

DALHOUSIE UNIVERSITY FACULTY OF AGRICULTURE

2021-2026 STRATEGIC RESEARCH PLAN



**DALHOUSIE
UNIVERSITY**

FACULTY OF AGRICULTURE

PREFACE



There is now a tremendous sense of excitement and urgency amongst the public, educators, scientists, industry, and governments at all levels around agriculture and food. It is therefore not surprising that Dalhousie University has committed its research strategy towards several key areas – including Food Security – that fully align with the Faculty of Agriculture. This recognizes the opportunities and challenges research in agriculture and food presents to Dalhousie, and that the university is prepared to fully back strategic research initiatives that will in large part stem from and through the Faculty of Agriculture. A brighter spotlight on agriculture means our Faculty must strive to better define our research strategy as it relates to world class scholarship, regional needs, training, cross-cutting collaboration, and capacity building (personnel and infrastructure) in select areas.

The 2014-2019 Faculty of Agriculture Research Strategic Plan was largely focused on strategies and tactics to strengthen the culture of research on our campus, and its strategic directions and actions will serve as a foundation for continued research success.

What is now needed is a Research Plan that delineates and rationalizes broader strategic research directions for our Faculty. Beginning in

Dalhousie's 5 signature research clusters and two cross-cutting themes

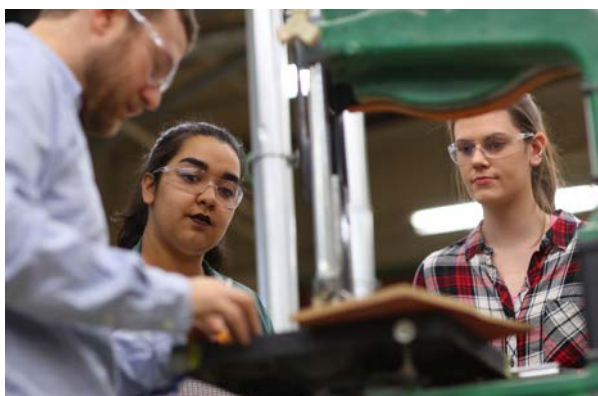


2019 the Faculty undertook a consultative process with each of its four departments to understand where they intend to build capacity, the rationale for focusing on these areas, and the personnel and infrastructure desired to meet these goals. This feedback has provided senior leaders, department Chairs, and faculty members transparent and goal-oriented plans to guide succession planning related to new hires and strategic research priorities in order to maximize impact and cross-cutting synergies between units, within the Faculty and across the University.

RESEARCH & INNOVATION VISION, MISSION, VALUES, GOALS

The research vision, mission, and values of the Faculty of Agriculture necessarily align tightly to those of Dalhousie University as a whole.

	FACULTY OF AGRICULTURE	DALHOUSIE UNIVERSITY
Research Vision	To be an international leader for education, training, research and advice to agricultural learners, partners and communities	We are a leading innovative, research-intensive university, inspiring our diverse scholarly community to serve Nova Scotia, our region, our nation and our world
Research Mission	To generate knowledge, train leaders, and develop solutions for healthy, sustainable societies	To create a hub of world-leading research and innovation, adding to the intellectual, social and economic capital of our communities
Research Values	The highest standards of research ethics, rigour, and professionalism Excellence in discovery and innovation, driven by a spirit of curiosity, creativity and awareness of the issues Commitment to environmental and social sustainability when seeking solutions to the most pressing local and global challenges Interdisciplinary collaboration with a multiplicity of exceptional stakeholders and researchers Training and mentorship of tomorrow's leaders is at the centre of our research enterprise Commitment to a more equitable, diverse and inclusive (EDI) Faculty research enterprise	Dalhousie researchers are committed to the ethical conduct of research Dalhousie researchers seek opportunities for collaboration and recognize that new perspectives enrich research insights Dalhousie University is committed to providing opportunities and mentorship to tomorrow's research leaders Dalhousie researchers seek solutions to today's most pressing research challenges in an effort to create sustainable, positive change Dalhousie University partners with the world's best, engaging with research leaders at universities, institutes and the private sector around the globe Dalhousie will propel research and innovation excellence across all disciplines, fully aligned with the university's EDI goals



FUNDAMENTAL PRINCIPLES



Our fundamental strategic research principles will help ensure our research success. These serve as the foundation for our strategic research actions in key areas.

