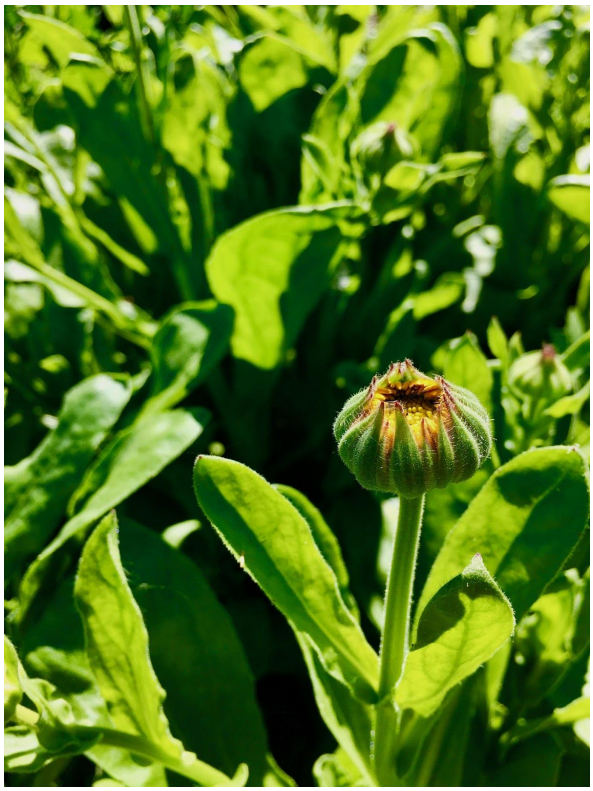

MPSG TOOLKIT

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1. What is permaculture?

Permaculture is a set of design principles used to create sustainable settlements in which humans and nature can coexist symbiotically. Although permaculture principles can be used to design houses, cities, and even societies, permaculture is commonly used as a form of sustainable, integrated, regenerative agriculture which makes use of primarily perennial crops. In this case, permaculture uses techniques similar to agroforestry and biomimicry to maintain ecosystem services, biodiversity, and resilience, while providing food and other materials for humans – the result often resembles a 'food forest'. At the heart of permaculture exists three ethics: Earth Care, People Care, and Fair Share (or equitable distribution).

The word 'permaculture' comes from the phrase "permanent agriculture" or "permanent culture". It is a system of design based on the observation of nature that aims to create long-term sustainable human societies. It seeks to work with nature instead of against it to create abundant, resilient, and regenerative systems. Successful designs are ones that require the least amount of work or input, and are able to meet all of their needs alone. Rather than a set of fixed techniques or methods, permaculture design is a constantly evolving process guided by 3 ethics and 12 principles.

3 Permaculture Ethics

1. Earth Care: Humans are capable of having a measurable positive impact on the Earth by recognizing ourselves as part of the system and not extracting more than we are giving back.
2. People Care: Fostering community, interdependence, and collaboration is required for change. By looking after ourselves and each other we become part of a stronger, more resilient system.
3. Fair Share: Managing surplus and overflow is essential for a system to keep working. Continuous growth is impossible and there are limits to how much we can take and use- redistributing surplus allows us to benefit not only ourselves, but the whole community.

12 Permaculture Principles

1. Observe and Interact
2. Catch and Store Energy
3. Obtain a Yield
4. Apply Self-Regulation and Accept Feedback
5. Use and Value Renewable Resources and Services
6. Produce No Waste
7. Design from Patterns to Details
8. Integrate Rather Than Segregate
9. Use Small and Slow Solutions
10. Use and Value Diversity
11. Use Edges and Value the Marginal
12. Creatively Use and Respond to Change

2. About the project

The Macdonald Permaculture Showcase Garden consists of a quarter acre plot at the Farm Centre of the Macdonald Campus of McGill University in Sainte-Anne-de-Bellevue, Quebec. This unused area was transformed into a Permaculture Garden intended to serve as a demonstration site of permaculture techniques and principles. It aims to raise awareness and educate about permaculture by serving as an example of a productive, diverse ecosystem that can be studied and used for research. The project was started by Chris Wrobel and Audrey Wagner (president & founder of the McGill Permaculture Club) in the fall of 2016. The project was approved and funded by the Sustainability Projects Fund in the spring of 2017, after which a group of McGill students took the Permaculture Design Certification Course with Graham Calder, founder of P3 Permaculture. Together they designed the garden as an extracurricular project. The project broke ground in May of 2017 with Ella Martin as Garden Coordinator.

