NORTHERN LABORATORY

A PROJECT FOCUSED ON SOCIAL AND TECHNOLOGICAL INNOVATION IN THE AGRI-FOOD SECTOR

FACTSHEETS AND RESEARCH RESULTS

CISA
SOCIAL INNOVATION
AGRICULTURE • FOOD
INAB CÉGEP DE VICTORIAVILLE

© Matthew Gaines, 2022)

Québec

Agence de la santé publique du Canada
Public Health Agency of Canada

RESEARCH AND WRITING:

Hugo Valls-Fox, M.Sc., Ph.D., Centre for Social Innovation in Agriculture (CISA), Cégep de Victoriaville

Audrey Roy, M. A., CISA, Cégep de Victoriaville

Catherine Riel, M. A., CISA, Cégep de Victoriaville

Sam Chauvette, agronomist, M.Sc., CISA, Cégep de Victoriaville

Julie Courchesne, M. A., CISA, Cégep de Victoriaville

Maya Lalonde-Boivin, agronomist M.Sc., Institut national d'agriculture biologique, Cégep de Victoriaville

Suetlana Bergeron, CISA, Cégep de Victoriaville

Charlotte Giard-Laliberté, agronomist M.Sc., Centre d'expertise en agriculture biologique et de proximité (CETAB+), Cégep de Victoriaville

Didier Haillot, Eng., M.Sc., Ph.D., Department of Mechanical Engineering, École de Technologie Supérieure (ÉTS)

Marie Teillot, Master's student, Department of Mechanical Engineering, École de Technologie Supérieure (ÉTS)

GRAPHICS AND LAYOUT:

Marie-France Guay, Communications Services, Cégep de Victoriaville

REVISION AND LAYOUT:

Kateline Grondin, communication advisor, CISA, Cégep de Victoriaville

DIRECTION :

Jean-David Martel, management and methodological orientations, CISA, Cégep de Victoriaville

ACKNOWLEDGMENTS:

We would like to warmly thank all the members of the communities of Matagami, Radisson, Kuujjuaq, Kangiqsualujjuaq, Chisasibi, and Opitciwan who collaborated with the Northern Laboratory for their hospitality and generosity throughout the project. We would also like to acknowledge the invaluable contribution of our partners from ÉTS: Vincent Cottéreau, Timothé Maheux, Camille Leblanc-Robichaud, Danielle Monfet, and Paul Piché, as well as Mélodie Desrosiers from the Solidarity Cooperative Gaïa. We also thank Marie-Pier Clavette for her valuable contribution. Our warm thanks to Sophie Legault, without whom this project would not have seen the light of day. We also wish to express our gratitude towards Marie-Josée Parent, Camille Hétu, Philippe Marceau, Isabelle Touchette, Bernard Gambier, and Bianca Kamenovic, who participated in this project over the last two years.

TERRITORIAL ACKNOWLEDGMENT:

We wish to acknowledge that this work was carried out in Eeyou Istchee, on the ancestral territory of the Cree people, in Nunavik the territory of the Inuit people, and on the unceded ancestral territory of the Nitaskinan. We are grateful to the Atikamekw, Cree, and Inuit Nations for their hospitality and great generosity. We also recognize that the offices of the CISA are located on the ancestral territory of the W8banaki Nation, the Ndakina.

HOW TO CITE THIS DOCUMENT:

Valls-Fox, Hugo, Catherine Riel, Sam Chauvette, Audrey Roy, Julie Courchesne, Maya Lalonde-Boivin, Suetlana Bergeron, Charlotte Giard-Laliberté, Didier Haillot, Marie Teillot. 2024. "NORTHERN LABORATORY, A PROJECT FOCUSED ON SOCIAL AND TECHNOLOGICAL INNOVATION IN THE AGRI-FOOD SECTOR: Factsheets and Research Results". Final Report. Centre for Social Innovation in Agriculture, Cégep de Victoriaville.

THIS NORTHERN LABORATORY PROJECT WAS FUNDED BY:

Québec

Agence de la santé publique du Canada | Public Health Agency of Canada

TABLE OF CONTENTS

Container gardening, Jardins du 53e Taïga, Radisson
(© CISA, 2022)

INTRODUCTION

The development of greenhouse projects has seen unprecedented growth in the northern regions of Quebec (Société du Plan Nord, 2021). The Northern Laboratory project emerged from the desire to conduct research that addresses the challenges faced by northern communities in designing, implementing, and sustaining their agri-food initiatives. This collaboration began with projects to develop or improve greenhouse projects in the communities of Kuujjuaq, Radisson, and Matagami, with researchers from the Centre for Social Innovation in Agriculture (CISA) at the Cégep de Victoriaville and the École de Technologie Supérieure (ÉTS).

These collaborations led to the design of the Northern Laboratory prototype project (April 2022-March 2024), coordinated by CISA, in partnership with Centre d'expertise et de technologie en agriculture biologique et de proximité (CETAB+) and ÉTS, as well as about twenty partners in the regions of Northern Quebec and the Côte-Nord region (North Shore) of Quebec. The project quickly evolved in two complementary directions:

- The first was to support partnerships between research and technological transfer organizations and organizations carrying agri-food projects. These partnerships have strengthened local capacities through technical and organizational support in agriculture.
- The second was to create networking opportunities among various stakeholders involved in the food systems of different northern regions of Quebec to break down silos and reduce the impact of distances.

These two directions converge in this report in sheets intended for current or future agri-food project holders to help them in their reflections.

THIS REPORT COMPRISES FOUR CHAPTERS:

1. Why Build a Greenhouse? This chapter aims to accompany the preliminary reflection to ensure that the project truly meets the needs of the community. We present how greenhouses can contribute to the food supply, provide learning opportunities, and foster social ties. This critical analysis discusses the advantages and disadvantages of greenhouses in the northern context as well as alternatives that can be considered to meet the needs of communities.

2. How to Farm in the North? This chapter is divided into three sheets. The first summarizes the factors to consider when farming in a northern environment and selecting the right location. The second presents how the characteristics of a greenhouse such as geometry, orientation, materials used, and climate control systems enable effective and adapted greenhouses for northern conditions. Finally, the third sheet summarizes outdoor farming method both in containers and in the ground.

3. How to Ensure the Sustainability of Agri-Food Projects? This chapter addresses the different components necessary for a project to endure over time. Good management and community mobilization are the two pillars of agri-food projects. The first sheet focuses on the role of greenhouse managers in identifying the desired skills to handle the multiple tasks expected from planning the season to the year-end review. The second sheet proposes an approach that can support collective reflection to strengthen community involvement. Finally, the third sheet discusses different paths for alternative revenue streams that can contribute to projects' financial sustainability.

4. Factsheets. From the North Shore to James Bay, these 10 sheets illustrate the diversity of innovative and inspiring projects. The diverse histories, organizational modes, and infrastructures of northern communities all contribute uniquely to their food systems, learning opportunities, and social connections!

OUR REFLECTIVE FRAMEWORK:

Addressing complex issues such as food sovereignty and population health solely from the perspective of the development of northern greenhouses is extremely limiting and has many blind spots. Therefore, the Northern Laboratory project has adopted a broader framework based on the notions of health and food systems.

Health | The concept of health we use is systemic. It includes physical health, as well as the links between this physical health and dietary habits, mental health, and the well-being of individuals. However, health extends beyond individuals: it includes relational health, which covers the interactions between individuals and their environment; the health of nature, which is at the heart of the concerns of the northern populations of Quebec; and the economic health of a community, according to that community's own criteria.

Food System | The notion of a food system allows us to broaden the horizons of discussions to consider actions on production, processing, distribution, consumption, and waste management. It also allows for the envisioning of concrete and targeted actions and innovations on the various links within the system.

Learning | Implementing new agri-food initiatives often requires dthe development of new knowledge and skills in those involved. The creation, transmission, and mobilization of knowledge are envisaged with respectful approaches adapted to the needs of the people who value their knowledge and their learning modalities.

Enjoy your reading!

CHAPTER 1

WHY BUILD A GREENHOUSE?

Greenhouse built in Kuujjuaq, Nunavik
(photo : CISA, 2023)

WHY BUILD A GREENHOUSE?

INTRODUCTION

Greenhouses have been established in northern Quebec for several decades. Initially, they served as experimental sites for research on the viability of agriculture in northern regions. In recent years, community organizations, cooperatives, businesses, and even local government agencies have been undertaking their own greenhouse projects. There are various reasons why a community or organization might choose to build a greenhouse, and these motivations can change over time based on the community's evolving needs. Among the three main reasons that will be discussed in the following pages, there are:

- enhancing the food supply,
- establishing educational spaces,
- and fostering social connections for the population's well-being.

For each of these motivations, the ways in which greenhouses meet these needs will be named. The limitations of these facilities will be described and alternatives to greenhouses, which also meet each of the main reasons, will be proposed. All of this is illustrated with concrete examples from communities in Eeyou Istchee James Bay, Nunavik, the North Shore, and the Nitaskinan.

The goal of this document is not to promote the construction of a greenhouse at all costs. Instead, it aims to encourage a reflection on the advantages and disadvantages of greenhouses in the development of agriculture in northern regions. We invite each community and collective to consider the following question in their own context: "How can these production infrastructures contribute to food production and create spaces for learning and socialization within our community?"

1. IMPROVING THE FOOD SUPPLY

Access to a variety of fruits and vegetables varies among northern communities, but generally, all desire to improve their food offerings. The main reasons put forward are the very high prices of food and the challenges related to transport and handling, which affect their quality and reduce their shelf life. Additionally, the current situation means that communities are highly dependent on shipments from the south, which makes them particularly vulnerable when land, maritime, or air communication routes are disrupted due to weather conditions or extreme events (storms, floods, fires, etc.). As a result, northern populations eat fewer fruits and vegetables than those in southern Quebec, and when they do consume them, they are less nutritious, negatively impacting their health. Thus, the main reasons for northern communities to build greenhouses and produce locally are to improve access to fresh, quality fruits and vegetables and to be more autonomous from southern distribution networks. This section highlights the beneficial contributions of greenhouses to the northern food offering but also their limits. Alternatives to greenhouses, which also improve the food offering, are presented.

The beneficial impact of greenhouses on food offering:

The benefits of northern greenhouses regarding improving the food offering revolve around two main elements: the availability and cost-effectiveness of quality food produced.

The proximity to production sites allows communities to benefit from fresh, quality products, usually grown in environmentally friendly conditions. In addition to making them tastier and extending their shelf life, this freshness allows the foods to retain more of their original vitamin and mineral content. It is also known that people who grow their vegetables tend to eat more of them. Evidence suggests that when vegetables are more accessible and affordable — for example, through home growing — people tend to consume them in greater quantities. Expanding the availability of fruits and vegetables through northern greenhouse production could similarly support healthier diets, helping to combat chronic disease and improve overall health." Nearby cultivation also makes it possible to produce vegetables that are not available in grocery stores. An interesting example is the cultivation of mountain sorrel (known as *qunguliit* in Inuktitut), a traditional plant in Inuit culture that has been grown in greenhouses and indoor cultures in recent years in several Nunavik communities.

Consuming locally produced fruits and vegetables is particularly attractive when their prices are more advantageous than those in grocery stores. Depending on the management modes of the organizations in charge of food production, the food produced may be given away, sold at a lower price than at the grocery store, or exchanged for a certain number of hours worked, the nature of which can vary according to needs. Currently, these projects are mainly possible thanks to financial support from various government organizations. Also, when internal resources are not sufficient, external agronomic and organizational support can significantly enhance the potential of the crops.

Challenges and Limitations of Northern Greenhouses on Food Production

The limitations of northern greenhouses on community food supply primarily involve the quantity of produce, crop seasonality, and the costs and labour needed to manage these facilities.

One of the main limitations of greenhouses is the amount of surface area needed to produce a significant quantity of fruits and vegetables compared to the annual consumption of local populations. Based on greenhouse productivity data from southern Quebec and our estimates of achievable yields in northern agriculture, growing 30 small baskets of vegetables (equivalent to 7 portions, with one basket serving two people[1]) for one week would require 48 square metres of greenhouse space. This estimate does not account for additional space needed for crop succession, plants that are not yet ready for harvest, green manures, and pathways for circulation between the beds.

Currently, Northern greenhouses range in size from 50 m^2 to 140 m^2. Due to the limited data available on Northern agriculture and the significant variations in production from year to year, influenced by location and organizational factors, this estimate should be considered with caution. Nevertheless, it provides a useful scale for understanding expectations regarding food supply from greenhouses. Fresh vegetable supplies can positively impact these communities for part of the year, but the overall volume produced remains low in comparison to annual consumption.

Vegetables that grow well in a Northern greenhouse and can be grown in large quantities are leafy greens (lettuces, spinach, etc.) and herbs since they grow quickly. This type of vegetable is rich in vitamins and minerals, but low in calories. Root vegetables such as carrots, beet and potatoes have a significant calorie content. They grow well in cool conditions

[1] In this typical basket, there would be 2-3 tomatoes, 3-4 peppers, 1 English cucumber, 1 lettuce, 1 bunch of carrots, 300 g peas and 500 g beans.

Young lettuces in the greenhouses, Jardins du 53e Taïga de Radisson, 2023
(© CISA, 2023)

and require a larger cultivation area than leafy vegetables. It is also possible to grow more demanding crops such as tomatoes and cucumbers. However, choices have to be made regarding variety selection and production methods. In the case of tomatoes, for example, it would be wiser to grow determinate early varieties than to try to grow indeterminate varieties for long periods.

The production potential of greenhouses can be enhanced by using minimal heating for cold-climate vegetables, such as greens, and providing more substantial heating to extend the growing season for demanding crops, like tomatoes and cucumbers. However, as autumn approaches, brightness quickly becomes a limiting factor, especially for greenhouses located at high latitudes. As a result, supplementary lighting often becomes necessary.

Project managers need to carefully consider the costs associated with efficiently producing warm-climate vegetables and make informed decisions about growing methods and plant varieties. Therefore, whenever possible, it's advisable to explore alternatives that typically require less investment than traditional greenhouses. These alternatives are discussed in more detail in the « "Northern Outdoor Gardens" factsheet.

Several factors limit food production in northern regions, as highlighted in the "Challenges of the Northern Environment" factsheet. The short growing season, limited by temperature and sunshine, lasts only a few months. However, greenhouses can help extend this period. For instance, in Kuujjuaq, it is possible to grow plants from late May to mid-October without the need for heating. To produce crops during the winter months, though, the greenhouse would require heating and additional lighting.

Summer is the best time to grow food in Quebec, especially in the northern regions. Farming, particularly greenhouse farming, requires a significant investment of time and regular maintenance. It's essential to be present every day for at least a few hours. This commitment can conflict with the lifestyles of people in the North, who often visit during this season to enjoy the abundance of food. If you are considering setting up a greenhouse, it's important to keep this limitation in mind, as it may require time that overlaps with various activities tied to northern culture.

Another important consideration is the necessary skills and knowledge for successful greenhouse farming. Greenhouses are sensitive environments that require careful regulation of factors like temperature, humidity, ventilation, irrigation, and soil quality. Being knowledgeable about these elements is crucial for effective management. Access to professional support can also play a significant role in helping crops thrive by identifying and addressing potential issues early on. Optimal control of these factors can enhance plant production, while poor management can lead to rapid crop failure. Therefore, having a certain level of expertise is vital for efficient food production in greenhouses. This knowledge can be gained through internships, online courses, mentoring, and hands-on experimentation. Consequently, it's essential to remember that a greenhouse's food production capacity is directly tied to the experience, diligence, and organizational skills of those managing it.

In summary, recognizing the limitations of greenhouse production is essential for project sustainability. Significant investment and operational costs are involved, and specific skills are required. While greenhouse cultivation can enhance

access to fresh, quality produce and extend the growing season, it alone cannot meet all community food needs. The current use of conventional single-deck greenhouses, which are not very resilient to low temperatures, highlights the need for better-suited models for northern conditions (see "Characteristics of Greenhouses Adapted to Northern Conditions").

Possible alternatives

There are several alternatives to greenhouses that can enhance the food supply in Nord-du-Québec. The suitability of these alternatives depends on the specific needs of each community, as well as local soil and climate conditions.

Before focusing on vegetable production, it is essential to examine the existing distribution structures. Engaging in discussions with grocery and convenience stores can help identify the obstacles they face and the strategies they can employ to enrich the community's food supply. Additionally, participating in collective purchasing groups and utilizing the services of individual distributors are effective ways to improve the food supply.

Establishing solidarity networks within communities, along with creating storage or processing infrastructures like freezers and smokehouses, can make local resources more accessible. These initiatives can provide communities with seasonal products such as fish, meat, mushrooms, berries, and a variety of other edible items. For instance, many northern communities have successfully sold locally harvested frozen berries in grocery stores.

Other alternative initiatives to increase the food supply include planting fruit bushes and preserving food for winter consumption by canning, drying, or freezing. Furthermore, collectively sharing equipment such as dehydrators, smokehouses, freezers, or cellars is a practical approach to enhance the year-round food supply without the need for extensive farming efforts.

Collective Management: The management of cultivated areas is carried out collectively by a group of people. Harvests are divided based on specific criteria, such as the number of hours worked.

Community Management: Individual plots of land are assigned to a person or a group who are responsible for their upkeep. These individuals must generally follow the rules established for all plot owners.

Outdoor gardens, whether individual or communal, provide many people with access to fresh, high-quality produce. For instance, in Opitciwan, several community members participated in a collective garden during its inaugural year to learn the basics of gardening. Afterward, they created their own vegetable gardens at home, allowing others to benefit from the collective garden as well. Contrary to popular belief, outdoor farming is possible in most regions of Northern Quebec, including Kuujjuaq!

Different types of greenhouses are listed in the "Characteristics of Greenhouses Adapted to Northern Conditions" sheet. Several alternative or complementary infrastructures to greenhouses are detailed in the following factsheets. Whatever the production method, it's important to choose infrastructures that are robust enough to withstand blizzards, and that take into account the large presence of dogs in northern villages. Their choice can vary according to the needs they meet. For example, an open-ground garden is less costly and, in many regions, can be used to grow a variety of vegetables.

Growing in tubs can ensure a depth of soil suited to horticultural production and allow cultivation in uncontaminated soil. Raised planters can also facilitate participation by people with reduced mobility. Whether in containers or on the ground, learn more about growing outdoor gardens by consulting this factsheet.

For outdoor cultivation, several methods can be employed to extend the production period, such as floating covers and mini-tunnels. These options are inexpensive, flexible, and easy to move. For instance, Solidarité Alimentaire Matagami, successfully grew spinach, carrots, radishes, beets, lettuce, and more in its garden under mini-tunnels from the summer of 2023 until mid-October. More permanent structures such as caterpillar tunnels, cold frames, and light domes also utilize simple technologies to prolong the growing season and are generally more affordable than greenhouses. Les Jardins du 53e Taïga de Radisson constructed wooden cold frames equipped with adjustable windows that could be opened or closed based on the temperature. This approach allowed them to cultivate a wide variety of vegetables throughout the summer with great success.

Indoor growing presents numerous advantages in terms of climate adaptation and operational efficiency. Garden towers, such as those in use in Kuujjuaq and Kangiqsualujjuaq, facilitate the production of a variety of fruits and vegetables within a school setting, requiring only a moderate investment of time and money. Customized hydroponics projects have been implemented in various schools across southern Quebec and could easily be adapted for any community interested in pursuing them. Additionally, containerized hydroponic production modules are available for communities seeking a more intensive production approach. However, it is crucial to ensure that the community has enough manpower to operate these facilities and a sufficient demand for the types and quantities

of vegetables produced.

In summary, greenhouses are one option among many for improving food supply, which can be addressed through various methods in food production, processing, or distribution. Before implementing any agricultural infrastructure, it is crucial to assess the community's needs, food preferences, and capacity for mobilization. Additionally, all solutions should be seen as complementary; combining several approaches can provide a more diverse response to the community's requirements. For initial market gardening projects, it may be wise to start with more affordable infrastructure rather than greenhouses to establish the project and engage the community. Over time, we can expand and enhance our infrastructure based on our evolving needs and preferences, possibly integrating greenhouses later on.

2. CREATING A LEARNING SPACE

Establishing a community greenhouse provides an opportunity for a village to create a learning environment. Many northern agri-food initiatives are supported by or closely connected to school service centres, which promote education about agriculture and healthy lifestyles. Additionally, the community can organize workshops and training courses.

The Role of Greenhouses in Creating Learning Environments

The greenhouse provides numerous learning opportunities for people of all ages. In addition to teaching the basics of gardening and where some of our food originates, the crops can serve as practical examples to enhance the school curriculum. Teachers can utilize the greenhouse infrastructure in their science, chemistry, and physics lessons. This allows them to demonstrate concepts such as the life cycle of a plant, the nature and absorption of nutrients and fertilizers in the soil, and the light spectrum and diffusion quality. Teaching science through gardening not only fosters student engagement but is especially beneficial for those with learning difficulties[i].

Considering this, several schools have established partnerships or acquired greenhouses. For instance, James Bay Eeyou High School in Chisasibi has had a greenhouse for several years see the Chisasibi factsheet for more details. Teachers utilize this space to demonstrate various gardening concepts to interested students.

Greenhouses also provide vocational training opportunities. In Opitciwan, Mikisiw High School has created a horticultural work platform for students with special needs. These students take regular courses, such as math and French, while also earning credits for work placements.

Students enrolled in work preparation training are introduced to various work environments, including horticultural production. Those in the semi-skilled trades program select a specific internship and receive 450 hours of training over one or two years. They gain both theoretical and practical knowledge through workshops focused on indoor (greenhouse) and outdoor (community gardens) food production. Upon completing their internship, students receive a certificate from the Ministry.

Additionally, the greenhouses can be utilized to enhance the knowledge of both young and older community members regarding food production and healthy eating. By welcoming community members into the greenhouse, guiding them in crop care, and offering workshops, the program aims to spark their interest in food, develop their knowledge and skills in a practical way, and foster independence. Greenhouses can also provide vocational training opportunities.

Since the 1980s, greenhouses have also been built in Nord-du-Québec for research purposes, to develop knowledge about northern agriculture. More recently, a technology was tested in Kuujjuaq, then in Radisson: stone beds were built in passive greenhouses, to test a new way of redistributing heat during the night[vi]. In 2023, the Chisasibi Eeyou Resource and Research Institute (CERRI) built a geodesic

Sprout workshop organized by Solidarité Alimentaire Matagami
(© CISA, 2023)

research greenhouse. A community garden will be installed there, and the community will be invited to participate in the development of knowledge about northern agriculture while learning to garden (for more information, consult this factsheet).

Limits and Challenges of Greenhouse Learning

From the perspective of providing learning opportunities, one limitation of school greenhouses is the mismatch between the school calendar and the growing season. School vacations often coincide with the period when plants are most productive. Therefore, if a greenhouse is established in the spring, someone must be responsible for its care during the summer. Additionally, in many Indigenous communities, there are vacation periods dedicated to cultural activities, which often take place outside the community for a few weeks in the spring and fall. This can significantly jeopardize cultural practices if no one is available to maintain the greenhouse.

Another challenge is that the participation of teachers and community members in greenhouse activities is largely dependent on their goodwill and interest. This makes such initiatives vulnerable to staff turnover. Moreover, to successfully execute these activities and training programs, participants must possess a basic level of knowledge, communication skills, and access to tools, along with adequate preparation time.

Finally, it is essential to be cautious when linking the development of gardening and food knowledge with the promotion of healthy eating habits. Insufficient access to fresh, high-quality food is often tied to financial constraints or limited availability. Simply raising awareness about the benefits of consuming fresh fruits and vegetables is insufficient to improve eating habits; initiatives must also focus on enhancing the food supply.

Possible Alternatives

A slightly more expensive infrastructure that is more adaptable to the school calendar is a hydroponic vertical growing tower. This indoor system, equipped with its own lighting, allows for the demonstration of a plant's life cycle. It can be used year-round, enabling you to pause production whenever needed and quickly restart another growing cycle. Such installations have been successfully utilized for several years at the Kangiqsualujjuaq elementary school and now at the Kuujjuaq school.

However, this system requires a certain level of hydroponic expertise, including the preparation of nutrient solutions and lamp maintenance. It is important to anticipate costs and delivery times for purchasing necessary inputs, such as liquid fertilizers.

If you want to run a community garden or greenhouse project for educational purposes, you can organize it in a way that benefits students during the school year while also serving the community during the summer. By creating partnerships between the school, local government, daycare centres, day camps, food security organizations, and hospital centers, you can pool resources to train both students and community members throughout the year, in addition to ensuring food production in the summer.

This approach also alleviates teachers of the greenhouse's operational responsibilities and ensures continuity in agricultural activities over a longer period. However, it is essential that the infrastructure is set up in locations that remain accessible when the school is closed, or that partnerships are established to facilitate this access.

3. STRENGTHENING SOCIAL TIES AND ENHANCING COMMUNITY WELL-BEING

In small villages with limited gathering spaces, agricultural projects like community greenhouses can significantly enhance community vitality and individual well-being. This often-overlooked aspect is one that project promoters should highlight.

The Positive Contribution of Greenhouses to Community Well-Being

When we think of community gardening, we often view it primarily as a leisure activity. However, these projects provide not only opportunities for physical activity and outdoor engagement but also spaces for social interaction and a sense of belonging. Several studies have shown that participation in community gardening projects can boost morale and self-esteem while reducing anxiety and feelings of helplessness. The process of choosing, growing, and consuming the food cultivates a sense of pride in participants and develops their capacity for action. These positive experiences can also empower individuals to take on new projects, benefiting both themselves and the community as a whole. Community greenhouses promote the physical and mental health of participants, especially when there is a balanced and healthy division of responsibilities.

While greenhouses or gardens are typically seen as spaces for hobbyists, community greenhouses can provide a new, accessible activity for the villages of Nord-du-Québec. Moreover, they can be envisioned as gathering places and safe communal spaces for the community. This is particularly beneficial in northern climates, where greenhouses offer a temperate environment shielded from the harsh weather, allowing for extended conversations and activities. Organizing social events in these greenhouses fosters connections among community members and helps to energize and mobilize the community. Additionally, establishing or maintaining an agri-food initiative can lead

to the creation of valuable job opportunities.

A greenhouse or community garden project, for example, can be an opportunity for a member of the community or an outsider to stand out for his or her skills or willingness to get involved in the project. Agricultural work can also be a way of reintegrating people into society or promoting the integration of people with atypical profiles.

