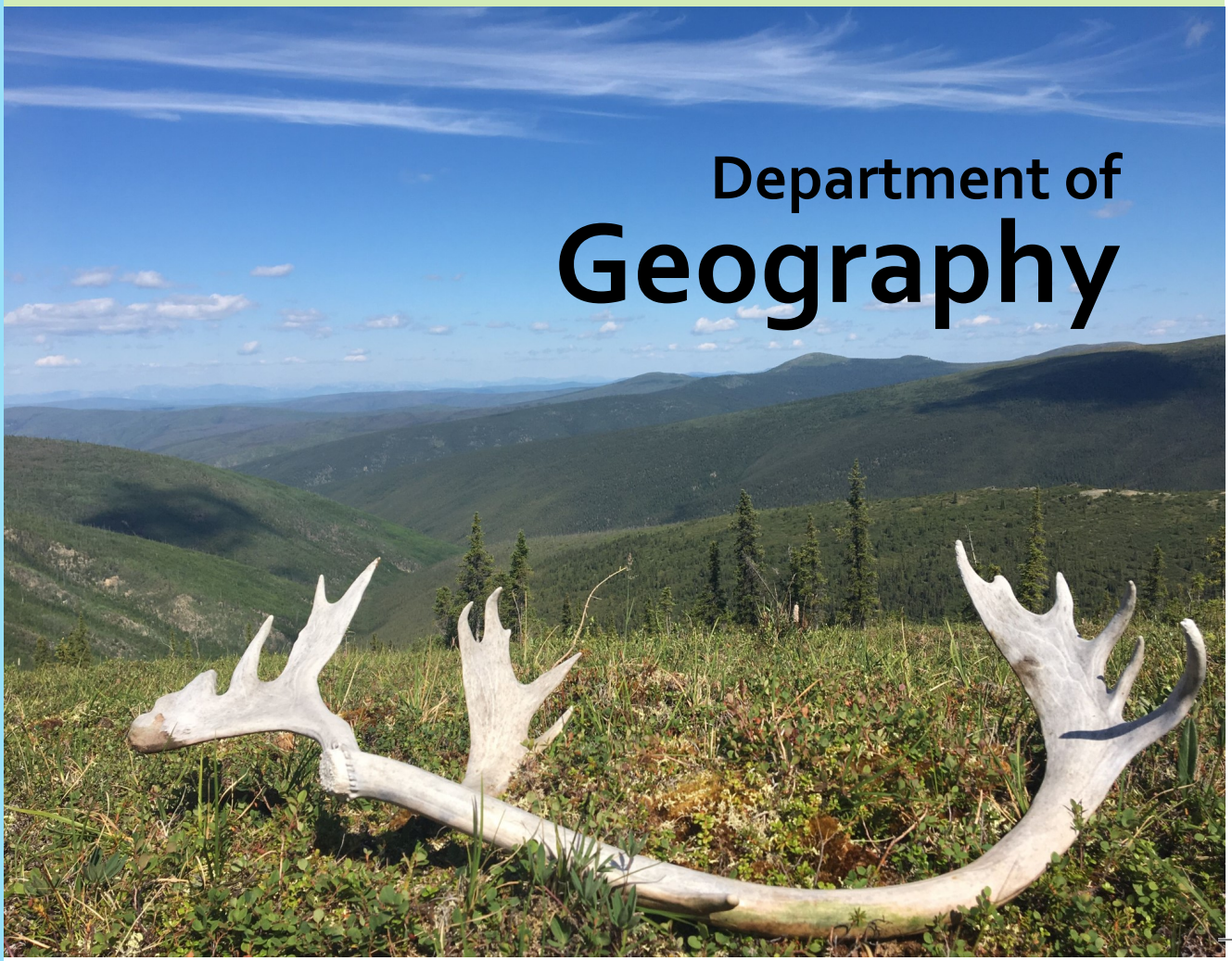
MEMORIAL UNIVERSITY

Research Report

2020-21



Department of Geography

WELCOME MESSAGE

Dr. Arn Keeling, Head of Department

Dr. Carissa Brown, Graduate Officer

It is our pleasure to introduce this fifth edition of the Department of Geography Research Report, highlighting the breadth, scope, dynamics, and significance of our actvities. This work is aligned with our five **research clusters:** Climate and Environmental Change; Globalization, Economy, and Resources; Health and Well-being; Society, Knowledge, and Values; and Sustainable Communities and Regions. As usual the report includes profiles of faculty members, graduate students, and affiliated researchers and their work. This edition features just some of the diverse and exciting research in Geography at Memorial, including: self-built housing in Inuit Nunaat; the links between urban mobility and migration in Atlantic Cities; Indigenous and settler wildfire management in Northern Saskatchewan; tracing microplastics in the marine environment; reconstructing past climate and human settlement at L'Anse aux Meadows; exploring global ocean change; Indigenous knowledge and technology for sea ice monitoring; and urban forests and climate change.

Support from the Faculty of Humanities and Social Sciences to produce this report is gratefully acknowledged.

RESEARCH

Our departmental website (www.mun.ca/geog/research/projects/) provides links to information on all our research activities. We welcome researchers and visitors from around the globe, in our continuing efforts to highlight human-environment relationships that benefit communities and society worldwide.

Our research interests encompass five clusters

Globalization, Economy, and Resources