The goal of this project is to increase student and faculty engagement with the Macdonald Permaculture Showcase Garden, and to create learning opportunities in the field of permaculture at McGill. Using an open source concept, the Permaculture Club wishes for the garden to serve as a door for new and innovative projects in which students and faculty at McGill are able to apply systems thinking approaches towards interdisciplinary fields of research. This project is expected to expose people to alternative and sustainable agricultural systems. The garden is meant to portray an exemplary model of a field designed using the 12 Permaculture Principles, therefore the Permaculture Club hopes that it serves as an outlet for people to creatively expand on the principles as they see fit. The overall involvement from students and faculty in the garden is designed and expected to create a community surrounding the project, and to further overall education about permaculture at McGill.

Garden Coordinator Timeline:

1. Ella Martin – Summer 2017
    a. Funded by the SPF (Sustainability Project Fund)
2. Audrey Wagner – Fall 2017
    a. Funded by the SPF
3. Sophie Theron – Summer 2018
    a. Funded by the SPF and SEEF (Student Experience Enhancement Fund)

3. Sections of the garden

a. Food Forest: Food Forests are perfect examples of creating edible ecosystems that are resilient and self-maintaining over time. They incorporate plants of varying canopy layers and with different functions. The canopy layers, from larger fruit trees to groundcovers maximize the use of vertical space and interactions between plants. The variety of functions in the plants ensures that all of the needs of the system will be provided for. This eventually reduces the amount of work needed to maintain the food forest. The result is an integrated polyculture that produces food, provides habitat and shelter for wildlife, and protects and builds soil. Food forests are a form of regenerative agriculture that will grow and become more productive with time.

Principles: Small and slow solutions; Integrate rather than segregate; Observe and Interact

Plant name	Life Cycle	Year planted
Golden Pourpier	Perennial	1
Lovage	Perennial	1
Anise Hyssop	Perennial	1
Leaf Fennel	Perennial	1
Marshmallow	Perennial	1
Calendula	Perennial	1
Garlic Chives	Perennial	1
Yarrow	Perennial	1
Comfrey	Perennial	1
Lavender	Perennial	1
Oregano	Perennial	1
Thyme	Perennial	1
Wild Ginger	Perennial	1
Horseradish	Perennial	1
Stanley Plum	Perennial	2
Pear 4-in-1	Perennial	2
Honeycrisp Apple	Perennial	2
Gooseberry	Perennial	2
Currant	Perennial	2
Shiso	Perennial	2

b. Vegetable Beds: Permaculture aims to use as many perennial species as possible in order to create sustainable, low-maintenance ecosystems. However, during a garden's earliest stages, annuals are often planted to obtain a yield while the perennial species are getting established. These annual vegetable beds do just that, while also increasing biodiversity, providing food for pollinators and stabilizing the soil.

Principles: Use and Value Diversity, Obtain a Yield

Bed 1

Plant name	Life cycle	Year planted
Cantaloupe	Annual	1
Pole bean	Annual	1
Pea	Annual	1
Tobacco	Annual	1
Comfrey	Perennial	1
Calendula	Perennial	1
Tomatoes	Annual	2
Hot pepper	Annual	2
Onion	Annual	2
Parsley	Annual	2
Basil	Annual	2
Marigold	Annual	2
Mint	Annual	2
Rosemary	Annual	2

Bed 2

Plant name	Life cycle	Year planted
Tomato	Annual	1
Asparagus	Perennial	1
Borage	Annual	1
Basil/Citrus lime basil	Annual	1
Marjoram	Annual	1
Garlic chives	Annual	1
Parsley	Annual	1
Nasturtium	Perennial	1
Corn	Annual	2
Squash	Annual	2
Pumpkin	Annual	2
Bean	Annual	2
Peas	Annual	2

Bed 3

Plant name	Life cycle	Year planted
Good king henry	Perennial	1
Arugula	Perennial	1
Kale	Annual	1
Korean Mint	Annual	1
Nasturtium	Perennial	1
Dill	Annual	1
Cilantro	Annual	1
Cabbage	Annual	2
Beet	Annual	2
Carrot	Annual	2
Radish	Annual	2
Swiss chard	Annual	2
Collards	Annual	2
Rosemary	Annual	2
Parsley	Biannual	2
Pineapple sage	Perennial	2
Purple sage	Perennial	2

Vegetable bed	Main plant family year 1	Main plant family year 2
1	Curcurbitaceae	Solonaceae
2	Solonaceae	3 sister guilds (cucurbitaceae, poaceae, fabaceae)
3	Brassicasea	Chenipodiaceae

c. Windbreak: The windbreak protects the area from strong winds that can erode soil and damage the garden. Windbreaks also help stabilize temperature and reduce the amount of water that plants lose to

evapotranspiration. Our windbreak is composed of strong, fast-growing trees and shrubs that will quickly grow to provide adequate protection for the more tender plant species in the garden. Many of the plants in the windbreak provide secondary services such as nitrogen fixation, wildlife habitat or the production of food and mulch.

