Northern Greenhouses:

An Alternative Local Food Provisioning Strategy for Nunavik

Thèse

Ellen Avard

Doctorat en sciences géographiques
Philosophiae doctor (Ph.D.)

Québec, Canada

Résumé

Les serres nordiques: Une approche alternative à la sécurité alimentaire au Nunavik

Les communautés inuites font face à des changements socioculturels et environnementaux rapides ainsi qu'à plusieurs défis concernant la sécurité alimentaire. Récemment, plusieurs projets innovateurs ont pris forme pour pallier aux coûts élevés et la qualité discutable des aliments frais dans le Nord.

Cette recherche s'est déroulée au Nunavik (la région inuite de la province de Québec, Canada) et a été élaborée en utilisant une approche de recherche participative. L'objectif de ce travail était de documenter et de participer au développement d'un projet pilote de serre dans le village de Kuujjuaq dans le but de développer un modèle de sécurité alimentaire alternative pour le Nord.

Plusieurs personnes ont, de prime abord, remis en question la viabilité à long terme d'un projet de serre dans une communauté inuite. Pourtant, les résultats de cette recherche démontrent qu'il y a de l'intérêt et du soutien de tous les secteurs pour ce type d'initiative. Les résultats démontrent également qu'une stratégie d'approvisionnement local basée sur la serriculture est techniquement faisable et socialement acceptable.

La conclusion générale de cette recherche est que les serres nordiques ont le potentiel de devenir des éléments clés dans une nouvelle stratégie alimentaire nordique, une stratégie qui sera plus résiliente que celle que nous connaissons aujourd'hui, et qui va contribuer de manière durable à l'essor de la capacité communautaire et au développement socioéconomique des villages nordiques.

Abstract

Northern Greenhouses: An Alternative Approach to Food Security in Nunavik

Inuit communities are currently facing rapid sociocultural and environmental change as well as numerous food security issues. However, these issues are being addressed in increasingly innovative ways; notably through the implementation of alternative agricultural projects that address the high cost and questionable quality of fresh food in the North.

This research took place in Nunavik (the Inuit region of the province of Quebec, Canada) and was elaborated using a Community-Based Participatory Research (CBPR) approach. The objective of this work was to participate in and document the development of a greenhouse pilot project in the village of Kuujjuaq and, through this process, develop a framework for an alternative type of northern food security initiative.

While many initially questioned the long-term viability of a greenhouse project in an Inuit community, results of this research show that there is indeed interest in and concerted support from all sectors for this type of initiative. Results also show that a greenhouse-based local food strategy in Nunavik is technically feasible and can be developed in a manner that is culturally appropriate and socially acceptable.

The overall conclusion drawn from this research is that northern greenhouses have the potential to become key elements in a new type of northern food strategy, a strategy that will be more resilient than the one that we know today and that will contribute in a sustainable manner to the building up of the community capacity and socioeconomic stability of northern villages.

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ᑕᕐᕋᒥ ᐱᕈᕐᓰᕕᖃᕐᓂᖅ ᐃᓪᓗᔪᐊᒦᑦᑐᓂᒃ: ᓄᓇᕕᒻᒥ ᐊᓯᐊᒎᕐᑐᒥᒃ ᐱᓇᓱᐊᒐᓱᓐᓂᖅ ᓂᕆᔭᑦᓴᖃᕐᑎᓯᑦᓯᐊᒋᐊᖃᕐᓂᖅ ᐱᓪᓗᒍ

ᐃᓄᐃᑦ ᓄᓇᓕᖕᒋᑦ ᐊᑑᑎᖕᒪᑕ ᓱᑲᑦᑐᔪᐊᒥᒃ ᐃᓄᖕᒋᑕ ᐃᓕᕿᓯᕐᑎᒍᑦ ᐊᕙᑎᖕᒐᑎᒍᓪᓗ ᐊᓯᑦᔨᑐᒥᒃ ᐃᓚᖃᓪᓚᓇᑦᓱᓂ ᓂᕆᔭᑦᓴᖃᕐᑎᓯᑦᓯᐊᒋᐊᖃᕐᓂᐅᑉ ᐃᑉᐱᒋᔭᐅᒋᐊᖃᕐᓂᖕᒐᓂᒃ. ᑕᒪᓐᓇᐅᒐᓗᐊᕐᑎᓗᒍ, ᑕᒪᒃᑯᐊ ᐱᓇᓱᐊᕈᑕᐅᓂᕐᕙᓪᓕᐊᔪᑦ ᐃᓱᒪᓇᖅᑲᑦᑕᓯᒪᖖᒋᑐᑎᒍᑦ; ᑕᑯᑦᓴᐅᓯᑎᓗᐊᖖᒍᐊᖅ ᑲᔪᓯᑎᑕᐅᕙᓪᓕᐊᒪᑕ ᐊᓯᐊᒎᕐᑐᑎᒍᑦ ᐱᕈᕐᓯᐊᓴᔭᓂᒃ ᐱᓇᓱᐊᕐᓂᐅᔭᑦ ᐊᑭᑐᔪᐊᓘᓂᖕᒐ ᓱᔪᒍᐊᕐᑑᓂᖕᒋᓪᓗ ᓂᖀᑦ ᑎᑭᑉᐸᑐᑦ ᑕᕐᕋᒧᑦ ᐱᓪᓗᒋᑦ.

ᑕᒪᑐᒥᖕᒐ ᖃᐅᔨᓴᕐᓂᖅ ᐊᑐᓚᐅᕐᑐᖅ ᓄᓇᕕᒻᒥ (ᐃᓄᐃᑦ ᓄᓈ ᑯᐯᒃ ᐊᐅᓚᑕᖕᒐᓂ, ᑲᓇᑕᒥᒃ) ᑭᓪᓕᖕᒋᐅᑎᓴᐅᑦᓯᓂ ᓄᓇᓕᖕᓂ ᑐᖖᒐᕕᖃᓪᓚᓇᑦᑑᔭᑦ ᖃᐅᔨᓴᕐᑐᓄᑦ ᐃᓚᐅᓪᓚᓇᑦᑎᑐᒋᑦ. ᑕᒪᑐᒪ ᑐᕌᕐᑕᓇᔭᖕᒐ ᐱᓇᓱᐊᕐᑕᐅᔫᑉ ᐃᓚᐅᕕᒋᓗᒍ ᐊᓪᓚᕙᓪᓕᐊᒍᑎᒋᓯᓐᓈᑦ ᐃᓪᓗᔪᐊᒦᑦᑐᓂᒃ ᐱᕈᕐᓰᕕᑦᓯᓚᐅᕐᓂᖅ ᑰᑦᔭᐊᒥ ᒪᓪᓗ, ᐱᓕᕆᐅᕙᓪᓕᐊᓕᕐᑎᓗᒍ, ᓄᐃᑦᓯᒍᑕᐅᕙᓪᓕᐊᓂᐊᕐᒪᑦ ᐋᕐᕿᓯᒪᒍᑕᐅᔭᓐᓇᓂᐊᕐᑐᒥᒃ ᐊᓯᐊᒍᑦᑕᐅᖅ ᑕᕐᕋᒥ ᓂᕆᔭᑦᓴᖃᕐᑎᓯᑦᓯᐊᒋᐊᖃᕐᓂᐅᔪᖅ ᐊᐅᓚᑦᓴᒋᐊᕆᑎᒋᓗᒍ.

ᐊᒥᓱᑦ ᖁᓚᑦᔪᑎᖃᓚᐅᕐᒎᒐᓗᐊᑦ ᑲᔪᓯᑎᐅᒐᕐᑐᒥᒃ ᓄᐃᑕᒍᓐᓇᓂᐊᕐᒪᖕᒑᑦ ᐃᓪᓗᔪᐊᒦᑦᑐᓂᒃ ᐱᕈᕐᓰᕕᖃᕐᓂᖅ ᐃᓄᐃᑦ ᓄᓇᓕᖕᒐᓐᓃᓗᓂ, ᑐᑭᓯᒐᑦᓴᑭᓯᒪᔭᑦ ᑕᒃᓲᓇ ᖃᐅᔨᓴᕐᓂᑎᒍᑦ ᓄᐃᑦᓯᓯᐊᕐᑐᑦ ᐃᖅᑲᓇᔭᐅᑦᓯᐊᓂᖕᒐᓂᒃ ᑲᑐᑎᔭᒥᓪᓗ ᓴᐳᑦᔭᐅᓯᒪᓂᖃᑦᓯᐊᓯᓂ ᓇᑭᓖᖅ ᑕᒪᓐᓇ ᐊᐅᓚᑦᓴᒋᐊᕆᑕᐅᔪᒪᔪᖅ. ᑐᑭᓯᓇᕐᓯᖃᑕᐅᓚᐅᕐᑐᑦ ᒪᓐᓇ ᐃᓪᓗᔪᐊᒥ ᐱᕈᕐᓯᐊᕕᓂᕐᓂᒃ ᓄᓇᓕᐅᑉ ᓂᕆᔭᑦᓴᖃᕐᑎᓯᒍᑎᒥᓂᐊᕐᒥᓴᖕᒐ ᓄᓇᕕᒻᒥᑕᐅᖅ ᓯᖅᑯᐃᓯᒍᑎᑦᓴᑕᑕᒃ ᐱᔭᓇᓚᖕᒪᒥᒋᐊᖕᒐ, ᐱᕙᓪᓕᐊᑎᑕᐅᔭᓐᓇᓯᓂᑐ ᐱᓇᓱᐊᕈᑎᒥᑐᓂᐅᑉ ᐃᓕᕿᓯᐅᑉ ᓇᓖᒍᕐᑐᒥᒃ ᐃᓄᖕᓄᓄ ᐱᔭᒪᓴᐅᑦᓯᐊᑐᓂ.

ᐃᑐᓐᓇᒥ ᐃᓱᓕᒋᐊᕈᑎᒋᑐᒍ ᑐᑭᓯᓇᕐᓯᓯᒪᔪᖅ ᑕᒃᕚᖕᒐᑦ ᖃᐅᔨᓴᕐᓂᒥᒃ ᒪᓐᓇ ᒪᑯᐊ ᑕᕐᕋᒥ ᐃᓪᓗᔪᐊᒦᓪᓗᑎᒃ ᐱᕈᕐᓰᕕᑦᓯᑦ ᐊᑐᕐᓂᕆᒋᐊᓕᖕᒥᓅᑦᓴᑐᐃᓇᓇᕆᐊᖃᑦᓯᐊᑐᑦ ᐃᓚᒋᔭᐅᓪᓚᓇᓯᑐᑎᒃ ᑕᕐᕋᒥ ᓂᕆᔭᑦᓴᖃᕐᑎᓯᑦᓯᐊᒋᐊᖃᕐᓂᖅ ᐸᕐᓇᕈᑕᐅᓯᒪᓂᐊᕐᒥᐸᑦ; ᐸᕐᓇᑕᓂ ᐊᑦᑕᓄᓐᓂᓴᓕᐊᓇᓗᒍ ᑖᑦᓯᒪᖖᒐᑦ ᖃᐅᔨᒪᓕᕐᑕᑎᓐᓂᒃ ᐅᓪᓗᒥᐅᔪᖅ, ᐃᑲᔪᕐᓯᕙᓪᓕᐊᓂᐊᕐᓱᓂᓗ ᑲᔪᓯᑎᐅᒐᕈᓐᓇᓂᐊᑐᒥᒃ ᓄᓇᓕᐅᑉ ᐱᔭᓐᓇᓕᕐᑕᖕᒋᓐᓄᑦ ᐃᓚᒋᓕᐅᑎᓗᓂ ᐃᓄᖕᒋᓐᓂᓗ ᑮᓇᐅᔭᒥᒃ ᐊᐅᓚᑦᓯᓂᖕᒐᓂᒃ ᐊᑦᑕᓄᓂᐅᒥᑎᑦᓯᓗᓂ ᑕᕐᕋᒥ ᓄᓇᓕᐅᔭᓂ.

Table of Contents

List of Tables

List of Figures

List of Abbreviations and Acronyms

AAFC	Agriculture and Agri-Food Canada
ACUNS	Association of Canadian Universities for Northern Studies
AEES	Advanced Ecologically Engineered Systems
AFNQL	Assembly of First Nations of Quebec and Labrador
ATV	All Terrain Vehicle
CBPR	Community-Based Participatory Research
CBR	Community-Based Research
CCB	Community Capacity Building
CEN	Centre d’études nordiques / Centre for Northern Studies
CÉRUL	Comités d’éthique de la recherche avec des êtres humains—Université Laval
CFIA	Canadian Food Inspection Agency
CHC	Canadian Horticultural Council
CMHC	Canada Mortgage and Housing Corporation
CQH	Conseil québécois de l’horticulture
DITRD-NL	Department of Innovation, Trade and Rural Development—Newfoundland and Labrador
FAO	Food and Agricultural Organization
FCNQ	Fédération des coopératives du Nouveau-Québec
FNQLSDI	First Nations of Quebec and Labrador Sustainable Development Institute
GDDs	Growing Degree Days
GPS	Global Positioning System
HBC	Hudson’s Bay Company
HSP	Hunter Support Program
IASC	International Arctic Science Committee
ICNGD	International Centre for Northern Governance and Development
INAC	Indian and Northern Affairs Canada

IPY	International Polar Year
IQ	Inuit Qaujimajatuqangit
IT	Inuit Tukisimajatuqanga
IK	Indigenous Knowledge
ITK	Inuit Tapiriit Kanatami
JBNQA	James Bay and Northern Quebec Agreement
KAP	Kuujjuaq Agricultural Committee
KEAC	Kativik Environmental Advisory Committee
KRG	Kativik Regional Government
KSB	Kativik School Board
LEK	Local Ecological Knowledge
MAPAQ	Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec
NGO	Non-Governmental Organization
NILCA	Nunavik Inuit Land Claim Agreement
NRBHSS	Nunavik Regional Board of Health and Social Services
NRI	Nunavut Research Institute
NSDC	Nunavut Social Development Council
NNC	Nutrition North Canada
NVK	Northern Village of Kuujjuaq
NWMP	Northwest Mounted Police
NWT	Northwest Territories
QEF	Québec en forme
RCMP	Royal Canadian Mounted Police
TEK	Traditional Ecological Knowledge
TK	Traditional Knowledge
UPA	Union des producteurs agricoles
UNESCO	United Nations Educational, Scientific and Cultural Organization

Glossary (Definitions of Selected Keywords)

Collective Garden	Collective gardens are most often found in urban environments. The principal difference between collective gardens and community gardens is that collective gardens have an express social mission. While they provide many of the same social benefits as community gardens, their principal raison d'être is not recreation and leisure—it is to respond to social problems in communities and to foster the empowerment of citizens.
Community-Based Participatory Research (CBPR)	CBPR involves both community stakeholders and investigators equitably at all levels of the research process, from design to dissemination. It involves a partnership between the community and the investigator(s) in which each group shares equal ownership of the process and products of research collaboration. It is a process through which decision-making power is shared between the researcher and the community involved, bi-directional research capacity and co-learning are promoted, and new knowledge is co-created and disseminated in a manner that is mutually beneficial.
Community Capacity Building (CCB)	CCB is a process through which local partners add value to communities. Its goal is to develop the capacity of communities to respond to their own challenges and opportunities. The heart of capacity building is people, and capacity is simply the ways and means needed to do what has to be done. Community capacity is an important consideration in community development, as the process of community development itself often results in increased capacity.
Community Garden	Community gardens are one of the most common forms of local food production, and they engage members of society of all ages and from all walks of life. A community garden is an open space, managed by volunteers, where horticultural activities are practised. Most often established in urban environments, community gardens provide green-space for city residents who would otherwise not have access to land. They are generally an ensemble of small, individual garden plots set up on larger pieces of "unused" land or vacant lots.

Country Food — Country foods, or traditional foods, are culturally acceptable foods available from local natural resources that constitute the food systems of Aboriginal peoples. Country food is normally given or shared; it is rarely paid for.

Ecological Design — Ecological design is design for human settlements and infrastructure that incorporates principles inherent in the natural world in order to sustain human populations over a long span of time. Ecological design is any form of design that minimizes environmentally destructive impacts by integrating itself with living processes.

Food Security — Food security exists when all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and food preferences and supports an active and healthy life. Food security is comprised of four dimensions: availability, access, utilization, and stability.

Inuit — The Inuit are a group of culturally similar indigenous peoples inhabiting the Arctic regions of Greenland, Canada, and Alaska. For more than four thousand years, Inuit—a founding people of what is now Canada—have occupied the Arctic land and waters from the Mackenzie Delta in the west to the Labrador coast in the east and from the Hudson's Bay Coast to the islands of the High Arctic.

Inuit Qaujimajatuqangit (IQ) — IQ is essentially traditional knowledge that is consistent with the beliefs, customs, values, and language of the Inuit, a long-standing knowledge base and world view reflecting time-honoured values and practices. IQ is a comprehensive term, encompassing all aspects of Inuit culture; some translate it as knowledge that has proven to be useful in the past and is still useful today, while others take it to mean "the things that Inuit have known for a long time".

Inuit Tukisimajatuqanga (IT) — Inuit Tukisimajatuqanga is a newly emerging concept; it is similar to IQ but is specific to Nunavik.

Kuujjuaq The Northern Village of Kuujjuaq is the administrative centre of Nunavik. It is not only the largest settlement in the region (population 2350), but also a critical transportation and information hub. Kuujjuaq, which means "Great River" in Inuktitut, is located on the western shore of the Koksoak River, approximately 50 km upstream (south) of Ungava Bay. Modern day Kuujjuaq is a thriving, rapidly growing village with a population that takes pride in traditional Inuit culture and local initiatives.

Local Food The term "local food" is often used to refer to food that is produced near its point of consumption in contrast to food delivered from more distant sources through the mainstream industrial food system. The local food movement is a social phenomenon that is gaining more ground worldwide each year. At the root of this movement are initiatives that are often referred to as either Community-based Food Systems (CFSs) or Local Food Systems (LFSs). Collectively, these initiatives are understood to be collaborative efforts to build locallybased food systems and economies.

Market Food Market foods, or store-bought foods, are foods that are imported from southern markets and purchased at stores.

Nunavik Nunavik is an Inuit Territory located in the Canadian Eastern Arctic. It is part of what is known in Canada as the Inuit Homeland, or "Inuit Nunangat." Nunavik covers roughly 660,000km^2, approximately one third of the landmass of the province of Quebec.

Qallunaat Qallunaat is a term used to refer to people who are non-Inuit, typically people of European or European-Canadian descent.

Sustainable Development Sustainable development, as originally defined by the World Commission on Environment and Development, is "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

To the staff at the Nunavik Research Centre:
On behalf of all the students and young
researchers you have helped over the years—
Heartfelt thanks

"Inuit invented the 100-mile diet, and
continue to live off the bounty of the land."
– Inuit Tapiriit Kanatami

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A big part of this research involved speaking with the community to get a sense of how best to move forward with project development. For this, I want to extend my express appreciation to all the community members and local and regional leaders who participated in formal interview sessions as well as those who generously shared their views and ideas in numerous informal conversations over the years. Your thoughts and suggestions form the basis of the results presented in this thesis.

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Preface

When I boarded the Air Inuit flight to Kuujjuaq for the first time in the fall of 2009 I had no idea of the extent to which this project would evolve in just six short years. At the time, I was very nervous that the idea of northern greenhouses would be categorically rejected by the community, and that I would return home at the end of my first field season with the news that the idea of growing fresh food in a northern village was just another idealistic (and unrealistic) scheme from the South. Nothing could have been further from the truth; within a very short time I discovered that a number of Kuujjuamiut (residents of Kuujjuaq) had already been experimenting with small-scale greenhouses and gardening for decades, and that the idea of launching a new greenhouse project in the village was generating real curiosity and interest from virtually all sectors. To my immense relief, in the months that followed my first trip to Kuujjuaq, local and regional leaders, community members, as well as governmental and paragovernmental partners embraced the idea of an alternative local food project in Nunavik, and together we began to plan the development of the Kuujjuaq Greenhouse Project, the initiative that is at the heart of this research.

The pilot project that is the focus of this work grew out of research that began in the fall of 2009. This research eventually formed the core of my master's thesis, entitled "Greenhouses in Arctic Communities: A Study of the Perceptions of Nunavimmiut Regarding Alternative Systems of Food Production." The results of this work have been integrated into this PhD thesis. This early research involved speaking with community members, community leaders, and potential stakeholders and supporters about the level of interest in greenhouse-based agro-food development in the North, development that could potentially help address some of the food security issues as well as social and environmental challenges present in Inuit communities. The results of this research were overwhelmingly positive—a real interest was demonstrated—and in the months between the end of the initial study in 2009 and the beginning of "Phase I of the Kuujjuaq Greenhouse Pilot Project" in 2011, a number of interest groups (from all levels of government, from research institutions, and from the NGO and paragovernmental sector) pledged their support to the development of this initiative. The Kuujjuaq Greenhouse Project was hence put in place to serve as an incubator for eight horticultural microprojects that all tied into the previously existing community greenhouse in the village. Following positive outcomes in 2011, Phase II of the Kuujjuaq Greenhouse Project was initiated in 2012, and the original eight microprojects were further developed. Since the fall of 2010 the development and implementation processes surrounding these microprojects became the main focus of this research, and, while the project itself is ongoing, it is results obtained during the first two seasons (2011 and 2012) that form the bulk of the research material upon which this PhD thesis is based.

It is important to mention here that this PhD research does not address specific technical and/or economic aspects of constructing or operating northern greenhouses.[1] The focus of this work is the process of developing and implementing alternative, culturally appropriate ways of addressing food security issues in northern and remote regions, regions where innovation will be the key to adaptation and resilience in this era of rapid sociocultural and environmental change.

[1] Work of this nature has not only been thoroughly done in the past (see Romer, 1987, for one of the first notable examples), but has also been recently revisited by others who specialize in the field of controlled environment agriculture (see Aurora Research Institute, 2013, and Villeneuve and Vallières, 2012). Further to this, the potential of northern greenhouses for economic development has been covered in detail in a study that was recently commissioned by Agriculture and Agri-Food Canada entitled "Understanding Sustainable Northern Greenhouse Technologies for Creating Economic Development Opportunities and Supporting Food Security" (see Agriteam Canada Consulting Ltd, 2013).

Chapter 1.

Food in the North

Rapid sociocultural and environmental change in the Arctic is profoundly altering the Canadian North. The region's remote communities face a complex array of social, economic, and environmental challenges. Notable among these are acute food security issues, especially problems relating to the availability, quality, and cost of fresh fruit and vegetables (Chan *et al*, 2006; Power, 2008; Damman *et al*, 2008; FSC, 2011; De Schutter, 2012; ICC, 2012; Payne, 2013; Council of Canadian Academies, 2014). This research project was formulated with the idea of developing a viable way to mitigate this specific food security issue, while at the same time addressing some of the larger social and environmental issues affecting the North.

The general objective of this work, which was based on an action research approach, was to develop a sustainable, culturally appropriate northern agricultural framework for the eastern Arctic. The specific objective was to participate in and document the development of the greenhouse pilot project in Kuujjuaq and, through this process, develop potential alternatives to the current food system in Nunavik. The research question that was the focus of this PhD project was the following: "Can a new type of greenhouse-based local food strategy in Nunavik make a sustainable, culturally appropriate contribution to community capacity development if it is informed by ecological design, grounded in Inuit praxis, and developed in a manner that meets the distinctive current and future needs of Inuit communities?"

This thesis is divided into eight chapters. The goal of chapters one and two (entitled "Food in the North" and "Agriculture in the North") is to set the stage for the reader by describing the social and historical context of this PhD project. The focus of the third chapter (entitled "Mobilizing an Alternative Northern Food Strategy") is to introduce the theoretical concepts that form the framework of this thesis. They are as follows: Local Food, Ecological Design, and Community Capacity. The fourth chapter carries the title "Action Research in the North" and its purpose is to explain how the concepts introduced in the third chapter were applied and operationalized within the context of this research. This is where the research methodology (Community-Based Participatory Research) is introduced to the reader. The fifth chapter presents the data collected during the course of this research. It is entitled "The Kuujjuaq Greenhouse Project – Turning an Idea into Reality." The sixth and seventh chapters (entitled "Greenhouse-Based Food Production in Nunavik: Challenges and Resources" and "Framework for Developing a Greenhouse-Based Food Production Strategy in Nunavik") are where the results are discussed, analyzed, and moulded into the final results. The title of the last chapter is "A Future for Northern Greenhouses?" and consists of thoughts regarding the long-term feasibility of projects such as this one, as well as a summary of the research results, areas of interest for further research, and a general conclusion.

As noted in the previous paragraph, the purpose of this first chapter is to introduce the reader to the sociocultural context within which this research has been elaborated and, in so doing, provide the background information that is essential for understanding why, in fact, this research was undertaken. The first subsection of this chapter will introduce the concept of food security and examine the main food issues facing Northerners in Canada today. This will be followed by an overview of the history and geography of the territory where this work was conducted in order to situate the reader in time and place. While Inuit have historically been virtually self-sufficient in all aspects of their lives (including food provisioning), the rapid modernization of their society has imposed constraints on their ability to remain so. In order to understand this phenomenon, the second section of this chapter will provide an overview of Inuit food provisioning and consumption practices, including an in-depth overview of the cultural transformation—as it relates to food—that has swept through Inuit society over the last few generations as well as a review of the main issues regarding food practice in Nunavik today.

1.1 Food Issues and the Northern Social Context

1.1.1 Food Security in the Canadian North

Since the goal of this work is to examine local food production in the North, it is pertinent to open this section with a brief introduction to the concept of food security. The most widely accepted definition of food security is the one issued by the Food and Agricultural Organization (FAO) at the World Food Summit in 1996. It states that "Food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food which meets their dietary needs and food preferences for an active and healthy life" (FAO, 2006: 1). This definition of food security—which was endorsed by the Canadian government in the same year (AAFC, 1998)—comprises four dimensions: availability, access, utilization, and stability (FAO, 2006: 1). These are sometimes referred to as the pillars of food security. Power (2008) proposes that the currently accepted notion of food security be expanded to include a new category—that of "cultural food security" — when it is applied to Aboriginal peoples. The reason is that the harvesting of food in traditional systems is not only key to cultural identity, health, and survival but is also the primary means of transmitting cultural values, skills, and spirituality. Indicators of cultural food security include levels of traditional food knowledge, access to traditional food systems, and the safety of traditional/country food (Power, 2008: 96).

Complementary to the concept of food security is the concept of food sovereignty. This is a notion that has at its core a set of goals that include strengthening community, enhancing livelihoods, and ensuring that nutritious and culturally appropriate food can be produced, distributed, and consumed in a socially and environmentally sustainable way (Desmarais and Wittman, 2014). Food sovereignty is much more encompassing than food security and the right to food because it places questions of what food is produced, where, how, by whom, and at what scale at the centre of public debate and also raises similar questions about food consumption and distribution (*ibid.*). In discussing food sovereignty in an Aboriginal context, the Indigenous Circle of Food Secure Canada emphasizes that "Food sovereignty understands food as sacred, part of a web of relationships with the natural world that define culture and community" (PPFP, 2011).

According to Delisle (1998), food security is a translation of the basic human right to food and is an important factor in determining quality of life. This author considers food security from two perspectives: the first is qualitative (dealing with the variety, safety, and social and cultural acceptability of food); the second is quantitative (touching on the availability of calories and nutrients). Delisle also underscores the difference between food security and nutritional security. While the first refers to a state of nutrition that is acceptable for the human body, the second refers to a state of well-being stemming from a healthy diet and access to health care (*ibid.*). Duhaime and Godmaire (2002) further elaborate upon this theme, stating that food security is "the result of the relations between social factors (demography, health), intermediating mechanisms (food production and circulation in the market and non-market spheres), and food consumption determinants (accessibility, availability)." It is important to note that the concept of food security can be approached at all levels of geographic scale: the individual, the household, the community, the region, the nation, and finally, the world.

It is widely acknowledged that food insecurity is an urgent public health issue for all Aboriginal peoples in Canada, Inuit included (Chan *et al*, 2006; Power, 2008; Damman *et al*, 2008; Council of Canadian Academies, 2014). In a recent discussion paper issued by Food Secure Canada, the authors state that "Indigenous people, especially from the North, encounter many problems in accessing healthy, inexpensive and nutritious foods" (FSC, 2011: 11). These problems were underscored by Olivier De Schutter (United Nations Special Rapporteur on the Right to Food) during his visit to Canada in 2012 (De Schutter, 2012), and were also highlighted in a recent interview given by Terry Audla, president of Inuit Tapiriit Kanatami (the organisation representing all Canadian Inuit). Mr. Audla noted that "Access to nutritious food is a very real crisis for Inuit who eat less "country food," which they harvest, and more food from the South, which is increasingly out of many people's financial reach" (Payne, 2013). High rates of poverty, the effects of climate change, pollution of traditional food systems, and high rates of diet-related diseases are all understood to be principal contributors to Aboriginal food insecurity (Power, 2008; FSC, 2011; ICC 2012).

To fully appreciate the complexity of the food security issues faced by Nunavimmiut (residents of Nunavik), it is important to take into consideration the current social situation in the region. Inuit in Nunavik, especially those living in the village of Kuujjuaq, are experiencing sociocultural change at a very rapid pace compared to populations living in the Canadian South. This change in way of life has engendered certain serious socioeconomic problems—problems mirrored in Inuit communities across all of northern Canada. The socioeconomic issues that generally receive the most attention in the media include substance abuse, high rates of suicide, crowded living conditions due to lack of available housing, low rates of academic success, high rates of unemployment, and a rapidly growing population (more than 60% of the population in Nunavik is under the age of 30) (Makivik Corporation, 2013a). All of these issues play into the cycle of poverty that affects a disproportionate number of northern residents (compared to residents of southern Canadian communities), and these issues are further compounded by the very high cost of living in Arctic communities. This high cost of living translates into a high cost of food, which, in turn, contributes significantly to the high rate of food insecurity in the Canadian North.

1.1.2 Introduction to Nunavik and to the Northern Village of Kuujjuaq

The territory where this research was conducted is the Canadian North, with a particular focus on Nunavik, the Arctic region of the province of Quebec (for a map of Nunavik, see Figure 1). A defining characteristic of the North, and one that is central to the purpose of this research, is that it is geographically remote from urban centres of production and distribution—what Hamelin (2003) calls southern "bases." According to Hamelin, the Canadian North can be divided into four sub-groups, or belts. They are: the Near North, the Middle North, the High North, and the Far North (Hamelin, 2003). These belts cover ecosystems ranging from the Boreal Forest and Subarctic to the Arctic and High Arctic. While classifying northern regions by ecosystem is pertinent for physical geographers, this method does not provide enough layers of information for research grounded in human geography. Hence, in this work, in addition to environmental classification, northern regions (and villages) will also be defined by the social and economic factors that shape their relationship with the world around them.

Nunavik is part of what is known in Canada as the Inuit Homeland, or "Inuit Nunangat." Inuit Nunangat encompasses the land, water, and ice of the Canadian Arctic (ITK, 2012). This region comprises, from east to west, Nunatsiavut (Northern Labrador), Nunavik (Northern Quebec), Nunavut (formerly the eastern half of the Northwest Territories), and the Inuvialuit Settlement Region (covering the northwestern part of the Northwest Territories and the northern part of the Yukon Territory (Stern, 2010; ITK, 2012). Inuit Nunangat, in turn, is part of what is commonly referred to as the "Circumpolar World," the geographic region comprising Greenland, Nunatsiavut, Nunavik, Nunavut, the Inuvialuit Settlement Region, Alaska, and Siberia (Makivik Corporation, 2009). In a political context, the Circumpolar World may also refer to the eight member states of the Arctic Council: Canada, Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, the Russian Federation, Sweden, and the United States of America (Alaska) (Arctic Council, 2011).

FIGURE 1 Map of Nunavik.

Source: www.makivik.org/images/map/01_nunavik.gi

The Inuit Territory of Nunavik is part of the region commonly referred to as the Canadian Eastern Arctic. Nunavik covers roughly 660,000km^2 and contains approximately one third of the landmass of the province of Quebec (Makivik Corporation, 2009). Inuit have inhabited the territory of Nunavik for over 4,000 years. Like all polar peoples, Nunavik Inuit were a nomadic population until their adoption of a more sedentary lifestyle during the middle of the 20th century. This lifestyle change was influenced (and driven) by contact with Euro-Canadian modes of living, and scholars agree that the most notable changes to Inuit lifestyle came about over the course of four distinct, recent historical periods. As described in Collignon (1993: 72), these periods are: 1) The Hunting Period (that ended in the 1920s and 1930s), 2) Trapping Period One (which ran until the relocation of settlements in the 1950s and 1960s), 3) Trapping Period Two (which is also called Settlement Period One, and which ran until the 1970s), and 4) The Contemporary Period (which is also called Settlement Period Two and is still developing).

During the past 300 years the most significant sustained contact that Inuit have had with Qallunaat (non-Inuit) of European descent has been with whalers, missionaries, traders, and representatives of the Northwest Mounted Police (NWMP) and later the Royal Canadian Mounted Police (RCMP) (Brody, 1977; Bonesteel, 2006). In 1756, the Hudson's Bay Company (HBC) opened its first trading post in Nunavik at Whapmagoostui-Kuujjuarapik (then known as Great Whale River) (Bhiry *et al*, 2011). In 1870, when Rupert's Land was transferred to Canada and became the Northwest Territories, the administrative region that was to become Nunavik was given the title of the District of Ungava (Qumaq and Dorais, 2010). In 1912, the District of Ungava was annexed to the province of Quebec and the region became known as Nouveau-Québec.

In 1932, the first missionary school was founded in Kuujjuaq (then called Fort Chimo), and in the early 1940s the American Army established an air base across the river from the settlement (Mesher, 1995; Qumaq and Dorais, 2010; Makivik Corporation, 2012a). In the mid-1950s, a military airfield was also built at Whapmagoostui-Kuujjuarapik, which prompted Cree and Inuit families to settle nearby (Bhiry *et al*, 2011). In 1950, the federal government imposed schooling in all Inuit communities and, in the years that followed, government support, in the form of social transfer payments (family allowance and old age pension cheques), began to arrive in Nunavik (Gombay, 2010; Qumaq and Dorais, 2010).

In 1963 the "Direction générale du Nouveau-Québec" was created (*ibid.*) and following the signing of the James Bay and Northern Quebec Agreement (JBNQA) in 1975, politicians created the region of Kativik—the territory encompassing all of the villages situated above the 55th parallel (Lepage, 2005: 73).[2] Following the creation of the JBNQA, several key institutions, such as the Kativik Regional Government (KRG), the Kativik School Board (KSB), and Makivik Corporation, were created (Bonesteel, 2006; Makivik Corporation, 2012a).[3,4] The region, now officially known as Nunavik (meaning "place to live" in Inuktitut), became of real interest to Southerners when the Quebec government and

[2] The James Bay and Northern Quebec Agreement (JBNQA) was the first major comprehensive land claims agreement in northern Canada. Among other things, it provided financial compensation to First Nations and Inuit for the use of their territory—most notably for hydro-electric development (Bonesteel, 2006; Papillon, 2008). The JBNQA provided $225-million in compensation to the James Bay Cree and the Inuit of Northern Quebec, to be paid by Canada and Quebec. Compensation funding for the Cree was paid to the Cree Regional Authority, and for the Inuit it was paid to Makivik Corporation. In addition to settling native land claims and providing financial compensation, the agreements defined Aboriginal rights and established regimes for future relations between Aboriginal peoples and non-Aboriginals in the region and among local, regional, provincial, and federal governments. Harvesting rights were provided, land categories set out, and resource management regimes set up. School boards were created, health services were restructured, and regional governments were established (Makivik Corporation, 2014).

[3] Makivik, which in Inuktitut means "to rise up," is the name of the ethnic development corporation mandated to manage the heritage funds of the Inuit of Nunavik provided for under the 1975 James Bay and Northern Quebec Agreement (JBNQA) and the more recent offshore Nunavik Inuit Land Claim Agreement (NILCA) that came into effect in 2008 (Makivik Corporation, 2012c). Makivik's role includes protecting the rights, interests, and financial compensation of Nunavik Inuit beneficiaries. It also involves the administration and investment of the JBNQA heritage funds and the promotion of economic growth by providing assistance for the creation of Inuit-operated businesses in Nunavik. Makivik's objectives include preserving Inuit language and culture, relieving poverty, and promoting the health, welfare, and education of Inuit in the fourteen communities of Nunavik (KRG, 2014).