Examples of ongoing research projects include study of community and small-scale fisheries; community engagement in mine closure and remediation; international trade in rubbish electronics; and community rights to resources in Atlantic and Arctic Canada.

Sustainable Communities and Regions

Examples of ongoing research projects include building sustainable communities in the coastal subarctic; complexity in multiple-use coastal areas; global small-scale fisheries; and immigrant settlement and retention in Atlantic Canada.

Climate and Environmental Change

Examples of ongoing research projects include SmartICE: Integration of Inuit Qaujimajatuqangit in sea-ice monitoring and forecasting; global treeline range expansion and impacts of fire in boreal forests; habitat and environmental impacts on cold-water corals; and forecasting Grand Banks fog.

Society, Knowledge, and Values

Examples of ongoing research projects include analysis of human dimensions in wildlife resources in boreal and northern regions; GIS analysis of marine habitats and marine protected areas; and monitoring marine plastics in extreme environments.

Health and Well-Being

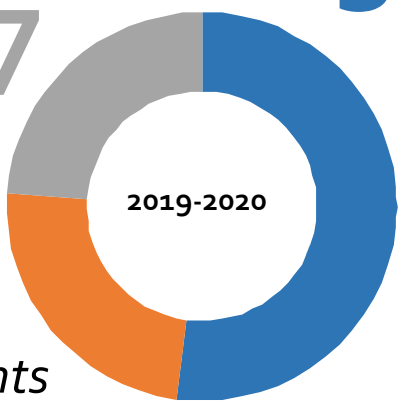
Examples of ongoing research projects include analysis of Anthropocene impacts in marine and coastal regions; community-based economic development in Atlantic Canada; and investigating relationships among science, technology, and society.

GEOGRAPHY IN

WE ARE:

17 *Faculty*

37 *MA and MSc Students*



17 *PhD Students*

8 Post-doctoral fellows

3 Honorary Research Professors

4 Professors Emeriti

3 Cross-appointed Professors

7 Adjunct Professors

In the past year, we held 96 research grants and contracts, valued in excess of

$4.2 million

NUMBERS

BETWEEN 2019 AND 2020

OUR STUDENTS WERE AWARDED

- **4** SSHRC Doctoral Scholarships
- **1** Trudeau Foundation Fellow
- **2** W. Garfield Weston Graduate Fellowships for Northern Conservation
- **1** Top 25 Environmentalist Under 25
- **1** Young Nature Leader