Principles: Integrate, Use Edges: Value the Marginal

Plant name	Number	Life cycle	Year planted
Hazelnut *(Corylus Avellana)*	1	Perennial	1
Hazelnut *(Corylus Cornuta)*	1	Perennial	1
Saskatoon Berry	2	Perennial	1
Siberian Pea Shrub	1	Perennial	1
Alder	1	Perennial	1
Serviceberries	4	Perennial	1

Planted okra, watermelon, and cucumbers - but they all died
Trees that were planted during tree planting event - not sure which ones are still alive

d. Swales: Swales consist of a trench dug on contour with each point located at an equal elevation. Excavated soil is piled on the downhill side forming a 'berm', which is also completely level. Its purpose is to slow the flow of water, and reabsorb it into the soil to prevent runoff and erosion. Water flows into the swale, spreads across it, then infiltrates into the ground, distributing itself across the field and providing a natural irrigation system. The plants on the berm help to stabilize the soil and ensure the water is trapped by the swale.

Swale 1

Plant name	Life cycle	Year
Amaranth	Annual	1
Calendula	Annual	1
Borage	Annual	1
Alfalfa	Perennial	1
White Clover	Perennial	1
Nasturtium	Perennial	1
Blackberry	Perennial	1

Plant name	Life cycle	Year
Calendula	Annual	1&2
Crimson sweet clover	Biannual	1&2
White Clover	Perennial	1&2
Nasturtium	Perennial	1&2
Borage	Annual	1
Raspberry	Perennial	1
Blueberry	Perennial	1
Lupine (2)	Perennial	2

Swale 2

e. Herb Spiral: The spiral pattern in permaculture is usually associated with the concentration or dissipation of energy. In the herb spiral, small variations in sunlight and moisture create 'microclimates', or greatly different growing conditions within a small area. This allows many different plants with different needs to coexist in a single structure. The top of the spiral is the most exposed to sunlight and the driest. The bottom of the spiral contains the most shade and is the wettest area as water flows down the spiral.

Herb Spiral	Life Cycle	Year
Sage	Perennial	2
Thyme	Perennial	2
Parsley	Perennial	2
Basil	Annual	2
Lemon basil	Annual	2
Anise Hyssop	Perennial	2
Korean Mint	Perennial	2
Chives	Perennial	2

f. Flower Border: The flower border is not only for aesthetic purposes, but also for attracting pollinators and providing insect habitat. Providing habitat and resources for especially wild native pollinators is extremely important for their conservation as well as for the ecosystem services they provide. We selected a variety of flower species, many of which are native perennials. The flowers were chosen so that there would always be something in bloom throughout the season, and in a range of colours. This provides food for the greatest number of species over the longest period of time. Perennial species make the garden more self-sustaining and minimize the work needed over time.

Principles: Use and value renewable resources and services, Use and value diversity, Use edges and value the marginal

Plant name	Life cycle	Year
Asclepias/Butterfly milkweed	Perennial	1
Anise hyssop	Perennial	1
Echinacea/cone flower	Perennial	1
Nasturtium	Perennial	1
Lavender	Perennial	1
Golden pourpier	Annual	1
Red lobelia	Annual	1
False sunflower	Annual	1
Wild bergamot	Annual	1

g. Medicinal Garden: The medicinal garden hosts a variety of herbs and medicinal plants. Medicinal plants and herbs have many purposes- they not only have medicinal and culinary uses, but also serve to

attract pollinators and their strong aromas to deter pests. The species planted can cater to specific needs, depending on the climate and the user. This lot usually holds native species.

Principles: Obtain a yield, Use and value diversity

Plant name	Life cycle	Year
Lavender	Perennial	1
Sage	Perennial	1
Asclepias	Perennial	1
Anise Hyssop	Perennial	1
Catnip	Perennial	1
Lemon balm	Perennial	1
Watercress	Perennial	1
Oregano	Perennial	1

h. Pergola: It is a structure designed to support climbing species. The pergola was inaugurated in Fall 2017 by students from McGill. The wood came from recycled materials and was put up in one afternoon. The goal is to create a shaded area from the vines growing along the beams. This space provides shelter during hot summer days and is ideal to relax, put up a hammock and take a long nap.

Principles: Observe and interact, Use edges

1. Sheet Mulch: Sheet mulching is a site-preparation technique, whereby several layers of organic matter are stacked in order to suppress weeds and build soil. The technique is to essentially make a lasagna of several layers of cardboard, compost, manure and straw. The addition of organic material greatly increases the soil microbial activity and provides an abundance of vital plant nutrients.