Greenhouse management challenges for individuals and groups

As mentioned above, greenhouses require time and maintenance. It can be difficult to mobilize the community on an ongoing and sustained basis, specifically in the northern context where people travel and work a lot and therefore have little free time to devote to this kind of activity. This often leads the few available and motivated people to take on demanding projects. Unfortunately, this pace is difficult to maintain and can lead to burnout or demobilization. If a high level of community involvement is required to make it work, concrete efforts must be made in this direction and planned in advance(for more details, see the "Cultivating together" factsheet).

Community greenhouses can serve as a valuable opportunity to promote social diversity by bringing together individuals from various backgrounds. It is crucial, however, to include those who have little to no experience in gardening, rather than limiting access to so-called «experts,» who are often non-indigenous members of indigenous communities. Without mechanisms and efforts to actively include underrepresented or vulnerable populations, and without addressing systemic barriers to participation, there is a high risk of perpetuating social inequalities. Furthermore, it is essential to ensure that participants in the greenhouse are represented in decision-making bodies, such as boards of directors.

Possible Alternatives

Activities other than greenhouse gardening can also serve as spaces to strengthen social bonds and the well-being of community members. Group cooking and collective kitchens are ways to come together around food, share knowledge, develop skills, and create relationships with other community members. Similarly, foraging clubs allow for physical activity in a pleasant environment, meeting people, and chatting while picking delicious foods. Lastly, it is possible to combine agricultural greenhouse and garden projects with food security and socialization projects. The Sirivik Food Center in Inukjuak is an example of a convivial social space that brings community members together around food. The food security organization offers communal meals, food aid services, collective cooking workshops, and traditional knowledge development activities, which are open to all members of the Inuit community. Hydroponic growing spaces, indoor gardens, and external cold frames are (or will be) also set up to produce food used for its many activities and for educational purposes. This makes it a lively place, where community members gather through various agri-food activities.

CONCLUSION

We have observed that greenhouses can significantly enhance the food supply for northern communities. However, it is essential to recognize that there are many alternatives for food production and improving food autonomy in these areas. Agri-food projects, including greenhouses, also offer valuable educational and social benefits that can help sustain these initiatives by fostering better integration within the community.

By engaging in agriculture and food production projects, communities become empowered, more resilient, and better equipped to meet their needs. Each new agri-food project, whether a greenhouse or another type of facility, typically requires considerable material and human resources, which are often limited in northern regions. Therefore, it is crucial to choose a project that aligns with the community's needs, food preferences, and cultural practices, and that is scaled appropriately to the community's level of mobilization.

[i] These benefits are mentioned by Tom Allen in his conference report on circumpolar agriculture (the report is available here: https://www.uarctic.org/media/1002371/sustainable-agriculture-and-food-security-in-the-circumpolar-north-2.pdf and Allen's presentation can be found on page 58). The researcher also provides other examples of benefits for communities that might be interesting to consider for your northern agricultural projects.

CHAPTER 2

HOW TO FARM IN THE NORTH

CHALLENGES OF THE NORTHERN ENVIRONNEMENT

The northern regions encompass realities that cannot be simply summarized by their location north of an imaginary line, such as the 49th parallel. From an agricultural perspective, we define northern agriculture as the practice conducted north of historically recognized agricultural regions. The ecosystems in these areas are generally characterized by:

- Vegetation dominated by boreal forest or tundra;
- Shallow and acidic soils or no soil;
- A cold climate (hardiness zone 0 to 3b);
- A short summer growing season.

In this sheet, we will address the main pedoclimatic constraints (interactions between soil and climate) of these regions from the perspective of agriculture and then more concretely discuss the factors to consider when implementing an agricultural project in a small northern community. The majority of the residents of these regions live in small communities of a few hundred to a few thousand people. These communities are remote, some connected by road, others by sea or air routes. A large majority of the people living in these regions are from First Nations and Inuit communities. It is important to remember that the northern regions correspond to the ancestral territories of various First Nations and Inuit, and these regions are subject to claims and treaties.

Kangiqsualujjuaq, Nunavik, 2023
(© CISA, 2023)

1. LIMITING FACTORS OF NORTHERN AGRICULTURE

Agriculture in northern regions is feasible, but also presents a stimulating challenge, particularly because of the short growing season. The soil exhibits certain characteristics unique to the boreal environment, and the further one goes in latitude, the rarer horticulturally potential soil becomes.

To successfully produce fresh fruits and vegetables in northern regions, it is imperative to demonstrate ingenuity and implement various agricultural techniques. There are, however, certain advantages to northern regions:

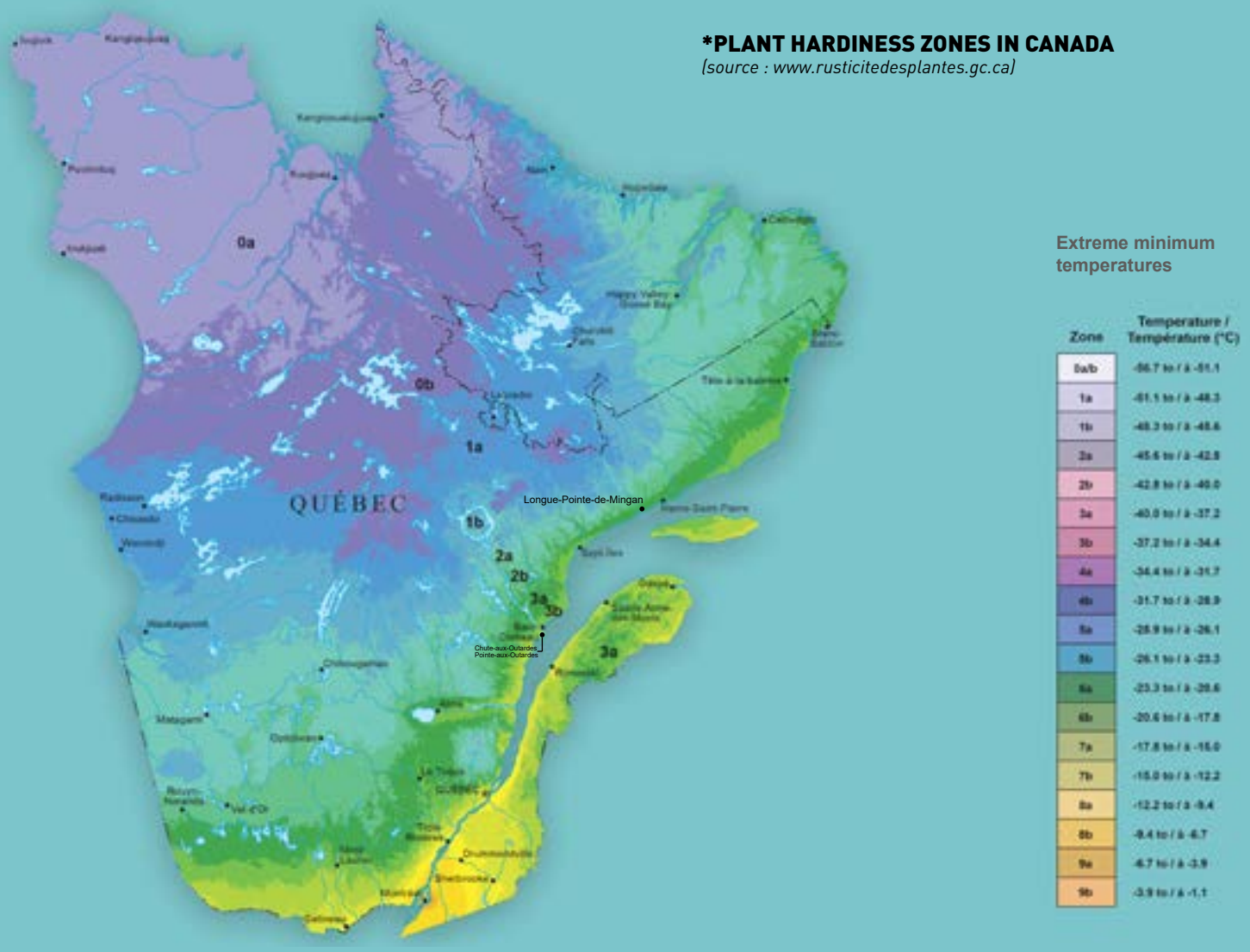
- The prolonged sunlight during the summer season can allow for optimal cultivation of certain high-yield plants; during the winter, the snow cover can protect the roots and aerial parts of small plants.
- During the winter, the snow cover can protect the roots and aerial parts of small plants.

We know that for a plant to grow and be productive, it needs light, water and CO^2 to complete its photosynthesis, minerals that it will draw from the soil, and an adequate temperature.

The challenge of northern agriculture is therefore to create a conducive environment for a long enough period so that the selected plants can reach full maturity and thus ensure a satisfactory harvest of fruits and vegetables.

In addition to temperature, access to soil conducive to agriculture is just as important for achieving good yields. Although there are many interactions between these different factors, we sequentially present the effects of temperature, light, water access, and soil on northern agriculture.

***PLANT HARDINESS ZONES IN CANADA**
(source : www.rusticitedesplantes.gc.ca)



**Although this map covers all of Canada, only the Quebec portion has been retained, as all the communities mentioned in this report are located in this territory.*

1.1 Temperature

In northern regions, temperature significantly limits agricultural productivity. Depending on latitude, the duration of the «frost-free» growing season can vary from 90 to 135 days (Climate Atlas of Canada, 2024). Fortunately, there are several food plants that can tolerate frost or at least withstand cold temperatures. Examples include cabbages (both headed and leafy), carrots, beets, winter radishes, rutabagas, and Asian greens. Within each species, some varieties have better cold tolerance or shorter growth cycles, allowing them to be harvested before the first frosts. Additionally, certain indigenous plants can be cultivated; for instance, mountain sorrel, known as qungulit in Inuktitut, is a traditional plant in Inuit culture and has been grown in several communities in Nunavik in recent years.

A method often used in horticultural production to decide on the choice of cultivated species is to adhere to hardiness zones The map developed by Natural Resources Canada provides an idea of the relative ability of a given plant to thrive in a specific location. It is important to note that this map offers a general scale. The topography, the presence of water bodies or buildings, for example, can have varying impacts on this potential.

Moreover, among the species cultivated in horticulture, there are varieties that have very different capabilities to tolerate cold temperatures. Plant (nursery) and seed suppliers generally provide information about the hardiness zone of their plants. Various techniques and infrastructures allow for the creation of a more favourable microclimate and extend the growing season. Greenhouses are the best known. They provide significant benefits in extending the growing season, particularly by offering relative protection against frosts. These benefits are enhanced if the greenhouses include a heating system, a heat storage system, or insulation. More

minimalist structures are also used, such as hotbeds, mini tunnels, and caterpillar tunnels. The use of geotextiles and floating row covers also helps limit the effects of cold. It is important to consider that all these methods generally only provide a few degrees Celsius gain during the night if no heating system is in place.

Finally, organizing production by optimizing the schedule, using transplants from nurseries rather than direct seeding, or good soil management in the spring to speed up its warming are all techniques that save time and increase temperature. Also, by working with a minimal heating system and adapting the production schedule, great achievements can be made. A method increasingly used by market gardeners in Southern Quebec is greenhouse production with minimal heating combined with the use of resistant cultivars and floating row covers. The challenges and potential of this approach can be seen in the documentary Récolter l'Hiver (Harvesting Winter).

1.2 Light and Seasonality

In the northern regions, the growing season is particularly short. To address this, it is advisable to select crops that are well-suited to the climate and choose varieties that mature quickly. For instance, radishes take only 21 days to go from sowing to your table. However, it is essential to base your vegetable choices on the preferences of the local population, as the success of your project largely depends on this.

It is recommended to prioritize the production of transplants rather than direct seeding. Therefore, you will need to allocate sufficient space for this task, which is likely to begin during a colder period.

Additionally, the amount of sunlight can vary by about 2.5 hours from one parallel to another during the peak growing season. This variation represents a significant advantage for northern growers. If you can provide suitable temperatures, your plants will benefit from this extra sunlight.

Moreover, the snow cover in winter serves as a protective layer for perennial or biennial crops, allowing you to grow garlic even in Radisson at 53°N. However, heavy snow cover can take a long time to melt in spring, delaying the start of outdoor crops. In this context, it may be wise to prioritize the use of transplants and to focus on crops that you will harvest in the fall, rather than attempting to produce early crops at the start of the season.

1.3 Water

Water is an essential factor for plant growth. In the north, water supply can become complicated due to the risk of freezing and the negative effects on growth from using irrigation water that is too cold. In some communities, such as northern Inuit villages, water is delivered by tanker truck, so it is crucial to be vigilant and plan water delivery in time.

It is possible that your water source may be frozen when you need it, either early in the spring or late in the fall. To optimize the use of the greenhouse (extend the seasons) and prevent equipment damage, a «frost-free» irrigation system must be designed. Otherwise, greenhouse users must start their season later and end it earlier for fear that the water will freeze in the pipes. Depending on the context, the methods used can simply involve having water tanks inside a minimally heated greenhouse or ensuring that the water supply pipes are protected from freezing with insulation and heating cables.

In practice, irrigation may seem straightforward, but too often it is a neglected part of production systems and can be a factor that makes all the difference between the success and failure of your crops. Watering in sufficient quantity, at the right time, and with the right frequency are not always easy questions to answer. Always ensure good irrigation in the morning and return if necessary in the early afternoon. A tip is to dig into the soil with your hand to ensure that the soil is moist up to the root tips, but that there is no water accumulation. Water needs will vary according to your crops, their stage of development, the temperature, and the sunlight. In outdoor production, the wind might cause your plants to need water more often. You must also adapt your irrigation according to the weather; the needs will not be the same on a cloudy day as on a sunny and windy day. Using tensiometers to assess water availability in your soil can also be a good decision-making tool. If possible, avoid using water that is too cold, which will slow down the growth of your plants by causing stress.

1.4 Soil and Nutrients

A plant uses its roots both to anchor itself in the soil and to absorb the water and nutrients essential for its survival and growth. Therefore, unless you choose hydroponic or aeroponic cultivation methods, your plants will require soil. While this may seem straightforward, it can present challenges that are not always easy to overcome. In northern regions, soil with agricultural potential may be frozen, scarce, or nearly nonexistent, often requiring it to be imported from suppliers located in the southern part of the province. When soil is available, significant preparation work is often needed, such as levelling, drainage, subsoiling, organic amendments, and liming.

The quality of your soil significantly affects the productivity of your agricultural project. One crucial factor is ensuring that the soil is not contaminated. Historical soil contamination by hydrocarbons or other toxic wastes has occurred without proper documentation. This issue can be found sporadically in various towns and villages across Quebec, both in northern and southern areas. Additionally, your soil should be balanced in nutrients, contain a minimum

What is soil?

Soil is a complex and fragile medium. Soil is composed of air, water, mineral matter, organic matter, and all the organisms and microorganisms that live in the soil. These elements are inseparable for having fertile soil. The physical characteristics mainly influence the movement of water and air, depending on the particle size and its porosity (the size of the holes). The chemical characteristics represent the concentrations of minerals and trace elements that the plant feeds on, while the biological characteristics represent the life of the soil (bacteria, fungi, plant roots, and soil fauna). The life of the soil is a real factory transforming organic matter into nutrients that plants can then use for their growth.

level of organic matter, have an appropriate pH, and include a sufficient presence of living organisms. Optimal conditions may vary depending on the chosen crops.

Building soil with horticultural potential takes time; it is advisable to prepare it at least one year before your initial plantings to allow for necessary adjustments. A critical consideration during this period is controlling adventitious plants, commonly known as weeds. One year, or one growing season, is typically required to eliminate weeds in a new plot without the use of pesticides, by employing a strategic combination of fallowing, mulching, and green manuring. Utilizing green manures is also beneficial for achieving several goals in market gardening. This preparation phase is an ideal opportunity to enhance the long-term horticultural potential of the plot through soil work and amendments, such as levelling, subsoiling, composting, and liming.

Don't hesitate to seek advice from agronomists. It is recommended to conduct a physicochemical analysis of your soil through specialized laboratories. Your agronomist can assist you in interpreting the results and suggest appropriate actions. If you plan to cultivate in the open ground, having an agronomist perform a soil profile analysis is an excellent choice for understanding the soil's potential and determining necessary corrections (Weill, 2009).

Without soil, one would need to consider creating soil from locally available materials or importing it at great expense. This latter option can significantly increase the cost of your project and influence your choice of production method; in-ground, in containers, etc.

Research is ongoing to enable northern communities to use locally available materials to create quality horticultural soil. This involves identifying sites from which to source the mineral portion (sand, silt, clay) and identifying sources of organic materials to enrich the soil. Composting initiatives represent a promising future by creating local compost from community food waste. In the summer of 2022, trials of composting fragmented branch wood (FBW) of speckled alder were conducted in Opitciwan by Biopterre in collaboration with CISA with the aim of creating fertile potting soil. For more details, consult the documentary produced by our team "Nordic agriculture : growing for the community" as well as the Opitciwan profile sheet.

2. LOCATION

The chosen location will be a compromise between the type of facilities selected (garden, greenhouses, containers, etc.), the environmental conditions described in the previous section, and especially the site's accessibility.

Here are several general criteria to consider that apply to both greenhouse and outdoor crops:

- Where possible, group all your infrastructure (greenhouses, fields, packing room, etc.) in the same place to maximize complementarities and reduce transportation time.
- Ensure you have access to electricity and potable water.
- A site that is accessible at all times to users (staff members, volunteers, customers), ideally near the village centre so that the place is visible and inviting to the population.
- Also, ensure that the site is accessible for the delivery of inputs as well as for the sale or distribution of agricultural products.
- Ensure compliance with various regulations from relevant authorities and check if there are any water pipes or electrical lines nearby.
- Choose a flat terrain where water does not accumulate and is out of a flood zone.
- Choose a sunny site protected from strong winds. If you are cultivating in open soil, conduct a soil analysis to check for the absence of contaminants (hydrocarbons, heavy metals, etc.).
- Perform physicochemical analyses and correct as needed (pH, fertilization).
- Orient your buildings and plots to optimize light and ventilation, facing the prevailing winds.

Sometimes, there are not many choices available for the location. It is more about where there is available space, especially if you want to have access to water and electricity. Check with the community or municipality if any conduits pass under the land and try to place the greenhouse according to these conduits.

2.1 Greenhouse Location

A greenhouse in a northern environment is a costly investment. Therefore, it is particularly important to carefully select its location. Before installing a greenhouse on your property, ensure to eliminate slopes as much as possible; it may be justified to level the ground or create ditches around your property depending on the topography and soil texture. This is referred to as surface drainage.

Drainage around the infrastructure should be implemented to prevent water backflow during precipitation. Consider the water that will come off the greenhouse roof during rainfall and snow melt. It is suggested to install a perforated 100 mm (4 inch) drain at a depth of 0.6 to 1 m. The drains should have a slight slope of 0.1% towards an outlet and be covered with highly permeable gravel (¾ inch clear) (Guimont et al., 2020).

In the same vein, the height of the water table should be considered, whether in a greenhouse or in the field, as your plants' roots will need to grow in soil that is not water-saturated. Depending on the selected location, underground drainage might need to be considered.

In Quebec, the prevailing winds generally come from the west. For a shelter whose production is concentrated between the months of April and October, a north-south orientation allows for good uniformity of light and better ventilation inside the shelter. If production continues until late autumn or in winter, an east-west orientation might then be considered. It is also advisable to check at the site that the greenhouse is oriented to minimize the constraints due to winds while maximizing the natural ventilation they can provide. It is advisable to consult a specialist when choosing the site and orientation of the greenhouse. (see the dedicated sheet on this subject).

Furthermore, a distance of 5 metres between greenhouses is recommended if there are multiple greenhouses arranged side by side, and care should be taken to keep them away from the shade of a nearby building.

2.2 Location for Outdoor Production

For open field production, the same elements should be considered: maximum sunlight, protection from prevailing winds, well-drained soil, and proximity to your facilities. Access to potable water and electricity is just as important as for greenhouse cultivation.

Boreal forest dominated by black spruce in Eeyou Istchee James Bay
(© CISA, 2023)

3. ENVIRONMENTAL IMPACTS AND EXTERNALITIES

We have seen that northern agriculture projects can have numerous positive effects in terms of food production, education, and social ties within communities, as discussed in the sheet Why build a greenhouse". These projects can also enhance contact with nature, preserve biodiversity, reduce greenhouse gas emissions, and contribute to communities' adaptation to climate change.

However, agricultural operations will impact their environment, regardless of the location or practices used. Among these impacts, agriculture consumes water and can generate pollution in case of poor management of inputs, even under organic management. These impacts can be seen as disadvantages, which is why a legislative system has been established. It is important to manage the use of fertilizers and phytosanitary products according to Quebec and Canadian regulations and standards.

The regulation surrounding agricultural operations covers, in a non-exhaustive way, the protection of environmental quality, including the management of fertilizing materials, the protection of water bodies, the extraction and quality of water, the protection of wetlands, and the code for pesticide management.

The lack of waste management infrastructure in many northern communities means it is important to anticipate the impacts of certain agricultural waste, including the many plastics used for greenhouses, floating covers, nets, irrigation hoses, trays for transplants, and even packaging for sale or distribution. Today, various options exist to limit the use of plastics or at least use more durable ones.

REFERENCES

Climate Atlas of Canada. (2024). Climate Atlas of Canada. Climate Atlas of Canada.

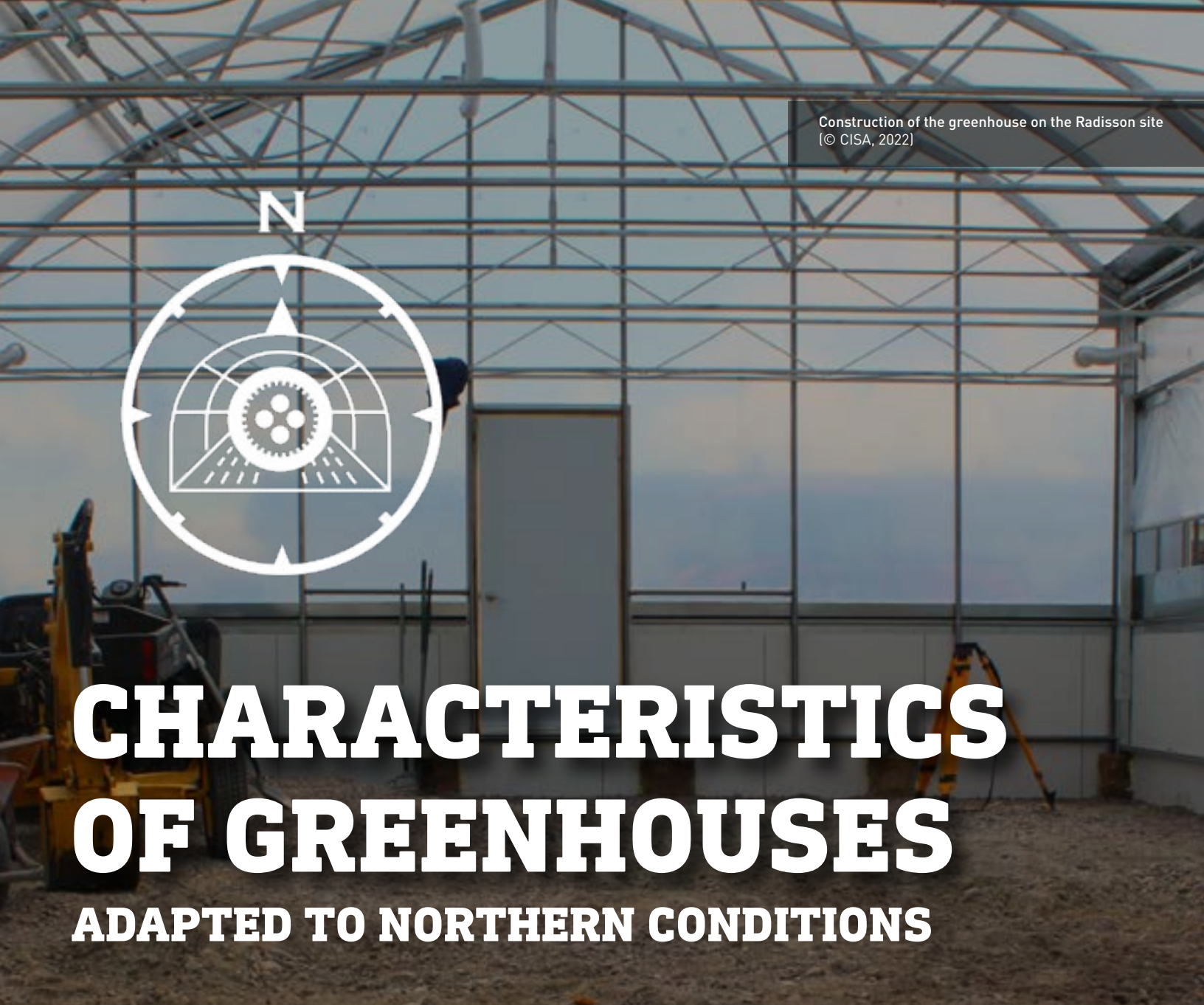
Direction de l'aménagement, du milieu hydrique et de l'agroenvironnement. (2021). Guide de référence du Règlement sur les exploitations agricoles (L.R.Q., c. Q-2, r. 26). Ministère de l'environnement et de la lutte contre les changements climatiques.

Guimont, S., Villeneuve, C., Martin, Y., Leblanc, J., Legault, G., Le Mat, A., & Taillon, P.-A. (2020). Guide de production : Poivron et tomate biologiques sous abris. https://www.craaq.qc.ca/Publications-du-CRAAQ/guide-de-production-poivron-et-tomate-biologiques-sous-abris-pdf/p/PEABI004

Ressources naturelles Canada. (2022). Rusticité des plantes. http://planthardiness.gc.ca/index.pl?m=1&lang=fr

Thériault, J., Coutin-Beaulieu, C., Le Mat, A., Martin, Y., Taillon, P.-A., & Leblanc, J. (2023). Guide d'implantation : Serre individuelle en maraîchage diversifié. Centre de référence en agriculture et en agroalimentaire du Québec.

Weill, A. (2009). Les profils de sol agronomiques. CRAAQ.



Construction of the greenhouse on the Radisson site
(© CISA, 2022)

CHARACTERISTICS OF GREENHOUSES

ADAPTED TO NORTHERN CONDITIONS

INTRODUCTION : WHAT IS A GREENHOUSE?

A greenhouse is a closed structure with translucent walls. These walls allow ultraviolet and visible radiation to pass through while blocking infrared radiation that transfers heat. Thus, the structure prevents some of the heat from escaping, a phenomenon commonly referred to as the "greenhouse effect." Limiting the natural circulation of air to the outside is also an element that helps retain heat. Other systems that create protected spaces with a greenhouse effect exist: movable tunnels (or caterpillar tunnels), cold frames, bell jars, etc. One of their differences from greenhouses lies in their lifespan and use. Greenhouses have a lifespan of about ten years or more. Also, the dimensions of greenhouses allow a person to enter and work comfortably inside. Here, we will consider both heated and unheated greenhouses, although some authors use different nomenclature for the two types of systems.

