomitria* is absent from the collection record for the 1900s, and just four populations in very accessible regions (two in southern Ontario and two in west Quebec) have been documented since 2011. By planning with common challenges in mind and actively inviting wide participation, we hope the assessment of *F. trichomitria* can offer useful experience for future conservation status evaluations.

NL-15:36 / Qc-14:06 / BC-11:06

### Are cyanobacteria associated with feather-mosses influenced by canopy composition?

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Bryophytes occupy a significant part of the boreal forest, in terms of cover area, biomass and diversity. Likewise, they influence several ecosystem processes that include their association with $N_2$-fixing cyanobacteria, which is often a primary source of ecosystem N inputs in boreal forests. Despite our increasing understanding of cyanobacteria-moss association, particularly related with their N-fixation role, little is still known about the factors that influence the presence of cyanobacterial communities in bryophyte species. The purpose of this work is to analyze if the canopy dominance has an influence on cyanobacterial association with feather mosses. In the clay belt of Québec, two contrasting forests were chosen, one dominated by black spruce (*Picea mariana*) and the other dominated by trembling aspen (*Populus tremuloides*). Samples of feather mosses (*Pleurozium schreberi* and *Ptilium crista-castrensis*) were collected to identify their associated cyanobacteria and to determine if the association is affected by the canopy dominance. Our hypothesis is that cyanobacteria associated with feather mosses will depend on moss identity and it will be independent on canopy composition. Therefore, bryophyte samples were processed to obtain the bryophyte phyllosphere and were sequenced using the universal primers (16S, 515F/926R) with Illumina sequencing. Considering the importance of moss-associated cyanobacteria in nutrient cycles, we explore the implications that the variation of cyanobacterial communities can have on the boreal forest.

## Cataloging and citizen science – Catalogage et science citoyenne

NL-17:15-17:27 / Qc-15:45-15:57 / BC-12:45-12:57

NL-17:15 / Qc-15:45 / BC-12:45

### A lichen catalogue of the Prairie provinces of Canada

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The central Canadian provinces of Alberta, Saskatchewan, and Manitoba are collectively referred to as the "prairie provinces" and cover a wide variety of ecosystems, including prairie, boreal forest, alpine, and tundra. Unfortunately, little is known about the lichen diversity of this area. The most recent catalogue of lichen collections from this area was published in 1972 and listed a total of 542 species and 669 taxa. We have taken on the task of revising and updating this catalogue. The resulting database will hopefully prove useful for anyone investigating the biodiversity, ecology, or phytogeography of the region. Records of biodiversity are increasingly important given the rise in disturbance due to human activity and climate change. We hope to use the data collected for this project to educate both scientists and the general public about the lichens around them.

NL-17:18 / Qc-15:48 / BC-12:48

### MorphoBank: An online tool to visually display phenetic data

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MorphoBank (https://morphobank.org/) is a web application and online database that hosts scientific data for the fields of comparative biology, paleontology and anthropology. These data may be in the form of both two- (and three) dimensional images, and in the form of phylogenetic matrices of text and numbers. MorphoBank databases are associated with over 700 publications in more than 130 journals, and contain data on over 20,000 species. Exemplar images shown here have been posted on MorphoBank to depict variation in hawthorn leaf venation visualized using soft x-rays. Many other kinds of phenetic data have been uploaded to MorphoBank, notably from studies of vertebrate evolution. MorphoBank was launched in 2001 at Stony Brook University with support from NSF and some other sources. It operates with a part time staff of five professional software developers and two part time curators. Going forward, sustained, long-term support for MorphoBank will come from voluntary, paid membership by universities and museums. The poster will provide further information about MorphoBank such as data ownership, image licensing, how to publish links to MorphoBank images, and details of the membership model.

## Cataloging and citizen science – Catalogage et science citoyenne

NL-17:15-17:27 / Qc-15:45-15:57 / BC-12:45-12:57

NL-17:21 / Qc-15:51 / BC-12:51

### Under–use of citizen science data for botanic research: What are we waiting for?

**Mariano Feldman**[1] (marianojavier.feldman@uqat.ca), Nicole Fenton[1], Louis Imbeau[1]

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Global biodiversity monitoring usually requires large-scale information, which is usually hardly affordable for scientist due to resource restrictions. In our time, most biodiversity data are in the form of unstructured records, so although data quality is challenging, the potential for research is huge. Large amount of digital observations are produced and stored in broad databases such as GBIF or iNaturalist, and in specific botanic platforms such as Pl@ntNet, Project Bud Burst, or Plant Watch Canada. In this context of increasingly available citizen science (CS) data, we reviewed 224 published studies that have used CS data as a source for species distribution models (SDMs) in order to identify taxonomic gaps and challenges. Our review showed an increase in the use of citizen science over time, but revealed a great gap in botanic research. Papers using CS on plants (n=17), lichens (n=1), fungus (n=3) and bryophytes (n=1) are remarkably under-represented comparing to papers using animal data. Here, we provide a useful example of how the full potential of botanic CS is far from being achieved. For the general public plant initiatives seems to be highly attractive, but researchers do not seem to be using enough. What are we waiting for? What are we missing if these data are ignored? We hope to encourage botanist to consider CS to meet data collection, engagement, and conservation goals. Strengthening citizen-botanist partnerships will help monitor and investigate biodiversity in a local, regional and global scale.

NL-17:24 / Qc-15:54 / BC-12:54

### Using topic modeling to identify topic content and gaps in invasibility research

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Research on community invasibility has had rapid advances over the past few decades and keeping up with the growing body of literature poses a challenge to researchers new or senior to the field. Increased computational power and development of new statistical tools have popularized automated text analyses as a means to summarize large textual information. Topic modeling, in particular, is used to identify relationships among latent topics that form textual content and allows researchers to identify potential research gaps. I applied topic modeling (latent Dirichlet allocation) to 860 peer-reviewed articles and reviews on "invasibility" to assess the landscape of this research field. My analysis yielded 15 different topics, spanning all ecological levels of organization across terrestrial and aquatic habitats and a variety of methodological approaches. I found that articles on invasibility generally address broad themes within ecology and commonly co-occur with many other topics, indicating a high generality and interdisciplinarity of the field. The main research gaps relate to mathematical modeling approaches which are generally very specific and rarely correlate to other topics that would benefit from them, such as research on forest and grassland habitats. My analysis then captured previously known trends and deficiencies in the field and identified new directions for study with potential applications for conservation of invaded ecosystems.

