Urban forests … both victim and solution in a warming climate

Dr. David Phillips

Conference Opening // Keynote, Cardigan Hillsborough, October 3, 2022, 8:30 AM - 10:00 AM

Biography:
David Phillips, CM is a climatologist for Environment Canada, a spokesperson for the Meteorological Service of Canada, and author.

David, born and raised in Windsor, Ontario, studied geography at the University of Windsor and after graduating in 1967, began working at the Meteorological Branch of Transport Canada — conducting research on the Great Lakes in Toronto. The work involved using climatological data to answer the questions of the users about climatic records: farmers asking for frost-free seasons or temperature trend, urban planners assessing the location for an airport or climatology the wind for tall-buildings and more general public queries.

David produced reports, eventually published, including an article about a Climatic Severity Index, ranking of 150 locations in Canada for their most extreme weather. After the article was cited by Southam News in the 1980s, Phillips was asked to go on television to respond. He has since become the spokesman for Environment Canada Meteorological Service.

David received the Patterson Medal for Distinguished Service to Meteorology in Canada, two Public Service Merit Awards, honorary doctorates from the University of Waterloo and Nipissing University, and the Order of Canada. He has authored The Climates Of Canada, Blame It On The Weather and The Day Niagara Falls Ran Dry and created The Canadian Weather Trivia Calendar.

David was awarded the Camsell Medal by the Royal Canadian Geographical Society in 1993. He received Member of Order of Canada in 2001.

Can anyone deny that Planet Earth is warming up faster and greater now than it has in a long, long time? In Canada, runaway warming is rising twice as much as the global average and in half the time. In urban settings, where 80 per cent of Canadians live, warming is accelerating, owing to climate change and expanding urban heat islands. The various facets of a changing climate are unlikely to be friendly to trees in towns and cities. Urban forests offer a mitigation contribution through sequestration of carbon gas emissions and, much more importantly, a nature-based adaptation solution to make our cities more livable, likeable, and valuable.

Urban Soils for Urban Forests: Making brown infrastructure work for our cities

Dr. Susan Day

Keynote 2 & 3, Cardigan Hillsborough, October 3, 2022, 10:30 AM - 11:15 PM

Biography:

Susan is a Professor of Urban Forestry in the Department of Forest Resources Management and the Program Director for the urban forestry degree at the University of British Columbia in Vancouver, Canada. Susan's research focuses on managing the below-ground systems to enhance urban tree growth and longevity in the context of environmental challenges such as stormwater mitigation and land development. She helped shape the Sustainable Sites Initiative (SITES®) crediting system for soils and has published more than 150 articles and book chapters on urban forests and urban soils. She is the 2017 recipient of the L.C. Chadwick Award for Arboricultural Research. Susan holds a B.A. from Yale University, a M.S. from Cornell University, and a Ph.D. from Virginia Tech.

Soils are the foundation, the essential support system for our urban forests. But challenges are everywhere: compacted, contaminated, and missing soils as well as increased use of new soil blends and engineered soils. But we can flip the script and see how new approaches to urban soils can help solve problems and even contribute to climate change solutions. Strategies and perspectives that assess, protect, and manage urban soils as both a living system and a essential infrastructure can completely refocus our perception of the urban forest and open up new possibilities for green sustainable cities of the future.

Reversing the Irreversible: Urban Canada's opportunity to restore what's important to Canadians

Megan Leslie

Keynote, Cardigan Hillsborough, October 3, 2022, 11:15 PM - 12:15 PM

Biography:

Megan began as head of World Wildlife Fund Canada in December of 2017 after nearly two years at the organization, first as a consultant on oceans governance, then as head of ocean conservation. Before joining WWF, Megan was a Member of Parliament, representing Halifax for two terms, during which she was deputy leader of the official Opposition, environment critic and vice-chair of the government committee on environment and sustainable development. In Ottawa, Megan introduced a motion and guided its unanimous passage to add plastic microbeads to the list of toxic substances under the Environmental Protection Act. She also worked across party lines to successfully expedite the passage of a bill to create Sable Island National Park Reserve. After university and before entering politics, she was a community legal worker and presented at the 2005 United Nations Framework Convention on Climate Change in Montreal on the issue of energy poverty. Megan is the proud recipient of an Honourary Degree from Mount Saint Vincent University in Halifax and is a Senior Policy Fellow at the Munk School of Global Affairs and Public Policy at the University of Toronto.

Extreme temperatures. Floods. Super storms. Wildfires. We are living the climate crisis and must take steps now to reverse the situation. It turns out that nature is one of the most powerful tools in this battle by ensuring connectivity; maintaining diversity and redundancy; and, by encouraging learning and participation so that we - and our surroundings - can successfully adapt. WWF-Canada president and CEO Megan Leslie discusses the important connections between climate change and biodiversity loss, the power of restoration, and how reconnecting with nature can put us on a path to a brighter future.

Urban forest strategies for a changing climate – the Canadian experience

Mr. Philip van Wassenaer[1], Prof. Cecil Konijnendijk, Ms. Martha Copestake, Dr. Lorien Nesbitt, Mr. Alex Satel, Mr. Peter Duinker, Dr. Melissa McHale
[1]*Urban Forest Innovations Inc.*

Parallel Session 1.1 - Panel, Tignish, October 3, 2022, 1:30 PM - 3:00 PM

Biography:
Philip van Wassenaer, B.Sc. Environmental Sciences, Master of Forest Conservation, is the principal consultant for Urban Forest Innovations, Inc., which specializes in the preservation, enhancement, and management of the urban forest using a research- and science-based approach. He is an ISA Certified Arborist, an ASCA Registered Consulting Arborist, Current Board Member of ASCA, a Past President and Director of the Ontario Urban Forest Council and a 2009 recipient of the ISA True Professionals of Arboriculture Award.

A strategic approach to urban forestry is crucial in times of growing demands and challenges for the field. Research and practice have shown that the development of multifunctional and resilient urban forests that help cities adapt to climate change requires a strategic approach, good governance, and the development of comprehensive urban forest strategies. This panel session presents and discusses good practices in urban forest strategy development in Canada, drawing upon experiences from consultants, municipal foresters, and academics. The session highlights lessons learnt to date, focuses on essential components of strategies, their preparation, and implementations, and discusses some of the impacts urban forest strategies have had. After brief presentations of case studies from across Canada, participants will engage in an interactive knowledge sharing discussion.

The panel session will start with brief talks on the importance of urban forest strategies in times of climate and other changes. Speakers, who come from municipal and consultancy practice, as well as academia, will share their experience with e.g., developing strategies and plans that have made a difference. After the talks, an interactive discussion involving the audience will focus on identifying good practice in urban forest strategy development and implementation.

Satellite and drone thermal imaging of forest restoration, urban LDD defoliation and other issues

Dr. Jonas Hamberg[1], Dr. Patrick James[1], Dr. Jonathan Ruppert[2], Jessica Turecek[3], Dr. Josh Fisher[4]
[1]University Of Toronto, [2]Toronto and Region Conservation Authority, [3]University of Waterloo, [4]Chapman University

Parallel Session 1.2, Bonshaw, October 3, 2022, 1:30 PM - 3:00 PM

Biography:
I am a MITACs postdoctoral fellow at the University of Toronto, working with the Toronto and Region Conservation Authorities Ecosystem and Climate Science team. I combine on the ground ecological studies with remote sensing, mainly through thermal imagers on satellites and drones.

We are using thermal imagers on satellites, the International Space Station, and drones (RPAS) to monitor and measure the effect of restoration and ecological issues on surface temperature in urban, suburban, and rural forest and meadow ecosystems. Along with specific results, we will be explaining the theory and technology behind why thermal imaging can be linked to tree health, tree management, ecosystem services, and climate change adaptation.

Using the ECOSTRESS thermal imager on the ISS we measured the effect of forest restoration on surface temperature and evapotranspiration at different times of the day and night at two large groups of restoration projects (n=35 and n=8 respectively) in Southern Ontario. We found a 4-7 C° difference in the afternoon between forest restoration and agriculture and suburban areas and significant cooling over time since restoration.
We will also present ongoing research using thermal cameras on drones to measure and monitor the thermal effect of LDD moth defoliation in and around the watersheds of the Toronto and Region Conservation Authority (TRCA), and the cooling effect of meadow restoration on the Meadoway project that runs through Scarborough.

Overall, our results show that forests are important urban cooling centres - not just because of shading, but also because of their energy conversion and storage. Restoration can buffer extreme heat in urban and suburban areas, and issues that stress trees and other vegetation, such as LDD moth defoliation, decreases the thermal buffering ability of the ecosystems, decreasing human wellbeing and habitat for certain animals.

