Appendices

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Appendix A: Supplementary Material

Research capacity in the region

Research Institutes

Dalhousie University is the largest university in Nova Scotia with a student body of approximately 20,000[1] and four campuses, including Studley, Carleton and Sexton Campuses in Halifax, the Agricultural Campus in Truro/Bible Hill, and a satellite in partnership with the University of New Brunswick Saint John. Dalhousie is also home to 1,000 faculty,[2] and attracts $181 million[3] in research funding annually. Its size and research focus places it in the U15, a collective of Canadian universities that describe themselves as research-intensive.[4] Dalhousie boasts more than 200 undergraduate and graduate-level programs, where students can undertake more than 200 degrees in 13 faculties. Dalhousie actively pursues funding from federal programs, prestigious research awards, and a strategic research agenda to bolster its internationally acclaimed faculty and research outputs, grouped in strategic "signature research clusters" grounded in the United Nations' Sustainable Development Goals. The university partners with 300 universities in 67 countries worldwide, giving it strong international connections.

The Nova Scotia Community College (NSCC) system trains 20,000 students in 130 programs at 14 campuses across Nova Scotia. The community college system focuses on industry-driven training for students as well as current workforce needs, inclusive access to education, applied research, and career-focused programs. Most of their programs are co-developed with industry, and NSCC allocates placement numbers in key programs in cooperation with Government. Their applied

[1] http://www.atlanticuniversities.ca/sites/default/files/u160/Full-time%20plus%20Part-time%20Enrolments_20-21_Oct30%2720.pdf
[2] https://www.dal.ca/about-dal/dal-at-a-glance.html
[3] https://www.dal.ca/about-dal/dal-at-a-glance.html
[4] https://u15.ca/member/dalhousie-university

research program adds depth to their vocational programming, working with industry to use research to solve technological challenges.

Next in size are Saint Mary's University (Halifax), St. Francis Xavier University (Antigonish), Cape Breton University (Sydney), Acadia University (Wolfville), and Mount St. Vincent University (Halifax), each with a student body of between 4000 and 6500. Often more undergraduate focused, these institutions also offer graduate programs, and compete nationally and internationally, bringing in research funding, international faculty and students from around the world. Discussions on research capacity should not overlook these smaller schools who have much to contribute to the province's research agenda.

There are also institutions that are focused entirely or substantially on undergraduate programming, and which are more specialized in their teaching, but that house faculty whose research may be relevant to forestry in some limited way. This group includes the University of King's College (Halifax), Nova Scotia College of Art and Design (Halifax), Université Sainte-Anne (multiple locations), and Atlantic School of Theology (Halifax). King's College focuses on liberal arts and journalism, NSCAD on visual and material arts, AST on theology and ethics, while Ste-Anne has developed specializations in Francophone studies, agrifoods and wine, and aquaculture.

Significant research also takes place at hospitals and health research facilities operated by Nova Scotia Health (formerly Nova Scotia Health Authority) and at the IWK Health Centre. These institutions perform life sciences and clinical research. They are outside of the scope of this agenda but are vital to the success of Nova Scotia's research prestige nationally and internationally.

The following table lists each postsecondary institution by enrolment and research funding level.[5]

Institution	Location	Total Enrolment	Research Funding[6]	Research Strengths
Dalhousie University[7]	Halifax; Truro	20,380	$181 million[8]	Big data **Clean tech, energy, the environment** Culture, society, community development Food security Healthy people, healthy communities, healthy populations **Innovation and entrepreneurship** Sustainable ocean
Nova Scotia Community College[9]	Across Province	20,000		Energy **Engineered technologies** **Environment and agriculture** Geomatics Oceans

[5] Enrolment data: http://www.atlanticuniversities.ca/sites/default/files/u160/Full-time%20plus%20Part-time%20Enrolments_20-21_Oct30%2720.pdf

[6] This column details external research funding (federal, provincial, industry) for the top 5 universities; data for NSCC was not available at the time of writing.