## Biodiversity – Biodiversité

NL-17:15-17:30 / Qc-15:45-16:00 / BC-12:45-13:00

Cancelled - Annulé

### Applying plant spectra to plant biodiversity assessment in the northern temperate forest.

**Anna Crofts**[1] (anna.leigh.crofts@usherbrooke.ca)

[1]Université de Sherbrooke

Plants interact with light in complex and mostly invisible ways, where plant reflectance profiles (i.e., plant spectra) – the way plants absorb, reflect, and transmit light across a range of wavelengths – are integrative measures of chemical, structural, and morphological traits. Plant spectra reflect both within- and between species differences; and can be measured remotely through imaging spectroscopy. Given the unprecedented amount of information summarized by plant spectra and the ability to quantify it continuously across landscape-to-regional scales, plant spectra have the ability to forward plant biodiversity sciences. Spectral diversity, defined as the spatial variation in plant reflectance, is emerging as a new dimension in biodiversity sciences. Spectral diversity is in its early stages and, currently, cannot be interpreted without field-based data. Here, I will present the conceptual framework surrounding applying plant spectra to biodiversity assessment in northern temperate forest. I propose to examine the relationship between spectral diversity and taxonomic and functional diversity and then, apply these relationships to examine how spectral diversity changes across altitudinal and logging history gradient at Parc National du Mont Mégantic in south-eastern Québec.

NL-17:18 / Qc-15:48 / BC-12:48

### Plant diversity and distribution of Bedrock Meadows – biodiversity hotspots in the temperate rainforest belt of Interior Pacific Northwest

**Ricarda Pätsch**[1] (ricarda.paetsch@gmail.com), Toby Spribille[1], Hans Georg Stroh[2], Thomas Becker3, Viktoria Wagner[4]

[1]University of Alberta, [2]Büro àchero, Göttingen, [3]University of Trier, [4]University of Göttingen

Natural or semi-natural grasslands provide important ecosystem services. They form biodiversity refugia and hotspots for plants and animals, preserve genetic biodiversity, maintain hydrological regimes, and mitigate climate change effects. In the last decades much progress has been made to describe open habitat types and understand their biodiversity and ecological functions. However, we still lack basic information on montane and vernally moist meadow communities (hence: Bedrock Meadows) that frequently occur across mountain ranges in northern Idaho, northwest Montana (USA) and southern British Columbia (Canada). Their small size could make them disproportionately vulnerable to the pressures of land-use change, including resource exploitation, a warming climate and invasive species. The lack of information on the biodiversity, functioning, distribution, and conservation value of Bedrock Meadows has profound effects for land-use and environmental policy in the region. Our data show that this habitat occurs primarily on shallow and periodically seepy soils over dense bedrock (argillite) and is rich in annual plants (e.g. *Idahoa scapigera*, *Mimulus breweri*) and perennials with underground storage organs (*Claytonia lanceolata*, *Lomatium ambiguum*). We analyzed the diversity of vascular plants, bryophytes and lichens in this overlooked habitat based on a plot-based vegetation survey in the Salish, Purcell, and Cabinet Mountains in British Columbia, Montana and Idaho in 2018 and 2019. In addition, we are planning to analyse how their vascular plant composition relates to other open habitats in the Pacific Northwest.

## Biodiversity – Biodiversité

NL-17:15-17:30 / Qc-15:45-16:00 / BC-12:45-13:00

NL-17:21 / Qc-15:51 / BC-12:51

### Vulnerability of cultural keystone species to cumulative impacts of anthropogenic and natural disturbances

**Maxime Thomas**[1] (maxime.thomas@uqat.ca), Hugo Asselin[1], Mebarek Lamara[1], Nicole Fenton[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

The boreal forest is subject to numerous and various disturbances such as fire, insect outbreaks, climate change and industrial exploitation, which interact and generate hard to predict cumulative impacts. These impacts will especially affect Indigenous communities due to the strong links they share with their traditional territories. Cultural keystone species, which are species important in Indigenous cultures as well as for ecosystem functioning, are a part of these links. Thus, studying cultural keystone species is a way to understand the effects of cumulative impacts on social-ecological systems. Being sedentary, plant species are well suited for this kind of study as there is less variation in their exposition to disturbances over time compared to animals. Thus, this project aims to study the effects of cumulative impacts on three cultural keystone species on the traditional territories of two Cree and one Anicinapek communities. The cumulative impacts of environmental changes on these species, selected in collaboration with the communities, will be studied on three aspects of their biology: 1) their distribution range will be modeled under different scenarios of environmental changes; 2) the variation in gene expression between individuals of the same species will be determined; 3) the ecosystem services provided by the species will be assessed in terms of fruit or leaf biomass and content in biologically active compounds. The results will allow us to improve our understanding of the vulnerability of cultural keystone species to cumulative impacts in a complex social-ecological system.