4. From Seed to Harvest

This section is designed to guide one through the process of managing the Permaculture Showcase Garden from beginning to end.

a. Before you start anything, plan.

1. Make a trip out to the garden and observe the lay of the land. Record all observations. Make note of areas of the garden that you would like to improve.
    a. Observe each section of the garden individually (i.e. windbreak, food forest, swales, vegetable beds, etc.). Think of ways in which ecosystem services could be increased in each section.
    b. Take note of the weeds. What areas of the garden are the most overgrown with weeds? How can these weeds be outcompeted using permaculture techniques?
2. Brainstorm. Make a list of your main priorities/projects.
3. Come up with a garden design.
    a. Vegetable beds: Think about crop rotations, companion planting, the incorporation of more perennials, etc.
    b. Could perennial plants be added to any other area of the garden?
    c. Swale berm: come up with seed mix (see section 3d for seed mix examples from the previous two summers).
    d. Flower border: Could more perennial flowers be incorporated at the border?
4. Think of resources. For the garden projects/design that you have come up with, what materials need to be acquired? Where will you get them from? How can you maximize quantity and minimize price? How much will it cost? What stakeholders can be contacted? (see section 7 for stakeholder information).
    a. Potential materials to think about: seeds, plants, compost, woodchips, cardboard, straw, etc.
5. Can any of the ideas you have come up with be facilitated with the help of volunteers in the form of workshops? Will you host weekly drop-in volunteer hours at the garden? If so, it is a good idea to host these hours during your normal garden shifts.
6. Set deadlines. Now that you have come up with a list of projects, garden design, materials needed, and workshops, make a calendar outlining key dates for the duration of the project. As you are your own boss, this step is really important as it will give you a timeframe to work under. Making this calendar before the project starts will allow you to determine the feasibility of the projects you have planned out before you begin the project.

b. Swine Complex:

The Garden Coordinator will need to request access to the Swine Complex via activation of their McGill ID card by emailing Paul Meldrum (see contact list in section 7). If the Garden Coordinator is to go to the garden on a weekend, they must notify Macdonald Campus Security beforehand. This is so that security can de-activate the alarm from their offices.

The Swine Complex contains all MPSG equipment. See section __ for equipment inventory.

c. Purchasing Plants:

In the past, the garden coordinator has purchased plants for the garden at Pepiniere de L'ouest, a plant nursery in the West Island. For more information visit their website at: https://westislandnursery.com

d. Acquiring seeds:

Here is a list of places that the Garden Coordinator has acquired seeds from in previous years:

1. Tourne-Sol Co-Operative Farm: online order. Approximately $3.50 per seed package.

For more information about Tourne-Sol, please visit their website here:

https://www.fermetournesol.qc.ca/en/

2. Macdonald Campus Seed Library: obtained at the Macdonald Campus Library. Free.

For more information about borrowing seeds, returning seeds, and how to save seeds, please visit:

https://www.mcgill.ca/library/branches/macdonald/seed-library

e. Seedlings:

In the past, the Garden Coordinator has ordered seeds and seeded them in the MacDonald Campus Raymond Greenhouse before the end of the academic school year. The Garden Coordinator must get permission to use space in the greenhouse, to borrow seedling trays, and to use potting soil (see section 7 of toolkit for contact information).

Plan ahead. Read the back of the seed package to know the amount of days to germination after you plant each seed. This will allow you to plan when to transport the seeds from the greenhouse to the garden for transplantation.

From the start, it is a good idea to quantify everything. For example, approximate how many seeds were placed in each hole of the seedling tray, record the success rate of the plants as they germinate, document the date that the seeds were planted. Make a calendar approximating when each type of seed will be ready for transplantation to the garden, and when each seed will be ready for harvest (indicated by "days to maturity" on the back of the seed package).

Once you have planted all seeds, the seeds will need watering about once a day in order to keep the potting soil moist. The Garden Coordinator can ask for help from the Permaculture Club's Executive Members (see contact list in section 7) in order to devise the watering.

Transportation of seeds from greenhouse to garden: Macdonald Campus Security (see contact list in section 7) has helped with this in the past. The Garden Coordinator should give security a call about 15 minutes in advance and set up a pick-up location. During these 15 minutes, the Garden Coordinator should move the seedling trays out of the Raymond Greenhouse to the pick-up location. It is important to bring large plastic bags as seat protection in order to prevent soil or water from leaking onto security's car seats.