Low-cost UAVs as a tool for urban forest management for climate adaptation

Ms. Sophie Nitoslawski[1], Max Yancho
[1]*University of British Columbia*

Parallel Session 1.2, Bonshaw, October 3, 2022, 1:30 PM - 3:00 PM

Biography:
Sophie Nitoslawski is a PhD Candidate in urban forestry at the University of British Columbia. Her research and professional interests include urban biodiversity, green infrastructure planning, urban technology, and municipal sustainability and resilience. She is particularly interested in
how smart cities and urban technologies will shape urban forestry and green space management. Sophie teaches various urban forestry courses at UBC and is a member of the International Society of Arboriculture (ISA) Science and Research Committee.

Public green spaces are critical urban infrastructure that provide key environmental benefits, and are a foundation for social, recreational, and cultural vitality – a fact that the COVID-19 pandemic has highlighted. These spaces will also likely become increasingly important for urban climate resilience. Data is an important component of effective green space management - for understanding the ecology, structure, and characteristics of these landscapes, in addition to the ecosystem services that they might provide to diverse residents. Digital technologies and platforms bolstered by increased connectivity and computing capacity have the potential to help collect this data more widely and efficiently.

Accordingly, we flew a low-cost consumer unmanned aerial vehicle (DJI Mavic 2 Pro), or UAV, across 27 public neighbourhood parks in Metro Vancouver to test flight parameters and techniques for remotely sensing forest structure and green space characteristics, including tree and crown size, type, and canopy and green cover at high spatial resolution. Beyond summarizing these findings, we present ways in which these data can help quantify climate-related benefits such as shade provisioning. We also propose other applications for UAV data and imagery, such as community engagement and urban park design.

This presentation will be of interest to practitioners and researchers interested in affordable remote-sensing tools that can complement (and supplement) more widely-used data sources (e.g. satellites, LiDAR) in the context of urban forest management.

SylvCiT : A new intelligent tool to improve urban forest resilience to global changes

Dr. Annick St-Denis[1], Dr. Fanny Maure[2], Mr. Raouf Belbahar[2], Prof Sylvain Delagrange[1], Prof Marie-Jean Meurs[2], Dr. Christian Messier[1,2]
[1]Université du Québec en Outaouais (ISFORT, CEF), [2]Université du Québec à Montréal

Parallel Session 1.2, Bonshaw, October 3, 2022, 1:30 PM - 3:00 PM

Biography:
Annick (Ph.D.), a forest ecologist, worked as an environmental sustainability consultant for the City of Laval before becoming a post-doctoral fellow (UQO). She has worked in conservation and management of natural environments, ecological restoration, evaluation of ecosystem services and urban forestry. She is particularly interested in the functional diversity and resilience of forests. Her main project aims to integrate these concepts into an intelligent software program (SylvCiT) to assist urban forest managers in their plantation planning.

Urban trees are facing and will continue to face many challenges in the next decades such as climate change, and the invasion of new pest and pathogens, which can have severe consequences particularly in low diversity urban forests (UF). Indeed, most UF of northeastern North America are dominated by only a few species. For example, in Montreal, Laval and Quebec cities, two genera are dominant: Acer and Fraxinus.

There is an urgent need to improve the resilience of UF to global changes by increasing the functional diversity of the canopy with strategic selection of tree species for plantation. Tree species with different traits will have different responses to threats and stresses. A resilient UF will maintain the production of ecosystem services despite the arrival of a new insect or exotic disease, a drought, a frost event or other stress event.

In collaboration with students in computer science, the aim of our project is to develop a new intelligent tool, SylvCiT, to guide UF managers in their planning of tree plantation. Based on inventories of georeferenced urban trees, the tool analyses species diversity, functional diversity and forest structure at different scales (city, neighborhood, park, street). SylvCiT then provides recommendations on a selection of tree species to plant to increase the functional diversity of the UF.

These suggestions also take into consideration the tree species' vulnerability to biotic and abiotic threats (e.g. insects, pathogens, drought, flood, ice storms, wind storms). Future climate conditions will soon be included to further guide species recommendations.

Urban Greening vs. Urban Densification: Modelling four urban forest scenarios for 2050

Prof. Cynthia Girling[1], Dr Sara Barron[1], Dr Lorien Nesbitt, Dr Stephen Sheppard, Zhaohua Cheng, Agatha Czekajlo

Dr. Sara Barron & Juliet Alva, University of British Columbia

Parallel Session 1.3, Cardigan Hillsborough, October 3, 2022, 1:30 PM - 3:00 PM

Despite climate action planning and implementation for over a decade, Canadian cities are not making adequate progress, while climate change is coming at double the rate anticipated. Most climate action planning in the recent past has focused on densification, green buildings, renewable energy, and transit. Urban greening has only recently been included in climate action to combat urban heat island effects and increasing numbers of extreme heat days in summers, which will impact human health and livability. Many cities are now including urban greening/tree planting in conjunction with climate action planning. However urban greening may conflict with strategies such as densification.

This presentation reports on a project that evaluates where and how much trees can contribute to climate mitigation (reduced energy use by buildings) and adaptation (outdoor shading) to maintain livability in increasingly dense neighbourhoods. We modelled four different future what-if scenarios for increasing the tree canopy cover and volume in a densifying neighbourhood in Vancouver to 2050. The scenarios included: maintaining existing municipal urban forestry policies with and without climate-adapted trees; strategically planting trees to reduce building energy; maximizing tree planting across the neighbourhood. We will present preliminary results including: visualized maps and data about where, what, and how many trees were “planted” in four different scenarios and how much trees decreased heating/cooling of buildings and street-level outdoor summer temperatures. We conclude with some observations about where and how two strategies for climate action- urban densification and urban greening- may conflict.

The importance of conserving natural forests in and around cities to build social-ecological resilience

Dr. Tahia Devisscher[1], Dr Matthew Mitchell[1], Prof. Cecil Konijnendijk[1,2]
[1]*University of British Columbia,* [2]*Nature Based Solutions Institute*

Parallel Session 1.3, Cardigan Hillsborough, October 3, 2022, 1:30 PM - 3:00 PM

Biography:
Tahia Devisscher is currently studying the extent to which forests in and around cities increase social-ecological resilience, and how to strengthen ways in which urbanites connect with nature. At UBC, Tahia is also teaching Urban Forest and Well-Being, Urban Forestry Administration, Policy and Law, and Urban Forest Inventory and Assessment. In past work with the Stockholm Environment Institute, Tahia implemented and led applied research to support climate adaptation through nature-based solutions. She has worked in 20 countries with local communities, NGOs, and governments. Tahia has an interdisciplinary background and a PhD in ecosystems science from the University of Oxford.

The health of urban ecosystems and wellbeing of urban dwellers will greatly depend on the way cities anticipate and prepare for rapid change in the next decade. As urban areas continue to grow, pressure on land intensifies and cities struggle to conserve their natural forest and biodiversity. At the same time, cities are becoming increasingly vulnerable to multiple risks caused by urbanization and climate change interactions. Urban forests have an important role to play in building healthier and more resilient cities, yet little work has been done to measure the effects of urbanization on the multiple, essential ecosystem services (ESs) these forests provide for urban resilience. There is also a need to better understand how urbanites engage with the urban forest in the context of climate change, and how they perceive the benefits these forests provide. This study will show results of research conducted along an urban-rural gradient in the City of Maple Ridge, British Columbia, selected due to its very rapid expansion into surrounding forests. Structure, composition, and ecosystem services deemed important for urban resilience were evaluated in forest plots along the gradient. Urban residents were engaged along the gradient to evaluate their interaction with and perceptions of the urban forest. Methods and insights generated with this study are of great value for cities in Canada experiencing rapid growth. Findings will be used by Maple Ridge to inform land policies, and the conservation of forest areas that play a key role in the resilience and sustainability of the city.

Is planting thousands of trees just good public relations? Not if done right.

Prof. Alain Paquette[1,2], Miss Elyssa Cameron[1], Dr. Alain Paquette[1]
[1]UQAM, [2]FRIAS

Parallel Session 1.3, Cardigan Hillsborough, October 3, 2022, 1:30 PM - 3:00 PM

Biography:
My work focuses on the relationship between biodiversity and ecosystem functioning. This young science (BEF) is rooted in the concern for biodiversity loss linked to global changes, with the accumulation of evidence of a generally negative impact on ecosystem functions. However, some aspects are still poorly understood or explored, among which how do these changes affect the ecosystem services that affect people, especially in cities?

Urban tree planting initiatives have been blooming worldwide to help address climate change and nurture healthy living environments for people. Many initiatives are characterized by ambitious targets based on the numbers of trees planted, but lack of clear objectives for planting, inappropriate species and sites selection, and inadequate post-planting management hamper the success of these initiatives. In this work, we propose four recommendations for practice that can help improve the success of tree planting initiatives by ensuring that the right types of trees are planted where they are needed most and where they will have the greatest impact.
Furthermore, we propose a spatially explicit approach for cities to determine these priority locations to achieve the greatest returns on specific benefits. Criteria for prioritization were developed in tandem with the City of Joliette, Canada, and based on nine indicators: surface temperature, tree density, vegetation cover, resilience, tree size and age, presence of species at risk, land use type, socioeconomic deprivation, and potential for active transportation. The resulting tree planting priority maps can be used to target street tree plantings to locations where trees are needed most. This approach can be readily applied to other cities as these criteria can be adjusted to accommodate specific tree canopy goals and planning constraints. As cities are looking to expand tree canopy, we hope this work will assist in sustaining and growing their urban forest, enabling it to be more resilient and to keep providing multiple and sustained benefits where they are needed the most.