ALIGNMENT WITH FACULTY AND DALHOUSIE STRATEGY

To maximize our research success, our strategy for building research excellence must align with the overarching strategic goals outlined in the 2020-2025 Faculty of Agriculture Strategic Plan: pillars of focus on global sustainability, food security, and health and well-being, within the context of the United Nations Sustainable Development Goals. Equally important, our strategy, tactics, and goals for research capacity building need to align with the research strategy of the University. Principles of equity, diversity, and inclusivity will be top of mind in everything we do.

ENHANCING AND RECOGNIZING DISCOVERY AND INNOVATION

We strive to recruit and retain the most talented researchers – professors, post-doctoral fellows, and students – and ensure we have in place tools and resources to maximize the impact of their discoveries and innovations. We strive to enhance scholarship and grantsmanship through training opportunities, mentorship programs, and peer review of funding applications, with

focus on Tri-Agency opportunities. We want our Faculty members to be leaders and will always push for recognition of their research excellence by nominating them for Faculty, University, and external research awards whenever the opportunity arises, and through increased multi-media exposure.

BUILDING AND STRENGTHENING COLLABORATION

Our Faculty has always recognized the importance of collaboration to research and innovation success. We will continue to nurture and build collaborations by seeking alliances with the very best scholars in the world. We commit to enhancing interdisciplinary efforts across our Faculty, within the diverse academic community of Dalhousie, and with other institutions. We will continue to support and increase collaborations with key industry, governments, NGO, and community partners, particularly those of under-represented groups, through which our work will be most impactful. We will continually promote our researchers so that stakeholders view our Faculty as an invaluable research asset.

SUPPORT FOR RESEARCH AND INNOVATION CULTURE

Research and innovation is a core mandate of our Faculty and University and we must ensure alignment of the Faculty Research Strategic Plan with capital projects and infrastructure planning, technical capacity in support of research, and administrative processes that serve the needs of researchers and students. Administration and senior faculty must foster a culture of scholarship

that ignites creation, advancement, and transfer of new knowledge to encourage curiosity, innovation, and mentorship for early career faculty, students, and post-doctoral scholars. Innovation exists in the application of new knowledge so particular attention must be given to ensure our knowledge gets into the hands of those who can best use it. This is achieved by the many supports that exist at Dalhousie for knowledge and technology transfer, and the support for entrepreneurship.

STRATEGIC RESEARCH GOALS AND TARGETS



The strategic implementation goals of our Faculty stem from our Fundamental Principles and align with the research goals for Dalhousie. They focus on propelling research impact by supporting our researchers while connecting across disciplines and leveraging partnerships with our many regional and international stakeholders. Key 2021-2026 goals and targets follow. The Research Subcommittee will track progress and push Faculty members and departments to help us reach these targets.