NL-17:24 / Qc-15:54 / BC-12:54

### Culturally important plants, traditional knowledge, and environmental change in Eeyou Istchee

**Allison Ford**[1] (allison.ford@mail.mcgill.ca)

[1]McGill University

Plants are important in Indigenous food systems and provide nutritional, medicinal, and spiritual benefits, yet are impacted by climate change. Traditional phenological knowledge (TPK) refers to seasonal knowledge, particularly as it relates to plant and animal life cycles and subsistence activities. Berries and medicinal plants are important to the well-being and food security of the Cree of Eeyou Istchee, northern Québec. The objectives of this project are: 1) To examine how traditional phenological and plant knowledge relate to environmental change in Eeyou Istchee; 2) To assess the impacts of environmental change on culturally significant plants and associated ways of life in Eeyou Istchee, with a proposed focus on culturally important species Labrador tea and blueberries; 3) To examine plant and seasonal knowledge in the context of cultural landscapes and how these contribute to social-ecological resilience. Using community-based participatory research methods, community consultation and collaboration will be sought throughout the research process. This project uses an interdisciplinary, mixed-methods approach that incorporates both qualitative and quantitative data. Traditional ecological knowledge will be used in conjunction with quantitative ecological field and climate data to assess the current and projected impact of climate change on these plants and associated ways of life. This work will provide insight into how environmental change is affecting northern ecosystems and ways of life, and how traditional knowledge systems can help facilitate climate change adaptation. The results of this project will be made available to communities to help inform climate change adaptation and conservation strategies.

## Biodiversity – Biodiversité

NL-17:15-17:30 / Qc-15:45-16:00 / BC-12:45-13:00

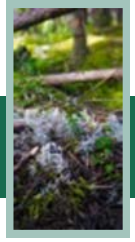
NL-17:27 / Qc-15:57 / BC-12:57

### The vascular flora of "Mars": ongoing floristic work at the Mars Desert Research Station, Utah

**Paul Sokoloff**[1] (psokoloff@nature.ca), David Murray[2], Samantha McBeth, Michael Irvine[3], Jeffery Saarela[1], Shannon Rupert[2]

[1]Canadian Museum of Nature, [2]Mars Society, [3]Live It

The Mars Desert Research Station outside of Hanksville, Utah, USA, is an internationally known Mars mission simulation facility, set in a Martian planetary analog desert just south of the floristically unique San Rafael Swell. Crews rotate through the station on one week to three month-long Martian simulation missions seeking to learn how best to live and work on our planetary neighbour, and often conducting geological and astrobiological field research across the station's local exploration area. Though there is a long history of botanical exploration in protected areas nearby, collections-based research at MDRS has only recently begun. Our team has been conducting floristic research at MDRS for the past six years, collecting vascular plant specimens in 2014, 2015, and 2019. To date we have documented 80 taxa from the MDRS area (78 species and two genera) from 24 families. These include species commonly found in the deserts across the southwest United States (such as *Populus fremontii*, *Eriogonum inflatum*, *Sphaeralcea coccinea*, etc) as well as species endemic to the area (*Hoffmannseggia repens*, *Astragalus woodruffii*, *Eremocrinum albomarginatum*, for example). Our work has been documented in one published paper and one forthcoming annotated checklist. These inventories will provide useful baseline data both to crews at MDRS and to botanists working in southeast Utah. Here we provide a summary of our botanical work at this unique site.



## Habitats: challenges and understanding – Habitats: enjeux et compréhension

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:15 / Qc-13:45 / BC-10:45

### Can *Crataegus douglasii* be found in Québec?

**Tim Dickinson**[1,2] (tim.dickinson@utoronto.ca),

[1]Royal Ontario Museum, [2]University of Toronto

The North American Douglas hawthorn, *C. douglasii* Lindl., is widespread in the Pacific Northwest, with a disjunct occurrence in the Upper Great Lakes basin. In addition, two Ontario specimens document the occurrence of this species in the Hudson Bay drainage, near Lake Abitibi. Unlike other Ontario hawthorn species (and many Ontario tree species generally) *C. douglasii* in eastern North America appears to be confined almost entirely to areas in close proximity to shorelines of the upper Great Lakes. Its distribution in Ontario bears little resemblance to that of other plant species that together give rise to the climate- and substrate-controlled ecozones and forest regions in this part of the continent. One hypothesis that has been advanced to explain this difference is the role of periglacial lakes as migration routes from west to east, and the limited ability of black-fruited *C. douglasii* to expand into the hinterland now occupied by red-fruited hawthorns that, together with many other woody species now dominant, most likely recolonized the Great Lakes basin from refugia in southeastern North America. This poster aims to renew awareness of these biogeographic questions and stimulate botanists to look for hitherto ignored or undiscovered occurrences of Douglas hawthorn in northwestern Québec.

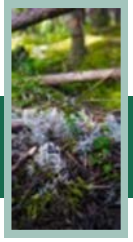
NL-15:18 / Qc-13:48 / BC-10:48

### Végétation d'habitats rares naturels et anthropiques : contribution à la biodiversité régionale et origine des colonisateurs

**Nils Ambec**[1] (nils.ambec@uqat.ca), Nicole Fenton[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

Dans un contexte d'anthropisation et de réchauffement global, la compréhension des écosystèmes qui nous entourent est capitale. Cette compréhension passe notamment par la connaissance de la biodiversité et des mécanismes expliquant sa présence à un point donné du territoire. Dans ces mécanismes on retrouve notamment l'habitat, l'histoire du paysage (glaciation, feux), la dispersion, la colonisation et l'extinction. Les plaines forestières et tourbières de l'Abitibi-Témiscamingue sont des systèmes bien étudiés mais l'emphase n'a jamais été mise sur les milieux rares alentours. Les milieux rares peuvent abriter près de la moitié de la biodiversité d'une région et leur isolement est parfois tel qu'il permet de les étudier à travers la théorie de la biogéographie insulaire. Ce sont des modèles de choix pour l'étude de la dispersion et de la biodiversité à l'échelle régionale. En Abitibi-Témiscamingue, les milieux rares sont représentés par les collines et les anciens sites miniers. Les collines contrastent par leur élévation et la présence d'un socle rocheux alors que les anciens sites miniers contrastent à travers leur géochimie, notamment avec des concentrations conséquentes de métaux lourds, et l'ouverture du milieu. L'objectif de la thèse est de quantifier et d'expliquer l'apport en biodiversité de ces milieux rares à l'échelle régionale.