The efficiency of a greenhouse in capturing solar radiation and retaining heat depends on many parameters, including geometry, orientation, dimensions, and materials. The greenhouse must also be able to withstand adverse weather conditions (strong winds, snowfall, ice). These various factors also influence the lifespan (in years) of the greenhouse. The aim of this sheet is to present the main characteristics that make up the structure of a greenhouse in order to choose the best-suited greenhouse for the selected site..

1. QUESTIONS TO ASK BEFORE INSTALLING A GREENHOUSE

Before embarking on a greenhouse project, and during the design phase, it is essential to ask the right questions. For more information on this section, feel free to learn more about the different uses of greenhouses presented in the sheet"Why Build a Greenhouse" in Chapter 1. Depending on the conditions encountered, other arrangements are also possible, such as those mentioned in the following sheet "Northern Outdoor Gardens."

What will be the use of the greenhouse? For which crops?

A greenhouse can be used for drying crops, producing transplants, or as a production facility. Generally, it is used to extend the agricultural season. Greenhouse crops can be edible or used for growing decorative plants. They can also be more or less resistant to cold and inclement weather. Finally, they can serve various purposes: community, commercial, educational, etc. (Schiller & Plinke, 2016).

The period of use of the greenhouse can also vary from one project to another. Greenhouses can be heated or unheated. The set temperatures and other operating parameters differ depending on the crops produced, the season, and the heating budget. It is important to design the greenhouse to best meet the needs. We summarize here very succinctly the questions to ask before installing a greenhouse; we recommend reading the CRAAQ's document: *Le Guide d'implantation : Serre individuelle en maraîchage diversifié* (see the "Further Information" section at the end of this sheet)

What are the weather conditions at the site?

Greenhouses allow the creation of a microclimate more favourable to plant cultivation than the external climate; however, the latter impacts the conditions inside the greenhouse. The greenhouse structure must adapt to prevailing winds and weather conditions (snowfall, rainfall) as well as sunlight. These phenomena influence the orientation and optimal shape of the greenhouse (Castilla, 2013; Tiwari 2005).

What resources are available at the potential installation sites?

When choosing the site for installing the greenhouse, it is useful to consider the available surfaces, if applicable, the different types of soils, and the existing obstacles. These obstacles can provide wind protection as well as sources of shade. Accessibility for users, early and late in the season, is a criterion not to be overlooked, as well as access to water and electricity on the site (on this subject, see the sheet "Challenges of the Northern Environment")

Construction of stone beds
(photo : Timothée Maheux, 2022)

2. DESIGN PARAMETERS

Below are summarized the main parameters found in the literature on greenhouses. These parameters influence one another and cannot be considered independently. The order of their presentation is neither chronological nor organized by priority.

2.1 Greenhouse Geometry

Greenhouses can come in various shapes, which influence their durability and resistance to loads as well as their thermal performance (Von Elsner et al., 2000a).

2.1.1 Different Geometries

Greenhouse designs are categorized into two main types: lean-to greenhouses and freestanding greenhouses (Ponce Cruz et al., 2015). A lean-to greenhouse is built against or attached to an existing structure, while freestanding greenhouses stand independently without attachment to any building. Among freestanding greenhouses, there are two primary forms: single-span and multi-span. A single-span greenhouse consists of one continuous space, whereas a multi-span greenhouse is made up of several single-span greenhouses aligned next to each other. We have summarized the main models of single-span greenhouses and provided two examples of multi-span greenhouses in the table below:

Table 1. Models of Single-Span and Multi-Span Greenhouses

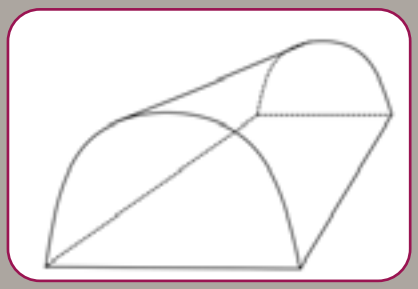


Figure 1. Quonset greenhouse - tunnel

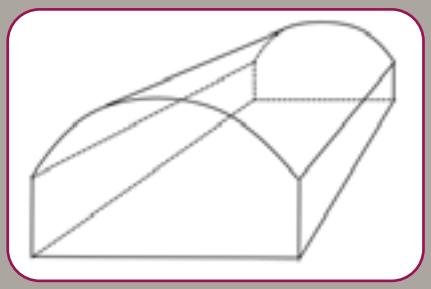


Figure 2. Modified arch greenhouse

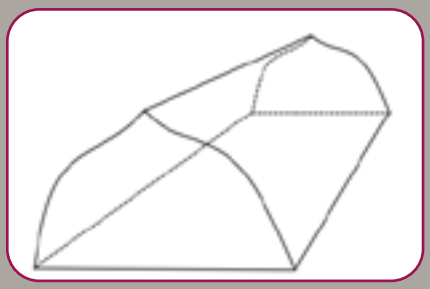


Figure 3. Gothic greenhouse

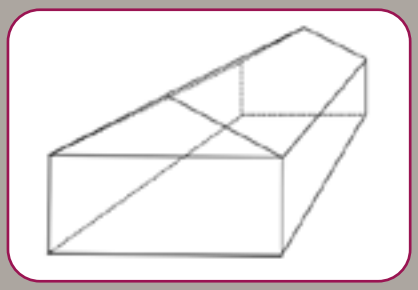


Figure 4. Greenhouse with symmetrical roof slopes

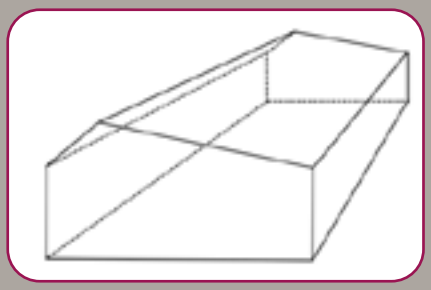


Figure 5. Greenhouse with asymmetrical roof slopes

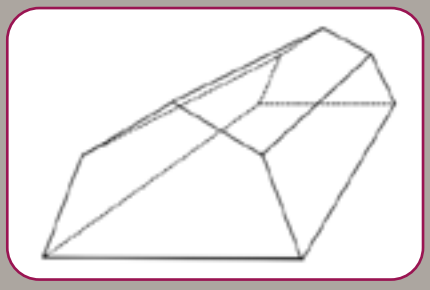


Figure 6. Vinery type greenhouse

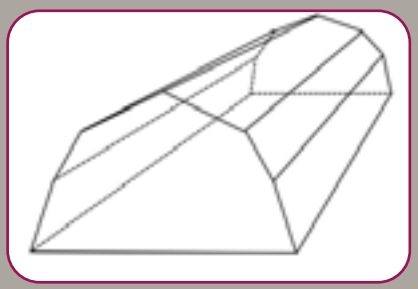


Figure 7. Mansard type greenhouse

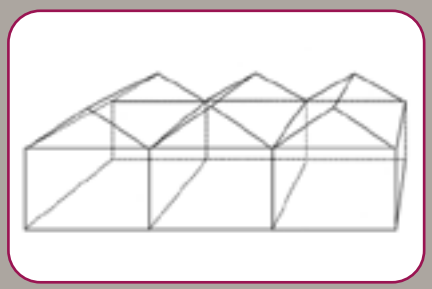


Figure 8. Multi-span greenhouse composed of greenhouses with symmetrical roof slopes

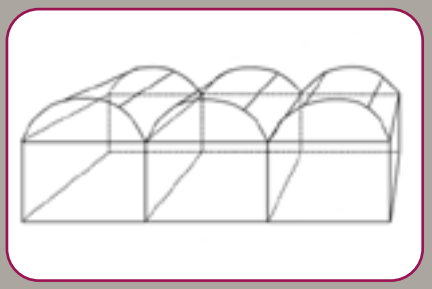


Figure 9. Multi-span greenhouse composed of modified arch greenhouses

There are also other types of large greenhouses designed for high-value crops (Piché, 2021), such as Venlo and sawtooth greenhouses presented here:

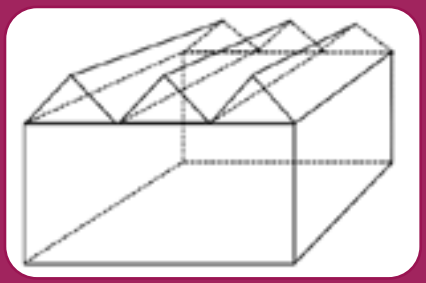


Figure 10. Venlo greenhouse

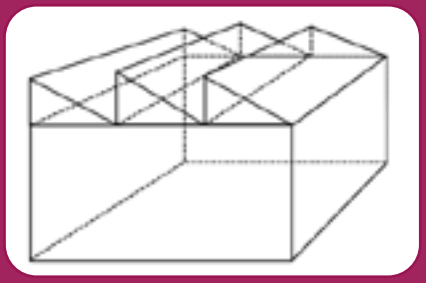


Figure 11. Sawtooth-shaped greenhouse

There are also smaller standalone greenhouses that do not resemble chapel-like shapes, including passive solar greenhouses, geodesic greenhouses, and greenhouses that are either buried or semi-buried.

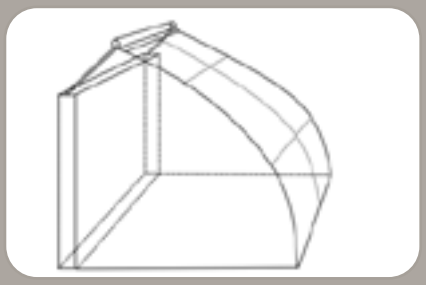


Figure 12. Passive solar greenhouse (also called a chinese greenhouse)

Figure 13. Geodesic greenhouse

2.1.2. Comparison of Geometries

a) Load Resistance

Load resistance is influenced by the shape of the structure and the framing elements, including the materials used and their dimensions. Therefore, it is essential to conduct structural calculations to determine the load resistance of a greenhouse. Certain geometrical features can significantly impact load resistance; for instance, rounded shapes help distribute loads, such as snow, more evenly and reduce wind resistance. Additionally, some roofs are designed to allow for quick drainage of snow and rainwater, which lessens the load on the structure. Incorporating intermediate supports or attachment elements can further help distribute stresses on the covering materials evenly, reducing the risk of tearing or twisting (Dougka & Briassoulis, 2020).

b) Solar Radiation Capture

Among the greenhouses listed in Table 1, the Quonset greenhouse receives the least radiation and the asymmetric roof pitch greenhouse the most radiation, regardless of the time of year and at any latitude. Thus, Quonset greenhouses are recommended for regions close to the equator, at latitudes of 10°N to limit heat within the greenhouse. At 30°N, it is advisable to install greenhouses with symmetric roof pitches or modified arches. For regions starting from 50°N, it is recommended to install greenhouses with east-west oriented asymmetrical roof pitches to capture maximum radiation (Sethi, 2009).

Increasing the roof slope allows more radiation to be captured in winter and less in summer. However, the shape of the greenhouse is not the only parameter influencing the capture of solar radiation. It is also important to choose the correct orientation and the right covering materials (von Elsner et al., 2000a).

c) Insulation of the Structure

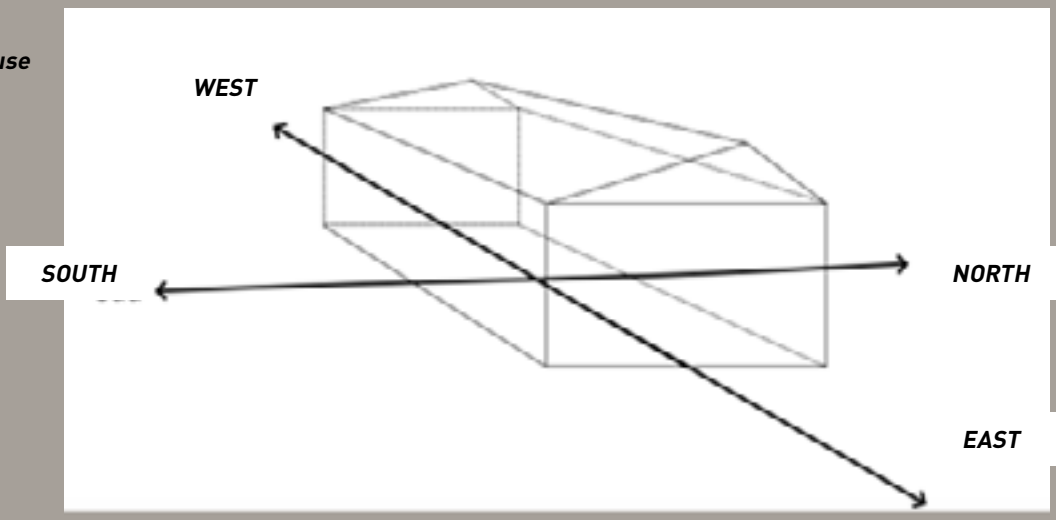
The insulation of a greenhouse is influenced by the characteristics of its structure and the ground beneath it. This includes the thermal resistance of the materials used and the airtightness of the greenhouse. Many greenhouse designs can be partially insulated on the north side or feature an insulated wall, as seen in passive solar greenhouses, lean-to greenhouses, and (semi) buried greenhouses. For the semi-buried type of greenhouse, it is essential to have appropriate soil, a very low risk of flooding, and a low water table (Greer, T. 2019). Additionally, temporary insulation systems, such as night covers, can be installed to help reduce thermal losses (Castilla, 2013; Sethi & Sharma, 2008; Tiwari, 2005).

2.1 Orientation

The orientation axis of the greenhouse corresponds to the direction followed by the largest dimension. For example, a greenhouse is oriented east-west if the longest sides face south and north, and the shorter sides face west and east (Figure 14) (Rader, 2013). In the northern hemisphere, it is preferable to orient a single-span greenhouse east-west to maximize sunlight exposure, especially if the greenhouse is used year-round or for three seasons. Be mindful of the shading produced by the crops; the rows to the south are favoured, and some compensatory strategies can be considered. Conversely, if one decides to grow only in the summer, a north-south orientation may be more beneficial to limit the shading effect between crops (Guimont et al., 2020). For passive solar greenhouses or semi-buried greenhouses, it is advisable to have a full south orientation for the translucent wall (Ahamed et al., 2018; Ponce Cruz et al., 2015; Sethi, 2009a). For multi-span greenhouses, a north-south orientation is generally recommended to notably limit the shadow of structural elements (Ponce Cruz et al., 2015).

For all greenhouses, it is necessary to observe the land to choose their orientation. Sources of shade can limit the performance of the greenhouse, and prevailing winds can create strong constraints on the structure. Therefore, consideration should be given to maximizing the radiation reaching the greenhouse (Ponce Cruz et al., 2015). A good practice is to seek the help of an expert in agronomy or someone with experience in greenhouse cultivation to observe the site with them and determine the best orientation together.

Figure 14. Diagram of an east-west oriented greenhouse



2.2 Dimensions

The dimensions of the greenhouse can influence its thermal performance. In the case of greenhouses with a north wall (whether it be a longitudinal wall or at the end), the larger the south-facing surface area relative to the east and west surfaces, the greater the captured radiation (Schiller & Plinke, 2016; Rader, 2013). Generally, it is suggested to have south-facing surfaces two or three times larger than the east and west facing surfaces. Also, the larger the volume of the greenhouse, the more stable the temperatures, since larger air masses take longer to change temperature (Morelli et al., 2022). However, heating needs increase with size (Von Elsner et al., 2000a).

2.3 Loads

For commercial use, a greenhouse must meet standards set according to the geographic area of the installation site. In Canada, provincial or municipal regulations must be applied. There are six types of loads to consider during the design and certification of greenhouses, which may vary more or less according to the codes in force (Ponce Cruz et al., 2015):

1. Permanent or dead loads: due to the weight of the structure (on average 10 to 25 kg/m^2);
2. Installation loads (semi-permanent): due to equipment installed in the greenhouse (heating, irrigation, shading systems, etc.) (on average 25 kg/m^2);
3. Wind loads (variable depending on the site's weather conditions);
4. Snow loads (on average 75 kg/m^2);
5. Crop loads: i.e., some crops may be supported or hung from the greenhouse structure. 20 kg/m^2
6. Seismic loads

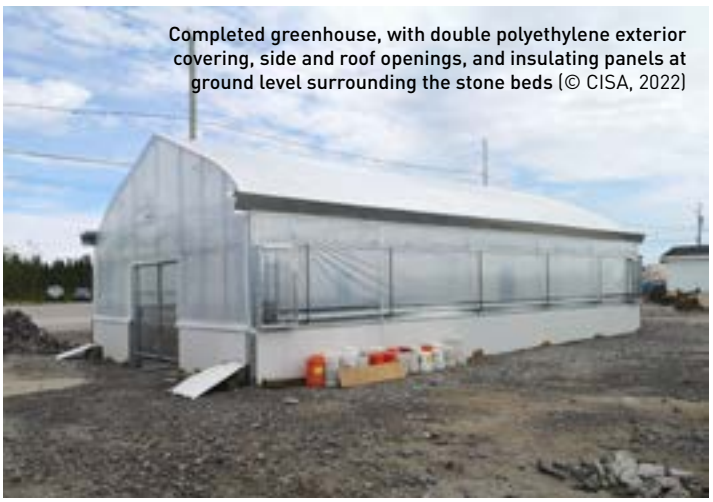
2.4 Choice of Materials

a) For the covering

In a greenhouse, the covering allows light rays to pass through, particularly the radiation used by plants for photosynthesis, known as photosynthetically active radiation (PAR as mentioned in Table 4), while protecting the crops from winds and thermal losses (Castilla, 2013). Criteria to consider in a greenhouse project include cost, material resistance (to winds, snowfall, impacts, etc.), lifespan and rate of degradation, as well as their weight so that the greenhouse frame can support the covering (Badji et al., 2022; Castilla, 2013). Three main categories of covering materials exist in greenhouse cultivation:

- **Glass** has very good optical properties and is very stable over time; it has a long lifespan. However, it is not the case if subjected to shocks, as it is very fragile. Moreover, other disadvantages include the high cost of the material and its weight, requiring a structure that can support it.
- **Rigid plastics** are lighter than glass, more impact-resistant, less expensive, but have a shorter lifespan than glass. They can also be flammable and react to UV or phytosanitary products.
- **Plastic films:** more flexible, very light, and very affordable, plastic films are increasingly used worldwide. However, their lifespan is much shorter: their optimal operation is often for one or two seasons. For some plastic films, it is possible to use them in double thickness. It is then usual to blow air between the two layers of film. The double thickness limits thermal losses but represents an additional cost compared to single film. Finally, it is not recommended to use single film in northern agriculture, as its thermal resistance is poor.

Greenhouse under construction, Radisson (© CISA, 2022)



Completed greenhouse, with double polyethylene exterior covering, side and roof openings, and insulating panels at ground level surrounding the stone beds (© CISA, 2022)

Table 2. Summary of Different Covering Materials. (Castilla, 2013; Schiller & Plinke, 2016; Tiwari, 2005)
$$$$=[22;30] $/m², $$$=[15;22]$/m², $$=[7;15]$/m², $=[0;7]$/m² (*indicative price subject to variation)

Type of Covering	Weight kg/m²	Lifespan (years)	Transmittance BY	R-Value	COST	Risks
Single-layer Glass	10	20	88-93 %	0,9	$$$$	
Double-layer Glass	20	20	75-80 %	1,4	$$$$	
Reinforced Fibreglass	1,5	12	80 %-85 %	1	$$$	
Single-thickness Polycarbonate	1,4	15	90,00 %	1,43	$$$	
Triple-thickness Polycarbonate	5	15	70-80 %	2	$$$	
Triple-thickness Polycarbonate	6,5	20	50 %	4	$$$$	
PMMA	5	20	82 %	0,5	$$$	
Double-layer Acrylic		20	80 %-90 %	2	$$$	
Rigid PVC	1,45	10	82 %		$$$	
ingle-thickness Polyethylene — film	0,092	1	91 %	0,83	$	
Single-thickness Polyethylene — film — UV treated	0,165	3	88 %-90 %	0,83	$	
Double-thickness Polyethylene — film	0,18	1 à 3		1		
EVA —film	0,179	3	90 %		$	
PVC —film	0,23	2	90 %		$	

b) For the Structure

The primary role of the greenhouse structure is to support the covering of the greenhouse and to be able to withstand the loads commonly applied to a greenhouse, such as wind, snow, and rain. Next, the structure is optimized to minimize shading while keeping costs as low as possible (Castilla, 2013).

The materials most commonly used in greenhouse structures are steel, aluminum, wood, and reinforced concrete (Tiwari, 2005). We provide in the table on the following page the main elements to know about each of these materials:

Table 3. Summary of Materials Used for the Structure

Materials	Application	Advantages	Disadvantages
Steel	• Can be used for all geometries. • Galvanized steel is often used, as it is robust and corrosion-resistant. • Suitable for supporting heavy coatings such as glass.	• Resistant. In addition to withstanding heavy loads, structural elements can be reduced in comparison with other structural elements.	• High cost. • Not very ductile, so shape cannot be easily altered.
Aluminum	• Can be used for all geometries.	• Light	• Less resistant than galvanized steel. • Corrosion may cause pitting. • Very high cost.
Wood	• For greenhouses with straight surfaces. • Often used for handcrafted greenhouses.	• Allows the isolation of connections between cladding elements, serves as thermal mass.	• Expands with humidity. • May be damaged by mold and insects. • Treatments that render wood rot-proof can be toxic to crops and people).

The structure of a greenhouse is also supported by foundations. These anchor the structure in the ground. They can be metal rod inserts plunging into the ground, or more complex systems with a concrete insert in the ground, or foundations with a concrete foot. The choice of anchoring technique must consider the structure and the loads that will be applied to it, as well as the frost zones/depths in the ground. It should be noted that site preparation (e.g. levelling) is an essential preliminary step to installing a greenhouse, but is not described here (Schiller & Plinke, 2016; Tiwari, 2005).

The choice of materials for greenhouse construction is also linked to their accessibility and cost for the installation locations under consideration. It may also be influenced by construction practices and habits in the region and the possibilities for maintenance and repair of breakages (access to materials, local skills) (Castilla, 2013; von Elsner et al., 2000a).

2.6 6. Greenhouses Adapted for the North?

Each project is unique and requires upstream assessment of the greenhouse's use and the resources available on site. However, the following points recur for installation projects in northern climates (Rader, 2013):

- **Efficiency and Heat Loss:** It's crucial to think about ways to make the greenhouse as energy efficient as possible to minimize heat loss. This can involve strategies such as installing a north-facing wall, opting for a passive solar design or other energy-efficient greenhouse models, and selecting high-performance coatings for glazed areas.
- **Site-Specific Loads:** Consider the specific loads at the installation site, particularly regarding snow and wind.
- **Thermal Storage and Operability:** Plan for thermal storage and ensure the greenhouse can operate effectively in snowy conditions. This might include creating an area for equipment storage that also provides insulation.
- **Ventilation Needs:** Proper ventilation is crucial to remove excess humidity and heat, as greenhouses can quickly become too warm, even in northern climates.
- **Geometric Design:** Selecting the appropriate geometric model for the greenhouse is vital for energy efficiency, depending on the bioclimatic context and the types of crops being grown.
- **Production Planning:** It's important to plan the types of production that will take place inside the greenhouse to ensure the necessary equipment can support optimal bioclimatic conditions for the plants.

3. INCORPORATING ADDITIONAL SYSTEMS

To ensure optimal climatic conditions in a greenhouse, it's advisable to incorporate additional systems. A climate controller and ventilation systems are essential for regulating temperature and humidity through forced ventilation and managing openings. Additionally, integrating irrigation, lighting, thermal storage, and heating systems can enhance the production potential of the greenhouse. These measures aim to create the best possible growing conditions for the plants cultivated within the greenhouse.

The interior of a greenhouse features a positive-pressure air core heating system. (© CISA, 2022)

To go further:

Piché, P. (2021). Amélioration du comportement thermique d'une serre nordique communautaire. PhD Thesis

Schiller, L., & Plinke, M. (2016). The year-round Solar Greenhouse (Vol. 1). New Society Publisher.

Sethi, V. P. (2009). On the selection of shape and orientation of a greenhouse : Thermal modeling and experimental validation. Solar Energy, 83(1), 21-38.

Rader, J (2013). Cold-Climate Greenhouse Resource, a guidebook for designing and building a cold-climate greenhouse. University of Minnesota.

Guimont, 2020, Guide de production, POIVRON ET TOMATE BIOLOGIQUES SOUS ABRIS.

Thériault J., Coutin-Beaulieu C., Le Mat A., Martin Y., Taillon P.-A., Leblanc J. (2023). Guide d'implantation: serre individuelle en maraîchage diversifié. CRAAQ. 140 p.

CETAB+. (2021). Principales étapes de construction d'une serre (vidéo). En ligne.

REFERENCES

Ahamed, M. S., Guo, H., & Tanino, K. (2018). Energy-efficient design of greenhouse for Canadian Prairies using a heating simulation model. International Journal of Energy Research, 42(6), 2263-2272. https://doi.org/10.1002/er.4019

Badji, A., Benseddik, A., Bensaha, H., Boukhelifa, A., & Hasrane, I. (2022). Design, technology, and management of greenhouse : A review. Journal of Cleaner Production, 373, 133753. https://doi.org/10.1016/j.jclepro.2022.133753

Gouvernement du Canada (1996). Code national de construction des bâtiments agricoles — Canada 1995. https://nrc.canada.ca/fr/certifications-evaluations-normes/codes-canada/publications-codes-canada/code-national-construction-batiments-agricoles-canada-1995

Castilla, N. (2013). Greenhouse Technology and Management, 2nd Edition (CAB Internationnal).

Dougka, G., & Briassoulis, D. (2020). Load carrying capacity of greenhouse covering films under wind action : Optimising the supporting systems of greenhouse films. Biosystems Engineering, 192, 199-214. https://doi.org/10.1016/j.biosystemseng.2020.01.020

Fortier, J.-M., & Sylvestre, C. (2021). Le maraichage nordique—Découvrir la culture Hivernale des légumes.

Greer T (2019). How to Build a Walipini Greenhouse , Morning Chores, repéré au lien suivant : https://morningchores.com/walipini/

Maraveas, C. (2020). Wind Pressure Coefficients on Greenhouse Structures. Agriculture, 10(5), Article 5. https://doi.org/10.3390/agriculture10050149

Morelli, S., Cossio, F., Monarca, D., Marucci, A., Selli, S., Pierini, D., & Carlini, M. (2022). Parametric sweep simulation for greenhouse temperature field optimization : An Italian case study. Energy Reports, 8, 881-895. https://doi.org/10.1016/j.egyr.2022.07.105

Piché, P. (2021). Amélioration du comportement thermique d'une serre nordique communautaire. Université de Pau des pays de l'Andou.