WE PRODUCED

84 Peer-reviewed articles

Volumes and chapters **31**

60 Conference Presentations

Research Reports **10**

RESEARCH

Uncovering the link between self-building and well-being in Canada and Greenland

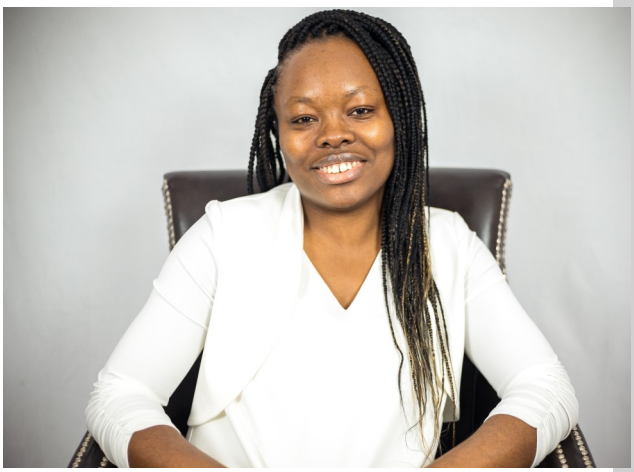
Susane Havelka

To provide appropriate, safe and healthy homes while reducing housing costs in remote regions, governments must adopt a new perspective on self-determination. I argue this new way of thinking must consider a capability approach. To date, however, little data has been collected on inhabitants' capability to self-build or the organizational strategies and government policies needed to enable it. Notably, shifting the planning and construction burden to this particular end-user population builds on an already strong foundation. Indeed, critical for survival, a self-building tradition has long been central to Inuit identity and culture. And, despite active government efforts to discourage the practice, my PhD research exposed a vibrant contemporary DIY building culture. By exploring the capacity of individuals to self-build, the place-specificity of self-building and the link to well-being, I plan to widen the scope of my doctoral work by presenting self-building not only as a capability but as a legitimate alternative to status quo housing solutions and one which addresses the National Housing Strategy call for alternative forms of sustainable and affordable housing (CMHC, 2019).

PhD and Post-Doc

Building Inclusive Cities and Mobility Systems for Immigrant in Atlantic Canada

Tolulope Victoria Akerele



Given the general convergence on the importance of immigration in Atlantic Canada, this research will inform stakeholders of the need for a mobility justice-centred approach when building welcoming communities. Although what makes immigrants feel welcomed is debated, I posit that an inclusion-focused transit policy will have far-reaching impacts on immigrant integration in Atlantic Canadian cities.

This research will explore existing transit frameworks and their current underlying policies related to immigrants' needs. There is a dearth of research-based understanding of immigrant settlement, integration, and belonging in Canada's non-traditional destination cities. This research will obtain the much-needed evidence required to develop sustainable immigrant-focused transport planning initiatives across the Atlantic Provinces and ultimately in small and medium-sized cities across Canada. This study argues that understanding the gap between existing transit systems and immigrants' needs will have far-reaching impacts on government policies, first within Atlantic Canada and throughout Canada. Overall, my research represents a crucial step in engaging immigrants in the governance and planning of transit in 21st-century Canadian cities. When this study informs transit policies, I hope to increase Atlantic Canada's reputation as a sustainable and welcoming destination for immigrants and contribute to the well-being of newcomers in this region.

Settler Fire Management: Examining Wildfire Policy and Practice In Northern Saskatchewan

Alex Zahara

When anthropogenic climate change combines with historical fire suppression practices, wildfires burn in ever changing ways. In Boreal Forest regions of what is presently called Canada, wildfire agencies and policy-makers are making decisions about how, whether, and by whom fires are to be managed in a context of changing fire regimes, limited budgets, and provincial government concerns and objectives. Importantly, the decisions being made about wildfires are always informed by social and cultural ideas and values, which in turn impact forest ecologies and people.

