OUR CAMPUS

McGill's Macdonald Campus, is home to the University's Faculty of Agricultural and Environmental Sciences.

The Faculty is located on 650 hectares of land — the largest green space on the island of Montreal and the largest private land holding in the region.

Established in 1907, Macdonald Campus is a key McGill University infrastructure for experiential learning pertaining to modern biological, environmental, agri-food production, and processing systems.

WHO WE ARE / WHAT WE DO

Bioresource Engineering is a unique field of engineering that is based on a blend between natural sciences and engineering design to manage bioresources, such as land, water and biological organisms to provide food and other biomaterials while also ensuring environmental sustainability.

McGill

GRADUATE PROGRAMS

Our department welcomes Bachelor of Engineering (B.Eng.) as well as Bachelor of Science (B.Sc.) graduates to pursue advanced degrees, such as a Master of Science (M.Sc.), Master of Science Applied (M.Sc.A.), and Doctor of Philosophy (Ph.D.) in Bioresource Engineering.

In addition to traditional thesis-based graduate programs (M.Sc., and Ph.D.), we offer focused non-thesis programs in Integrated Water Resource Management (M.Sc.), Integrated Food and Bioprocessing (M.Sc.A.) and Environmental Engineering (M.Sc.A.). Only B.Eng. or equivalent program graduates are eligible to pursue a M.Sc.A. degree.

McGill

OUR RESEARCH

Our research areas span across three disciplines including:

Bio-Environmental Engineering

Bio-Process Engineering

Bio-Production Engineering

McGill

OUR LABS

With 14 research labs across various research areas, our students have access to excellent facilities to encourage innovative design solutions. Through the process of design, simulation and prototyping, our labs allow students to bring their innovations to life with the mentorship of our supervising professors.

OUR LABS

Under the mentorship of the department chair,
Dr. Viacheslav Adamchuk, the Precision Agriculture
and Sensor Systems Engineering Lab is focused on:

· Development of Proximal Soil and Plant
  Sensing Systems

· Geospatial Data Processing and Management

· Practical Implementation of Precision Agriculture

Principal Investigator: Prof. Viacheslav Adamchuk
Email: viacheslav.adamchuk@mcgill.ca
Website: http://adamchukpa.mcgill.ca