## Habitats: challenges and understanding – Habitats: enjeux et compréhension

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:21 / Qc-13:51 / BC-10:51

### Warmer autumn temperatures affect wetland plant growth

**Melissa Aline Laplante**[1] (melissalaplante@hotmail.ca)

[1]Laurentian University

Temperature is an important driver of many plant developmental processes including seasonal activities; therefore, many studies have been conducted on the effect of increased temperatures on plants. These studies show delays in autumnal phenological events and advancements of spring events however often only look at leaf senescence and leaf unfolding or flowering date of primarily trees. Therefore, in this study, the whole-plant responses to increased temperature in autumn were studied for four common Northern Ontario wetland plants: *Carex lasiocarpa*, *Sparganium emersum*, *Dulichium arundinaceum* and *Rhynchospora alba*. Root and shoot growth in autumn, autumn senescence, production of over-wintering structures, root and shoot growth and reproduction in the following season will be observed and measured. The warm-autumn treatment consisted of transparent vinyl cold frames while the uncovered pools served as the control with ambient autumn temperatures. The treatments were applied from August 21st until November 5th. Preliminary results indicate interspecific differences in responses with trends of delayed senescence for several, but not all of the species. The effects of warm autumn on plant growth and reproduction in the following growing season will be investigated, and the autumn senescence will be investigated in further detail.

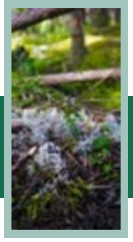
NL-15:24 / Qc-13:54 / BC-10:54

### Sensitivity of the growth of conifer and hardwood species to climatic forcing in the boreal mixedwood of Eastern Canada

**Emmanuel A. Boakye**[1] (emmanuelamoah.boakye@uqat.ca), Daniel Houle[2,3], Yves Bergeron[1,4], Igor Drobyshev[1,5]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]Ministère des Forêts, de la Faune et des Parcs du Québec (MFFP), [3]Ouranos Climate Change Consortium, [4]Université du Québec à Montréal (UQAM), [5]Swedish University of Agricultural Sciences

To enhance sustainable forest management, there is a need to monitor the response of forest dynamics to climatic variability. We analyzed growth rate changes of three conifers and two hardwood species (~2200 trees), which co-occur on two contrasting soil deposits, till and clay within the boreal mixedwood of Eastern Canada. We used moving window correlations to analyze the changes in the relationships between seasonal climatic variables and tree growth. *Abies balsamea*, *Picea glauca*, *Thuja occidentalis*, *Populus tremuloides* and *Betula papyrifera* of the two study sites displayed general increasing growth trend since the mid of the 20th century suggesting more favorable climatic conditions. We observed consistent positive correlations between seasonal precipitation, water availability and temperature on the growth of the species. The study emphasizes that trees species in the boreal mixedwood of eastern Canada will show enhanced growth rates, implying that the forest will be more productive in future. Further research is needed to evaluate the consequences of the enhanced growth rates on tree composition in the boreal mixedwood.



## Habitats: challenges and understanding – Habitats: enjeux et compréhension

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:27 / Qc-13:57 / BC-10:57

### Crop Assessment of Ruffed Grouse (*Bonasa umbellus*) and Spruce Grouse (*Falcipennis canadensis*) from North Central British Columbia: A Botanical Pandora's Box

Evan Ball[1] (ball1@unbc.ca), Mike Minard[1], Meghan Hilborn[1], Erin Gilbert[1], Kelsey Facca[1], Russell D. Dawson[1], **Hugues B. Massicotte1** (hugues.massicotte@unbc.ca ), Dan A. Aitken[2], Olav G. Hjeljord[3], Roy V. Rea[1]

[1]University of Northern British Columbia, [2] College of New Caledonia, [3]Norwegian University of Life Sciences,

No research has been conducted on the foraging ecology of grouse in northern British Columbia (BC). To explore the dietary habits of grouse from north central BC and to engage undergraduate students in research, we examined the crops of 90 ruffed (*Bonasa umbellus*) and 20 spruce (*Falcipennis canadensis*) grouse submitted by hunters during the autumn (September - November) of 2016 to 2019. To evaluate diet, we removed the crop contents from each bird and separated them by category: leaf, bud, twig, fruit, seed, flower, fungus, insect. Contents were well preserved within each crop (the food storage organ above the gizzard and stomach). Many items were easily identifiable (e.g., rose hips, complete leaves), while others were more difficult (e.g., buds, parts of twigs, or fractions of leaves). A working botanical knowledge was critical for identification of plant parts. Where required, we used available plant keys. Preliminary results suggest that autumn diets of ruffed grouse consist mostly of leaves and buds, with some seeds, twigs and fruits and, occasionally, insects and fungi. Leaves of white clover (*Trifolium repens*) and buds of buffaloberry (*Shepherdia canadensis*) were identified in most ruffed grouse crops. In contrast, spruce grouse diets were comprised almost entirely of conifer needles of white spruce (*Picea glauca*) and lodgepole pine (*Pinus contorta* var. *latifolia*). This implies possible foraging and dietary differences between these two species. Additionally, the project underscores the importance of plant morphology in crop content assessment, and highlights the challenges and enjoyment of team-oriented student research!