[7] https://www.dal.ca/research/SignatureResearchClusters.html

[8] https://www.dal.ca/research/ResearchEnterpriseatDalhousie.html

[9] https://www.nscc.ca/about_nscc/applied_research/index.asp

Saint Mary's University[10]	Halifax	6,468	$10.2 million[11]	Climate change and the environment - Monitoring, impact assessment, solutions Connecting to communities Innovative science - exploring fundamentals, developing applications Modern global citizenship issues Innovation in business and workplace studies
St. Francis Xavier[12]	Antigonish	5,640	$7.3 million[13]	Public policy, governance and leadership Climate and environment Healthy people and communities Cultures, societies and development
Cape Breton University[14]	Sydney	5,081	$5.9 million[15]	Culture and community Ecology, environment and sustainability Indigenous wellness and L'nu research Community economies and ecologies Sustainable health and wellness Research in science and engineering
Acadia University[16]	Wolfville	4,480	$7.4 million	Community life, organizations and cultural diversity Natural resources and environmental resilience Human health and wellness Innovative and enabling technologies Rural innovation, agrifoods and agriculture
Mount St. Vincent[17]	Halifax	4,000		Gender, Sexuality and Advancement of Women and Girls Inclusive Ways of Knowing and Dissemination Health and Wellness Across Lifespan Life, Computational and Physical Science
University of King's College[18]	Halifax	911		Liberal arts; humanities (Foundation Year Program) Journalism, Music, Creative Nonfiction History of Science and Technology
NSCAD University[19]	Halifax	834		Visual, material arts and design school Research focus areas: Visual and cultural literacies Sustainability and adaptability Material exploration Art and design education/pedagogy
Université Ste. Anne[20]	Baie Sainte-Marie / Across province	590		Agri-food, wine Francophonie and Acadian studies Aquaculture Biochemistry, microbiology and genomics

[10] https://www.smu.ca/webfiles/SMU-SRP-Renewal2021-26-Draft-Spring2021.pdf
[11] Correspondence with SMU
[12] https://www.stfx.ca/sites/default/files/2019-2025%20Strategic%20Plan%20for%20Research%20and%20Creative%20Works%20Final.pdf
[13] Correspondence with St FX
[14] https://www.cbu.ca/wp-content/uploads/2020/09/CBU-Strategic-Research-Plan-2020-FINAL.pdf
[15] https://www.cbu.ca/wp-content/uploads/2021/05/CBU-ANNUAL-RESEARCH-REPORT-2019-1.pdf
[16] https://www2.acadiau.ca/files/files/Files%20~%20Research/AU_Strategic_Research_Plan_May_2016.pdf
[17] http://www2.msvu.ca/DocumentCentral/Documents/Research%20Plan.pdf
[18] https://ukings.ca/wp-content/uploads/2019/05/FinalResearchPlanApprovedBOGJune2014.pdf
[19] https://www.chairs-chaires.gc.ca/program-programme/srp-prs/nscad-eng.pdf
[20] https://www.usainteanne.ca/plan-strategique-2019-2024#l-innovation-et-l-excellence-en-enseignement-et-en-recherche

Atlantic School of Theology[21]	Halifax	110		Theological studies Master of Divinity

Research Capacity in Nova Scotia

The following four tables list the researchers we came across throughout the course of our project. Their areas of interest, where available, are also included.

This list is not exhaustive; it is, rather, illustrative of the depth of forestry expertise within Nova Scotia.[22]

Name	*Institution*	*Title*	*Field of Study*	*Areas of Expertise*
Beazley, Karen	Dalhousie University		School for Resources and Environmental Studies	Biodiversity conservation, protected area system planning, co-production of knowledge and participatory mapping, Indigenous perspectives/relations with the land, Indigenous protected and conserved areas, ecological corridor and network design, environmental and research ethics, ethics for research with Indigenous Peoples
Bissix, Glyn	Acadia University		Community Development, Environmental & Sustainability Studies	Natural resource and environmental management, parks and open space resource development, outdoor recreation management, policy planning and decision making
Bondrup-Nielsen, Soren	Acadia University		Biology	Natural history of beetles and birds in forested and agricultural areas
Bouman, Thomas	Cape Breton, Dalhousie, SMU			Sustainable forestry, tree diversity in forests, advanced tree species regeneration, willow short rotation coppice, soil acidification and amelioration, participatory development of agriculture and forestry
Brazner, John	Gov of Nova Scotia & Dalhousie University		Wetland Ecosystem Biologist/School for Resource and Environmental Studies	Wetland condition indicators and roles
Burton, David	Dalhousie University		Department of Plant, Food, and	Environmental influences of soil on nature and the extent of microbial metabolism in soil

[21] http://www.astheology.ns.ca/home/about/index.html

[22] Research Nova Scotia has compiled further lists of researchers outside of Nova Scotia with forestry expertise; gaps in expertise may be supplemented through research partnerships with other regions.