OUR LABS

Under the supervision of Dr. Jan Adamowski, the Hydrology and Water Enginnering and Management Lab focuses on:
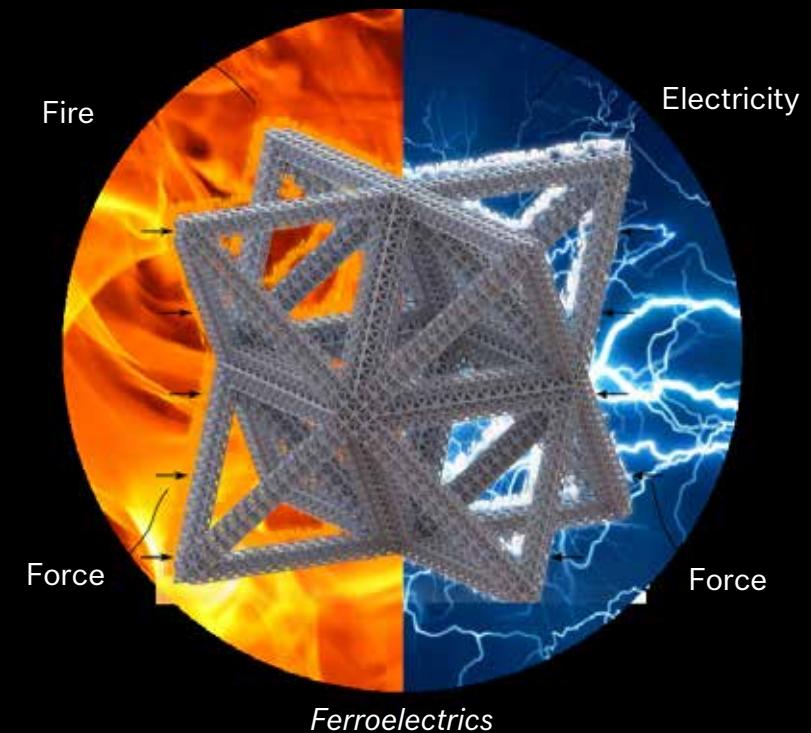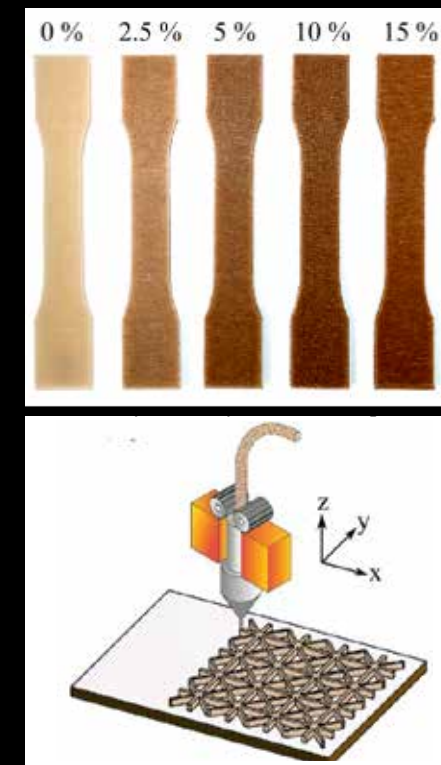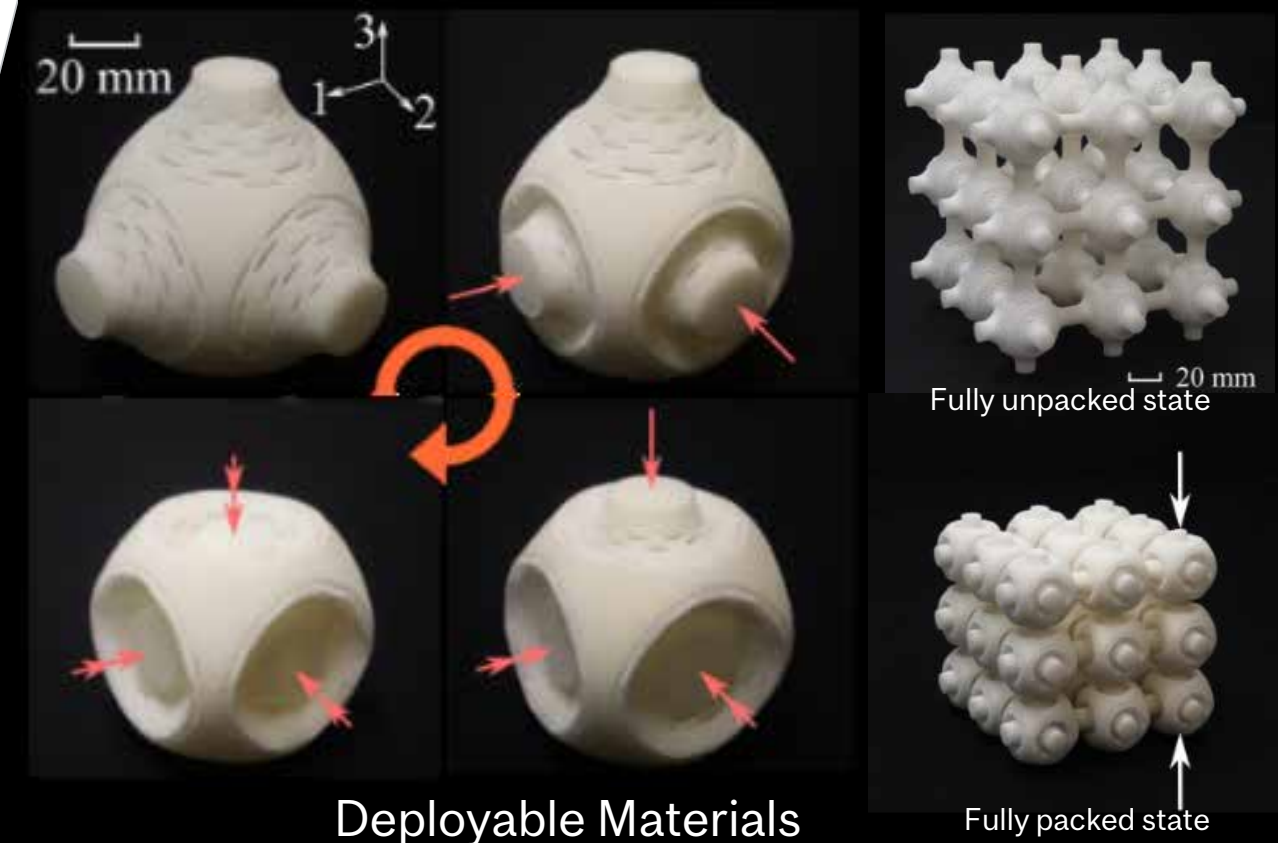
- Integrated and adaptive water resources management
- Participatory coupled human-water systems modeling
- Artificial intelligence applications in hydrology
- Sustainable agriculture
- Food and water security