GOAL	TARGET
Attract the best researchers	- Secure two new Canada Research Chairs - Establish two new Industry Research Chairs - Secure two major post-doctoral fellow awardees - Increase overall research funding by 10 percent per year - Increase Tri-Agency grants by 10 percent per year - Increase CFI funding by 50 percent - Increase peer-reviewed papers by 10 percent per year
Attract the best graduate students	- Double number of PhD students - Increase number of MSc students by 5 percent per year - Increase by 5 percent per year international PhD students through our joint international PhD programs - Have every professor supervising at least one graduate student per year - Double number of major graduate scholarships (e.g. NSERC, NSGS) by 2026
Enhance research collaboration with partners	- Increase industry funding and contracts by 25 percent - Hold biannual strategic planning meetings with NSDA - Increase collaboration with provincial and federal government scientists - Continued engagement and development of the Dal-AAFC strategic partnerships and goals - Hold at least one industry-Dal-government partnership event per year - At least one new international research collaboration per year with exchange of personnel - Enhance engagement and strategic planning with ILI office - Enhance engagement NS Knowledge & Technology Transfer (KTT) Working Group and establish a framework for knowledge delivery to stakeholders
Strengthening research capacity in strategic area	- Establish two new Centres by 2026 - Initiate three major research infrastructure projects - Continue to work with the Advancement Office to align strategic research goals with potential partners - Enhance partnerships with key colleagues, Centres, and Institutes within Dalhousie - Help Departments develop detailed concept notes for 2-3 strategic areas or facilities they want to develop - Ongoing engagement with Facilities Management to optimize planning and development of core facilities - Work with VPRI Office in improving core facilities models and inventories
Enhancing research culture	- Work with Department Chairs to enhance mentorship for all researchers - Continue to encourage and facilitate peer review of Tri-Agency and major grant applications - Continue to nominate researchers and students for internal and external awards - Expand Graduate Research Day to include post-doctoral researchers and faculty - Continued support for our Visiting Speaker Series - Establish MSc, PhD, and post-doctoral research awards - Establish and host annual agricultural research symposium
Drive policy	- Establish the Faculty of Agriculture as the 'go-to' place for government consultation on agriculture and food - Increase number of Dal-AC faculty and admin on government committees - Enhance consultation and engagement with government leaders
Create a strong culture of inclusive and active entrepreneurship and innovation	- Inter-departmental programming that promoting an entrepreneurial mindset among faculty, while supporting execution of ideas with real potential in the market place - Increase patents by 5 percent per year - Establish two spin-off companies by 2026

DEPARTMENT PRIORITIES



The Faculty boasts a unique complement of expertise and interests interspersed across four departments. Through a consultative process, each department identified key areas of research focus. This gives us transparent and goal-oriented direction to guide succession planning related to new hires and strategic research priorities in order to maximize impact and cross-cutting synergies between units, within the Faculty and across the University.

ANIMAL SCIENCE AND AQUACULTURE

The Department of Animal Science and Aquaculture (ASA) plans over the next five years to increase efforts to build its research strength in the areas of:

- animal genomics and breeding
- animal resiliency to climate change and disease
- animal nutrition innovations
- animal welfare, reproduction, development

To do so, ASA foresees a need to hire experts in genomics and breeding for disease resistance, gut microbiome analysis, and monogastric physiology. These areas of scholarship continue to have impact internationally, with increasing interdisciplinary opportunities. These areas are high priority for our many stakeholders in poultry, dairy, aquaculture, and other animal-based industries, which remain vital components of our regional and national agricultural enterprise.

Priority investments towards a Level 2 animal holding facility, upgrades to our aquaculture, genomics, nutrition, and dairy facilities will facilitate continued growth of our funding base and scholarly impact, while providing modern infrastructure to optimize student training, attract outstanding faculty, and grow inter-departmental linkages.

BUSINESS AND SOCIAL SCIENCES

The Department of Business and Social Sciences (BSS) will work to build research strength in:

- Sustainable agri-food systems – farm to table – through critical and engaged citizenship
- Agri-food production business sustainability, viability, policy, innovation, and entrepreneurship

BSS examines the development of sustainable food systems through our economic, political and social systems that can enhance agri-food innovations. Our research priorities are driven by challenges and opportunities we see in agricultural supply chains, food security, diversification of agricultural systems and inclusive agriculture entrepreneurship ecosystems. Our plan to bolster research impact of priority areas will be complemented by hiring of personnel in Food and Agribusiness Entrepreneurship and Sustainable Agri Food Systems.