			Environmental Sciences	
Bush, Peter	Gov of Nova Scotia, Dalhousie and SMU		Provincial Forester	Landscape ecology and connectivity, old-growth forests, GIS and remote sensing, wildlife habitat, avian ecology, ecological land classifications, wetlands
Cameron, Robert	Gov of Nova Scotia & Dalhousie University		Resource Planner (Ecologist)	Biodiversity conservation and protected areas, ecosystem classification tools for capturing representative ecosystems in protected areas, identification and classification of rare ecosystems, long-term ecological monitoring and assessing ecological integrity of protected areas, conservation ecology of rare lichens
Clancy, Peter	St. Francis Xavier University		Political Science	Governance, politics of natural resources and environment, industry and corporate politics
Crewe, Tara	Gov of Nova Scotia & Charles Darwin University		Environmental Science	Effective biodiversity conservation and management promotion, animal behaviour
Duinker, Peter	Dalhousie University		School for Resources and Environmental Studies	Forest, biodiversity, public engagement, environmental assessment, resource management, climate change, urban forests
Gauthier, David	Saint Mary's University		Department of Geography and Environmental Studies	Ecosystem management, parks and protected areas, resource management
Harper, Karen	Saint Mary's University		Department of Environmental Science	Forest edge fragmentation, conservation and patterns of structural diversity, spatial and temporary patterns of plant communities
Heung, Brandon	Dalhousie University		Department of Plant, Food, and Environmental Sciences	Soil science and surveying, digital soil mapping and assessments, geospatial information systems, spatial analysis and modeling, data-mining and machine-learning
Joseph, Alain	Nova Scotia Community College		Applied Research	Sustainable energy research, development, and testing
Kaszas, Dion	Acadia University	Part-time instructor	Community Development	Indigenous Research Methods and Methodologies, Decolonization and Indigenization
Kellman, Lisa	St. Francis Xavier University		Climate & Environment	Forest, agricultural, coastal environments, climate change, greenhouse gas exchanges, biogeochemical cycles, soil organic carbon storage, freshwater contamination, stable isotope tracers

Kernaghan, Gavin	Mount Saint Vincent University		Biology	Plant fungal relationships in undisturbed and managed ecosystems
Mackenzie, Tracey	Dalhousie University		Department of Plant, Food and Environmental Sciences	Arboriculture, urban tree management
MacLean, Jason	Unama'ki Institute of Natural Resources	Director of Forestry		
MacQuarrie, Stephanie	Cape Breton University		Chemistry	Highly valuable applications for waste products, carbon footprint reduction through advanced materials, development of functional materials for electronics, catalysis and absorption
McCarthy, Chris	Parks Canada & Dalhousie University		Resource Conservation Manager II	Protected area management, participatory resource management, large mammal ecology, population dynamics and ethology, species at risk recovery, coastal dynamics and invasive species management
McCorquodale, David	Cape Breton University		Biology	Species at risk in Canada
McGarrigle, Elizabeth	Gov of Nova Scotia & University of New Brunswick		Forest Inventory Data Analyst	Tree growth, forest management, forest ecology, climate change impacts, strategic management
Prosper, Kerry	St. Francis Xavier University		Inaugural Knowledge Keeper	
Sheehan, Lorn R.	Dalhousie University		Rowe School for Business & School for Resource and Environmental Studies	Tourism and travel, destination management, stakeholder management, sustainable development
Sherren, Kate	Dalhousie University		School for Resource and Environmental Studies	Climate adaptation, ecosystem services, renewable energy, sustainable agriculture, landscape values, spatial and visual methods
Stacier, Cindy	Dalhousie University		Biology	Forest bird ecology and behaviour, ecological monitoring, avian populations, bird, forest ecosystems, lake ecosystems, species conservation, vocal behaviour, wood-warblers
Steenberg, James	Gov of Nova Scotia		School for Resource and	Forest carbon and climate change analysis