Managing urban forests for diverse community values in light of on-going climate change.

Prof. Tenley Conway[1], Dr. Camilo Ordóñez Barona, Ms. Janina Kowalski, Dr. Lorien Nesbitt
[1]*University Of Toronto- Mississauga*

Parallel Session 2.1 - Panel, Tignish, October 3, 2022, 3:30 PM - 5:00 PM

Biography:
Tenley Conway is a Professor in the Department of Geography, Geomatics and Environment at the University of Toronto (Mississauga). Her recent research examines residents' role in urban forest governance; perceptions and experiences with urban forests; and green infrastructure discourse, perceptions and actions in Canada. She is currently a member of the International Society of Arboriculture Science and Research Committee, an associate editor of Urban Forestry and Urban Greening, and is a board member of LEAF, a non-profit organization dedicated to the protection and enhancement of the urban forest.

Successful urban forest management must balance a range of goals, including addressing communities' needs and expectations, while managing for a resilient urban forest. Recent research suggests that a diversity of urban forest values are held by urban populations across Canada. Diverse values, along with beliefs and attitudes, are associated with diversity identities, urban contexts, and experiences with urban trees. This panel session will discuss the following topics: (1) the range of urban forest values, along with associated beliefs and satisfaction with the current urban forest, held by diverse urban Canadians in different urban contexts; (2) ways that values, beliefs and experiences may be affected by climate change, including more frequent extreme weather events; and (3) strategies to manage urban forests that can build-on the diversity of values held by a community to increase the resilience of urban forests to future climate change. Panelists will draw on recent research from several metropolitan areas of Canada, including surveys capturing the range of perceptions held by urban populations and in-depth case studies on different urban forest experiences.

Targeting and protecting investments in nature-based climate solutions

Dr. Fanny Maure[1]
[1]*Habitat*

Parallel Session 2.2, Bonshaw, October 3, 2022, 3:30 PM - 5:00 PM

Biography:
Fanny Maure holds a Ph.D. in biology from the University of Montpellier II (France) and a post-doctorate in evolutionary biology from the University of Otago in New Zealand. She is currently interested in sustainable development and nature-based solutions. She has a particular interest in the management of trees in urban and forest environments, especially in terms of the services they provide to society. Fanny works at Habitat as Director of Communications and aims to make science more accessible to the general public and decision-makers in order to better protect our natural infrastructure.

Urban trees and forests provide an abundance of essential services for society. In response to climate change, expanding the urban canopy is increasingly part of a portfolio of nature-based climate solutions being adopted by municipalities to offset carbon emissions and provide ecosystem services to local residents. However, investments in nature-based solutions (urban trees) are themselves vulnerable to increasing environmental and climatic stressors such as flooding, extreme heat, drought and insects. Given present and future challenges, understanding how best to manage and expand the urban canopy will be critical to designing climate-smart investments in urban forests. To protect these investments, we must revisit the way we select, plant and manage trees in cities to ensure that they will resist strengthening climate pressures and preserve the many beneficial services they provide.

Here, through different case studies, we present a multi-step approach designed to guide municipalities towards more ambitious and strategic urban forest management plans adapted to their location and geographical constraints. This approach allows i) to assess and address current canopy vulnerabilities to climate change, ii) to identify spatial opportunities for canopy expansion and other nature-based solutions contributing to climate adaptation and iii) to improve tree diversity through a selection of species that can cope with and mitigate existing climate hazards. To ensure cities achieve their climate targets and grow resilient urban forests, urban trees need to be strategically managed and maintained through cities. Climate-smart investments in nature-based solutions will be a key component of the fight against climate change.

A new frontier for urban forestry planting; designing diverse, resilient and productive highways

Mr. Hugo Ouellet[1], Miss Elyssa Cameron[1], Prof. Alain Paquette[1]
[1]*UQAM*

Parallel Session 2.2, Bonshaw, October 3, 2022, 3:30 PM - 5:00 PM

Biography:
Master's candidate in biology at the Université du Québec à Montréal in the research chair on the urban forest directed by Alain Paquette. Since my bachelor's degree in natural sciences applied to the environment, environmental issues have always been what motivates my university studies. It is with a strong interest in societal issues related to the climate crisis that my study projects are oriented to find concrete and thoughtful solutions to fight against this crisis, and this mainly in urban areas where the impacts affect more people and more vulnerable populations.

As urbanization pressures continue to spread and intensify within cities, it is increasingly difficult for urban planners to find appropriate tree planting locations. Ironically, planners are equally tasked with the challenge of increasing canopy cover and ecosystem services in order to reach municipally and governmentally sanctioned targets. So where and how to plant all these trees? Highways provide an interesting avenue to answer these questions as they include largely under-planted spaces, which cannot be zoned for development, and are important sources of some of the most negative impacts (heat, carbon, pollution, noise) that trees are intended to help mitigate. However, highways can sometimes be seen as challenging environments for trees to grow and survive. Our studies aim to determine, on the one hand, whether the intensity of soil preparation leads to more successful planting and, on the other hand, what impact these plantations will have on temperature reduction in the future.

We will firstly be presenting how these highway planting strategies were constructed as well as the project's results pertaining to: how the temperature decreases between the tree line and the highway depending on the structure and the diversity of the vegetation (human health) and the observed mortality and growth rates and impacts on diversity (ecosystem services). Finally, we will present a framework to make this approach universally applicable to all cities and highway greening projects.

The future of the urban and rural forests: A case study in Eco-Evo Dynamics

Mr. Brian Schatteman[1,2], Ms. Natacha Papieau[1,2], Ms. Louise Toutée[1,2]
[1]*ECOLE Project,* [2]*McGill University*

Parallel Session 2.2, Bonshaw, October 3, 2022, 3:30 PM - 5:00 PM

Biography:
Brian Schatteman is a second year student at McGill University pursuing a joint major in Biology and Mathematics with concentrations in Ecology and Theory, respectively. He is a 2021-2022 facilitator at ECOLE. Louise Toutée is a third-year student at McGill University pursuing a major in Cognitive Science with a minor in Political Science. She is a student newspaper editor and a 2020-2022 facilitator at ECOLE. Natacha Papieau is a second-year student at McGill University pursing a B.A. Honours degree in Economics with minor concentrations in International Development Studies and Environment. She is a 2021-2022 facilitator at ECOLE.

Global change threatens the climate zones of Canada's major cities with rising winter temperatures and increased soil acidification, rainfall, and urban flooding. The increased frequency of extreme weather events and movement of species' fundamental niches, most notably in polar-tracking isotherms, thus jeopardize the stability of Canadian urban and rural forest communities. In monitoring the risk of single species catastrophe events and reduced native species fitness caused by climate change, biodiversity within these forests effectively approximates ecosystem resiliency. Unlike in rural forests, the composition of urban forests is largely determined by ecosystem services rather than ecological productivity/stability, and thus the biodiversity of urban forests has historically trailed that of rural forests. Ecologically, the extremely heterogeneous urban growth environment is characterized by low soil volume, water impermeable surfaces, and increased temperatures due to the heat island effect. Evolutionarily, differences in proximity to other biodiversity sources and frequency of range barriers between the two forests underlie the distinct processes that will dominate continued composition changes. Therefore, the primary strategy of rural forest managers in mitigating climate change may rely on ensuring gene flow and facilitating evolutionary rescue. Urban forest managers, however, could prioritize planting species well adapted to continuously developing niches, acknowledging the dependency of ecosystem services like stormwater attenuation on species composition. Planting strategies adopted by municipal governments to build climate-resilient urban forests must also consider socioeconomic factors, such as cultural attachment to particular species. By encouraging community participation, urban forest management has the potential to strengthen community social ties.