[4] The Kativik Regional Government (KRG) was created in 1978 pursuant to the James Bay and Northern Quebec Agreement (JBNQA) to deliver public services to Nunavimmiut (KRG, 2012). The KRG is a non-ethnic public organization. The organization has jurisdiction over nearly the entire territory of Quebec north of the 55th parallel in areas such as municipal matters, transportation, the environment, policing, employment, labour training, income security, childcare services, renewable resources, land-use planning, civil security, and economic development (KRG, 2014).

industry began to develop the mining and hydro-electric potential of the North in the 1950s (*ibid.*).[5,6]

This concerted interest in the North coincided with the beginning of the Inuit's permanent transition from a nomadic lifestyle to a sedentary one (Visart de Bocarmé and Petit, 2008). However, since Inuit were never subjected to the Indian Act, their villages have a status comparable to that of a municipality, not a reserve (Lepage, 2005: 73). There are over 10,000 Inuit in Nunavik living in fourteen villages along the Ungava Bay, Hudson Strait, and Hudson Bay coastlines (Makivik Corporation, 2013a).[7] These communities are situated between 1,000 and 1,900 kilometres from Montreal and, since there is no road network connecting these communities to each other nor to the South, year-round air service and seasonal maritime service are the principal modes of transport in Nunavik (*ibid.*). It is pertinent to note that the spatial organization of small cities and villages in the Arctic is primarily the result of the historical, cultural, and economic contacts established between Inuit and Qallunaat (Bergé-Gobit, 2008). Some changes are occurring, however, and it has been recently recognized that as a result of rapid growth northern villages are now experiencing what has been termed the "urban effect," in which suburban growth, expanding road networks, increased vehicle use, and other features of larger centres are beginning to appear (Desbiens and Ruffin, 2009).

The fieldwork portion of this project took place in the village of Kuujjuaq—the administrative centre of Nunavik. Kuujjuaq, which means "Great River" in Inuktitut, is located on the western shore of the Koksoak River, approximately 50 km upstream (south) of Ungava Bay. The first permanent settlement in the area was a Hudson's Bay Company (HBC) fur trading post, called Fort Chimo, which was established 5 km downstream from

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5 Inuktitut is the Inuit language; it is still spoken by 95% of Nunavik Inuit (Makivik Corporation, 2012a).

6 The term "southerner" is used in the Canadian North to refer generally to people who are from, or who live in, southern Canada.

7 According to the most recent Canadian census, held in 2011, the total population of Nunavik is 12,090 persons, of whom 89% are Inuit (Nunivaat, 2013). However, it is important to point out that the rate of population growth in Nunavik is one of the highest in the country—in 2011, 34% of the population was under the age of 15, and 68% of families were living in overcrowded conditions. Thus, the numbers cited above are already out of date.

present-day Kuujjuaq, on the eastern shore of the river. The construction and occupation of a U.S. Army Air Force base (Crystal 1) in the early 1940s, on the western shore of the Koksoak, favoured further development of the area, and after the U.S. turned the base over to the Canadian government following World War II, a Catholic mission, a nursing station, a school, and a weather station were permanently established at this site (Makivik Corporation, 2013b). Kuujjuaq is now the largest settlement in the region and also a critical transportation and information hub (Statistics Canada, 2013; Makivik Corporation, 2013b).

In 2011 the Canadian census calculated that the total population of Kuujjuaq was 2350. However, given rapid population growth, the total population is now is estimated to be well over 2500. This number refers to both Beneficiaries of the JBNQA (Inuit) and Non-Beneficiaries (Qallunaat). In June 2015 the number of recorded Beneficiaries living in Kuujjuaq was 2,015 (Nunavik Enrolment Office, 2015).

Modern day Kuujjuaq can be characterized as a thriving, rapidly growing village with a population that takes pride in traditional Inuit culture and local initiatives. As a dynamic northern community that has the ability to successfully combine modern innovations with traditional mores, it is an eminently logical place to envision implanting (and experimenting with) a new type of local food strategy in the North.

1.2 Overview of Inuit Food Provisioning and Consumption Practices

1.2.1 Transformation of Inuit Food Practice during the 19th and 20th Centuries

For centuries, Inuit have lived in tune with the Arctic seasons and have employed essentially the same techniques for harvesting and preparing food from the land year after year, generation after generation. Even today, when modern tools such as guns, boats, and snowmobiles are used, many of the techniques remain the same, and it goes without saying that the types of foods harvested are also the same as those harvested by generations gone by. This said, Inuit food practice has most definitely been transformed (and continues to be transformed at an ever increasing rate) by the forces of change that are driving and accompanying the North's rapid integration into the global economy.

In order to understand the impact and effects of this transition on Inuit society, it is important to first understand the background. Before transitioning to a sedentary lifestyle in the 1940s and '50s, Canadian Inuit were almost exclusively hunter-gatherers, ensuring their food security principally through hunting (Counil, Gauthier, and Dewailly, 2010), and complementing and adding variety to their diet with plant foods (Bennet and Rowley, 2004).

In the past, hunting was an activity reserved for Inuit men, and the principal species targeted in the Canadian Arctic were seal, walrus, beluga, and caribou. Other prized species of marine mammals included narwhal, bowhead whale, and occasionally polar bear (Bennet and Rowley, 2004). Other species of land mammals hunted in the Canadian Arctic include musk ox, fox, wolf, wolverine, and small animals such as squirrel and arctic hare (*ibid.*). Birds and their eggs were also much appreciated, and preferred species of birds included ptarmigan, murre, snow goose, canada goose, eider duck, and sometimes seagull (*ibid.*). Fishing, a communal event, also contributed significantly to the diet of the Inuit, and the species most commonly harvested included arctic cod, arctic char, sculpin, lake trout, whitefish, and salmon (*ibid.*).

Traditionally, the gathering of foodstuffs, including plant foods and shellfish, was considered women's work (Bennet and Rowley, 2004), and knowledge was passed down from mothers to daughters. As Aalsie Joamie, an Elder from Nunavut recalled:

> My mother taught me which plants were good. I would listen as she talked about them. I would watch my mother collecting plants. Some plants are edible and some are not. Others have medicinal uses.
>
> (Joamie and Ziegler, 2009: 7)

The types and parts of plants that were incorporated into the diets of Inuit included berries (blueberries/bilberries, crowberries, bearberries, mountain cranberries, and cloudberries/bakeapples), leaves (willow leaves), flowers and blossoms (fireweed, pussy willow, and mountain sorrel), as well as different types of roots and lichens (Kuhnlein and Turner, 1991; Bennet and Rowley, 2004; Joamie and Ziegler, 2009). Certain types of seaweeds, as well as clams and mussels, were also commonly gathered from intertidal zones (Bennet and Rowley, 2004; Joamie and Ziegler, 2009).

The hunter-gatherer lifestyle illustrated in the preceding paragraphs corresponds to what is known as a traditional indigenous food system. Kuhnlein and Receveur (1996) define traditional food systems as those systems that are composed of items from the local natural environment that are culturally acceptable. Willows (2005) adds that sociocultural meaning, acquisition, processing techniques, use, composition, and nutritional consequences for the people consuming the food are also important aspects of traditional food systems.

When discussing the topic of food provisioning and consumption in Nunavik, it is important to note that Inuit today make a distinction between two very different types of food groups. These two groups are “country foods” and “market foods”—sometimes referred to as “Inuit foods” and “Qallunaat foods” (Searles, 2002). Country foods, or traditional foods, are those that are defined as being culturally acceptable foods that are available from local natural resources and that constitute the food systems of Aboriginal peoples (Willows, 2005). Country food is normally given or shared; it is rarely paid for. Market foods, or store-bought foods, on the other hand, are foods that are imported from southern markets and purchased at stores. The term “industrial food” is sometimes used interchangeably with the terms market food and store-bought food, but it is important to note that, whereas the term industrial food refers specifically to food items that are usually rich in refined sugars and saturated fatty acids (i.e., “junk food”) (Duhaime *et al*, 2002), the other two terms refer to any and all food items that are purchased at a store, including healthy, unrefined, and unprocessed food items, such as fruit and vegetables, milk, flour, and pasta.

The role that traditional food plays in the lives of Inuit today has altered considerably since the sedentarization of communities and the “westernization” of diets (Counil, Gauthier, and Dewailly, 2010), and while traditional foods are still consumed regularly, today they only make up about 15–20% of the daily diet in Nunavik (Gombay, 2010; Grasser, 2011). How did Inuit transition from meeting virtually 100% of their food needs from the land less than a century ago to meeting only a small percentage of their dietary needs through this type of food procurement today? The answer lies in the larger story that is the "discovery" or "colonization" of the North, as changes in Inuit food practice over the last two centuries are directly related to the overarching sociocultural and environmental changes that have taken place in Inuit Nunangat over this time period.

While there is substantial historical evidence that Inuit did engage in trade across the circumpolar North even in the distant past (McGhee, 2005; Stern, 2010), it was not until the sustained presence in the North of European whalers, missionaries, and fur traders that non-traditional foods (initially things such as flour, sugar, lard, and tea) became incorporated to a significant degree in the Inuit diet. It was not until the relatively recent creation of regular air routes to the North that the variety in available foodstuffs increased exponentially, and that things such as fresh milk and fragile fruit and vegetables became incorporated into the Inuit diet.

While it must not be forgotten that historical events had profound effects on all aspects of Inuit life in Nunavik, for obvious reasons I will focus this discussion on the changes that occurred with respect to food practice. The most immediately obvious change concerns the types of tools and equipment that hunters used to obtain food from the land—tools and equipment that can be directly linked to the historical events that brought Inuit into sustained relationships with Qallunaat. With respect to the whaling industry, Inuit often traded items obtained through their traditional subsistence procurement strategies (such as caribou skins and meat, whalebone and baleen, walrus ivory, soapstone, dogs, and fish) for European household goods (such as metal knives and needles, rifles, tobacco, cloth, and food) (Brody, 1977; Bonesteel, 2006; Stern 2010). With respect to the fur trade (which filled an economic void after the collapse of the whaling industry at the end of the 19th century), Inuit were encouraged to trap ever increasing numbers of fox (*ibid.*) in exchange for much of the same types of European goods as before, including food items that were rapidly becoming staples in the Inuit diet such as flour, sugar, lard, baking powder, and tea (Searles, 2002; Counil, Gauthier and Dewailly, 2010). This involvement in the global economy changed the way that Inuit hunted for food to feed their families (e.g., using guns instead of spears), and also changed food provisioning practice in that Inuit were now able to buy and/or trade for new types of Euro-Canadian foodstuffs and supplement the food that they could harvest from the land. Furthermore, there are references to moments in time when Inuit—starving due to lack of available natural food resources—were able to survive because they had access to food from missionaries and trading posts (Mesher, 1995).

While trade relations were not always equitable—the traders often held the proverbial "big end of the stick"—it is to be noted that Inuit trade with European whalers and later with the HBC and Révillon Frères (a small French trading company) represented a type of economic model that was quite compatible with the nomadic lifestyle of the era. As noted by Stern (2010), "the activity of trapping was compatible with subsistence hunting." However, when international events (the First and Second World Wars and the Great Depression) drastically affected the demand, and therefore price of furs (Brody, 1977; Bonesteel, 2006; Stern, 2010), the hybrid hunting-gathering/trapping-trade lifestyle of Canadian Inuit was greatly affected. There are even some documented instances of starvation when Inuit, who had become dependent on trade goods for survival (guns and ammunition to hunt for country food and market food to supplement their diet), could no longer meet their basic needs (Brody, 1977; Gombay, 2010).

The building of the US Army Air Force Base at Fort Chimo (now Kuujjuaq), and the airfield at Whapmagoostui-Kuujjuarapik brought two changes that marked a significant turning point in Nunavik: the introduction of wage labour to the region and the importation of new types of market foods (for example, Coca Cola). During this time, while wage labour became an option available to Inuit, it was not yet a viable year-round alternative to traditional food provisioning strategies because Inuit were not yet living permanently in settlements. Instead, they were still highly mobile, following the traditional seasonal cycles of hunting, fishing, and gathering. Wage employment, in contrast to past subsistence economies and trade relationships, represented an economic model that was difficult to reconcile with a nomadic existence but one that, for better or for worse, now dominates in Inuit Nunangat. As Gombay (2010: 101) notes: "Having moved to settlements ... Inuit moved by default into the economic system that underpinned those settlements, and came to rely more and more on money to provide the necessities of life."

Following the end of World War II, a number of sociocultural factors, most notably "white man's diseases" such as polio, tuberculosis, influenza, measles, scarlet fever, and mumps, contributed to the social and economic dependence of Canadian Inuit on traders, missionaries, and other white colonial agents (Brody, 1977; Mesher, 1995; Gombay, 2010: 97). This era in the history of Nunavik represents a point in time when old ways and new ways co-existed, when Inuit were still living primarily in igloos and tents, and government workers and missionaries were living in wooden houses (Haché, 2009). It was at this time that the biggest transformations in Inuit food provisioning and consumption practice began.

As links between the North and the South grew stronger, Inuit began to incorporate more and more "modern" technologies into various aspects of their daily lives, including the realm of food practice. In terms of provisioning ("getting food"), Inuit men had already been using guns to hunt for generations (Brody, 1977; Saladin d'Anglure, 2001), but in the years following World War II many other new tools and types of equipment made their appearance in the North. Notable examples include snowmobiles (replacing dog teams), boats with outboard motors (replacing *qajaks* and *umiaqs*), all-terrain vehicles (replacing the need to walk over long distances), and more recently, electronic technologies such as GPS (global positioning systems) and satellite phones. While many traditional tools have been replaced by more efficient or effective modern tools, one notable exception in food practice should be underscored: the *ulu*, or woman's knife. This half-moon–shaped metal blade usually has a bone or wooden handle. It is used for everything from preparing food to preparing skins, and is as ubiquitous in Nunavik today as it was generations ago. As Ford (2013) has noted, it was not always the tool itself that was replaced, but simply the material with which the tool was made: "many traditional tools are still used today, it is just that they are made with steel or lumber, etc., instead of bone or rock for example" (see Figure 2).

It is also important to mention here that, in Nunavik, the transition to snowmobiles from dog teams was not one that was driven entirely by Inuit. "According to approximately 200 reports made by Nunavik Inuit, a series of dog slaughters was undertaken, or ordered to be undertaken, by Canadian and Quebec government officials or their representatives in several Nunavik communities from the mid-1950s until the late 1960s" (Makivik

Corporation, 2012b). For many years the RCMP claimed that there was no RCMP or federal policy to eliminate sled dogs, but they do admit that RCMP officers “destroyed some dogs because they were disease-ridden, hungry, the number of dogs was too high, or because they were dangerous” (*ibid.*).

FIGURE 2 Traditional sleds (qamutiit) made with modern materials.
Photo: Author’s personal collection

However, it has been claimed that the Nunavik dog slaughter was a direct attempt by white colonial agents to encourage Inuit to stay in the settlements by destroying their principal means of transportation. In a study conducted by Levesque (2008), it was concluded that while northern administrators did forcefully control Inuit dogs in order to limit certain risks, the overall objective was never to eliminate them all. Nevertheless, it seems that the killing of the dogs was at least indirectly a consequence of the desire of the Canadian and Quebec governments of that period to promote a southern lifestyle in a northern context. In the summer of 2011 the Premier of Quebec at the time, Jean Charest, formally apologized to the Inuit of Nunavik for the slaughter, but the fact remains that, not only did Inuit lose their principal means of transportation, they also lost one of their principal pieces of hunting "equipment." This, in turn, had a direct effect on the food provisioning strategies of Nunavik Inuit during this era. Following the event, men were no longer able to feed their families in the way they were accustomed to. Forced to modify their provisioning strategies, they turned to what wage employment was available, as well as activities such as stone carving and the sale of arts and crafts. It is interesting to note that the era of the dog slaughter coincides with the introduction of government support (namely welfare) in the North, and that this option was also regularly used to provide for families during that time (Brody, 1977; Gombay, 2010).

While changes in food provisioning tools and strategies were important, it is also pertinent to discuss the fact that there were also changes in the places where food came from over time. In the distant past all food was harvested from the land; in the recent past food could also be bartered or traded for at trading posts. Once permanent settlements were established, general stores became fixtures in the North. In Nunavik today there are usually two main stores in every village: the "Northern" store, which is a retail banner that was introduced in 1990 as part of the renaming of the former HBC outlets (North West Company, 2012) and the "Co-op" stores, which are run by the "Fédération des Co-opératives du Nouveau-Québec"—an Inuit organization that grew out of two separate Inuit co-operative initiatives initiated in Puvirnituq in 1959 and in Kangiqsualujjuaq in 1960 (Gombay, 2010). It should also be noted that in Kuujjuaq (which is the administrative centre of Nunavik and the largest of the fourteen villages) there is a third, independently owned, store called Newviq'vi and Tullik. During the initial years following the introduction of formal stores into settlements, the types of market foods available were limited to basic staples, and country food still made up a significant portion of the Inuit diet. However, as new types of market foods began to make their appearance on store shelves over the decades (and wage employment began to take precedence over hunting and gathering), the balance between country food and market food in Inuit diets began to shift in favour of the latter.

This shift in food provisioning and its resulting consequences will be examined in detail in the following section. However, before moving on, it is important to mention something that eloquently illustrates how food practice has evolved in the North. Flour, sugar, baking powder, lard, and tea are not country foods, but bannock (made from flour, baking powder, and lard) and tea are now considered typical "traditional" Inuit foods. As well, certain traditional meals that are cooked today (e.g., caribou stew) often contain ingredients such as potatoes, turnips, carrots, and onions—vegetables that, although they are not from the land, have nevertheless become key ingredients in certain "traditional" meals today. Loring and Gerlach (2010: 185) have also noted that "potatoes, turnips, and rutabagas, none of which are native to Alaska, are all considered "traditional" foods in the recipes and menus of the Athabascan potlatch ceremony and favorite home dishes." These examples demonstrate how elements of culture are not necessarily fixed in time and how food practice reflects this.

Another aspect of culture that is important to explore briefly is the Inuit practice of sharing. This is one of the elements of Inuit food provision and consumption practice that is central to Inuit culture, and it is also one of the elements of Inuit food practice that does not seem to have changed in any significant way over the course of history. As many researchers have noted, Inuit have a rich relationship with food, and the Inuit concept of sharing is something that is fundamental to this relationship. In a study by Duhaime *et al* (2003), the concept of giving and sharing food was examined. The results of the study show that "in the informal sector, food comes from "auto-production" (hunting, fishing, and, gathering) and then circulates between individuals and households via reciprocal methods of exchange, such as giving and sharing" (my translation). While there has been a certain amount of commoditization of country food in recent decades (Gombay, 2010), market food is now regularly shared as well. In general the Inuit tradition of sharing country food has not fallen by the wayside in Nunavik and is still a central component of day-to-day life. As noted by Stern (2010: 40): "The unrestricted sharing of food and other items related to subsistence harvesting continues in Inuit communities in every region of the North." The parallels between this type of sharing activity in a northern context and the sharing of garden produce in southern contexts (as described in Boulianne, 2014) is worth noting, as this cultural similarity is perhaps a basis upon which a new model of local northern food production could be constructed.

1.2.2 Main Issues Regarding Food Practice in Nunavik Today

Today, the main issues that surface during any discussion of Inuit food practice all relate in some way or another to the concept of food security as described previously, and in one way or another all of the cornerstones of food security tie into the issues that are at the heart of Inuit food practice. Inuit in Nunavik, while simultaneously facing many challenges and obstacles, have found ways to keep alive traditional food practices (for example, hunting, fishing, berry picking, and getting together for family meals and community feasts), while at the same time incorporating new modes of provision and consumption into their lives. In some cases, these new modes have brought about negative repercussions, such as diet-related disease (Counil, Gauthier, and Dewailly, 2010), but in other cases they have made way for the creation of "new traditions": for example, making sushi with fresh local fish and Japanese rice bought at the store, or eating traditional food while sitting at a table instead of on the floor—something that Searles (2002: 73) refers to as "syncretic" behaviour. The following subsections will explore this ever-evolving situation by examining Inuit food practice and how it relates to the following five factors as they affect current daily life: culture, economics, health, the natural environment, and political/territorial governance.

1.2.2.1 Culture and Inuit Food Practice. As recently as the 1940s and '50s many Inuit were still living in igloos and tents, and while it was possible to trade for certain "luxury" food items at trading posts, Inuit were still essentially dependent upon the land for food. While the introduction of grocery stores in the North has brought with it a certain amount of food security (for example, death from starvation is no longer a threat), this new way of obtaining provisions has engendered a certain disconnection between people and the food that they consume. Yet, while it is true that the introduction and ubiquitous consumption of market food has had a tangible impact on Inuit culture, it does not seem that there is any danger of country food becoming obsolete; it is too closely tied to Inuit identity for this to happen (Searles, 2002: 74).

Today, country food is still held in very high regard in Nunavik and, although it no longer composes the bulk of northern diets, it is still consumed regularly and is almost always viewed as being superior to market food. For example, many Inuit speak to the fact that meat and blood provide a type of long-lasting warmth, as well as strength and energy, that can be obtained in no other way (Searles, 2002), and that berries and certain indigenous plants can help cure various ailments. While it is virtually unheard of these days for men to be full-time hunters, traditional activities such as hunting, fishing, and gathering berries are still very much a part of life in Nunavik. Many families have camps or cabins on the land and spend weekends and holidays practising traditional activities. Summer camps are often only accessible by boat or ATV, and winter ice-fishing grounds are often reached by snowmobile across frozen rivers, lakes, and stretches of tundra that are not easily accessible at other times of the year. It is also interesting to note that on the days that the first berries begin to ripen in summer, many women call in "sick" to work, and when the caribou or geese arrive on the outskirts of town, office work gets relegated to the back burner—evidence that traditional cultural activities surrounding food practice still take precedence over modern ways of earning a living.

Closely related to this is the fact that many people often bring up the notion that food helps strengthen ties between generations. For example, mothers often speak about how much they enjoy berry picking with their daughters, and men take real pride in teaching young boys how to hunt.[8] Today, the importance of country food to the maintenance of culture has even been taken up as a cause by a number of regional governing bodies in Nunavik. Evidence of this can be seen in the posters promoting country food in many public places, and by the inclusion of food-based curriculum in the culture classes in Nunavik schools. As well, country food is now also an important part of the meal plan in Nunavik daycares—helping to teach children the importance of including it in their diet from an early age. It also goes without saying that country food is always on the menu at Elders' homes. Furthermore, while cooks at the hospital cafeteria in Kuujjuaq will not prepare country food (i.e., raw meat meals) in the main kitchen, the hospital administration is open to allowing visitors to bring country food to

[8] It is pertinent to note here that in Inuit culture the roles that are attributed to men and women in society are very distinct, yet also complementary and interdependent (Stern, 2010). In the past, men were primarily hunters and were responsible for not only the hunt but also for manufacturing and maintaining all of the necessary equipment. In turn, women were responsible for the preparation of the food and also for the sewing of clothing (parkas, kamiiks [boots], pualuks [mittens], etc.) that the men needed to survive while out on the land for weeks on end (ibid.). Today, while these cultural mores are generally unchanged (for example, a girl's ability to sew is highly regarded), I do know of some young women who also hunt.

patients, thus reinforcing the belief that eating country food helps with the healing process. Another interesting fact, which was touched upon briefly in the previous section and relates directly to the bond that exists between food and culture, is the way that the Inuit tradition of sharing food has been extended to include the sharing of market food. As Dorothy Mesher (1995: 85) states: "Food does not belong to one special person; it belongs to *everybody*".

1.2.2.2 Economics and Inuit Food Practice. In the previous section, the fact that many families still actively participate in traditional food provisioning and consumption activities was introduced. However, it is important to mention that in order to participate in these types of activities, families must have the financial means to do so: people must have well-paying jobs in order to buy the equipment necessary to go out on the land (Gombay, 2010; Stern, 2010). Today, some of the typical expenses include guns and ammunition, boats and fishing gear, a snowmobile (*sikiitu*), all terrain vehicles (ATVs—or Hondas as they are referred to in Nunavik), *qamutiit* (sleds pulled by dog teams or snowmobiles), a *tupik* (a type of cloth tent), a *qamaq* (a type of tent erected on a solid base), and 4x4 pickup trucks and trailers (Stern, 2010; Ford, 2013). Things such as gasoline, spare parts, outdoor clothing, and camping gear also represent important expenses. When everything is tallied up, it becomes obvious that people with lesser means can simply not afford to participate fully in traditional activities. Generally speaking, a person in Nunavik today needs to have a job and participate in the nine-to-five economy in order to be able to undertake traditional activities and participate in the vernacular economy. This situation is paradoxical, in that having a nine-to-five job limits the time that Inuit have to go out on the land, hence limiting the amount of country food that can be incorporated into the diet and making people dependent on market food, which can only be bought with money earned through wage employment.

In her book "Making a Living: Place, Food, and Economy in an Inuit Community" (2010), Nicole Gombay addresses the subject of the emergence of a mixed economy: a term referring to a hybrid of the vernacular and market economic systems. Gombay (2010: 12-13) notes that "These two economies, the market and the vernacular, have (historically) been operating in tandem—sometimes in apparent isolation, but are in fact increasingly overlapping and mixing together, with the distinction between them becoming blurred." In order to illustrate this, Gombay details how, in some instances, Inuit have begun to sell country food (often via Facebook), something that is quite contrary to the traditional notion of sharing and reciprocity that has always existed in Inuit society. This is done in order to make money and thus better participate in the market economy (and also buy hunting equipment). This obviously raises a number of moral questions and is one of the big issues that Inuit in the eastern Canadian Arctic are struggling to come to terms with today.

Compounding the difficulties associated with obtaining country foods is the high cost of market food in the North. This is notably due to the high cost of transportation: the further away the community from a centre of distribution (i.e., a southern city), the higher the cost of living in that community. Another thing that drives prices up in the North is the fact that Inuit, having never been included in the reserve system that structures First Nations communities in Canada, pay taxes, and the latter are calculated on the sale price of commodities (Duhaime and Caron, 2012). Therefore, the higher the price of an item in the North, the higher the tax paid, thus making Inuit the most highly taxed individuals in all of Canada and driving up the cost of living in the North exponentially. While food prices have always been higher in the North, the difference has become even greater in the past few years. For example, a 2006 study comparing the cost of food in Nunavik with the cost of food in the Quebec City area found that food was 57% more expensive in Nunavik (Bernard, 2006). A similar study, published in 2012, found that the average price difference had jumped to 81% (Duhaime and Caron, 2012). The authors of this study also note that the further away the village is from a regional centre (i.e., Kuujjuaq or Puvirnituq), the higher the prices, this being due to the cost of transportation (fuel) and the difficulties associated with transferring cargo to smaller communities using intraregional airplanes.

1.2.2.3 Health and Inuit Food Practice. The role that traditional food plays in the lives of Inuit today has altered considerably since the sedentarization of communities and the associated increase in the proportion of industrial foods in the diets of Northerners (Blanchet and Rochette, 2008; Counil, Gauthier, and Dewailly, 2010). Since the creation of regular air transport routes to remote regions, new types of foodstuffs have been introduced to northern communities, and significant changes in household diet over the last several decades have been observed. As northern communities have become progressively more exposed to southern Canadian society, industrial foods, often of questionable quality, have become more accessible to the average family. The changes in eating habits following the incorporation of industrial foods into traditional diets has led to significant health problems among the Inuit population in general (Duhaime, 2002; Willows, 2005; Damman *et al,* 2008; Power, 2008).

Industrial foods, due to their very nature, are not only more easily transportable and storable, but are also inherently less expensive and preserve their qualities (however dubious) longer than fresh produce. Given the constraints imposed by the location of their settlements, populations in Arctic communities have difficulty procuring fresh, healthy food that is regularly available, of acceptable quality, and reasonably priced (Caulfield, 2002; Willows, 2005; Chan *et al*, 2006). For this reason, individuals often choose to consume "unhealthy" industrial foods instead of "healthy" foods imported from the South (Kuhnlein *et al*, 2000). And, while it seems to be commonly understood that healthy food choices could prevent diet-related illness, healthier fresh foods are not always a viable or appealing choice for many families living in the Canadian North, notably due to their high cost and poor quality.

The most significant diet-related health problems present in Inuit communities today include obesity, heart disease, diabetes, anaemia, and poor dentition (Willows, 2005; Damman *et al*, 2008; Power, 2008). Further to this, high food costs compound poverty and malnutrition in the North, and this, in turn, has a domino effect, notably impacting children and youth with respect to their ability to perform in school.

What is particularly distressing about the information highlighted in the previous paragraphs is that this is not new data—the negative impacts on health engendered by poor diet and nutrition in the North have been of concern for decades. Illustrating this point is the following excerpt from a paper presented at the First Circumpolar Agricultural Conference in 1992 by M. J. Romer, W. R. Cummins, and J. Svoboda. What makes this excerpt even more striking is the fact that the source quoted in the last paragraph dates from 1973, over forty years ago.

> The demographic policies of the Canadian Government in the 1950's resulted in the settlement of traditionally nomadic native peoples into fixed communities

> where southern energy and food supplies were readily available. The resulting decline in the utilization of native "country" foods and the establishment of a food economy increasingly dependent on southern imports has had serious nutritional and economic consequences for arctic peoples.
>
> The nutritional base of meats from the land and sea mammals, typically high in protein, was replaced by carbohydrates and sugars. Food preparation techniques, evolved over generations to guarantee effective vitamin utilization, were replaced by southern methods such as baking and frying …
>
> Fresh food sources have been replaced by frozen, freeze dried or canned products and perishable produce, when available, is frequently of questionable quality due to long storage and transit times to northern communities. These changes have resulted in the appearance of many new health problems including heart disease, diabetes, tooth decay and vitamin deficiencies (Schaefer, 1973).
>
> (Romer, Cummins, and Svoboda, 1992).

In a study conducted in Greenland, where communities have experienced the same type of diet transition and related negative health effects as communities in Nunavik, some notable conclusions were drawn. It was discovered that a diet composed of a very high percentage of traditional foods was lacking in certain key nutrients such as calcium and folate, as well as being very low in dietary fibre and dangerously high in certain environmental contaminants such as mercury and a number of organic pollutants (Deutch *et al*, 2007). Conversely, a diet based exclusively on available imported food products was found to be risky, since availability and freshness could not be consistently guaranteed (*ibid.*). The authors of the study thus concluded that the best way for Inuit to ensure their overall dietary health would be to increase fruit and vegetable consumption when possible and not to increase the consumption of traditional food to higher than present levels (*ibid.*). These results are consistent with the results of a study done in Nunavut by Chan *et al* (2006), which suggest that increased overall food security could be gained through better access to cheaper, higher quality market food.

1.2.2.4 Natural Environment and Inuit Food Practice. The fact that global climate change is affecting many aspects of the biophysical environment, including sea ice extent, permafrost distribution and depth, river hydrology, geophysical processes, and the distribution of marine and terrestrial species has been well documented (Ford and Smit, 2004; Bhiry *et al*, 2011).

Therefore, it is no surprise that much of the current literature on Arctic food security deals with climate change and the impacts that it has, and will have in the future, on the availability and accessibility of country foods—country foods that are increasingly rare, contain higher levels of contaminants, and are of lesser quality than in the past (Pelletier and Desbiens, 2010). Climate change is affecting all terrestrial and marine plant and animal species in the North, and as a result is directly impacting the modes of food production that Inuit have depended on for generations. Examples of species that are affected include snow geese (migratory patterns have changed); arctic fox (territory is being invaded by red fox); beluga whales (affected by changes in ice freeze-thaw patterns); caribou (migratory patterns affected by availability of food sources); and polar bears, walrus, and various species of seals, which are directly affected by the changes in the extent of sea ice upon which they are dependent for resting, hunting, and raising their young (*ibid.*). It is also important to mention that climate change is having an impact on vegetation in the North, including not only the mosses and lichens eaten by terrestrial mammals and birds but also the much prized berries traditionally harvested by Inuit women (*ibid.*). Climate change is also affecting air and ocean currents and, as a result, pollutants and industrial contaminants are bioaccumulating to worrisome extents in many of the food species hunted by Inuit. Food sources of concern include whales (especially beluga), polar bears, seals, and various species of seabirds and their eggs (Duhaime *et al*, 2004; Pelletier and Desbiens, 2010). It is also important to note that not only is climate change affecting the species that Inuit hunt but also the environment—snow and ice—that Inuit depend upon to access animals and fish. In Kuujjuaq, for example, in the fall of 2010 the river and nearby lakes did not freeze over in November (as they had always done in the past), and Kuujjuamiut were unable to get to their traditional ice-fishing and camping grounds until much later in the winter.

1.2.2.5 Political and Territorial Governance and Inuit Food Practice. Given that food is such a central element of Inuit identity, it comes as no surprise that governing bodies (notably the Canadian federal government, Makivik Corporation, and the Kativik Regional Government) have on a number of occasions in the recent past elaborated and implemented food-based programs and continue to do so today. Past examples of food-based experimental initiatives in Nunavik include the False River Farm (a fully operational federal government farm that was operated near Kuujjuaq during the 1950s and 1960s), as well as a muskox farm, a chicken farm, and various types of country food commoditization projects (Gombay, 2010). All of these experimental projects were short-lived for various reasons. However, the Hunter Support Program (HSP) is an example of a government initiative that has over the years become one of the most well known and successful country food programs in the Canadian North. Created as part of the JBNQA in 1975 (Stern, 2010), it is one of the elements that emerged from a series of policies that saw to the provision of harvesting rights, the creation of land categories, and the implementation of resource management regimes designed to concretely benefit the Inuit of Nunavik. The primary goal of the HSP is "to favour, encourage and perpetuate the hunting, fishing and trapping activities of the beneficiaries of the JBNQA as a way of life and to guarantee Inuit communities a supply of produce from such activities" (Government of Quebec, 1982). In practice, this means that each municipality in Nunavik receives subsidies destined to support such things as purchasing hunting equipment, training youth, and buying country food (Gombay, 2010, Stern, 2010). In many cases the money is used to pay hunters, who are not otherwise employed, to supply the community with meat on an intermittent basis (*ibid.*). The meat and fish are then stored in a community freezer and distributed to those in need. This program therefore supports both the production and consumption of country food, and by virtue of its design, addresses the economic factors that limit access to country food, while at the same time respecting the traditional concept of sharing food; it is essentially a hybrid of modernity and tradition that responds to the needs of Inuit today (Gombay, 2010). This said, the HSP program has been criticized by some because there are ways to cheat the system, and abuse of the program has been noted in some villages.

Other food-based government and paragovernmental initiatives of note in Nunavik include the following: Unaaq Fisheries, a joint venture subsidiary company operated by Makivik Corporation; the Napukkaaliuvik Arctic Char Hatchery Project operated by the Nayumivik Landholding Corporation in Kuujjuaq; and the multiple country food monitoring programs operated by the Nunavik Research Centre (involving such things as testing for trichinosis in walrus meat, monitoring beluga populations, and conducting research on environmental contaminants and zoonotic diseases). As well, the Nunavik Regional Board of Health and

Social Services (NRBHSS) employs two full-time nutritionists whose mandate includes such things as developing menus for the regional daycares and working with local and regional organizations in their efforts to develop food-related initiatives and disseminate educational materials promoting healthy eating. The Kativik School Board (KSB) also has a Healthy Schools Coordinator, and several community kitchens (supported by different governing bodies through the Wellness Network) have made their appearance in recent years in Nunavik villages. It is also important to note that the two main governing bodies in Nunavik—Makivik Corporation and the Kativik Regional Government—support a subsidy program (through a specific agreement with Transport Quebec) that helps to reduce the cost of essential household items in the North. Under this program, the cost of certain staple food items is reduced by 20% (Duhaime and Caron, 2012: 9).

New and innovative food-based projects are also on the rise in Nunavik today. These have come about not only as a general response to the food security issues illustrated in the previous sections but also more specifically as a response to recent changes in federal policy. Drastic cuts to the federal Food Mail Program and its subsequent replacement by the less robust Nutrition North Canada program are currently having profound repercussions in the Canadian North. The former Food Mail Program was a combined effort of Indian and Northern Affairs Canada (INAC), Canada Post, and Health Canada. According to the former website of Indian and Northern Affairs Canada, it provided nutritious perishable food and other essential items to isolated northern communities at reduced postal rates. These items were provided to over 70,000 people in 80 communities across the North every week. As well, more than 18 million kilograms of food mail were shipped annually under the program (INAC, 2011), and this amount was steadily increasing until the program was terminated in October 2010 (Wingrove, 2011). While this program was not perfect (Rennie, 2014), many agree that it was better than its replacement, the Nutrition North Canada program. Launched on April 1, 2011, Nutrition North Canada is a subsidy program that seeks to improve access to perishable healthy food in isolated northern communities. It is based on a market-driven model whereby the subsidy is transferred to retailers and suppliers that are selected to register with the program. Businesses registered with the program are accountable for passing on the subsidy to consumers. According to the Nutrition North Canada website, “Northerners benefit from the subsidy when they buy subsidized items from retailers in their community. Individuals, commercial establishments such as local restaurants, and social institutions such as daycares can also benefit from the subsidy when they order eligible items directly from registered Southern suppliers" (NNC, 2012).