Ponce Cruz, P., Molina, A., Cepeda, P., Lugo, E., & C MacCleery, B. (2015). Greenhouse design and control (CRC Press/Balkema Book).

Rader, J (2013). Cold-Climate Greenhouse Resource, a guidebook for designing and building a cold-climate greenhouse. University of Minnesota, http://csbr.umn.edu/publications/reports.htmlSchiller, L., & Plinke, M. (2016). The year-round Solar Greenhouse (Vol. 1). New Society Publisher.

Sethi, V. P. (2009). On the selection of shape and orientation of a greenhouse: Thermal modeling and experimental validation. Solar Energy, 83(1), 21-38. https://doi.org/10.1016/j.solener.2008.05.018

Sethi, V. P., & Sharma, S. K. (2008). Survey and evaluation of heating technologies for worldwide agricultural greenhouse applications. Solar Energy, 82(9), 832-859. https://doi.org/10.1016/j.solener.2008.02.010

Singh, R. D., & Tiwari, G. N. (2010). Energy conservation in the greenhouse system : A steady state analysis. Energy, 35(6), 2367-2373. https://doi.org/10.1016/j.energy.2010.02.003

Tawalbeh, M., Aljaghoub, H., Alami, A. H., & Olabi, A. G. (2023). Selection criteria of cooling technologies for sustainable greenhouses : A comprehensive review. Thermal Science and Engineering Progress, 38, 101666. https://doi.org/10.1016/j.tsep.2023.101666

Tiwari, G. N. (2005). Greenhouse Technology for Controlled Environment (Alpha Science International Ltd.).

Von Elsner, B., Briassoulis, D., Waaijenberg, D., Mistriotis, A., von Zabeltitz, Chr., Gratraud, J., Russo, G., & Suay-Cortes, R. (2000a). Review of Structural and Functional Characteristics of Greenhouses in European Union Countries : Part I, Design Requirements. Journal of Agricultural Engineering Research, 75(1), 1-16. https://doi.org/10.1006/jaer.1999.0502

Von Elsner, B., Briassoulis, D., Waaijenberg, D., Mistriotis, A., von Zabeltitz, Chr., Gratraud, J., Russo, G., & Suay-Cortes, R. (2000 b). Review of Structural and Functional Characteristics of Greenhouses in European Union Countries, Part II : Typical Designs. Journal of Agricultural Engineering Research, 75(2), 111-126. https://doi.org/10.1006/jaer.1999.0512

Euro-métal, (2019) Propriétés des plastique PMMA, : http://www.euro-metal.fr/wp-content/uploads/2019/01/PMMA.pdf

Miro Aski community garden in Opitciwan
(photo : S. Bergeron,2023)

THE NORTHERN OUTDOOR GARDENS

INTRODUCTION

A garden is a space where vegetables, ornamental plants, or flowers are cultivated. Contrary to what many might think, outdoor cultivation can serve as an alternative or complement to greenhouse cultivation, especially in northern communities. This guide provides essential information and considerations specifically for outdoor cultivation in these areas.

Before starting a garden, there are several important questions to consider. First, you need to decide how you want to cultivate your plants: will it be done conventionally or organically, and will you opt for monoculture or a diversified approach? Additionally, determine the size of the area you wish to cultivate, as this will influence the equipment you use. Smaller or medium-sized plots can often be tended to manually, whereas larger areas may require specialized equipment. A review of various cultivation tools is provided at the end of this guide.

Another key decision is whether to cultivate in open ground or in containers. Each method has its own advantages and disadvantages, which we will discuss to help you choose between gardening in open ground, using containers, or incorporating both methods in your plan.

Finally, you must decide what to grow and how to grow it. Planning these elements in advance will help you anticipate your monetary and human resource needs—both in terms of paid staff and volunteers—and evaluate the potential for food production as well as the educational and social activities your garden could facilitate.

Compared to greenhouse gardens, outdoor gardens allow you to create a cultivation space with minimal financial investment and can yield positive results with less technical expertise. This method of cultivation is versatile and can be easily tailored to meet specific needs and budgets. Additionally, outdoor gardening complements greenhouse cultivation by providing space for plants that are less sensitive to temperature changes or that require more room to grow.

Early season weeding of the permanent raised beds and pathways at the Solidarité Alimentaire Matagami garden (source: CISA, 2022)

1. THE DIFFERENT APPROACHES IN MARKET GARDENING

Several methods can be used to successfully produce fruits and vegetables. One can choose to cultivate conventionally or organically. Conventional cultivation allows for the use of inputs such as synthetic fertilizers and pesticides, commonly referred to as chemicals. These are not permitted in certified organic cultivation. In organic production, fertilizers and pesticides must be of natural origin to be recognized as organic and are combined with agricultural practices that enhance soil fertility and combat pests. It also requires crop rotation, a practice generally recommended. In Canada and Quebec, certification is required to label a product as organic, as the designation is regulated by laws and regulations (more information is available on CARTV website). However, it is entirely possible to cultivate according to organic principles without obtaining certification, if the vegetables are not marketed as organic.

Another choice is related to the diversity of what is cultivated. Monoculture refers to the cultivation of a single type of crop. Generally, in community-scale gardens, diversified market gardening is practiced, meaning that several varieties of vegetables are grown in the garden. A form of diversified gardening that has become increasingly popular in recent years, especially since the publication of Jean-Martin Fortier's book «The Market Gardener,» is bio-intensive market gardening. This method aims to «maximize the yield of a cultivated area while maintaining or even improving soil quality.» This form of cultivation requires extensive knowledge of crop families, rotations, and fertilization to achieve optimal production without depleting the soil. Bio-intensive cultivation is generally carried out on permanent beds (more information on permanent beds is available below).

2. TYPES OF OUTDOOR GARDENS

Outdoor gardens can be created in open ground or in containers, such as raised planters. The specifics of each type are detailed in this section. A summary box of the advantages and disadvantages is available on p. 37 for open ground gardens and on p. 40 for container gardens.

2.1 Open Ground Garden

An open ground garden is a cleared or weeded area where plants are directly planted into the soil. There are two approaches that can differentiate an open ground garden: the creation of permanent beds or not. A permanent bed is a dedicated cultivation space bordered by pathways on each side. Each year, the bed is cultivated and receives applications of fertilizers and compost, enriching the soil over time. This method prevents walking on the cultivated soil, which typically improves soil structure and horticultural potential. This type of bed has been created in the Solidarité Alimentaire Matagami Garden. In contrast, non-permanent beds are not predefined. They are recreated at the beginning of each year and disappear at the end of the season. Cultivation still respects standard spacing between plants and crops. Pathways are also created, but only for the season. Beds often have specific dimensions that facilitate gardening (see the box below). In both cases, the soil can be left flat, or small ridges can be created on the row to improve soil warming or surface drainage.

Choosing the Garden Location

When the soil conditions allow, an open ground garden is the preferred choice. It provides better contact with soil organisms, promotes greater root development, and generally reduces the risk of mineral salt accumulation compared to container soil. Additionally, container gardening offers opportunities to grow horticultural crops in areas that are difficult to cultivate, such as asphalted schoolyards or soil that is compacted or contaminated.

To determine the best location for an open-ground garden, several key factors must be considered, including soil type, topography, and hydrology. The surrounding environment and hardiness zone are also important considerations for both open ground and container gardens.

It's crucial to assess the condition and type of soil. This evaluation ensures that the soil is not contaminated, if there are any concerns, and aids in identifying necessary amendments or improvements needed to enhance the soil's horticultural potential and the vitality and productivity of the plants.

Examples of Dimensions for Outdoor Gardens:

Standard Dimensions for Cultivation Beds in Diversified Market Gardening:

Width: 75 cm (30")
Length: 30 m (100')
Pathway Between Beds: 45 cm (18")

Dimensions of Gardens in Northern Communities:

Radisson

10 beds of 1.2 m by 8.8 m (10.56 m² each)

Matagami

16 beds of 1.2 m by 8 m (9.6 m² each)

Plant Hardiness Zones

The hardiness zone indicates which plants are suited to the climate of a geographical area. In Canada, there are 10 hardiness zones (0-10), each associated with a letter (A or B). The smaller the number (and letter), the colder the winters, the longer the frost period, etc. For example, Kangiqsualujjuaq, located in zone 0B, is colder than Matagami, located in zone 2A. A plant with a hardiness zone equal to or lower than the zone where the garden is located should survive the winter. It would be considered a perennial plant. Plants grown in the garden are often annuals, but the hardiness zone will still affect their development and productivity. It is recommended to choose plants that will mature before the first frosts. Information on the number of days to maturity is available on seed packets. PTo define the general hardiness zone of the region, the federal government has produced a directory by municipality.

When choosing a site, it is important to consider the local microclimate, which can be influenced by sunlight quality, the presence of wind corridors, and the ease of access for gardeners and other people likely to visit the gardens.

The Challenges of the Northern Environment sheet provides more details on this topic.

The agronomic potential of soil can be determined through physicochemical analysis in a laboratory and soil profiles conducted by professionals. If there is any doubt, additional analyses for heavy metals or other contaminants can be performed.

The quality of surface water drainage must be considered: we look for well-drained soils, meaning those that are permeable to water. It is important not to establish new gardens in flood-prone areas. The availability of quality water is also an important factor to consider for proper irrigation.

In terms of topography, it is preferable to cultivate relatively flat soil, although a slight slope can be acceptable.

There are also geomatic tools and ways to understand the elements described above. For those located on the Côte-Nord or the southern part of Nord-du-Québec, the Info-sols.ca website provides information on soil type, slope, hydrology, environment, and hardiness zone. Asking people who work the soil in the region about the history of the land can also provide additional information about the soil. Moreover, careful observation of potential sites will also yield information about the existing flora, weeds, surface water drainage, and soil profile. Several other factors can be considered depending on the planned crops, and it is recommended to undertake these steps with the assistance of an agronomist.

Once the soil and terrain characteristics have been assessed, there are generally two possibilities:

1. It is possible to cultivate on the chosen site's soil. It is often necessary to make adjustments to ensure the soil has good horticultural potential. This may involve drainage, liming, or amending with organic matter. The microbiological activity and soil structure can also be greatly improved, as observed at the Gaïa Cooperative on the Côte-Nord.
2. It is not possible to cultivate on the chosen site's soil. In this case, soil must either be imported or local inputs used to "create" soil. This was the case for most northern community garden projects, such as those in Matagami, Radisson and Opitciwan which had to import soil from southern Québec. This situation presents several challenges, such as finding quality soil and the significant costs of purchase and transport. This type of soil generally requires more maintenance (adding amendments) than local soil.

Construction of cultivation bed, Jardins du 53e Taïga, Radisson (© CISA, 2022)

The plot of open ground cultivation beds was installed on a site that was covered with gravel, so soil had to be imported to create the plot. This plot allows for 10 beds of 1.2 m by 8.8 m with a pathway of about 30 cm between the beds. The first installation step was to build a wooden frame to delineate the plot. This structure also helps to elevate and keep the soil in place to limit erosion. Cardboard (recovered from the Hydro-Québec cafeteria) was then installed to create a barrier against weeds. The soil was subsequently installed. Each bed required 7 bags of 107 liters of Lambert LM-ORG soil (for a total of 70 bags of soil for the entire plot). Since the soil was very dry and volatile, it had to be thoroughly moistened before planting. A drip irrigation system was also installed to supply each bed with water.

Setting Up the Garden

Setting up an open ground garden is relatively simple. The main aspect to consider is the environment in which the gardens are installed, as mentioned above and in the "Challenges of the Northern Environment.» l'environnement nordique" sheet. It is important to ensure that the terrain is relatively flat and well-drained, or to work with ridge cultivation. If wind exposure is not optimal, windbreak hedges can be installed. These can be natural, such as with trees or shrubs suitable for northern regions (e.g., Siberian pea shrub, alders, willows), or wooden fences, for example. It is very important to weed the plot before setting up, particularly to eliminate perennials like couch grass.

If the existing soil is not of good quality, excavation may be necessary to replace it with good horticultural soil. It is often preferable to start soil preparation work a year in advance and to plant a green manure if the soil is ready before the frost.

Cost

The cost of establishing an open ground garden will depend significantly on the availability of cultivable soil on-site. If suitable soil is not available, you should anticipate substantial expenses for purchasing and delivering soil. Alternatively, you may need to invest time and resources to find and create alternatives using local natural materials such as sand, decomposed moss, seaweed, shredded branches, and compost. Additionally, resources will be required for soil installation.

If soil is already present on-site, it will be necessary to ensure that the terrain is well-drained and cleared of unwanted plants, which can increase installation costs. Renting an already prepared space for horticultural purposes can be a cost-effective way to gain experience while growing various crops. Notably, in 2021, the Chapais Economic Development Corporation (CDEC) made 35 hectares of agricultural land available for rent.

Durability: Long

Once the open ground garden is established, it can last as long as it is maintained. Maintenance involves amending the soil (e.g., by adding compost) and weeding when necessary. An overgrown garden can be brought back into cultivation by covering it with a tarp (occultation); a period of a few months to over a year may be needed to eliminate weeds, depending on the species and the intensity of the infestation.

Advantages and Disadvantages of Open Ground Gardens

- Low Investment: Compared to a greenhouse, as there are fewer infrastructures and low operating costs.
- Low Environmental Impact: No infrastructure or heating required.
- Ease of Equipment Adaptation: Easier to adapt equipment and tools than in a greenhouse or container garden.
- Promotes Soil Life: The presence of a multitude of living organisms such as bacteria, fungi, protozoa, nematodes, viruses, and insects of various sizes makes the soil alive, which is more difficult and time-consuming to achieve in container gardening. These living organisms form a large community sensitive to environmental conditions (humidity, temperature, oxygen level, and organic and mineral food) and contribute to giving soil structure, aeration, and good porosity. They are part of the organic matter mineralization cycle, allowing plant roots to fully develop and provide all the necessary elements for plant growth.
- Better Winter Survival Rate: Perennial and biennial plants have a better survival rate in open ground gardens if the soil has good structure and the water table is not too high. Snow cover reduces the impact of frost compared to containers. Soil in the ground is less subject to temperature variations and frost than in containers, especially due to snow cover.
- Easier Access to Nutrients and Water: Plant roots can grow deeper in the soil, making it easier to access necessary nutrients and water.

- Potential Soil Acidity: Local soil may be acidic, which can significantly impact plant growth. The pH must be adjusted to optimal values for the targeted crops using ashes or lime, and it is recommended to seek advice from an agronomist for these amendments.
- Weed Invasion: More easily invaded by weeds (also known as undesirable plants). They are also more accessible to potential pests, such as dogs, deer, moose, bears, and certain insects.
- Exposure to Climate Variations: Directly exposed to temperature and precipitation variations, unlike covered environments like greenhouses. This means that uncovered soil takes longer to warm up in the spring, and precipitation can alter its composition and the shape of the mounds.
- Shorter Growing Season: The growing season is shorter than in greenhouses; crops are planted later in the spring and stop producing earlier in the fall due to frost risks.
- Weather-Related Losses: Higher risk of losses due to adverse weather conditions (heavy rain, wind).
- Outdoor Working Conditions: Gardeners may have to work in the rain and be prepared to brave the mosquito season!

Example of an outdoor container, Jardins du 53e Taïga, Radisson (photo : Camille Hétu)

Outdoor containers in Kuujjuaq reusing leftover materials from the greenhouse gabions (source : Page Faceebook Kuujjuaq Greenhouse Facebook page)

2.2 Container Garden

Outdoor gardening can also be done in containers, typically elevated structures that allow for soilless cultivation. The main advantage of containers is the ability to create a cultivation space on sites where open ground gardening is not possible: absence of soil, contaminated soil, or soil unsuitable for cultivation (e.g., too acidic). In these contexts, a container with a bottom is preferred, but in all cases, the bottom must allow for the drainage of excess water. A container with a bottom completely isolates the soil from the ground on which it is placed. This is the type of container built by Les Jardins du 53e Taïga, à Radisson.

When there is access to cultivable soil, a container without a bottom can be a good option. The bottomless container consists of only four sides: it allows for raising the soil level by adding soil to existing ground. The bottomless container's function is to hold the soil in place. In the northern context, where the depth of surface soil is often limited, an isolated but bottomless container can be interesting to enhance the existing soil. This type of container is suitable, among other things, for growing plants with larger root systems (e.g., fruit shrubs), as the plant roots will not be limited to the container's area. They can continue to grow and access nutrients in the existing soil. Bottomless containers are generally quite low (about 30 cm in height) and in direct contact with the ground, reducing the risk of freezing compared to elevated containers, as the soil is less exposed to the air.

Although turnkey container options are available on the market, containers are generally built by businesses or organizations to limit costs. Self-constructing containers also allows for planning their design according to the available space, the cultivation area needed for the project, the type of crops planned (which will influence the container's height and the amount of soil), the users (containers of varying heights to facilitate accessibility), and the materials available on site. Building containers is relatively simple, especially compared to a greenhouse.

Dimensions

A minimum height of 45 cm (18 inches) of substrate (soil) is recommended to ensure good versatility, allowing for adequate depth for a wide variety of crops. For example, lettuce needs a minimum of 15 cm of soil, while potatoes need 45 cm of depth for optimal growth.

A maximum width of 120 cm (4 feet) is recommended to facilitate crop maintenance. Regardless of the dimensions, it is important to ensure that the centre of the container is reachable from one of the sides. If the container is positioned against a wall or fence and thus accessible from only one side, it is suggested to reduce the width to about 90 cm (3 feet).

The desired length varies according to needs and available space. Generally, the larger the container dimensions, the greater the soil volume, making the container more resilient to temperature variations and soil drying. This can be advantageous in northern situations where temperature variations are a challenge. However, it is important to keep in mind that the larger the volume, the higher the soil costs, and the heavier and more difficult the containers will be to move.

Cost

The costs of a container garden project can vary greatly depending on the materials used, the number of containers, the dimensions of the containers, whether they are self-constructed or purchased new. For comparison, a bottomless container measuring 122 cm x 122 cm x 30.5 cm sells for an average of $100 on the market, while an elevated container with a bottom measuring 124 cm x 63 cm x 81 cm sells for about $200. For self-constructed containers, the construction time can be estimated at a few hours of work for someone experienced in building this type of structure. Besides the costs of the containers and their construction, other associated costs include the purchase and delivery of soil, which can be significant.

Durabilité : moyenne

The durability of containers varies depending on the materials used. For wooden containers, the main issue to anticipate is wood rot caused by soil moisture. To increase the lifespan of the containers, it is recommended to use water-resistant wood species (such as hemlock or cedar) and to install a protective membrane (geotextile) inside the containers to protect the wood in contact with the soil. Treated wood should be avoided for food production.

Type de matériaux	Advantages +	Disadvantages -
Wood	• Accessible • Inexpensive • Possibility of self-construction and repair	• Rot
Plastic / Fiberglass	• Durable • Inexpensive • Lightweight	• May have poor drainage • Difficult to repair • Some plastics do not withstand frost well and will crack quicklyt.
Metal	• Robust	• Conducts cold and heat • Rusts • Heavy
Geotextile	• Good root aeration • Lightweight	• Dimensions depend on suppliers (not as modular) • Expensive

Bottomless Growing Bed in Opitciwan (photo: CISA)

Advantages and Disadvantages of Raised Bed Gardening

- The installation is modular.
- Allows cultivation on mineralized land, contaminated soil sites, compacted soil, or sites with little or no soil.
- Provides better ergonomics if the beds are elevated, compared to ground gardening where one works crouched. For example, the beds in Radisson are about 1 meter high and were placed on wooden pallets to elevate them, allowing work without bending over. You can also move around both sides of the bed to facilitate crop maintenance.
- Weed management is simplified compared to ground gardening, as the start is done with commercial soil that contains fewer weed seeds. The walls of the bed also act as a physical barrier against weeds.
- Better oxygenation of the growing substrate in well-designed beds, which promotes a better root system.
- The soil warms up faster in a bed than in the ground. This allows the season to start earlier, which is significant in a northern context.
- Possibility of recycling materials or containers to make beds. For example, the gardens of Jardins du 53e Taiga in Radisson reused Hydro-Québec transport boxes as beds. In Kuujjuaq, outdoor beds were built with leftover materials from the greenhouse gabions. Other materials can also be used, such as in Salluit where bathtubs were reused for personal agricultural projects. However, when recycling materials, it is important to ensure they are not contaminated; materials that have contained toxic substances should not be reused for food production.
- Possibility of growing less hardy species, such as certain fruit shrubs or perennial plants that would not withstand frost, by growing them in smaller containers (bed, geotextile pot) that can be easily moved. This allows them to be stored in a temperature-controlled place for the winter period, ensuring their survival during the winter.

- Requires the purchase and importation of soil. In a northern context, the choice of suppliers and types of soil is limited, and the associated delivery costs are high. Projects for the creation of local soil are underway.
- The cultivation area is limited to the dimensions of the bed, so expanding the garden requires the construction of additional beds.
- Soil in beds dries out faster than in the ground (especially in beds made with porous materials). This requires more regular monitoring of crops, more watering, and therefore more maintenance time. The soil near the bed walls also dries out faster than the soil in the centre of the bed, resulting in uneven plant growth in different areas of the bed.
- Since we start with purchased soil, there is less life in the soil initially, which requires implementing agricultural practices to promote the development of biodiversity within the soil.
- Requires the addition of amendments to obtain soil suitable for cultivation. However, since the volume of the beds is predefined, there is not always space to, for example, add the necessary amount of compost at the beginning of each season.
- Greater temperature variations in the soil in beds compared to ground gardening: this causes stress to the plants, which can impact their growth and production capacity.
- Soil in beds freezes faster than in the ground: the risk of crop damage due to frost is therefore increased. In this sense, the survival rate of perennial plants can be lower in beds than in the ground. Crops planted in the fall for the following summer do not do as well in beds because the entire soil in the bed freezes during the winter. For example, at the 53rd Taiga Gardens, garlic (planted in the fall) does not succeed in beds, whereas in ground gardening, garlic cloves are better protected from frost and have a higher survival rate.
- Soil can accumulate mineral salts over time at the base. This phenomenon hinders plant growth. It is an element to monitor and correct as needed.

In summary, ground gardens and outdoor raised beds offer a flexible and affordable solution for northern agriculture. The adaptability of raised beds allows for a diversity of crops on various terrains. Although simple to set up, they require careful planning and management of irrigation and fertilization. The dimensions of the beds greatly influence the possible crops and the way to grow them. Therefore, it is important to define crop objectives and plan the beds accordingly.

Ground gardens require less rigour in irrigation and fertilization and allow plants to draw nutrients directly from the soil's microbial activity. Their temperature is also better regulated than that of raised beds. However, the condition and quality of the soil are the determining factors for the quality of a ground garden, and quality soil is often difficult to access in the north. Generally, outdoor cultivation is much more affordable than greenhouse cultivation, but the gardening season is also shorter.

3. GROWING IN AN OUTDOOR GARDEN

Outdoor gardens primarily allow for cultivation in the summer. Adding cold protection equipment (floating covers, mini-tunnels over the beds, cold frames discussed below) helps to start the season earlier and extend it into the fall.

3.1 Cultivated Species

All types of crops are possible if you consider the days to maturity (DTM), which is the number of days needed after direct seeding or transplanting before harvesting. The DTM of a variety is information available from most seed suppliers. To make the most of the short growing season, short-cycle crops like radishes, lettuce, and green onions should be prioritized.

Depending on the harvest period, this can allow for successive planting of vegetables in the same bed or on the same plot. Starting plants in a nursery before the season begins rather than sowing them directly in the ground is a real asset, as it allows the plants to have time to mature, produce earlier in the season, and achieve better overall yields. If the garden area is limited, such as in a raised bed, it can be beneficial to prioritize cultivars that take up less space.

The terms "patio," "baby," and "dwarf" should be considered when choosing cultivars, as they have been developed to remain smaller and more compact.

Finally, ensure that the available soil depth is adequate for the crops you want to grow. This is particularly important for raised bed gardens: their dimensions will influence the type of crops possible.

Crops Adapted to the Northern Context:

- Leafy Vegetables (lettuce, spinach, arugula, watercress, etc.)
- Root Vegetables (radish, beet, carrot, turnip, potato)
- Bulb Vegetables (yellow and red onion, green onion, leek, garlic
- Brassicas (cabbage, broccoli, kale, kohlrabi, etc.)
- Herbs (parsley, dill, mint, chives, etc.)
- Strawberries
- Sweet Peas and Snow Pea
- Some communities also successfully grow English and Lebanese cucumbers, zucchini, and cherry and beef tomatoes (see the profile sheets of the collective gardens of Chutes–aux-Outardes et de Opitciwan).

Less Suitable Crops:

- Long-maturing cucurbits such as winter squash.
- Heat-demanding crops like tomatoes and peppers, which will perform better in a greenhouse or with a cold frame.

Perennial crops for raised bed gardens. Since the soil completely freezes during the winter, the survival rate of perennials is not guaranteed. Insulating the beds can help with this aspect. Trials should be conducted with small quantities and possible adjustments.

This section will be enhanced over time with field experiences from northern communities. Understanding the behaviour of varieties for a given site is knowledge that grows like a garden.

3.2 Irrigation

Since an outdoor garden requires frequent watering and precipitation may not be sufficient, it is necessary to plan access to a quality water source that provides an adequate volume based on the area (for more information on this aspect, see the "Challenges of the Northern Environment" sheet. If crops are consumed after being washed with garden water, the water must obviously be potable. Special attention should be paid in communities where water is delivered by truck and stored in on-site tanks. A complete and adapted irrigation system is therefore necessary. It is possible to install a drip irrigation system or a sprinkler irrigation system. A drip irrigation system is more precise, as it allows watering at the base of the plants, thus reducing the amount of water used for irrigation. Beds with water reservoirs under the soil are also an option to limit soil drying in the bed[ii].

One of the important points for irrigating raised bed gardens is drainage. The beds should not be completely sealed to allow water to drain easily and prevent root asphyxiation. Drainage holes should be made at the bottom of the beds. The beds can also be elevated to ensure optimal drainage, as done by the 53rd Taiga Gardens by placing them on pallets.

Adding a layer of draining materials at the bottom of the beds (wood chips, clay balls, stones, etc.) does not replace drainage holes and is generally not recommended for raised bed gardening. It is preferable to have a good quantity of quality soil.