ROAD CLOSED BY FLOOD

Principal Investigator: Prof. Jan Adamowski
Email: jan.adamowski@mcgill.ca

McGill

OUR LABS

The Advanced Multifunctional and Multiphysics Metamaterials Lab (AM³L) is directed by Prof. Hamid Akbarzadeh. This lab is focused on designing and applying knowledge related to:

· **Advanced Sustainable Materials:** Metamaterials, cellular solids and Architectural materials
· **Advanced Manufacturing:** 3D printing and laser cutting of smart biocomposites
· **Computational & Theoretical Mechanics:** Multiscale and Multiphysics modelling

Deployable Materials

Fully unpacked state

Fully packed state

Sustainable Cellular Biocomposites

Energy Harvesters and Sensors

Fire

Electricity

Force

Force

Ferroelectrics

Principal Investigator: Prof. Hamid Akbarzadeh
Email: hamid.akbarzadeh@mcgill.ca

McGill

OUR LABS

The Ecological Engineering Lab, under the mentorship of Dr. Grant Clark, conducts research focused on:

- Ecological engineering
- Sustainable agricultural systems
- Circular economy
- Organic residuals managements
- Green infrastructure
- Modeling and simulation
- Optimize surface water management and irrigation of urban trees
- Ecological engineering for optimal management of agricultural and municipal organic residues
- Management strategies for nutrient use efficiency and greenhouse gas emissions reduction from biosolids-amended soils in Canada

Principal Investigator: Prof. Grant Clark
Email: grant.clark@mcgill.ca

McGill

OUR LABS

Under the supervision of Dr. Idaresit Ekaette, the Food and Bio-Based Material Engineering Lab leads research on:

- Natural health products: extraction, modification and applications in bioprocessing
- Hydrocolloids and biopolymers: extraction, synthesis and the characterization for bio-applications
- Value addition of waste materials from food, agricultural and industrial systems
- Material properties of biomass as engineering tools in fabrication of biomaterials
- Formulation engineering for custom made bioproducts

McGill

Principal Investigator: Prof. Idaresit Ekaette
Email: idaresit.ekaette@mcgill.ca

OUR LABS

The Sustainable Food Systems Engineering Lab, under the lead of Dr. Ebenezer Miezah Kwofie, is focused on:

- Food systems sustainability and resiliences
- Enhancing food systems sustainability and strengthening capacity of stakeholders
- Circular economy pathways for agro-waste utilization

Principal Investigator: Prof. Ebenezer Miezah Kwofie
Email: ebenezer.kwofie@mcgill.ca

McGill
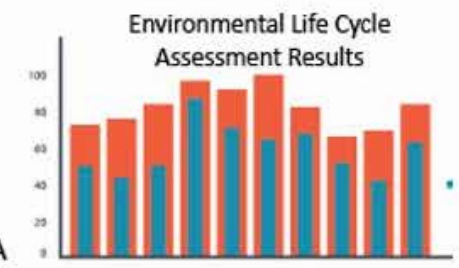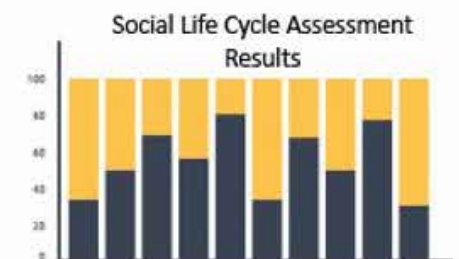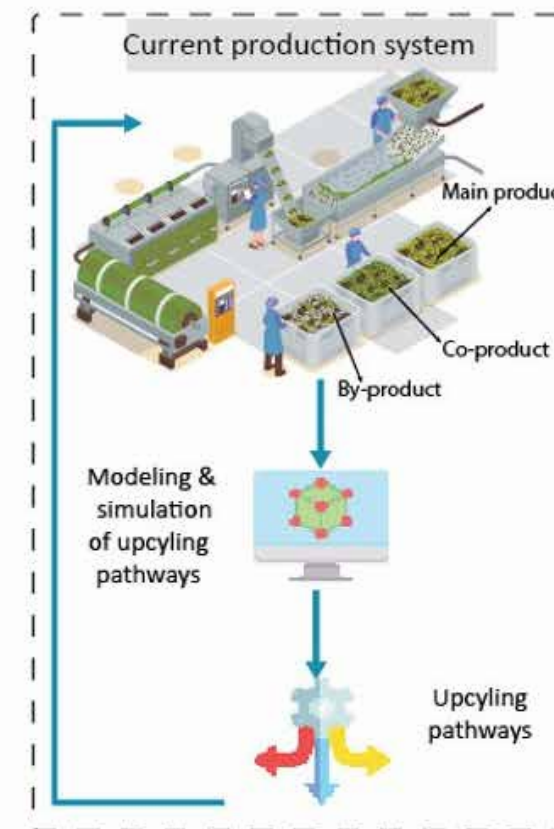
OUR LABS