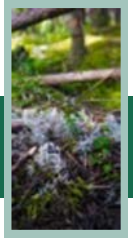
NL-15:30 / Qc-14:00 / BC-11:00

### Effects of landscape fragmentation on boreal bryophyte diversity

**Enrique Hernandez-Rodríguez[1]** (enrique.hernandezrodriguez@uqat.ca), Nicole Fenton[1], Juan Carlos Villarreal Aguilar[2], Philippe Marchand[1], Kristoffer Hylander[3]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]Université Laval, [3]Stockholm University

Habitat fragmentation is one of the principal drivers of biodiversity loss. A consequence of this process is a change in the landscape configuration and composition, including disturbed areas and forest patches with different habitat quality. The boreal forest in Quebec has experimented fragmentation by anthropogenic and natural disturbances that may put at risk its stability and resilience. Bryophytes (liverworts and mosses) are one of the principal biological components of this forest and due to their susceptibility to changes in the environment, they are an ideal group to evaluate forest fragmentation (FF). The objectives of this study are 1) to assess the effect of FF on bryophyte diversity (α and β) and their community composition, 2) to determine how landscape configuration features determine diversity patterns and community assembly, and 3) to know the thresholds of forest disturbance without compromising the bryophytes diversity. To do this, around 100 landscapes with a gradient of conditions (including variation in the trees species composition, age and size of their forest patches, as well as patch disturbance type) will be analyzed. In these landscapes, richness, species turnover and frequency will be evaluated relating to landscape configuration metrics (e.g., quality, size and patches arrangement). This study will improve the knowledge of FF considering an integral vision of the landscape configuration of the boreal forest. Finally, this research will provide information about how landscape configuration could help to keep the biodiversity and quality of the forest, important aspects in the context of sustainable forest management in Quebec.



## Habitats: challenges and understanding – Habitats: enjeux et compréhension

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:33 / Qc-14:03 / BC-11:03

### A 23 000 km transect: new Arctic plant & lichen collections from the Canada C3 Expedition

**Jeffery M. Saarela**[1] (jsaarela@nature.ca), Paul C. Sokoloff[1], Mark S. Graham[1], R. Troy McMullin[1], Noel R. Alfonso[1], Roger D. Bull[1], Oluwayemisi K. Dare[1], Jennifer Doubt[1], Mark A. Edwards[2], Caroline H. Fox[3], Paul B. Hamilton[1], Ed A. Hendrycks[1], Lisa Kresky[4], Julie LaRoche[3], Rhiannon Moore[5], Paula C. Piilonen[1], Vicki Sahanatien[6], Lianna Teeter[7], Man-Yin Tsang[8], Peter Van Buren[9]

[1]Canadian Museum of Nature, [2]Royal Alberta Museum, [3]Dalhousie University, [4]Maani Ulujuk Ilinniarvik (Rankin Inlet), [5]Ocean Wise (Vancouver), [6]Nunavut Wildlife Management Board (Iqaluit), [7]Department of Fisheries and Oceans (Victoria), [8]University of Toronto, [9]Institute of Ocean Sciences (Sydney, Canada)

Canada C3 was a 150 day marine journey from Toronto, Ontario to Victoria, British Columbia by way of the Northwest Passage. Based on the icebreaker Polar Prince, this expedition brought together a diverse group of Canadians to explore Canada?s coasts while reflecting on the journey's core themes of Diversity and Inclusion, Reconciliation, Youth Engagement and the Environment. During the expedition's scientific program, shipboard researchers collected plants and lichens at stops along the journey to add new knowledge on the floristic diversity of Canada. Specimens will be deposited at the National Herbarium of Canada at the Canadian Museum of Nature. In all 1321 collections were made by 42 collectors. The majority of these (922) were made in the Canadian Arctic, and many were gathered from places where no or few botanical collections have been made previously (e.g., Cape Barrow, Nunavut; Tree River, Nunavut). Notable Arctic collections include the Arctic orangebush lichen (*Xanthaptychia aurantiaca*), a globally rare (G1) species, and a significant eastward range extension of the spruce muskeg sedge (*Carex bigelowii* subsp. *lugens*). All Arctic collections will contribute to the museum's ongoing Arctic floristic research, and all expedition specimens will serve as a scientific legacy to this epic voyage.

NL-15:36 / Qc-14:06 / BC-11:06

### Patterns and biases in an Arctic herbarium specimen collection: Implications for phenological research

**Zoe Panchen**[1] (zoepanchen@sympatico.ca), Jennifer Doubt[2], Heather Kharouba[3], Mark Johnston[4]

[1]University of British Columbia, [2]Canadian Museum of Nature, [3]University of Ottawa, [4]Dalhousie University

Herbarium specimens are increasingly used for phenological studies. Plants are most often collected in flower or fruit and provide timing of flowering and fruiting over the last century. However, herbarium specimens have generally been collected for taxonomical and biogeographical purposes, without phenological studies in mind. Remoteness restricts herbarium specimen collection in the Arctic. Nunavut is 2.1million km$^2$, with just 25 small communities, none of which are accessible by road. Sea ice restricts boat access to two months at summer's end. Thus, vast areas of Nunavut are difficult to access. Expeditions by boat or plane have been the most common means of collecting herbarium specimens. Due to the very short snow-free season, the majority of collecting takes place in July. These limitations may result in collection biases that should be taken into account when interpreting phenological information in herbarium records. We assessed the presence of spatial, temporal, phenological, trait and collector biases in the Arctic herbarium specimen collection at the National Herbarium of Canada (CAN). We found specimens have only been collected from 0.63% of Nunavut's landmass; a preference to collect closer to easy points of access; a tendency to collect plants at peak flower irrespective of the population phenology stage at collection time; preferences to collect certain taxonomic groups, flower colours, growth habits and plant sizes; and 24% of collectors collected 90% of the collection. We recommend assessing patterns and biases of natural history collections to support more insightful interpretations of phenological studies.