Drip Irrigation system in the ground garden, Jardins du 53e Taïga, Radisson (picture : Camille Hétu)

Example of using organic mulch for leek cultivation at Le Grenier boréal farm (source : Coop de solidarité agroforestière de Minganie - Le Grenier boréal Facebook page)

Example of adding straw to retain moisture in the cultivation of onions and beets in raised beds, Jardins du 53e Taïga (photo : Camille Hétu)

3.3 A Good Practice: Using Mulch

Mulch can be used for outdoor cultivation. It covers the soil, offering several advantages: it helps maintain temperature and thus limits its variations, and it retains soil moisture, reducing water evaporation and thus the frequency of watering. By covering the soil, mulch limits the growth of unwanted weeds, reducing the need for weeding. There are two types of mulch, organic (decomposable) or inorganic (non-decomposable and often plastic), each with different strengths.

Organic Mulch

The use of organic mulch in northern agriculture offers multiple benefits, including improving soil quality and crop sustainability. These mulches, which can be composed of wood chips, straw, or other plant residues, contribute to moisture retention, soil temperature regulation, and erosion reduction. They also promote soil biological activity, particularly that of earthworms and microorganisms, which is essential for the decomposition of organic matter and soil aeration. Additionally, organic mulches help limit the spread of weeds.

Plastic Mulch

Plastic mulches are used to control weeds, limit soil water evaporation, and warm the soil (black mulch). The edges of plastic mulches are often buried on each side of the beds or held down with heavy materials. They can be woven or nonwoven. Woven plastics allow rain to pass through but are slightly less effective at weed suppression. In the long term, the use of plastic mulch can contribute to soil contamination with the accumulation of plastic residues and microplastics.

Examples of Plastic Mulch Used at Ferme du Rigolet à Tête à la Baleine (source : page Facebook de la Ferme du Rigolet)

4. EQUIPMENT AND TOOLS FACILITATING OUTDOOR PRODUCTION

Some tools and equipment are essential for outdoor cultivation, while others facilitate it and increase production. In all cases, they are recommended for northern outdoor cultivation. Ground gardens allow for the use of equipment and tools that facilitate soil preparation and crop maintenance, increasing gardening efficiency. Raised bed gardens, especially if elevated, make it more difficult to use several tools.

If the area is small or medium, manual tools can be used. If the cultivation area is larger, mechanized equipment (e.g., tractors and rototillers) will be more appropriate, at least for soil preparation. It should be noted that mechanized equipment, depending on the needs and area, is much more expensive to purchase and maintain than manual equipment. When possible, contracting out such operations can avoid costly equipment purchases that are rarely used. Some municipal tools can also have agricultural uses for soil preparation. Manual tools and equipment will be detailed below, along with the rototiller, as current northern gardens are small.

4.1 Basic Tools

The essential manual tools for outdoor cultivation (and even in greenhouses) are rakes, spades, hoes, hand hoes, and shovels. It is recommended to have several of each type for community/collective/educational projects. They are used for soil preparation, planting, and weeding, among other tasks.

For example, the hand hoe allows for more precise removal of weeds around seedlings or plants. It also helps to aerate the soil by breaking the surface crust, thus oxygenating it.

For seedling preparation, seeders, multi-cell trays of different sizes, soil, compost, vermiculite, and seeds are necessary. Heating mats, grow lights, and ventilation promote the production of quality seedlings.

It is recommended to set up a nursery in a heated community space, preferably a greenhouse dedicated to seedling production if the goal is to produce food in large quantities, to have an optimal climate for producing seedlings.

For harvesting and processing, harvest bins and a scale are useful. It is necessary to plan a functional space for washing the harvests and a hose. A salad spinner facilitates the drying and preservation of leafy vegetables.

Hand Hoe (source : Dubois Agrinovation)

Shovels and Compost Bin (in the Background) (source : CISA)

Multi-cell Tray
(source : CISA)

Black or White Non-Woven Covering Sheets

These can be used to warm the soil and eliminate weeds through occultation. They also protect against weather between crops, reducing soil work and saving time. They differ from the plastic mulch mentioned above as they are only used before planting or after the growing season. Depending on the species, the intensity of the infestation, and their development stage, a period of a few weeks/ months to over a year may be necessary to eliminate weeds.

Black Non-Woven Covering Sheet (source : Dubois Agrinovation)

Rototiller and Broadfork

These are used to prepare the cultivation beds in the spring. The rototiller is a small tractor. The equipment shown below is a BCS. It allows the use of several different tools, such as ridgers, weeders, mowers, etc. In the image, it is equipped with the rototiller head. As assembled, it allows shallow soil turning and the incorporation of compost or other amendments. It is difficult to use with raised bed gardening. The current trend in market gardening is to reduce the use of the rototiller, which can degrade soil structure quality, in favour of reduced soil tillage methods.

The broadfork allows for reduced soil work. It aerates the soil without turning the organic matter on the surface. It is very ergonomic and designed to work without injuring the back. There are several types of broadforks with varying numbers and lengths of tines.

Rototiller
(source : Les équipements Thivierge)

Broadfork (source : Grelinette : le guide complet pour vous aider à choisir votre modèle [quelle-grelinette.fr

4.2 The Stake

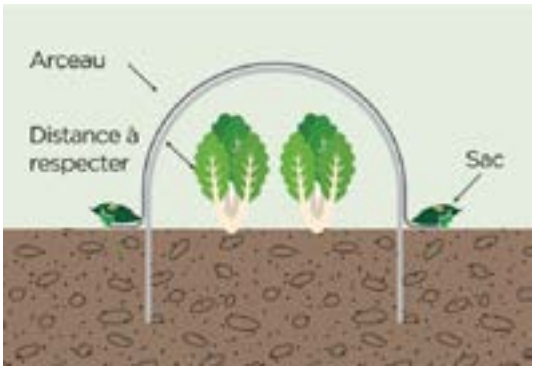
The stake provides support for climbing crops such as peas, beans, or cucumbers, or supports plants to limit damage caused by the weight of the fruits, wind, or weather (e.g., stakes for tomatoes, peppers, eggplants). For climbing crops, it optimizes the cultivation space by using vertical space instead of ground space.

Example of Staking at Jardins du 53e Taïga. (source : CISA)

4.3 Insect Netting

Insect netting is an integrated pest management method. It creates a physical barrier against pests, preventing them from reaching the crops. These nets, often made of woven polyethylene, are designed to cover plants to prevent pest insects. It is important to install them as soon as the plants are set in the garden. First, hoops are installed over the crops to be protected, then the insect netting is placed over the hoops and securely fastened. In ground gardens, the nets can be secured with weights (e.g., rock bags), while for raised bed gardening, the net can be directly attached to the bed to save space. The 53rd Taiga Gardens use binder clips (metal document clips) to attach the net directly to the hoop. There are different grades of nets that vary in mesh size. The choice of net and mesh size will depend on the pests to be avoided. Agricultural equipment suppliers generally have charts to help choose the net according to the crops to be protected.

Insect netting on outdoor raised beds at the 53rd taiga gardens (left) and on ground cultivation beds (right) (sources : Jardins du 53e Taïga Facebook page (left) and Camille Hétu, 2023 (right))



Installation diagram of insect netting
(source : Dubois Agrinovation[5])

4.4 Floating Cover

Floating covers are a valuable tool in northern agriculture. They create a favourable microclimate that increases temperature and preserves soil moisture, allowing plants to grow faster. These covers offer protection against adverse weather conditions such as frost, hail, and wind, while also acting as a physical barrier against harmful insects. They are useful for extending the growing season and improving crop quality. The installation process for floating covers is the same as for insect netting. As with nets, there are different types of floating covers on the market, and the thickness of the cover influences the degree of cold protection. The most commonly used is the P19, which means it weighs 19 grams per square meter. Multiple layers can be used for additional insulation, or a thicker cover can be chosen for more protection.

Caterpillar tunnels and floating covers at the gaïa cooperative (pointe-aux-outardes, manicouagan)
(source : Coopérative Gaïa Facebook Page)

Use of floating covers on permanent beds at solidarité alimentaire matagami.
(source : CISA, 2023)

4.5 Caterpillar Tunnels and Mini-Tunnels

Caterpillar tunnels and mini-tunnels are protective structures used in northern agriculture to extend the growing season and shield crops from adverse weather conditions. These structures consist of hoops anchored into the ground, which are then covered with a fabric (usually polyethylene). Caterpillar tunnels can protect multiple beds and allow for standing work inside. Mini-tunnels, on the other hand, are designed to protect a single crop bed. These tunnels provide a layer of protection against frost, temperature fluctuations, rain, and wind. They also help retain soil moisture by limiting water evaporation from the soil.

[5] Dubois Agrinovation, Filet d'exclusion anti-insectes, page consultée le 12-03-2024

Example of a mini-tunnel erected on a bottomless growing bed
(source : Shutterstock)

Example of a mini-tunnel installed in an open ground garden
(source : Dubois Agrinovation)

4.6 Protecting the Garden from Mammals

In some communities, many dogs may roam freely, and there may be more wildlife due to the proximity to nature. It may be wise to include a fence to protect valuable crops. This same situation is observed in several rural regions of southern Quebec, where market gardeners must install a fence about 3 meters high to prevent damage caused by deer. It might be interesting to make the fence out of wood to make it more inviting.

4.7 Regulations and Composting

Depending on the scale of the project, check with the municipality for the garden's location choice. The composting area may sometimes be regulated; in any case, it is important to plan the composting area well. It is highly recommended to consult a municipal urban planner, an agronomist, and/or an agricultural engineer to thoroughly cover the various regulatory aspects, especially for large-scale composting projects.

Cultivated Plot at Jardins du 53e Taïga en culture. (source : Jardins du 53e Taïga Facebook Page)

CONCLUSION

Open-ground gardening is often the best approach for growing vegetables when the soil conditions are suitable. The costs are lower than those of greenhouse or raised bed gardening, both for initial setup and maintenance. Raised bed gardening is an interesting alternative to optimize space, make garden operations more ergonomic, or to grow in imported soils. Best practices for maintaining healthy soil and techniques to extend the growing seasons are largely the same for both southern and northern Quebec. This knowledge is extensive and continues to be developed by numerous enthusiasts at all levels. More generally, outdoor gardening in soil and raised beds, as well as indoor gardening in greenhouses, hydroponics, etc., are complementary agricultural practices that benefit from being thoughtfully considered and implemented as such. The future of northern gardening promises to be very exciting!

Before the greenhouse was built, peppers, tomatoes, and herbs were grown in a container equipped with a minimally heated mini-tunnel, Jardins du 53e Taïga, Radisson (source : CISA, 2022)

REFERENCES

Le Jardinier maraîcher de Jean-Martin Fortier de Ecosociété

Site internet Agri-Dubois

CRAAQ, Fiche synthèse - Culture maraîchère biologique en contenants sous serre

FORTIN, Serge, Jardiner en bacs : pourquoi et comment bien faire?, Édition Pratico, 2022

DUMONT, Bertrand, Le Potager en pot, Les Éditions multimondes, 2019

Espace pour la vie, Organiser un potager surélevé, www.espacepourlavie.ca/organiser-un-potager-sureleve, page consultée le 02-02-204

Craque-Bitume, Conception de bacs à réservoir d'eau

[i] In Quebec, the certifying organizations are Québec Vrai (https://quebecvrai.org/) and Écocert (https://www.ecocert.com/fr/home) which are based on the Canadian standards for organic farming (https://inspection.canada.ca/fr/etiquetage-aliments/produits-biologiques/normes) and the Organic Certification Specifications in Quebec (https://cartv.gouv.qc.ca/app/uploads/2024/03/cahier_des_charges_bio_fr_v14-8_20240220.pdf)

[ii] For more information on self-watering planters and a tutorial on how to build them, visit this site: http://archives2019.lesjardins.alternatives.ca/www.lesjardins.alternatives.ca/sites/rooftopgardens.alternatives.ca/files/construction_jardiniere_reserve_eau.pdf

CHAPTER 3

HOW TO ENSURE THE SUSTAINABILITY OF AGRI-FOOD PROJECTS

GREENHOUSE MANAGER

Greenhouse managers play a vital role in the establishment and ongoing operations of community greenhouses. They are involved in all stages of cultivation, from planning for the season to evaluating the results, as well as maintaining plants and harvesting vegetables. Because greenhouse managers develop specialized knowledge about greenhouse operations, the most suitable crops, and the preferences of community members, it is crucial to attract motivated individuals and retain them in these roles.

The following sections aim to assist organizations in attracting and hiring suitable candidates. Details regarding the typical and atypical responsibilities of greenhouse managers are provided to clarify the role and set clear expectations for potential candidates. Job offer templates, available in both short and long formats, can be customized to meet the specific needs of the organization.

While it is generally easier to hire someone already residing in the community, there is often a lack of training available. To address this, organizations that wish to train community members can utilize a training offer template. Additionally, there are various funding and support opportunities for these projects from organizations such as School Service Centers, Regional Boards, and Health and Social Services Councils, as well as the Secretariat for Relations with First Nations and Inuit.

Finally, a list has been created to inform organizations about the factors that can either encourage or deter potential greenhouse managers from committing long-term to the organization.

THE GREENHOUSE MANAGER POSITION

For those less familiar with greenhouse management or vegetable production, the responsibilities associated with this job can be unclear. To help you understand, here is a list of typical and expected responsibilities and tasks for community greenhouse managers. Some tasks may not apply to your organization, for example, whether you sell your vegetables or not. We have also included a list of responsibilities that are generally not part of this type of position. If you want the hired person to take on unusual responsibilities, it is advisable to mention this as early as possible to create clear communication and accurately target goals and expectations.

TYPICAL AND EXPECTED RESPONSIBILITIES FOR GREENHOUSE MANAGEMENT

- **Agricultural:**
- Supervise and participate in production and maintenance operations in the greenhouse and nursery (starting seedlings in cells, preparing cultivation surfaces, planting, maintenance, fertilization, and irrigation of crops).
- Ensure crop protection (detecting diseases and pests, applying biological control methods, cleaning infrastructures, etc.).
- Maintain and ensure the proper functioning of infrastructures and equipment (irrigation, ventilation, and climate control automation systems, heating devices, various tools, etc.).
- Supervise management logs (fertilization, crop protection, irrigation, maintenance)
- Supervise and participate in harvesting

- **Planning:**
- Develop a cultivation plan and various management plans (fertilization, irrigation, maintenance, crop protection) and revise them as needed.
- Plan material, input, and equipment needs
- Conduct an inventory of seeds, inputs, and equipment.
- Purchase materials, inputs, and seeds as needed.
- Ensure there is an adequate conditioning space.
- Conduct a season review and identify possible improvements.

- **Distribution and/or Marketing:**
- Condition and package vegetables.
- Weigh vegetables and keep a production log.
- Ensure a consistent production of quality vegetables.
- Determine food prices.
- Manage the weekly kiosk/market.
- Maintain a sales log.
- Coordinate with partner-beneficiaries.
- Regularly promote the kiosk/market with the organization.

Management
- Organize daily work and plan for the entire season.
- Mobilize volunteers and organize activities.
- Manage employees and/or volunteers.
- Document greenhouse operations (trials, errors, successes), create task sheets for cultivation and conditioning operations, and make the information available in a single document to the organization.
- Participate in developing a 5-year agricultural project plan. If the plan is already in place, adhere to it.
- Create a community resource contact list (e.g., plumbing, electricity, etc.).
- Communicate with the organization's board of directors/responsible persons (unexpected expenses, etc.).
- Respond to requests from funding organizations and donors.
- Ensure health and safety at work through prevention and awareness.
- Establish a code of conduct within the greenhouse and share it with participants.

Other:
- Prepare the greenhouse for winter and spring
- Check and maintain the greenhouse daily (snow removal, check temperatures, propane/electricity operation, blower function, etc.).
- Organize open houses and workshops.
- Evaluate the operational costs of the greenhouse/participate in budgeting.
- Develop, in conjunction with the board of directors, a plan for extreme conditions.

UNUSUAL RESPONSIBILITIES TO DISCUSS WITH THE POTENTIAL HIRE:

- **Food Processing**

  Greenhouse managers are expected to wash, portion, and efficiently store the produced food, known as conditioning. However, it is rare for them to be tasked with dehydrating, preparing and freezing, or canning the food, which is considered food processing.

- **Handling Distribution and/or Marketing (Mixed)**

  Many people consider this task to be the organization's responsibility. Greenhouse managers may expect to run a kiosk, but they assume the organization will find beneficiaries or potential buyers, promote and advertise the kiosks, and help set food prices.

- **Promoting, Communicating, and Publicizing Greenhouse Activities**

  Greenhouse managers expect to participate in promoting greenhouse activities, particularly through their involvement in community life. However, it is expected that the organization will handle the communication strategy, social media posts, radio interventions, newsletters, etc.

- **Managing the Compost Chain**

  While having an efficient compost system is necessary, it is not assumed to be the greenhouse managers' responsibility to set it up or collect compost from partners (e.g., grocery stores).

JOB OFFER TEMPLATE

SHORT VERSION [Download the editable Word file here]

[Header with Organization's Logo]

[Job Offer] **Community Greenhouse Manager**

Are you looking for a unique experience that offers autonomy and flexibility while contributing to a constructive project with a direct impact on the community? Join the team at [organization name] and produce healthy food that contributes to the well-being of [community name]!

Job Description **| Example:**

Since [year], [organization name] has aimed to [organization's mission]. To achieve this, we built our community greenhouse in [year] and produce vegetables, fruits, and herbs, which we redistribute to [specific group?] in the community. The role of the future greenhouse manager will be to plan, supervise maintenance, organize, and manage food production in our community greenhouse [and our garden?] and to [add a specific project detail, if necessary].

- **More specifically, the main responsibilities will be:**
- Planning the season and maintaining crops (planning material needs, producing seedlings, preparing beds, managing irrigation, fertilization, etc.) and detecting diseases and pests
- Harvesting, conditioning, weighing the food, and [distributing/organizing its sale]
- Keeping necessary records
- Organizing community activities and participating in community mobilization
- Conducting a season review and identifying possible improvements
- Managing participating human resources
- Performing any other related tasks

Skills, Competencies, and Attitudes Sought:

- Curiosity and interest
- Strong work ethic
- Technical knowledge in agriculture and greenhouse production (northern context is an asset)
- Strong planning, organizational, and adaptability skills
- Ability to work in a team and interpersonal skills

Working Conditions:

- Workplace: [community name]
- Nature of the position: [permanent, indefinite contract, seasonal, etc.]
- Start date/Duration of the position: [start as soon as possible/from [date] to [date], etc.]
- Schedule: [describe the schedule]
- Salary: [X$/h to X$/h or XX,XXX$/year]
- Vacation and social benefits: [list if any]

To Apply:

Send us your CV to the following address [email address] [with a short description of yourself]. The application deadline is [date].

JOB OFFER TEMPLATE

LONG VERSION [Download the editable Word file here]

[Header with Organization's Logo]

Community Greenhouse Manager

Are you looking for a unique experience that offers autonomy and flexibility while contributing to a constructive project with a direct impact on the community? Join the team at [organization name] and produce healthy food that contributes to the well-being of [community name]!

Job Description | Example:
Since [year], [organization name] has aimed to [organization's mission]. To achieve this, we built our community greenhouse in [year] and produce vegetables, fruits, and herbs, which we redistribute to [specific group?] in the community. The role of the future greenhouse manager will be to plan, supervise maintenance, organize, and manage food production in our community greenhouse [and our garden?] and to [add a specific project detail, if necessary].

More specifically, the main responsibilities will be:

- Planning and maintaining crops (planning material needs, producing seedlings, preparing beds, managing irrigation, fertilization, etc.) and detecting diseases and pests
- Harvesting, conditioning, weighing the food, and [distributing/organizing its sale]
- Keeping a production [and sales] log
- Collaborating with [the work team, partners, and/or volunteers]
- Organizing community activities and participating in community mobilization
- Planning seed, material, input, and equipment needs and making purchases
- Frequently maintaining equipment and repairing it as needed
- Daily checking the proper functioning of the greenhouse and participating in its maintenance (snow removal, checking temperatures, proper functioning of [propane/electricity], blower, etc.)
- Representing the organization and promoting community greenhouse activities
- Conducting a season review and identifying possible improvements
- Participating in the organization's budgeting
- Ensuring health and safety at work through prevention and awareness
- Ensuring the sustainability of the greenhouse by documenting its operations in writing and making it available to the organization, establishing a code of conduct within the greenhouse, creating a community resource contact list, and responding to requests from funding organizations, for example..

Skills, Competencies, and Attitudes Sought:

- Technical knowledge in agriculture and greenhouse production (an asset in a northern context)
- Curiosity and interest
- Strong planning, organization, and adaptation skills
- Good observation skills and the ability to anticipate
- Proactivity and quick reaction time
- Diligence and rigour
- Resourcefulness, skills in construction, and equipment repair
- Ability to work in a team, delegate, and communicate knowledge
- Ease in approaching others, networking, and community mobilization skills
- Interpersonal skills and diplomacy
- Kindness, openness, and respect towards others

JOB OFFER TEMPLATE

LONG VERSION [PART 2]

[Header with Organization's Logo]

Working Conditions:

- Workplace: [community name]
- Nature of the position: [permanent, indefinite contract, seasonal, etc.]
- Start date/Duration of the position: [start as soon as possible/from [date] to [date], etc.]
- Schedule: [describe the schedule]
- Salary: [X$/h to X$/h or XX,XXX$/year]
- Vacation and social benefits: [list if any]

To Apply:

Send us your CV to the following address [email address] [with a short description of yourself]. The application deadline is [date].

TRAINING OFFER TEMPLATE

[Download the editable Word file here]

[Header with Organization's Logo]

Greenhouse Vegetable Production Training

Do you want to learn how to grow food and contribute to the well-being of your community? Sign up for the training to become one of the gardeners of [organization name].

Training description

Organization name] offers a [paid?] training for the [2024] season (from [start date] to [end date]). You will be guided by experts/trainers and will learn the basics of greenhouse production [and outdoor gardening?]. Specifically, you will learn to:

- Plan and maintain crops
- Harvest and process food
- Organize and manage greenhouse food production

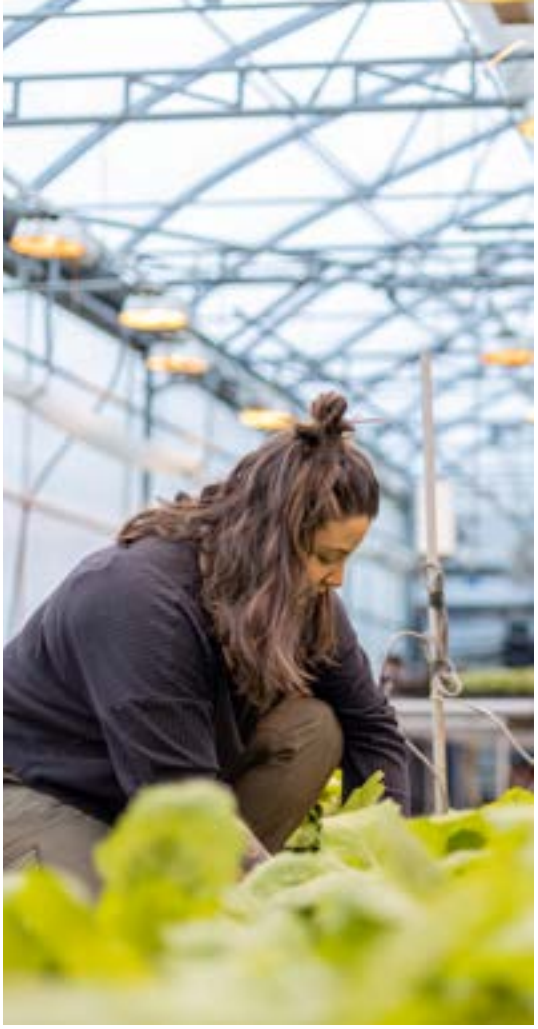
You do not need any gardening knowledge; we are looking for individuals with a good work ethic who are interested and curious about learning how to produce food.

Working Conditions:

- Workplace: [community name]
- Nature of the position: [permanent, indefinite contract, seasonal, etc.]
- Start date/Duration of the position: [start as soon as possible/from [date] to [date], etc.]
- Schedule: [describe the schedule]
- Salary: [X$/h to X$/h or XX,XXX$/year]
- Vacation and social benefits: [list if any]

To Apply:

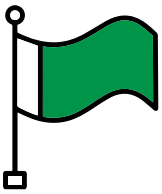
Send us your CV to the following address [email address] [with a short description of yourself]. The application deadline is [date].



GREEN FLAGS AND RED FLAGS

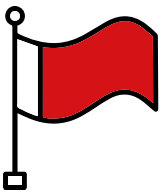
HOW TO ATTRACT GREENHOUSE MANAGERS

Despite all the opportunities that northern community greenhouses offer to those involved, it can be challenging to know how to attract an interesting and competent person for their management and make them want to stay. We discussed this with greenhouse managers who were tempted! Here are examples of elements and behaviors that could attract (green flags) greenhouse managers to your organization and others that could scare them away (red flags).



Green Flags :

- Have a clear mission.
- Establish clear and measurable objectives.
- Demonstrate transparency.
- Foster an organizational culture that maintains team and community spirit.
- Provide access to professional agricultural support. This can take the form of training, follow-up with an agronomist, participation in a network that allows for learning and improvement, etc.
- Develop an integration and welcome process that helps the person become familiar with the equipment, the locality, introduces them to community members, etc.
- Involve the greenhouse manager in decision-making and allow them some autonomy.
- Have functional and accessible equipment such as a computer and agricultural materials.



Red Flags:

- Having a list of responsibilities that is too long and too diverse Greenhouse managers are used to performing various tasks and being versatile on a daily basis. However, too many different responsibilities can be intimidating and give the impression that the team is too small to handle all its mandates.
- Offering minimum wage in a remote area As you know, the cost of living is particularly high in remote areas. If you want to attract someone from outside the community, you need attractive working conditions, including a competitive salary compared to southern Quebec. For comparison, an agricultural worker often earns $16.00/hour, while the median salary for a greenhouse manager in Quebec is $21.00/hour. It is also possible that the desired person maintains a residence in the south or needs to rent storage space. A salary too low to cover these expenses can be off-putting.
- Lack of transparency, including regarding financial resources Avoid making promises that cannot be kept and presenting the project as ideal. It is better to be honest about the challenges and limitations of the project, as this will create a bond of trust!
- Avoid putting pressure on the manager to settle long-term. Understand that there is an adaptation period to the northern context and respect it. The manager will quickly fall in love with the region!