The Biomass Production Engineering Lab, under the direction of Dr. Mark Lefsrud, is currently conducting research focused on:

· Light emitting diode evaluation for plant production in greenhouses
· Plant growth response in controlled environments
· Urban and vertical agriculture design
· Biocompatible concrete
· Medicinal cannabis (QAQCC)
· Oil and lipid Improvements in field pea, a non-traditional oilseed crop

Principal Investigator: Prof. Mark Lefsrud
Email: mark.lefsrud@mcgill.ca

McGill

OUR LABS

The Irrigation and Drainage Lab, led by Dr. Chandra Madramootoo, is currently researching:

• Effects of agricultural water management systems on greenhouse gas emissions in Eastern Canada
• Remote monitoring and modelling methane emissions from cattle feedlots
• Water quality assessment framework for a safe food system
• Managing agricultural systems to protect Canada's freshwater resources
• Application of variable rate irrigation technology for water efficiency and conservation
• Soil-plant-water dynamics and water productivity benefits of irrigated agriculture
• Alleviation of soil compaction due to heavy machinery on tile drained lands
• Use of machine learning models in remote sensing of crop water requirements

McGill

Principal Investigator: Prof. Chandra Madramootoo
Email: chandra.madramootoo@mcgill.ca

OUR LABS

Under the supervision of Dr. Michael Ngadi,
the Food Process Engineering Lab is focused on:

- Microstructural changes, surface characteristics and fat absorption kinetics in fried batter coated systems
- Texture of foods and biomaterials
- Hyperspectral Imaging assessment of food quality
- Assessment of nutrition sensitive value chains
- Quality, Nutrition and Health Impacts of Inclusion of Cassava Flour in Bread Formulation
- Development of systems for nutritional status assessment

Principal Investigator: Prof. Michael Ngadi
Email: michael.ngadi@mcgill.ca

McGill

OUR LABS

THe Food Quality, Safety and Security Engineering Lab, led by Dr. Valerie Orsat, is currently conducting resesrch related to:

- Development of processing methods for enhanced production, extraction and encapsulation of bioactive compounds for the functional foods sector
- Development of new products and processes for focussed food functionality
- Enhancement of the nutritive value of foods during handling and processing
- Better quality preservation of produce during handling (flavour, nutrient and phytochemicals)

McGill

OUR LABS

The Soil and Water Ecology Engineering Lab, directed by Dr. Shiv O. Prasher, is currently conducting research related to:

- Reducing environmental pollution from veterinary antibiotics, endocrine disruptive chemicals, and pathogens in livestock manure
- Impact of alkaline stabilized biosolids application on fate and transport of emerging substances of concern in agricultural soils, plant biomass and drainage water
- Evaluation of alternative best management practices in critical contributing areas in agricultural landscapes under changing climate
- Safe and effective use of untreated or partially treated wastewater in agriculture
- Increasing water use and fertilizer use efficiencies

Principal Investigator: Prof. Shiv Prasher
Email: shiv.prasher@mcgill.ca

McGill

OUR LABS

Under the mentorship of Dr. Zhiming Qi, The Water Resource and Environmental Systems Engineering Lab is focused on:

- Development and application of agricultural systems models to simulate water quality, water stress, nutrient cycle, crop production and greenhouse gas emission

- Monitoring of water quality (nano-particles), evapotranspiration, sediment deposition, snow accumulation & snowmelt, soil ice content and water drainage

- Climate change impacts on environmental quality and crop production

- Irrigation and drainage engineering

McGill

Principal Investigator: Prof. Zhiming Qi
Email: zhiming.qi@mcgill.ca

OUR LABS

The Post Harvest Technologies Engineering Lab, under the mentorship of Dr. Vijaya Raghavan, is focused on:

- High electric field drying and processing of thermosensitive food products
- High pressure pre-treatment for extending shelf life of produce without refrigeration
- Energy from microbial fuel cells using organic waste as a carbon source
- Microwave-assisted production of biochar and hydrochar from different biomasses
- Extraction of lipids and valued compounds from microalgae
- Microwave assisted retting of flax and hemp straws
- Enhancing food security in Africa through improvement of rice post-harvest handling, marketing and development of new products
- Innovations in post-harvest technologies for food security and safety, and for value addition to agricultural residues

Principal Investigator: Prof. Vijaya Raghavan
Email: vijaya.raghavan@mcgill.ca

McGill

OUR LABS

The Smart Production Systems Engineering Lab, led by Dr. Shangpeng Sun, is focused on:

· Developing and adopting innovative sensing technologies and computational methodology for solving challenges in next-generation smart agriculture, aiming to improve the production of high-quality food in the face of the rapidly growing human population and global environmental change.