## Forest management and sylviculture – Aménagement et sylviculture

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:15 / Qc-13:45 / BC-10:45

### Résilience des écosystèmes forestiers à divers stades de développement en réponse à différents traitements de coupe

**Marion Noualhaguet**[1] (marion.noualhaguet@uqat.ca), Nicole Fenton[1], Benoit Lafleur[1], Timothy Work[2]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]Université du Québec à Montréal (UQAM)

Au Québec, l'aménagement forestier écosystémique (AFE) constitue l'approche préconisée pour aménager durablement les écosystèmes forestiers. Cette approche a pour objectif de réduire les différences de composition et de structure entre les forêts naturelles et aménagées afin de conserver la biodiversité et les fonctions qui y sont associées. Pour ce faire, il est nécessaire de connaître les effets des perturbations naturelles sur les peuplements pour favoriser l'utilisation de traitements sylvicoles qui permettent de reproduire leurs effets. Tandis que les coupes totales (CT) ré-initient la régénération des peuplements à la manière des feux, les traitements de coupes partielles (CP), permettent de maintenir des peuplements mixtes et résineux à la manière des épidémies d'insectes. Le projet de recherche SAFE (Sylviculture et Aménagement Forestier Écosystémique) regroupe une série d'études expérimentales permettant de tester certains des objectifs de l'AFE. Des CT et CP (1/3, 2/3, par trouées) ont été appliquées dans des peuplements de début, mi et fin de succession dans la Forêt d'enseignement et de recherche du Lac Duparquet en Abitibi-Témiscamingue. Depuis l'initiation du projet en 1998, des suivis de la structure et de la composition des peuplements arbustifs, des nutriments du sol et de la décomposition du bois morts et de la litière ont été réalisés. Ce projet a pour objectif d'effectuer un suivi de ces attributs, 20 ans après l'application des traitements de récolte et de caractériser la dynamique de la régénération des peuplements afin déterminer les impacts à moyen terme des différents traitements de coupe sur la biodiversité, les fonctions écosystémiques et la productivité forestière.

NL-15:18 / Qc-13:48 / BC-10:48

### How different harvesting methods influence forest dynamics in the boreal mixedwood of western Quebec, Canada

**Kobra Maleki**[1] (kobra.maleki@uqat.ca), Benoit Lafleur[1], Alain Leduc[2], Yves Bergeron[1,2]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]Université du Québec à Montréal (UQAM)

Forest ecosystem management is gaining an increasing interest in using forest simulators, especially those operating based upon gap dynamics, for evaluating and emulating the effects of harvesting on stand structure and composition, which might result in maintaining the dynamics more comparable to natural stands. We used SORTIE-ND, a spatially explicit stand dynamics simulator, to simulate the dynamics of post-harvest stands over a period of 100 years following clear-cut and a range of partial cuts (dispersed cuts (30% and 60% basal area removal), aggregated cuts (30% and 60% basal area removal)). Using the basal area proportion of hardwoods to conifers, we assembled 431 sampling plots in three stand types (deciduous, mixed deciduous and mixed coniferous) and assessed the long-term impact of harvest on each type. We found that the spatial configuration of harvested and residual trees performed more importantly than tree removal intensity, on stand dynamics modifications. In deciduous and mixed deciduous stands, dispersed partial cuts promoted stands with structure and species composition comparable to unmanaged stands. In these stand types, clear-cuts and aggregated harvestings favoured high regeneration and basal area of aspen, setting the succession back to initial aspen dominance, typically observed after wildfires. In mixed coniferous stands, dispersed partial cuts of both intensities and 30% aggregated cuts helped maintain the recruitment and dominance of softwoods analogous to unmanaged stands. Finally, in aspen dominated stands cleat-cut acted as a stand-replacing natural disturbance and promoted the establishment of stands with structure and species composition similar to those observed in early-successional stages.

## Forest management and sylviculture – Aménagement et sylviculture

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:21 / Qc-13:51 / BC-10:51

### Factors influencing forest productivity and forest structure along a wet boreal climosequence in eastern Canada.

**André Arsenault**[1] (andre.arsenault2@canada.ca), Robert LeBlanc[1], Patricia Baines[1]

[1]Atlantic Forestry Centre - Canadian Forest Service (Newfoundland and Labrador)

Many ecological models predict that climate change, particularly increases in temperature will have a profound influence on future forest change. However, these models rarely incorporate factors such as the ability of tree species to acclimate to a changing environment. Hence, empirical studies are essential to gain a better understanding of the relationship between trees, forest function and climate. A long-term study of a wet boreal climosequence was established to examine the functioning of mature balsam fir forests in four regions along a latitudinal gradient representing a difference of 5 degrees Celsius between southern Newfoundland to eastern Labrador. The purpose of this climosequence platform is to better inform inferences about forest alteration under different climate change scenarios. The objective of this study was to characterize forest productivity using tree rings and forest structure using national forest inventory standards and examine how these were influenced by specific factors such as monthly air temperature and precipitation, tree age, time since disturbance, and types of disturbance. Forest productivity measured as mean annual increment in diameter was significantly lower in the north. Similarly, forest age (time since last major disturbance) was also significantly different with old forests in the north (167-267 years) and mid-seral forest in the south (40-100 years). Tree rings revealed that defoliating insect outbreaks were a major influence on tree growth along the entire climosequence. However, forest stands in the two most southerly regions were initiated following forest harvesting which complicates inferences that can be made by this climosequence.

NL-15:24 / Qc-13:54 / BC-10:54

### Factors influencing facilitation between boreal tree species during the regeneration process in post–mining sites

**Supun Madhumadhawa Pawuluwage**[1] (paws02@uqat.ca), Philippe Marchand[1], Nicole Fenton[1], Mélanie Roy[2], Benoit Lafleur[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]Université Paul Sabatier - Centre National de la Recherche Scientifique

Primary succession of vegetation in post-mining areas offers great opportunities to study, how mycorrhizal symbiosis influence the revegetalization in degraded environments. Fungal mycelia produce common mycorrhizal networks by colonizing roots of neighboring trees, and those networks facilitate the uptake and transportation of nutrients among plants. In this study, we determine how seedling growth and survival is affected by below-ground facilitation via mycorrhizal networks. Specifically, we i) determine which intraspecific and interspecific interactions affect seedling growth at an early successional stage on a former mining site, ii) identify existing mycorrhizae species and types using molecular analysis and iii) if evidence of facilitation is found in i), determine whether this facilitation is due to mycorrhizal networks or due to other factors. The study site is a mine tailings site of the Beattie Gold Mine near Lake Duparquet in north-west Quebec. *Betula papyrifera*, *Populus balsamifera*, *Picea glauca* and *Thuja occidentalis* were used as focal species and the effect of neighbouring plants were identified. Annual height increment was used for all the plants to see if growth depends on neighbourhood metrics using neighbourhood competition index. Content (mg) and concentration (mg/g) of nutrients in soil and leaf samples and selected heavy metals were analyzed. Mycorrhizal fungi were sequenced using molecular markers and analyzed to detect possible species sharing. This study will provide strong evidence about ecological processes that determine the success of forest regeneration after disturbances. Findings of this research will provide a valuable tool for foresters, ecologists and conservation biologists who work with mycorrhizae.