Tools to support urban forest resilience in a changing world

Dr. Dan McKenney, John Pedlar
[1]*Natural Resources Canada - Canadian Forest Service*

Parallel Session 2.3, Cardigan Hillsborough, October 3, 2022, 3:30 PM - 5:00 PM

Biography:
Dan McKenney is a senior scientist and Director, of the Integrative Ecology and Economics Division at the Great Lakes Forestry Centre, Sault Ste Marie. His research interests includes climate change, behavioural economics, cost-benefit analysis and urban forests. He has a PhD in Forest Economics and Policy from the Australian National University, a Master's in Resource Economics from the University of Guelph and a BSc in Forest Science from Texas A&M University. He is an Adjunct at Universities of Toronto, Guelph, and Waterloo

Urban forests provide a key connection to the natural world for city dwellers. However, these forests are currently facing a variety of threats, particularly from climate change and invasive species. This talk will present a number of resources/tools developed at the Canadian Forest Service, Great Lakes Forestry Centre of Natural Resources Canada (GLFC-NRCAN) to help support urban forest resilience. For example, over two decades, we have developed an extensive database of plant occurrence records, which we have used to generate climate envelope models for more than 3000 North American plant species. These models can be and have been used to support climate-smart urban tree planting decisions. We have also developed a similar, lesser-known tool for forest insect pests, which can provide urban forest managers with projections of potential insect threats in the coming decades. Finally, we will summarize efforts to establish a national street tree survey to support risk assessments on emerging forest pests in Canada. To date, surveys have been completed for more than 150 communities across Canada. The data collected so far allow an important snapshot of regional variation in street tree size and composition across Canada. This information has already contributed to economic impact assessments for several invasive species threats including Emerald Ash Borer, Asian Long-horned Beetle and Oak Wilt but also provides insights on threats and opportunities for urban forest resilience under a rapidly changing climate.

Effective Tools for Regulating Trees in Land Use Planning and in General

Ms. Amelia Needoba[1]
[1]*Diamond Head Consulting*

Parallel Session 2.3, Cardigan Hillsborough, October 3, 2022, 3:30 PM - 5:00 PM

Biography:
Amelia Needoba has 20 years of experience in the strategic planning, development and management of urban and natural forests in Canada, the United States and Australia. She has worked as both a consultant and municipal urban forester, developing and implementing urban forest strategies and managing community engagement processes. Amelia has experience in urban forestry, forest health management, wildfire planning, and urban forest climate adaptation. Amelia is a registered Project Management Professional and ISA Certified Arborist.

Communities across Canada are grappling with how to respond to climate emergencies. Many municipalities are looking to urban forests for mitigation and adaptation benefits such as carbon storage, rainwater interception, and cooling. And yet, municipalities are struggling to effectively retain and replace healthy trees and soils in urban areas. For example, global forest cover data indicates more than 90% of municipalities in British Columbia had a net loss of canopy between 2000 and 2016.

Rapidly growing urban populations make climate adaptation solutions imperative for cities and nature-based solutions could become a cornerstone of adaptation. Unfortunately, opportunities for tree and soil retention and replacement with development are being lost because policies are missing or misaligned. Arborists and environmental planners are usually in the role of advocating for the urban forest on development projects. However, it is also the developer, architect, engineer, planner, builder and landscape architect who must collaborate to successfully incorporate trees and soils into development projects. With the urban forest occupying premium real estate, regulation is necessary to mandate the preservation or replacement of the urban forest, its climate mitigation, and adaptation functions.

In this session, we provide an overview of Metro Vancouver's recent Tree Regulations Toolkit, and some examples of where these tools are being applied across Canada. The Toolkit provides urban forestry practitioners with guidance on selecting tools ranging from higher-level plans, tools regulating land use, and tools primarily regulating trees.

On the importance of private trees – a Canadian network of urban forest permanent plots

Prof. Alain Paquette[1], Tristan Lambry[1], Kayleigh Hutt-Taylor[2], Dr Rita Sousa Silva[3], Miss Elyssa Cameron[1], Dr Michaël Belluau[1], Dr Tonia De Bellis[4], Dr. Carly Ziter[2]
[1]UQAM, [2]Concordia University, [3]UNI Freiburg, [4]Dawson College

Parallel Session 2.3, Cardigan Hillsborough, October 3, 2022, 3:30 PM - 5:00 PM

Biography:
My work focuses on the relationship between biodiversity and ecosystem functioning. This young science (BEF) is rooted in the concern for biodiversity loss linked to global changes, with the accumulation of evidence of a generally negative impact on ecosystem functions. However, some aspects are still poorly understood or explored, among which how do these changes affect the ecosystem services that affect people, especially in cities?

The value of urban trees is increasingly recognized due to the ecosystem services they provide, particularly in a changing climate. However, trees themselves are also sensitive to the effects of climate change. Maximizing diversity is a key strategy to ensure resilient urban forests. Alongside this work, we urgently need to develop training programs about urban forest conservation, including citizen education and engagement.
Traditionally, urban forest research and planning are limited by the extent of available inventories. Most contain data on public trees, representing roughly half of urban trees. The other half, private and institutional trees, are almost completely unknown in terms of composition, diversity, and size distribution. Thus, researchers and practitioners are relying on a partial, and likely unrepresentative, dataset to make important urban forest management decisions.
Here, we present data from three urban forest plots in Montreal, (Eastern Canada), each encompassing multiple private and public green space types. Plots were surveyed using traditional as well as remote-sensing and citizen science techniques. While all three plots lacked diversity, we also noted differences in tree richness, composition, and size distribution across green space types – demonstrating the importance of including private trees in future inventories, and the need for methods to support this.
All three plots were established around higher education institutions (two universities, one college) as our objectives include research, teaching, and outreach. This communication is therefore also a call to establish a Canada-wide network of urban forest plots to continue building a more holistic understanding of urban forest diversity.

Assessing the effect of urban development on tree species performance in forest landscape restoration

Mr. Menilek Beyene[1]
[1]*University Of Toronto Scarborough*

Posters (presenters listed within) / Exhibits, Rustico/Tracadie, October 3, 2022, 5:00 PM - 6:30 PM

Biography:
Menilek Beyene is a second-year Ph.D. student in the Physical and Environmental Sciences Department supervised by Dr. Marc Cadotte. He has a deep interest in the environment, its connection to people, and our dependence on its functioning. His driving research interests are in determining how we can restore urban habitats to better provide services to people while conserving biodiversity and ecosystem stability. Menilek aims to continue research in ecological restoration that has meaningful impact in solving the many global issues we face today like climate change, environmental pollution, and species extinction.

Urban development and land-use change plays a significant role in habitat loss, reduced ecosystem functioning, and environmental pollution. Through the proliferation of roads, buildings, and other paved surfaces, urban centers have presented a homogeneous assemblage that reduce groundwater infiltration, absorbs more solar radiation, and increases carbon dioxide concentrations compared to their peri-urban surroundings. Growing efforts to counteract anthropogenic disturbances of natural systems have taken the form of forest restoration projects and organized tree-planting campaigns. When conducted in urban settings, these initiatives aim to address the effects of climate impacts through carbon sequestration, increasing surface reflectance, and restoring surface water infiltration. However, it can be expected that urban environmental changes influence the suitability of habitats for species by restricting their establishment and influencing species performance. For urban reforestation efforts to be successful suitable species with appropriate traits for urban site conditions must be determined.

My research addresses this gap by investigating urban forest landscape restoration projects in the Greater Toronto Area. I ask whether species assemblage (i.e., observed vs expected species abundances) and performance (functional traits, herbivory, resource uptake) in planted trees differ across a gradient of urban development. In addition, I test assumptions that landscape-level urban land use/cover patterns influence environmental conditions by measuring local site conditions, such as soil structure, nutrient concentrations, water content, and air temperature against predicted values of landscape models. I present this research through a conceptual model of urban forest restoration from the individual tree scale, and preliminary findings from the 2022 field season.

Using fine-scale perception and location data for resilient urban forests in a changing climate

Ms. Johanna Bock[1], Dr. Angela Rout[1]
[1]*University Of British Columbia*

Posters (presenters listed within) / Exhibits, Rustico/Tracadie, October 3, 2022, 5:00 PM - 6:30 PM

Biography:
Johanna Bock is a PhD student of Urban Forestry at the University of British Columbia where she examines benefits of urban greenspace use for human well-being. With an MS in health and ecopsychology, her interest lays in the mechanisms that keep persons living in diverse urban environments healthy and happy. Johanna's research combines different types of data - Public Participation GIS, traditional survey formats, census and landcover data. Currently, she forms part of a research collaboration that explores the application of new technologies in the context of natural asset management, and how these are perceived and used by the public.

Research shows that climate change events can have damaging risks for city residents. These risks, from events such as heat waves, storms, or heavy rainfall, can be partially mitigated by carefully planned and maintained urban green infrastructure. Some forms of ecosystem services (e.g. those that are regulatory) can passively support urban residents without active engagement. Other urban green space functions such as provisioning and cultural services, have been found to protect urban residents against some climate risks, yet they require active perceptual and behavioural engagement on behalf of citizens to fully realize these benefits. Our research project focuses on geolocated digital data to obtain insights into how people perceive and use urban green spaces. We offer a case study, highlighting park use and perceptions within the city of Vancouver, British Columbia, Canada; a city that is recognized as one of the greenest cities in the world, yet has suffered from significant climate risks in recent months including an extreme heat event and extensive flooding due to unprecedented rainfall. We leverage findings from a georeferenced survey and mobile data to describe how human green space use varies under different conditions, and according to socioeconomic factors. Using a poster format we map insights regarding visited locations, activities and perceptions, and will discuss implications and possibilities for applying digital surveys and mobile data to support resilient and equitable urban planning and management.