My PhD research is a community-informed study, examining the social and cultural aspects of wildfire policy and practice taking place in my home community of kistahpinânihk or Prince Albert, Saskatchewan, focusing on settler colonialism and Indigenous resurgence. In what is presently northern Saskatchewan, wildfires disproportionately impact the region's majority-Indigenous (Woodland Cree, Dene, Métis) residents, whose social, economic, cultural, language, and wellness practices are directly tied to the land. In alignment with community interests and goals, my research looks at the history of recent changes to wildfire management in the province, including: a shift from fire suppression to a policy of 'values protection', known locally as 'Let it Burn'; the replacement of local -in-person fire tower workers with remotely-operated cameras; and the use of firefighting sharing agreements and standards that have reduced employment of local firefighting crews. The project will contribute to a broader understanding of the social and cultural dimensions of wildfire management in the province, with the aim of assisting local organizations and governments in developing more equitable solutions to wildfire issues.

PhD and Masters

Sources of marine plastic pollution in Newfoundland and Labrador

Nadia Duman

Plastic pollution research and monitoring have proliferated in Newfoundland and Labrador over the last decades; however, little is known about the sources and pathways of marine plastics flowing in and out of this province.

With support from the Civic Laboratory for Environmental Action Research (CLEAR) and guidance from Dr Max Liboiron, I will investigate land and ocean-based sources of marine plastic pollution in the region. To achieve this, I will use opportunistically recovered fish tags from the Department of Fisheries and Oceans (DFO) to report on the spatial characteristics including origins, sinks and fates of derelict fishing tags issued in Newfoundland and Labrador, Nova Scotia and New Brunswick fisheries, as well as the amount of time between their use in fishing activities and recovery on shorelines. In addition, I will use data collected by the Multi-Materials Stewardship Board (MSSB) during their coastline litter audit held in 2019 to conduct a detailed analysis that identifies key origins and mechanisms enabling the escape of litter, particularly plastics, from provincial roadsides to the marine environment. The knowledge generated through this investigation will assist in the mitigation of plastic pollution in the province by informing stakeholders on the sectors and infrastructures contributing to the issue.

The PEAT (Palaeoecology, Environmental Archaeology & Timescales) Lab

Drs. Paul Ledger (Geography and Archaeology) and Véronique Forbes (Archaeology)

In PEAT lab we are interested in the **P**alaeo-ecology, **E**nvironmental **A**rchaeology and **T**imescales of human-environment interactions in Newfoundland and Labrador and the wider north Atlantic the region. The name of our laboratory is more than just an acronym and reflects our interest in exploring human history through the medium of peat. Peat is widespread across Newfoundland, covering approximately 17% of the land surface and is the perfect media for the type of work we do.

Unlike a lot of palaeoecology, which tends to look to understanding the past at the landscape scale through lake-based environmental archives, we emphasise the local. Peat bogs are perfect. They tend to record localized signatures of past environmental change, and when in close proximity to an archaeological site, a peat bog represents a stratified archive of environmental history associated with that site. The acidic and anoxic conditions within peatlands are perfect for preserving a variety of plant and insect exoskeletal remains. Therefore, there is a wealth of information pertaining to more than 5000 years of human-environmental interactions on the island, waiting to be explored in these seemingly hostile, sodden, midge-infested areas!

Currently, our work in the PEAT lab is focused on two main projects in Newfoundland and Greenland. In Newfoundland, our current work centers on the Northern Peninsula in a project entitled Biocultural and Archaeological Legacies at L'Anse aux Meadows (LAM).

The Palaeoecology, Environmental Archaeology & Timescales Laboratory at Memorial University

LAM is a UNESCO World Heritage site and multi-period archaeological site located at the tip of the Northern Peninsula. The site lies within striking distance of the Strait of Belle Isle, Labrador and important communication routes from the Arctic into more southerly temperate latitudes and vice versa that have been well trafficked by people since the beginning of the Holocene through to the present day. The site is most famous for the earliest known evidence of Europeans in the Americas, dating from around AD 1000, but this is little more than a blink in the eye over 5000 years of human activity at LAM.

Our research at LAM is focused around the theme of legacies. This includes the archaeological legacies, relating to interpretational paradigms, methods and traditions used to inform the narrative of the site, but also the biocultural and environmental legacies of over 5000 years of human-environment interactions and north-south movements of people from the Arctic into the temperate south and vice versa. This research program is generously funded by SSHRC and currently supports three Masters students in archaeology (**Jeffrey Speller, Juliet Lanphear and Carlos Salazar Guerra**).