Collective Garden Project, Opitciwan
(photo : CISA, 2022)

GROWING TOGETHER: STRATEGIES TO MOBILIZE AND ENGAGE THE COMMUNITY

Many agricultural projects in northern regions are emerging to improve food supply. Mobilizing your community around this project is the cornerstone of success to ensure that the project endures and meets the needs of community members. Mobilizing a community means bringing it together around a common vision to implement positive change. In small, remote communities, this mobilization is essential to overcome the challenges that will arise: climatic hazards, technical difficulties, turnover of involved individuals, or the lack of qualified labor in agriculture.

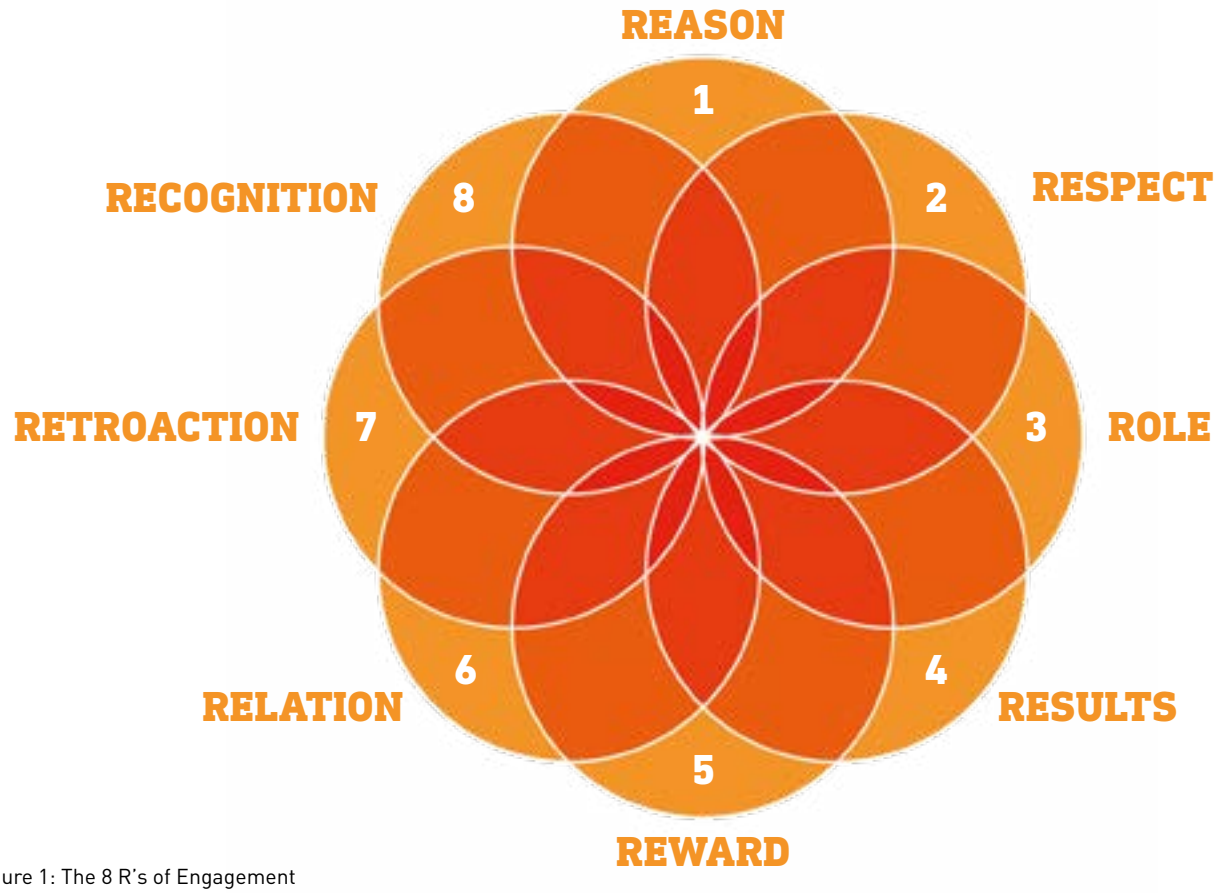


Figure 1: The 8 R's of Engagement

Tools like the «8 R's of Engagement»[1] can help create and maintain the engagement of volunteers and other individuals involved in community projects. Chances are, you are already incorporating several of these «R's.» This tool aims to highlight what you are already doing and find ways to enhance your engagement methods that are easy and tailored to your project.

This sheet can also serve as a basis for individual reflection and/or for conducting a collective intelligence workshop. In the appendix, you will find a proposed editable document to perform the analysis on the «R's» of your choice.

Note: The approach that led to this sheet is based on the Nordic Laboratory project, a two-year project conducted with communities in Northern Quebec.

The reflection paths and examples of actions proposed below seem relevant and facilitating for individuals or organizations wishing to question their mobilization approach. However, we are aware that the approach proposed in this sheet may reflect some of our unconscious biases and that many other ways of doing things exist, depending on the context in which the reflection is conducted..

[1] A tool adapted by Marie-Pierre Clavette from the 6 «R's» of engagement by Villes et Villages en santé (1998)

1. REASON

It is essential to understand why people get involved and to formulate a common intention to channel everyone's strengths. Targeting this common intention, referring to it periodically, and nurturing it facilitates engagement.

- **Reflection Points:**
- What motivates people who want to get involved?
- What is in place to bring out a common vision for the project?
- How is the vision shared with those participating in the project and with community members?
- How can they participate in its evolution?

- **Examples of Actions:**
- Ask a person who is starting their involvement to share the reasons why they are doing so.
- Invite people to share what matters to them in the project (e.g., informal discussion moments in the garden, social media surveys, a notebook placed at the garden entrance).
- Create a poster with the project's vision and display it in a significant location.
- Disseminate the project's purpose and vision (on social media or at a public meeting).
- Clearly indicate who will benefit from the harvests (e.g., Meals on Wheels, the senior citizens' home).

2. RESPECT

The notion of respect is very subjective and is often the root of conflicts among participants. It is important to respect the values, ideas, opinions, and culture of each person involved, as well as their reality, availability, and capacity to contribute to the project.

- **Reflection Points:**
- What are the collective operating rules of the project? How are they developed and what are the consequences if they are violated? How can participants adopt them?
- What are the common values of the people involved? How can they be embodied in the project?
- How do we define respect within our group? What do we do when we notice a lack of respect?
- What are the availabilities of the people involved? How can they communicate them?
- How can the schedule of activities or volunteer time slots be made available to participants?
- What type of people do we want to attract and what are the obstacles that may limit their participation (e.g., children, atypical schedules, etc.)?

- **Examples of Actions:**
- Establish operating rules with participants by creating a team charter that describes common values, rules to be followed, roles of each person, and consequences in case of deviation.
- Create spaces and opportunities for sharing, by dedicating areas to the cultivation of traditional plants. Creating a context to facilitate the emergence of informal sharing allows people to open up, learn more about each other's reality, and respect cultural differences.
- Plan the agricultural project objectives at the beginning of the season (quantity of vegetables produced, number of beds cultivated, number of activities to be carried out) and estimate how much time is needed for the tasks they require per week. Ask interested people to realistically state their capacity to contribute for the season. Review the objectives if necessary.
- Survey interested people to determine the time slots that suit the majority.
- Plan an activity calendar at the beginning of the season and share it with the community so that interested people can organize themselves in advance.
- Set up a play area or a specific garden for children.

3. ROLE

To feel fulfilled, a person must feel that they play a significant role in a project and that their contribution is valued. This generally aligns with their interests, tastes, and skills. Defining the roles and responsibilities of each person promotes good project management and prevents participant burnout.

Reflection Points:

- What are the roles and responsibilities within the project?
- How is power and decision-making shared within the group?
- How are tasks distributed among the people involved? How much flexibility do participants have in defining their role according to their preferences?
- What is in place to allow participants to propose ideas? How can these discussions be encouraged?
- What types of collaboration can be made with another community organization to help with the project?

- **Examples of Actions:**
- Ensure the presence of democratic and effective governance.
- Define a team charter that outlines the roles and responsibilities of participants.
- Have adequate professional, technical, and financial resources (meeting facilitation, minutes, convocations, financial follow-ups, information research, etc.).
- Create a list of volunteers and interested people, noting their skills, interests, and preferences, what they would like to learn, and what they do not want to do. These details can go beyond gardening. Engage them in related tasks that match their interests and/or skills (e.g., creating a video, managing social media, designing a project logo, plumbing, electricity, cooking, event organization, etc.).
- At the beginning of the season and the start of activities, list all the tasks to be done and let people choose the ones they want to do.
- Ensure role variety, especially for less interesting tasks. Perform more demanding or boring tasks together (e.g., weeding).
- Promote the employment and training of community members. Several funding programs allow for the hiring of employees or interns, and partnerships are possible with post-secondary education or vocational training programs. For more details on the roles, responsibilities, and skills of a project manager in agriculture, refer to the sheet "Greenhouse Manager: A Major Role in the Sustainability of Greenhouses."
- Set up a committee bringing together different community stakeholders (or integrate it if one already exists) to promote collaboration between organizations, share certain responsibilities, and pool resources.

4. RESULTS

People who contribute to the project appreciate seeing tangible and concrete results of their efforts. The same goes for the community in general.

- **Reflection Points:**
- What makes us proud of our season?
- What have we accomplished together?
- What results can be shared with volunteers and the community?
- What can we learn from our experiences?

Examples of Actions:

- Highlight each successful stage during the season (seedlings, planting, harvesting, etc.).
- Showcase all achievements and milestones by creating a social media page. Regularly post photos (e.g., before and after photos of a planting or weeding task).
- Write a monthly newsletter to share the project's successes and offer tips to gardeners.
- Conduct reviews and share them with the entire community (e.g., number of varieties cultivated, total weight harvested during the season, number of activities carried out and people reached, number of people involved in the project, etc.).

5. REWARD

Everyone likes to benefit from their actions (eating vegetables, learning new skills, having fun, etc.).

- **Reflection Points:**
- What are the expectations of volunteers and those interested in the project? How can these expectations be met?
- Are the proposed activities aligned with the benefits participants would like to receive?
- Are the different rewards for participation known to the community and those involved? Is it possible to publicize these various benefits?

- **Examples of Actions:**
- Encourage exchanges among participants to identify everyone's expectations at the beginning of the season. Adapt the type of rewards or the range of activities offered.
- Offer vegetables and fruits to volunteers.
- Provide agricultural advice to participants. This way, participants leave with more knowledge and often better harvests due to improved practices. Consider prioritizing local expertise before inviting external speakers for conferences or training sessions.

6. RELATION

- Many people appreciate having a network of relationships and consider that a good network is beneficial for the community and for themselves. Agricultural projects in northern regions are often privileged places for socialization.

- **Reflection Points:**
- What is in place for participants to create bonds with each other?
- What opportunities are there to create connections with other community members?
- What methods are used to make the project known to the entire community?

- **Examples of Actions:**
- Organize group tasks (e.g., weeding, sowing, planting, etc.). Use these occasions to take breaks together with a snack.
- Organize activities open to the entire population, such as:
- Garden barbecues. This is an opportunity for people to see the facilities while socializing.
- Open days where volunteers can present the project themselves, from their perspectives.
- Horticultural workshops for different groups of the population.
- Form small teams to carry out tasks in the garden.
- Create a social media group that brings together gardeners to dedicate a space for exchanging advice and questions that could benefit many people.
- At the beginning of each activity, have a round of introductions. If there are new people, let each person introduce themselves and talk a bit about themselves. You can also share how you feel. In some groups, the facilitator proposes a question for everyone to answer (e.g., what is your favourite flower, what do you particularly like to cook, etc.).
- Set up relaxation areas at the sites (chairs, picnic tables, pergola).

7. RETROACTION

People appreciate receiving feedback on their actions and being able to adjust. They also like having the opportunity to express their agreement or disagreement and their complementary ideas when they are involved in projects. They are generally interested in giving and receiving feedback. Good feedback practices also promote transparency in the management of the agricultural project.

Reflection Points:

- How do we let people know they are doing a good job?
- What is in place to provide opportunities for the group to review and adjust?
- How is a sensitive situation managed?
- How is risk-taking valued in a community gardening context?
- How is success evaluated in the project?

Examples of Actions:

- Conduct a roundtable at the end of each meeting or activity, asking participants to share what they liked and disliked, what could be done differently next time, etc.
- Verbally acknowledge when someone does a good job (to the individual and/or the group, depending on the context).
- Create a suggestion/feedback box and check it frequently.
- Conduct an end-of-season survey to find out what could be improved and what people would like to see for the next season.
- Conduct a review at the end of each season to identify successes, challenges, and lessons for the following year. This review can be shared in various ways: presentation at a municipal council meeting, newsletter, social media post, letter by mail, organization of an Annual General Meeting. Invite people to share their reactions and comments.

8. RECOGNITION

Everyone wants to be recognized for their contribution, even though this recognition can take different forms. It is important to acknowledge the involvement of participants to encourage their long-term participation in the project. It is also important to recognize our own needs for recognition, one expression of which is making oneself «indispensable» to better highlight one's value.

Reflection Points:

- What are our own needs for recognition?
- What are our practices for recognizing and valuing the involvement of our stakeholders?
- How do we highlight our volunteers? Our community partners?
- How is our appreciation expressed towards them?

Examples of Actions:

- Acknowledge the group's efforts during particularly difficult, demanding, or important tasks for the project.
- As a team, discuss our own needs for recognition and share responsibilities to avoid making one person "indispensable" and potentially blocking collective functioning in their absence.
- Organize a specific celebration for volunteers and/or an award ceremony to recognize their contribution to the project.
- Organize a harvest festival to celebrate the work accomplished and share it with the community.
- Highlight the role of volunteers and publicize the possible benefits of participating in agricultural activities, sharing them on social media, on the radio, with members/beneficiaries of other community organizations, with the regional citizen mobilization committee, etc

SOURCES OF INCOME

Due to the numerous expenses involved in maintaining and operating a greenhouse, it may be necessary to have varied and complementary sources of income to ensure the longevity of an agricultural initiative. Combining activities can help agricultural projects move towards profitability. In this sheet, we illustrate a variety of activities that can be considered based on the capacities of the sponsoring organization and the needs of the community. We will not address wage subsidies or other grants that can play a major role in funding organizations and should not be overlooked, especially when it is possible to access recurring funding, such as the Community Organization Support Program (PSOC).

PRODUCT SALES

The first and most obvious source of income is the sale of vegetables or products directly from the facilities. Sales can be conducted in various ways: self-service kiosks, on-site sales, small markets, farm boxes, partnerships with local institutions or businesses.

Products can also be processed to take advantage of added value, such as making jams, preserves, fermented vegetables, or canned goods. However, the production and sale of processed products are subject to numerous standards and regulations[1]. It is therefore essential to carefully plan your food processing project to comply with these regulations.

Selling microgreens can also be a source of income to fill the gaps when the greenhouse and gardens are not in production during the winter. Microgreens are grown indoors and allow for the profitability of the production space and the materials used for seedlings. This is a short-cycle production (harvest after 1 to 2 weeks depending on the varieties), which allows for continuous succession. However, microgreens need to be stored in a cold place after harvest and have a relatively short shelf life (about 1 week). Therefore, it is important to carefully plan production quantities based on demand to limit losses.

Another possible type of sale is vegetable or flower plants for individuals or for municipal landscaping services. In some remote communities, it is not always possible to obtain plants locally for those who wish to garden. The situation is similar for municipalities that want to beautify or green their facilities and must order from outside, risking damage to the plants during transport. Moreover, for towns like Radisson and Matagami, where the risk of frost extends longer into the season, plants may be sent too early and need to be kept sheltered for longer. Obtaining them locally, in addition to supporting the local economy, potentially reduces the necessary handling and the risk of plants being damaged by transport or weather.

It is also possible for an organization to optimize transport costs and benefit from an additional source of income by selling gardening products purchased in bulk to those who want them. This situation is particularly interesting in remote communities where transport costs can represent the majority of the bill and where gardening and production supplies, specialized or not, are uncommon. These could include soil, fertilizers, seeds, rolls of floating row cover, etc.

[1] https://www.mapaq.gouv.qc.ca/fr/Restauration/Pages/Demarrageentreprises.aspx
https://media.mapaq.gouv.qc.ca/formation_hygiene_salubrite/

RENTING

Renting gardening tools to individuals or between organizations can be an option to diversify income sources. This allows for the profitability of equipment purchases by renting them out when they are not being used internally. Depending on the type of tools, hourly or daily rates can be implemented. Tool rental can be particularly interesting for larger equipment (e.g., rototiller, BCS, or simply a broadfork) that is not used frequently (only used at the beginning of the season to prepare the soil, for example). Offering the rental service also helps strengthen community ties and provides gardening advice.

In addition to tool rental, labor rental is also a possibility to provide assistance to citizens or other organizations (see the reference sheet for the Chute-aux-Outardes collective garden (link to be added)). Of course, sufficient human resources are needed to carry out this activity successfully.

SERVICES

Organizations and businesses with an agricultural project can also enhance their income sources by offering services to the population, businesses, or the locality. This allows for the profitability of agricultural equipment purchases and leverages the expertise developed internally.

The organization could offer the service of maintaining the locality's green spaces. Done on a contract basis, this involves taking charge of the design, implementation, and maintenance of public space landscaping. This can be a great showcase to make the agricultural project known to a larger number of people.

Similarly, the organization could offer to maintain citizens' gardens during their absence, ensuring watering or harvesting, for example. This service requires good logistical planning but could meet a need for individuals since residents of northern communities often leave for long periods (vacations, hunting, fishing).

Tourist visits to the agricultural project can also be organized. This allows for explaining the garden's activities and highlighting the project's infrastructure that enables agriculture in the North (e.g., stone beds, cold frames). Visits can also be aligned with garden events: a harvest festival, for example. Events can take various forms (e.g., yoga in the garden, film screenings, farm-to-table dinners, etc.).

Workshops with other community organizations such as schools and health centres can be designed to showcase the agricultural expertise developed internally. These workshops can be held directly in the garden or another gathering place.

Depending on the organization's activities, workshops can cover various aspects of agriculture (e.g., Gardening 101, seedling, indoor cultivation, mushroom cultivation, etc.). For example, the Jardins du 53e Taïga in Radisson have conducted several workshops for the school, including an

Outdoor gardening activities to introduce the basics of fruit and vegetable cultivation. These activities took place in Opitciwan. (photo : CISA, 2022)

introduction to mushroom cultivation and an activity where students were invited to paint the garden's new beehives. Once the content and educational materials are prepared, the workshop can be presented again with minimal preparation. Some more theoretical workshops or those related to indoor cultivation can provide a source of income outside the garden's production period.

The organization can also offer consulting services to highlight the expertise developed internally. For example, it could offer its services to help set up a similar project in another community.

Although the primary goals of northern agriculture are to ensure food autonomy for remote regions and to weave a social fabric, the economic aspect must also be considered to ensure the sustainability of enterprises. Agriculture here serves as a socio-economic pivot.

In this sense, it may be advantageous to be considered an agricultural enterprise and to register as a farm. You will then need to generate an annual gross agricultural income of $5,000 or more or demonstrate that the business is on track to produce a minimum annual gross income of $5,000 (MAPAQ, 2024).

Furthermore, be aware that all agricultural enterprises must comply with the regulations on agricultural operations, the REA. It results from an exercise to modernize the Regulation on the Reduction of Agricultural Pollution (RRPOA) implemented in 1997. The reference guide for the regulation can be a good source of reference here.

MEMBERSHIP

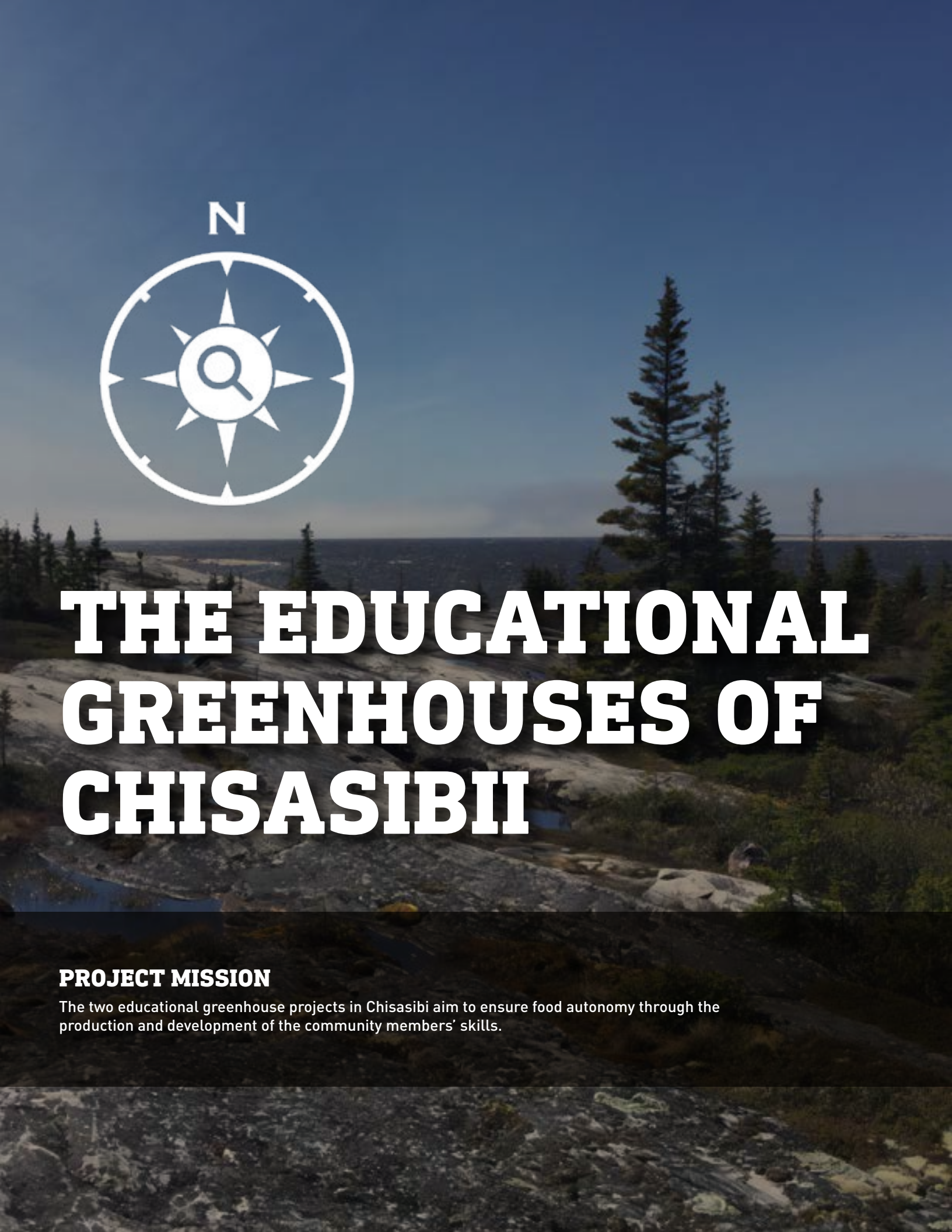
The implementation of a membership card can also be a way to generate a small income, but above all to encourage community members to take advantage of the services offered by the organization. Having a membership card can, for example, provide access to services at preferential rates or ensure a certain priority in the case of high demand. Implementing this measure requires a certain level of organization and logistics, but it has the potential to encourage citizen involvement and a sense of belonging to a collective entrepreneurial project.

CONCLUSION

For each new marketing channel and for each product or service considered, it is important to carefully plan the projects to ensure that the organization is able to implement them. It is necessary to ensure that the expertise, materials, and labor required to successfully carry out these various initiatives are available. Properly evaluating the costs and time required is essential to ensure the sustainability of the projects from a financial perspective, but also in terms of community involvement.

CHAPTER 4

10 FACTSHEETS ON FARMS & COMMUNITY GARDENS IN NORTHERN QUEBEC



THE EDUCATIONAL GREENHOUSES OF CHISASIBII

PROJECT MISSION

The two educational greenhouse projects in Chisasibi aim to ensure food autonomy through the production and development of the community members' skills.

CONTEXT

JBES GREENHOUSE PROJECT

Project Type: Educational Greenhouse

Lead Organization: James Bay Eeyou School

Type of Organization: Educational Institution

Location : Chisasibi, Eeyou Istchee Baie-James

AGRICULTURE RESEARCH DOME

Project Type: Research and Educational Greenhouse**Lead Organization:** Chisasibi Eeyou Resource and Research Institute (CERRI)

Type of Organization: Non-Profit Organization

Location : Chisasibi, Eeyou Istchee Baie-James

Chisasibi is a Cree community located in Eeyou Istchee, on the edge of James Bay and the La Grande River. In 2021, 4,985 people lived there, making it the second most populous town in Northern Quebec.[1]

The population traditionally resided on Fort George Island but was forced to move to the mainland in 1980 due to the construction of hydroelectric dams on the La Grande River. In the 1900s, two residential schools were located on the island, and agriculture was practised there from the 1950s to the 1970s[2]. In reference to this past, a pilot project for the production of potatoes and shallots took place on the island from 2018 to 2020.

The municipality is accessible via the Billy-Diamond Road and receives its supplies by truck. It is located more than 10 hours by road from Val-d'Or, the starting point for food supplies. The long distances to be covered and infrequent deliveries make it difficult to access fresh, quality food in sufficient quantities and at a reasonable price.

To ensure food autonomy through the production and development of community members' skills, several educational greenhouse projects have taken shape in Chisasibi. The first greenhouse project is linked to the James Bay Eeyou School (JBES), and the second is a research greenhouse led by the Chisasibi Eeyou Resource and Research Institute (CERRI).

The educational greenhouse project originated from Rubin McNeely's class, a teacher in the pre-work training program. In 2014, the construction of the greenhouse adjacent to the James Bay Eeyou School began, and production officially started in 2016. It is the result of collaboration between the school and the non-profit organization Nihtaauchin Chisasibi Center for Sustainability and aims to provide students with knowledge about greenhouse vegetable production, promote healthy eating, and ensure food security. The greenhouse also aimed to create jobs in the community and contribute to food sovereignty by producing vegetables sustainably and developing expertise in northern food systems.[3]

The construction of a new school is expected to be completed in 2024, and it is planned to include a rooftop greenhouse. This will replace the one at the old high school. Projects to repurpose the greenhouse from the old school are being developed, including a project involving the community's elders.

The CERRI, a community-led and community-driven research centre, develops applied research projects focused on nature. It combines Western research approaches with traditional Cree ecological knowledge and aims to train young people from Chisasibi to become community researchers. The agricultural research greenhouse, built in the fall of 2023, aligns with this vision, contributing to the development of knowledge on fruit and vegetable cultivation methods through community involvement. More broadly, it aims to improve Chisasibi's food sovereignty by promoting sustainable agriculture and improving access to fresh and healthy food. The dome thus plays a triple role: developing knowledge on northern agriculture, strengthening community members' capacities, and producing food locally.