Assessing juvenile street tree sensitivity to climate variability in Halifax, Nova Scotia

Mr. Tyler Doucet[1]
[1]*Dalhousie University*

Posters (presenters listed within) / Exhibits, Rustico/Tracadie, October 3, 2022, 5:00 PM - 6:30 PM

Biography:
Hailing from Toronto, Ontario, Tyler has traveled from coast to coast in pursuit of his urban forest studies. He completed his Bachelor of Urban Forestry at the University of British Columbia before moving to Halifax, Nova Scotia where he is currently a Master of Environmental Studies candidate at Dalhousie University.

At Dalhousie University, Tyler is working on research projects that meet at the intersection of his academic interests; urban forest resilience, municipal forest management, and environmental governance. His thesis research explores participation in urban forest governance and the contributions that NGOs make in municipal forest processes, programs, and decision-making.

Urban environments oftentimes foster arduous growing conditions for street trees. Juvenile street trees are especially susceptible to stressors in built environments. Moreover, as climate conditions become increasingly extreme and variable, urban forests are at a greater risk of poor health and early mortality. Understanding the contribution of climate change in tree mortality is crucial for canopy cover accounting and retention. Using Halifax, Nova Scotia, as our study location, we measured and performed condition assessment on four cohorts of urban street trees planted between 2013 – 2016. The cohorts were remeasured and conditions reassessed five years following each initial measurement, allowing us to quantify the growth and morality of 5403 trees. This study explores factors contributing to early tree mortality to explain divergences in growth and mortality rates across the four cohorts and various species. Two candidate hypotheses for the high mortality rates are drought-stress and early dehardening and budbreak. In comparing historical climate normals with the seasonal weather conditions following planting, we can infer (1) if present, whether weather anomalies adversely affected the survival of each cohort of street trees, (2) which species are more tolerant and resilient to outlier temperature and rainfall events and (3) if high mortality rates are in part a consequence of climate change. The results of this study can inform urban forest management in municipalities across Canada. Understanding the impact of climate change on mortality is crucial for urban forest practitioners who can bias their maintenance practices and species selection to promote greater tree survivorship.

Urban tree pollens: a step forward in increasing capacity to predict identity and concentrations

Miss Sarah Tardif[1], Prof. Alain Paquette[2], Mme Isabelle Laforest-Lapointe[3], Prof. Alain Paquette[1]
[1]Université Du Québec À Montréal, [2]FRIAS, University of Freiburg, [3]Université de Sherbrooke

Posters (presenters listed within) / Exhibits, Rustico/Tracadie, October 3, 2022, 5:00 PM - 6:30 PM

Biography:
Sarah Tardif completed a master's degree in forest ecology in Nancy (France), and she has specialized in urban forests during her graduation internship. She worked on the influence of urbanization rate and tree diversity on bird and arthropod predation and also on herbivory on lime trees of Nancy. Urban forests have charmed her and she continues to study them during her PhD, which she has started in September 2021 in Alain Paquette's laboratory at the university of Quebec at Montreal. Her research focuses on urban pollens and the relationship with human health and allergies.

Exposure to allergenic pollen is a risk factor for respiratory allergies and a major public health concern, especially as climate change is lengthening the pollen season. Pollen concentrations vary spatially and temporally, and therefore pollen monitoring is an important tool for research and healthcare improvement. However, little is known about how levels of pollen types and species vary within a city and whether this variation affects the development or exacerbation of allergic reactions. Pollen concentrations are often obtained from a single station used to represent exposure over a large geographic area. Furthermore, due to negligible morphological differences between related species, pollen grains are rarely identified at the species level. In this project, pollen is being collected with 24 gravimetric traps during the pollen season placed throughout the island of Montreal. Portable samplers are also used to collect pollen in high-traffic areas. Simultaneously, we launched an online survey of allergy sufferers to better understand the relationship between the severity of allergic symptoms and the concentration of each pollen species at the local level. The ultimate goal of the project is to develop spatial models to characterize pollen exposures based on the collected pollen data and environmental predictors, such as land use and land cover variables, vegetation composition, flowering time, and meteorological parameters relevant to pollen release and dispersal, which will represent a major step forward toward a better pollen forecast for people with pollen-related allergies or asthma to manage their symptoms.

Toward an improved monitoring of GHG emissions and removals from Canadian urban trees

Cyr D[1], Grenier-Héon D[2], Samson C[1]
[1]Environment and Climate Change Canada - Pollutant Inventories and Reporting Division, [2]Université du Québec à Montréal

Parallel Session 3.1 - Coordinated Presentation/Présentation coordonnée, Tignish, October 4, 2022, 8:30 AM - 10:00 AM

Biography:
Dominic Cyr is a research scientist at the Pollutant Inventories and Reporting Division at Environment and Climate Change Canada. He has a background in fire ecology and natural disturbance-based forest management, but has recently focused on forest carbon modeling, trying to improve the quantification of tree-related GHG sinks and sources within Canada's official monitoring and reporting framework.

Environment and Climate Change Canada (ECCC) has the mandate to prepare and submit the National Inventory Report (NIR) to the international community. The NIR documents GHG sources and sinks in Canada, including the contribution of urban trees. Producing national estimates in compliance with UNFCCC standards presents specific challenges. Here we present those, provide an overview of estimates covering 1990 to 2020 based on our current methodology, and discuss known limitations as well as possible biases. The increasing availability of high-resolution remote sensing data, as well as ongoing field projects and collaborations that aim at providing more accurate allometric models and growth parameters, presents opportunities to address several of those limitations.

Developing allometric equations to estimate carbon stocks in urban trees using multisource LiDAR data

The allometric equations currently used to estimate urban tree biomass to produce Canada's National Inventory Report either come from natural forests or from the United States, casting a great deal of uncertainty on carbon estimates.
By combining terrestrial, mobile and airborne LiDAR data sampled in Montreal, we developed a collection of new allometric equations to estimate tree volume and biomass from a variety of input data. We assess how interspecific and inter-site variability influence allometry, and how that variability can guide us extrapolating estimates in a variety of urban contexts based on the best information available. We also compare urban-specific allometric models with those obtained from the natural forest and quantify biases associated with the use the latter types of model to fill data gaps in urban environments.

Monitoring urban expansion and associated impacts on urban forest carbon stocks using the Landsat archive

For GHG reporting to the UNFCCC, urban areas are part of the "Settlements" category. There are currently no data products that delineate urban areas or settlements consistently across Canada, contributing to the uncertainty of national estimates. Moreover, emissions and removals associated with land use conversion must also be reported, further contributing to the need for a reconciled and authoritative land use and land use change data product.
Using Sentinel 2 and Landsat archives in combination with Continuous Change Detection and Classification algorithm, we documented a time series of urban expansion in the Metropolitan areas of Canada from 1990

to 2020. We also identified key land cover subcategories predicted with high resolution imagery and used to stratify urban growing environments to better estimate carbon stocks and sequestration rates across Canada.

Conclusion

Even after a successful operationalization of those improvements, several data gaps are likely to persist. We will thus conclude by presenting ECCC's "wish list", hoping to generate new collaborations that will both contribute to improve national and local estimates.

Co-Managing the Urban Forest for Climate and Human Health Resilience

Ms. Catherine Dowdell, Heather Johnstone, Ryan Senechal, Dr. Sara Barron[1], Dr. Sara Barron[2]
[1]University of Washington, [2]University of British Columbia

Parallel Session 3.2, Bonshaw, October 4, 2022, 8:30 AM - 10:00 AM

Biography:
Sara is a lecturer in UBC's Masters of Urban Forestry Leadership. Prior to this role, she was a lecturer in the Master of Urban Horticulture program in the School of Ecosystem and Forest Sciences at the University of Melbourne, Burnley campus. Sara's research interests bridge landscape architecture and urban forestry. Her PhD focused on how suburban landscapes can be re-imagined to balance healthy suburban forests with higher density housing. She has expertise in large-scale sustainable community planning and climate change research projects and holds a Landscape Architecture degree from UBC.

In recent years nations and cities are responding to two sets of crises – climate and human health. The challenges and implications of each are both distinct and interrelated. Research indicates that the urban forest is a nature-based solution that can promote resilience through climate adaptation and promotion of human health. Our team will present from two recent projects and publications that translate research on urban forest benefits to best practices that are implementable at multiple scales. First, the Greening Blocks project offers a site-to-neighborhood scale typology to effectively integrate trees into built environments, while also promoting the human experiences of nearby nature that boost physical, mental and social health. We'll present the design guidelines including: View from within, Plant entrances, Bring nature nearby, Retain the mature, Generate diversity, Create refuge, Connect experiences, and Optimize green infrastructure. Another project, done in collaboration with the US Forest Service, is a menu of urban forest planning and management options that comprehensively generate a wide and long view on trees in cities to optimize climate adaptation while also integrating the latest research on nature-centered health response. The menu is structured as nine Strategies, each further detailed as Approaches and Tactics. The strategies range in scale from city-wide policies and planning, to natural areas management, to trees in built environments. All are presented as context for human health intervention, either by reducing direct climate impacts (such as urban heat) or by addressing the physical and mental health public health issues associated with climate change.