In Greenland, our research focuses on similar themes pertaining to the legacies of human-environmental interactions within a different UNESCO World Heritage site: the Norse and Inuit farming landscape of Kujataa (southern Greenland). As a part of a multinational NSF-funded heritage project (RESPONSE), we are examining the human-mediated environmental change associated with medieval Norse farming, Moravian missionary settlement and Inuit sheep farming since the early 20th century.

Strategies for a Changing Ocean

Dr. Gerald Singh

Changes in global oceans are more than a physical phenomenon. While global carbon dioxide emissions and climate change are affecting ocean chemistry (ocean acidification), sea surface temperature and the frequency, duration, and intensity of coastal storms, oceans are also regions of new economic activity and policy aspirations. Growing and emerging ocean industries such as offshore oil and aquaculture offer new opportunities and risks for coastal communities and livelihoods, such as small scale fishing communities. Oceans are also spaces where new aspirations are developing, with new policy goals aiming to reshape how people relate to their environment and each other. These include ideas of sustainable development, promising meaningful jobs that are environmentally sustainable and contribute to international equity.

Confronting the physical, social, and economic changes that oceans and coastal communities face in order to achieve aspirational sustainable development policy requires robust strategies. My research team and I are conducting research to inform strategies to navigate the coming ocean changes. With funding from the Nippon Foundation Ocean Nexus Center, we work at the intersection of ocean science, risk assessment, decision science and policy to inform policy strategy.

Our work is actively contributing to policy decisions in Canada and abroad. Through the Nippon Foundation Ocean Nexus Center we work with a large network of international researchers to address complex and multifaceted ocean research. We have created a decision process to aid small island states to plan ocean policy around the Sustainable Development Goals, which has been trialled in Aruba.

We have also structured a research process to aid the new UN Ocean Decade of Ocean Science for Sustainable Development to propose and evaluate potential policy solutions to coastal and ocean challenges. We are setting up a webinar endorsed by the UN Ocean Decade to introduce and promote this research design. Within Canada, we have conducted research to evaluate whether Canada's ocean policies are suitably designed in a context of climate change or if they are at risk of failing their aims. For example, a policy to create a protected area for an endangered marine biome may fail if climate impacts force a poleward migration of associated species and the policy does not allow for protected area boundaries to move as well. This work is being used to inform ongoing planning for Canada's Blue Economy strategy.

Ongoing and future research also aims to inform ocean policy in a changing world. Work led by **Jack Daly**, a MUN Geography research assistant and a Nippon Foundation Ocean Nexus Center Affiliated Fellow, is leading a project on assessing climate vulnerabilities in an intersectional lens, acknowledging that climate risks are not felt homogenously across and within nations. MUN Geography postdoctoral researcher and Nippon Foundation Ocean Nexus Research Fellow Leah Fusco is leading research on how regional planning processes are being used in coastal and offshore development in Newfoundland and beyond, and how these processes can be more inclusive. If you're interested in finding out more, please visit our website: changingoceanstrategies.com

THE NIPPON FOUNDATION

Research

SMARTICE

Dr. Trevor Bell

SmartICE is an internationally recognized social enterprise that empowers Indigenous communities to adapt to unpredictable ice conditions. It is the world's first climate change adaptation to integrate Indigenous knowledge of ice with advanced data acquisition and remote monitoring technology. As a social innovator, SmartICE harnesses the vast potential of Indigenous women and men—especially youth—to embrace science, technology and Indigenous knowledge as a vehicle for sustainable employment, economic development and wellbeing in their communities.

Geographers are playing a significant role in the growth and success of SmartICE through leadership (**Dr. Trevor Bell**, Founder), recent graduate hires (**Emily Best**, BA '18, Memorial; Northern Communications Lead) and postgraduate research. The following are some examples of current research projects.