## Forest management and sylviculture – Aménagement et sylviculture

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:27 / Qc-13:57 / BC-10:57

### Comment le mélange d'espèces et le type de sol modifient–ils la vulnérabilité des écosystèmes forestiers nordiques québécois aux changements climatiques?

**Raphaël Chavardès**[1] (raphael.chavardes@uqat.ca), Fabio Gennaretti[1], Lorena Balducci[2], Yves Bergeron[1], Alain Leduc[3], Xavier Cavard[1], Danielle Charron[3], Ari Kainelainen[1], Théo Châtellier[4]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT), [2]Université du Québec à Chicoutimi (UQAC), [3]Université du Québec à Montréal (UQAM), [4]L'Ecole Nationale Supérieure Agronomique de Toulouse

Cette recherche a pour but d'identifier des conditions environnementales qui supportent la résilience d'écosystèmes forestiers nordiques québécois aux changements climatiques. Pour cela nous allons : 1) évaluer les relations climat-croissance pour trois espèces d'arbres dominantes dans les forêts boréales du Québec (le pin gris, l'épinette noire et le peuplier faux-tremble) en fonction du mélange de ces espèces dans le peuplement et le type de sol, et 2) comprendre comment la croissance de ces espèces pourrait répondre aux différents scénarios en matière de changements climatiques. Pour développer notre recherche, un dispositif de terrain sera mis en place au nord d'Authier-Nord dans la région de l'Abitibi. Ce dispositif inclura 120 cellules de compétition dans des forêts boréales et aura comme objectif d'analyser les relations entre le climat et la croissance interannuelle des cernes pour les trois espèces sélectionnées dans des peuplements purs ou mélangés, et sur des sols argileux ou sableux. En évaluant les relations climat-croissance, plusieurs trajectoires de croissance future pourront ensuite être identifiées pour les trois espèces selon leur environnement et scénarios de changements climatiques. Nos travaux préliminaires pour des peuplements d'épinette noire et de peuplier faux-tremble sur sols argileux montrent que la croissance de ces espèces, les impacts d'épidémies d'insectes, et les relations climat-croissance varient en fonction du mélange du peuplement.

NL-15:30 / Qc-14:00 / BC-11:00

### Le mélèze peut–il limiter la paludification?

**Andréane Garant**[1] (andreane.garant@uqat.ca), Nicole Fenton[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

La croissance de l'épinette noire, dans les milieux humides de la forêt boréale, pourrait être facilitée par la présence du mélèze laricin. Le mélèze, contrairement à l'épinette noire, perd ses aiguilles à l'automne, présente un taux de transpiration élevé et laisse pénétrer une grande quantité de lumière en sous-bois. Ces attributs du mélèze nous permettent de prédire qu'il aurait la capacité de générer des conditions environnementales de sous-bois qui limiteraient l'invasion du sol forestier par la sphaigne. Il est donc pertinent de comprendre comment le mélèze modifie les conditions environnementales du sous-bois par rapport à celles que l'on retrouve dans un peuplement pur d'épinette noire. L'objectif de cette recherche est de quantifier l'impact de la proportion de tiges de mélèze dans un peuplement d'épinette noire sur les caractéristiques hydrogéochimiques du sol, la croissance des sphaignes et le changement en abondance et en traits fonctionnels des communautés de bryophytes et d'herbacées du sous-bois. Quinze sites ont été sélectionnés selon une diversité de proportion de mélèze. Pour chaque site, des mesures de profondeur de nappe phréatique, d'ouverture de la canopée et des inventaires floristiques seront effectués dans 10 quadrats aléatoires de 4m². De plus, un suivi de croissance de sphaignes et l'installation de quadrats permanents pour mesurer l'effet de la chute des aiguilles sur le sous-bois seront effectués. À la lumière de ces connaissances, nous serons en mesure d'évaluer l'effet à long terme du mélèze sur le niveau de paludification des sites, un facteur limitant important pour la croissance de l'épinette noire

## Forest management and sylviculture – Aménagement et sylviculture

NL-15:15-15:39 / Qc-13:45-14:09 / BC-10:45-11:09

NL-15:33 / Qc-14:03 / BC-11:03

### Differences in paper birch physiological strategies in a northern boreal common garden experiment

**Jenna Rabley**[1] (rabj02@uqat.ca), Annie DesRochers[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

Studies have identified plasticity variation within paper birch (*Betula papyrifera*) functional traits due to its wide natural distribution and large degree of genetic diversity, allowing for competitive local adaptation and varying physiological characteristics. In order to understand the eco-physiological and environmental factors influencing rapid establishment, growth and the morphology of paper birch, we designed a common garden experiment with five sites at differing latitudinal locations across Abitibi-Temiscamingue. Net photosynthesis, foliar nutrient concentration (N, K and P), specific leaf area (SLA), leaf carbon isotope composition (δ13C), growth characteristics and edaphic variables were measured for each provenance at each site. Climate data was acquired from ANUSPLIN climate models. After 10 years of growth, we found significant difference amongst provenance tree height with the largest trees located at La Motte (4 – 9m) and the smallest at Senneterre (2 – 4.8m). Significant provenance variation was determined for net photosynthesis (4.9 – 23 μmol $m^{-2}$ $s^{-1}$) and SLA (79.47 – 188.3 $cm^2$ $g^{-1}$). However, given the high variability of net photosynthesis and SLA across all five sites, only a weak trend could be established. Even though no interaction between site and provenance was found regarding physiological strategy this result indicates that environmental factors play a key role in the growth and establishment of paper birch in plantations across Abitibi-Temiscamingue. The findings gathered from this study will benefit the Canadian forestry sector and increase the profit margins of private woodlot owners who have been targeted for the establishment of fast-growing, high-quality wood plantations in Quebec.