A Métis Nation Perspective on Urban Forests and the Challenges of Climate Change

Miss Tayler Fleming[1]
[1]*Manitoba Métis Federation*

Parallel Session 3.2, Bonshaw, October 4, 2022, 8:30 AM - 10:00 AM

Biography:
Tayler Fleming is the Green Initiatives Coordinator for the Manitoba Métis Federation (MMF), responsible for the planning and implementation of environmental programs that aim to lessen the effects climate change may have on the Red River Métis Community and educational programs that bring Métis Citizens and youth together on-the-land to learn about the history of Métis Culture and its integral link with stewardship.

Tayler holds a BSc from Brandon University, a diploma from Assiniboine Community College, and has dedicated her time to building MMF's Make Our Homeland Green Again Initiative - a 2 Million Tree Commitment, from the ground up.

The Métis Nation is among 3 Indigenous Peoples within Canada with a large footprint spanning across the provinces and territories and into the United States of America. Having rooted at the fork of the Red and Assiniboine River in Manitoba, Canada, the Red River Métis blossomed into a culture unique to none other. Historically, the Métis Nation was strong in the trading industry relying on close connections with the lands, waters, and environment for both livelihood and sustenance. Therefore, it was, and still is, imperative that the Red River Métis work to protect the environment for today and for future generations. The Manitoba Métis Federation (MMF), through an initiative entitled – Make Our Homeland Green Again, has committed to planting two million trees across the Homeland of the Métis Nation to join the fight against climate change.

A key part of this initiative includes expanding urban forests. Urban forests can capture carbon directly at the source aiding in the removal of emissions from communities. And, through the planting of an edible forest network across the Métis Homeland, the MMF will bring nature back into communities providing opportunities for healing, reconnecting with one’s cultural practices, and harvesting of traditional plants within city limits. Urban forests have an integral role in continuing to connect Métis people to the environment and the communities in which they live. Having a role in the greening of urban spaces has the potential to bring justice to the Red River Métis and spread equity across urban populations.

Urban Food Trees and Climate Resilience

Ms. Janina Kowalski[1]
[1]*University Of Toronto- Mississauga*

Parallel Session 3.2, Bonshaw, October 4, 2022, 8:30 AM - 10:00 AM

Biography:
Janina Kowalski (she/her) is a PhD candidate in Geography at the University of Toronto- Mississauga. Her research is on urban food trees across Canada focusing on their governance, human-environment interactions, and equity. She completed field work in Victoria, Calgary, Edmonton and Toronto in the summer of 2019. Janina has volunteered with Susan Poizner at the Ben Nobleman Park Community Orchard in Toronto for the past five seasons, and is very excited to learn more about fruit tree grafting.

Urban dwellers and municipal actors are increasingly considering the impacts of climate change and developing strategies to support urban resilience. Urban forests are recognized as one approach to locally address climate impacts with recent studies exploring strategies for mitigation and adaptation. This presentation explores the different ways that urban food trees may be a valuable way for urban populations to engage with the urban forest and support social resilience in the context of climate change. Given their placement between urban forestry, urban agriculture, and community development, urban food trees are a unique way to address urban climate resilience. Interviews were conducted with food tree volunteers, associated not-for-profits, and municipal actors in Victoria, Calgary, Edmonton, and Toronto. Policy documents related to food security and climate change were also evaluated to determine current and potential opportunities for integration of food trees within climate resilience strategies. Results indicate that planting and caring for urban food trees in public spaces creates opportunities for urban populations to learn vital skills and knowledge to support food production and maintain a source of local cultivars to use for future propagation. Additionally, engagement with food trees and the consideration of future generations may ease distress in the face of climate change. This presentation will also discuss findings related to the benefits and challenges of integrating urban food trees into the urban forest in light of the changing climate.

Integrating density and forests for climate-resilient cities

Ms. Zhaohua Cheng[1], Dr. Lorien Nesbitt[1], Ms. Julieta Alva[1], Dr. Stephen Sheppard[1], Prof. Cecil Konijnendijk[1], Ms. Sophie Nitoslawski[1]
[1]*University Of British Columbia*

Parallel Session 3.3, Cardigan Hillsborough, October 4, 2022, 8:30 AM - 10:00 AM

Biography:
Zhaohua (Cindy) Cheng is a PhD candidate at the Urban Natures Lab, the University of British Columbia (UBC). She has over five years of experience in community and youth engagement, climate change adaptation, student advising and engagement, and project management. Her PhD research focuses on exploring urban forest-based solutions for climate resilience and urban livability. Besides her PhD, she is a researcher at the Collaborative for Advanced Landscape Planning (CALP) and the Coordinator of the Bachelor of Urban Forestry Program at UBC.

Densification, increased building or population density, has been recognized and practised by many cities as a way to mitigate and adapt to climate change and other urban challenges, such as housing affordability, walkability, and access to amenities. Many terms, such as compact cities, complete neighbourhoods, and transit-oriented communities, are used to describe favourable urban development patterns that encourage higher density. Densification is also preferred as it constrains urban expansion and thereby minimizes the negative impacts of urban sprawl on surrounding ecosystems. However, within urban areas, densification has become a threat to urban forests, which indicates a weak integration amongst climate action, urban forestry and urban planning policies. In fact, urban forests have only recently been considered as part of climate action planning in Canadian cities. Previous studies have indicated potential conflicts between urban greening and densification as part of climate actions. But there is very little research that clearly maps the relationships, including trade-offs, between urban greening and densification. This presentation will introduce a study that aims to fill the gap by interviewing key informants to understand the synergies and trade-offs between various climate action and urban forestry practices in Metro Vancouver, BC. The presentation will go over the rationale, methods, key findings of the study. Suggestions will be provided at the end of the presentation on addressing potential trade-offs while sustaining synergies in Canadian cities.

Resilient urban forests for Canadians: How urban trees coped with past climate events.

Mme Meggy Legault[1], Dr. Kaisa Rissanen[1], Dr Greg King[2], Dr Daniel Kneeshaw[1], Prof. Alain Paquette[1]
[1]Université du Québec à Montréal (UQAM), [2]University of Alberta

Parallel Session 3.3, Cardigan Hillsborough, October 4, 2022, 8:30 AM - 10:00 AM

Biography:
Post-doctoral researcher at the lab of Alain Paquette (Paqlab), Université du Québec à Montréal (UQAM). In my master's and doctoral studies at the University of Helsinki, I studied tree physiology and ecophysiology, concentrating on the relations between water transport, defence systems and emissions of volatile organic compounds in Scots pine forests. In my current post-doc, I've switched studying tree functions from natural to urban systems. I work to understand both the temporal and spatial water use patterns of urban trees, analysing for example the potential impacts of dry periods on the trees' potential to transpiration and cool the air.

Urban trees are expected to help in mitigating the negative effects of climate change on infrastructures and human well-being in cities, for example through their ability to cool the air by transpiration and to reduce storm water run-off. However, warming climate and potentially longer and more intensive dry and hot periods will also affect tree function and survival in cities. To better understand the resilience and resistance of urban trees in face of climate change, we conduct a Canada-wide collection of tree cores from cities with diverging climates. Currently, the participating cities include Edmonton, Montreal, Quebec City, and Halifax, the climates ranging from continental to maritime and annual mean temperature from 3 to 7 °C. Using dendrochronology tools, we assess the tree growth responses to dry and hot periods, comparing between common urban tree species with different water-use strategies, and between trees in parks and on streets to cover the heterogeneity in urban environmental conditions. Finally, by examining the tree growth responses over the climate gradient, we aim to form predictions on the growth and resilience of urban trees in the future conditions. Our preliminary results from Montreal show that trees in streets tend to be more resilient to droughts, in addition to present a similar variability in growth than trees in parks. These results invalidate the initial hypotheses and increase the fact that with richer data, we will be able to identify best practices for developing resilient urban forests that will support ecosystem services now and in the future.

The Role of Small and Medium Sized Municipalities in Urban Forest Planning and Management

Tree Canada

Tree Canada Session, Cardigan Hillsborough, October 4, 2022, 10:30 AM - 12:00 PM

Format: The multi-disciplinary panel is composed of three panellists and one facilitator. A total of 15 minutes will be allocated for panelists to share their initial thoughts. The remaining 45 minutes will consist of a panel discussion led by the facilitator, based on pre-identified questions and questions from the audience.