Once transported, if seeds need to remain at the garden overnight, the Garden Coordinator can keep them under the spruce trees on the outside edges of the garden. This will prevent the seedlings from drying out and will increase moisture retention.

f. Planting the vegetable beds:

Planting the vegetable beds alone is a large task that could be facilitated by the help of volunteers in the form of a workshop.

g. Watering the plants: attach one end of a garden hose to a faucet located inside the swine complex. One hose alone is not long enough to reach the garden; therefore, the garden coordinator will need to attach 2 or 3 together depending on which faucet is used within the swine complex. The hoses can be found with the MPSG equipment in the swine complex.

h. Advertising for workshops/volunteer hours:

The Garden Coordinator should request to become an admin of the McGill Permaculture Club's Facebook page in order to create and post events, volunteer hours, photos, etc.

An effective method to inform people of workshops and volunteer hours is to put up posters around Macdonald Campus. Posters must be time stamped at the MCSS counter (located in the Centennial Center of Macdonald Campus) and need to be removed before or on the date of expiry. Posters can only be placed on cork boards or within display cases. Posters are recommended not to exceed 30cm x 22cm.

i. Harvest:

It is up to the Garden Coordinator to decide what to do with the harvest. In previous years, it has been utilized for workshops hosted by the McGill Permaculture Club in the fall semester, and donated to organizations within the Montreal community such as:

1. La Rue Des Femmes
    a. For more information on the organization, please visit: http://laruedesfemmes.org/node/44
2. Corbeille de Pain (Ugly But Loved Project)
    a. For more information on the organization, please visit: https://www.corbeilledepain.com/ugly-but-loved-moches-mais-cheris

5. Academic Integration

a. The Garden as a Classroom:

One of the main objectives of the Macdonald Permaculture Showcase Garden is to increase community engagement. In order to accomplish this, the Permaculture Club is in the process of creating an Outdoor classroom in the garden as a means to create a space for Macdonald classes, students, professors, and the residents of St Anne to join in community, to engage with a direct example of Permaculture in their community, and to use the classroom as a creative and innovative educational space. Ways in which the Outdoor Classroom can be used for educational purposes in the future include classroom lectures given by Macdonald Campus professors, activities and workshops hosted by various Mac Campus student clubs, classroom field trips, research projects, etc. It can also be used as a place to go have lunch with friends in breaks between classes, for small outdoor concerts, and more. A broader aim of the Outdoor Classroom is to intensify the community's involvement with the land to ensure future sustainability and self-reliance. The construction of the Outdoor Classroom will be completed by the start of the 2019 Fall academic semester, just in time for professors, students, and clubs on campus to use the space and spend more time enjoying, engaging with, and learning from the Macdonald Permaculture Showcase Garden.

Pictured left: A 3D rendering model and design of the Outdoor Classroom.

Pictured right: A team of volunteers at the Permaculture Clubs 'Learn How to Excavate 101 workshop, where volunteers learned how to do some earthwork and excavate in order to build a solid foundation for the outdoor classroom.

The outdoor classroom will be composed of three 3-tiered benches arranged in a semi-circle, and is designed to fit approximately 48 people. It was designed in collaboration with students from the Bioresource Engineering program at Macdonald Campus, and engineer, friend of the project, and former McGill student, Mathieu Roberge. Construction is to be completed in the summer of 2019, and the plans, materials, and contacts will be included here upon finalization.

b. Professor and Course Involvement:

Below is a list and description of potential Macdonald Campus courses whose course descriptions align with the principles of the Macdonald Permaculture Showcase Garden. The garden being a close and

accessible example of a regenerative and sustainable ecosystem on Macdonald Campus, professors will be able to incorporate trips to the Permaculture Garden as part of their course syllabus in order to present lectures in the outdoor classroom and to provide students with a more interactive and engaging university learning experience.

Course Code	Term	Associated Professor	Course Name & Overview **as depicted on the McGill Website
AEBI 210	FALL	N/A	Organisms 1: The biology of plants and plant-based systems in managed and natural terrestrial environments. The interactions between autotrophs and soil organisms and selected groups of animals with close ecological and evolutionary connections with plants (e.g., herbivores and pollinators) will be explored in lecture and laboratory.
AEBI 211	WINTER	Jessica Head	Organisms 2: Introduction to the biology, physiology, structure and function of heterotrophs and their interactions with other organisms. This course will focus on animals in terrestrial, freshwater and marine environments. Topics include bioenergetics and functional metabolism, adaptations to environments, animal-animal, animal-plant, and animal-pathogen interactions.
AEBI 212	WINTER	N/A	Evolution and Phylogeny: A phylogenetic-based overview of the tree of life and examination of relationships between major taxa, from bacteria and archaea to eukaryotes. Evolution will be discussed via topics including: evolution by natural selection, Neo-Darwinism and alternatives, myths and misconceptions in evolution, species and speciation.
AGRI 215	FALL	Caroline Begg / Elsa Vasseur	Agro-Ecosystems Field Course: Through case studies and field trips, students will examine the problems and constraints within the Canadian agro-ecosystem, including the interrelationships among food production, the environment, agricultural policy and social issues. Research in this field of study will also be introduced.
AGRI 340	WINTER	Caroline Begg	Principles of Ecological Agriculture: Focus on low-input, sustainable, and organic agriculture: the farm as an ecosystem; complex system theory; practical examples of soil management, pest control, integrated crop and livestock production, and marketing systems.