In report released in May 2012, the United Nations Special Rapporteur on the Right to Food expressed concerns about the implementation of the Nutrition North Canada program. In his End of Mission Statement, Olivier De Schutter explains that "the retail subsidy is not being fully passed on to the consumer and that in the absence of adequate monitoring by those it is intended to benefit, the programme is not achieving its desired outcome." (De Schutter, 2012: 5). This change to the way that food subsidies are being administered in the Canadian North has prompted an even greater degree of interest on behalf of governing bodies to address the issue of food sovereignty in the North, and in recent months we have seen the emergence of new agro-food policies aimed at specifically addressing northern food security issues. The Kativik Regional Government, for example, has a "Specific Agreement concerning Agro-food Development in the Nord-du-Québec Region" and is also one of the founding members of the "Nord-du-Québec Bio-Food Network."

In addition, the bio-food sector has an important place in the Quebec Government's Plan Nord as well as in Nunavik's Parnasimautik (Plan Nunavik). The Plan Nord was launched by Jean Charest's Liberal government in September 2008 as a response to the worldwide financial crisis that began in 2007. The Plan Nord is part of a five-point strategy to sustain growth in Quebec while repositioning the province within the global economy through the development of the North's potential in fields such as mining, energy, and tourism (Desbiens and Rivard, 2013: 103). The territory covered by the Plan Nord includes the region of Quebec located north of the 49th parallel. This accounts for nearly 72 percent of the province's land base. In total, 63 communities are located in this area, 31 Aboriginal and 23 non-Aboriginal. The Plan Nord envisions the development of strategic partnerships between governments, businesses, and northern communities (*ibid.*). Parnasimautik is the name of a process (and ensuing document) that was initiated in response to the Plan Nord by the Inuit of Nunavik. According to the website of Makivik Corporation:

> Parnasimautik is for Nunavimmiut. It is intended to be a process to create a comprehensive vision for the development of our region. A vision whereby the Inuit traditional way of life (our culture, identity and language) and the environment will be protected and enhanced, and whereby Nunavimmiut will determine under what conditions our region develops. Parnasimautik is an opportunity for all Nunavimmiut to examine the multiple sectors of our lives (Who We Are, Our Communities and Our Region) and propose a sustainable model of development acceptable to us all.
>
> (Makivik Corporation, 2014)

Of special interest here, is the fact that all of the aforementioned policies and plans (including Plan Nord and Parnasimautik) have specific provisions for supporting the research and development of greenhouses in Nunavik.

While food-based government initiatives in Nunavik have not always been successful in the long term, what is important today is that this history does not seem to be a deterrent. Activity in the bio-food sector is growing every year, and the discourse put forward by key stakeholders often speaks to notions that are at the core of the local food movement. Because of the nutritional, cultural, and economic problems associated with external, imported food sources, political will has been evolving in support of a new type of local food strategy, a hybrid of both modern and traditional ways that promoters hope will contribute to increased food security in the North and improvement in the health of northern populations. Promoters are also hoping that a new local food strategy will contribute to more diversified and stable local economies. As outlined in Plan Nunavik, "the consumption of ever more expensive southern food items will do little for Nunavik's economy or the health of its population. Throughout the world and down through history, the ability to feed one's people is the cornerstone of civilization and development. We must increase our actions and commitment to make Nunavik's food supply more self-sufficient and secure" (Kativik Regional Government and Makivik Corporation, 2011: 84).

Chapter 2.
Agriculture in the North

While the previous chapter presented an overview of food in the North—and the role that food plays in Inuit society in Nunavik today—this chapter will focus specifically on agriculture in the North. In order for the reader to get a general sense of the present context within which this research has been elaborated, a brief overview of what has been termed "circumpolar agriculture" will be presented in the first section of this chapter. The second section will introduce agricultural initiatives specific to Nunavik (and to Kuujjuaq), and the final section will follow up with an overview of a series of northern greenhouse projects of varied types and uses that have been developed over the years.

2.1 Overview of Agriculture in the Circumpolar North

It cannot, by any stretch of the imagination, be said that agriculture has flourished in the North (especially when compared to southern regions of the globe), however, there is a long-standing history of agriculture in arctic and subarctic regions that cannot be ignored. For example, Vikings struck out from Iceland in AD 982, and by AD 1000 had successfully founded farming settlements in Greenland in virtually all of the southern fjords. Contrary to popular belief, archaeologists and historians now believe that Viking farmers, not Inuit (or their ancestors), were the first inhabitants of South Greenland (Ross, 1996; McGhee, 2005). In northern areas where there is arable land, such as in parts of Alaska, the Yukon, the Northwest Territories, Greenland, Iceland, Norway, Sweden, Finland, and Russia, there is a distinct (albeit marginal) history of growing crops as well as raising certain types of livestock (IASC, 2012). Nevertheless, according to the International Arctic Science Committee (2012), agriculture in high-latitude regions still remains a relatively small industry in the twenty-first century. In the North, agriculture consists mostly of growing cool season forage crops (such as alfalfa, clover, or timothy grass), cool season vegetables (potatoes, carrots, beets, cabbage, turnips, radishes, spinach, kale, green peas), and small grains (barley and oats). It also includes, raising traditional types of livestock—especially hardy heritage breeds of cattle, sheep, goats, pigs, and poultry. Reindeer herding is one of the most visible agricultural activities in the Arctic, and is practised notably by the indigenous Sami people in Scandinavia as well as by over thirty other different northern peoples (ICRH and AWRH, 2014). The operation of elk, bison, yak, and muskox ranches in Alaska and northwestern Canada is also a viable small-scale agricultural activity (*ibid.*). Raising Muskox for their highly prized wool (known as *qiviut*) is something that has been experimented with in the past as well, and that still exists on a small scale in certain regions of North America today. In addition, the cultivation of berries in parts of Scandinavia is something that is growing in popularity, as the health benefits (i.e., antioxidant properties) of these northern "super foods" is becoming increasingly recognized (Jaakola, Uleberg and Martinussen, 2013).

While agriculture is most notably limited by climatic factors in the Arctic and Subarctic, it is also constrained by a lack of infrastructure, a small population base, remoteness from markets, and land ownership issues (IASC, 2012). Major climatic limitations include short growing seasons (not enough time for crops to mature or to produce high enough yields), lack of heat energy (too few Growing Degree Days [GDDs] during the summer season), long and/or unfavourable winter weather that can limit the survival of perennial crops, and high moisture stress (lack of water) in some areas (*ibid.*). In the eastern Canadian Arctic, as well as in higher latitude regions across the North, lack of arable land (i.e., good, fertile soil) as well as issues with permafrost (in areas where there is soil), have posed significant challenges to conventional agricultural development. It is for these very reasons that agricultural initiatives in Nunavut, Nunavik, and Nunatsiavut have been very limited in scope in comparison to other regions of the North. In regions such as Alaska, the Yukon, the Northwest Territories, Scandinavia, and Russia, for example, relatively favourable climatic conditions mean that the tree line (and, consequently, what might be called the "arable soil line") extends to a higher latitude, thus providing more favourable baseline conditions for conventional agriculture.

When considering the evolution of agriculture in the North, it is interesting to note how marked the difference is between agricultural development in Scandinavia and northern Canada, for example. Due to a combination of historical, sociological, political, and geographical factors, agricultural development in Scandinavia is much more advanced. Finland, for example, had approximately 10,000 farms at the turn of the twenty-first century, whereas the Yukon government and Statistics Canada documented only 170 farms in the Yukon and only 30 agricultural operations in the Northwest Territories during this same period (Statistics Canada, 2001; Hill *et al*, 2002; IASC, 2012). This said, the past few years have seen a rise in the number of agricultural initiatives in both the Yukon and the Northwest Territories, as young farmers—frustrated by high prices and the lack of available fresh produce, and encouraged by increasing government and consumer support—try their hands once again at "growing local."

While on the surface it might seem that agriculture in the Canadian North is a relatively new thing, it is important to underscore the fact that this is not the case. In a recent interview, Lone Sorensen, the founder of the Yellowknife local food advocacy group Northern Roots, noted that "…residents of Yellowknife once grew their own food. In the 1930s, gold mines opened and home gardens provided workers with greens and potatoes. But cheap fuel after World War II led to a reliance on shipped goods and local farming dwindled" (Nobel, 2013). This history in the Northwest Territories parallels agriculture history in the Yukon, where farms evolved from humble beginnings in the early 1800s and actually reached peak production during the Klondike Gold Rush. In fact, up until the mid-1950s farms around Dawson City, Mayo, and along the Yukon River produced healthy crops of vegetables and hay that were equal in quality to southern produce. However, changes in modes of transportation (the loss of horse-drawn equipment and riverboats and the construction of the Alaska Highway) as well as a decline in population triggered a fall in the number of farms, since produce could henceforth be imported cheaply to the region (Robinson, 2010).

While, as noted above, the 1850s through to the 1950s were the heyday of northern agriculture, agricultural history in the Canadian North goes back even further than this—in the western Subarctic, agriculture has been practised, to varying degrees, for over 300 years! Farming and gardening were first introduced to northern Canada by the Hudson's Bay Company (HBC) at outposts located in the Hudson Bay region (Leechman, 1970; Moodie, 1978). Historical evidence shows that there were gardens at Fort Albany, Moose Factory, Fort Severn, Fort York, and Fort Churchill, among other places. The two principal reasons for encouraging and supporting agricultural initiatives at bayside posts were to counter the effects of scurvy and to reduce the cost of shipping large amounts of food from England. Between the years 1670 and 1774, company policy dictated that gardening become a regular activity at all company posts (Leechman, 1970; Moodie, 1978; HBC, 2014). Illustrating this is an excerpt from a letter sent to Governor Fullartine at Fort Albany in 1708:

> We doe order that you take care that the garden be fitted with all things that may be useful for the Factory, especially Turnips Carrotts Pease and Beanes, and that you order that the same be begun as soon as the Season will permit, and that this bee not omitted in any yeare on any pretence whatsoever.
>
> (As reproduced in: Romer, 1983: 5)

While numerous types of crops were tested by HBC employees over the decades, the most successful were coleworts, radishes, turnips, lettuce, mustard greens, cress, peas, beans, carrots, parsnips, celery, cabbage, potatoes, onions, cucumbers, and spinach (Moodie, 1978; Romer, 1983; HBC, 2014). Of significance is the fact that all crops grown by the HBC were more successful at the southern outposts than the more northerly ones. An example of note from northeastern Canada is the highly successful farm operated by Donald Smith (later Lord Strathcona, 28th Governor of the HBC, and a founding director of the Canadian Pacific Railway) in the mid-nineteenth century at North West River in Labrador. Fertilized with fish offal, his farm grew cucumbers, pumpkins, potatoes, and peas and featured a greenhouse to shelter other types of more tender produce (HBC, 2014).

Throughout the 1800s, small gardens were cultivated at all of the forts of the Hudson's Bay Company as well as those of the North West Company, but it was not until the arrival of the Anglican and Roman Catholic missionaries in the late 1850s that garden plots grew to substantial sizes in the North. According to Albright (1933 and 1937) and Hunt (1978), the missionaries (who had substantial experience in farming) undertook the arduous task of clearing and farming the land, and the produce grown was used to supplement meat diets at missions, hospitals, and trading posts in the Canadian northwest. One of the most impressive church-run farming initiatives was situated at Fort Simpson, where, in the early 1900s, over one hundred hectares were brought under cultivation. On the west coast of Hudson Bay, members of the Oblate order of missionaries regularly cultivated gardens and built small greenhouses beginning around this same time and continuing through until the 1980s (Romer, 1983). Even though the Oblate gardens were rudimentary—the Fathers relied chiefly on local resources to create soil, using lake-bottom or riverbed alluvium, shredded seaweed, peat, and human waste (termed “Christian fertilizer”) for nutrient amendments—a number of root and leaf crops were successfully grown (Webb, 1976a; Romer, 1983). The missionaries were also very active in Labrador, where the Moravian Missions were famous for their large gardens. As seen in the picture below (taken in 1908), Inuit were actively involved in gardening activities.

FIGURE 3 Inuit women in a Moravian Mission garden, Labrador [ca 1908].
Source: The Rooms Provincial Archives, VA 118-154.3, “Agriculture”

Another interesting example comes from York Factory, where Edith May Griffiths ran a school for White and Métis children from 1912-1915. In her memoirs she describes the use of techniques, such as raised beds and cold frames, in the HBC garden near her school:

> On account of being built up summer gardens did well in producing some vegetables … The frost never left the ground deeper than 18 inches. Lettuce and radishes thrived. Potatoes grew slightly smaller and turnips about the size of hen's eggs. Carrots and beets were small, but good. Peas and beans developed … The garden owned by the Company was near the school. It was enclosed by a picket fence and a gate. The ground was formed in small elevated plots … to take full advantage of the sun's rays during the long hours of daylight of the short summer … Vegetables that grew above the ground did well. Some things were planted in a hot bed to escape the early frost.
>
> (HBC, 2014)

As noted on the website of the HBC Archives Department, "Company executives felt that the health and well-being of both staff and customers in remote areas was of primary concern, and gardening was considered a practical means to promote these two things." (HBC, 2014).[9] To this end, tools, seeds, fertilizer, and information were provided free of charge by the company, and by the mid-20th century handbooks on gardening (see Figure 4) could be found in the libraries of all posts of the Fur Trade Department" (*ibid.*). As well, competitions for the best post gardens were established, and in 1942 gardeners could enter their produce in one of four categories: vegetables, champion vegetables, flowers, and Arctic gardens (*ibid.*).

[9] Of significance is the fact that the idea of increasing health and wellbeing through gardening—a central tenet of today's community garden movement—is not new; it has roots that go back generations!

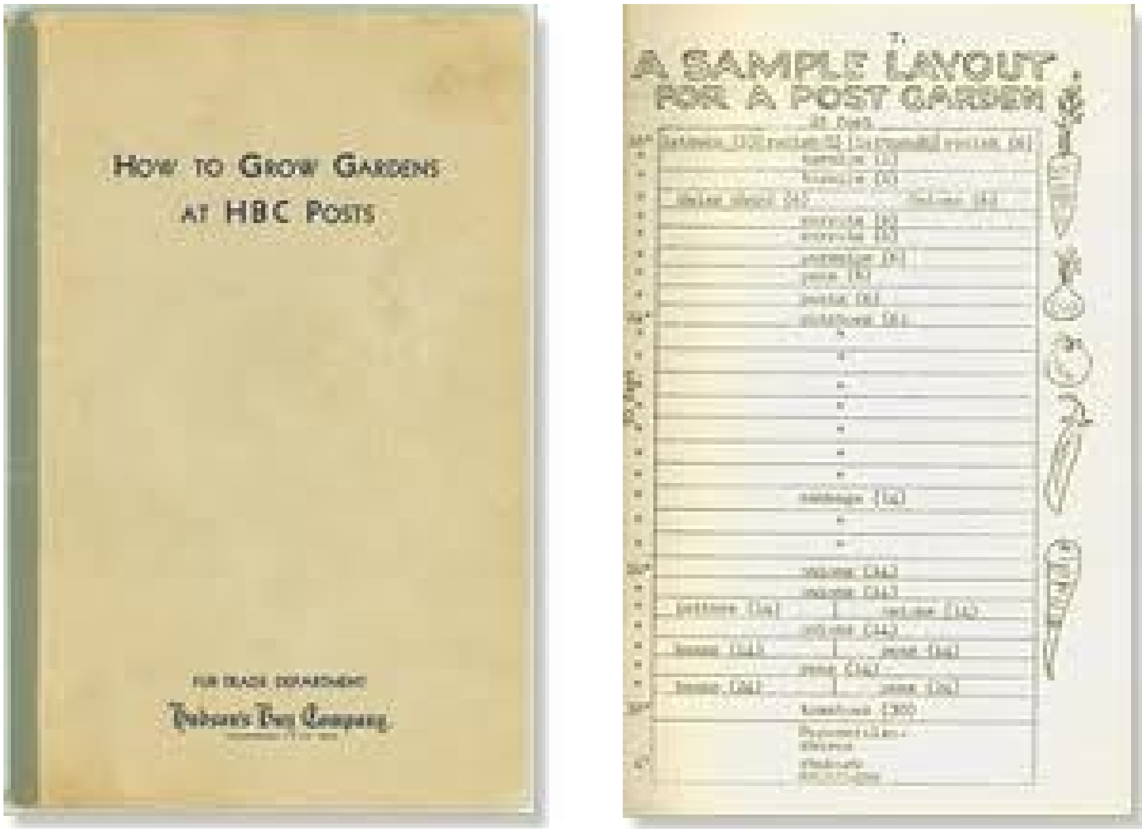

FIGURE 4 Gardening manual published by the HBC in 1940.

Source: http://www.hbcheritage.ca/hbcheritage/history/business/fur/a-little-bit-of-green-gardening-in-support-of-the-trade

Northern First Nations have also been involved in agricultural activities. A systematic study of the history of high-latitude agriculture in Alaska by Loring and Gerlach (2010) found that "for over a century, various forms of crop cultivation, including family, community and school gardens were components of the foodways of many Alaska Native communities." This form of "outpost agriculture," promoted by missionaries and agricultural extension officers (and viewed by non-natives as a mechanism for the economic development of the region), has roots that reach back as far as the late 1800s and was found to be valued for its role, not as an exclusive means of subsistence, but as one of many equally important components in a flexible and diversified subsistence strategy (*ibid.*). Unfortunately, this agricultural history has long gone unrecognized and, as these authors conclude, this has consequences for modern-day northern communities that are currently experimenting with community gardens and other innovative responses to rapid ecological, climatic, and socioeconomic change (*ibid.*).

Loring and Gerlach present the positive aspects of past First Nations' agricultural initiatives; however, it is important to consider the fact that, within the larger colonial context, agriculture has often been used as a means of cultural assimilation. In many cases, Native communities in North America were incited to leave behind traditional forms of subsistence and encouraged instead to embrace modern Euro-Canadian forms of agriculture—actions that have significantly contributed to the erosion of Aboriginal culture. Nevertheless, certain Aboriginal groups independently developed and subsequently relied upon agriculture as their principal mode of subsistence eons ago. In Canada, the Iroquois—who traditionally cultivated the "Three Sisters" (corn, beans, and squash) are the most notable example.

While the previous paragraphs focused on historical examples of agriculture in the North, it is important to point out that there is a resurgence of interest in local agricultural production in northern communities. For example, a recent northern agricultural initiative that takes a "whole-picture" approach is the "Projet pour un mode de vie sain" ("Project for a Healthy Lifestyle") that was established in 2005 in the Lower North Shore region of the province of Quebec (Government of Canada, 2010). This project covers production (agriculture), transformation (cooking), and distribution of fresh, healthy foods in an isolated region that is home to approximately 5,500 people of both Aboriginal (Innu) and Euro-Canadian descent. The goal of this multistakeholder integrated public health management project was to increase access to, and consumption of, healthy foods in the fourteen remote villages of the region—villages where the elevated cost and lack of variety of fruit and vegetables is of real concern. This three-year project was based on a "sustainable healthy communities" approach, and coordinators simultaneously orchestrated action in the social, environmental, and economic spheres of the region (*ibid.*). The initiative was directed by a local NGO (The Coasters Association) and, among other things, successfully established community gardens, community kitchens, and "meals on wheels" projects that contributed significantly to the nutrition and food security goals of the villages (*ibid.*). This is an inspiring example because it illustrates how investment in low-tech northern agricultural initiatives (in this case, community gardens in remote villages) can lead to comprehensive sustainable development in marginalized regions.

2.2 Agricultural Initiatives in Nunavik

As in other parts of arctic and subarctic Canada, attempts to develop agriculture, including small-scale gardens and several greenhouses, were also made in the past in Nunavik, either by missionaries or by Hudson's Bay Company employees. One of the best-known greenhouses in Nunavik was constructed in Kangiqsujuaq by the Oblate Missionaries (see Figure 5).

FIGURE 5 Father Jules Dion in front of the greenhouse at the Kangiqsujuaq Mission.
Source: Haché, 2009: 236

The following is an excerpt from the biography of Father Jules Dion in which he speaks about the small greenhouse at the mission:

> In Kangirsujuaq, the Missionary Oblates of Mary Immaculate set up a greenhouse at the end of the rectory. Brother André Chauvel, O.M.I., spent much time looking after it. In the North, the land cannot be tilled and the land is covered with infertile sand. He used to make earth by picking up algae and dog droppings. He would bury this in the soil and when it had decomposed, it became a type of compost that was used as manure.
>
> To get a good crop, we had to sow vegetables around June 15. At that time the sun rose at 3:04am and set at 10:35pm providing daylight for 19 hours and 52 minutes. Too much sunshine is not good for a garden. It needs times of rest. Brother Chauvel decided to frame the vegetable garden with winter windows, double windows and, in fact, it resembled a greenhouse. To simulate the night, he spread canvas over the greenhouse to create darkness for the garden.
>
> I would like to add that later I changed the double windows for plastic…a novelty which did not last long. A helicopter flew over the greenhouse and the plastic flew up in the air. Even the foundation of the mission was almost blown away! Luckily the pilot repaired the damage.
>
> We sowed vegetables and flowers: radishes, lettuce, Chinese cabbage, pansies, etc. We harvested our own vegetables until mid-August.
>
> This greenhouse was used until 1992, but we put an end to it, because of climate change. Spring arrives later now. In June, the earth is still frozen. At the beginning of July, it is too late to sow. We also made renovations to the outside of the house and had to demolish the greenhouse. For many years this greenhouse was of great value to us because at the time, we could not buy fresh vegetables at the store. Now it is very different because we can buy them at the Northern Store or Coop every week.
>
> (Haché, 2009: 203-204)

Another greenhouse of note is the one built in Inukjuak at the HBC manager's house. The original structure was built in the 1940s and '50s and was approximately 12 feet wide by 18 feet long. This structure was unusual in that it was dug into the ground; to enter, one had to go down three steps. This design feature maximizes heat retention and moderates temperature swings, as the ground acts as a heat sink. This greenhouse also had the added benefit of enabling one to work at waist or chest level. The principal vegetables grown over the decades included potatoes, carrots, wax beans, baby cucumbers, and lettuce (Jones, 2013).

While not technically in Nunavik, the hamlet of Sanikiluaq, N.W.T., (located on the Belcher Islands, just off the Hudson Coast between Kuujjuarapik and Inukjuak) is geographically much closer to Nunavik than to the Northwest Territories. For that reason, the former greenhouse project there deserves mention here. In 1976, the Northwest Territories Department of Economic Development, in cooperation with the Manitoba Greenhouse Research Project, undertook two large greenhouse projects: one in Frobisher Bay (Iqaluit) and one in Sanikiluaq (Campbell, 1976; Webb, 1976a and 1976b; Romer, 1983). For the Sanikiluaq project, virtually all of the necessary components, including the greenhouse structure, sphagnum peat moss substrate, and seedlings, were imported. Despite the great cost, damage to seedlings during transportation, and a late start, 75 cucumber plants matured, producing a total of 600 pounds of cucumbers. A small number of tomato plants also produced fruit (Willams, 1976; Romer, 1983). Records show that this project (as well as concurrent initiatives in Pelly Bay, Inuvik, and Frobisher Bay) was technically and economically viable (Poole, 1985); however, the project did not last. The downfall of the Sanikiluaq project (as well as the others) seems to have been a result of the abrupt termination of funding, and the abrupt departure of the person responsible for the project, these two factors being, of course, interrelated (*ibid.*).

Perhaps the best-known example of coventional agriculture in Nunavik is the former federal experimental farm (see Figures 6 and 7). Between 1944 and 1956, agricultural research in the Canadian North was at its most active level, and five agricultural substations were established, including one near Kuujjuaq (Nowosad, 1958 and 1963; Hunt, 1978).

FIGURE 6 Photo from the Fort Chimo federal experimental farm.
Source: Nowosad et al, 1967: 18

The False River Experimental Substation was established in 1956 (Romer, 1983) and was operational until the mid-1960s. It employed not only government scientists, but local Inuit as well (Saunders, 2009). It was built near the junction of the Upper False River and Kohlmeister Lake (located about 11.5 kilometres east of Old Fort Chimo and about 18 kilometres from present day Kuujjuaq). Research at the substation was oriented towards experimentation with, and selection of, hardy, rapid growing, early maturing, and cold-resistant crops, as well as the development of techniques aimed at increasing the length of the growing season (i.e., greenhouses), improving soil nutrient status and moisture retention, and increasing low substrate temperatures (Nowosad, 1958 and 1963; Nowosad *et al*, 1967; Romer, 1983).

FIGURE 7 Interior of one greenhouse at the Fort Chimo federal experimental farm.
Source: Nowosad et al., 1967: 23

Of note are the four greenhouses that were constructed and used to start seedlings, raise crops, and conduct experiments at the farm site (see Figures 8 and 9) (Hamilton, 1958; Nowosad *et al*, 1967). As shown in Figure 10, animals, including sheep, pigs, geese, and chickens, were also raised on the farm, and their manure was used to fertilize the soil along with compost manufactured on-site (Saunders, 2009). Final results from a decade of tests suggest that the most viable crops for field production in the Fort Chimo region are cabbage, cauliflower, broccoli, turnips, lettuce, spinach, and radishes (Nowosad *et al*, 1967). While these vegetables were not commonly consumed by Inuit at the time, Saunders (2009) notes that people were nonetheless very happy to receive them, as hunger was still often a reality in the community.

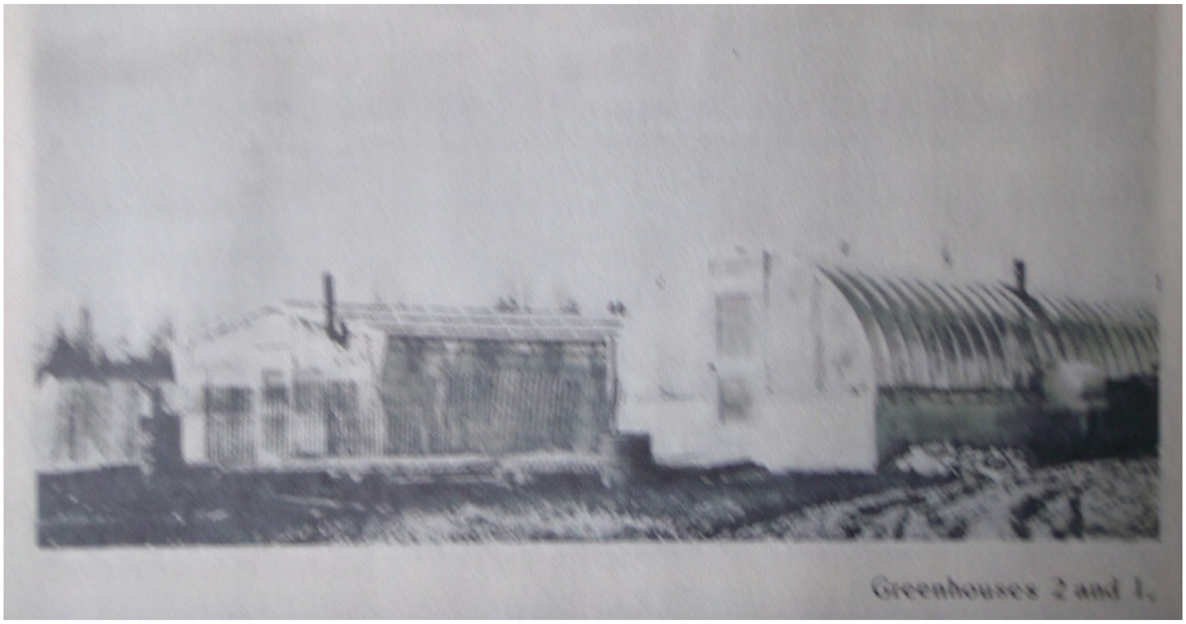

FIGURE 8 Greenhouses 1 and 2 at the Fort Chimo federal experimental farm.

Source: Nowosad et al, 1967: 10

FIGURE 9 Greenhouses 2, 3, and 4 at the Fort Chimo federal experimental farm.

Source: Nowosad et al, 1967: 10

FIGURE 10 Sheep at the Fort Chimo federal experimental farm.
Source: Courtesy of M. Romer

The federal experimental farm was the most elaborate agricultural undertaking in Nunavik; however, it was not the first agriculture initiative in the region. Long before the Dominion Department of Agriculture arrived on the scene in the 1950s, traders and missionaries had experimented with raising pigs, geese, and chickens at Fort Chimo (see Figure11) (Gordon, 2013). As well, the federal department of transportation experimented with raising sheep and chickens on Nottingham Island at the western end of Hudson Strait in the 1940s and 1950s. (Grasser, 2014).

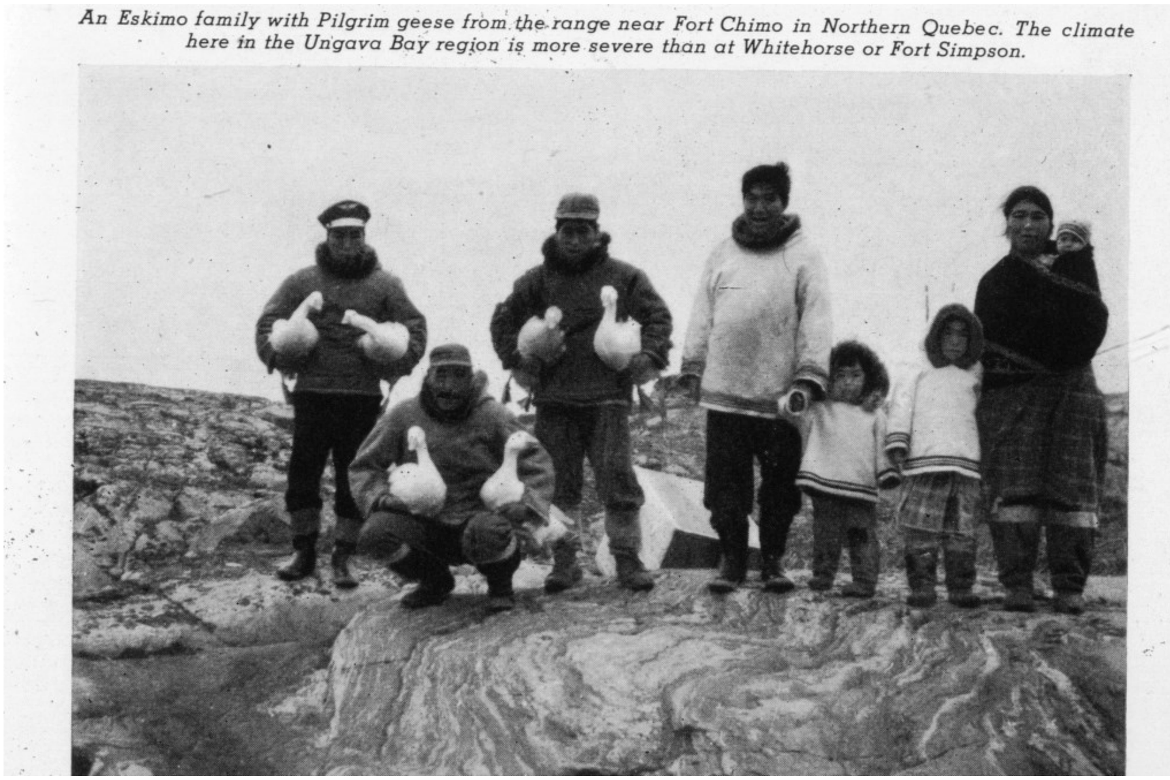

FIGURE 11 Inuit with Pilgrim geese near Fort Chimo.
Source: Courtesy of M. Romer

The Roman Catholic Mission, the Anglican Mission, and the Hudson's Bay Company have also all operated small greenhouses in Kuujjuaq in the past (Ford and Ford, 2013; Jones, 2013; Morency, 2013), and a principal in Aupaluk also ran a greenhouse at the high school for a number of years. Also of note are the muskox farm (operated in the latter half of the twentieth century at the Old Fort Chimo site) and an experimental chicken farm. In the 1990s, private residents successfully reared a litter of pigs during one summer (the animals were fed a diet of food scraps and local vegetation) (Chalmers, 2013), and other residents have recently experimented with raising chickens on a small scale.

Apart from those built and maintained by the HBC and the missions, Kuujjuaq also has several other greenhouse precedents, the most prominent of these being the small greenhouse situated on the outskirts of the town.[10] This greenhouse was initially built for a revegetation

10 This is the greenhouse that eventually became the focus of this research project.

project in 1995 by the Municipality of Kuujjuaq (NVK), which commissioned the Centre for Northern Studies (CEN, a research centre based at Université Laval) to experiment with growing grass and tree seedlings that were then planted in and around the village in order to control dust levels and "green" the community (Babeux and Houle, 1996). This project was a collaborative effort with a significant community outreach component and was financed in part by the Canada Mortgage and Housing Corporation (CMHC). When the project was completed, the greenhouse was turned over to the municipality and has been used every summer since then by local residents, who grow their own vegetables in small community garden plots.

The municipality of Kuujjuaq is also home to a number of intrepid gardeners, who over the years have built and maintained their own greenhouses, either in town or at cabins on the land. To date, over twenty private greenhouse gardens have been identified in Kuujjuaq, and it is a proud fact that a number of varieties of vegetables grown in Kuujjuaq have proven to be just as good as those grown in the South! Potatoes have also been grown in the sandy soil beside homes in town, at the Old Chimo site, and on the Range Road. Rhubarb, first planted decades ago, has thrived in certain locations in and around town, and a chain of "gifting" cuttings of the rootstock of this hearty plant that links at least nine Kuujjuaq families over five decades has been identified. Some residents have also recently experimented with transplants of the original rootstock at their cabins. As well, members of the community as a whole (both Inuit and Qallunaat) grow and maintain a significant number of houseplants. Houseplants are also often present in the workplace, and many people actively trade and share cuttings and/or baby plants with friends and neighbours. As well, houseplant cuttings and baby plants are popular items at fundraising events; they are among the first things to sell out at the High School Christmas bazaar, for example. Finally, a small gardening section at the general store (Tullik) in Kuujjuaq is testimony to the interest that Kuujjuamiut have for gardening

2.3 Examples of Northern and Arctic Greenhouses

Since it is obvious from the two previous sections that greenhouses have played, and still do play, an important role in northern agriculture (and also because northern greenhouses are at the heart of this work), the following section will introduce a series of greenhouse projects that have served as inspiration for this research. I must point out, however, that the scientific literature on the subject of northern greenhouses is virtually non-existent. Nevertheless, there is sufficient information to be had from local and regional media sources, as well as from institutional websites, and through personal communications, to be able to gain a relatively good understanding of the current state of affairs and the advancements that have been made in this domain in recent years. This said, many innovative local greenhouse initiatives do not appear on the radar of the mainstream media and, as such, I must stress that the following examples are just that—examples—and that the next section cannot be considered an exhaustive list of northern greenhouse projects. It is also important to note here that, given the rapidly growing interest in the subject of northern greenhouses and the overarching field of northern food security, more and more greenhouse initiatives are making their appearance in the North every year.[11]

The following section will present several examples of different types of greenhouse projects: community greenhouses, research and educational greenhouses, commercial greenhouses, and finally, a few examples of personal, backyard greenhouses from across the North.

2.3.1 Community Greenhouses

2.3.1.1 Iqaluit Community Greenhouse. The city of Iqaluit (population 7000), located on the south coast of Baffin Island in the Canadian Territory of Nunavut, is currently the site of an active greenhouse project. However, Piruqsiavut (the official name of the greenhouse) is not the first greenhouse project to be undertaken here (George, 2008). An initial attempt was made in the 1960s when a glass-covered greenhouse was constructed. A second, plastic-covered structure was erected in 1976 by the Northwest Territories Department of Economic

[11] The success of an event held in the fall of 2012— the International Centre for Northern Governance and Development (ICNGD) workshop on Northern Greenhouses—is testimony to the growing interest in northern greenhouses. Attendance at this was almost double what had initially been expected; over 100 people were present. As well, due to an increasing number of requests for information, Agriculture Canada commissioned a study on the subject (Agriteam Canada Consulting Ltd., 2013), and Food Secure Canada (FSC) has held a series of webinars on northern and remote greenhouses over the last two years. The Circumpolar Agriculture Association (CAA) and the Northern Food Security Thematic Network of the University of the Arctic (UArctic) also highlighted the subject of northern greenhouses during an international conference in the fall of 2013.