Geospatial mapping is central to SmartICE's approach to reducing travel risk for ice users. From point and track measurements of ice, slush and snow thickness using sensor technology along community trails to the production of community ice travel safety maps, spatial information on ice conditions is critical for route planning and travel preparation. For example, our in-development SmartICE travel safety maps represent an integration of Inuit sea-ice knowledge (IQ) and observations with ice condition analyses from satellite image interpretation. Curriculum and training program are being co-created by **Dr. Lynn Moorman** (Mount Royal University), **Becky Segal** (MSc '19, Victoria), and SmartICE operators to build for the first time local Inuit expertise in remote sensing interpretation and digital mapping skills.

SmartICE's success is grounded in its founding principles, one of which is to augment—not replace—Inuit Qaujimajatuqangit (IQ) of safe ice travel. **Katherine Wilson** (PhD candidate, Memorial) and Andrew Arreak (Nunavut Operations Lead, SmartICE) from Mittimatalik have documented local IQ of the seasonal ice cycle, including which ice conditions are safe for travel, and which are more dangerous, such as thin or rough ice, open water, or ice cracks. Where these travels hazards were known to recur in the same locations from year to year, they have marked them on maps along with safe snowmobile routes and locations of cabins and shelter. This geospatial ice IQ is an important information layer in the SmartICE community ice travel safety maps.

Slush forms between snow and sea ice when thick snow overlies thin ice and seawater floods the ice surface. It can be difficult to detect while travelling on the surface, causing snowmobilers to sink in and get stuck, potentially triggering a search-and-rescue response. Because slush conditions are projected to be more common with changing climate, as snow accumulation increases on thinning landfast ice, SmartICE needs to map slush occurrence along community trails. **Dr. Anne Irvin** (Postdoctoral Fellow, Memorial) has pioneered a method for real time mapping of slush thickness over landfast ice using multi-frequency, electromagnetic induction surveys. Dr. Irvin has integrated the new instrumentation and algorithms into SmartICE's mobile user interface to permit display of slush and ice thickness both in real time for the operator as well as on a colour-coded map for the community.

Research Lab

4D OCEANS Lab

Drs. Evan Edinger and Katleen Robert

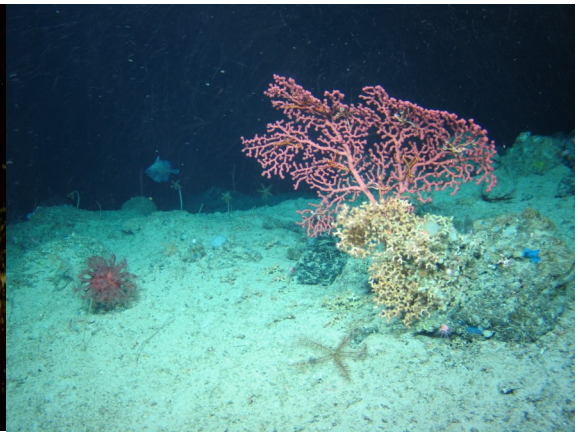
Marine Habitat Mapping is a form of remote sensing. **Dr. Katleen Robert** (Canada Research Chair in Ocean Mapping, Marine Institute, cross-appointed to Geography) and **Dr. Evan Edinger** (joint appointment with MUN Biology) lead research. The 4D OCEANS Lab focuses on mapping the spatial complexity of the ocean from the seafloor to the surface. This is crucial as the ocean contributes significantly to Canada's economy, yet less than 20% has been adequately mapped and the spatial distribution of most species is not well understood. In order to map both the physical and biological components of the seafloor, we use sonars which give us information on depth and substrate composition. Video cameras are used to identify and count large benthic invertebrates. Our goal is to advance our understanding of seafloor spatial heterogeneity, distributions of benthic communities, how habitats may respond to different human-induced and natural stressors, and how scale (extent and resolution) affects our ability to detect and monitor change.