	& Dalhousie University		Environmental Studies	
Taylor, Phil	Acadia University		Biology	Animal movement through landscapes and dynamics
Vankoughnett, Matthew	Nova Scotia Community College		Applied Research	Terrestrial ecosystems, biogeochemical cycling, plant ecology, global change ecology
vom Hagen, Ulrich	Gov of Nova Scotia & Dalhousie University		Senior Corporate Strategist	Environmental assessment, ecological forestry, renewable energy (renewable natural gas, wood heat), circular economy, biodiversity policy development and planning, environmental sociology
Webster, Timothy	Nova Scotia Community College		Applied Research	lidar and other high-resolution remote sensing and Geographic Information System (GIS) techniques for mapping, monitoring and modelling processes, with an emphasis on flood risk and erosion
Westwood, Alana	Dalhousie University		School for Resource and Environmental Studies	Forest ecology and management, boreal and maritime forests, impact assessment, terrestrial species at risk, protected areas planning, knowledge exchange across the science-policy interface, justice, reconciliation and reparations in science and research
White, Kellie	Cape Breton University		Biology	Conservation, conservation ecology and endangered species
Zurba, Melanie	Dalhousie University		School for Resources and Environmental Studies	Environmental governance, collaboration, Indigenous perspectives and leadership in environmental management and governance, learning, qualitative methodologies, social justice

Project Inputs:

The following table outlines the key inputs incorporated into the research agenda process. Further information is available in the main body of the report, and below.

	Within Nova Scotia	Outside Nova Scotia
Government/Crown priorities, research programs and plans	DLF (now DNRR)[23] Woodland survey Departmental priorities Silviculture guide[24] Ecological forestry matrix[25] Market opportunities[26] Innovacorp Ecological Forestry Forum[27]	Jurisdictional reviews Finland trade mission[28] NRCAN: Adapting to change (The State of Canada's Forests)[29]
Postsecondary/research programs and initiatives	NSCC Dal Perennia (websites, sector profiles, strategic plans)	Jurisdictional reviews Information sessions and consultation (reports, plans)
Industry needs	Focus groups Follow-up survey	McKinsey & Company – Data: The next wave in forestry productivity[30]
Independent reviews	Lahey Report[31] Research Nova Scotia Mission-Oriented Research Strategy	

Review of Woodland Survey

The project team reviewed Narrative Research's 2021 Woodland Survey commissioned by the Nova Scotia Department of Lands and Forestry (now Department of Natural Resources and

[23] https://novascotia.ca/natr/forestry/programs/timberman/pdf/FMG.pdf, https://novascotia.ca/natr/forestry/pdf/State_of_the_Forest_Update_2018.pdf, https://novascotia.ca/natr/forestry/Forest_Review/Government-Response-to-Independent-Forestry-Report.pdf
[24] https://novascotia.ca/natr/consultation/docs/Draft-SGEM-Jan-2021.pdf
[25] https://novascotia.ca/ecological-forestry/Triad-A-New-Vision-for-NS-Forests.pdf
[26] https://novascotia.ca/forestry-sector-support/docs/Forestry%20Export%20Opportunities%202020.pdf
[27] https://novascotia.ca/natr/forestry/Forest_Review/What-We-Heard-Ecological-Forestry-Forum-June-2019.pdf
[28] https://novascotia.ca/forestry-sector-support/docs/Virtual-Forestry-Mission-Report.pdf
[29] https://www.nrcan.gc.ca/our-natural-resources/forests-forestry/state-canadas-forests-report/16496
[30] https://www.mckinsey.com/industries/paper-forest-products-and-packaging/our-insights/data-the-next-wave-in-forestry-productivity
[31] https://nslegislature.ca/legislative-business/committees/standing/public-accounts/archive/public-accounts/pa2021mar10?fbclid=IwAR39D1Vwr1dj4A28f4KxKwHv4QsAhcEdqAYPed596w-8BbnzhjhiJ2NfePk https://novascotia.ca/natr/forestry/Forest_Review/Lahey_FP_Review_Report_ExecSummary.pdf

Renewables).[32] The study explores the needs, interests and knowledge of private woodland owners across Nova Scotia.

As the largest landowner type in the province, private woodland owners have a significant role to play in the management of Nova Scotia's forests. The survey found private woodland owners widely value forest protection, recreation, access to resources, unrestricted management, wildlife and wildlife habitat, and income. They also face challenges related to woodland ownership, including low market prices, forest management and silviculture assistance, and road maintenance and/or access.

In addition to these challenges, a series of concerns were raised ranging from the impacts of insects and/or diseases on woodlands, the need to protect biodiversity, market prices for wood products, climate change impacts, regulations, species at risk requirements, negative public perception of wood harvesting, silviculture cost, availability of technical experts and forest workers, and the perceived competition from the sale of Crown wood. While these are significant concerns, woodland owners also identified factors of personal importance to woodland ownership: these include the importance of receiving income, environmental considerations such as wildlife habitat and sustainable forest management, and other personal aspects such as preserving family tradition and having privacy.