Development in cooperation with the Manitoba Greenhouse Research Project (Campbell, 1976; Webb, 1976a and 1976b; Romer, 1983). The 1976 greenhouse was a prefabricated structure that used passive heat absorption techniques and local sand as a planting substrate. Unfortunately, due to a late start and improper planning, only some greens and small root crops were harvested at the time (Webb, 1976b).

No further attempts to build and operate a greenhouse were made until 2001, when a group of local residents formed the non-profit Iqaluit Community Greenhouse Society (ICGS, 2014). Partially funded by the government of Nunavut, the greenhouse was constructed in 2007 out of polycarbonate over a steel frame and covers an area of approximately 90 square metres (see Figure 12). It is notable for being the most northern society-driven greenhouse above the treeline (National Post, 2013). The local store (Northmart) helps support the greenhouse by shipping up manure at a discounted rate and the city provides free water (Murphy, 2012). This greenhouse functions as a community garden, and in 2012 and 2013 it was run using a collective model, in which all thirty members participated jointly in gardening tasks and then divided up the harvest equally.

FIGURE 12 Exterior view of the Iqaluit Community Greenhouse.

Source: http://sybaritica.me/2012/06/14/nunavut-the-iqaluit-community-greenhouse/

From June to September, society members grow and harvest lettuce, spinach, kale, beans, peas, radishes, carrots, cherry tomatoes, peppers, and herbs (*ibid.*). On summer Fridays, members hold crop-picking parties, and on weekends they deliver vegetables to a local soup kitchen, as well as to a local women's shelter (Nobel, 2013). The greenhouse has no extra mechanical source of heating—relying entirely on the sun's energy—but there is a passive heating technique that uses large water-filled bins to store up heat during the day and slowly release it during the cooler nights. In this greenhouse, plants are grown in bins placed on raised platforms (counters), and vertical space is also maximized by placing pots on shelves along the walls and hanging many plants from the ceiling in specially designed planting bags (see Figure13).

FIGURE 13 Interior view of the Iqaluit Community Greenhouse.
Source: http://www.nunatsiaqonline.ca/stories/article/65674photo_lettuce_anyone/

John Lamb, President of the Iqaluit Greenhouse Society in 2007, stresses the point that this greenhouse is not just about gardening; rather, it's about how and where the community gets its food (Minogue, 2007). Lamb also states that "the goal [of this project] is to grow fresh vegetables close to home, rather than relying on aging fruit and vegetables that are flown in at great cost to the consumer and to the environment." (*ibid.*). While soil for the greenhouse must be shipped in from southern Canada, and maintenance and insurance fees are costly—meaning that membership fees run around $90.00 a year—greenhouse members definitely appreciate the good community atmosphere and fresh produce (Nobel, 2013; National Post, 2013).

2.3.1.2 Inuvik Community Greenhouse. The town of Inuvik, situated near the coast of the Arctic Ocean in the Northwest Territories, has one of the best established (and best known) northern greenhouses (see Figure 14).

FIGURE 14 Exterior and interior views of the Inuvik Community Greenhouse.
Source: http://www.ryerson.ca/carrotcity/board_pages/community/inuvik.html

The Inuvik Community Greenhouse, located 200 km above the Arctic Circle and 70 km south of the tree line, is North America's most northern commercial greenhouse operation and the only community greenhouse of its kind in the world (Mahoney, 2004; O'Neill, 2009; ICG, 2014). In 1998 a non-profit organization, formed by a group of local residents, raised funds in order to transform an old Quonset-style arena that had been slated for demolition. With the help and support of Aurora College, the project officially got underway in the summer of 1999. The tin roof of the building was removed and replaced with polycarbonate glazing, allowing the 24 hour "midnight sun" (present from mid-May until mid-August) to stream in through the ceiling (Mahoney, 2004; ICG, 2014). This innovative approach means that gardeners can take advantage of an indoor growing season similar in length to the southern Canadian season and can therefore plant and harvest crops from May until October (*ibid.*).

The greenhouse is comprised of two main sections: one consists of raised community garden plots installed on the 12,000 square foot ground floor (with 5000 square feet of growing space), and the other is a 4,000 square foot commercial greenhouse where bedding plants and hydroponic vegetables (tomatoes and English cucumbers) are produced in order to cover operation and management costs (Mahoney, 2004; Adams, 2011; ICG, 2014). Over the years, a number of community, governmental, paragovernmental, research, and industry partners have helped finance the greenhouse, but the greenhouse still depends on yearly fundraisers and volunteer labour to make ends meet (ICG, 2014).

Today, the greenhouse holds seventy-four full-size plots. Each full plot is approximately 10 feet by 4 feet. The rental fee per full plot is $100 (and $50 per half plot). Each member pays a $25 membership fee per year and completes fifteen volunteer hours. Garden plots are available to residents of Inuvik, and are also sponsored for Elders, group homes, children's groups, the mentally disabled, and other local charities (*ibid.*). Gardeners typically grow fast-growing vegetables such as lettuce, peas, and beans. However, other crops, including potatoes, carrots, corn, bok choy, herbs, and flowers are also common (O'Neill, 2009; ICG, 2014). As stated on the website of the Community Gardening Society, "The objective [of the greenhouse project] is to utilize this space to allow for the production of a variety of crops in an area where fresh, economical produce is often unavailable." (*ibid.*). A well developed composting project—that involves both gardeners and community members—has also become an integral part of the overall initiative (*ibid.).*

Over the last decade, the greenhouse has also become a focal point for community development, creating jobs and attracting people of all ages and experience to the community garden movement. Significant interest in the project has also been demonstrated by local Aboriginal peoples—the Gwich'in and Inuvialuit (Mahoney, 2004). The greenhouse hires a full-time coordinator from May until September, but is otherwise dependent on volunteers for many of the day-to-day tasks. Since its inception, the Inuvik Community Greenhouse has not only provided opportunities for both recreational gardening and food production but has also contributed to the building of a sense of community (through member support and the sharing of knowledge) and has provided learning opportunities through workshops, classes, and work placements (ICG, 2014). The Inuvik Community Gardening Society also helped to launch a small community greenhouse in Tuktoyaktuk.

2.3.1.3 Little Salmon / Carmacks First Nation Community Greenhouse. The Little Salmon / Carmacks First Nation (LSCFN) is located in south-central Yukon, about two and a half hours north of Whitehorse, and is home to approximately 630 status and non-status beneficiaries (LSCFN, 2014). The community greenhouse and farm operations have really come into their own over the last decade (see Figure 15), and the facilities now include two greenhouses, a garden, a potato farm, and cold storage (Yukon Wellness, 2012).

FIGURE 15 Inside view of the LSCFN Greenhouse.

Source: http://www.yukonwellness.ca/stories_greenhouse.php#.VHTiIosVho5

This initiative is owned and operated by the LSCFN, which hires a full time manager/supervisor as well as seasonal staff (North of 56, 2012). The operation produces a wide variety of organic vegetables (including corn and zucchini), which are distributed to members or sold farm-gate style to tourists and locals (*ibid.*). Vegetables are also distributed free-of-charge to Elders, to the sick, and to single and nursing mothers in order to promote and encourage healthy eating habits (Climate Telling, 2014). The greenhouse has also given extra vegetables to the local school lunch program. Project supporters are proud to underscore the fact that vegetables from the greenhouses, garden, and the farm ensure safe, locally grown, healthy food for local residents and citizens (*ibid.*). As well, recent tests comparing produce (tomatoes) grown at this operation to produce bought in Whitehorse concluded that LSCFN tomatoes are not only a safer, more reliable, and more nutritious food source but are responsible for fewer greenhouse gas emissions (*ibid.*).

2.3.1.4 Hay River Community Greenhouse. Hay River is a community of 3,600 people, located on the south shore of Great Slave Lake in the Northwest Territories. In 2013 users of the Hay River Community Gardens finished building a brand new 10 by 20 metre greenhouse. This new structure extends the growing season in this northern community by two whole months; cold crops can now be planted and harvested well into October. Of note is the fact that, with the guidance of a local expert, this new structure was built entirely by volunteers, mostly women who use the community gardens already. Jackie Milne, president of the Territorial Farmers Association, notes that the community gardens in Hay River (which have been in existence for several years now) are a great place for people with less gardening experience to learn from other more experienced gardeners. For Milne, the learning process and experimentation are part of what makes the initiative an effective and worthwhile pursuit (Ladik, 2013). As well as enhancing food production, this community garden project is playing an important role in the reclamation and remediation of its physical site, since all the natural topsoil had previously been cleared away some time ago to make way for industrial use. This community garden/greenhouse project is also part of a study commissioned by NWT Senator Nick Sibbeston, who is looking at ways to build local economies in the North (CBC News, 2012). Environmental consultant Jamie Bastedo, a promoter of projects driven by community spirit and based on appropriate small-scale technologies, notes that building a greenhouse in Hay River (and having other communities learn from their experience), also enhances federal sovereignty (*ibid.*).

2.3.2 Research and Educational Greenhouses

2.3.2.1 Keewatin Gardens, Rankin Inlet, Northwest Territories. One of the first comprehensive, university-based, greenhouse research projects in the Canadian North was undertaken in Rankin Inlet, Northwest Territories, in the late 1970s. The Keewatin Gardens project ran from 1979 until 1982 and was the subject of an M.Sc. thesis written by Marc J. Romer (currently Director of the McGill University Phytotron). This work was based at the University of Toronto and was financially supported by the Donner Canadian Foundation. This five-year research program involved constructing greenhouse facilities in Rankin Inlet and at Alexandra Fiord on Ellesmere Island. Research at these sites was focused on the small-scale seasonal cultivation of crops, and a heavy emphasis was put on the utilization of local resources and the implementation of inexpensive techniques to improve growing conditions (Romer, 1983; Bergsma, 1986; Cummins *et al*, 1987). A wide range of temperate crops and several edible tundra species were grown during the summer months in insulated cold frames and lightweight domes (see Figure 16). Soil mixtures used in these structures were prepared using local sand, organic peat, and lake sediment deposits. According to a comprehensive report written by Romer in 1987, the studies clearly demonstrated that:

- A wide variety of vegetables including potatoes, lettuce, spinach, Chinese cabbage, turnips, radishes and beets could be grown economically in small-scale cold frame gardens during the short growing season;
- Local soil resources could be utilized to provide an effective growth medium for vegetable cultivation;
- Several species of indigenous tundra plants including Dandelion (<u>Taraxacum lacerum</u>) and Mountain Sorrel (<u>Oxyria digyna</u>) demonstrated potential use as northern cultivars;
- Growing conditions could be easily improved using simple and cost-effective ameliorative techniques which reduced heat loss and extended the growing season; and
- Sufficient local interest was generated to ensure acceptance by the community and its participation in future projects.

(Romer, 1987: 5)

Plate 13: "Keewatin Gardens" cold frame gardening complex in Rankin Inlet, NWT, July 1982.

Plate 14: Temperate cultivars growing in cold frame gardens at "Keewatin Gardens" on August 22, 1982.

FIGURE 16 Cold frames and lightweight domes at the Keewatin Gardens, Rankin Inlet.

Source: Romer, 1983:271

Green Igloos Experimental Farm, Alexandra Fiord, Northwest Territories (1982-1984)

Following on the heels of the work that was done in Rankin Inlet, a team composed of graduate students and their supervisors from the University of Toronto and the University of Guelph embarked upon a sister research project in the High Arctic in order to further the work that had been begun at the Keewatin Gardens site. The Green Igloo Experimental Farm was operational from 1982 to 1984, and some spectacular (and unexpected) results were achieved during this time. The Green Igloo infrastructure consisted of a dozen plastic domes (measuring 3 metres in diameter and 7 metres square) and two larger plastic domes (measuring 6 metres in diameter and 28 metres square) (see Figure 17).

FIGURE 17 Green Igloos Farm – Alexandra Fiord Lowland, Ellesmere Island.
Source: Svoboda et al., 2013

Several other microsites having either plastic windbreaks or plastic mulch were also constructed and planted for the purposes of this study (Svoboda *et al*, 2013). While some of the challenges that researchers had to cope with included high winds and snow in July, the team proved that growing potatoes as well as a number of other common varieties of vegetables was not only possible but feasible. As noted by Doctor Joseph Svoboda (now Professor Emeritus at the University of Toronto and one of the lead Green Igloo researchers at the time), "The overwhelming response of native plants to the amelioration was dazzling and unexpected. It offers an impetus for selection of the most promising species for breeding as edible cultivars” (Svoboda *et al*, 2013).

2.3.2.2 Polar Solar Greenhouse, Pond Inlet, Northwest Territories. Building on what was learned in Rankin Inlet and in Alexandra Fiord, a third greenhouse initiative was undertaken in Pond Inlet a few years later; the purpose of which was to further build up the body of knowledge regarding the potential for arctic agriculture in Canada. The Polar Solar greenhouse project ran from 1985 until 1986 and involved the design, construction, and operation of a small greenhouse, in order to examine some of the technical, horticultural, and economic aspects of northern vegetable production (Romer, 1987). As well as the greenhouse, several cold frames were constructed, empty oil drums were modified to serve as container gardens, and two domes (previously used in Alexandra Fiord) were erected in the village. This work was supported financially by the Government of the Northwest Territories (GNWT) and the Department of Indian Affairs and Northern Development (DIAND). Logistical support was provided by the Toonoonik-Sahoonik Co-op. After having completed the initial construction of the greenhouse during the summer of 1985, it was relocated in the fall of the same year to a location adjacent to the newly constructed Sauniq Hotel. At the same time, a number of significant upgrades were made to the greenhouse that allowed for operations to take place throughout the year. Both soil and hydroponic systems were used in this greenhouse, and results demonstrated that year-round production of selected temperate vegetables was feasible from both a technological and a horticultural perspective when efficient climate control, insulation, and plant growth were incorporated into the project design (Poole, 1985; Romer, 1987). The economic viability of greenhouse production was also demonstrated for certain vegetable varieties, especially when production was limited to the spring, summer, and fall seasons, since production during the winter months proved to be very expensive in terms of heating and electrical costs (*ibid.*).

2.3.2.3 Yukon College Northern Greenhouse Research Project. Yukon College, located in Whitehorse, began building its greenhouse in the fall of 2011 (see Figure 18). It operates as a partnership between three of the college’s divisions: the Yukon Research Centre, the School of Access, and the School of Trades, Plumbing, and Carpentry.

FIGURE 18 The Yukon College Greenhouse.
Source: Drury, 2012

The greenhouse provides hands-on education in greenhouse operation and supplies fresh greens to the school cafeteria in winter. One of its principal objectives, however, is to test new technologies for making growing more efficient and overcoming challenges particular to the North, especially extreme cold weather, low-light winter growing conditions, moisture build-up inside the greenhouse, the high cost of heating, air exchange problems, and carbon dioxide depletion in the growing environment (Drury, 2012). Adapting existing greenhouse technologies (such as, polycarbonate glazing and insulated shades) to the North is also an important part of the research being carried out at Yukon College. Some recent innovations that have been incorporated into this greenhouse include the mechanization of most of the greenhouse systems (watering, shutters, lighting, ventilation, bed temperature control, and battery charging/generator operation) as well as the installation of LED grow lights (*ibid.*).

One of the most notable innovations implemented in this greenhouse is the thermal storage and heat modulation system. This system—comprised of used aluminum beverage cans filled with water and placed under the growing beds—is not only extremely low-tech, but is also a cost-efficient and environmentally friendly way to address one of the biggest challenges of northern gardening (see Figure 19).

FIGURE 19 Thermal storage and heat modulation system, Yukon College Greenhouse.
Source: Drury, 2012

2.3.2.4 University of Alaska Fairbanks School of Natural Resources and Agricultural Sciences Research Greenhouse. The University of Alaska Fairbanks (UAF) has had a research greenhouse on campus for over forty years. When the old greenhouse had to be demolished in 2011 to make way for a new building, it wasn't long before a new $5 million greenhouse was constructed (see Figure 20).

FIGURE 20 The University of Alaska Fairbanks Greenhouse.
Source: Tarnai, 2012

The new 4,500 square-foot facility includes teaching and research areas equipped with state-of-the-art environmental controls and innovative plant production systems (Tarnai and Helfferich, 2012). There is also a headhouse directly connected to the greenhouse; this all-important sister building is not only well lit, but has also been designed especially for seeding, transplanting, and collecting data. University officials underscore the fact that this new greenhouse will provide "excellent opportunities for students to prepare for careers in the modern greenhouse industry" (*ibid.*), and researchers are keen to increase their knowledge regarding best practices for greenhouse crop production in the state of Alaska and across the North. The greenhouse has been deemed a critical component of the School of Natural Resources and Agricultural Sciences' (SNRAS) horticulture program, As the Chancellor of UAF has remarked, "We'll be able to reach out to communities, help in the drive for food security, extend the growing season and create new economic opportunities" (*ibid.*). The director of the UAF Cooperative Extension Service (CES) also notes that controlled environments such as greenhouses will help expand agriculture in the state of Alaska and help the state become more self-sufficient. The Dean of SNRAS underscores this point, noting the fact that controlled environments are the future of agriculture in Alaska (*ibid.*).

2.3.2.5 Arthur Clarke Mars Greenhouse, Devon Island, Nunavut. Also worthy of mention, even though its goals differ substantially from the food security goals of most of the previously described initiatives, is the Arthur Clarke Mars Greenhouse, on Devon Island in Nunavut (see Figure 21).

FIGURE 21 Outside and inside views of the Arthur Clarke Mars Greenhouse.

Source: http://www.cbc.ca/news/technology/arctic-greenhouse-may-lead-to-farms-on-mars; Haughton-Mars Project 2005 http://www.spaceref.com/news/viewsr.html?

This greenhouse was built during the summer of 2002, and additional equipment was installed in 2003. Full operations began in 2004 (SpaceRef Interactive Inc., 2009). The purpose of this greenhouse is to allow the growth, propagation, and harvesting of selected plants in support of basic and applied research in the fields of astrobiology, space biology, life support systems studies, information technologies, and human factor investigations (*ibid.*). While these fields of study are not directly related to community food security and local economic development, advances in technological applications from this highly specific research greenhouse could likely be applied in future commercial greenhouses in the North. The principal institutions involved in this project include the Canadian Space Agency, the University of Guelph, Simon Fraser University, and the University of Florida (Mars Institute, 2009). The main crops grown in this greenhouse (which is characterized by periods of autonomous, computer controlled operations) are cucumbers, radishes, lettuce, and zinnias (*ibid.*). While there is no express community or social well-being component to this particular greenhouse, researchers regularly receive comments from staff and colleagues working on the project (both on site, and in the university laboratory) regarding the mental and social benefits of working in a bright, lush green space (Dixon, 2012)—heady praise indeed from engineers!

2.3.2.6 Centre d'études nordiques (CEN) Whapmagoostui-Kuujjuarapik Research Greenhouse. Another research greenhouse of note is the one at the CEN research station in Whapmagoostui-Kuujjuarapik, in Nunavik. While construction of a brand new greenhouse was completed in 2011, it is important to mention that this is not the first greenhouse at the station; during the 1980s both a greenhouse and a high tunnel were maintained at the site. While these old structures are no longer in use, they served for many years to support the work of biologists researching questions related to restoration ecology and the revegetation of disturbed northern environments (Boudreau, 2014). Over the years, CEN researchers have developed restoration techniques that have proved to be highly effective, and their work has attracted the interest and gained the support of the community. During that time, local students have also been involved in working and volunteering at the CEN greenhouse.

At the moment, the new greenhouse, a 7.5 metre by 9 metre Harnois brand structure, is used primarily for fundamental research on plant ecology (CEN, 2010; Boudreau, 2014). Work on northern herbaceous species of dune plants and beach grasses at the greenhouse has led to the creation and implementation of a number of projects dealing with the re-vegetation and subsequent restoration of disturbed environments, notably in areas surrounding the village of Whapmagoostui-Kuujjuarapik and the CEN research station (Boudreau, 2014). Due to occasional problems with vandalism related to the location of the old greenhouse and high tunnel on the edges of the station compound, it was decided that the new greenhouse should be constructed within the complex. As shown in Figure 22, the new CEN greenhouse stands between the station manager's residence and the kitchen, at the heart of the complex. In the image, the greenhouse is the third building from the top, on the right-hand side. Note the old high tunnel structure at the top left of the image; the old greenhouse is just outside the bottom of the frame.

FIGURE 22 CEN research station showing greenhouse and old high tunnel structure.
Source: http://132.203.57.253/document/kuujjuarapik_en_2013_08_22.pdf

The new CEN greenhouse currently operates only during the summer months (from mid-June until the end of August), when researchers and students are on site. However, since the greenhouse does have comprehensive heating and lighting systems, the structure could theoretically be used for a much longer period. CEN researchers are hoping that interest in using this state-of-the-art facility will increase over the years.

2.3.2.7 Antarctica. While obviously not in the North, it is still pertinent to mention that there are greenhouses at many of the operating bases in Antarctica, including the Italian base at Terra Nova Bay, the South Pole Research Centre, and McMurdo Station. The main purpose of these greenhouses is to provide fresh food to staff who are overwintering. However, increasingly, experiments are also being done on the growing of hydroponic vegetables in controlled environment systems, notably for future applications in space (Campiotti, 2009; NASA-Space Biosciences Division, 2014). One of the most interesting things to note is that these greenhouses seem to be valued by staff just as much for their "bright lights and lush, humid environments" as for the fresh food that they produce (NSF, 2004).

2.3.3 Commercial Greenhouse Operations

2.3.3.1 Commercial Greenhouses, South Ostrobothnia, Finland. In Finland, in the region of South Ostrobothnia, greenhouse production was first introduced in 1916 (Palomaki and Noble, 1995). The poor socioeconomic situation of the population, as well as the prevalence of rocky and boggy soil, meant that conditions were favourable to a new and promising agricultural venture. However, the adoption of this new method of production was slow and it wasn't until the 1960s that it was generally accepted in the region (*ibid.*). There are five principal vegetables grown in Finnish greenhouses: tomatoes, cucumbers, lettuce, bok choy, and parsley; however, flowers, especially roses, are also an important crop. According to Palomaki and Noble (1995), the principal challenge facing horticulturalists in Finland has to do with the long hours of darkness in late winter and early spring, coupled with the cold climate, which drives up the costs of heating and artificial lighting. Yet, the fact that the quality of the final product is high, especially in the case of tomatoes, means that the niches that the Finns have carved for themselves in the local, regional, and international markets have good long-term prospects (*ibid.*). Several prominent Finnish institutions, such as the Finnish Glasshouse Growers Association, The University of Helsinki Faculty of Agriculture and Forestry, The Martens Garden Foundation, and the Finnish Ministry of Agriculture, are dedicated to research and innovation in this sector. For example, the horticultural department of the Ministry of Agriculture is currently focusing its efforts on research into closed greenhouse environments and the determination of ideal cultivation conditions within them (MTT, 2009).

2.3.3.2 Commercial Tomato Production, Nybyn Sweden. Inspired by the Finnish greenhouses just across the border, Swedish entrepreneur Roger Nilsson launched a commercial tomato production facility in 2012 (Radio Sweden, 2012) (see Figure 23).

FIGURE 23 Tomato greenhouses in the village of Nybyn, Sweden.

Source: http://www.gettyimages.ca/detail/news-photo/tomato-greenhouses-are-seen-at-the-nybyn-village-north-of-news-photo/156657122

Right at the Arctic Circle, this small village of 245 inhabitants in Swedish Lapland is now home to a 1,500 m^2 greenhouse that produces tomatoes year-round (*ibid.*). The greenhouse holds 3,700 plants and produces 1000 tonnes of tomatoes per year. Although it is expensive to heat in winter, producing tomatoes this way and marketing them locally actually uses less energy than importing tomatoes from countries like Spain (Laouchez, 2012).

2.3.3.3 Commercial Greenhouses, South Iceland. Perhaps some of the most famous northern greenhouses in the world are those in Iceland, which are unique because they use geothermal energy to power their operations (see Figure 24).

FIGURE 24 Geothermal greenhouses in Iceland.
Source: http://www.nea.is/geothermal/direct-utilization/greenhouses/

Apart from space heating, warming greenhouses is one of Iceland's oldest and most important uses for geothermal energy (Orkustofnun, 2014). This practice began in 1924 – almost a century ago now (*ibid.*). The technology, which harnesses heat and steam from underground volcanic sources, powers and heats much of the public and private sector in Iceland, and it is no surprise that greenhouse growers caught on to this innovative use of a clean and renewable energy source, especially since heating is one of the biggest costs in any greenhouse operation. The majority of Iceland's greenhouses are in the south of the country, and the town of Hveragerði, is perhaps one of the most renowned locations for these types of horticultural operations (Gourmet Iceland, 2010). For the most part, Icelandic greenhouses are constructed of glass, and many operations use inert growing media (such as volcanic scoria and rhyolite) placed directly on concrete floors to grow their crops. Interestingly, geothermal heat is not only used to heat the air and soil in Icelandic greenhouses but is also often used to boil and disinfect growing media in order to reduce disease and contamination (Orkustofnun, 2014). In Iceland, 50% of greenhouse capacity is dedicated to vegetables (tomatoes, cucumbers, peppers, etc.) and strawberries, 26% is dedicated to growing cut flowers and potted plants for the domestic market, and 24% is used to grow bedding and forest plants (*ibid.*).

2.3.3.4 Small-Scale Commercial Greenhouse, Narsaq, South Greenland. The community of Narsaq (population 1600) is situated in the Kujalleq municipality in South Greenland. A greenhouse pilot project was launched there in 2006. When the experimental project ended, the greenhouse installation was bought by two local entrepreneurs, who continue to grow and sell fresh produce to this day (see Figure 25). The principal goals and objectives of the 2006 experimental project were to prove that greenhouse gardening in an arctic climate is a viable alternative to importing fresh fruits and vegetables from abroad, and that solar technologies can generate substantial economic, environmental, and social benefits (Narsaq Greenhouse, 2009). According to the project website, "Growing produce domestically would boost Arctic economies and produce better, fresher, and healthier products for local communities" (*ibid.*). Produce successfully grown in the greenhouse during the initial project phase included tomatoes, cucumbers, peppers, cabbage, broccoli, celery, parsley, and even bananas (Arctic Technology Centre, 2009).

FIGURE 25 Exterior view of commercial greenhouse in Narsaq, South Greenland.
Photo: Author's personal collection

The greenhouse depends primarily on solar energy, yet also has an oil-fired boiler which provides backup heating. The floor of the greenhouse also has a bed of sand in which hot water pipes are embedded in order to store and distribute heat. The current owners of the greenhouse focus primarily on tomatoes and cucumbers (see Figure 26), growing special cultivars of these plants (that cost over one dollar a seed) that mature rapidly in the short arctic growing season (Madsen, 2011). As shown in Figure 27, a series of cold frames next to the greenhouse are used to grow such things as radishes, greens, and herbs. As well, flowers, specifically geraniums, are also being grown in the greenhouse to sell for use as bedding plants and in window boxes in the community (see Figure 28). When questioned as to his opinion of the greenhouse, the chef at the hotel restaurant commented that even if he has to pay double the price for locally grown produce, it still makes economic sense to him because at least half of the produce he imports arrives damaged and has to be thrown away. And, he noted, fresh produce always tastes better than imported.

FIGURE 26 Interior views of Narsaq greenhouse, showing tomatoes and cucumbers.
Photo: Author's personal collection

FIGURE 27 Cold frames (at beginning of season) next to the Narsaq greenhouse.

Photo: Author's personal collection

FIGURE 28 Production of bedding plants in the Narsaq greenhouse.

Photo: Author's personal collection

2.3.3.5 Chena Fresh Greenhouse, Chena Hot Springs Resort, Alaska. According to the website of the Chena Fresh Greenhouse, "one of the most underreported challenges currently facing Alaska is food security. Today, Alaska imports 98% of its food" (Chena Fresh Greenhouse, 2014). Since the Chena Hot Springs Resort's objective is to be sustainable, self-sufficient, and self-reliant in their northern location, it comes as no surprise therefore, that these environmental pioneers have been striving to address this concern since they built their first test greenhouse in 2004 (*ibid.*). This greenhouse, heated year round, relies entirely on 165°F (73.9°C) water pumped from the same geothermal source that heats the therapeutic pools that the resort is famous for. A two-inch (5.08 cm) radiant fin tube installed around the perimeter of the growing area acts as a conduit for the hot water and provides part of the heat, while the same water pumped through a radiant air exchanger provides the rest (CHSR, 2014). During the winter months, warm air is also blown between layers of plastic on the roof and end walls to create an insulating cover. This method has proven to be extremely effective. During the winter of 2005, this system kept the inside temperature at a balmy 78°F (25.6°C) while outside temperatures dropped to -56°F (-47°C) (*ibid.*). Hydroponically grown tomatoes and lettuce are the main crops produced in the Chena greenhouses at the moment. However, the resort has recently expanded their controlled environment facilities and now boasts a new 4320 ft^2 (1317 m^2) greenhouse that will provide the hotel restaurant, staff, and local consumers with an even greater variety of fresh produce (see Figure 29). The new greenhouse complex also includes not only a work area, but also a public viewing area: the resort owners understand the value of sharing their knowledge and educating the public!

FIGURE 29 Exterior and interior views of the Chena Hot Springs greenhouse, Alaska.
Source: http://www.chenafresh.com/photo-gallery/chena-fresh-greenhouse/

2.3.3.6 St. Paul Greenhouse Project, Pribilof Island, Alaska. The Pribilof Island community of St. Paul has always been well-known for its seafood; however, a new project is aiming to broaden local food production to include greenhouse-grown vegetables (Paulin, 2012). The Tribal Government of the Aleut Community of St. Paul Island recently received a substantial federal grant ($437,524 USD) from the Administration for Native Americans through its Social and Economic Development Strategies program. Using these funds, the tribal government intends to develop and implement a local agricultural enterprise that, while incorporating sustainable practices, will grow fresh produce year-round in this Alaskan community (*ibid.*). The greenhouse project promoters have a three-year plan. Year one will involve acquiring and assembling the greenhouse, recruiting and training volunteers, and planning for cultivation activities. Year two will focus on the production of the first crops (most likely tomatoes, lettuce, and cucumbers), as well as trials and testing of certain other vegetables. Year two will also see greenhouse staff attend management and training courses, the training of volunteers, the sale of produce at the local store, and the implementation of cooking demonstrations as well as "tasting tours." Based on the results obtained in year two, year three will involve further expanding the selection of crops in the greenhouse as well as rotating them. In addition, year three will involve working with a renewable energy company to incorporate a wind turbine into the greenhouse system in order to reduce energy costs. Of note is the fact that the overarching goal of this project is long-term sustainability (as opposed to profit generation) and that all profits generated through the sale of produce will be re-invested into the greenhouse in order to ensure continued operation in the future (*ibid.*). Promoters are really striving to include the community as much as possible in the elaboration of all stages of this project, and consequently community contributions, in-kind donations, and volunteer participation are an integral part of the business plan. The project has substantial local support, and a number of community organizations—including the Central Bering Sea Fisherman's Association, Tanadgusix Corporation, Pribilof School District, and the City of St. Paul—have already committed to the project (*ibid.*).

2.3.3.7 Meyers Farm, Bethel Alaska. Meyers Farm is located on a barren, windswept plain along the Kuskokwim River outside of the village of Bethel in far western Alaska. It is not the sort of place where one would expect to find strawberries in bloom or lettuce a couple of inches high in late May but, thanks to a low-tech solution called a "high tunnel", this is possible (Medred, 2013). High tunnels (see Figure 30) are similar to greenhouses; in fact they are greenhouses in their most primitive form - no extra heating, no ventilation, no carbon dioxide production, not even any "end-walls" in some cases. However, these simple, relatively inexpensive structures made largely of high-tech, durable, translucent plastic, can modify local growing environments to impressive extents. By cutting the wind, harnessing solar radiation from the sun, and trapping humidity, high tunnels can give northern farmers a real leg up.

FIGURE 30 High Tunnel on Meyers Farm in Bethel, Alaska.
Source: http://www.adn.com/article/20130609/farm-flourishes-alaska-tundra

Tim Meyers, founder and owner of Meyers Farm and a self-proclaimed outside-the-box kind of guy who dislikes rigid and predictable thinking, has embraced this technology, stating that high tunnels are easy to construct and perfect for small-scale farming (*ibid.*). Mr. Meyers notes that he has doubled the length of his growing season since having constructed high tunnels on his farm and he can now usually begin harvesting his first crops in May. Strawberries, lettuce, onions, celery, broccoli, cauliflower, peas, turnips, beets, parsley, and rosemary all thrive in his tunnels, and he has a steady following of customers at the farm stand that he opens twice a week. Meyers has been critical of past attempts to increase agricultural productivity in the North: "Obviously what we've been doing isn't working. So let's try doing things differently" (*ibid.*). The solution that Meyers proposes hinges on a combined high/low-tech approach inspired by traditional ways of doing things. Meyers believes that this approach to local food production will help Alaskans to become more self-sufficient and food secure in the coming years. The Alaskan government also seems to be coming around to this way of thinking, since it has now subsidized the purchase of approximately 500 high tunnels since 2010 (Clayton, 2013).

2.3.4 Personal Greenhouses

The following images represent a selection of personal northern greenhouses and agricultural initiatives. These types of initiatives deserve mention because the owners possess detailed local knowledge (often gleaned over many, many years) and substantial experience regarding what works best ("best practice") in their community. This type of vernacular knowledge is invaluable when harnessed and applied to the development of larger-scale projects in the same villages.

FIGURE 31 Churchill, Manitoba, Canada – Cold frames attached to side of a house.
Photo: B. Ford

FIGURE 32 Kuujjuaq, Quebec, Canada – Indoor garden and greenhouse on the land.

Photos D. Whitely; Author's personal collection

FIGURE 33 Kuujjuaq, Quebec, Canada – Cold frame near house and tundra garden.

Photos: Author's personal collection

FIGURE 34 Kuujjuaq, Quebec, Canada – Cold frame, pepper, pansies, and cold frame.

Photos: Author's personal collection

FIGURE 35 Salluit, Quebec, Canada – Exterior and interior of two small greenhouses.

Photos: Author's personal collection

FIGURE 36 Salluit, Quebec, Canada – Lettuce from an experimental hydroponic garden.

Photos: Courtesy of S. Grasser

FIGURE 37 Greenland – Personal greenhouses in Nuuk, Kangerlussuaq, and Narsaq.

Photos: Author's personal collection; http://www.reuters.com/article/2013/03/26/us -greenland-climate-agriculture-idUSBRE92P0EX20130326

What is important to take away from this chapter is the fact that, even though it seems counterintuitive today, agriculture is not actually new to the North. Even greenhouses, a relatively new invention in the long history of agriculture, have been part of the northern landscape in the past. As with many other elements of culture, agriculture travelled with those people who practised it, from the Vikings in Greenland to the first missionaries and HBC factors to establish themselves in the North. In the case of the first Europeans who came to Canada, gardening and growing vegetables was a familiar, proven way to produce food. In fact, it was virtually the only way to get fresh vegetables, since the maritime and overland travel of the time was too slow to permit anything but the transportation of non-perishable goods. With the emergence of our conventional—now globalized—food system came a transition in the Canadian North that was paralleled in many regions of the globe. With the advent of modern air transportation in the middle of the last century, it was no longer necessary to grow one's own fresh produce because, with regular flights from the South, fresh fruit and vegetables could now be rapidly shipped to the North. However, even though it was recognized at the time that the cost of shipping produce was high and the quality was often less than desired, it was nonetheless easier to simply go to the general store than plant and mantain a garden.

Today, while transportation to the North is faster and better than ever, northern communities are awakening to the fact that our conventional, globalized food system has inherent flaws—flaws that are ever more apparent the farther one is away from centres of production and distribution. Not only is there a huge environmental cost to importing food from elsewhere, but if there were ever a break in the transportation chain that links northern villages to their southern supply bases, it would not be very long before acute food shortages would manifest themselves.

Before modern transportation created a dependency on southern goods, Northerners were much more self-sufficient—and ultimately resilient—than they are today. With the looming spectre of rapid sociocultural and environmental change in the North (including rapid population growth leading to an increasing number of mouths to feed), as well as the potential for disruption of the global food supply chain, it is becoming apparent that Northerners need to examine how to once again increase their ability to meet more of their food needs themselves. After all, the lessons of the past have proven that it is technically feasible to operate productive agricultural initiatives in the North, and the question of adaptation in the face of rapid change is one that is of the essence today.