We will continue to enhance the collaborations with other departments and stakeholders through the Rural Research Collaboration, Rural Futures Research Centre, Agri-Food Analytics, and others, which we hope will lead to investment in social computing (big data analytics). It is clear that an increasing number of grant funding programs and stakeholders require and would benefit from an inter-disciplinary approach to addressing modern agriculture problems. BSS will therefore play a key role in 'closing the circle' by bringing a social science and business lens to the natural sciences and engineering research efforts of colleagues in our other departments.

ENGINEERING

The Department of Engineering will focus on building research strength in the areas of:

- digital and precision agriculture
- clean agricultural technology and energy

The next generation of agricultural innovators and entrepreneurs will need to be highly skilled with heavy reliance on data to optimize decision-making. Our planned hiring of a professor in Systems Engineering and Data Analytics will complement the research mission of our core team in precision and digital agriculture to improve organization, analysis, interpretation, automation, and prediction of agricultural operations and technologies. Our inter-departmental proposal to develop a Centre of Digital and Precision Agriculture will coincide with prioritized infrastructure upgrades towards a Digital and Precision Agriculture Core Facility.

The challenge of developing agricultural technologies to improve performance, productivity and efficiency while reducing costs, energy consumption, and waste is one that has been embraced by our Department of Engineering. In transitioning from a petroleum to a bio economy, efforts towards agriculture clean technology, bio-resources, and energy play a critical role. Our anticipated hiring of a professor in Clean Agricultural Technology and Energy will add to our research team in this area and help us meet stakeholder and training demands in an area of high interest for Dalhousie and the Government of Canada.





PLANT, FOOD, AND ENVIRONMENTAL SCIENCES

The Department of Plant, Food, and Environmental Sciences (PFES) core areas of strategic research are:

- Climate Action and Environmental Stewardship
- Smart Sustainable Plant Agriculture
- Food Innovation, Value-Added Agriculture
- Sustainable Land and Landscapes

These focal areas align mainly with the University strategic clusters of Food Security; Healthy People, Healthy Communities, Healthy Populations; and, Clean Tech, Energy, the Environment. Over the next five years PFES plans to further strengthen its research capacity in our core strategic areas through targeted faculty recruitment in the areas of: (a) Smart and Sustainable Plant Agriculture (agronomy, cropping systems, field crops,

sustainable food systems); (b) Agricultural Residue Chemistry (environmental stewardship, residue and pesticide chemistry, environmental toxicology); and (c) Biodiversity - Food Security Linkages (agroecosystem resiliency, ecosystem services, agroecology).

PFES will leverage its expertise across and beyond the Faculty to establish research and training centres in the areas of Food security and Sustainable, Climate Smart Food Systems. The Organic Agriculture Centre of Canada (OACC) will continue to serve the research, development, and training needs of the organic sector. PFES also proposes to establish: (i) a Centre for Sustainable Soil Management, and (ii) a Centre for Food Innovation.

PFES will also endeavor to modernize its greenhouse and indoor production infrastructure and to reorganize and optimize departmental lab space usage designated in support of research.

COLLABORATIVE OPPORTUNITIES



Increased interdisciplinary collaboration will help maximize the impact and success of our research and innovation goals. Inter-departmental opportunities for collaboration that will be pursued include:

- The Department of Animal Sciences and Aquaculture (ASA) will examine opportunities with members of the Department of Plant, Food, and Environmental Sciences (PFES) to study bioproduct/supplement characterization and effects on animal and human health.
- The Department of Engineering will use its expertise in sensor development, digital systems, and machine learning to innovate technologies that will assist colleagues in ASA in their research of animal behavior and nutrition in or order to optimize management, welfare, and productivity of animals.
- Business and Social Sciences (BSS) will collaborate with ASA and PFES on using agri-business principles for modelling resilient production systems. For example, smaller farms producing healthier milk and meat from pasture, and new aquaculture species business planning.
- Personnel in the Department of Engineering will collaborate with ASA on improving aquaponics and land-based aquaculture systems
- ASA will work with PFES on bioproduct characterization and supplement effects on animal health, e.g. utilization of marine products to improve gut health.
- PFES will combine their expertise in horticulture, plant physiology, plant molecular biology and genetics, and greenhouse production, with complementary skills in energy, automation, and infrastructure in our Engineering Department to collaborate on indoor and controlled environment agriculture research.