Intro:
Nicole Hurtubise, CEO, Tree Canada

Moderators:
Michael Petryk, Director of Operations, Tree Canada
Katherine Forster, Program Manager, Tree Canada

Speakers:
Sandy Smith, Professor and Director of Forestry Programs, University of Toronto,
Kevin Rankin, Manager of Parks and Forestry Operations, City of Barrie
Dustin Carey, Lead, Land Use Sector Development, Green Municipal Fund, Federation of Canadian Municipalities

Urban forests – trees, forests, green spaces, and related abiotic and biotic components in areas extending from urban cores to urban fringes – generate multiple environmental, social, and economic benefits. These include improved well-being of communities through enhanced tree canopies and green infrastructure; citizen engagement and stewardship; enhanced local biodiversity and wildlife habitat; and, improved stormwater management, erosion control and flood protection.

Sustained planting, protection, and maintenance of trees, forests, greenspaces, and related resources in and around urban areas require effective urban forest management planning. Municipal governments play an essential role in maximizing and sustaining the impact generated by growing, protecting, and maintaining the canopy. While larger cities have the resources to develop and implement urban forest management planning, small and medium sized municipalities often struggle to do so, lacking the expertise to develop locally adapted plans as well as the budget to implement them over multiple years. Building the resilience of urban forests in the face of climate variability and impacts (extreme temperatures, drought, pest outbreaks) now represents an additional set of challenges.

The panellists will explore the essential components of urban forest management planning and the type of resources required by small and medium municipalities to implement these plans.

Smart urban management for invasive EAB

Dr. Rhoda deJonge[1], Preetpal Singh[2, 3, 4]
[1]BioForest/Lallemand Plant Care, [2]Natural Resources Canada, [3]Canadian Forest Service, [4]Institute of Forestry and Conservation, University of Toronto

Parallel Session 4.2, Bonshaw, October 5, 2022, 8:30 AM - 10:00 AM

Biography:
Rhoda deJonge is the Technical Manager for Urban Forestry at BioForest/Lallemand Plant Care. She completed her PhD at the University of Toronto's Faculty of Forestry where she studied native biological controls for invasive species management. In her current position, she conducts research on biologically-based solutions to help solve urban forestry problems including tree establishment and invasive pest management. Her research assures that BioForest/Lallemand is able to make evidence-based decisions on the efficacy of their products in order to provide low-toxic biologically-based solutions for urban forestry applications. Rhoda lives in Hamilton, ON with her charming husband and two ridiculous children.

The financial burden Canadian municipalities' bear in combatting the negative impacts of invasive species will only increase in the coming decades due to climate change. Municipalities are seeking direction for the best and most-efficient use of labour and resources to restore and improve canopy coverage, even with increased threats from invasive species that will thrive due to warmer climates. Using the case study of the invasive wood-boring beetle, Emerald Ash Borer (EAB), our study, developed in partnership with the University of Toronto's Faculty of Forestry and the City of Toronto, investigates factors present in urban environments that may influence EAB pest pressure. This study is the first of its kind as it discusses key factors influencing successful treatment programs and ways that management can be directed in order to build resilient urban forests in a changing climate. The results of this study may provide a template for effective management of future invasive urban forest pests.

Sources of variability in water use and water status of trees in urban environment

Dr. Kaisa Rissanen[1], Dr Gauthier Lapa[1], Dr Daniel Kneeshaw[1], Dr Daniel Houle[2], Prof. Alain Paquette[1]
[1]Université Du Québec À Montréal, [2]Environment and Climate Change Canada

Parallel Session 4.2, Bonshaw, October 5, 2022, 8:30 AM - 10:00 AM

Biography:
Post-doctoral researcher at the lab of Alain Paquette (Paqlab), Université du Québec à Montréal (UQAM). In my master's and doctoral studies at the University of Helsinki, I studied tree physiology and ecophysiology, concentrating on the relations between water transport, defence systems and emissions of volatile organic compounds in Scots pine forests. In my current post-doc, I've switched studying tree functions from natural to urban systems. I work to understand both the temporal and spatial water use patterns of urban trees, analysing for example the potential impacts of dry periods on the trees' potential to transpiration and cool the air.

Water use of urban trees is linked to their capacity to cool air by transpiration and control storm water, and to their survival and growth in potentially stressful urban environments. Both spatial characteristics such as tree location or species, and temporal drivers such as weather conditions are known to drive the tree water use and water status, but these effects have not been well quantified in urban environments. For example, street trees surrounded by paved surfaces have reduced access to rainwater, but they may profit from alternative water sources. Both these effects can strongly shape the tree water use patterns and vulnerability to drought. In addition, as long-living species, trees can acclimate in response to their conditions by changes in their structure and functions.

Here, we present two interlinked studies exploring the variability in tree water use and acclimation to urban conditions. First, we used sap flow sensors to study water use of in total 54 trees in parks and streets of Montreal to better understand how the location and species affected water use and water status, and whether they defined the responses of water use to dry periods during the growing season. After finding small species-level differences between the study locations, we investigated potential location-wise differences in the wood anatomy related to water transport safety and efficiency. These differences hinted that urban trees may have an important capacity to adjust their vessel sizes and distribution to buffer the potentially unfavourable location effects on water use and status.

How can urban forestry contribute to climate justice in Canada?

Dr. Lorien Nesbitt[1]
[1]*University of British Columbia*

Parallel Session 4.3, Cardigan Hillsborough, October 5, 2022, 8:30 AM - 10:00 AM

Biography:
I seek to create more liveable and equitable urban environments. During my career, I have had the privilege to work with communities and organizations across Canada and internationally to achieve sustainability and environmental justice goals.

My research focuses on urban forestry and social-ecological interactions in urban environments, with an emphasis on environmental justice, human health, well-being, and climate change. In the realm of environmental justice, my current research is particularly concerned with understanding the nature and dynamics of green gentrification, i.e., the physical or psychological displacement of residents due to local greening activities.

As climate change worsens, climate justice is an increasingly important issue in Canada. Climate justice refers to the equitable distribution of the impacts of, and involvement in responses to, climate change. Impacts such as heat waves and flooding are becoming increasingly common, calling us to consider how those impacts and our responses to them are distributed, and who is involved in crafting responses and building resilience. Given the well-known microclimatic and wellbeing benefits of urban forests, urban foresters have a role to play in building urban climate resilience in an equitable way.

Distributional green equity analyses have highlighted the inequitable distribution of urban forests in various contexts. When we consider that those populations that are least likely to have high-quality urban forest access are often those who are most vulnerable to climate change impacts such as heat waves, climate justice becomes a clear issue of public health and wellbeing, as well as urban forest management.

Given these realities, how can urban forestry contribute to climate justice in Canada? This presentation will consider how to improve climate justice, building on distributional green equity research and the potential for urban green gentrification, i.e., the physical or psychological displacement of marginalized urban populations due to urban forest improvement. It will highlight potential pitfalls of urban greening programs and present a path toward climate justice in Canada based on holistic environmental justice, recognitional green equity and mosaic governance.

Wealthy, educated, and... non-millennial? Patterns of inequitable distribution of urban vegetation in Canada

Ms. Jessica Quinton, Dr. Lorien Nesbitt
[1]*University of British Columbia*

Parallel Session 4.3, Cardigan Hillsborough, October 5, 2022, 8:30 AM - 10:00 AM

Biography:
Jessica Quinton is a PhD Candidate at The University of British Columbia. Her research focuses on issues of environmental justice and green gentrification in Canadian cities. She hopes her research can be used to inform more equitable outcomes and processes of governance and management of urban forests.

Urban forests, including trees and other associated vegetation, are critical for creating resilience to the impacts of climate change. However, previous research (primarily conducted in the USA) suggests that canopy cover and green space are not always equitably distributed, often leaving low-income, racialized, and less-educated households more vulnerable to the impacts of climate change. Our study assesses the distribution of urban vegetation in 31 Canadian cities to determine whether certain social-economic/demographic factors are associated with increased vegetation. Using spatial lag models, Canadian census data, and urban 'greenness fractions' derived from Landsat imagery, we find diversity in the factors associated with increased urban vegetation between cities. This makes it difficult to establish a single overarching narrative about the state of environmental and climate justice relating to the distribution of vegetation in Canadian cities. Greater household income and educational attainment were positively associated with proximity to vegetation in numerous cities, while the proportion of millennials was often negatively associated. Variables including the proportion of visible minorities, Indigenous people, and recent immigrants infrequently had significant associations with urban vegetation. These results highlight the need for urban forestry planning and management actions tailored to individual Canadian cities to improve green equity and climate resilience for marginalized and underserved groups. Funding for public and private greening initiatives and maintenance; democratic participation, engagement, and education opportunities for residents; climate-adaptation planning that considers the challenge of greening dense environments; and consideration of potential negative outcomes of greening, such as gentrification, are necessary.