Chapter 3.

Mobilizing an Alternative Northern Food Strategy

While the previous chapters have been mostly descriptive in nature, this chapter will delve into the realms of theory by introducing the three key concepts that form the framework of this thesis. These concepts, and the framework that they form, are a base upon which I believe an alternative northern food strategy can be built. Such a strategy might not only help to address issues related to food security but also certain larger issues relating to current environmental and social concerns in the North.

Throughout the beginning stages of this work and during subsequent discussions with community members, leaders, and stakeholders, certain themes emerged. The three key concepts that best represent these themes are the following: 1) food security—the project must directly address the difficulties associated with obtaining fresh produce in the North, 2) sustainable development—the project must be economically, environmentally, and socially viable over the long term, and 3) social/community development—the project must address the social challenges that are present in Inuit communities, especially those that affect youth. In order to address these issues I chose three working concepts that together form the conceptual framework of this thesis: 1) local food, 2) ecological design, and 3) community capacity.

This chapter will introduce these three working concepts, concepts that I feel could be successfully used to mobilize the development of positive, sustainable change in northern food systems. As the reader will note, the amount of time spent discussing each of the three concepts here is not equal; a disproportionately large amount of time has been spent on the concept of local food. This is because, for me, the concept of local food is the most important of the three concepts, since the end goal of this work is the design of an alternative local food procurement strategy for Nunavik. With that in mind, I have made a conscious decision to use local food as an overarching concept and have the other two concepts—ecological design and community capacity—play complementary, supporting roles. I chose the concept of ecological design because it provides a technical paradigm that is consistent with the core values of the local food movement and also because greenhouses are regularly included in ecological design projects. The concept of community capacity was also essential to include because it is one of the most valued spin-offs of the multifaceted community-based project—the Kuujjuaq Greenhouse Project—that is at the core of this research.

3.1 Local Food

3.1.1 Introduction and Overview of the Local Food Movement

3.1.1.1 Community-based Food Systems (CFSs) and Local Food Systems (LFSs). The local food movement is a social phenomenon that is gaining more ground worldwide each year. At the root of this movement are initiatives that are often referred to as either community-based food systems (CFSs) or local food systems (LFSs). Collectively, these initiatives are understood to be collaborative efforts to build locally based food systems and economies (Peters, 1997). The term "local food" is often used to refer to food produced near its point of consumption in relation to the modern/dominant mainstream food system (Deverre and Lamine, 2010; Peters *et al*, 2008). As Macias (2008) points out, concerns regarding the risks inherent in industrial food production, as well as growing uncertainties about the costs of fossil fuel inputs needed to sustain this industry and the "food miles" travelled between farm and dinner plate, have placed the local food movement on firmer ground in recent years. Macias (2008) notes that the past few years have been characterized by a growing consumer awareness of the benefits of local agriculture, and that this in turn has the potential to foster a local food ethos that has been varyingly labelled "food citizenship", "ecological citizenship", and "civic agriculture". While for many the concept of local food may be new, it is important to underline that this concept is essentially a resurgence of old ways, moulded to fit new realities.

Community-based food systems and local food systems prioritize local resources and local markets, emphasize social equity and environmental sustainability, and rely on relationships between growers and eaters, retailers and distributors, and producers and processors of food within the community (Heller, 2005). In speaking to the concept of local food production and consumption, Kloppenberg (1996) coined the term "foodshed", an idea inspired by the concept of watersheds. This author states that foodsheds are "self-reliant locally or regionally based food systems comprising diversified farms using sustainable practices to supply fresher, more nutritious food to small-scale processors and consumers to whom producers are linked by the bonds of community as well as economy."

With respect to the concept of "local"—which indicates a specific relationship with a geographic place—it is important to note that most organizations involved in local food initiatives entertain very broad definitions of the term, often incorporating specific goals and objectives that CFSs and LFSs ought to deliver into the definition itself. Kneafsey *et al* (2013) note that generally local food systems are defined as those where production, processing, and consumption of food occur in a defined reduced geographical area (depending on the sources) of about 20 to 100 km radius). According to Blouin *et al* (2009), there are three distinct aspects of CFSs and LFSs that encompass the notion of "local": proximity, objectives, and distribution mechanisms. One of the emerging debates surrounding the notion of local pertains to its definition in terms of physical distance versus sociopolitical boundaries. Martinez *et al* (2010) note that there is no consensus on a definition of "local" or "local food systems" in terms of the geographic distance between production and consumption. These same authors mention, however, that defining "local" based on marketing arrangements, such as farmers selling directly to consumers at regional farmers' markets or to schools, is well recognized. Chinnakonda and Telford (2007), also underscore the fact that there is no consensus as to how to define "local" but note that there are several different ways that the concept has been elaborated in recent years. For example, in northern Europe the concept is often associated with notions of sustainable production, traceability, animal welfare, health, and food security. In southern European countries (most notably Spain, Italy, and France), the concept has been expanded to include regional characteristics that are intimately linked to crops, soil, and climate and to artisans who produce and transform food (*ibid.*). These authors note, however, that these types of definitions are largely ignored in practice and that many organisations tend to fall upon an operational definition of local that is based on the distance between field and plate. As well, many governments have developed definitions of local that are based on the territorial boundaries between cities, regions, and countries. In the USA, the concept of local is most often linked to the notion of distance (i.e., food produced less than thirty miles away from the point of sale), but it has also been linked to the notion of time travelled from the point of production to the point of sale (i.e., less than twenty-four hours of travel time) (*ibid.*). In Canada, the federal Food Inspection Agency (CFIA) has adopted an interim policy on local food that recognizes “local” as: 1) food produced in the province or territory in which it is sold, or 2) food sold across provincial borders within fifty kilometres of the originating province or territory (CFIA, 2014).

There are two dominant modes of production in the local food movement: market-based (production of food for sale) and non-market-based (production of food for personal consumption or to supply a food bank, for example). These two modes of production represent opposing ends of a spectrum, and while many local food initiatives operate strictly under the auspices of one mode or the other, there are many initiatives that are situated somewhere in the middle of the spectrum. Examples of these types of hybrid initiatives include collective gardens that have a fruit/vegetable stand where produce is sold to the public and community gardeners who sell their surplus to friends and neighbours.

CFSs and LFSs are noted for their linking together of two grass-roots movements - sustainable agriculture and community food security.[12] They are characterized by short food supply chains (SFSC), where food is grown and consumed directly by household members or purchased directly from farmers or through local businesses and the number of intermediaries is minimized (Kneafsey *et al*, 2013; Deverre and Lamine, 2010; Blouin *et al*, 2009; Conner and Levine, 2007).[13] In French, the term *approvisionnement local* is used to describe the concept in terms of a local food supply. As well, the expression *systèmes*

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[12] According to the United States Department of Agriculture (USDA, 2010), “The term sustainable agriculture means an integrated system of plant and animal production practices having a site-specific application that will, over the long term: satisfy human food and fibre needs; enhance environmental quality and the natural resource base upon which the agricultural economy depends; make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls; sustain the economic viability of farm operations; and, enhance the quality of life for farmers and society as a whole.”

[13] According to Martinez *et al* (2010), the most important feature of a short food supply chain (SFSC) is that the product reaches consumers with embedded information, through package labelling or personal communication, that enables them to connect with the place of production and, perhaps, the people involved and methods used to produce the product. One criterion used to differentiate SFSCs is spatial proximity, where products are produced and retailed in a specific region of production and consumers are made aware of the local nature of products (ibid.).

agroalimentaires alternatifs or S3A, referring to "alternative food systems," is also commonly employed (Deverre and Lamine, 2010). These expressions are often used interchangeably with the term "local food production," and all of these terms are usually discussed within the context of an urban environment—whether that involves producing food directly in cities (urban agriculture—UA) or supplying cities with produce from adjacent rural regions.

3.1.1.2 Urban Agriculture. Mougeot (2005: 2) describes urban agriculture as "an industry located within (intra-urban) or on the fringe (peri-urban) of a town, a city or a metropolis, which grows, raises, processes and distributes a diversity of food and non-food products, (re-)using largely human and material resources, products and services found in and around that urban area, and in turn supplying human and material resources, products and services largely to that urban area." This author identifies two major forces that drive people from all walks of life (but most particularly those having low incomes) to cultivate land in the city. These forces are food security and income generation. Duchemin *et al* (2009) note that urban agriculture (sometimes called "city farming") encompasses the following: the growing of plants and trees that yield edible and non-edible products, animal husbandry, and the transformation and commercialization of products derived from these activities. These authors also underscore the fact that urban agriculture helps improve economic conditions, as well as the health of the poor and the vulnerable—especially women and children—in both developing and industrialized nations. According to the Food and Agriculture Organization of the United Nations:

> Urban and peri-urban agriculture (UPA) contributes to food availability, particularly of fresh produce, provides employment and income and can contribute to the food security and nutrition of urban dwellers. It encompasses a complex and diverse mix of food production activities, including fisheries and forestry, in many cities in both developed and developing countries. It contributes to food availability (particularly of fresh produce), provides employment and income and can contribute to the food security and nutrition of urban dwellers.
>
> (FAO, 2014)

Further to this, the Resource Centres on Urban Agriculture and Food Security Foundation (RUAF) notes that urban agriculture is increasingly recognized by city authorities and civil society organisations for its capacity to strengthen the resilience of the urban food system, enhance access of the urban poor to nutritious food, generate (self-)employment and income, and help the city to adapt to climate change and reduce its ecological footprint (RUAF, 2014). It is perhaps pertinent to note here that while communities in the Canadian North are generally very small and cannot really be considered urban in a conventional sense, they do face many of the same challenges (for example, lack of access to arable soil) that face local food initiatives in larger centres.

3.1.2 Examples of Local Food Production Systems

As noted previously, there is a wide diversity of community and local food systems and, while many types of new and innovative local food strategies are emerging daily, I have chosen to focus here on two specific types of initiatives: community gardens and collective gardens.[14] [15] The reason for this choice is that these are the types of initiatives that are presently of most interest to Nunavimmiut.

3.1.2.1 Community gardens. Community gardens, sometimes called allotment gardens, are one of the most common forms of local food production, and they engage members of society of all ages and from all walks of life. Cosgrove (1998) explains that a community garden is an "open space that a group of citizens voluntarily manage, where horticultural activities are practised."[16] In the same vein, Patel (1991) describes community gardens as "neighbourhood

[14] It is important to specify here that the following descriptions of community and collective gardens focus on the models most commonly implemented in North America and specifically in Quebec. Overseas, in Europe notably, community and collective gardens are organized in slightly different ways.

[15] Other common types of local food production and marketing initiatives include community supported agriculture (CSA), food box programs, farmers' markets, farm shops (notably fruit and vegetable stands and pick-your-own operations), virtual or Internet markets, and institutional procurement strategies. (Kneafsey *et al*, 2013)

[16] The technical definition of horticulture is "the art or science of garden cultivation" (Canadian Oxford Dictionary, 2004). However, the horticultural industry entertains a broader notion of the concept, one that includes the cultivation of all types of market vegetables (potatoes, tomatoes, lettuce, carrots, etc.) as well as all types of berries (blueberries, cranberries, strawberries, etc.), tree fruit (apples, pears, plums, etc.) and vines (grapes) (CHC, 2010). As well, greenhouses are considered horticultural initiatives—whether they produce food, flowers, or ornamental plants (CQH, 2010).

open spaces managed by and for the members of the community." Most often established in urban environments, community gardens provide green space for city residents (often apartment dwellers) who would otherwise not have access to land. Community gardens are generally an ensemble of small, individual garden plots set up on larger pieces of "unused" land or vacant lots (Pedneault and Grenier, 1996). Individual plots generally range in size from 2.8 to 24 square metres (Boulianne *et al*, 2010; Olivier-d'Avignon *et al*, 2009). Community gardens come in all sizes—some as small as only a dozen plots, and some having in excess of three hundred. As well as being located on vacant lots, community gardens can also sometimes be found in unusual places such as rooftops.

Garden plots are generally rented to gardeners for a small yearly fee (usually \$10–\$20) that is paid to a garden society, and then put towards maintenance and upkeep of the site. "Garden society" is a general term used to refer to the group that is responsible for the operation and maintenance of the community garden. In some cases these societies are citizen groups—composed of a president, secretary, treasurer, and various board members—and in other cases municipalities or city boroughs fulfill this role (Olivier-d'Avignon *et al*, 2009). Most community gardens have certain installations and amenities that all gardeners can use as needed (*ibid.*), namely tool storage sheds, watering hoses, compost bins, picnic tables and benches, and sometimes playgrounds for children. Most community gardens are low-tech and tend to use organic gardening methods.[17] Some garden societies insist that the majority of the individual garden plot be used for vegetable production and restrict the growing of flowers to only a small percentage of the surface area. Some societies also designate specific (shared) plots for the growing of crops such as: large plants (for example, sunflowers,

[17] Canadian Organic Growers, a national advocacy organization, defines organic agriculture as an agricultural method that adheres to the following seven principles: 1) Protect the environment, minimize soil degradation and erosion, decrease pollution, optimize biological productivity, and promote a sound state of health, 2) Maintain long-term soil fertility by optimizing conditions for biological activity within the soil, 3) Maintain biological diversity within the soil, 4) Recycle materials and resources to the greatest extent possible within the enterprise, 5) Provide attentive care that promotes the health and meets the behavioural needs of livestock, 6) Prepare organic products, emphasizing careful processing and handling methods in order to maintain the organic integrity and vital qualities of the products at all stages of production, 7) Rely on renewable resources in locally organized agricultural systems. (Canadian Organic Growers, 2010)

pumpkins, and zucchinis); herbs, spices, and medicinal plants; and, flowers and/or ornamental plants (Boulianne *et al*, 2010).

While it is evident that community gardens contribute in a meaningful way to household food security, a recent study discovered that the reason that a vast majority of people garden in community settings is for the pleasure of the activity and for the social benefits that they derive from this leisure activity (Boulianne *et al*, 2010; Pedneault and Grenier, 1996). The multiple benefits, as well as the challenges, of community gardening will be discussed in further detail in sections 3.1.3 and 3.1.4.

3.1.2.2 Collective gardens. Collective gardens, like community gardens, are most often found in urban environments. The principal difference between collective gardens and community gardens is that collective gardens all have an express social mission (Boulianne, 2014; Olivier-d'Avignon *et al*, 2009). [18] While at the end of the day they procure many of the same social benefits as community gardens, their principal raison d'être is not to provide recreation and leisure—it is to respond to social problems in communities and to foster the empowerment of citizens (Boulianne, 2014; Stiegman, 2004; Duchemin *et al*, 2009; Olivier-d'Avignon *et al*, 2009). Examples of challenges that collective gardening initiatives respond to include food security, public health, education, and social integration (*ibid.*). As stated by Castell (2010: 1): "Collective gardening has often been initiated as a strategy to cope with problems of marginalization, stigmatization and social exclusion, and as a means of revitalizing deprived neighbourhoods." Collective gardens are often associated with non-governmental organizations (NGOs) that have a social mission to which gardens (and the act of gardening) can respond. Examples of NGOs that operate collective gardens include food banks and community kitchens; organizations that work with new immigrants, young mothers, and senior citizens; organizations that work with the mentally and physically challenged; rehabilitation centres; and organizations that help youth and disadvantaged

[18] In the English literature, it is only in recent years that a distinction has been made between "community gardens" and "collective gardens." In the past, it was common to employ the all-encompassing term "community garden" when referring to the many varied activities that fall under the umbrella category of urban agriculture. In the French literature the distinction between these two predominant types of urban agriculture has always been recognized.

persons develop job skills (Frohardt, 1993; Stiegman, 2004; Duchemin *et al*, 2009; Boulianne, 2010). While many collective gardens operate under this NGO model (and are administered and operated by paid staff [Boulianne, 2010]), others are completely volunteer based and independent of umbrella organizations. It is also important to underline the fact that, while collective garden initiatives are open to all, the vast majority of participants are women (Stiegman, 2004; Boulianne, 2010). Collective gardens, unlike community gardens that have many individual plots, are generally composed of one single large plot that is cultivated together by all members of the garden group (Olivier-d'Avignon *et al*, 2009). Some collective garden groups have as few as four members and others as many as fifty members (*ibid.*). In some cases, garden produce is divided and shared equally among participating members, and in other cases the harvest is donated and redistributed to families in need. As is the case with community gardens, collective gardens generally adhere to the principles of organic gardening (*ibid.*).

A type of collective gardening that deserves special mention is market gardening. This form of collective gardening is an entrepreneurial approach to urban agriculture that generally fulfills a social mission as well. Market gardening has many of the same social, psychological, and environmental attributes of community and collective gardening. What makes it distinct, however, is that it creates a platform for microbusiness development—a platform that can in turn lead to job creation and revenue generation (Frohardt, 1993). According to the Village Vancouver Transition Society (2014), urban market gardens are social enterprises organized to grow and sell more food in the city. Market gardening encourages and provides an outlet for local entrepreneurial activity and can provide opportunities for youth education and job training (*ibid.*). Market gardens link together different players in the local food movement, as produce is generally sold to or distributed through farmers' markets, fruit and vegetable stands, local stores, local restaurants and bakeries, and even churches. As well as garden produce (vegetables, herbs, fruit, etc.) and flowers and ornamental plants, some market gardens also produce and sell value-added products such as herb vinegars, firewood (from damaged city trees), and compost (*ibid.*).

3.1.3 Benefits of Local Food

Local food has become a topic of great importance for many organizations and governments in recent years, and it has been broached from many angles; notably, health and safety, environmental sustainability, economic development, food security, and, support for farmers (Markell, 2009: 1). Heller (2005: 5), notes that "When local agriculture and food production are integrated in community, food becomes part of a community's problem-solving capacity rather than just a commodity that is bought and sold." Community food systems and local food systems are known to have positive impacts on the environment and economy and in the social realm. In other words they are systems that are aligned perfectly with the concept of sustainable development, and they are often lauded for their ability to contribute significantly to community capacity building and to the generation of positive development spirals (Castell, 2010). Boulianne *et al* (2010: 8) outline four dimensions of social benefits that have been identified in urban agriculture initiatives in the industrialized world. They are: 1) the socioeconomic dimension, 2) the socioenvironmental dimension, 3) the sociospatial dimension, and 4) the sociopolitical dimension. These authors note that, while in theory these dimensions can be distinguished as separate entities, in reality they overlap considerably and are often embedded in one another (*ibid.*).

The following section will be divided into three sub-sections, focusing on the social, economic, and environmental benefits of local food production. As was the case in the previous section, the reader will notice that the primary focus of this section is on the benefits associated with community and collective gardens.

3.1.3.1 Social. The social benefits of local food production seem to be the type of benefits that are most readily mentioned by participants in community and collective garden projects. In terms of social impacts, there is evidence, according to Kneafsey *et al* (2013), that short food supply chains favour interaction and connection between farmers and consumers, thus promoting the development of trust and social capital. This can lead to the development of a sense of community and of living together and may even result in behavioural changes (e.g., eating habits, environmental awareness, etc.). One of the primary benefits of local food production is food security (Boulianne, 2014; Bellows *et al*, 2004; Moskow, 1999;

Schmelzkopf, 1996; Patel, 1991), and while not many gardeners will explicitly use this technical term, the concept is implied when they talk about being able to augment the quantity of fresh produce in their homes, and the quality and freshness of this food. Closely related to food security are the health benefits of urban agriculture, which are often discussed in terms of access to nutritious food (Bellows *et al*, 2004; Patel, 1991) as well as in terms of opportunities for physical exercise in a safe, aesthetically appealing, and stimulating outdoor environment (Boulianne, 2014; Bellows *et al*, 2004; Moskow, 1999; Malakoff, 1998; Schmelzkopf, 1996). The aspect of leisure and recreation (socialization, making new friends, and "getting out of the house") has also been underscored by numerous authors (Boulianne, 2014; Saldivar-Tanaka and Krasny, 2004; Moskow, 1999; Schmelzkopf, 1996; Patel, 1991). The contributions to personal morale and self-worth (feeling useful and contributing to ones' household) are also important benefits that are associated with opportunities for the empowerment of vulnerable members of society, particularly seniors, women, and the poor (Moskow, 1999). These benefits are indicative of the potential that exists for the development of human and social capital within community and collective gardening initiatives (Macias, 2008; Glover, Parry, and Shinew, 2005). This aspect of urban agriculture is, in turn, closely related to the benefits for marginalized members of society (e.g., the mentally and physically challenged, residents of rehabilitation centres, at-risk youth, new immigrants, welfare recipients, and single mothers) in terms of social integration, education, and job skills training (Macias, 2008; Malakoff, 1998; Frohardt, 1993). The introduction of children to gardening, and the ability to teach them where food comes from, has also been cited as an important social benefit of community gardening (Malakoff, 1998; Schmelzkopf, 1996; Landman, 1993). As well, the revitalization and greening of neighbourhoods (e.g., turning vacant lots into safe spaces) rates high on the list of social benefits mentioned by members of community and collective gardens in urban environments (Boulianne, 2014; Moskow, 1999; Schmelzkopf, 1995; Landman, 1993; Patel, 1991). Finally, it is important to underline the fact that community gardens are places where the social fabric of communities is woven (Boulianne, 2001). They are places where people from all socioeconomic backgrounds and ethnicities can mix freely and where there is a constant exchange of knowledge, as well as a willingness and desire to share food (*ibid.*). Bellows *et al* (2004: 1) state that: "Growing food and non-food crops in and near cities contributes to healthy communities by engaging residents in work and recreation that improves individual and public well-being." Saldivar-Tanaka and Krasny (2004) note that urban gardening is an effective tool for crime reduction, maintenance of cultural diversity, community empowerment, and the promotion of civic participation.

3.1.3.2 Economic. The economic benefits of local food produced in community gardens relate mostly to the microeconomics of individual households. Community gardeners often speak about the reduction in household food costs as a result of growing their own food, and this anecdotal evidence tends to be confirmed by more systematic studies (Bellows *et al*, 2004; Malakoff, 1998; Patel, 1991). People who grow their own food can also sell a percentage of their harvest in order to make some money to buy products (seeds, other types of food, etc.) that they cannot produce themselves (Moskow, 1999). This action of selling only a small, surplus amount of garden produce is called "small market production." In the case of urban collective gardens, discussions about economic benefits revolve not only around the impact on personal and household finances (sometimes people who work in collective gardens take home a percentage of the harvest) but also around revenue-generating opportunities from the sale of garden produce and value-added products—revenue that is then generally reinvested back into the garden initiative. Collective gardens (mostly those associated with NGOs) are often operated and managed by salaried employees (Stiegman, 2004), and these initiatives also frequently employ summer students and/or interns (Frohardt, 1993). Even though the focus of this section is on community and collective gardens, it is important to note that one of the principal economic impacts of the local food movement in general is the fact that money and economic profit stay and circulate within the region, thus contributing to the long-term health of the local economy and, perhaps more importantly, the long-term health of local farms through job security for farmers (Deverre and Lamine, 2010; Saldivar-Tanaka and Krasny, 2004).

3.1.3.3 Environmental. The environmental benefits of community and collective gardens, and urban agriculture initiatives in general, are numerous and far-reaching. Discussions about these benefits often begin simply with the mention of the positive impacts generated by the beautification of neighbourhoods and the greening of the city (Malakoff, 1998;

Schmelzkopf, 1996; Landman, 1993). This, in turn, is often further developed into discussions dealing with the sustainable development of urban environments (Castell, 2010), urban ecology (Moskow, 1999), and the preservation of urban biodiversity (Saldivar-Tanaka and Krasny, 2004). Urban gardens have been described as the lungs of the city, referring to the fact that vegetation helps attenuate air pollution (Malakoff, 1998). Urban gardens also create shade and help reduce the heat dome effect often observed in cites during hot summer months (*ibid.*). Community and collective gardens help reduce the ecological and carbon footprints of city dwellers through waste diversion from landfill via composting (*ibid.*), as well as by reducing the number of food miles associated with transporting fruit and vegetables to the city from far away (Macias, 2008). Regarding local food production in general and, more specifically, initiatives that involve farms adjacent to cities—the local food movement also contributes in a significant manner to the preservation of rural landscapes and rural communities.

3.1.4 Challenges of Local Food

While there are obviously many benefits associated with local food production, the challenges faced by urban food project promoters are many and there are often significant barriers to the development of local food initiatives. Chief among them are the lack of financing for small-scale projects, the economic power wielded by large corporations, and a lack of knowledge (Blouin *et al*, 2009). Gardens that are already in place are often located in what Saldivar-Tanaka and Krasny (2004) call "contested spaces", where the land tenure of garden societies is not always guaranteed. It is often the case that when gardens were created they were planted on vacant lots that, over time, have increased in value and are now of interest to developers who wish to build upon them (Saldivar-Tanaka and Krasny, 2004; Schmelzkopf, 1995). The threat of eviction in the face of development is therefore a very real one for many urban gardeners (Schmelzkopf, 1995). Urban sprawl is also a concern for community and collective gardens located on the peri-urban fringe (Boulianne *et al*, 2010; Bellows *et al* 2004).

On a smaller (individual gardener) scale, there are a number of problems and challenges that have been identified by gardeners and researchers over the years. They include lack of basic resources such as water, tools, soil, plants, and building materials (Saldivar-Tanaka and Krasny, 2004); vandalism of installations such as storage sheds; theft of vegetables, tools, and equipment (Macias, 2008; Saldivar-Tanaka and Krasny, 2004); "garden politics," which can range from power struggles and backbiting to conflicts related to different ethnic and gender backgrounds (Schmelzkopf, 1995); fights and spats between gardeners over such things as unkempt plots or the shading of neighbours' beds with tall plants; the elitism of garden "management"; and the creation of feelings of exclusion and jealousy between paid employees and volunteers in collective gardens. Bellows *et al* (2004: 10-11) also list several health risks associated with urban gardening, among them: exposure to heavy metals and other pollutants present in contaminated soil, risk of the spread of disease through the use of incompletely composted animal manure, the attraction of mosquitoes to sources of standing water, as well as injury caused by improper use of tools and accidents related to sharp gardening implements. These authors note, however, that these types of risks can most often be mitigated through simple, common sense measures.

While the previous paragraphs focused predominantly on the challenges associated with only two sectors of the local food movement, the following section will examine certain difficult aspects of the movement from a broader angle. Dupuis and Goodman (2005: 1) speak about the local food movement in terms of "localism" and note that, within this context, "the global becomes the universal logic of capitalism and the local the point of resistance to this global logic." These authors go on to explain that in other realms of society the local is often a site of inequality and hegemonic domination. While many among us are embracing the aspects of environmental sustainability and social justice that local food systems bring about, we must be aware of the fact that there is always the possibility that local food production systems become ways for local elites to create protective territories for themselves. These authors raise concerns about what they term "unreflexive" politics, a form of localism based on the interests of a narrow, sectionalist, even authoritarian elite.

Another problematic aspect of local food systems is that, due to market forces and economies of scale that advantage industrial food production, local food (that is purchased, not grown by oneself) is often more expensive than food that is industrially produced and marketed. As

Macias (2008) discusses, this means that fresh, good quality local food is often inaccessible to the poor and the vulnerable, and hence reserved for those members of society who are generally well off. Kneafsey *et al*, (2013) also remark on this phenomenon, stating that there are a few examples where short food supply chains have been seen to be associated with social exclusion (i.e., an excess of localism has led to a focus on wealthy consumers). While discussing the concept of food equity in relation to the higher monetary cost of local food, Macias also explains that lack of time can be a barrier to the consumption of local produce and that this, as well, disproportionately disadvantages the poor and the marginalized (Macias, 2008). This is because buying fresh, raw food implies that one must transform, process, and prepare meals from scratch. While this is not a significant obstacle for medium- to high-income families, low-income families (those headed by single mothers working two jobs, for example) will struggle to find the time, not only to prepare meals from scratch, but also to go out and purchase local food from specialty markets or pick up food boxes from distribution sites on specific days of the week (*ibid.*).

Overall local food production and marketing initiatives bring about a number of benefits to communities, but they are not a panacea, since there are always challenges to contend with and obstacles to overcome, no matter what type of local food model is operated.

3.2 Ecological Design

Before delving into a discussion of ecological design, it is essential to introduce the concept of sustainable development, since it is essentially as a response to the need to develop in a sustainable manner that the field of ecological design came into being. Environmentalists and social activists began ringing alarm bells as early as the 1950s and 1960s, the era when Rachel Carson's *Silent Spring* and Paul Ehrlich's *The Population Bomb* were published (see Carson, 2002 and Ehrlich, 1968). However, it wasn't until the late 1980s, after the major international oil crisis, that the environment and its degradation at the hands of human beings began to noticeably preoccupy politicians and international decision makers. In 1987, the World Commission on Environment and Development published its seminal work, *Our Common Future,* which first brought the concept of sustainable development to the attention of the global community. According to its widely quoted definition, sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 16). Sustainable development is attained when all three of its interconnected spheres—the environment, the economy, and the social realm—are in harmony. See Table 1 for examples of needs that are often categorized in each of these spheres. The Canadian government states that: “[Sustainable development] is about improving the standard of living by protecting human health, conserving the environment, using resources efficiently and advancing long-term economic competitiveness. [Sustainable development] requires the integration of environmental, economic, and social priorities into policies and programs and requires action at all levels—citizens, industry, and governments” (Environment Canada, 2014).

TABLE 1

Examples of Environmental, Economic, and Social Needs

ENVIRONMENT	ECONOMY	SOCIAL
Biodiversity	Services	Equity
Natural Resources	Household Needs	Participation
Carrying Capacity	Industrial Growth	Empowerment
Ecosystem Integrity	Agricultural Growth	Social Mobility
Clean Air and Water	Efficient Use of Labour	Cultural Preservation

(Table inspired by World Bank, 2014)

While the initial proponents of ecological design were already active well before the official WCED policy came out in 1987 (Jack Todd and Todd, 1993), the fact that governments had begun to take the condition of the environment seriously gave their work the backing (and credibility) that it needed, and even though more than twenty years later ecological design is not yet a mainstream phenomenon, it is gaining ground each year.

Ecological design is essentially a conceptual tool that employs nature’s operating instructions in the design of sustainable anthropocentric systems (Jack Todd, 2005: 161). As defined by John Todd and Nancy Jack Todd, ecological design is “design for human settlements and infrastructure that incorporates principles inherent in the natural world in order to sustain human populations over a long span of time; adapting the wisdom and strategies of the natural world to human problems" (*ibid.*). Van der Ryn and Cowan (2007: 33) refer to ecological design as "any form of design that minimizes environmentally destructive impacts by integrating itself with living processes", and Orr (2002) describes ecological design as "the careful meshing of human purposes with the larger patterns and flows of the natural world and the study of those patterns and flows to inform human action." Finally, Gross (2010) defines ecological design as "any form of human intervention with the natural environment that attempts to improve natural conditions or reverse environmentally destructive impacts."

Within the context of the Kuujjuaq Greenhouse Project it is important to underscore the fact that ecological design also regularly incorporates traditional knowledge (for example, when to start planting based on local weather patterns) into modern production systems and that all of the above-mentioned definitions contain elements that are consistent with Aboriginal ways of viewing the human/nature interrelationship. It is also important to note the recommendation of the First Nations of Quebec and Labrador Sustainable Development Institute that all projects involving Aboriginal peoples incorporate a First Nations rights pillar that would encompass all activities on Native territories (Johnson and Basile, 2006).

According to Todd, Doshi, and McInnis (2010), ecological design takes place at three levels, with each level (or order) acting as the foundation for the next level of integration. Together, these levels provide an infrastructural framework that has the potential to underpin new economies while maintaining environmental integrity (*ibid.*). First-order ecological design addresses the strengthening of weakened ecosystems, rapid soil creation, natural resource development, and ecomimetic technologies that support new economic activities. Examples of first-order ecological design include sustainable forestry and agroforestry initiatives, biointensive and permaculture food systems, grey water recycling, and composting. Second-order ecological design involves the development of new symbiotic systems that link across sectors, including energy, natural resources, and regional resource-based manufacturing and service industries. Ecological industrial parks, where diverse entities are brought together to create new symbiotic systems based on the utilization of each other's waste materials and energy are examples of second-order ecological design. Ecological industrial parks, based on agriculture and natural resources (where energy and food production or preparation create new symbiotic systems) are lynchpins for economic diversification. Third-order ecological design adds a time dimension (the concept of succession), both to the landscape itself and to the institutions required to transform the landscape into a durable economy developed to serve the people of the region. (*ibid.*)

According to Van der Ryn and Cowan (2007: 72-74), there are five basic principles of ecological design. The first of these principles, "solutions grow from place", states that solutions grow from the unique cultural and physical characteristics of a place, considerations that are typically ignored in standard design. The second principle, "ecological accounting informs design", allows environmental and social factors (including such things as site, water, energy, materials, and indoor air quality) to be weighted side by side with financial metrics in the design process. The third principle, "design with nature", involves doing such things as designing building orientation and shape to reflect the movement of the sun. The fourth principle, "everyone is a designer", places collaboration with all stakeholders at the centre of the design process. The fifth and final principle, "making nature visible", stresses that each design project has the potential to become a pedagogical opportunity (aimed at both children and adults) for the exploration of water, energy, food, materials, waste, and biodiversity.

The overall objective of ecological design is to establish sustainable economies, beginning with (if necessary) the restoration of the natural environment and, over time, evolving into community development strategies founded on comprehensive educational initiatives. According to Todd, Doshi, and McInnis (2010: 9), the end goal of ecological design is to create vibrant, diversified economies that are founded on principles of environmental stewardship, sustainable development, and social justice.

These principles, as well as the other elements of ecological design that have been outlined above, are all consistent with the vision that the stakeholders have for the Kuujjuaq Greenhouse Project. While the Kuujjuaq project is still in its early days, the fact that it even exists in its current form is testimony to the willingness of stakeholders to embrace a new way of addressing the question of food security in the North, a multidisciplinary way of doing things that not only addresses the root question of food security, but also reaches out into other spheres of human activity. The concept of ecological design as a development tool is especially pertinent in the North, where not only is the fragile Arctic environment particularly susceptible to damage caused by traditional types of industrial development, but social challenges faced by Northerners also loom large. As noted in a recent document entitled *Nunavik: A Homeland in Transition*, "the current demographic profile in Nunavik points to considerable population growth in the coming years. This growth will increase demand on community services, municipal infrastructure—waste water treatment, solid waste disposal, drinking water systems, fuel storage, housing and transportation—education and health facilities, and the provision of jobs particularly for the growing population of young adults" (Jacobs, Berrouard and Paul, 2009: 47). The North is also far removed from the industrial centres—or southern bases (Hamelin, 1980)—that provide many of the goods upon which it is dependent, making populations vulnerable to the vagaries of long range transportation systems. Hence, any technology that can reduce dependency on the South, as well as lessen (or even eliminate) environmental damage while also creating employment, makes sense. Ecological design, with its multifaceted approach, thus becomes a logical and appropriate choice for northern development in this overall context. It is also worth pointing out that many of the elements that the local food movement strives to address, notably through the development of community and collective gardens, are the same as the ones that proponents of ecological design are working on. Further to this, if we take a look at some of the very first historical gardening and agricultural initiatives in the North, we see that they too contain elements of design and function that are common in today's ecological design projects.

3.3 Community Capacity

Community capacity is most often discussed in terms of how to build it in communities where there are social issues that could benefit from concerted development. Community capacity building, commonly referred to as CCB, is a process whereby local partners add value to communities. It is about developing the capacity of communities to respond to their own challenges and opportunities (DITRD-NL, 2010). The heart of capacity building is people, and capacity is simply the ways and means needed to do what has to be done (Frank and Smith, 1999). Accordingly, community capacity is an important consideration in community development, as the process of community development itself often results in increased capacity (*ibid.)*.

The Arctic Council (2000) states that the term "capacity building" is intended to capture the notion of meeting challenges "by increasing the ability of individuals, communities, businesses, industries, institutions, governments, and other organizations to access, understand, and apply information and knowledge in a manner that allows them to solve their own problems in ways that contribute to sustainable development, including environmental integrity."

Capacity, or lack thereof, is reflected in the people, economy, environment, culture, attitude, and appearance of the community, and includes attributes that empower a community to effect social change (Frank and Smith, 1999; Fletcher *et al*, 2007). According to Frank and Smith (1999) capacity is all that is brought to bear on a process to make it successful and is commonly agreed to include the following components:

1. People who are willing to be involved;
2. Skills, knowledge, and abilities;
3. Wellness and community health;
4. Ability to identify and access opportunities;
5. Motivation and wherewithal to carry out initiatives;
6. Infrastructure, supportive institutions, and physical resources;
7. Leadership and the structures needed for participation;
8. Economic and financial resources; and
9. Enabling policies and systems.