---

[1] These data come from Statistics Canada https://fr.wikipedia.org/wiki/Chisasibi_(terre_r%C3%A9serv%C3%A9e_crie)).

[2] A resume of this story is available here: https://www.cbc.ca/news/canada/north/chisasibi-greenhouse-programs-1.4286789 .

[3] To learn more about the first greenhouse project, consult : http://nationnews.ca/community/how-chisasibis-school-greenhouse-is-growing-a-healthier-future, https://www.cbc.ca/news/canada/north/chisasibi-greenhouse-programs-1.4286789 et https://eeyoueducation.ca/youth/schools/chisasibi/jbes https://www.nihtaauchin.ca/Chisasibi-Community-Greenhouse-Project.php

FACILITIES OVERVIEW

JBES GREENHOUSE PROJECT	AGRICULTURE RESEARCH DOME
Year of Construction: 2014 (first greenhouse); 2024 (new greenhouse at the new school) **Type of Greenhouse:** Single-span **Climate Regulation System:** An automated system is planned for the new greenhouse	**Year of Construction:** 2023 **Surface Area of Each Greenhouse (m²):** 79 m² Type of Greenhouse: Geodesic **Heating System:** None **Automatic Ventilation System:** Solar-powered fans **Thermal Storage System:** Water basin and thermal mass materials on the walls

OPERATING MODE

JBES GREENHOUSE PROJECT	AGRICULTURE RESEARCH DOME
In the past, the greenhouse was managed by students enrolled in the Work-Oriented Path Program. Each year, students participated in developing new methods and incorporating new agricultural technologies. For example, a program for indoor cultivation using a hydroponic system was created by the students in the class. The operating model of the new greenhouse has not yet been finalized; several community stakeholders will be engaged to reflect on it.	The first growing season for the research dome will take place in 2024. The project will take the form of collective gardens, focusing on experimenting with soil-based cultivation, hydroponics, and soil regeneration methods. Interested individuals will be invited to participate in the more detailed development of its operations. They will contribute to decisions, such as the selection of plants, take part in cultivation with the support of the CERRI team, and share the harvests.

PARTNERS

The construction of the first greenhouse at JBES was made possible thanks to the support of the Chisasibi Band Council and local construction workers, who sponsored and built the greenhouse. The Band Council also hired young people to maintain the crops. Other partners included the Cree School Board and the Chisasibi Business Service Center. McGill University (Montreal) and the Northern Farm Training Institute (Northwest Territories) contributed by providing training for individuals involved in the project. The Chisasibi Eeyou Resource and Research Institute (CERRI) will support the new greenhouse project in collaboration with the James Bay Eeyou School.

INFORMATION

Website:
https://eeyoueducation.ca/youth/schools/chisasibi/jbes
https://www.cerri.ca/

Email:
cerri@chisasibi.ca

Facebook:
JBES Greenhouse Project | Fort-George QC | Facebook
Chisasibi Eeyou Resource and Research Institute | Facebook

Press Articles:
Des légumes cris qui n'ont pas froid aux yeux
Cree community of Chisasibi aims to return to its roots through gardening programs

LES JARDINS DU 53e TAÏGA

PROJECT MISSION

Les Jardins du 53e Taïga produce fresh and affordable vegetables using environmentally friendly practices while fostering the development of northern agriculture. The organization's goal is to contribute to the revitalization of the Radisson community through this food offering, while increasing Radisson's food autonomy.

Project Type: Non-Profit Organization
Lead Organization: Les Jardins du 53e Taïga

Location: Radisson, Eeyou Istchee Baie-James

CONTEXTE

The organization Les Jardins du 53e Taïga (J53T) was founded in 2018 by a group of citizens from Radisson who came together to establish a community greenhouse project. This initiative was designed to meet the community's needs by improving access to fresh vegetables and creating a space for gatherings and socializing. While aiming to build a greenhouse in Radisson, the J53T members initially began with container gardening (#see container gardening factsheet), adding more containers each year.

In 2020, J53T partnered with the Centre d'innovation sociale en agriculture (CISA) to develop a business plan (Legault et al., 2020) and move forward with the greenhouse project. In 2022, the École de technologies supérieures (ÉTS) joined the initiative to adapt the Radisson greenhouse to the northern climate while optimizing energy efficiency. They implemented a passive thermal storage system known as stone beds (#see stone beds factsheet), which helps stabilize the greenhouse's temperature fluctuations (Piché et al., 2022). This system had previously been used in one of Kuujjuaq's greenhouses in 2019 (Piché, 2021).

The greenhouse was built during the summer of 2022. The containers, previously located nearby, were relocated to the greenhouse site in the spring of 2023. The greenhouse's first growing season was in 2023.

In 2022, Les Jardins du 53e Taïga hired a horticultural manager to plan crops, cultivate both the greenhouse and outdoor garden, and support the organization's development. The J53T board's decision to hire a full-time individual with agricultural training for crop planning has significantly advanced the project's vision. For example, the summer of 2023 was marked by new initiatives such as installing beehives on the greenhouse property and experimenting with mushroom cultivation. Additional initiatives are planned for the coming years, including the construction of a nursery and the addition of a storage space for vegetables.



FACILITIES OVERVIEW

The Greenhouse

Year of Construction: 2022
Dimensions: 7.6 m x 15 m
Surface Area of the Greenhouse: 114 m^2
Cultivable Area: 56.11 m^2. The greenhouse's stone bed system consists of two cultivation beds separated in width by a wooden walkway to allow movement. This configuration results in a total of 4 planting beds, each measuring 13.11 m x 1.07 m x 0.5 m, with an approximate volume of 7 m^3.
Type of Greenhouse: Quonset
Heating System: Stone bed system within the greenhouse, supplemented by a propane heater used only during risks of freezing rain to prevent structural damage.
Automatic Ventilation System: Openable sides and roof.
Irrigation System: Automated drip irrigation system, manual watering.

The Containers

Year of Installation: 2020
Dimensions: 34 containers of varying sizes, most measuring 3.15 m x 1.2 m x 0.91 m, with an approximate volume of 3.44 m^3.
Heating System: The containers are not equipped with a heating system. However, some containers include cold frames as a protection against low temperatures.
Irrigation System: Automated drip irrigation system, manual watering.

Field Garden

Year of Construction: 2023
Dimensions: 10 planting beds, each measuring 1.2 m x 8.8 m.
Irrigation System: Automated drip irrigation system, manual watering.
Additional Features: A wooden frame surrounds the garden to reduce soil erosion, and mulch has been installed in the pathways between the beds.

•DETAILS ON CROPS

- **Crops that Perform Best:**
  Outdoors: Lettuce, carrots, onions, cabbages, beets, and peas.
  In the Greenhouse: Primarily lettuce, bush beans, and cucumbers.
- **Season Start and End Dates:** Mid-April to late September
- **Container Gardening (Outdoors):** Root vegetables (carrots, beets, turnips, potatoes), leafy greens, herbs, beans, peas, and flowers.
- **Field Crops:** Green, red, and kale cabbages; kohlrabi; potatoes; broccoli; cauliflower; leafy greens; garlic.
  Greenhouse Crops: Tomatoes, spinach, beans, cucumbers.
- **Production Capacity:** The production capacity is still being determined as the greenhouse is in the early stages of operation. However, as a reference, one greenhouse row produced 400 kg of cucumbers. Vegetable sales were possible from early May to mid-October during the 2023 season.
- **Other Details:**
  Soil and compost were initially imported in bales and bags from a supplier in southern Quebec. However, since summer 2023, a partnership has been established with Hydro-Québec's kitchens and the local grocery store to collect food scraps for partial local compost production.

PROJECT GOVERNANCE

- The greenhouse is owned by Les Jardins du 53e Taïga.
- Major projects and decisions are discussed and approved during board meetings. The board of directors consists of seven volunteer members.
- Technical decisions related to crops are made by the employed gardener.

OPERATING MODEL

Planning and Maintenance: The planning and upkeep of the facilities are managed by the organization's team. In the long term, the organization aims to create permanent jobs for the management of the gardens and greenhouse.

Community Involvement: Radisson residents are encouraged to participate in various tasks at the garden and greenhouse. Volunteers are always welcome to lend a hand.

Agricultural Workshops: Les Jardins du 53e Taïga have offered agricultural workshops at the local school and continue to provide them at Radisson's youth centre.

Vegetable Marketing

Direct Sales: During the growing season, vegetables can be purchased directly at the greenhouse during opening hours.

Local Market: J53T also sells their produce twice a week at a stand in the centre of the community.

Partnership with Hydro-Québec: Since summer 2023, a partnership with Hydro-Québec has been in place, allowing J53Tto supply part of the fresh produce needed for the kitchens at Hydro-Québec's complex in Radisson.

INFORMATION

Facebook: https://www.facebook.com/jardins.du.53.taiga

Video Clips:
- Une introduction au J53T
- Les Jardins à Radisson — la Mobilisation
- Les jardins à Radisson
- De bons œufs frais au 53e parallèle nord
- Les Jardins à Radisson —La jeunesse

BIBLIOGRAPHY

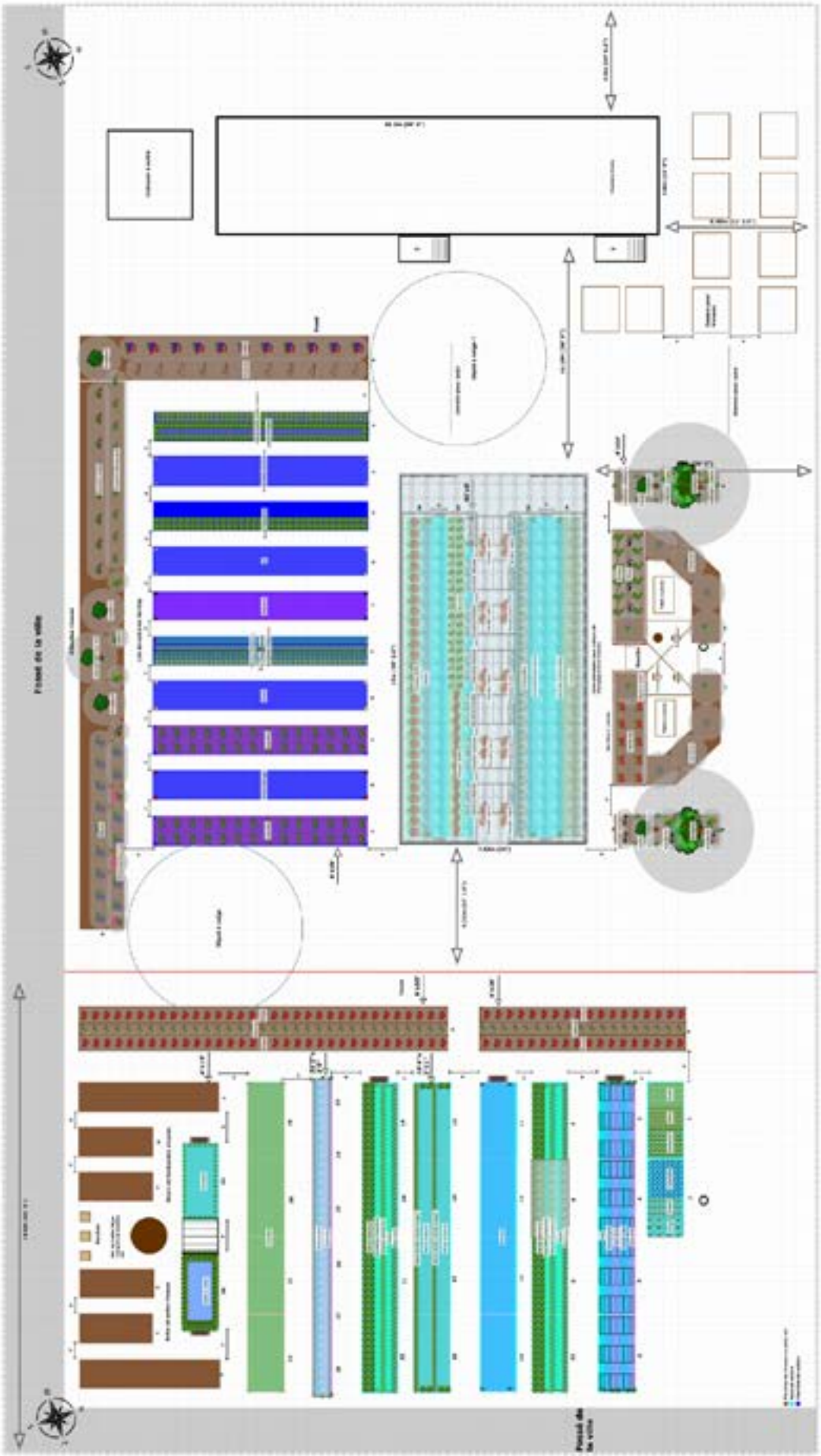
Legault, Sophie, Marie-Joëlle Brassard, Simon Dugré, Vincent Lacharité-Laframboise, et Émilie Parent. 2020. « Plan d'Affaire : mise en place d'une serre communautaire à Radisson ». CISA.

Piché, Paul. 2021. « Amélioration du comportement thermique d'une serre nordique communautaire. » Doctorat, Université de Pau et des Pays de l'Adour. (Polar Harvest)

Piché, Paul, Timothée Maheux, Didier Haillot, Stéphane Gibout, et Danielle Monfet. 2022. « Rapport de construction d'un système de stockage thermique de l'énergie (lits de roches) dans la serre de Radisson ».

2024 GARDEN AND GREENHOUSE PLAN

created by Les Jardins du 53e Taïga



SOLIDARITÉ ALIMENTAIRE MATAGAMI

PROJECT MISSION

The mission of Solidarité Alimentaire Matagami (SAM) is to contribute to food security for the population of Matagami through food assistance, group cooking activities, and a meal-on-wheels program. The establishment of a greenhouse and garden was therefore undertaken to produce vegetables that can be used in the services offered by the organization.

SAM is also interested in developing the educational aspect of the greenhouse and garden once production management is more established. Since the greenhouse and garden have only recently started operating, there is still much to learn. However, occasional workshops have been offered to the public on topics such as seed planting, germination, and non-timber forest products (NTFPS).

Project Type : Garden and greenhouse aimed at producing vegetables to supply the organization's activities

Lead Organization: Solidarité alimentaire Matagami

Organization Type: Non-Profit Organization (NPO)

CONTEXT

Matagami is a vibrant community of approximately 1,400 residents located in the southern part of Eeyou Istchee Baie-James, near the 50th parallel. In 2020, an action plan was developed by the Coopérative de Solidarité Gaïa at the request of Solidarité Alimentaire Matagami for the establishment of a community garden and greenhouse (Coopérative de Solidarité Gaïa, 2020).

Solidarité Alimentaire Matagami received funding from the Société du Plan Nord, the ARBJ (Administration régionale Baie-James), and the CRSSSBJ (Centre régional de santé et de services sociaux de la Baie-James) to implement their projects. Thanks to the support (and shovels) of numerous local residents, the garden was established in 2021 on land provided by the Centre de femmes Uni-vers-elle. Construction of the greenhouse began in the summer of 2022. Both installations are located near Matagami's downtown area.

FACILITIES OVERVIEW

Greenhouse

Year of Construction: 2022
Greenhouse Area: 116 m²
Cultivable Area: 3 planting beds of 13 m x 1.2 m, totalling 46.8 m²
Greenhouse Type: Quonset
Heating System: Propane
Automatic Ventilation System: Positive pressure ventilation, HAF fans, and roll-up sides
Irrigation System: Drip irrigation for the beds and manual watering for the table
Additional Feature: A 24 m² table dedicated to seedling production

Field Garden

Year of Construction: 2021
Dimensions: 16 beds of 8 m x 1.2 m, totalling a surface area of 153.6 m²
Additional Features: The soil was imported from a company located in Rouyn-Noranda. Approximately 73 m³ of soil was imported for the garden and around 18 m³ for the greenhouse.

DETAILS ON CROPS

Best-Performing Crops:
Garden: Beets, radishes, potatoes, and lettuce.
Greenhouse: Tomatoes and cucumbers.
Season Duration:
Greenhouse: The season can start as early as late March and extend to late October.
Garden: The season typically runs from early June to mid-October.

Field Crops: Beets, radishes, potatoes, lettuce, cauliflower, cabbage, broccoli, asparagus, rhubarb, onions, spinach, beans, peas, and herbs.
Greenhouse Crops: Bell peppers, tomatoes, cucumbers, herbs, chili peppers, radishes, spinach, beets, lettuce, tatsoi, pak-choi, turnips, and strawberries.

Note: The 2023 season was exceptional due to favourable temperatures and abundant sunlight, which may have influenced some of the data mentioned above.

PROJECT GOVERNANCE

The greenhouse is owned by SAM. Employees work under the supervision of SAM's board of directors. In general, the organization employs two staff members: one responsible for coordination and another who manages activities and cooking.

The availability of a dedicated staff member for maintaining the greenhouse and garden depends on the organization's financial resources and its ability to recruit someone interested in the position.

OPERATING MODEL

In 2022 and 2023, vegetable production relied on the presence of an employee dedicated to maintaining the garden and greenhouse. The employee also received occasional assistance from volunteers.

The harvests from the greenhouse and garden are used in the organization's activities, either for food preparation or emergency food aid. When harvests are abundant, the organization sells surplus fruits and vegetables to the public.

INFORMATION

Facebook: SolidariteAlimentaireMatagami

Email: solidaritealimentairematagami@gmail.com

Website: https://solidaritealimentairematagami.com/

Video - Jardiner à Matagami !

Video - La serre de Solidarité alimentaire Matagami

Video - La mission et services de Solidarité alimentaire Matagami

BIBLIOGRAPHY

Coopérative de solidarité Gaïa. (2020). *Plan d'action —Jardins de Solidarité alimentaire Matagami.*

Statistique Canada. (2022). *Tableau de profil—Matagami.* Statistique Canada. https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/details/page.cfm?Lang=F&SearchText=Matagami&DGUIDlist=2021A00052499015&GENDERlist=1,2,3&STATISTIClist=1&HEADERlist=0

THE KUUJJUAQ GREENHOUSES

PROJECT MISSION

Provide a safe and organized space for the people of Kuujjuaq to garden.

Project Type: 2 Community Greenhouses

Lead Organization: The northern village of Kuujjuaq and the Kuujjuaq Greenhouse Committee

Location: Kuujjuaq, Nunavik

CONTEXT

Located 48 km south of Ungava Bay and accessible only by plane or boat, Kuujjuaq is an Inuit village with a population of approximately 5,000 people. As a service hub for all of Nunavik, its population is composed of 50% Inuit and 50% Qallunaaq (Qallunaaq means a non-Inuit person in Inuktitut).

Since the mid-1990s, people have been gardening in greenhouses in Kuujjuaq. However, it wasn't until 2012 that a greenhouse committee was established to develop an organizational structure and oversee operations. With growing demand for gardening in the greenhouse, it became clear that one greenhouse was not enough. A second greenhouse was therefore built in 2013.

To explore ways of extending the growing season in the greenhouses, a partnership was established with researchers from the Observatoire Hommes-Milieux International (OHMI) Nunavik, affiliated with ÉTS and the Université de Pau et des Pays de l'Adour (UPPA). This collaboration led to the installation of a thermal storage system in the new greenhouse in 2019. This system aims to reduce temperature fluctuations between day and night, providing a more favourable climate for growing fruits and vegetables.

FACILITIES OVERVIEW

Greenhouses
Year of Construction: 1995 and 2013
Surface Area of Each Greenhouse: 140 m^2
Type of Greenhouse: Chapel-style with double-walled polycarbonate panels
Heating System: None
Automatic Ventilation System: Fans and openable roofs
Irrigation System: Manual, with a hose in each greenhouse
Thermal Storage System: Stone bed system installed in the second greenhouse since 2019
Number of Plots: 46 plots available (24 in the new greenhouse and 22 in the old greenhouse)
Plot Size: 4 m^2
Number of Participants: Approximately 150

Outdoor Containers
Year of Construction: 2023
Cultivable Area: 4 containers, totalling 7 m^2

DETAILS ON CROPS

- Best-Performing Crops: Green vegetables (lettuce, kale, zucchini, bok choy, radishes, peas).
- Most participants plant foods that are not, or rarely, available in local grocery stores.
- Greenhouse Growing Season: Late May to late September
- Outdoor Container Crops: Garlic, rhubarb, and Qunguliit (mountain sorrel, a traditional Inuit plant)
- Production Capacity: 1 ton/year for both greenhouses

PROJECT GOVERNANCE

The greenhouses are owned by the Northern Village (NV) of Kuujjuaq. The Kuujjuaq Greenhouse Committee was created to manage the two greenhouses throughout the season.

For the committee to operate effectively, it must consist of 4 to 6 volunteers. The committee meets every two weeks from April to November. Each year, a general meeting is held to assign roles and elect new members. The Northern Village appoints one of its employees to serve on the committee.

OPERATING MODEL

The greenhouses operate as a community garden. The two greenhouses are divided into individual plots, with each gardener being responsible for and autonomous in their planting. Interested individuals must submit an application at the beginning of the year to be entered into the plot lottery. To apply, individuals must have lived in Kuujjuaq for at least one year.

Unique Feature of the Kuujjuaq Project: The Grandfather Clause!
This clause guarantees a plot to gardeners who have been participating since the beginning. Residents who have lived in Kuujjuaq for 10 years or more and submit an application are also automatically allocated a plot in one of the greenhouses. These measures aim to prioritize long-term and local residents of Kuujjuaq.

Gardeners often team up in pairs or groups of 3–4 to manage a single plot. This arrangement allows for task-sharing, such as watering during vacations, and ensures the harvest is distributed throughout the season.

A few years ago, a sharing group was established. Ten plots were set aside for more intensive gardening to maximize harvests and promote collective gardening. This group welcomed all individuals who had not been allocated a plot. However, since the COVID-19 pandemic, the group has been discontinued. One of the challenges was the need for a group coordinator to oversee the maintenance and harvesting process. Such intensive gardening also requires a deeper knowledge of greenhouse gardening techniques.

The Supervised House, a community housing organization in Kuujjuaq that supports men in reintegrating into their community, is responsible for preparing compost at the two greenhouse sites. The compost produced is available for gardeners to use.

FOR MORE INFORMATION

Email:
kuujjuaqgreenhouse@gmail.com

Press Articles:

- Northern Greenhouses : An Alternative Local Food Provisioning Strategy for Nunavik
- Amélioration du comportement thermique de la serre communautaire de Kuujjuaq
- Soutenir la sécurité alimentaire dans le Grand Nord : projets communautaires d'agriculture sous serre au Nunavik et au Nunavut

Interesting links:

- OHMI Nunavik
- Maraîchage nordique : cultiver pour la communauté

THE AGROFOOD INITIATIVE OF OPITCIWAN

PROJECT MISSION

Various garden projects are being implemented within the community to improve economic access to a variety of fruits and vegetables in Opitciwan and to curb the rise of nutrition- and inactivity-related diseases.

Project Type: Community-based

Lead Organization: The Atikamekw Council of Opitciwan and Mikisiw Secondary School

Location : Opitciwan, Haute-Mauricie

CONTEXT

Opitciwan is one of three Atikamekw communities, located in Haute-Mauricie.The community consists of approximately 2,800 members (with 400 living outside the community). It is about 160 km of forest roads away from the nearest paved road. To reach the closest town, community members must travel 220 km, a distance that not only increases food prices but also reduces the availability and quality of fruits and vegetables.

In 2017, the Atikamekw Council of Opitciwan initiated a community garden project. The goal was to provide families in Opitciwan with access to fresh, high-quality, and affordable fruits and vegetables to promote the community's food autonomy. A governance process for the Atikamekw food system is underway.

Since 2018, the CISA has been collaborating with the Opitciwan community to develop local organic agriculture. Over time, several gardening spaces and an educational greenhouse have been established, and indoor and outdoor production activities are carried out in schools and during community-wide events. Several parallel research projects are also underway to develop agricultural methods that respect Atikamekw cultural specificities.

FACILITIES OVERVIEW

Mikisiw Secondary School Educational Greenhouse:

Year of Construction: 2022
Greenhouse Area: 55.5 m²
Cultivable Area: 15 m²
Greenhouse Type: Single polyethylene greenhouse with double walls
Heating System: Propane furnace
Irrigation System: Manual — 1 garden hose

Miro Aski Community Garden:
Year of Construction: 2018
Cultivated Area: 1,150 m²
Number of Containers: 23
Container Area: 50 m²
Number of Individual Plots: 24
Irrigation System: 4 x 1,000 L tanks and watering cans, manual watering
Other Adjacent Facilities: Shed, adjacent shelter, picnic table
Additional Feature: Fully fenced gardening space

Collective Food Security Garden

Year of Construction: 2017
Garden Area: 120 m²
Number of Ground Beds: 7
Bed Dimensions: 12 m

Raised Beds at the Tapiskwan Elders' Home

Year of Construction: 2019
Number of Beds: 2
Cultivable Area: 1.5 m²

Food Forest at Mikisiw Secondary School

Year Established: 2023
Area: 240 m²
Location: Mikisiw Secondary School
Special Feature: The circular design of the forest is inspired by the Medicine Wheel. Plants were selected based on their colours and arranged in a circle to represent the elements of the Medicine Wheel (white in the north, yellow in the east, red in the south, and black in the west).

Irrigation System:
Type: Drip irrigation system using a pump submerged in the lake.
Location: Adjacent to the community garden.



DETAILS ON CROPS

Best-Performing Crops:

- In the Garden: Tomatoes, zucchini, strawberries, peas, carrots, potatoes, and beets.
- In the Greenhouse: Tomatoes, carrots, lettuce, beans, eggplants, and peppers.

Challenging Crops:

- Cabbages in general (due to cabbage white butterfly infestations).

Growing Seasons:

- Greenhouse: Mid-May to mid-October.
- Outdoor Gardens: Mid-June to mid-September.

Food Forest: The plants for the food forest were selected based on Opitciwan's hardiness zone and the preferences of community members.

Varieties Planted:
Grapevines (2 plants), blackcurrant (1 plant), chokeberry (1 plant), haskap (1 plant), sunflowers (about 40), yellow potentilla (2 plants), daisies (2 bunches of about 20 flowers), white currant (1 plant), chamomile, yarrow, thyme, strawberries, raspberries (2 plants), red currant (1 plant). More plants and varieties will be added in the coming years.

PROJECT GOVERNANCE

The Miro Aski Community Garden and the Food Security Garden are owned by the Atikamekw Council of Opitciwan and managed by the Community Development sector.