BREE 518	WINTER	Grant Clark	Ecological Engineering: Concepts and practice of ecological engineering – the planned creation or management of a community of organisms, their nonliving surroundings, and technological components to provide services. Survey of applications such as constructed wetlands, aquatic production systems, green infrastructure for urban stormwater management, environmental restoration. Taught cooperatively with a parallel course at University of Nebraska-Lincoln. Online collaboration with an interdisciplinary, international team is an important component of the course.
BREE 529	FALL	Viacheslav Adamchuk, Jeffrey A Cardille	GIS for Natural Resource Management: Applications of Geographic Information Systems (GIS) and spatial analysis techniques to the presentation and analysis of ecological information, including sources and capture of spatial data; characterizing, transforming, displaying spatial data; and spatial analysis to solve resource management problems.
ENTO 330	FALL	Stephanie Boucher	Insect Biology: Insect structure and function, development and specialization; ecology and behavior; diversity, evolution and classification of insect orders and common families; pest management
ENVB 201	FALL	Cynthia Kallenbach	The Biophysical Environment: With reference to the ecosystems in the St Lawrence lowlands, the principles and processes governing climate-landform-water-soil-vegetation systems and their interactions will be examined in lecture and laboratory. Emphasis on the natural environment as an integrated system.
ENVB 222	FALL	Melissa McKinney	St. Lawrence Ecosystems: Integrative field biology course about the biodiversity and ecology of terrestrial and aquatic ecosystems within the St. Lawrence Lowlands. Research projects about the natural history of the regional flora and fauna. Fundamentals of community, ecosystem and landscape ecology.
ENVB 410	FALL	Elena M Bennett	Ecosystem Ecology: Biotic and abiotic processes that control the flows of energy, nutrients and water through ecosystems; emergent system properties; approaches to analyzing complex systems. Labs include collection and multivariate analysis of field data.

FAES 300	FALL WINTER SUMMER	Kendra D Gray	Internship 2: Full-time work-term intended to complement the student's undergraduate studies. Course work will be graded by a Faculty member with expertise relevant to the student's area of study. Finding a work placement is the responsibility of the student and facilitated by the Faculty's Internship Office.
LSCI 451	FALL WINTER	__	Research Project 1: A research project on a topic relevant to the life sciences. This course is intended for senior (U3) undergraduates.
NUTR 512	WINTER	Timothy A Johns	Herbs, Foods and Phytochemicals: An overview of the use of herbal medicines and food phytochemicals and the benefits and risks of their consumption. The physiological basis for activity and the assessment of toxicity will be presented. Current practices relating to the regulation, commercialization and promotion of herbs and phytochemicals will be considered
PLNT 300	FALL	Donald L Smith	Cropping Systems: Application of plant science and soil science to production of agronomic and horticultural crops. Use and sustainability of fertilization, weed control, crop rotation, tillage, drainage and irrigation practices.
PLNT 304	WINTER	Suha Jabaji	Biology of Fungi: This course describes the various groups of fungi and explores in depth their biology and physiology, their ecological niches and the role in various ecosystems and their benefits and uses in industry and biotechnology.
PLNT 353	WINTER	Jacqueline C Bede	Plant Structure and Function: The general anatomy and physiology of vascular plants with emphasis on how physiological processes influence function.
PLNT 358	FALL	Frieda Beauregard	Flowering Plant Diversity: Principles of classification and identification of flowering plants and ferns, with emphasis on 35 major families of flowering plants and the habitats in which they grow.
PLNT 426	WINTER	Jacqueline C Bede	Plant Ecophysiology: This course investigates the complex interactions between plants and their environment, focusing on the mechanisms underlying plant physiological processes. Plasticity of plants to their ecological environment; topics include phytoremediation, plant stress responses, plant-symbiosis and plant-insect interactions

PLNT 460	FALL	Thomas Pray	Plant Ecology: Theory and practice of plant ecology with an emphasis on the interaction between patterns and ecological processes and the dynamics, conservation and management of plant populations and communities over a range of temporal and spatial scales.
SOIL 300	WINTER	George McCourt	Geosystems: Interactions between Earth's various geologic systems and how these interactions lead to mineral and rock formation. Geomorphic processes and how various landforms are created by the interactions at the Earth's surface between the various geologic systems.
SOIL 315	FALL	Joann Karen Whalen	Soil Nutrient Management: Plant nutrients in the soil, influence of soil properties on nutrient absorption and plant growth, use of organic and inorganic fertilizers.