(Frank and Smith, 1999: 10)

Community capacity is often evaluated in terms of human capital. Putnam (1993a) notes that an investment in education can enhance a person's human capital and increase that person's productivity in much the same way that a screwdriver (or any other tool) makes a person more productive by enhancing his or her physical capital. According to Coleman (1988), human capital is created by changes in persons that bring about skills and capabilities that make them able to act in new ways. Once the human capital of a community reaches a certain positive level, the possibility of breaking the cycle of poverty that is often associated with social and economic exclusion becomes a reality.

Trudel (2003), comments that discussions about endogenous capacity development have now come to include necessary complementary concepts such as the basic notion of social capital. Social capital is one of the five types of capital (the others being: human, cultural, economic, and natural) that Chambers (1987) describes when referring to “things” that impoverished communities already possess and that they owe it to themselves to valorise. Massam and Dickenson (1999) explain that social capital refers to organizations, structures, and social relations that are built up by people themselves independently of the state or large corporations. Social capital refers to "relationships, and is manifested in the structure of relations between and among persons.” Putnam (1993b) adds that social capital refers to traits displayed by social organizations, including networks that factilitate interaction, social mores that set rules, and confidence in others that arises from collaboration. Putnam underscores the fact that these traits are auto-reinforcing and cumulative, that they engender coordination and cooperation and, therefore, bring about benefits to all, benefits that could be interpreted as increased capacity. This author also remarks that successful collaboration reinforces ties between individuals and facilitates further collaboration. As noted by Flicker *et al* (2008), community-based research can be a community development strategy, which can, among other things, be used to build up capacity. Local community capacity-building projects can reinforce an already present sense of community through the coming together of people to work on shared problems (Fletcher *et al*, 2007). According to Smith *et al* (2003), community capacity is an important step towards self-determination, especially in minority and marginalized populations—groups that often face social and economic exclusion. Atkinson and Willis (2005: 2) define CCB as “local solutions to local problems, which enable communities to deal with problems, ultimately without relying on external resources.” These authors see CCB as a series of grassroots processes by which communities:

1. Organize and plan together;
2. Develop healthy lifestyle options;
3. Empower themselves;
4. Reduce poverty and suffering;

5. Create employment and economic opportunities; and
6. Achieve social, economic, cultural, and environmental goals together.

   (Atkinson and Willis, 2005: 2)

Simpson *et al* (2003: 278), in an article entitled "Community Capacity Building: Starting with People not Projects", sum up this notion in one short paragraph. They state that: "If communities are to survive economic and social crises, the popular argument is that they can best do so by becoming empowered, by building their existing capacity and by using skills they have to make their own futures." According to these authors, broad-based community participation is seen to facilitate this process, and it is to be noted that community-based participatory research strategies, combined with approaches specific to certain geographic regions and cultural communities, can play an important role in this process as well. In sum, CCB is essentially site-specific, bottom-up development that is based on collaboration between all partners, the end goal being the improvement of quality of life through the concerted development and increase of human and social capital.

Multiple, solid links exist between the three concepts presented and discussed in this chapter: local food, ecological design, and community capacity. For example, a local food strategy can be nested inside a larger ecological design project, and an ecological design project can in turn lead to an increase in community capacity through the development of empowering educational and employment opportunities. Link-ups between these concepts, through their practical application, can also lead to harmonization between the three realms of sustainable development: the environment, the economy, and the social realm. For example, a gardening project in Nunavik that trains and employs local residents to grow and sell plants traditionally harvested on the land by Inuit could contribute to the local economy by creating jobs, while at the same time contributing to the environmental remediation of disturbed land and educating youth about traditional culture. Such a project could also lead to an increase of community capacity (by building up the human capital of employees), and could contribute to the reduction of the ecological footprint of the community, as well as increase its self-sufficiency through the local production of fresh food.

Suffice it to say, the potential for internal link-ups between these concepts is seemingly endless, and this potential lends itself well to a community-based participatory research strategy (to be presented in the next chapter).

Chapter 4.
Action Research in the North

The concepts presented in the previous chapter shaped the direction that this research took from the beginning. However, in order to apply these concepts in practical terms, an operational framework was necessary. To this end I chose to use an action research methodological approach, applying the practice of community-based participatory research (CBPR) to my work. The following chapter presents the overarching research protocol within which my work was conducted and introduces the concept of CBPR. It also demonstrates the suitability of this emerging research paradigm as a tool for research in the North. The second section of this chapter will deal with the more technical aspect of data collection, illustrating how information was obtained, and new knowledge created, through the combination of traditional and non-conventional research methodologies.

4.1 Research Protocol

This research work was formulated as a case study (focusing on one particular community in Nunavik) and, hence, the protocol and methodology are site specific. It is also important to mention that the greenhouse project was the motor driving this action research and that this work has been not only an academic exercise but also an initiative that has led to the creation of concrete, practical knowledge as well as permanent infrastructure in the community of Kuujjuaq. This initiative, structured around an academic research project, has been not only a tool for knowledge creation, but has also concretely responded to needs demonstrated by residents of the village of Kuujjuaq.

Given the cross-cultural nature of this research initiative (involving a non-indigenous researcher working with an Inuit community), a culturally sensitive approach to data collection was imperative. To this end, an approach was elaborated that was consistent with the recommendations outlined by several governmental, intergovernmental, and academic organizations concerned with human research and research in the North. For example, recommendations outlined in the report issued by UNESCO—following the International Expert Meeting on Climate Change and Arctic Sustainable Development (UNESCO, 2009)—were adhered to. In addition, all aspects of this research have been conducted in accordance with the rules and regulations outlined in the Canadian government's Tri-Council Policy Statement, "Ethical Conduct for Research Involving Humans" (Government of Canada, 2009). As well, the guidelines outlined by the First Nations of Quebec and Labrador Sustainable Development Institute (FNQLSDI, 2005) and the Association of Canadian Universities for Northern Studies (ACUNS, 2003) were strictly followed. The initial research proposal was also submitted to a rigorous ethical review process, in accordance with the policy of the ethics committee at Université Laval, the "Comité d'éthique de la recherche avec des êtres humains (CÉRUL)."

4.2 Research Paradigm

4.2.1 Community-Based Participatory Research (CBPR): Introduction and Overview

The academic paradigm within which this research has been elaborated is that of community-based participatory research. The Harvard Clinical and Translational Science Centre (2010) defines CBPR as "an emerging orientation to research which involves scientific inquiry that equitably involves both community stakeholders and investigators at all levels of the research process from design to dissemination. CBPR involves a partnership between the community and the investigator(s) where each group shares equal ownership of the process and products of research collaboration." According to the Canadian federal government's Panel on Research Ethics, "in general, community-based research takes place at community sites. Some forms of research are community-centred in that the research focuses not only on individuals but on the community itself, and may become a project conducted by, for and with the community" (PRE, 2013). Castleden, Morgan, and Lamb (2012: 160) stipulate that community-based participatory research "is generally understood as a process by which decision-making power and ownership are shared between the researcher and the community involved, bi-directional research capacity and co-learning are promoted, and new knowledge is co-created and disseminated in a manner that is mutually beneficial for all those involved." In discussing participatory research in the specific context of local organic food networks, Guzman *et al* (2012) define participatory action research (PAR) as "a methodological approach to collaborating with local communities that enables researchers and local partners to advance in the restructuring of physical flows, economies, and information that support local farming as a means to achieve greater autonomy and self-management."

Most often applied in the fields of public health and social work, CBPR methodology has emerged over the past several decades as an alternative research paradigm that combines education and social action (Wallerstein and Duran, 2006). This innovative, flexible, and adaptable orientation to research, built upon foundations laid by Paulo Freire and Kurt Lewin (Israel *et al*, 2001; Wallerstein and Duran, 2003; Flicker *et al*, 2008), focuses on relationships between academic and community partners where principles of co-learning, mutual benefit, and long-term commitment are prioritized. Participatory research is a systematic inquiry that includes the active involvement of those who are the subject of the research. Participatory research is usually action oriented, where those involved in the research process collaborate to define the research project, collect and analyze the data, produce a final product, and act on the results. It is based on respect, relevance, reciprocity, and mutual responsibility (PRE, 2013). As underscored by Israel *et al* (2001), CBPR is a partnership approach to research that equitably involves community members, organizational representatives, and researchers in all aspects of the research process. The basic principles of CBPR were initially described by Israel and colleagues in 1998; they are as follows:

1. CBPR recognizes community as a unit of identity;
2. CBPR builds on strengths and resources of the community;
3. CBPR facilitates collaborative partnerships in all phases of the research;
4. CBPR integrates knowledge and action for the mutual benefit of all partners;
5. CBPR promotes a co-learning and empowering process that attends to social inequalities;
6. CBPR involves a cyclical and iterative process;
7. CBPR addresses health from both positive and ecological perspectives; and
8. CBPR disseminates findings and knowledge gained to all partners.

(Israel *et al*, 1998: 178-180)

Flicker *et al* (2008)—who use the term community-based research (CBR) instead of the traditional (American) CBPR—suggest three rationales for adopting a CBR approach: 1) CBR can enrich the research process and outcomes (i.e., improve the quality and validity of research by engaging local knowledge and local theory to enhance the relevance and usefulness of data collected), 2) CBR can be a community development strategy (i.e., build capacity, mobilize groups, and provide the possibility for additional funds and possible employment opportunities for community partners), and finally 3) CBR can improve community-university relations (i.e., by building trust and bringing together partners with diverse skills, knowledge, and expertise).[19] Markey, Hasleth, and Manson (2010) note that local citizens are increasingly active agents in the development of their communities—they are no longer simply passive recipients of top-down decision making—and that this fundamentally alters the relationships, conditions, and methods linking researchers with their places of study.

LaVeaux and Christopher (2009) note that the eight basic principles of CBPR, initially outlined by Israel *et al* in 1998 and adopted by many others in the following years, address many of the concerns that tribal leaders and Aboriginal community members have about allowing research among their people. However, they note that it is necessary to go beyond these founding tenets of CBPR in order to contextualize research in indigenous terms when working in a Native community. To this end, these authors have identified nine additional considerations (or principles) for researchers working in Native communities who are interested in using a CBPR approach. They are as follows:

1. Acknowledge historical experiences with research and with health issues and work to overcome the negative image of research;
2. Recognize tribal sovereignty;
3. Differentiate between tribal and community membership;
4. Understand tribal diversity and its implications;
5. Plan for extended timelines;
6. Recognize key gatekeepers;
7. Prepare for leadership turnover;
8. Interpret data within the cultural context; and
9. Utilize indigenous ways of knowing.

(LaVeaux and Christopher, 2009: 11)

[19] There is much discussion in the field today as to the appropriateness of using the term CBR vs. CBPR. I have made a conscious decision to use the term (concept) CBPR instead of CBR (which is the term/concept used more often in Canada), because I feel that it more accurately supports the role of community participants in my research.

These nine considerations mesh well with a series of guidelines published by Inuit Tapiriit Kanatami (ITK) and the Nunavut Research Institute (NRI) that help researchers to develop good working relationships with Inuit communities. These guidelines stress the importance of community involvement in academic research, stating that "involving Inuit in research projects from the earliest stages, and throughout the research process, is increasingly being recognized as beneficial. Furthermore, local involvement in northern research often enhances the research value to the community" (ITK and NRI, 2007: 5).

This is consistent with the stance taken by the Association of Canadian Universities for Northern Studies (ACUNS) who state in their Ethical Principles for Conduct of Research in the North that "a new spirit of partnership between northerners and researchers is emerging in northern research" (ACUNS, 2003: 4). ACUNS also notes that there is "increasing involvement of northerners not only as subjects or passive observers of research but in all aspects of the research process" (*ibid.)* Finally, this institution notes that "high quality research depends both on communities understanding the needs and concerns of researchers and on researchers understanding the needs and concerns of communities" (*ibid.).* These statements are obviously in line with the principles of CBPR (as outlined above), as are the guiding ethical principles of this organization which, among other things, state that there should be appropriate community consultation at all stages of research, including design and practice, and that ongoing explanations of research objectives, methods, findings, and their interpretation should be made available to the community (ACUNS, 2003).

The Research Protocol of the Assembly of First Nations of Quebec and Labrador also puts forward a participatory approach, stating that "the partnership that research implies must be built on the improvement of relations between communities, scientists and researchers as well as on their cooperation in a work context focused on trust, respect, cooperation and mutual understanding" (AFNQL, 2005). The AFNQL also notes that "while in the past communities mostly limited themselves to providing knowledge as study subjects, now they can and must get directly involved in the research process, from its design up to the dissemination of the results."

The AFNQL states that an Aboriginal community or a First Nation should thus:

1. Establish research partnerships;
2. Identify its research interests and needs;
3. Participate actively in the development of research goals and objectives;
4. Develop methodology jointly with the researcher(s);
5. Claim the status of main client of the research;
6. Be the first ones to use the results;
7. Endorse the role of funding partly;
8. Assume the granting of research permits; and
9. Co-realize and co-manage research projects on its territory.

(AFNQL, 2005: 5)

It is important to mention here that the region of Nunavik does not yet have an official research protocol in place, which is why information from other federal (ITK), territorial (NRI), and provincial sources (AFNQL) has been used in order to discuss the Aboriginal dimension of the CBPR approach here. However, a discussion about CBPR in a northern Aboriginal context would not be complete without mention of the concept of Inuit Qaujimajatuqangit (often simply termed "IQ").

IQ is essentially traditional knowledge that is consistent with the beliefs, customs, values, and language of Inuit, a long-standing knowledge base and world view based on time-honoured values and practices (Government of Nunavut, 2005). IQ is a comprehensive term, encompassing all aspects of Inuit culture (Wilman, 2002). Some translate it as knowledge that has proven to be useful in the past and is still useful today (Laugrand and Oosten, 2009), while others take it to mean "the things that Inuit have known for a long time" (Stern, 2010: 33-34). The term was coined in 1998 by a Nunavut Social Development Council (NSDC) working group that was established to determine how to best preserve and use traditional Inuit beliefs and values in daily life and in government programs (Wilman, 2002). It emerged as a new concept, distinct from traditional knowledge (TK), traditional ecological knowledge (TEK), and indigenous knowledge (IK), at the same time as the new Inuit territory of Nunavut came into being in the 1990s (Tester and Irniq, 2007; Laugrand and Oosten, 2009; Stern, 2010). On the website of the Government of Nunavut there is a detailed explanation of IQ that outlines the three implicit overarching values—connection values, work values, and coping values—and the guiding principles with which they are associated. These guiding principles are as follows:

1. ***Pijitsirarniq*****:** Concept of serving;
2. ***Aajiiqatigiingniq*****:** Consensus-decision making;
3. ***Pilimmaksarniq*****:** Concept of skills and knowledge acquisition;
4. ***Qanuqtuurungnarniq*****:** Concept of being resourceful to solve problems;
5. ***Piliriqatigiingniq*****:** Concept of collaborative relationship or working together for a common purpose; and
6. ***Avatimik Kamattiarniq*****:** Concept of environmental stewardship.

(Government of Nunavut, 2005)

IQ was first conceptualized and elaborated in Nunavut, yet it is important to point out that, while there are many cultural similarities among the different regions that comprise Inuit Nunangat, there are also numerous cultural differences that distinguish each subgroup. Given those differences, it is important not to assume that, since IQ is an Inuit creation, it can simply be applied in its original form across all of the Canadian North.

Recently, within the context of an innovative new community social involvement (CSI) program being developed by Raglan Mine in partnership with local communities and regional authorities, the question of adapting IQ to Nunavik came up. This process is still in the beginning stages. However, in the spring of 2014, the CSI team, together with a local coordinator from the village of Salluit, adapted the notion of IQ and its guiding principles to reflect the subtle differences in language and culture that exist between the regions of Nunavut and Nunavik. This newly emerging concept—specific to Nunavik—is entitled The Inuit Tukisimajatuqanga (IT) Approach. IT is similar to IQ but is specific to Nunavik. The guiding principles of IT are:

1. *Avatimik Pitsianiq*: Concept of environmental stewardship;
2. *Pijariursaniq*: Concept of skills and knowledge acquisition;
3. *Ikajursimaniq*: Concept of helping;
4. *Tukitaaqatigiinniq*: Concept of consensus/deciding together;
5. *Pinasuqatigiinniq*: Concept of collaborative relationships/working together for a common purpose; and
6. *Qanuqtuurungnarniq*: Concept of being resourceful to solve problems.

(Pijariurusiq-CSI Program, 2014)

It is important to point out that while this new concept of IT has been submitted to a comprehensive community review process, regional authorities had yet to formally endorse it at the time this thesis was written.

While IQ and IT are not yet considered conventional CBPR tools, I posit that they should definitely be considered as such when research projects are elaborated in Inuit Nunangat. This is because they are tools that have been developed by the very people whose issues and concerns will be addressed by research projects. Inuit will also be those directly affected by research results, and so it is only logical that the framework and methodology used for obtaining results is informed by their beliefs and values. Accordingly, I have incorporated IQ and IT to the best of my ability in the way that I have framed my research, a decision that I feel is entirely consistent with a CBPR approach, which, by definition, is innovative, flexible, and adaptable.

4.2.2 Challenges of CBPR for Local Food Strategy Development in Nunavik

Before getting into the challenges for CBPR that are specific to Nunavik and to food system development, it is pertinent to first examine some of those that are common in any type of research setting where CBPR is used. Flicker *et al* (2008) note five major themes when it comes to CBPR challenges; namely, time, funding, understanding and clarity of roles and expectations, involvement, and sustainability and outcomes.

With respect to time, challenges that are typically faced in the field relate to lack of time for the development of meaningful relationships between the researcher and the community, different understandings of time and timelines by researchers and community partners, and time crunches that prevent community members from being truly involved in data analysis (Flicker *et al*, 2008: 242). With respect to funding, challenges include insufficient funds to involve community members meaningfully, traditional research funding apparatuses not set up to accommodate CBPR, and funding bodies that do not see the value in non-academic or popular dissemination strategies. Concerning understanding and clarity of roles and expectations, it has been noted that communication difficulties are sometimes exacerbated by the different cultural world views of researchers and community partners, that sometimes internal disagreements (among and between both academic and community partners) hamper research, and that occasional power struggles around fund administration can cause problems. With respect to involvement, it has been noted that academics often wish that they could be more involved in the community and, conversely, community members often express the desire to be more involved in the research process. Finally, concerning sustainability and outcomes, some of the challenges that are typically faced include the dissolution of partnerships after funding runs out and lack of buy-in from organizational leaders in order to maintain outcomes over the long term (*ibid.*).

As well as challenges that are specific to CBPR, there are challenges that are specific to research in northern communities. Inuit Tapiriit Kanatami and the Nunavut Research Institute (ITK and NRI, 2007) have identified twelve community concerns with respect to research in Inuit Nunangat. They are as follows:

1. Lack of input/consultation in identifying research needs and questions and in designing studies;
2. Lack of local involvement in the research process;
3. Token or cursory inclusion of local expertise in research;
4. Lack of recognition or compensation;
5. Generalization/decontextualization of local knowledge;
6. Appropriation of expertise and knowledge;
7. Inappropriate research methodologies;
8. Short, typically summer, field seasons;
9. Lack of locally relevant or beneficial research;
10. Lack of funding for locally initiated projects;
11. Lack of local data ownership; and
12. Inadequate reporting by researchers.

(ITK and NRI, 2007: 2-4)

Since the research that is at the core of this project is not only inspired by CBPR methodology but also takes place in the North, the following paragraphs will examine how research on food system development in Nunavik has been and continues to be affected by both of these factors.

With respect to the element of time and the development of a new type of greenhouse-based local food strategy in Nunavik, two main issues have affected research on the Kuujjuaq Greenhouse Project. One is the distance separating the village of Kuujjuaq and Université Laval. Because of that and challenges relating to the cost of air travel and the availability of accommodation for researchers in the village, the actual amount of time that I could spend in the community was generally limited to only a few months in the year. The other time-related challenge involves community partners and stakeholders, who are very busy and have many demands on their time. Getting all stakeholders around the table or on the same conference call at one time was virtually impossible. This was partly because all stakeholders do not live or work in the same village, but it was also because the people who were actively involved in the project were also responsible for many other things, and this project was not necessarily a priority when compared to some of the other pressing issues in the North. In some cases, therefore, it took a long time to get feedback in order to make decisions on aspects of the research process that needed to be approved by everybody, and this meant that the development of the project was in some ways slower than desired. This said, however, one of the wishes of the stakeholders was that this project move ahead slowly so that things would be done well in the end and the long-term success of the project would be ensured. Nobody wanted to rush ahead and risk doing things poorly just for the sake of meeting deadlines. Hence, what is often characterized as a problem—the inability to move forward rapidly—might, in the end, be just the thing that will ensure the success of this project.

With respect to funding and the development of a new type of greenhouse-based local food strategy in Nunavik, there are no major issues for the moment. This is principally because the project is still very small in scale, and as such does not require much investment at this stage. As well, since much of the data collection involved qualitative methodology (i.e., interviews and participatory observation), not much money needed to be spent on expensive equipment. The availability of funds for project development and research also reflects a high level of interest (from all levels of government, NGOs, and academia) in the development of food security strategies in the North in general and in northern greenhouses in particular. However, if research and project development are to continue evolving at the present rate, funding might become an issue in the future, especially if the project reaches commercial proportions. This is especially important to note, since the cost of transporting material (for the construction of future greenhouses, for example) via air and sealift is very high.

When dealing with understanding and clarity of roles and expectations, one of the biggest hurdles to overcome when working in the North is the legacy of past researchers. As noted by LaVeaux and Christopher (2009: 11), it is important to "acknowledge historical experiences with research ... and work to overcome the negative image of research." While most researchers adhere to strict codes of ethics, there have been some cases in the past when these codes have been broken and issues of trust between Northerners and Southerners have arisen. It is also important to mention that Inuit have been, and are still today, the most studied ethnic group in the world, and not only have precedents been created for the compensation of interview time (figures of over one hundred dollars per interview are not unheard of) but sometimes feelings of disinterest and disdain for scientific research and researchers surface in Inuit communities. Inuit, like people anywhere, have varied and conflicting views about the relevance and value of scientific research (ITK and NRI, 2007), and while these feelings are completely understandable, they do sometimes make for uncomfortable situations, especially for researchers who are new to the North. As is to be expected, the language barrier can also cause problems, especially when communicating with Elders. But what was most challenging in the context of a horticultural research project was the fact that agriculture is simply not an element of traditional Inuit culture. So, while interest and curiosity about research on the Kuujjuaq Greenhouse Project were demonstrated by many Inuit, others were simply not interested or did not see the pertinence of my work. This said, virtually everybody with whom I spoke was nonetheless polite and willing to at least hear a bit about the project.

In terms of researcher involvement in the community, the main factor to be considered here is time, or lack thereof. Ideally, researchers would be able to stay in the community for extended periods of time and hence have the chance to become more involved in day-to-day activities and thus gain a better understanding of life in the North, Inuit culture, etc. However, as outlined in a previous paragraph, constraints associated with transportation and lack of accommodation make this difficult. During the course of my research, I was actually relatively lucky in that I was able to spend several weeks to several months a year, over a period of six years, in Kuujjuaq. As such, I was able to create a network of colleagues and friends. This network, which grew every year, enabled me to not only find adequate accommodation in the village (a challenge in and of itself), but also meant that I had the chance to engage in different community activities and cultural events not related to my research, thus expanding my own personal horizons and allowing me to gain a better understanding of the community as a whole. Coming back every year, and being able to spend extended periods in town, also made it possible for me to connect on a regular basis with many different local leaders and community members who had a vested interest in the project. This was not only beneficial to me as a researcher but also allowed me to give regular (albeit informal) reports to key stakeholders on the progress of the project. Essentially, this enabled me to start the process of returning research results to the community during the course of the work.

In terms of community involvement in research, the big challenge for the Kuujjuaq Greenhouse Project was communication with the general public, specifically getting feedback from the community at large, because people have many other priorities. However, over the years, I did notice that if people had real concerns, they were generally voiced sooner or later. What I have come to conclude is that, the important thing is to continually share information (results, plans, etc.), regardless of the amount of direct feedback from the community. Using local media, such as the community radio and regional publications such as "Makivik Magazine", "Nunatsiaq News," and the KRG newsletter, and keeping in touch through community meetings and Facebook are effective ways to keep lines of communication open. This way, people who are genuinely interested in becoming involved will be aware of opportunities to do so.

Finally, with respect to sustainability and outcomes, the main challenge in Kuujjuaq will be the long-term viability of the greenhouse project. At the moment, things look good on this front, since the community is very much involved in the elaboration of all aspects of the greenhouse. However there are many examples of projects in Nunavik that worked very well for a number of years and then fell by the wayside when the project leader either left the region or went on to other things. Such examples even include a precedent for a greenhouse project at the high school in Aupaluk that was very successful, but that ended when the school principal moved on. Related to this are the challenges associated with changes in leadership (LaVeaux and Christopher, 2009) and the high rate of turnover of employees in the North—something that has already presented itself on several occasions in the context of the Kuujjuaq Greenhouse Project, and which leads to a certain degree of lost time, since one must often start from zero with a new contact person.

In general, the challenges for CBPR and the development of a new type of local food strategy in Nunavik are not unrelated to the typical roster of challenges faced by researchers working on other projects, in other parts of the world. Overall, the most significant obstacles encountered during the course of this research were those related to time and to cultural differences (especially regarding agriculture), but I think that these can be overcome if further research is conducted in a way that promotes openness, honesty, and continuous communication between researchers, project stakeholders, and community members. It is also important to state here that real life does not always unfold as written in the textbooks, so it has been important not to get discouraged by setbacks and challenges but instead to adapt research methodologies to suit the realities encountered in the field—something that I think is entirely aligned with a CBPR approach.

4.2.3 Potential of CBPR for Local Food Strategy Development in Nunavik

Although there are numerous challenges to the application of a CBPR approach in Nunavik, there are also many ways in which CBPR methodologies can be applied successfully in the North, and, as this research project has demonstrated, there is real potential for CBPR as a strategy for the successful elaboration of a new type of local food strategy in Nunavik.

CBPR is a profoundly human way to approach research, and it provides many opportunities for both researchers and community partners to ease into the research process. One of the most interesting and positive things to come out of recent research pertaining to CBPR is the notion of engaged acclimatization—an approach that helps researchers to better understand the communities with which they wish to work, hence improving the quality of the results. As defined by Grimwood *et al* (2012), engaged acclimatization is a notion that has been elaborated as a complement to CBPR, and it is essentially a concept that "facilitates endogenous research by approaching research ethics as a lived experience, initiating and nurturing relationships as a central component of research, and centering research methods on circumstances within participating communities" (Grimwood *et al*, 2012: 211). The four fundamentals of engaged acclimatization are 1) crafting relations, 2) learning, 3) immersion, and 4) activism (Grimwood *et al*, 2012).

The first step—crafting relations—usually involves a visit to the community prior to any official data gathering. The purpose of this visit (sometimes referred to as "pre-fieldwork") is to set in motion personal relationships that give the researcher a more intimate connection to the social, cultural, and ecological fabric of the community (Grimwood *et al*, 2012).

The second step—learning—essentially involves getting researchers to leave behind their "academic baggage" and to open up to the new environment around them. As stated by Desbiens (2010), "assuming the mantle of a learner facilitates the shift from research driven by expertise, certainty, and efficiency to humility, ambiguity, and a willingness to deal with flux in the processes, practices, peoples, and place that constitute research." This attitude is consistent with recommendations made by ITK and NRI regarding ways for researchers to successfully negotiate relationships with communities. These recommendations are as follows:

1. Be honest;
2. Be humble;
3. Be informed;
4. Be open;
5. Be patient;
6. Express a willingness to learn;
7. Educate locally;
8. Hire/purchase locally;
9. Maintain communication;
10. Respect local cultures, customs, and authority;
11. Try new things; and
12. Use the local language.

(ITK and NRI, 2007: 7-8)

The third fundamental of engaged acclimatization—immersion—refers to the generation (and subsequent understanding) of knowledge through local experiential and corporeal encounters with the things, peoples, communities, or relations with which researchers seek to learn and work (Grimwood *et al*, 2012: 223).

The fourth and final fundamental of engaged acclimatization—activism—involves conceptualizing how CBPR might be oriented toward possibilities and capacities (*ibid.*) and is particularly useful in helping to decolonize traditional research methodologies. Tuhiwai Smith (2002), while reflecting on the relationship between non-indigenous researchers and indigenous peoples, underscores the importance of researchers taking into consideration the "complex ways in which the pursuit of knowledge is deeply embedded in the multiple layers of imperial colonial practices" and the importance of recognizing the role that the scientific and academic community sees itself as playing within this context. Further to this, Tuhiwai Smith notes in a more recent piece that "the history of research from many indigenous perspectives is so deeply embedded in colonization that it has been regarded as a tool only of colonization and not as a potential tool for self-determination and development" (Tuhiwai Smith, 2005: 87). We see here that there is great potential for CBPR (and by extension for engaged acclimatization) to not only change how research has been done in the past but also to set new precedents in academia. By putting researchers and community partners on equal footing, we can create a type of balanced research that benefits everybody equally.

Engaged acclimatization pushes the boundaries of traditional CBPR methodology. It creates space, and time, for researchers to learn about and to adapt to communities before embarking on projects. This is one of the great possibilities of CBPR in a northern context, since it addresses a key concern—that I, myself, have heard voiced repeatedly—which is that southern researchers often come North for only short periods of time, collect their data, and then return home to publish (and profit) from information that is not solely, or wholly, theirs while Northerners simply look on. This phenomenon—sometimes termed helicopter research (fly in, fly out, and then publish in the South)—is an unfortunate reality in northern research, but one that CBPR can definitely address through the education of researchers and their subsequent, culturally sensitive integration into communities.

It goes almost without saying that CBPR also allows for the concerted participation of communities in the research process and that this is the element that will ensure, not only the "justness" of the research, but also the longevity of the impacts and results. As mentioned in the previous section, many projects in the North have known only short-term success, since their continued operation was dependent on Southerners or southern resources. By using a research paradigm that involves Northerners—and more importantly Inuit—right from the outset, not only are projects tailored to local specifics but a sense of ownership and responsibility for projects is created. The knowledge generated by the research also remains in the community, thus lessening dependence on outsiders and outside resources.

Closely tied to this idea of knowledge staying in the community, is the idea of knowledge dissemination to the general public via non-academic routes—something that is central to CBPR practice. Not only does this publication/communication strategy help generate discussion between researchers and the immediate community, but since non-academic media reach wider audiences, the possibilities for reaching out to others (from all walks of life and from all cultural and professional milieus) who can contribute to the research process is increased exponentially. This is a phenomenon that has already been observed in the context of the Kuujjuaq Greenhouse Project, and a number of very positive links with other researchers and professionals have been established following the publication of newspaper and magazine articles on the project as well as after radio and television interviews. This phenomenon will be discussed in more detail in the results section of this thesis, but just to illustrate the scope of these links, some of the more useful contacts I have established in this way have included individuals and organizations such as: a professional researcher working on controlled systems agriculture in the U.S. (this person is responsible for the greenhouse at one of the research stations in Antarctica); a Cree business development organization interested in developing greenhouses in Eeyou Istchee; a contractor responsible for installing cogeneration technology for Hydro-Quebec in Nunavik; an entrepreneur who is developing comprehensive composting strategies for remote regions; and another graduate student (now an employee of the Government of Nunavut) working on northern greenhouse initiatives in Nunavut.

While all of the above-mentioned benefits are important aspects of CBPR in the context of the development of a new type of local food security in Nunavik, one of the most pertinent results that CBPR can achieve is to ensure continuous dialogue between all of the project stakeholders at every stage of project development. This seemingly simple thing sometimes takes a great deal of time and energy, but the end results are more than worth the effort, since not only are the possibilities of making mistakes or "faux-pas" lessened, but the results truly reflect reality and the wishes of the community.

In sum, I was able to assess through my research that CBPR really is the best approach for the development of a new type of local food strategy in Nunavik. I think that it has shown real potential, notably because of the way it equitably involves both researchers and communities in the knowledge development process. For example, in Kuujjuaq the community stakeholders know what they need and want and also have expert knowledge of the local environment and community dynamics. However, they do not have expert knowledge pertaining to the implementation of greenhouses in their community—nobody does, yet. Researchers, in this case have an important role to play; they can access and mobilize resources from organizations and institutions that are well placed to study how to achieve the community's goal. By meshing these two types of knowledge (local and scientific), project partners can attain a goal that neither of these two groups could aspire to on their own—an advantage that derives from the fundamental principles of CBPR.

4.3 Data Collection Methodology

The data collection for this research involved two distinct but complementary processes: traditional qualitative methodology (interviews and participatory observation) and community-based participatory research (CBPR). I began research on the subject of northern greenhouses in the spring of 2009 during the course of my masters degree, and I then followed through with a PhD (beginning in the fall of 2010) in order to continue working on this subject in conjunction with the community of Kuujjuaq.

Given the time constraints related to working in the North (as a result of housing being available only during certain periods of the year) and the fact that gardening is a seasonal activity, data collection did not follow the conventional pattern of spending a consecutive number of months in the field. Instead it took the form of a multifaceted approach that spanned a total of five years, from the fall of 2009 until the summer of 2013. For periods spanning several weeks to several months each year, I spent time on-site in Kuujjuaq, and then throughout the rest of the year continued to work on and follow project developments from my location in the South, communicating with project stakeholders via email, phone, and teleconference. The results presented in this thesis are based, for the most part, on data that were collected during the course of these five years. However, it is important to mention that since this project is still ongoing (and I am still involved to a certain—though much lesser—degree), information that I continued to receive in an unofficial capacity throughout the fall of 2013 and the winter, spring, and summer of 2014 has been incorporated into this document.

This research involved five distinct phases over five years, which were:

2009 – **Interviews (Preliminary Study)** [20]

3 months in Kuujjuaq in the fall

31 structured interviews with questionnaires; 36 semi-directed interviews

[20] See Appendix 1 for a copy of the questionnaire used in this preliminary study. This questionnaire, as well as all other participant recruitment tools and supporting documentation, was translated and made available in Inuktitut.

2010 – **Community Consultations: Presentation of Results of 2009 Interviews**

1 week in Kuujjuaq in the fall

3 formal sessions; multiple smaller meetings

2011 – **Participation in Phase I of the Kuujjuaq Greenhouse Project**

2 months in Kuujjuaq in the summer

Researcher in the role of project supervisor

2012 – **Participation in Phase II of the Kuujjuaq Greenhouse Project**

2 months in Kuujjuaq in the summer

Researcher in the role of project supervisor

2013 – **Interviews (Concluding Study)** [21]

5 weeks in Kuujjuaq in the spring

32 structured interviews with guidelines; 11 semi-directed interviews

– **Participation in Phase III of the Kuujjuaq Greenhouse Project**

3 weeks in Kuujjuaq in the summer

Participatory observation

As a researcher I was very lucky to be able to actively participate in the development of all aspects of the Kuujjuaq Greenhouse Project, notably as project supervisor for two summers. This was a privilege that allowed me to build solid relationships with all the project partners, and I feel this has given me very valuable insight into the processes involved in developing new projects in the North.

While much of the information presented in this thesis stems from the work that was done on the development of the Kuujjuaq Greenhouse Project, I also spent a lot of time engaging in other complementary activities. For example, I took a course at the Faculty of Food and Agricultural Sciences (FFSA) at Université Laval entitled “Cultures en serre” (Greenhouse Cultivation), in order to learn the technical aspects of controlled environment agriculture. I also spoke with owners and managers of northern greenhouses, visited a number of

[21] See Appendix 2 for a copy of the guidelines used in this concluding study. This questionnaire, as well as all other participant recruitment tools and supporting documentation, was translated and made available in Inuktitut.

greenhouse operations (in both the North and the South), and attended horticultural conferences in order to learn from researchers and producers active in the development of new greenhouse systems.

Some of the commercial greenhouse operations that I had the chance to visit included:

- Les Serres Demers (hydroponic tomatoes), St-Nicolas, Quebec;
- Narsaq Greenhouse (market garden produce), Narsaq, South Greenland;
- Arc-en-Ciel Aquaponics (trout and lettuce), Ste-Agathe-des-Monts, Quebec;
- Les Serres Mirabel (lettuce), Mirabel, Quebec;
- Go-Organics (experimental hydroponics), Montreal, Quebec; and
- Bell's Nursery (tomatoes and cucumbers), Anchorage, Alaska.