The Educational Greenhouse is owned by Mikisiw Secondary School. It was developed by the Economic Development team and is strongly supported by the Community Development sector of the Council.

OPERATING MODEL

Implementation at Mikisiw Secondary School (since 2023)
The goal is to prepare students for the agricultural job market. Indoor, outdoor, and greenhouse gardening workshops are included in the curriculum for the school's adapted classes. The agricultural technician from CISA provides the training and manages the greenhouse. Students participate in crop maintenance while acquiring foundational knowledge and basic agricultural techniques.

Miro Aski Community Garden
Gardeners interested in accessing a plot express their interest at the beginning or during the growing season. Available plots are allocated to them. Plots are assigned for an indefinite period; if a gardener no longer wishes to participate, they relinquish their plot, making it available to other community members. Gardeners with a plot in the community garden are responsible for its upkeep throughout the season. If they would like guidance or support, they can seek assistance from CISA's agricultural technician.

Food Security Garden
The planning and maintenance of the food security garden are handled by CISA's agricultural technician, supported by groups of young people and volunteers who wish to contribute. Harvested fruits and vegetables are donated to the Elders' Home and social services.

Raised Garden Beds at Tapiskwan Elders' Home
The raised garden beds are maintained by staff, and the vegetables produced are incorporated into meals.

Food Forest at Mikisiw Secondary School
Located in front of the school, all community members are invited to harvest the fruits, herbs, and flowers grown there and enjoy the space.

Community Engagement
Numerous gardening workshops are organized for elementary school classes and community members. Additionally, BBQ evenings are hosted at the Miro Aski Community Garden, providing opportunities to invite community members to the garden. These events are ideal for promoting healthy lifestyles and fostering social interactions in a pleasant environment.

FOR MORE INFORMATION

Facebook:
https://www.facebook.com/jardinmiroaski

CISA's Website:
- PROGRAMME AGROALIMENTAIRE À OPITCIWAN
- FORÊT NOURRICIÈRE ATIKAMEKW : DE LA FORÊT À L'ASSIETTE

Press Articles:
- Approche agriculturelle de la souveraineté alimentaire à Opitciwan
- De l'expertise agricole pour aider les Autochtones à produire leurs légumes

Video clips:
- Jardin Miro Aski 2021, Opitciwan, Québec, (Obedjiwan)
- Jardiner à Obedjiwan pour la sécurité alimentaire
- Maraîchage nordique : cultiver pour la communauté

COOPÉRATIVE DE SOLIDARITÉ GAÏA

PROJECT MISSION

The mission of the Coopérative Gaïa is to produce and provide healthy, locally sourced food while fostering small-scale, human-centered northern agriculture based on ecological production principles.

Project Type: Bio-intensive vegetable farm

Lead Organization: Coopérative de solidarité Gaïa

Organization Type: Cooperative

Location: Pointe-aux-Outardes, Manicouagan, Côte-Nord

CONTEXT

In 2008, the Coopérative Gaïa team settled in Pointe-aux-Outardes to address the lack of locally grown vegetables in the region. Various allies, including La Ferme Aux Jardins des Prés—also based in the Côte-Nord—lent their support and gathered to design cooperative vegetable production projects.

For the past 15 years, Coopérative Gaïa has been working to develop a food network in the Manicouagan region through the sale of fruits and vegetables, the creation of edible landscapes, and practical and educational workshops. Through its educational initiatives, the cooperative raises awareness about ecological production principles and sustainable development.

The Coopérative Gaïa aims to establish a sustainable agrifood production and distribution system to serve its members. Its goal is to achieve food sovereignty and ensure sustainable and responsible land use by promoting local, human-scale ecological agriculture.

FACILITIES OVERVIEW

- Acquisition in 2009 of a 36-hectare plot of land
- Restoration of 3 hectares of horticultural potential (crops and green manure)
- The facilities and horticultural crops occupy nearly 5 hectares, with the remainder consisting of various more or less wooded ecosystems.

Greenhouse 1

Year of Construction: 2018
Greenhouse Area: 116 m²
Cultivable Area: 5 permanent beds, each 11 m²
Greenhouse Type: Harnois Ovaltech3 greenhouse
Heating System: Propane heating distributed via ventilation balloons
Automatic Ventilation System: Positive pressure and roll-up sides
Main Crops: Tomatoes and cucumbers

Greenhouse 2

Year of Construction: 2018
Greenhouse Area: 232 m²
Cultivable Area: 5 permanent beds, each 22 m²
Greenhouse Type: Tessier tunnel greenhouse with double polyethylene cover
Heating System: Electric air heater
Automatic Ventilation System: Positive pressure and roll-up sides
Irrigation System: Automated drip irrigation with tensiometer
Main Crops: Tomatoes and peppers

Nursery Greenhouse

Year of Construction: 2018
Greenhouse Area: 297 m²
Tables: 6 mobile tables, each 33 m²
Greenhouse Type: Harnois Ovaltech4 greenhouse
Heating System: Propane heating distributed via ventilation balloons
Automatic Ventilation System: Positive pressure and roll-up sides
Main Crops: Seedlings for production and sale, and potted herbs

Office Greenhouse

Year of Construction: 2012
Greenhouse Area: 75 m²
Cultivable Area: 4 permanent beds, each 4 m²
Greenhouse Type: Custom-built wooden and polyethylene greenhouse with the north side adjacent to the main building
Heating System: Electric air heater
Ventilation System: Manual
Irrigation System: Automated drip irrigation
Main Crops: Basil and cucumbers

Passive Greenhouse

Year of Construction: 2015
Greenhouse Area: 186 m²
Cultivable Area: 2 growing beds, each 19 m²
Greenhouse Type: Polycarbonate greenhouse dug into the ground and insulated with sand-filled tires
Heating System: Electric air heater as needed
Ventilation System: Passive with air outlets at the gable and a ground drain
Irrigation System: Manual
Main Crops: Basil and seedlings (nursery)

Warm Tunnel

Year of Construction: 2022
Tunnel Area: 350 m²
Cultivable Area: 6 permanent beds, each 41 m²
Tunnel Type: Multi Shelter double polyethylene tunnel
Heating System: Radiant glycol heating embedded in the soil
Ventilation System: Roll-up sides
Irrigation System: Automated drip irrigation
Main Crops: Early vegetables (green onions, mesclun, carrots, climbing beans, greens, etc.) and cucumbers

Caterpillar Tunnels

Dimensions: 15 m² each
Number of Tunnels: 7
Irrigation System: Automated drip irrigation
Main Crops: Early vegetables (green onions, mesclun, carrots, greens, cruciferous vegetables), zucchinis, and Italian tomatoes

Fields

Years of Development: 2009 to 2020
Division: 21 blocks, each 465 m²
Block Dimensions: 10 permanent beds, each 28 m²



OPERATING MODEL

The consumers of Coopérative Gaïa are both members and owners of the business, and decisions are made collaboratively, considering everyone's interests. The cooperative operates on the principle of meeting the diverse needs of its members, which include producers seeking distribution channels, consumers wanting fresh, local products, and workers looking to invest their time in the agricultural sector. The core objective of Coopérative Gaïa is to produce fresh, local food that aligns with the diverse expectations of its members. As a cooperative entity, its existence is intrinsically tied to satisfying the needs of its members. The cooperative also features a decision-making board of directors and a sovereign general assembly.The primary focus of its activities is the production of organic vegetable baskets distributed weekly over a 15-week period. However, the cooperative has diversified its market to meet the demands of its members and the local population.

- Organic Baskets (150)
- Sale of Certified Organic Vegetable Plants
- Retail and Bulk Vegetables for Various Clients
- Workshops and Training on Northern Bio-Intensive Agriculture
- Turnkey Edible Landscape Installations
- Support for Various Northern Vegetable Farming Projects

Distribution Channels and Marketine

- 3 drop-off points for baskets
- 8 local restaurants
- 4 local retailers
- 1 public market
- 1 mobile market network to cover the region

DEFINITION :

In a solidarity cooperative, various categories of members come together to achieve their objectives.

The advantages of this type of organization include:

- Effectively bringing together different individuals united by a common cause
- Contributing to the achievement of the organization's goals and introducing new ideas
- Promoting workforce retention
- Enhancing the capitalization of the organization

Source : https://cdrq.coop/comprendre-les-differents-types-de-cooperatives.html

FOR MORE INFORMATION

Facebook: https://www.facebook.com/cooperativegaia

Email: cooperativegaia@gmail.com

Site web: www.coopgaia.ca

Resources: Les coopératives de solidarité - Guide pratique

Documentary: Maraîchage nordique : cultiver pour la communauté

CHUTE-AUX-OUTARDES COLLECTIVE GARDEN

PROJECT MISSION

The Chute-aux-Outardes Collective Garden aims to increase the quality and quantity of vegetables available to its users. It is a project where beneficiaries can actively participate in food production, contributing to improved food security in the region.

Project Type : Bio-intensive gardens in fields and greenhouses

Lead Organization : Carrefour Familial de Chute-Aux-Outardes

Oranization Type: Non-profit Organization

Location: Chute-aux-Outardes, Manicouagan, Côte-Nord

CONTEXT

The *Carrefour Familial* has a mission to support parents facing challenging situations by offering activities that promote mutual support among families and the development of parenting skills.

For several years, the *Carrefour* had already been providing various services to support its clients' food needs, such as a collective kitchen, food assistance, and a green box (group purchasing).

In 2020, the *Carrefour* sought to improve the quality and quantity of vegetables available to its users. A collective garden project, including a greenhouse and orchard, was established to concretely support its food activities and enhance the food supply for beneficiaries. This project emerged from the collaboration on food autonomy and security organized by the CISSS Côte-Nord.

To develop the project, the *Carrefour Familial* partnered with the *Coopérative Gaïa* for planning, design, maintenance, and the hiring of specialized labor.

FACILITIES OVERVIEW

Greenhouse
Year of Construction: 2022
Greenhouse Area: 116 m²

Cultivable Area:
3 permanent beds of 11 m² each (cultivation of tomatoes and cucumbers)
1 fixed table for seedlings and transplants (transplants for fields, potted herbs, potted chili peppers)

Greenhouse Type: Galvanized steel structure covered with polyethylene
Heating System: Electric air heater
Automatic Ventilation System: Positive pressure and roll-up sides
Irrigation System: Automated drip irrigation

Field Garden
Years of Construction: 2020–2022
Dimensions: 3 plots of 465 m² each
Irrigation System: Automated drip irrigation and sprinkler system

Orchard :
Various fruit trees and shrubs

DETAILS ON CROPS

BA wide variety of vegetables are grown, and the garden is highly successful!

Field Crops: Basil, Swiss chard, beets, bok choy, broccoli, carrots, celery leaves, various cabbage varieties, Brussels sprouts, cauliflower, kale, kohlrabi, English and Lebanese cucumbers, zucchini, mesclun and lettuce, yellow and red onions, green onions, leeks, parsley, sugar snap peas and snow peas, bush beans, chili peppers, turnips, summer radishes, cherry and beef tomatoes, and various herbs.

Growing Season: Planting begins on May 25, and the final harvest is on October 15

PROJECT GOVERNANCE

The garden and greenhouse are owned by the Carrefour Familial de Chute-aux-Outardes. They are managed by a coordinator employed by the Carrefour Familial.

OPERATING MODEL

This project is a collective garden, meaning that each volunteer must contribute at least 8 hours of field preparation during the pre-planting period to qualify for the harvest season. Once qualified, members are required to work one hour per week in the garden to receive their weekly vegetable basket. Attendance and basket distribution are tracked by the coordinator.

Tools and task lists are made available to members during pre-scheduled time slots determined by the coordinator. Volunteer gardeners are appointed for the season and are responsible for harvesting and distributing the baskets.

All major farming tasks in the field and greenhouse are carried out by the Carrefour Familial employee as well as a farmer from Coopérative Gaïa. The Coopérative Gaïa provides a staff member to support the Carrefour with seasonal planning, garden and greenhouse layout, and maintenance.

Approximately 50 families participate in the collective garden!

LINKED PROJECTS

Collective Kitchens
Food Assistance

FOR MORE INFORMATION

Email: carolinemarte@hotmail.com
Documentary: Maraîchage nordique : cultiver pour la communauté

FERME DU RIGOLET

PROJECT MISSION

Contribute to diversifying the economy and developing food autonomy in Tête-à-la-Baleine by cultivating fruits, vegetables, and native plants of the Côte-Nord region.

Project Type: Diversified fruit and vegetable production in fields and greenhouses

Lead Organization: Ferme du Rigolet

Organization Type: Non-Profit Organization

Location: Tête-à-la-Baleine, Basse-Côte-Nord

CONTEXT

Initiated in 2020 by Samuel Bellefleur, a resident by adoption of Tête-à-la-Baleine, the project, in collaboration with the Centre d'expérimentation et de développement en forêt boréale (CEDFOB), focuses on experimenting with the cultivation of rhodiola rosea (rose root) for its medicinal properties. The project also aims to enhance the food supply of this village of about 100 residents by growing vegetables both in open fields and in a greenhouse, while also planting a variety of fruit trees and shrubs.

FACILITIES OVERVIEW

Greenhouse
Area: 116 m²
Type: Tessier (25' x 50')
Heating System: Electric
Automatic Ventilation System: Orisha
Irrigation System: Automated drip irrigation
Main Crops: Tomatoes, cucumbers, peppers, herbs (Nutrition Nord)

Caterpillar Tunnel
Year of Construction: 2024
Area: 116 m²
Type: Gothic Tessier (25' x 50')
Heating System: None

Fields

- Rhodiola Cultivation Trial
  Year of Establishment: 2022 (to be harvested in 2027)
  Cultivable Area: 8 beds totalling 275 m²
- Fruit Crop Trials
  Years of Establishment: 2021 and 2022
  Cultivable Area: Approximately 1,000 m²
  Main Crops: Apple trees, pear trees, plum trees, chum, sea buckthorn, chokeberry, raspberries, blackberries, strawberries, and lingonberries.
- Vegetable Crop Trials
  Cultivable Area: 100 m² (cleared in 2023, half cultivated the same year)
  Other Features: 4 gardens with 6 beds, each 6 m long
  Main Crops: Potatoes, ground cherries, zucchini, cabbages, shallots, radishes, and parsley

CROPS DETAILS

Field Growing Season: Fieldwork begins in May and ends in late October.
Greenhouse Growing Season: April to November.
Production Capacity: To be determined.

PROJECT GOVERNANCE

The organization is a non-profit (NPO), with a board of directors composed of five members, in addition to the executive director. In the summer of 2023, a full-time seasonal position for agricultural coordination was created.

OPERATING MODEL

During the growing season, several part-time employees join the organization.

UPCOMING PROJECTS

A food processing project is being considered to diversify market offerings and extend sales throughout the year to meet the population's food needs.
Additionally, a reconfiguration and drainage project for the vegetable crop trial plot is planned for 2024.

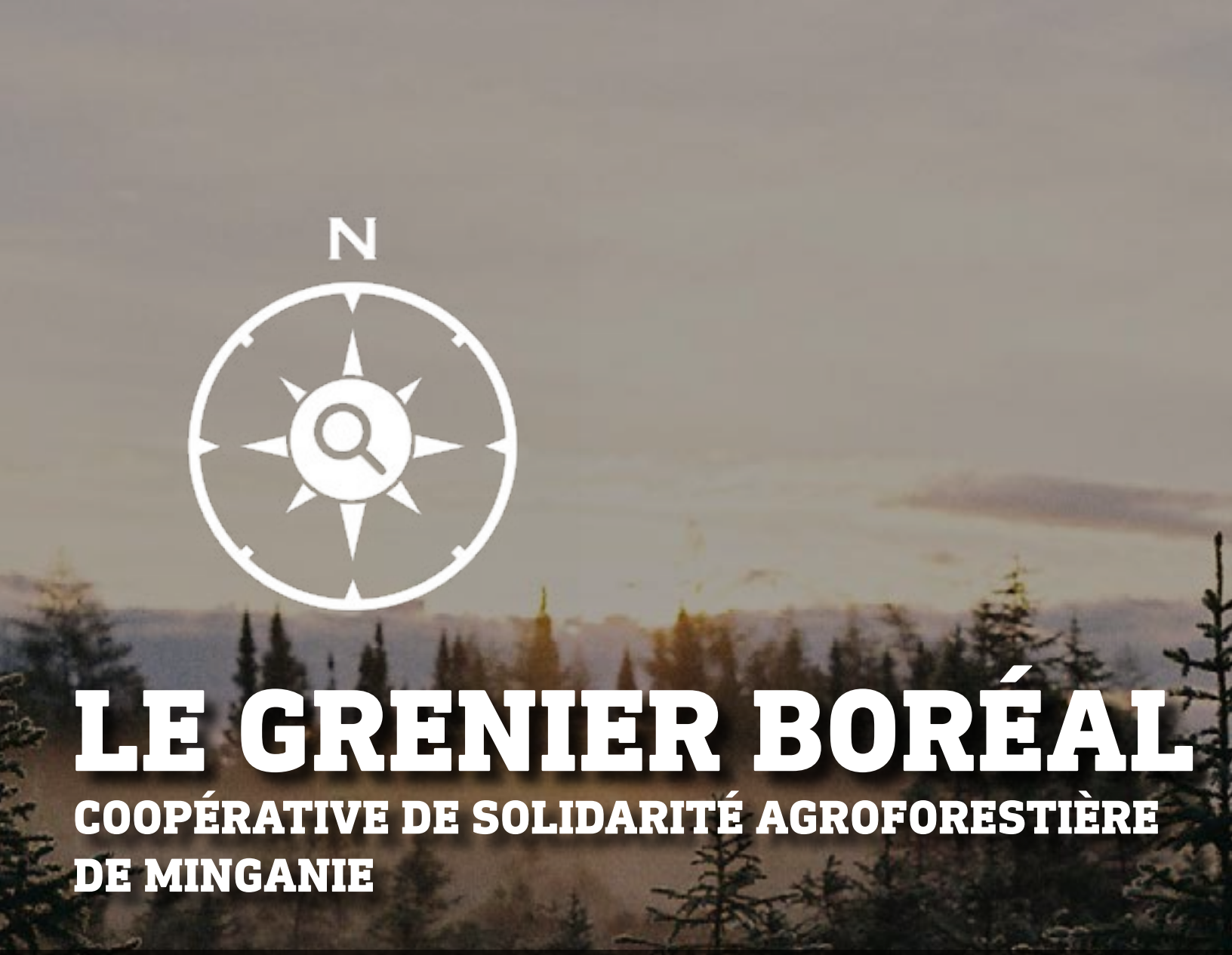
FOR MORE INFORMATION

Email: info@fermedurigolet.ca

Facebook: https://www.facebook.com/fermedurigolet

Instagram: https://www.instagram.com/fermerigolet/?hl=fr

Press Articles: https://ici.radio-canada.ca/nouvelle/1973619/tete-a-la-baleine-ferme-rigolet-autosuffisance-alimentaire



LE GRENIER BORÉAL

COOPÉRATIVE DE SOLIDARITÉ AGROFORESTIÈRE DE MINGANIE

PROJECT MISSION

The mission of Grenier boréal is to provide work for its members through the production, harvesting, processing, and marketing of products and services in the fields of agriculture and agroforestry, while respecting the principles of sustainable development.

Project Type: Cooperative enterprise focused on the production of fruits and vegetables, non-timber forest products (NTFPs), and agritourism.
Lead Organization: Le Grenier boréal
Organization Type: Solidarity cooperative, non-profit organization

Location: Longue-Pointe-de-Mingan, Côte-Nord

CONTEXT

The project began in 2004 with an initiative by residents of the Minganie RCM who wanted to create community gardens to access healthy, fresh food.

In 2010, the Bioressources project conducted an inventory of 22 non-timber forest products (NTFPs) across the Minganie RCM. The report highlighted the immense potential of the Côte-Nord region for harvesting edible or medicinal plants, mushrooms, and berries, where the tradition of berry picking is already well established.

Following these two initiatives, a provisional committee was formed to create a business plan, which led to the establishment of the Grenier boréal, the Minganie Agroforestry Solidarity Cooperative, in 2013.

Since then, Grenier boréal has cultivated approximately 1.1 hectares, producing fruits (strawberries, haskap berries, and raspberries) and around 30 different vegetables in fields and greenhouses. Additionally, the cooperative promotes the region's NTFPs to restaurants, microbreweries, and distilleries across Quebec.

FACILITIES OVERVIEW

Greenhouses

Greenhouse Area: 415 m²
Greenhouse Type: Single chapel greenhouse
Heating System: Propane
Automatic Ventilation System: Roll-up sides and roof, positive ventilation, HAF ventilation, automatic I-Grow controller
Irrigation System: Drip irrigation with solenoid valves and Irritrol automatic controller

Tunnels

Year of Construction: 2013
Dimensions: 84 m²
Heating System: None

In Fields

- The rented farm includes 5 fields in production.

  Dimensions:
  80 beds, 0.75 m x 30 m each
  22 beds, 1.2 m x 14 m each
  29 beds of variable dimensions, 1.2 m wide and between 37 m and 124 m long



CROPS DETAILS

The farm produces: Strawberries, haskap berries, garlic, eggplants, basil, beets, bok choy, broccoli, carrots, celery, ground cherries, cabbage, Chinese cabbage, cucumbers, cilantro, zucchini, squash, spinach, fennel, turnip greens, beans, kale, head lettuce, mesclun, onions, green onions, parsley, leeks, sugar snap peas, peppers, potatoes, turnips, radishes, arugula, rutabaga, beef tomatoes, and cherry tomatoes.

Field Growing Season: Fieldwork begins in May and ends in late October.
Greenhouse Growing Season: May to October.
Production Capacity: 1.1 hectares of cultivable area.

PROJECT GOVERNANCE

The solidarity cooperative operates through a board of directors, a general management team, and four categories of members: regular worker members, contract worker members, individual support members, and corporate support members (institutions, companies, municipalities, etc.).

The board of directors holds full authority to manage the cooperative's affairs. It is responsible for making all decisions related to the cooperative, including agreements, contracts, expenses, and activities.

The general management team is tasked with overseeing the cooperative's operations and management in line with the strategic directions established by the board of directors.

An annual general meeting composed of the members is held every year.

WHAT IS A SOLIDARITY COOPERATIVE?

In a solidarity cooperative, several categories of members come together to achieve their objectives.

The advantages of this type of organization include:

- Effectively bringing together individuals who are passionate about a common cause
- Contributing to the organization's goals and introducing new ideas
- Promoting workforce retention
- Enhancing the organization's capitalization

Source : https://cdrq.coop/comprendre-les-differents-types-de-cooperatives.html

OPERATNG MODEL

The organization aims to produce agricultural and agroforestry products ecologically, without chemical inputs or genetically modified organisms (GMOs). These products are then processed naturally, without chemicals, and marketed, prioritizing short supply chains whenever possible.

The cooperative also provides support in ecological gardening for various organizations and offers educational workshops on topics such as gardening, harvesting non-timber forest products (NTFPs), environmental protection, and sustainable development.

Additionally, it has developed an agritourism offering, including self-guided and guided tours, a local products shop, and gastronomic events.

Distribution Channels and Marketing

- Public markets
- Self-service stand
- U-pick
- Sales to businesses and organizations (e.g., CPE Longue-Pointe-de-Mingan, grocery store in Baie-Joan-Beetz, restaurants, Parks Canada).

FOR MORE INFORMATION

Facebook: https://www.facebook.com/groups/grenierboreal/?locale=fr_CA

Email: info@grenierboreal.coop

Website: https://grenierboreal.coop/

Press Articles: https://ici.radio-canada.ca/nouvelle/2008689/meteo-ete-2023-agriculture-minganie

THE GREEN ROOF AT UNITY DOMRÉMY

PROJECT MISSION

The Unité Domrémy Green Roof project aims to provide the organization's users with access to fresh, high-quality food. It also serves as a space for socialization, offering users various learning opportunities, including planting, maintenance, harvesting, preparation, and food preservation.

Project Type: Urban rooftop garden using smart pots
Lead Organization: Unité Domrémy
Organization Type: Non-profit organization

Location: Baie-Comeau, Côte-Nord

CONTEXT

Since 1977, the Unité Domrémy in Baie-Comeau has provided citizens with a welcoming space as well as support and assistance services aimed at improving their quality of life. In addition to various awareness workshops, psychosocial follow-ups, and social reintegration support, the organization hosts the only community fridge in the Marquette sector of Baie-Comeau.

In 2020, the organization's director, Curby Charette Graveline, initiated efforts to create a rooftop garden with the goal of enhancing the food supply for the community fridge and increasing access to fresh produce. The project was selected as part of the Ma Ville, ma Voix citizen participation initiative, and the consulting firm MU Conseils supported the project's development. The Coopérative Gaïa also provided technical assistance.

The garden was officially inaugurated in September 2023!

Centre communautaire
UNITÉ DOMRÉMY
de Baie-Comeau

FACILITIES OVERVIEW

Geotextile pots ranging from 10 to 100 gallons of soil, depending on the crops, are set up on the organization's rooftop.Approximately 30 different varieties of vegetables are grown in the pots.

CROPS DETAILS

Best-Performing Crops:
Herbs: Thyme and parsley
Leafy Vegetables: Kale and lettuce
Fruit Vegetables: Tomatoes, cucumbers, and zucchinis

Growing Season:
Early June to mid-October

PROJECT GOVERNANCE

The garden is managed and maintained by a coordinator employed by the Unité Domrémy. As a non-profit organization, a board of directors oversees and ensures the fulfillment of the organization's mission.

OPERATING MODEL

The coordinator oversees the maintenance and management of the garden throughout the growing season. Users are encouraged to participate in maintenance activities, but their involvement is not mandatory.

The harvests are made freely accessible to users through the community fridge. Additionally, educational cooking workshops are organized to transform the harvested produce into meals, which are then redistributed to the community via the fridge.

In summary, the production goals of the project are:

- To bring users together around a tangible project
- To grow vegetables for collective kitchens and the community fridge
- To provide workshops on vegetable cultivation and food transformation
- To strengthen users' connection to food production

The garden is a beautiful space for building relationships and fostering the development of a positive social network!

RELATED PROJECT

Hydroponic Growing Tower

FOR MORE INFORMATION

Facebook: https://www.facebook.com/UniteDomremyBC

Email: unitedomremybc@globetrotter.net

Press Articles: https://ici.radio-canada.ca/ohdio/premiere/emissions/bonjour-la-cote/segments/reportage/456347/unite-domremy-baie-comeau-toit-vert-atelier-jardin

CISA
SOCIAL INNOVATION
AGRICULTURE • FOOD
INAB CÉGEP DE VICTORIAVILLE

FOR MORE INFORMATION

info@cisainnovation.com
819 758-6401, poste 2361

cisainnovation.com