· Developing ground/aerial remote sensing platforms to gather crop data for indoor and in-field conditions, and designs data mining algorithms using AI, 2D/3D computer vision, and statistical theory to extract meaningful information from the imaging data.

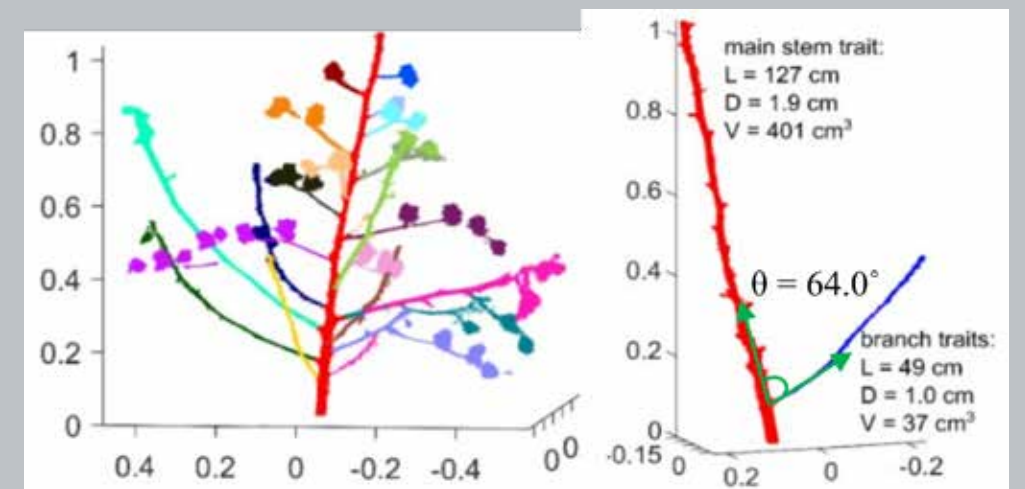Currently, the lab is researching:
- High-throughput plant phenotyping
- Crop growth and development monitoring
- Sensor fusion and 2D/3D computer vision
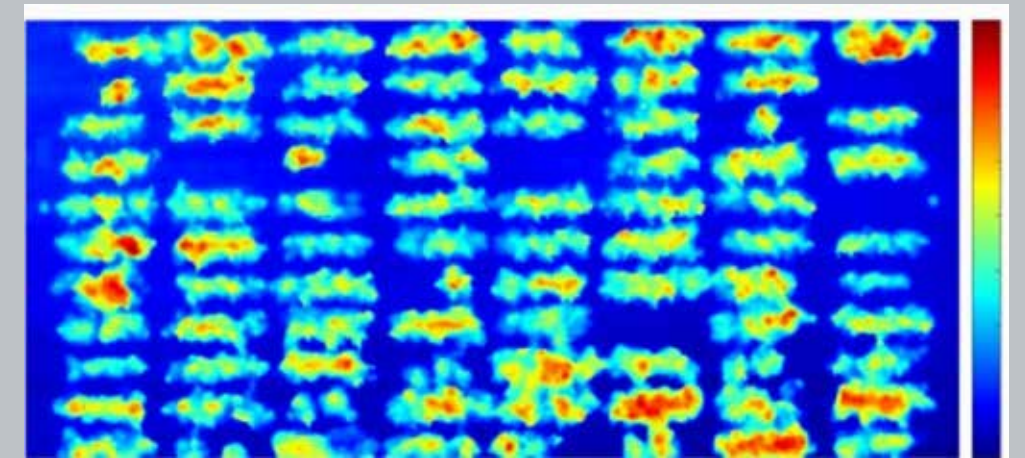
UAV-based crop canopy development monitoring

Strawberry fruit detection and counting

3D plant segmentation and structural traits extraction

main stem trait:
L = 127 cm
D = 1.9 cm
V = 401 cm³

θ = 64.0°

branch traits:
L = 49 cm
D = 1.0 cm
V = 37 cm³

Principal Investigator: Prof. Shangpeng Sun
Email: shangpeng.sun@mcgill.ca

McGill