Throughout the course of the years that I worked on the development of the Kuujjuaq Greenhouse Project, I also invested a great deal of time in the creation of a network of colleagues in order to gather and share information related to the development of northern greenhouse initiatives. For example, I attended federal and provincial government working groups and committee meetings, and I also presented at over twenty scientific conferences and public and government events. [22] As well, I gave twenty-three interviews with local, regional, national, and international media.[23] I also reached out to and fielded requests for information from researchers, professionals, and students on a regular basis

[22] The following is a list of some of the events where the Kuujjuaq Greenhouse Project has been presented: ArcticNet; the Table Bioalimentaire de la Côte-Nord; the International Congress of Arctic Social Sciences; the 8th Circumpolar Agricultural Conference and University of the Arctic Inaugural Food Summit; the International Centre for Northern Governance and Development; the Association de communicateurs et rédacteurs de l'agroalimentaire; the Nunavik Food Production Conference; Québec en forme: Grand Rassemblement; the Canadian Association of Geographers; the American Association of Geographers; the Ministère de l'Agriculture, des Pêcheries et de l'Alimentation du Québec; The Réseau d'agriculture urbaine de Québec; the Association of Canadian Universities for Northern Studies; the Centre de recherche en horticulture; and the Union des producteurs agricoles.

[23] The following is a list of some of the media coverage that the Kuujjuaq Greenhouse Project has enjoyed over the last few years: television interviews with Télé-Québec, APTN, and Taqramiut Nipingat; radio interviews with CBC, CBC North, Radio Canada, and Kuujjuaq Community Radio; newspaper interviews with The Globe and Mail, Le Soleil, Nunatsiaq News, and La Terre de chez nous; and, magazine interviews with Québec Science; Canadian Geographic, and Makivik Magazine.

from 2009 through to 2014.[24] All of this work took a great deal of time and energy, yet the payoffs were well worth the effort, because every time I engaged with others I was able to both gather, and share, new insights and information. Towards the end of the research process, these types of meetings and conversations also helped to validate my results.

It is important to underscore the fact the field of northern greenhouses/northern agriculture still holds only emergent status in the academic community. It also touches and draws upon a wide range of existing fields of research. Consequently, it was necessary to tap into many different academic, government, paragovernmental, and NGO networks in order to access the information that went into building up the final research product. To do this, I connected and worked with specialists in fields as diverse as agriculture, urban agriculture, controlled environment systems, soil sciences, engineering, indigenous and Aboriginal development, northern development, community development, economic development, human geography, anthropology, political science, health sciences, and biology. The complexity of this network (representing people from across Quebec, Canada, the rest of North America, and Europe) speaks to the fact that this research really is multi- and interdisciplinary.

It is also important to underscore the non-negligible contributions to this research that were made by the residents of Kuujjuaq over the years. Throughout the weeks and months that I spent in town, I often solicited feedback and opinions not only from key project stakeholders and community leaders but also from people who simply live and work in Kuujjuaq and therefore have a more profound knowledge of the community (and of the North in general) than I do. This iterative process, which is often unacknowledged in the scientific community,

[24] To illustrate this point, the following is a list of just some of the interest groups, organizations, companies, and government departments with whom I have collaborated and/or worked with to share information on the subject of northern greenhouses: the Rural and Co-operatives Secretariat (Agriculture Canada); the Arctic Council – Indigenous Peoples' Secretariat (IPS); the Ministère de la Santé et des Services Sociaux (Quebec Provicial Government); the **Centre local de services communautaires - CLSC** (Ungava Tulattavik Health Centre); the National Aboriginal Health Organization (NAHO); Inuit Tuttargvingat; Waska Resources (Cree First Nation); Niska Ressources (Cree First Nation); Nimschu-iskudow Inc. (Cree First Nation); Ni Dakinan (Tismiskaming First Nation); the Science Media Centre; the Syndicat des producteurs en serre du Québec (SPSQ); Glencore - Raglan Mine; Qaujimautik Systems Inc.; the Jackson School of International Studies; as well as a number of other university-based researchers, contractors, small business owners, and students interested in northern greenhouses and related subjects.

has helped to refine and ameliorate all aspects of the development of the Kuujjuaq Greenhouse Project in general, as well as this research in particular.

Finally, I want to point out that there is an extraordinary culture of helping and sharing that is very prevalent within the northern research community and in the North in general. Right from the beginning, I was astounded by the willingness of others in Kuujjuaq, and across Nunavik, to help and to support the development of my work. This type of cooperative spirit led to the development of a series of very valuable partnerships with Nunavik organizations, all the while proving the effectiveness of new types of community-based participatory research strategies.

Chapter 5.

The Kuujjuaq Greenhouse Project—Turning an Idea into Reality

This chapter presents the results of five years of intensive, collaborative action research on the subject of northern greenhouses. It begins with a brief, yet detailed, history of the Kuujjuaq Greenhouse Project. This is followed by a second section that presents the results of the preliminary study carried out in 2009, and a third section that presents the results of the community consultations that took place in 2010. The fourth section details the outcomes of the microprojects that form the heart of the Kuujjuaq Greenhouse Project. The chapter closes with the results of the concluding study, which was based on a series of interviews with community members and project stakeholders carried out in 2013.

5.1 Context and History of the Kuujjuaq Greenhouse Project

This research began as a collaborative initiative between the Geography Department (Faculty of Forestry, Geography, and Geomatics) at Université Laval and the Quebec Horticultural Council (Le Conseil québécois de l'horticulture – CQH). The Geography Department at Université Laval has a long history of carrying out research in Nunavik, and many of its current and former professorial staff have worked in the North for decades. It was thus a logical place to anchor this research. The CQH is a non-profit organization affiliated with both the Quebec Agricultural Producers Union (L'Union des Producteurs Agricole – UPA) and the Canadian Horticultural Council (CHC). Part of the CQH's mission is to contribute to the development and competitiveness of the Quebec horticultural industry by supporting the horizontal coordination of its members as well as innovation in the sector. Overall, the CQH strives to represent, inform, and improve the horticultural industry in Quebec (CQH, 2010). In late 2008, the CQH approached the Geography Department at Université Laval looking for a graduate student to collaborate on a research project examining the potential for greenhouses in Nunavik; in early 2009 an agreement was reached that involved the CQH funding three months of field research in Kuujjuaq. However, this story actually began a number of years earlier—in 2000—when a conversation between the General Director at the Centre d'information et de développement experimental en serriculture / the Centre for

Information and Experimental Greenhouse Development (CIDES) and a leader from Nunavik sparked the idea of new research into the potential for greenhouse development in northern regions. This led to the preparation of a proposal entitled « La serriculture en milieu nordique: Évaluation du potentiel de développement de la culture en serre en région nordique » / “Greenhouse Agriculture in Northern Areas: An Evaluation of the Potential for the Development of Greenhouse Agriculture in Northern Regions” (CIDES, 2000). However, the moment wasn’t right, and work on this subject went no further at the time. Eight years later, the same employee (the former General Director of CIDES) who had worked on the original proposal, contacted Université Laval on behalf of the CQH and got the project moving again.

I came into the picture in the spring of 2009 and began putting together a research proposal in order to study the social acceptability of greenhouses in Nunavik. This was to become my master’s work. This study examined whether the development of greenhouse projects in Nunavik could be an acceptable way to address not only food security issues but also certain social problems (e.g., low rates of academic achievement among young people and high rates of unemployment in certain communities). Results from this initial study proved that there was a great deal of interest in the subject and that the Northern Village of Kuujjuaq—which already had an existing community greenhouse—was ready and willing to host a greenhouse pilot project that would incubate a series of small horticultural initiatives.

Part of the agreement with the CQH was that a project report be written (see Avard, 2010) and that I be available to present research results to potential project partners and stakeholders. After the project report was distributed in early 2010 and the results of the study had been presented in a number of venues, both in the North and in the South, a group of stakeholders interested in supporting this innovative research emerged, among them the Ministère de l’Agriculture, des Pêcheries et de l’Alimentation du Québec (MAPAQ), Québec en forme (an NGO dedicated to promoting healthy living skills amongst children and youth in Quebec), and the Department of Research and Economic Development of the Kativik Regional Government (KRG). It is important to note here that a crucial step in this process was a series of community meetings that took place in Kuujjuaq in the fall of 2010, one year after the initial research was conducted. In these meetings, a representative from the QHC and I presented the results of the study and collected feedback from community members and local leaders. Following these meetings—as requested by the Kativik Regional Government—we prepared a document that summarized the information collected to date (see Laniel and Avard, 2010). Included in this document was a draft framework for a potential greenhouse-based horticultural strategy in a northern village. In early 2011 we also prepared and submitted to the Kativik Regional Government (KRG) and the Northern Village of Kuujjuaq (NVK) an outline for a technical and economic feasibility study on the subject of northern greenhouses (see Laniel and Avard, 2011a). As well, later in the spring of that same year, we wrote a grant application for the NVK that provided a comprehensive overview of all of the work done to date, as well as a detailed plan for future project development (see Laniel and Avard, 2011b).

Overall, the work that was conducted in Kuujjuaq on this subject in 2009 and 2010 proved that there was in fact horticultural potential in Nunavik, and this in turn led to the notion of greenhouse development being included in the Quebec government's Plan Nord strategy in 2010 (made public in 2011), as well as in "Parnasimautik" (Plan Nunavik) in the following year. In accordance with these intentions, the MAPAQ undertook to back the development of greenhouse pilot projects in each of the regions touched by the Plan Nord. In November, 2011, $800,000 was earmarked by the province for this, and the long-term vision promoted at the time was the construction of a greenhouse in every village of the Plan Nord territory (Corbeil, 2011; Forest, 2011). In 2011, greenhouse development was also included in the mandate of the Nord du Québec Bio-Food Network, with the result that, in the months that followed, I participated actively in a series of meetings and knowledge transfer activities coordinated by the MAPAQ on this subject (Plan Nord – Groupe de travail sur les Serres Nordiques / Plan Nord – Working Group on Northern Greenhouses).

In 2011, funding was secured to go ahead with Phase I of the Kuujjuaq Greenhouse Project, and it was agreed that I would act as coordinator for the development of eight greenhouse-based horticultural microprojects in the community, a dream opportunity for a student working within a community-based participatory research paradigm! In 2011, I spent the summer in Kuujjuaq and—together with local volunteers, staff from the Kativik Regional Government, the Northern Village of Kuujjuaq, and the Ungava Supervised Apartments (a community group home for people with mental illness)—I helped further develop and/or lay the groundwork for the following microprojects: the community garden, a compost project, a horticultural therapy project, a potato test bed, planning of the second greenhouse, a youth employment and training project, curriculum development with the Kativik School Board, and hydroponic trials. During this time a data collection program involving local gardeners was also set up in order to establish which vegetables grew best in the Kuujjuaq greenhouse.

As an aside, it is important to note that as the Kuujjuaq Greenhouse Project was evolving, so was the idea of a sister project in another village in Nunavik. To this end, the Kativik Regional Government (Department of Regional and Local Development) commissioned a study that examined the technical aspects of greenhouse construction in Nunavik (Villeneuve and Vallières, 2012). This study focused on the village of Salluit, the second most northern village in Nunavik. The idea was that in basing the study in a place where the environmental conditions are among the harshest in the region, any greenhouse model developed for this village could then be easily transposed to other, more southern, communities.

In 2012 the principal partners in the Kuujjuaq project—notably, the Kativik Regional Government (Department of Regional and Local Development), the Northern Village of Kuujjuaq, the Ungava Supervised Apartments, a local volunteer, and myself from Université Laval—began planning the season early in the new year in order to establish project goals as well as the budget needed to support them. Overall, Phase II of the Kuujjuaq Greenhouse Project advanced significantly on several fronts, even though some growing pains were experienced. In 2012, the eight microprojects were brought under the umbrella of the Kuujjuaq Greenhouse Project, and marked advances were made in several areas. For example, the compost project was significantly expanded to include six commercial/institutional pick-up points, construction began on the foundation for the new greenhouse, and a school visit was organized for the Grade 4 class.

Early 2013 saw further development of the Kuujjuaq Greenhouse Project; notably, funding for the hiring of a greenhouse project coordinator was secured, the compost project was once again enlarged in scope, positive developments regarding the hydroponic pilot project were made, and construction began on the new community greenhouse. 2013 also marked the end of the period of intensive research by me, and I chose to wrap up my work by conducting a series of interviews with community members and local and regional leaders in order to assess what had been accomplished. Overall, the response to the idea of northern greenhouses and new types of sustainable agricultural strategies in Inuit communities was found to be still overwhelmingly positive. Of note were comments suggesting that in order to be successful over the long term, projects should to be community driven and children and youth should be actively involved.

The following sections of this chapter will present, in detail, the results of the research that was conducted in collaboration with community partners and project stakeholders on the development of the Kuujjuaq Greenhouse Project from the fall of 2009 through to the summer of 2013 inclusively.

5.2 Results of Preliminary Study: 2009

This study, conducted over a period of three months in the fall of 2009, was entitled "Greenhouses in Arctic Communities: A Study of the Perceptions of Nunavimmiut Regarding Alternative Systems of Food Production" (Avard, 2010). The principal goal of the study was to learn about the perceptions held by Nunavimmiut regarding the construction of greenhouses in arctic communities. More specifically, this study sought to determine the degree of interest of the residents of a target community (Kuujjuaq) in a potential greenhouse project. In order to do so, a series of thirty-one structured interviews was conducted with residents (See Appendix 1). Thirty-six semidirected interviews were also conducted with leaders, administrators, and professionals working at both the local and regional levels.[25] Following the interviews, the raw data from both the structured and semistructured interviews weres analyzed with a view towards gaining an understanding of the perceptions of

[25] Interviews were primarily conducted in English—the principal administrative language of the region of Nunavik; however, some were also conducted in French and Inuktitut (with the assistance of an interpreter).

Nunavimmiut regarding three main elements: 1) eating fruit and vegetables, 2) gardening and greenhouse agriculture, and 3) the establishment of a greenhouse pilot project in Kuujjuaq.

5.2.1 Dietary Habits in Kuujjuaq: Fruit and Vegetable Consumption

The results of a previous study conducted in Nunavik by the Regional Board of Health and Social Services (NRBHSS) indicate that overall consumption of fruit and vegetables is low. As stated in *Qanuippitaa? How Are We? - Nunavik Inuit Health Survey 2004*: "Only 11% of Inuit adults consume the Canadian Food Guide's (First Nations, Inuit and Métis version) recommended minimum of seven servings of fruit and vegetables per day" (Blanchet and Rochette, 2008: 31). While this may be true for most of the population of Nunavik, results obtained through interviews and through direct observation in the community indicate that the residents of Kuujjuaq consume significantly more fruit and vegetables.

Kuujjuaq, compared to other northern communities, has a relatively varied choice of foods—including fresh fruit and vegetables. This seems to be in part due to the fact that Kuujjuaq (being an administrative centre) has attracted important numbers of Southerner's (Qallunaat) who have come to live and work in this community. This has consequently created a steady increase in demand for many types of market food and has, over time, exposed the local Inuit population to new ways of cooking and preparing non-traditional foods. The fact that the relatively large population of Kuujjuaq has allowed for the successful operation of an independent food retailer (who orders fresh produce directly from Montreal on a weekly basis) has also greatly contributed to the good quality and reasonable prices of fruit and vegetables in this community (see Figure 38 for images of the fresh food isle at New Viq'vi, the local independent grocery store in Kuujjuaq).

FIGURE 38 The fresh food isle at New Viq'vi.

Photos: Author's personal collection

It seems that the actors mentioned above have, in combination, led to the relatively high overall consumption of fresh fruit and vegetables by residents of Kuujjuaq. Results indicate that the majority of respondents spend "quite a bit" (25-33%) of their household food budget on fruit and vegetables (see Figure 39). Results also show that the majority of respondents (and their families) like fruit and vegetables "a lot" to "quite a lot" (see Figure 40).

5.2.2 General Interest in Gardening and Greenhouses

In 2009, when interview respondents were asked if they would be interested in gardening in a community greenhouse in Kuujjuaq, the majority (23 out of 31) answered yes, while six answered maybe, and only two said no (see Figure 41 for a graph of these results). Common themes that came up in discussion on this subject included the merits of individual vs. shared plots, the desire for a community greenhouse to be in a central location (easy walking distance from home), and the need for gardening courses (both introductory and advanced).

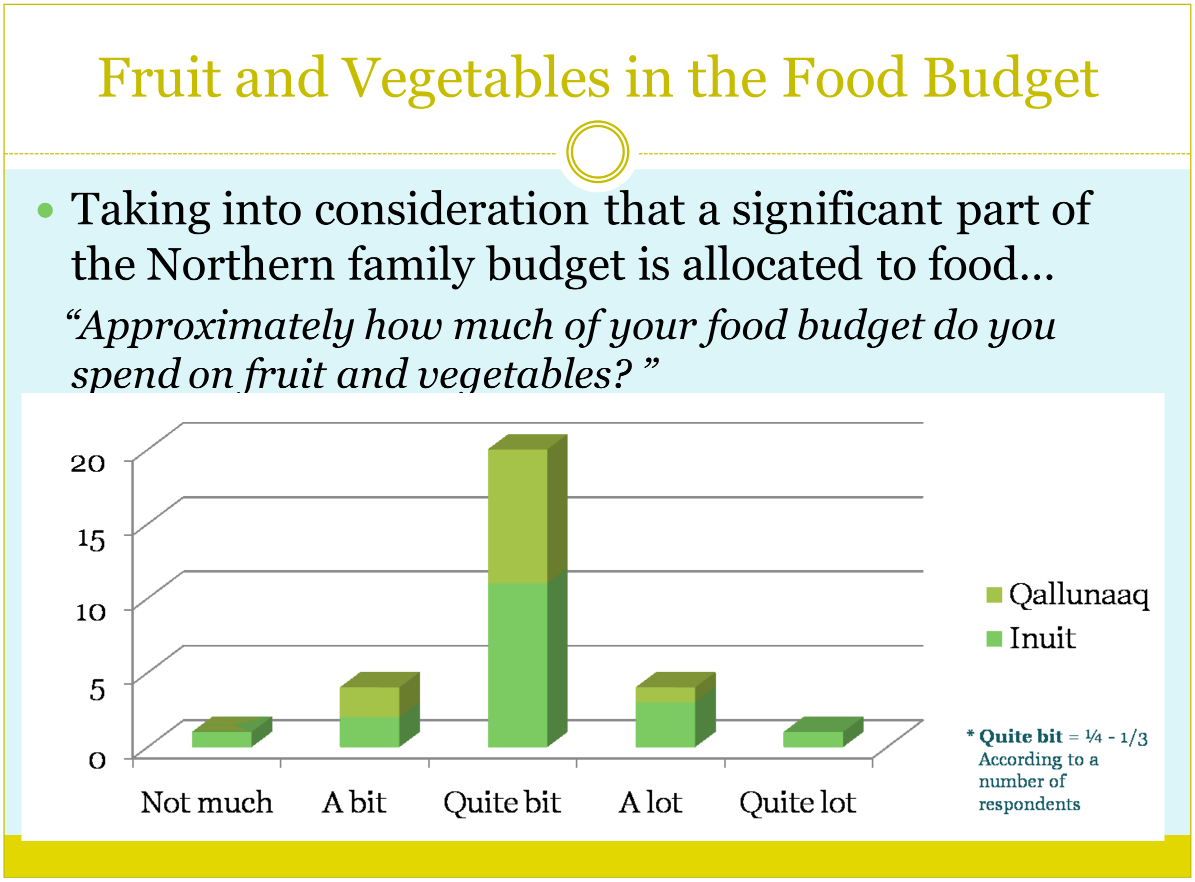

FIGURE 39 Fruit and vegetables in the food budget of Kuujjuamiut in 2009.

When interview respondents were asked if they, and the members of their household, would be interested in consuming fresh produce from a locally operated greenhouse, almost all respondents (29 out of 31) answered "yes, very much", while the other two respondents answered "yes, a lot" (see Figure 42 for a graph of these results). This positive response leads to the conclusion that locally grown produce could easily be sold in the community itself. The principal reasons given by respondents for wanting to buy local produce included pride in community-based initiatives and a desire to support them and an appreciation for the quality (freshness/better taste) of locally grown fruit and vegetables. It is important to note that, overall, respondents mentioned that they would be willing to pay slightly more for this type of produce.

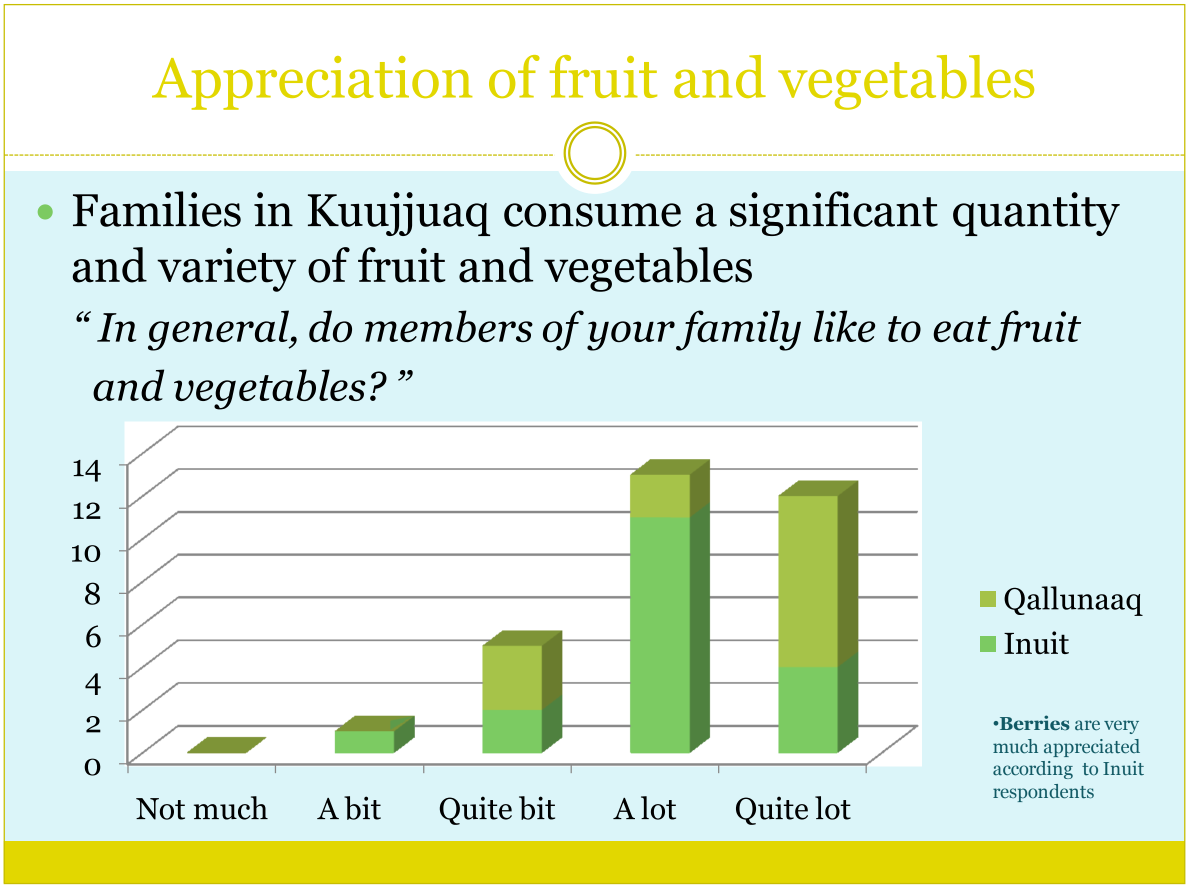

FIGURE 40 Level of appreciation of fruit and vegetables by Kuujjuamiut in 2009.

5.2.3 Opinions and Ideas Regarding a Greenhouse Project in the Community

When respondents were asked what they thought about the idea of having a greenhouse in the community, over two thirds (22 people) responded that they thought that it was a "very good idea" and just under one third (9 people) responded that they thought that it was a "good idea" (see Figure 43 for a graph of these results). When respondents were asked to expand upon their opinions and ideas regarding a potential greenhouse project, recurring themes that came up in discussion included a desire for it to be managed by a local organization, be a non-profit enterprise (with funds being reinvested in the project and/or the community), and have an interest in involving children/youth/schools in the undertaking.

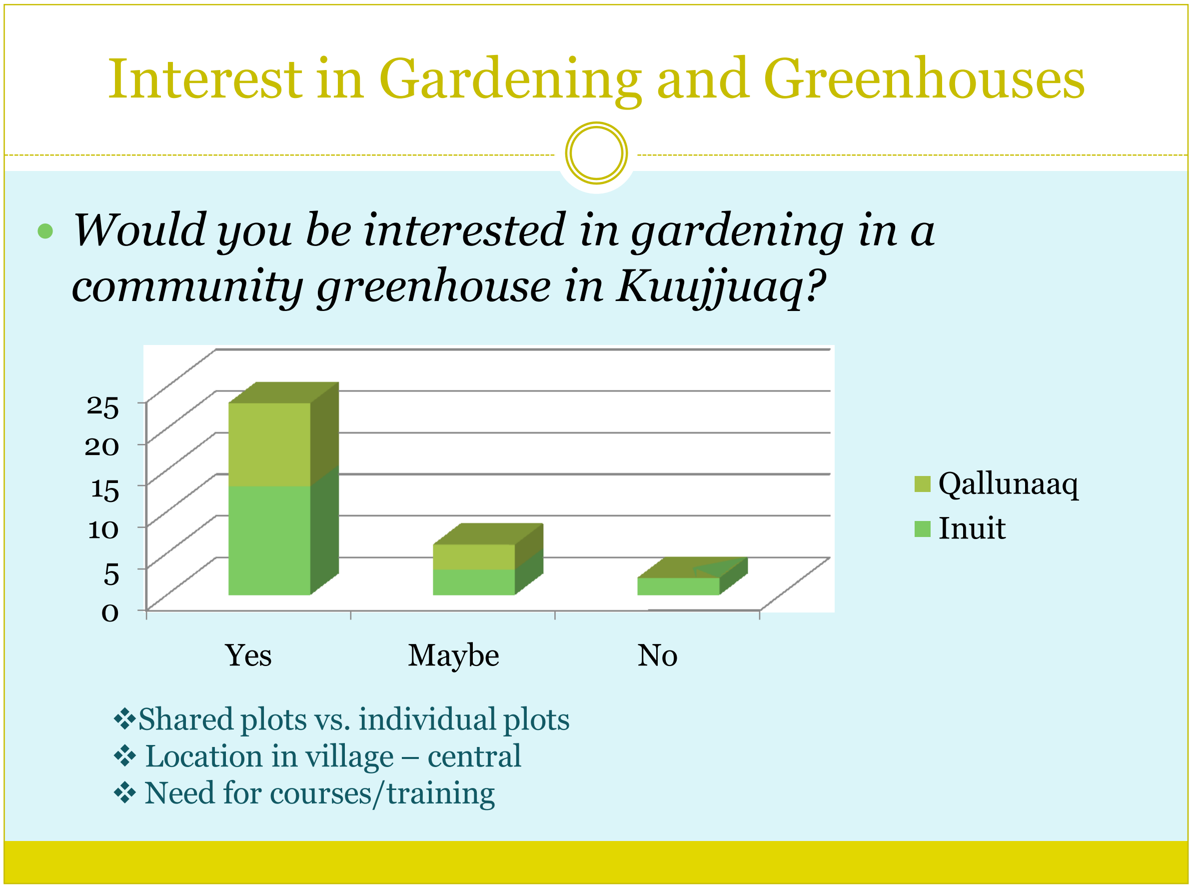

FIGURE 41 Interest in gardening demonstrated by Kuujjuamiut in 2009.

Representatives from the Nunavik Regional Board of Health and Social Services (NRBHSS), as well as staff responsible for childcare in Nunavik, demonstrated significant interest in a greenhouse initiative, stating that such a project would mesh well with existing regional initiatives promoting nutrition and healthy eating. Administrators and teachers working for the Kativik School Board (KSB) were also very enthusiastic about a greenhouse project, stating that many different types of curriculum could be developed around such an initiative. It was also often mentioned that hands-on work in a greenhouse could be very beneficial for special needs students. Representatives of local and regional governments also underscored this thought, mentioning that employment and training opportunities tailored to people who are manually adept, as well as to those who are mentally and physically challenged, would be very welcome in the community.

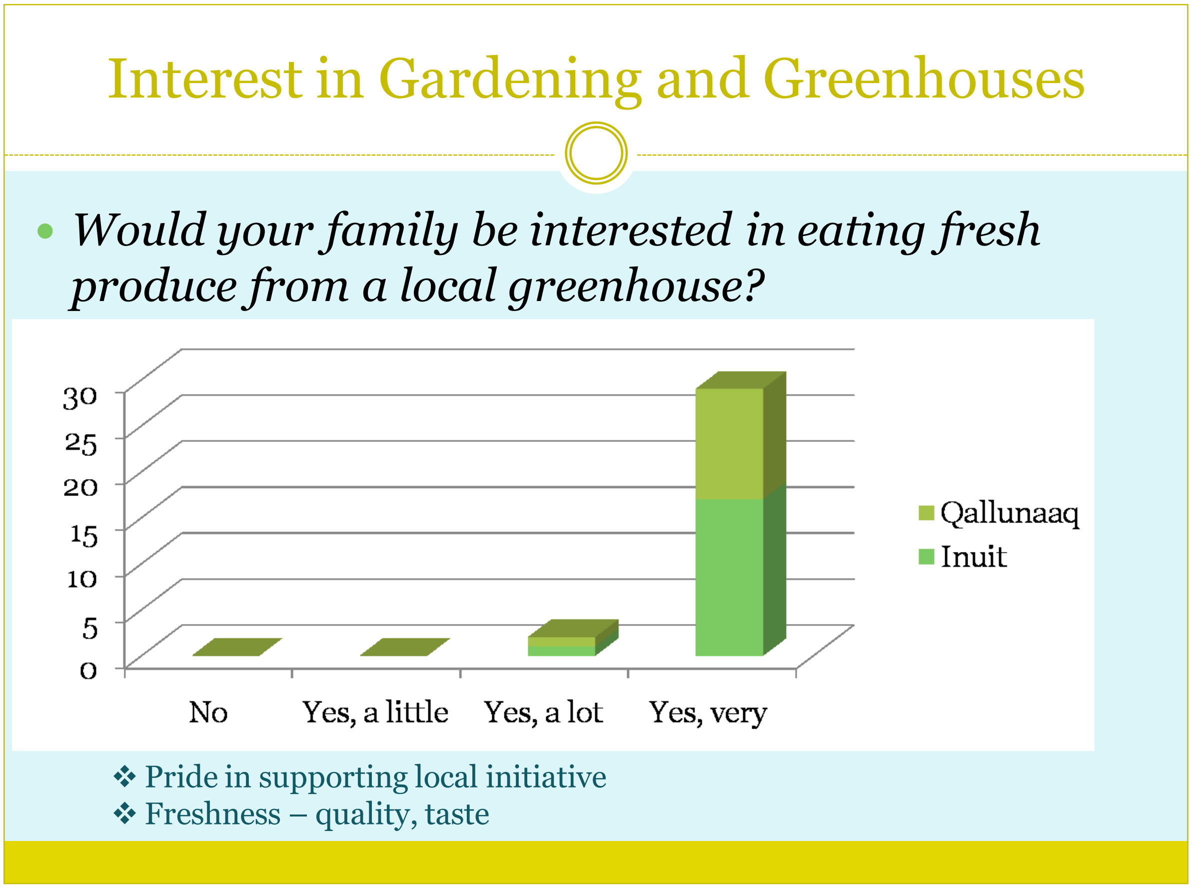

FIGURE 42 Interest in greenhouse produce demonstrated by Kuujjuamiut in 2009.

While the general response to the idea of a greenhouse project was resoundingly positive in 2009, it is important to underline a concern that was repeatedly voiced at the time. The concern is that many past projects (often backed by southern organizations) encountered difficulties in the long run. The principal reasons cited for this lack of success were lack of long-term commitment on behalf of outside project instigators, lack of adequate training for local personnel, and lack of technical support. It is interesting to note that these issues are consistent with concerns voiced in regard to past greenhouse and agricultural initiatives in the North.

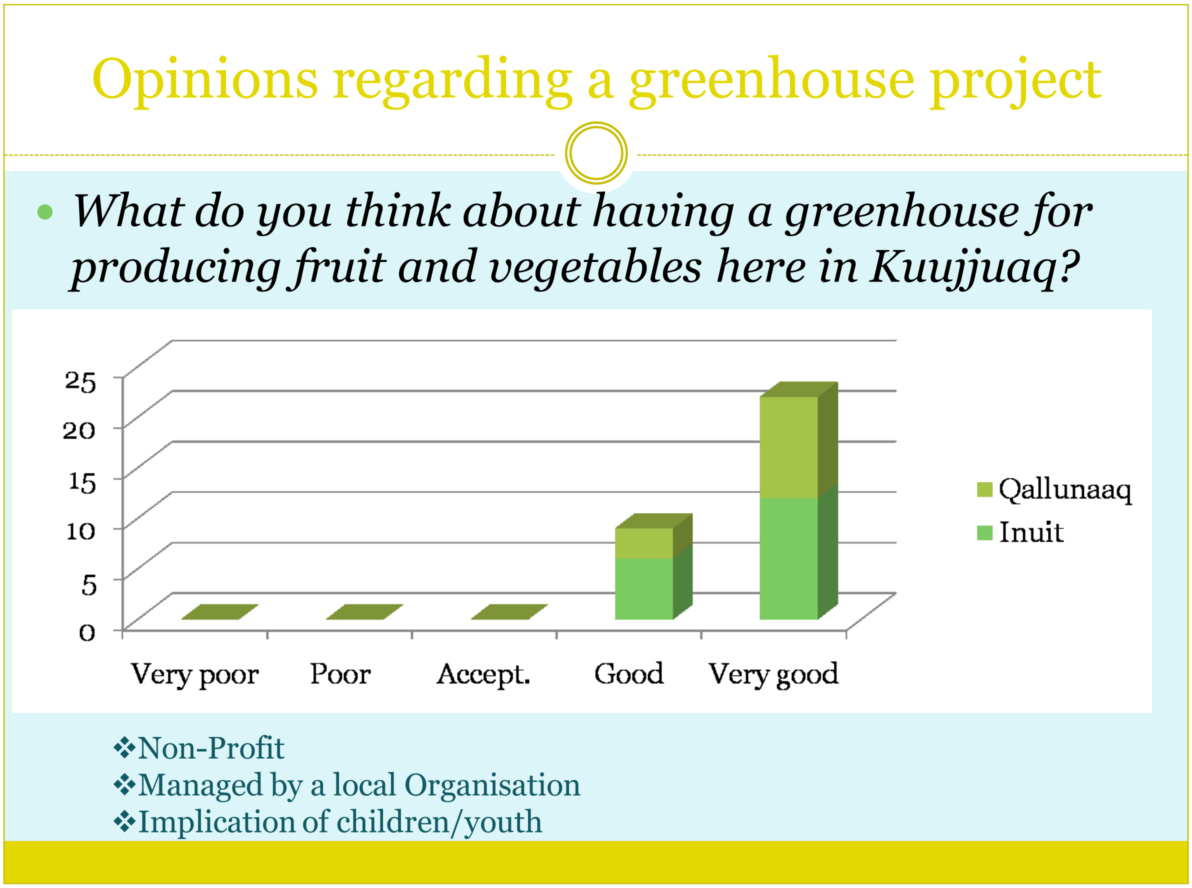

FIGURE 43 Interest in a greenhouse project demonstrated by Kuujjuamiut in 2009.

5.2.4 Local Support for a Greenhouse Initiative

As evidenced by the results presented above, there was a great deal of interest in the community of Kuujjuaq regarding a greenhouse project in 2009. Further positive support came from three local organizations that demonstrated a real interest in backing a greenhouse project. These organizations were: 1) Kuujjuamiut Inc. (an agency established at the signing of the JBNQA, whose mandate includes improving the standard of living of the Inuit of Kuujjuaq), 2) Nayumivik Landholding Corporation of Kuujjuaq (an organization that owns the land titles in the Kuujjuaq area, and whose mandate is to represent the beneficiaries of the JBNQA at the community level through the promotion of different types of commercial and non-commercial activities), and 3) the Corporation of the Northern Village of Kuujjuaq (NVK). While the first two organizations listed above have continued to support the idea of the Kuujjuaq Greenhouse Project, it is the NVK that has taken the lead and become one of the principal project partners (along with the Kativik Regional Government [KRG]).