c. Research Topics / Questions

The table below contains a list of potential research topics that could be explored by Macdonald Campus professors, researchers, and students who aim to complete an independent study course or internship in the garden:

Main topic	**Subtopics**
GIS	- Mapping the local sustainable food system in Ste-Anne-de-Bellevue - Mapping MPSG with higher degrees of resolution, encompassing the location of each perennial plant, the topography and water flows
Soil Ecology	- Root adaptation under induced drought stress - Investigating carbon sequestration and GHG emissions under different plant systems - The effect of perennial nitrogen fixers on N-cycling in the soil - Rhizospheric community dynamics and their interaction via signalling molecules - Plant microbe interactions
Entomology	- Insect biodiversity (comparing the MPSG to other agro-ecosystems - How to improve nesting aids/insect hotels - Evaluating effectiveness and colonization of insect hotels and ground-nesting bee habitats
Other fields with potential to be researched:	- Sustainable/ regenerative agriculture - Pollinator ecology and conservation - Plant/insect Ecology

	- Mapping - Food systems - Indigenous food issues - Integrated water management - Climate change - Decomposition and compost

d. Past and current intern projects

Semester	Student	Supervisor	Topic
Winter 2019	Catherine Destrempes	Jeffrey Cardille	GIS Mapping of Ste-Anne-de-Bellevue food and agriculture related projects
Summer 2019	Christie Liem	Audrey Constance Wagner & Ella Martin	Introduction to permaculture and the management of the MPSG
Summer 2019	Akshara Chandrabalan	Chun Chung Yeung [Richard]	Decomposition rates in different agricultural systems
Summer 2019	Sophia Bullard	Jeffrey Cardille	GIS Mapping of the MPSG
Summer 2019	Janella Snagg-Romeo	Morgan Jackson, Caroline Begg	Comparing pollinator species in different agricultural systems
Summer 2019	Mackenzie Burnett	Morgan Jackson	Soil insect diversity in the MPSG
Summer 2019	Leela Riddle-Merritte	Caroline Begg	Developing permaculture education materials for elementary school students

6. Equipment Chart

Table outlining the organization of the MPSG equipment located in bins within the swine complex.

Bin 1	Bin 2	Bin 3	Bin 4	Bin 5

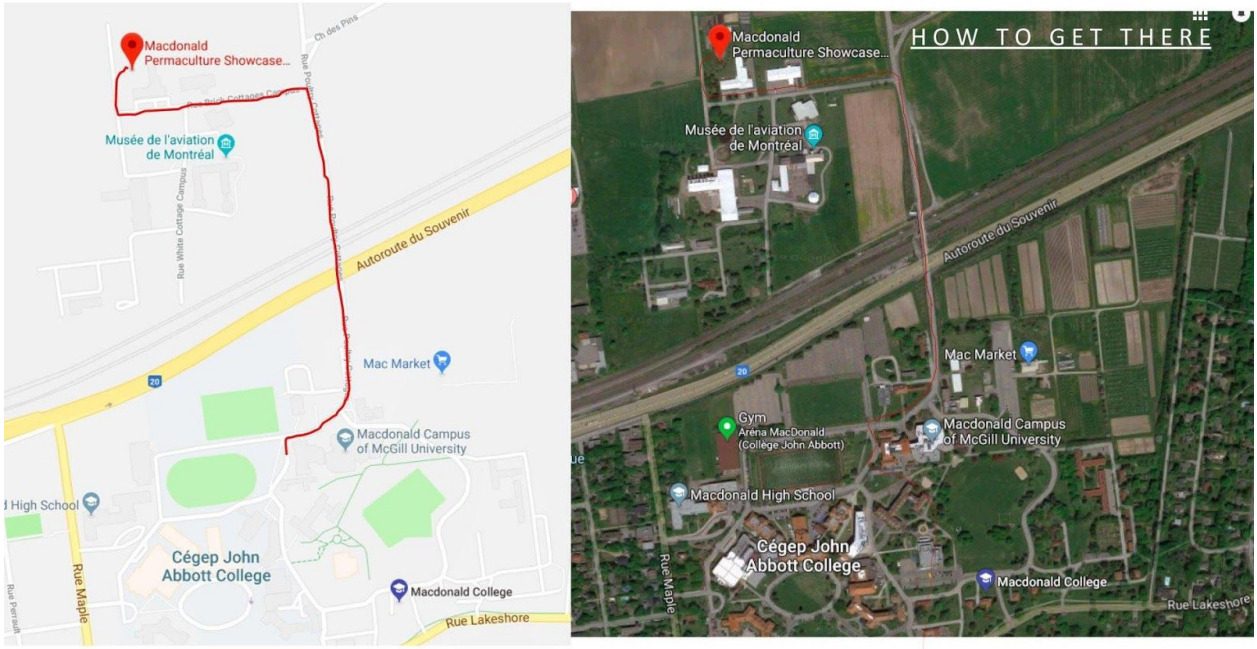
Equipment	n	Equipment	n	Equipment	n	Equipment	n	X
Band Aids, Medicare	1	Bone plus	1	Garden Hose, 50 ft light duty	4	Black Landscape Fabric	11	X
Bug Spray	2	First Aid Kit	1			Plant Pots, circle	16	X
Garden gloves (green)	6	Fish emulsion	1			Plant Pots, square	24	X
Garden gloves (white)	1	Garbage Bags	3			Plant Spray	1	X
Hydrogen Peroxide	1	Measuring Tape	2			Pot Holders, circle	2	X
Pruners	4	Misc. Box	1			Pot Holders, square	3	X
Shears, Fiskar Hedge	1	Misc. Rope, orange	2			Seedling Trays, Jiffy Seed Starter	2	X
Shovel (small) (yellow + black handel)	2	Stem Attachment	12					X
Shovel (small), floral	2							X
Shovel (small), red + black handel	1							X
Sixers (small)	1							X
Sunscreen	1							