NL-15:36 / Qc-14:06 / BC-11:06

### Effet de la densité de la plantation et de la préparation mécanique du terrain sur le sous–bois, le sol et les arbres

**Amira Fetouab**[1] (amira.fetouab@uqat.ca), Nicole Fenton[1]

[1]Université du Québec en Abitibi-Témiscamingue (UQAT)

La durabilité de l'aménagement forestier dépend, notamment, du succès de régénération des sites coupés. Parmi d'autres facteurs, la densité de reboisement est un facteur important qui influence le développement des nouveaux peuplements. Également, il est souvent nécessaire de faire une préparation mécanique du sol avant la plantation dans certaines régions de la forêt boréale. Ce traitement peut influencer la végétation de sous-bois et la croissance des arbres plantés, mais son effet en interaction avec la densité de plantation est inconnu. Notre objectif est de comprendre cette interaction dans le contexte de la régénération de stations coupées puis sujettes à la paludification. Pour ce faire, nous avons établi une expérience comprenant neufs parcelles principales de 32 ha chacune qui contiennent toutes de 15 à 18 placettes échantillons. Nous avons soumis les parcelles principales à un traitement de hersage forestier, de scarifiage ou les avons conservées comme témoins (aucune préparation mécanique du sol). Chaque parcelle principale a été divisée en deux sous-parcelles soumises à une densité de plantation simple (1200 plants/ha) ou double (2500 plants/ha). Nous réaliserons des inventaires floristiques, des mesures sur les arbres plantés et caractériserons le sol seront réalisés dans des placettes de 400 $m^2$. Les connaissances que nous acquerrons dans cette étude guideront la sylviculture des peuplements boréaux en respect des principes de l'aménagement écosystémique des forêts.

# CBA MEETINGS AND INFORMATIONS

# RENCONTRE ABC ET INFORMATIONS

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# AFFICHES

# Section meetings – Réunions de sections
## NSERC short talk – Courte présentation du CRSNG

### Section meetings

Section meetings are opportunities for informal discussion among members of each section of the CBA that share common interests. Discussions may encompass anything from initiating new collaborative projects, discussing current research projects, to finding innovative ways to teach botany.
All members are welcome to attend!

### Rencontres de section

Les rencontres de sections sont des opportunités de discussion informelle entre les membres de chaque section de l'ABC qui partagent des intérêts communs. Les discussions peuvent porter sur toutes sortes de sujets, par exemple le développement de nouvelles collaborations, la discussion de projets de recherche en cours, ou encore tenter de trouver des manières innovantes d'enseigner la botanique.
Tous les membres sont les bienvenus !

### Program

JUNE 1 JUIN - NL-15:45 / Qc-14:15 / BC-11:15

Section meetings, in three different rooms:
**Ecology, Systematics, Plant development**

Rencontres de sections dans 3 salles différentes:
**Écologie, Systématique, Développement des plantes**

JUNE 2 JUIN - NL-15:45 / Qc-14:15 / BC-11:15

Section meeting: **Teaching**
Rencontres de section: **Enseignement**

JUNE 2 JUIN - NL-15:45 / Qc-14:15 / BC-11:15

NSERC presentation on funding research and scholarships
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Présentation du CRSNG sur le financement et les bourses d'études:
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# CBA Annual general meeting (AGM) and Awards

JUNE 2 JUIN - NL-18:15 / Qc-16:45 / BC-13:45

All members and conference attendees are encouraged to attend the Annual General Meeting, which will be followed by the Awards Ceremony for the major annual awards (the Lawson Medal, the Mary E. Elliot Award, and the Magister Teaching Award).

Winners of the best paper by students in Ecology (Stan Rowe Award), mycology (Luella K. Weresub Memorial Award), plant development, structure or morphology (Taylor A. Steeves Award), and in Systematics and Phytogeography (Porsild-Consul Award) will also be announced.

Finally the winners of the best student oral and poster presentations for the conference will be announced.

For information on the many awards handed out by the CBA every year please visit: https://www.cba-abc.ca/awards/

# Assemblée générale de l'ABC (AGA) et Prix et distinctions

JUNE 2 JUIN - NL-18:15 / Qc-16:45 / BC-13:45

Tous les membres et les participants à la conférence sont encouragés à assister à l'Assemblée générale annuelle, qui sera suivie de la cérémonie de remise des prix pour les principales récompenses annuelles (la médaille Lawson, le prix Mary E. Elliot et le prix d'enseignement Magister).

Les lauréats des meilleurs articles par des étudiants en écologie (prix Stan Rowe), en mycologie (prix Luella K.Weresub Memorial), en développement végétal, en structure ou morphologie (prix Taylor A. Steeves), et en systématique et phytogéographie (prix Porsche-Consul) seront également annoncés.

Enfin, les lauréats des meilleures présentations orales et des meilleurs posters de la conférence, réalisés par les étudiants, seront annoncés.

Pour obtenir de l'information sur les nombreux prix décernés chaque année par l'ABC, veuillez visiter: https://www.cba-abc.ca/fr/prix-de-distinction/

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## Photos

Special thanks for all the pictures from our team:

Mélanie Jean, Sophie Laliberté, Julie Arseneault, Xiangbo Yin, Marion Noualaguet, Juanita Rodriguez Rodriguez, Nils Ambec, Nada Aloui

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# Thank you for your participation!

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