The survey identified specific products harvested over the last five years. In order of most commonly harvested, these products are:

- Fuelwood/firewood
- Sawlogs/timber
- Studwood/lumber
- Pulpwood
- Hardwoods
- Softwoods
- Christmas trees
- Non-forest products.

Woodland owners rely on a range of information sources for advice on woodland management. The most common source comes from woodland co-operatives or associations. Professionals, forestry contractors, and consultants are also important avenues for information as they provide a range of advice from harvest and silviculture treatments to forest management plans. The top three types of information identified as most important to woodland owners are:

- Financial assistance for silviculture
- Financial assistance for road construction and maintenance
- Advice on silviculture (including restoration activities)

[32] https://novascotia.ca/natr/consultation/woodland-owner-survey.asp

Although there are a range of tools used for woodland management, the most commonly used tool is static satellite imagery such as Google Earth or Planet.com. Other tools used by woodland owners include GIS programs such as Avenza Maps and the provincial geographic data directory. However, most woodland owners polled in the survey stated they do not use tools or technology, indicating a lack of knowledge or familiarity with technology supports that could be improved. Engaging woodland owners in active forest management is key: woodland owners will attend provincial woodland owner conferences, access silviculture and road funding, and use provincial forest management guides. But despite the availability of a variety of resources, tools, and supports, many woodland owners indicate they had not used any of the government of Nova Scotia's tools or supports in the last five years. This may suggest that more outreach, communication, and training are needed to effectively engage woodland owners in active and long-term forest management.

As the project team heard during the focus group sessions, the meaning or understanding of ecological forestry to woodland owners varies. An equal amount of those surveyed are not familiar with the term ecological forestry compared to those who feel it means using the forest without damaging or destroying it. Other descriptions provided include sustainable forest management and harvesting, protecting wildlife and maintaining habitat, respecting or encouraging biodiversity, and working with nature to respect the natural ecology of the forest.

When polled about familiarity with the Lahey report, most woodland owners are very or somewhat familiar with it. Those familiar with the report identify the following main themes as important considerations in ecological forestry:

- Sustainable forestry practices
- Less clearcutting
- Triad management approach
- Balanced approach between environmental and economic factors
- Protecting or preserving forests and habitats

When asked if woodland owners support or oppose the Lahey Report recommendations regardless of familiarity, there is a high level of completely or mostly supportive.

The survey results suggest that there is significant appetite for improved processes and understanding of forests among private woodland owners, and that increased socialization, education and familiarization may be welcome. We recommend considering research collaborations that work with woodland owners to support their needs.

Focus Group Participants

The following table lists all organizations who participated in focus group sessions and/or one-on-one conversations. Organizations who were contacted to participate but were not present during a focus group session are not listed below. The project team spoke to approximately 130 people over the course of seven weeks.

Mi'kmaq First Nations Organizations

Confederacy of Mainland Mi'kmaq
Kwilmu'kw Maw-klusuaqn
Mi'kmaq Forestry Initiative
Ulnooweg
Unama'ki Institute of Natural Resources

Woodlot Services and Landowner Associations

Association of Sustainable Forestry
Athol Forestry Co-op Ltd.
Cape Breton Privateland Partnership
Conform Ltd.
Family Forest Centre
Federation of Nova Scotia Woodland Owners
Forest Nova Scotia

Landowners

North Nova Forestry
Nova Scotia Landowner and Forest Fibre Producers Association
Nova Scotia Woodlot Owners and Operators Association
Western Woodlot Services Cooperative

Sawmills and Other Forest Products

Breton Forest Co-op
Freeman Lumber
Larch Wood Canada
Scotsburn Lumber Ltd.
Taylor Lumber Co. Ltd.

Crown Land Managers

Great Northern Timber Institute
Medway Community Forest Cooperative

Northern Pulp
Port Hawkesbury Paper
WestFor Management Inc.

Environmental Non-governmental Organizations

Community Forests International
Ecology Action Centre
Healthy Forest Coalition

Government

Nova Scotia Department of Natural Resources and Renewables
Nova Scotia Department of Advanced Education
Nova Scotia Department of Intergovernmental Affairs
Nova Scotia Department of Environment and Climate Change

Innovation Support and Related Organizations

Genome Atlantic
Innovacorp
Nova Scotia Business Inc.
Nova Scotia Innovation Hub
Springboard Atlantic
Verschuren Centre

Federal Departments

Canadian Wildlife Service
Environment Canada
Natural Resources Canada
Atlantic Canada Opportunities Agency