Bin 6		Bin 7		Bin 8		Bin 9		Bin 10	
Equipment	n	Equipment	n	Equipment	n	Equipment	n	Equipment	n
Garden Hose, dark green	4	Bamboo Sticks	6	Watering Can	2	Rake	2	Alpine Shovel (large), Garant	1
		Metal Stakes	2			Shove (large), Garant Pro Series	1	Shovel (large)	2
		Pylex 50"	4					Shovel (large) (green), Garant	2
		Tree Trunk Protector	2					Spade (large), Landscaper Tough Ames	1

Seed Collection:
https://docs.google.com/spreadsheets/d/1ks4nvjNWGtZL8V5y_YNRCEHtyQ6b_5CkdgYnDPMMwgU/edit?usp=sharing

7. How to get to the garden

From Macdonald Campus (21111 Lakeshore, Sainte-Anne-de-Belleview), cross the overpass towards highway-20, then turn left to get to the Macdonald Farm on Rue Poultry Cottages. Continue straight down the main path until the end of the road then turn right. The garden is located just behind the Swine Complex, next to the Macdonald Student-Run Ecological Gardens.



8. Contact List:

- Mike Bleho (Director of the Macdonald Horticulture Center) for agronomic advice and free compost.
  Email: michael.bleho@mcgill.ca
- Peter Knox (chair of Macdonald Campus Facilities Operations Safety Committee) for help with transportation of compost from Horticulture Center to garden. Charges fee by the hour.
  Email: peter.knox@mcgill.ca
- Paul Meldrum (Director of the Farm Center) for agronomic advice, materials such as water containers, straw, logistics, etc.
  Email: paul.meldrum@mcgill.ca

- Martin Chaumont (Paul Meldrum's lead hand) for materials such as topsoil and rocks. In the past, he has transported the desired materials directly to the site. Best to go and see him in the Swine Complex (building beside garden project).
  Email: martin.chaumont@mcgill.ca
- Brian Duffy (Tree Contractor) for free wood chips delivered to the site.
  Tel. (514)831-8733
- Jeanne Page (Head Landscaper at Macdonald campus) for agronomic advice (especially on flowers, herbs and trees).
  Email: jeanne.page@mcgill.ca
- MacDonald Campus Security – located in Laird Hall. Best to call or go see them in person. Will help with Transportation of materials (i.e. seedling trays) from campus to the garden. Can also get 3-hour bike rentals for faster transportation to and from the garden.
  Email: macdonald.security@mcgill.ca
  General Inquiries: 514-398-7770
  Emergencies: 514-398-7777

9. Continuity

To ensure the transfer of knowledge each year, it is important that there is careful record keeping and regular additions to:

1. The garden worklogs (should be updated after every garden session)
   a. Garden Worklog 2019: https://docs.google.com/document/d/1w89bxkpC_Xo-wPj0xvfyBKoNKJydh2aseDe6ZZOJZu0/edit?usp=sharing
2. This toolkit
3. The garden website: https://macpermaculture.wixsite.com/mpsg
   a. Login email: mcgillpermacultureclub@gmail.com
   b. password: permaculture