Strategic collaborative priorities outside our Faculty have also been identified. Multiple discussions with government and industry stakeholders have identified the following as crucial areas for research and innovation partnerships, funding, and training of research personnel.

Climate change action

Big data

Digital agriculture

Food business entrepreneurship

Functional foods and health

Soil health and conservation

Vertical farming

Agricultural automation

Marketing

Clean agricultural technology

Animal and soil microbiome

Food innovation

Environmental toxicology

STRATEGIC INITIATIVES

Our Faculty will continue to make investments in areas of strategic research focus. Our plan includes: a foundation in agricultural technology development; advancement of farming support systems like soil, energy and water; adaption to specific production systems to ensure farm applicability; and, overall focus on data acquisition, management, and analysis for informed decision making at the farm level. Along with human resource priorities described above, the following are examples of projects identified as targeting strategic needs and opportunities that will allow us to fulfill our research mission.

DAIRY FACILITY RENEWAL

The dairy industry is a vital component of the Atlantic economy, a backbone of our rural communities, and essential to the basic food security of Atlantic Canadians. Our dairy industry faces significant challenges, and there are unique conditions in Atlantic Canada that require targeted research and training. We have an excellent track record of dairy research and partnerships, but our current dairy facility does not support the training and research needs of our modern industry. The condition of the existing facility limits innovation, discovery, automation adoption, technology integration, data-driven research decision-making, and industry collaboration. Our industry and government stakeholders have helped identify areas of multi-disciplinary research critical for Atlantic Canada – technology and automation, public trust, big data, forages, climate change, and farm management – that will be made possible through investing in this new facility.

CENTRE FOR SUSTAINABLE SOIL MANAGEMENT

Our Faculty is home to an internationally recognized team of multidisciplinary experts who have strong track records of collaborative research partnership with key stakeholders regionally and beyond. In order to grow our research strength in this area even further, we will be submitting a proposal for a Dalhousie Senate approved Centre for Sustainable Soil Management (CSSM). CSSM will coordinate solutions to enhance soil management, and link them to regional, provincial and national socio-economic policy drivers. CSSM will engage government scientists,

policy makers, extension experts, and industry partners, associations, and forums. Establishment of an Advanced Soil Characterization Laboratory (ASCL) will allow CSSM to be national leaders in soil research with focus on enhancing Atlantic Canadian agriculture through basic discovery, farm-focused innovation, high-throughput analysis, HQP training, knowledge transfer, cross-cutting collaboration, and stakeholder engagement.

CENTRE FOR DIGITAL AND PRECISION AGRICULTURE

Our Faculty has built an international reputation in digital and precision agriculture. We have focused on assembling a strong complement of researchers in this area who have forged outstanding collaborative partnerships with industry partners and stakeholders both big and small. We will develop a proposal for a Dalhousie Senate approved Centre for Digital and Precision Agriculture. The formal designation of this Centre will acknowledge the strength, coordination, and collaborative research and innovations pursuits already undertaken by precision and digital agriculture team. The team realizes that their ambitions in this area need to be supported by infrastructure upgrades to the Department of Engineering, culminating in construction of a Digital and Precision Agriculture Core Facility in the Banting Building.

These three projects will be complemented by other strategic research initiatives of interest to the Faculty, our partners, and stakeholder (e.g. aquaculture facility renewal, new plant food lab, new controlled environment facilities, and more).