Students in the 4D OCEANS Lab work on projects ranging from local coastal areas to Arctic environments, to deep-sea areas. MUN marine habitat mapping student projects in Placentia Bay focus on mapping coastal waters and habitats in Placentia Bay, including structure-forming invertebrates (**Shreya Nemani),** seaweeds (**Julia Mackin-Mackenzie**), and eelgrass beds (**Aaron Sneep).** The eelgrass beds can be mapped using drone-based aerial photography. Other students are working on characterizing the spatio-temporal heterogeneity of a sub-arctic bay near Holyrood, NL. This involves challenging winter fieldwork and the use of a cabled-observatory, as what is happening underwater in winter at northern latitudes remains understudied.

4D OCEANS

At the Charlie-Gibbs Fracture Zone, in the middle on the North Atlantic Ocean, a student is looking at characterizing Vulnerable Marine Ecosystems such as cold-water coral and sponge gardens to inform the management of a Marine Protected Area. In Newfoundland and Labrador as well as the Arctic, we are characterizing the heterogeneity of fjord habitats. In coastal Labrador, we work with our partners in Nunatsiavut and Fisheries and Oceans Canada to map the nearshore habitats that are used by tagged Greenland Cod, Arctic Char, and ringed seals, whose movements are tracked using acoustic telemetry. The resulting movement and habitat map will feed in the Nunatsiavut government's Imappivut coastal marine conservation program (link, https://imappivut.com/about/).

Through this work, the 4D OCEANS Lab creates an integrated picture of our oceans which will allow us to understand the relationships between habitats, resources, human activities and changing conditions. Please check out: https://www.4d-oceans.com/, or follow us on twitter @4DOceansLab.



Research Lab

Finding climate change solutions in Newfoundland's urban forests

Dr. Carissa Brown, Dr. Joel Finnis, and Erin Pearson

When thinking about forests on the island of Newfoundland, "urban" might not be the first word that comes to mind. Yet, even in cities and towns surrounded by boreal forest like those on the island, trees within urban green spaces ('urban forests') make critical contributions to the vital services green spaces provide. In addition to offering aesthetic qualities that benefit human health (something we all appreciate a bit more through the pandemic), urban forests stabilize their environment by improving air quality, reducing erosion, and moderating microclimates via shade, wind breaks, and by cooling air through evapotranspiration. Urban forests serve as natural infrastructure capable of moderating many anticipated climate change impacts, including warming, amplified urban heat island effects, shifting wind exposure, and greater risk of flooding.

Here's the catch: ongoing climate change may create an urban environment less suited to many tree species that are currently grown in urban forests, compromising all of those services they provide. To anticipate when and where climate change might have negative effects on urban forests, we need a better understanding of the suitability and adaptive potential of urban tree species to climate change.

Where do Newfoundland's urban forests come into this story? Well, although climate change outcomes will be unevenly distributed across Canada, warming is expected to be most pronounced in winter in most of the country. Winter warming increases freeze-thaw cycles, stressing plant species that use warming as cues for life events, and those unable to cope with ice formation. The island of Newfoundland presents an ideal environment to study the impacts of these factors on common urban tree species, as our moderate winters are characterized by frequent freeze-thaw cycles, and plant species on the island must adapt to these conditions to succeed.

Climate change may also influence tree blowdown, either directly through increased exposure to high winds or indirectly through influences on tree stability (frost heaving, timing of leaf fall). These concerns are amplified in Newfoundland, which frequently experiences high winds. Given that the current characteristics of Newfoundland's climate reflect projected conditions for much of Canada, it follows that Newfoundland is an ideal natural laboratory in which to test the hardiness of different tree species and tree populations (or provenances) under future urban conditions.

In 2020, we began a baseline survey of coastal urban forests to assess tree health and adaptability to shifting conditions in the Atlantic, and to compare them to relatively natural forests adjacent to urban areas. One of our first steps was to install temperature dataloggers in treed and treeless urban areas to better understand the role of trees in altering local climate. Our new research project will lay the groundwork for a broader study of trees as natural infrastructure for climate change migration and adaptation, including the development of a guide to urban forestry as an adaptation option for coastal communities in Newfoundland, as well as the design of subsequent cross-Atlantic research efforts.

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For more information about graduate study at Memorial, visit **www.mun.ca/sgs**

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