The Role of Environmental Justice in Combating Climate Change in Vulnerable Communities

Mr. Matt Spitsen
[1]*Arbor Day Foundation*

Parallel Session 4.3, Cardigan Hillsborough, October 5, 2022, 8:30 AM - 10:00 AM

Biography:
Matt Spitsen leads the Arbor Day Foundation's Alliance for Community Trees (ACT) program, a network of community-based organizations that plant and care for trees in cities and towns across North America. He provides ACT members with educational and networking opportunities, professional resources, and access to funding opportunities with the Arbor Day Foundation's donors and corporate partners around the world. For over 16 years Matt has served in director roles in the nonprofit sector with organizations like Nonprofit Hub, Launch Leadership, the Boy Scouts of America Cornhusker Council and the Leadership Council for the Young Nonprofit Professionals Network in Lincoln, NE.

The Role of Environmental Justice in Combating Climate Change in Vulnerable Communities
Environmental Justice is the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. It's often these communities that feel the impacts of climate change the hardest, as racist housing practices have left these communities with much lower tree canopy percentages than their richer and whiter neighbors. To equitably move forward with urban forestry best practices that tackle climate change, it's imperative our organizations do so with an Environmental Justice lens to meaningfully engage under-served and low-canopy communities.

Since 2020, the Arbor Day Foundation has been prioritizing Environmental Justice with partners that plant and care for trees in cities and towns across North America. Through the Foundation's Alliance for Community Trees program, an in-depth training series on Environmental Justice was facilitated to this network of 200 community-based tree planting organizations in 2021. This training series focused on strategies to meaningfully engage community members, ensuring their involvement to increase the tree canopy in their communities.

In this presentation you will learn how the Arbor Day Foundation has been working with its network of planting partners to advance Environmental Justice best practices in cities and towns – in addition to the Foundation's new Environmental Justice Grant Program, which is providing multi-year support to organizations to increase their capacity for community engagement and planting trees where they're needed most.

The Future of Urban Forestry

Dr. Sara Barron[1], Ms. Catherine Dowdell[1], Ryan Senechal[1], Heather Johnstone[1]
[1]*University Of British Columbia*

Parallel Session 5.1 - Panel, Tignish, October 5, 2022, 10:30 AM - 12:00 PM

Biography:
Sara is a lecturer in UBC's Masters of Urban Forestry Leadership. Prior to this role, she was a lecturer in the Master of Urban Horticulture program in the School of Ecosystem and Forest Sciences at the University of Melbourne, Burnley campus. Sara's research interests bridge landscape architecture and urban forestry. Her PhD focused on how suburban landscapes can be re-imagined to balance healthy suburban forests with higher density housing. She has expertise in large-scale sustainable community planning and climate change research projects and holds a Landscape Architecture degree from UBC.

Extreme weather events have altered our urban forests in a myriad of different ways. From extreme heat, to unprecedented wind, to prolonged drought, the trees in our cities are facing new climate realities. These challenges create opportunity to think strategically about how different urban forestry scenarios could play out over the next decades. In this interactive panel session, three graduates from the first cohort of UBC's Faculty of Forestry Master of Urban Forestry Leadership program draw on their personal, professional and program experiences to provide future urban forestry scenarios specific to their regions. Using a 2x2 scenario framework, the graduates showcase plausible urban forestry scenarios specific to their regions: the City of Victoria, British Columbia; the City of Calgary, Alberta; and the City of Perth in Western Australia.

The panel will discuss the logic behind their scenario creation and share how futures thinking can shift organisational mindsets to build resilience in our urban forests. The panel will cover topics of urban forest governance, assessment, adaptation to climate change, strategic thinking, and policy analysis. Each unique case study highlights ways that urban forest leaders can plan for local climate impacts, and how those plans can fit within the unique governance infrastructure of their communities. While highlighting differences in climate realities, the panel demonstrates how the urban forest community can work together to support emerging leaders in their quest to plan and manage for the future.

Growing Climate Resilient Urban Forests: Canada's Contributions

Ms. Christy Arseneau, Ms. Verna Crossman, Dr. Dan McKenney, Mr. Michael Petryk, Natural Resources Canada[1]
[1]*Natural Resources Canada, Canadian Forest Service*

Parallel Session 5.2 - Panel, Bonshaw, October 5, 2022, 10:30 AM - 12:00 PM

Growing climate-resilient urban forests is complex, and requires solutions to address research, policy and practice gaps. This panel presentation will highlight how Natural Resources Canada's 2 Billion Trees program builds on the Canadian Forest Service's ongoing history of urban forest-relevant research and convenor role by supporting communities and cities across Canada in their efforts to grow more climate resilient urban forests.

Trees planted in cities are exposed to diverse abiotic stresses, such as drought, air pollution or roadwork traumas, making them more vulnerable to pests and diseases. In the context of climate change, cities need the right trees – resilient species adapted to these conditions - in increasing quantities. Moreover, the human well-being, infrastructure and environmental co-benefits of urban forests are increasingly being recognized, meaning once we have the right tree, how do we ensure it is planted in the right place for long-term survival and access?

Preparing the urban forest supply-chain to meet ambitious canopy cover targets

Dr. Darby McGrath[2], Mr. Steve Robinson[3]
[1]BioForest/Lallemand Plant Care, [2]Vineland Research and Innovation Centre, [3]City of Burlington

Parallel Session 5.3, Cardigan Hillsborough, October 5, 2022, 10:30 AM - 12:00 PM

Biography:
Darby McGrath is the Senior Research Scientist for Environmental Horticulture and Program Lead for the Plant Response & Environment at the Vineland Research and Innovation Centre. She is also the Leader of the newly launched, Greening the Landscape Research Consortium at Vineland.

Her research is focused on developing solutions to improve urban tree establishment by working with tree production nurseries, the landscape sector, developers, consultants and municipalities. She has a MES and PhD from the University of Waterloo. She is also an adjunct professor at the University of Waterloo and Brock University.

Dr. Rhoda deJonge

Biography:
Rhoda is the Technical Manager of Urban Forestry at BioForest/Lallemand Plant Care where she oversees research on ways to use microbial technology to improve urban tree survivorship at time of planting and invasive species control. Rhoda completed her PhD at the University of Toronto's Faculty of Forestry, studying the biological control of invasive species in the urban forest, and has worked as a post-doctoral fellow with the Faculty of Forestry and Agriculture and Agri-food Canada. Prior to her work in academia, Rhoda gained valuable project management experience in the environmental non-profit sector in both the USA and Canada.

In order for cities to grow their urban forest canopy, the formula appears rather simple: the right trees, plus the right conditions, plus the right care equals success. These simplified "tree chain of custody" steps, however, represent activities along a very complex supply chain in Canada. In the urban forest supply chain, there are distinct production phases with multiple producers involved in the 10+ year cycle before a tree is ready for sale. The distribution channel tends to be very complex, with procurement processes that include low-bid tendering, planting by third parties, and a strong marketplace with influences on species-selection trends. Once in the landscape, urban trees face harsh artificial conditions with budget-restricted maintenance which limit the success of tree planting and ultimately, make it challenging to meet aggressive canopy enhancement targets.

Given that there is heightened demand for urban tree planting as natural climate solutions become the norm, how can we prepare the supply chain to meet these demands? This panel will outline findings from recent studies working with urban forest supply chain members investigating obstacles to successful urban forest growth and establishment. The panel will explore the potential benefits of an integrative interdisciplinary approach to knowledge-sharing all along the urban tree supply chain. The three pillars of the new approach will be discussed by panelists including 1) Information sharing for evidenced-based practice 2) New approaches for enhanced decision-making and 3) Developing tools for monitoring and evaluating new practices.

Now is the Time for Trees: Celebrating leadership and the delicate chemistry of strong urban forestry programs

Dan Lambe

Closing // Keynote, Cardigan Hillsborough, October 5, 2022, 1:30 PM - 3:00 PM

Biography:
Dan Lambe is the president of the Arbor Day Foundation, an organization founded in 1972 that has grown to become the largest nonprofit membership organization dedicated to planting trees. During his 15 years with the Foundation, Dan has led the development of innovative programs that expand the organization's global reach — including international forest restoration efforts and the most recent Tree Cities of the World program. In addition, Dan spearheads the Arbor Day Foundation's Evergreen Alliance — a strategic group of corporate leaders dedicated to helping the organization meet its recently announced Time for Trees initiative to plant 100 million trees and inspire 5 million tree planters by 2022.When not educating and empowering people to plant, nurture and celebrate trees, Dan is often training and struggling to complete triathlons or searching for another unique restaurant to explore. He finds any chance possible to travel for fun and adventure with his wife and two fantastic kids.

In this presentation, Lambe emphasizes the urgency of this critical moment in time, and the powerful work of urban forests to provide a solution to help people and the planet. He calls out the key elements and catalysts that build sustainable and high impact programs and make a difference on people's lives. He will offer an optimistic call to action for all attendees around the role they play in this essential community of leaders.