While for many reasons the village of Kuujjuaq came across as being the ideal place to implement a greenhouse project, it is important to underscore the fact that a number of people suggested that it would also be very pertinent to envision greenhouse initiatives in other Nunavik villages—villages where fruit and vegetables are more difficult to procure, are of lesser quality, and are significantly more expensive than in Kuujjuaq. Having a greenhouse project in a smaller village could also help address the rates of unemployment, which in some villages in Nunavik can reach as high as 20%.

5.2.5 Significance of Preliminary Results

The results of this preliminary study showed that fruit and vegetables play an important role in the diets of Kuujjuamiut (the majority of respondents stated that they spent over 25% of their food budget on fruit and vegetables). Results also indicated that there was significant interest among the population for a greenhouse project. On a related note, there also seemed to be potential for the development of horticultural initiatives involving the production of flowers and other types of ornamentals, as well as, shrubs, bushes, and trees for future community greening initiatives. Overall, results indicated that greenhouse initiatives (carried out in Kuujjuaq as well as in other villages) could concretely assist the sustainable development of arctic communities through the local production and distribution of fresh produce, through better access to a variety of good quality fruits and vegetables, and, finally, through the creation of local employment and training opportunities. As stated by a local leader in one interview, “Given the serious problems faced today by our society, anything positive is welcome.”

5.3 Results of Community Consultations: 2010

During the fall of 2010 a series of community meetings took place in Kuujjuaq in order to present and verify the results of the preliminary study presented above. This trip was made possible in part by funding provided by the Kativik Regional Government (Department of Research and Economic Development) and Air Inuit. At the time, I, and a representative from the QHC, consulted with community members and local and regional organizations (from both the ethnic and non-ethnic sector) regarding the development of a potential greenhouse project in Nunavik.

Three formal consultation sessions were held during the week of November 22nd – 26th, 2010, in order to present the results of the study to the people and organizations that participated in it. The first session was held on the afternoon of November 23rd at the Municipal Council Office in Kuujjuaq. At this session representatives from the NVK, Kuujjuamiut Inc., Nayumivik Landholding Corporation, and KRG-Research and Economic Development were present. The second session was held on the morning of November 24th at the KRG conference room. At this session representatives from a number of different departments, as well as administrators of several regional organisations, were present.[26] The third, and final, session was an open community meeting that was held on the evening of November 24th, also at the KRG conference room. Present at this session were a dozen community members, from all walks of life, who were interested in learning about a potential greenhouse project for personal as well as professional reasons. Following these three formal sessions, a number of smaller meetings were held with local and regional leaders and administrators in order to continue discussing the subject and to examine how to proceed with the development of a project.

The dialogue generated during these consultations confirmed that the information that was gathered during the course of the preliminary study was accurate, and it also clearly indicated that local and regional leaders were still interested in pursuing some sort of horticultural initiative; specifically, the development of greenhouse projects. The aspects of horticultural project development that community members as well as local and regional leaders were most interested in exploring included food security (cost, quality, and availability of food); education, training, and employment opportunities (especially for youth and marginalized members of the community); environmental protection (reducing “food miles,” composting,

[26] Among them: KRG-Renewable Resources, KRG-Employment and Training, KRG-Research and Economic Development, Makivik-Research, Makivik-Economic Development, and Nunavik Regional Board of Health and Social Services.

and using waste heat or waste oil for heating greenhouses); and, beautification/greening of the village—and all this within the context of improving the quality of life and well-being of Nunavimmiut.

The different meetings, encounters, and discussions that were had during this consultation process brought to light different needs that could be addressed by specially adapted horticultural initiatives. These needs can be loosely classed as either social or economic. Examples of needs that fell within the social category included the improvement of nutrition, health, and quality of life and education and training (especially with respect to special needs students and the reintegration of marginalized members of the community). These types of needs could be partially met through the creation of community or collective gardens (in greenhouses or exterior greenhouse tunnels) as well as through private household greenhouses and gardens. Needs that fell within the economic category were mostly related to the supply of fresh produce to food service industries (hotels, restaurants, and cafeterias) as well as to food distribution networks (grocery stores). These types of needs could be addressed through the development of commercial greenhouse operations of varying scale—operations that could potentially include social integration and vocational aspects.

Overall, it was recognized that there is a general lack of both practical and technical agricultural knowledge in northern communities. Inuit have expert knowledge of hunting, fishing, and gathering but little experience with agriculture, which is a non-traditional activity. There are also many challenges associated with the availability of soil, seeds, and agricultural equipment in the North. These challenges notwithstanding, it was agreed by all stakeholders, given the obvious interest in and feasibility of a greenhouse project in Nunavik, that upon completion of the consultation process the next step would be the presentation of a framework for a pilot project in Kuujjuaq. As mentioned in the previous section, this framework was developed in the months that followed the community consultation process, and this in turn led to the elaboration of Phase I of the Kuujjuaq Greenhouse Project.

5.4 Results of Phase I and Phase II of Kuujjuaq Greenhouse Project: 2011 and 2012

Following the consultation process presented in the previous subsection, as well as an intensive planning period during the winter and spring of 2011, funding was secured to go ahead with the first stages of a greenhouse pilot project in Kuujjuaq. This section will present the detailed results of the development of the eight horticultural microprojects that make up the Kuujjuaq Greenhouse Project. I will begin with an introduction and overview of Phase I and Phase II of the project and will then present the results by category, each category covering the two-year period for which each of the microprojects was studied.

5.4.1 Overview

During the summer of 2011, many advances were made in the development of the Kuujjuaq Greenhouse Project. In late spring and early summer, community members began planting their garden beds in the existing greenhouse and plans to develop other horticultural microprojects associated with the greenhouse began to take shape. Over the course of the summer of 2011, the community of Kuujjuaq put in place many of the different aspects of the greenhouse project that had been on the table since 2009. By the end of the season there were eight horticultural microprojects associated with the Kuujjuaq Greenhouse Project, five actively in operation and three in the process of emerging. The five active projects were: 1) the community garden in the existing greenhouse, 2) planning of the construction of a second greenhouse, 3) a composting project with the two local food stores, 4) a potato test bed in collaboration with the Quebec Horticultural Council and Progest (a potato research centre), and 5) a horticultural therapy project with the Ungava Supervised Apartments (a community home for people with mental health issues). The three emerging projects were: 1) youth employment and training with Carrefour jeunesse emploi, 2) curriculum development with the Kativik School Board, and 3) hydroponic trials.

The Regional and Local Development Department of the Kativik Regional Government funded the development of all of these initiatives. The Northern Village of Kuujjuaq (which owns and maintains the existing greenhouse) administered these funds and also contributed financially and in kind to the project. In total, the KRG allotted $22, 463.00 to the project for the development of Phase I. By the end of the summer of 2011 (August 31st), $13, 495.76

had been spent on repairs to the existing greenhouse, various supplies, gardening equipment, data collection, materials, and labour. Due to time constraints, not all of the microprojects were fully developed during the summer of 2011, which explains why there was a surplus in the budget. However, a significant portion of the remaining money was allotted to other needs, such as the purchase of a rotary tiller for the 2012 summer season.

One aspect of Phase I to which a significant amount of time and energy was allotted was the creation of The Kuujjuaq Agricultural Project (KAP) Steering Committee. This organizational body, which was mandated to oversee the development and implementation of the eight individual microprojects previously identified, was never officially put in place, but all the groundwork was done, including confirmation of the organizational structure by the principal stakeholders and the writing of a draft set of committee by-laws. In this organizational model the KAP steering committee was to be made up of representatives from the Regional and Local Development Department of the Kativik Regional Government, the Northern Village of Kuujjuaq, and the eight executive committees representing each of the eight microprojects, as well as from representatives of local and regional organizations that had a vested interest in the development of bio-food and/or community projects in Kuujjuaq and Nunavik (for example, Makivik Corporation, the Kativik Environmental Advisory Committee, and the Nunavik Regional Board of Health and Social Services), and representatives from the Nayumivik Landholding Corporation and Kuujjuamiut Inc.

On another note, it is important to mention that the early development of the Kuujjuaq Greenhouse Project was watched closely by two groups of observers and supporters. These groups were the Nord-du-Québec Bio-Food Network (an association of Inuit, Cree, and Jamesian organizations) and the Bio-food Sector of the Quebec government's Plan Nord program. These two groups not only pledged support to the Kuujjuaq project but also pledged to remain partners in the long-term development of this initiative.

Following the inaugural Phase I in 2011, the 2012 season—Phase II of the Kuujjuaq Greenhouse Project—was considered to have been a success as well. The project advanced significantly on several fronts, and while some growing pains were experienced, this was deemed acceptable, given that nothing of this sort had ever been attempted before in Kuujjuaq. As in 2011, eight microprojects fell under the umbrella of the Kuujjuaq Greenhouse Project. Six of these projects were in active operation during the summer of 2012, and two were still in the process of emerging.

The principal project partners—notably, the Kativik Regional Government (Department of Regional and Local Development), the Northern Village of Kuujjuaq, the Ungava Supervised Apartments, and volunteers from the Nunavik Regional Board of Health and Social Services and Université Laval—began planning the 2012 season early in the new year in order to establish the season's project goals as well as the budget needed to support them. In total, the sum of $40,506.00 was granted to the Northern Village of Kuujjuaq by the Kativik Regional Government in order to support the development of Phase II of the Kuujjuaq Greenhouse Project. As in Phase I of the project, the funds were administered by the Northern Village of Kuujjuaq, and this organization also, once again, contributed in kind to the project in many different ways; for example, by providing accounting services and administering project funds, supplying electricity and water to the greenhouse, preparing the site for the construction of the new greenhouse, maintaining the project vehicle, and constructing and maintaining composting installations and equipment. Staff and residents of the Ungava Supervised Apartments were key players in the further development and expansion of the Compost Project. Engineers and architects from the Kativik Regional Government (Department of Public Works) were responsible for the management of the new greenhouse project, and all of the microproject initiatives were generally overseen and supported to varying degrees by project volunteers.

While media promotion activities were not expressly part of the project mandate, it is nonetheless important to underline the increased media interest that the Kuujjuaq Greenhouse Project enjoyed in 2012. Of note is a one-hour television documentary filmed by Taqramiut Nipingat Inc. (an Inuit-owned production company based in Kuujjuaq) on the subject of gardening, greenhouses, and composting in Kuujjuaq and Nunavik. Also of note is the work that was done by Productions Vic Pelletier (PVP) as part of the Objectif Nord multimedia initiative that was officially launched by Télé-Québec in March 2013. Both the community garden in the greenhouse and the compost project were featured in a short web-based video documentary, and 360º images of the Kuujjuaq Greenhouse were also included on the Télé-Québec Objectif Nord website (PVP, 2013). Finally, an article that appeared in the Globe and Mail, entitled "Greenhouse idea grows in Far North," introduced the Kuujjuaq Greenhouse Project, while discussing the potential and growing interest in this type of initiative in the Canadian North (Mehler Paperny, 2012).

5.4.2 Existing Greenhouse: Community Garden

The existing greenhouse in Kuujjuaq is home to a community garden that has been operating since the mid-1990s (see Figure 44). While in the past the garden had no official group or organizational body responsible for its day-to-day operations, such as the maintenance of membership and waiting lists and the distribution of garden beds, it operated well enough through the sustained efforts of a few dedicated community members. Today, as in the past, the Northern Village of Kuujjuaq takes care of all of the building maintenance, ensures an adequate supply of water and electricity, and also insures the building.

FIGURE 44 Exterior and interior view of the original Kuujjuaq greenhouse.
Photos: Author's personal collection

During the summer of 2011, a significant amount of time and energy went into developing a basic organizational structure for the creation of a greenhouse committee, and to this end many seemingly mundane but essential tasks were accomplished. For example, a list of all the gardeners with their contact information was created, the garden beds were all given numbers, plastic number tags were affixed to the walls of the greenhouse above the individual beds, and a greenhouse map with the names of all the gardeners matched to their beds—an essential tool for many administrative tasks—was created. As well, a meeting was held on August 24th, to discuss the creation of a future greenhouse garden committee that would be responsible for overseeing the general operations of the community garden. The vision and objectives of the community garden were also concretely established at this meeting. Following the meeting, the minutes were sent out in order to collect feedback from the gardeners and other stakeholders, and the Iqaluit Community Greenhouse Society was contacted for advice on how to move forward with the task of creating a committee.

On a more practical note, a number of repairs to the greenhouse itself were completed in 2011. The jet fan ventilation system was relocated, the roof louvres (an essential component of the automatic ventilation system) were repaired, and the plumbing system was retrofitted and repositioned to make it more easily accessible for all users. As well, a number of new garden tools (shovels, rakes, pitchforks, hand tools, etc.) were purchased for communal use in the greenhouse.

During the summer of 2011, a significant amount of time and energy also went towards the collection of data pertaining to the types of crops grown in the greenhouse. Data collection sheets were created, and all of the gardeners were invited to participate in writing down the details pertaining to their vegetables (e.g., cultivar, date seeds sowed, use of fertilizers, and total weight of harvest). The overall goal of this part of the project was to determine which crops and cultivars grew best in the greenhouse. These data will be very useful in the future for the planning of other projects and immediately useful in the short term for gardeners looking to plant the most appropriate crops in Kuujjuaq. As well as crop data, local weather data and inside greenhouse temperatures were also recorded on a daily basis, and soil tests were begun on the garden beds (see Appendix 3 for copies of various data collection tools used in 2011). It is worth noting that from late July to mid-August temperatures regularly soared to above thirty degrees Celsius in the greenhouse, and occasionally even went over forty degrees. For example, on July 31st, 2011 the temperature in the Kuujjuaq greenhouse peaked at 49 degrees Celsius (Avard, 2011).

Based on the data collected in 2011, the overall conclusion is that crops that enjoy relatively cool temperatures do very well, hence the prolific production of lettuce and herbs that was observed. One interesting result that emerged from the data was the fact that it was possible to still continue harvesting certain varieties of lettuce, spinach, and herbs well after the temperature had begun to dip below zero degrees Celsius at night. The first sub-zero temperature of the season was recorded on September 5th, and the last peas were harvested on September 15th, the last parsley on October 2nd, and the last lettuce and spinach October 6th.

It is also interesting to note that in some cases a small number of plants have the potential to yield a significant volume of produce by the end of the season. For example, six lettuce plants (cultivar: Grand Rapids) yielded 7.1 kg over the course of the summer, six spinach plants (cultivar: Tetragonia tetragonioides) yielded 4.25 kg, and, a one metre long row of densely planted radishes yielded 1.27 kg as early as the 21st of July. As well, zucchinis grew to sizes worthy of any garden down south!

Overall, the 2011 garden season proved to be very successful. Significant advances were made towards creating a greenhouse committee, and the majority of gardeners were happy with the results that their garden beds yielded. The data that were collected with the assistance of the gardeners served to back up anecdotal evidence regarding the types of crops that do well in the greenhouse, and many of the technical problems with the greenhouse structure were addressed.

The success of the 2011 greenhouse season sparked a renewed interest in gardening, and the desire to participate in this activity grew rapidly in Kuujjuaq over the winter. To this end, early spring 2012 saw the construction of several new garden beds in the greenhouse; these were built in a space previously taken up by an underused work table. Compost that had been produced in 2011 was combined with local mineral soil and used to fill these new plots, which were constructed by volunteers from recycled scrap wood.

In the early months of 2012 it became evident that there were more people interested in gardening than there were garden beds available in the greenhouse. Consequently, a random draw was devised to allocate the six available garden beds. While some criticized this procedure, it was the only option available to volunteers and the best possible solution to a difficult and challenging task, given the lack of an official organizing body to manage the process in any other way.

Once all the greenhouse plots had been allocated, community members began preparing their garden beds—watering (rehydrating) and turning over the soil as well as sowing the first seeds in the greenhouse in mid-May. At this time, many of the seedlings that had been started earlier in homes, or flown in from garden centres in the South, were also transplanted into garden beds.

Harvesting of the first crops (lettuce and herbs) began in late June, with the bulk of crops maturing in late August and early September, and the final cold crops (lettuce, Swiss chard, and scallions) remaining viable until mid-late October.

From a technical perspective, the results achieved by greenhouse gardeners in 2012 were just as encouraging as they were in 2011. While data collection in 2012 was limited due to unforeseen circumstances (which prevented a comprehensive data collection program, involving all gardeners, from being put in place), data were, however, rigorously collected by a small group of greenhouse members who gardened together in a new collective garden plot comprised of four garden beds. Data collection consisted of weighing harvests using an electronic kitchen scale and recording the information on specially prepared data collection sheets (see Figure 45). The data were subsequently entered in to an Excel spreadsheet.

FIGURE 45 Harvesting and weighing greenhouse produce.
Photos: Author's personal collection

Overall, the data collected from this small sample size are consistent with the information that was collected during the 2011 season and serve to reinforce conclusions that were drawn then. For example, crops that thrive in cool temperatures (e.g., lettuce, herbs, Swiss chard, Bok Choy, and radishes) perform exceptionally well. Root crops (e.g., potatoes, onions, carrots, and beets) are easy to grow and achieve respectable sizes, and heat-loving crops prove difficult to bring to fruition if they have not been started at home well before the beginning of the season. (For a detailed list of best crops, good crops, and possible crops grown in the Kuujjuaq Greenhouse, see Table 2).

As was the case in 2011, lettuce (notably the cultivar "Grand Rapids") proved to be the star crop in the greenhouse during the summer of 2012. It not only produced consistently—allowing significant harvests on a weekly basis from June 27th until October 19th—but also produced the largest quantity (in kilograms) of food of all the crops sown in the greenhouse.

For example, in the four garden beds where data was collected, gardeners harvested a total of 12.41 kg of Grand Rapids lettuce alone. Other crops of note in these four garden beds include Swiss chard—which produced significant harvests from July 11th until October 19th—totalling 6.83 kg of produce; radishes which were harvested on a weekly basis from August 15th until October 6th and produced a total of 3.42 kg; onions—the bulk of which were harvested in mid-September and produced 4.6 kg in total; and scallions and leeks which came in at total harvest weights of 2.77 kg and 3.4 kg respectively (see Table 3).

In the four garden beds where data were collected, the total amount of food produced amounted to an astonishing 53.869 kg. It is important to note here that while data were not officially collected from the other garden plots in the greenhouse, anecdotal evidence suggests that a number of other gardeners enjoyed similar success in 2012. Therefore, by extrapolating from the data collected over the past two years, it would not be unreasonable to suggest that the Kuujjuaq Greenhouse (which measures approximately 7.6 metres x 18.3 metres (25 feet x 60 feet)) could potentially produce at least 300 kg of food in its 23 garden beds in any given year.

TABLE 2

Kuujjuaq Greenhouse Crops (2011 and 2012)

BEST CROPS: (Were easy to grow and produced a significant volume in a small space)			
• Herbs: - Parsley - Coriander - Oregano - Chives - Dill - Mint - Thyme - Tarragon	• Lettuces: - Leaf "Grand Rapids" - Romaine - Arugula - Chicory - Mixed greens "mesclun" - Mizuna - Tah-tsai	• Bok Choy • Radishes • Swiss chard	
GOOD CROPS: (Were easy to grow and did very well)			
• Basil • Beans • Beets • Carrots	• Garlic • Leeks • Onions • Peas	• Potatoes • Scallions (Green Onions)	• Shallots • Spinach • Zucchinis
POSSIBLE CROPS: (Were possible to grow, but required an early start and/or did not produce well, either in quality or quantity)			
• Cucumbers (Field and English varieties) • Physalis (Ground Cherries) • Tomatoes ("Cherry" as well as "normal" size [Beefsteak, Plum, etc.]) • Peppers (Chili and Bell varieties)			

TABLE 3

Harvest Log (2012): Plots 17, 18, 19, and 20 (Collective Garden)

DATE	Jun 27th	Jul 4th	Jul 11th	Aug 15th	Aug 22nd	Aug 29th	Sept 6th	Sept 22nd	Sept 26th	Oct 6th	Oct 13th	Oct 19th	**TOTAL**
CROP	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Weight (gr.)	Total (gr.)
Arugula			900	205	594	131			25				1855
Beans			800			144				1340			2284
Beets						1818	1308		400	322			3848
Bok Choy					226		529		800	968			2523
Carrots			900		495					964			2359
Chives	434				337		110		100				981
Coriander				140	36	59	48	42	32	35			392
Cucumber					485				112				597
Garlic			1100										1100
Leeks											3400		3400
Lettuce	356	1576	2000	1900	1386	443	1496	227	1000	698	456	875	12.413
Onions			300				4300						4600
Parsley				124	148		92		50				416
Peas			300	840	840	438			10				2428
Radishes				800	200	78	297	600	995	450			3420
Scallions			700									2065	2765
Spinach			700										700
Sw. chard			1100	1035	709	1062	979		676		434	835	6830
Tarragon					93					300			393
Thyme					65		100				400		565
TOTALWEIGHT (kg): All Crops Combined													**53.869 kg**

While the main focus of this microproject was obviously to support the maintenance and development of gardens inside the greenhouse, it is also worth mentioning that a small outdoor garden plot was also planted next to the greenhouse in 2012. The plot was sheltered from the wind and probably also benefited from a slightly warmer microclimate, given its proximity to the greenhouse. In any case, the vegetables that were planted in it did remarkably well. Turnips grew to respectable sizes, and peas and raspberries produced a number of good-sized fruit as well. It is particularly interesting to note that, compared to a container garden that was observed during the summer (planted by a Kuujjuaq resident alongside a home) where the plants were exposed to relatively strong, constant winds, the plants in the outdoor plot next to the greenhouse were not at all stunted, as was the case with the vegetables that were planted in the windy container garden site. From this we can conclude that, by only slightly modifying the growing environment (microclimate) or strategically placing garden beds in sheltered locations, numerous types of crops can also be grown successfully out of doors in Kuujjuaq. This statement is corroborated by the fact that local residents have successfully been growing crops such as rhubarb and potatoes outdoors for years.

While it is important to report on the food production aspect of the greenhouse project, it is of equal importance to underline several other aspects of innovative project development (however small they may be) that took place in the greenhouse in 2012. For example, as alluded to in previous paragraphs, a new type of gardening practice emerged in the greenhouse. This was a small collective garden, an initiative involving seven people who combined four garden beds together and divided tasks such as planting, harvesting, and watering amongst themselves. Not only did this increase the area available for planting (since pathways that had previously divided the garden beds could now be filled with new soil), but this practice also resolved several of the more common problems encountered by gardeners in the past; notably, continuing to care for the garden when someone was on leave or vacation during the summer and sharing the burden of some of the more difficult tasks, such as weeding and preparing the plot at the beginning of the season.

Other small innovations of note this year included the use of homemade fish fertilizer (a water-based emulsion of ground-up fish heads and other fish scraps from locally caught fish) that was applied on a regular basis as a very effective soil amendment in certain plots; the installation of hanging baskets for cucumber plants made from discarded milk crates lined with newspaper; and the construction of shelving alongside the back wall of the greenhouse to use for growing herbs in small pots and boxes (see Figure 46).

FIGURE 46 Interior of the greenhouse; note hanging baskets and new shelving system.
Photo: Author's personal collection

The introduction of edible flowers, such as pansies and nasturtiums, to a number of gardens was also a successful initiative that enlivened many a salad, enchanting both adult gardeners and children alike (see Figure 47). The success of flowers in the greenhouse is significant because many Kuujjuamiut have demonstrated an interest in this type of crop, noting that flowers could perhaps eventually be used to decorate public spaces in the village.

FIGURE 47 Flowers grown in the greenhouse; note edible pansies and nasturtiums.
Photos: Author's personal collection

It is interesting and encouraging as well that many gardeners made a concerted effort to bring their children to the greenhouse and actively include them in planting, watering, and harvesting activities (see Figure 48). This fact is important because, as we all know, the key to the long-term success of any new type of community development project lies in getting children and youth interested.

Another initiative of note was the creation of a Facebook page for the Kuujjuaq Greenhouse. Since a vast majority of Nunavummiut have embraced this new technology, volunteers thought that it would be the ideal tool to use to communicate with gardeners. Much to everyone's surprise, the page has garnered the attention of many more people than just those who have plots at the greenhouse: by early 2013, the Kuujjuaq Greenhouse Facebook page had over 200 friends, and one year later had close to 300! This serves to highlight the depth and breadth of interest in the project, since people from not only Kuujjuaq but from all over Nunavik as well as elsewhere in Canada and abroad have signed on.

FIGURE 48 Children often participate in gardening activities at the greenhouse.
Photo: Author's personal collection; Eva Gunn; Sarah Rogers.

Dealing with the issue of greenhouse management proved to be more difficult, however. One of the biggest challenges to the sustained advancement of the goals of the Kuujjuaq Greenhouse Project was the lack of a coordinating body to oversee day-to-day operations and maintenance, including such details as maintaining up-to-date contact information, having water delivered, communicating information about the greenhouse to the community, and restarting operations in the new growing season. It had been agreed by all project partners in 2011 that the best way to address this challenge would be to create a committee that could divide the assorted tasks among its members. To this end, project volunteers, in consultation with project partners and community members, spent a considerable amount of time in 2012 figuring out how to best structure such a committee. Two meetings were held (on September 5th and October10th, 2012) to plan and discuss with greenhouse gardeners and interested community members how to move forward on this file. One of the principal outcomes of this process was the creation of a detailed committee profile, including task lists for executive members of the committee. The minutes of the meeting from September 5th, 2012 provide a detailed description of plans for the community greenhouse, including guidelines for committee members (see Appendix 4).

While many pertinent points were raised and discussed at these two meetings and certain details were agreed upon by all, not all issues met with consensus; hence, a formal committee was not formed in 2012. It was, however, agreed upon by all present at the two meetings that, in the interim, daily operations and decisions regarding the greenhouse would be the responsibility of the Northern Village of Kuujjuaq. Of particular note was the suggestion that was put forward that the committee, once formed, could act as a purely consultative body; thus, all important decisions would not be made by the committee itself but by elected officials of the Council of the Northern Village of Kuujjuaq. Such an approach would allow the committee to focus its energies on the day-to-day management of the greenhouse and community garden, while experienced community leaders could handle issues and decisions that were more political in nature.

As a whole, the 2012 greenhouse gardening season can be considered a success. From a technical horticultural perspective, the harvest was good, a number of innovative ideas were initiated, and the managerial aspects of the greenhouse committee were addressed. However, for a few months during Phase Two of the project, interethnic frictions (which were subsequently resolved) threatened further progress. Tensions (and tempers) ran high, and accusations of Qallunaat "taking over the greenhouse" were heard. While everyone involved in the project was in agreement that the overarching, long-term goal of the project was to increase food security for Inuit, the reality was that many Qallunaat living in Kuujjuaq were also interested in gardening, and many had been accessing the greenhouse as well. Since there have been other occasions in the recent past where Inuit have felt pushed aside from their own public events or public spaces in Kuujjuaq, the perception that the same thing was happening in the greenhouse led to some hard things being said and created an obstacle to further progress over the next few months. However, after much discussion (and soul searching) the consensus was that it actually made sense for both Inuit and Qallunaat to garden together in the greenhouse. This conclusion not only reflected the fact that the actual infrastructure belonged to the Northern Village of Kuujjuaq (a non-ethnic organization dedicated to serving all residents of the village) but also the realization that Qallunaat with experience would be able to show and teach others how to garden, thus facilitating the transfer of knowledge as well as the creation of a sense of community—and perhaps new relationships—through the growing and sharing of food.

5.4.3 Construction of a Second Greenhouse

As mentioned previously, one of the main problems with the existing greenhouse in Kuujjuaq in 2011 was lack of space. There were more people interested in gardening than there were garden beds available; hence, the interest in the construction of a new, second greenhouse. Since a project of this type is such a big undertaking, it was initially thought that it would be several years before plans for a second greenhouse could be envisioned. However, during the summer of 2011, the Municipal Public Works Department of the Kativik Regional Government came forward with an offer to help secure 80% of the cost of a new greenhouse through a government granting agency. This department was also in a position to undertake all aspects of project management associated with this endeavour.

Some of the principal actions that were taken in 2011 to move this initiative forward included obtaining final approval for this project from all the different levels of government, as well as from local administrative bodies; securing the remaining 20% of the financing; evaluating the possible re-use of the greenhouse frame that was formerly used at the old swimming pool (this option was eventually discounted); researching and investigating the different types of foundation pads that could be used (pre-fabricated, modular concrete pads had been proposed but were eventually rejected in favour of the usual gravel pad); procuring enough soil to fill the garden beds (collecting local topsoil from recent construction sites was considered, but in the end soil was shipped up on sea-lift); and discussing the usage and division of space in this new greenhouse (e.g., deciding whether there should be more community garden beds, whether some garden beds should be reserved for youth and Elders, or whether an experimental hydroponic system should be installed).

Following these initial discussions during the summer of 2011, the Kativik Regional Government (Department of Public Works) and the Northern Village of Kuujjuaq began to plan the construction of the new greenhouse to be built next to the existing one (see Figure 49 for one of the original site plans). During the fall of 2011 and the winter of 2012 the remaining funding was secured and, following the standard tendering process, a greenhouse was purchased from the well-known Quebec greenhouse manufacturer Les Industries

Harnois Inc. (the same company that built the existing greenhouse almost two decades earlier).

FIGURE 49 Original site plans for the new greenhouse.
Plans: Courtesy of Isabelle Champagne

During the summer of 2012 the Northern Village of Kuujjuaq began building the gravel foundation pad upon which the new greenhouse was eventually placed (see Figure 50). The new greenhouse was to have almost the same dimensions as the existing one and would be placed parallel to the current greenhouse at a distance of approximately 10-12 metres. The reason for this spacing was twofold: first, it would facilitate snow removal (an accumulation of too much snow on or against the greenhouses could cause structural damage), and second, it created an ideal place for installing a series of outdoor garden beds that would benefit from the windbreak and microclimate created by the surrounding walls.

FIGURE 50 Building the foundation pad for the new greenhouse.
Photos: Author's personal collection

Plans to eventually construct a connecting building (headhouse) between the two greenhouses were also elaborated by project stakeholders and volunteers. This building would serve many useful purposes. including, for example, housing furnaces to heat the greenhouses in order to extend the season in spring and fall, housing water tanks (to prevent the water from freezing so that water can be delivered earlier in the season), providing work space for potting and transplanting, providing work space and office space for teaching and knowledge transfer activities, and providing storage for communal tools and lockers for personal effects belonging to gardeners. Construction of the new greenhouse was planned for 2013, and construction of the connecting building will go ahead when funds become available in the future. In the fall of 2012, on the last sea-lift of the year, the greenhouse structure and all of the soil were shipped from the port of Montreal to Kuujjuaq, and the new greenhouse was assembled beside the old one in the spring of 2013. (See Figures 51 and 52.)

In response to the mobilization of this aspect of the project, several residents also put forth the idea of partially funding, or otherwise supporting, the construction of small greenhouses that residents could install next to their homes. This solution was proposed in the wake of a certain amount of discontent that was voiced by community members who wanted to garden but did not have access to a plot. While the lack of available garden beds has led to a certain amount of tension in the village, it is important to note that the problem of too many gardeners is, in fact, a good problem to have, since it shows that public interest and support for greenhouses, gardening in general, and the Kuujjuaq Greenhouse Project specifically has grown significantly in only a very few years.

FIGURE 51 Exterior and interior of new greenhouse upon completion of construction.
Photos: Author's personal collection

FIGURE 52 New greenhouse (at left) beside the old one.
Photo: Author's personal collection

5.4.4 Compost Collection

Creating compost has been on the minds of those involved with the greenhouse since the beginning of this project. The reason for this stems primarily from a need to address the lack of useable soil in Kuujjuaq; the locality is characterized by mostly sandy and rocky substrate. In the past, gardeners have had to order bags and palettes of soil from the South—some having incorporated as much as $1000.00 of potting soil into their individual garden beds. Over the summer of 2011, a pilot composting project was put in place in order to test the feasibility of composting on a relatively large scale. To this end, a composting site was constructed (using predominantly reclaimed materials) next to the greenhouse, and a small ATV trailer was purchased to help collect vegetable waste from the two food stores in the community.

Store managers and produce managers at both Newviq'vi and Northern were very willing and eager to participate in this project, noting that it was a very positive way to reduce waste as well as a way to contribute to the community. After having purchased new, clean garbage pails to collect the vegetable waste in the storerooms (keeping the waste odour free and bug free was an import consideration, given that it was to be stored temporarily in food preparation areas), and having agreed upon a schedule with the produce managers, volunteers collected the waste three times a week for a period of two and half months—from August 2nd through to October 14th.

When creating compost, it is necessary to combine a source of carbon with the wet/green vegetable waste in order for proper bacterial and chemical decomposition to occur. In the South, carbon is often added to compost piles in the form of leaves; however, this resource is very scarce in Kuujjuaq. In order to meet the carbon needs in the Kuujjuaq compost pile, shredded office paper (also a tree-based product) was substituted. The office paper was obtained with the help of the Kativik Environmental Advisory Committee (KEAC), an organization that has been keen on observing the progress of the greenhouse project because of its obvious connection with sustainable development. The KEAC was quick to underline the fact that composting is not only a way to create a very rich type of soil but also has the potential to be a very effective way to reduce waste in Nunavik communities, which have become increasingly interested in evaluating new ways to divert waste from their landfill sites.

A data collection log was created for this pilot project, and information pertaining to the amount of vegetable waste collected, as well as how much paper, water, and compost accelerator were used to build each new pile, was recorded each collection day. Notes pertaining to humidity levels and pile temperature were also recorded, as well as dates when the weekly piles were turned. In sum, an average of approximately one medium-sized (75 litre/25 gallon) garbage pail of vegetable waste was collected per day, and the accumulated waste yielded approximately 1 cubic meter of useable compost that was incorporated into the greenhouse garden beds in the spring of 2012.

As a complement to this larger pilot project, two small compost bins were also constructed adjacent to the greenhouse in order to address the desire of many gardeners (and other Kuujjuamiut) to compost their household food scraps as well as waste plant material from the garden beds. Several individual household compost bins (constructed by enthusiastic northern gardeners) were also observed throughout the summer in order to learn from the experience of residents (see Figure 53). As well, a small-scale (household, undercounter) vermicomposting experiment was also launched, and this initiative produced some very positive (albeit short-term) results. This positive outcome is consistent with anecdotal evidence gained from several residents who have been composting with this type of worm-based system in the North for a number of years.

Finally, discussions with the management of the hospital cafeteria and the restaurant at the Kuujjuaq Inn during the summer of 2011 also revealed a real interest on their part to participate in the composting project. These multiple aspects of the compost pilot project served to illustrate that there is real interest in the community for this type of initiative, an initiative that responds not only to a need for soil creation for gardeners but to environmental concerns as well.

FIGURE 53 Household compost bins. Note shredded paper, seaweed, and dried leaves.
Photos: Author's personal collection

Building upon the success of the initial compost initiative in 2011, project partners undertook to expand this program in 2012. In late spring 2012, staff from the Kativik Regional Government's Department of Renewable Resources (who were exploring ways to modify the government's current waste management strategy) as well as staff from the Ungava Supervised Apartments (who were looking for social reintegration opportunities for their residents) and a volunteer from the Nunavik Regional Board of Health and Social Services met with different potential suppliers of clean organic waste in the community.

Along with the two food stores in the village—Newviq'vi and Northern (North West Company)—that participated in the program in 2011, two construction camps (Laval Fortin Adams and Makivik Construction), the Iqitauvik Daycare Centre, and the Nunavik Research Centre were identified as being good pick-up points for the expanded program. In early 2012 the Kativik Environmental Advisory Committee (KEAC) also reaffirmed its willingness to help with the supply of shredded office paper (to mix with the food waste in order to facilitate the composting process). Additional funding for this rapidly expanding project was also obtained through the Nunavik Regional Board of Health and Social Services to provide for the salaries, safety equipment, and transportation of the two residents of the Ungava Supervised Apartments who were hired to work on the project.

Once the groundwork had been done, and a regular supply of organic waste had been established, the day-to-day operations of the compost project were addressed. For example, trilingual (Inuktitut / English / French) educational materials regarding what, and what not, to put in the compost collection bins were developed (see Figure 54), and volunteers met with staff at the food stores, the construction camps, the daycare, and the research centre to establish a collection schedule and coordinate pick-up procedures.

FIGURE 54 Trilingual posters placed at compost collection sites.

New, clean garbage pails and plastic Rubbermaid-style bins were purchased for collecting the organic waste in store rooms and kitchens, and these were delivered and set up at the pick-up points. As well, funds allocated to the compost project were used to purchase a heavy-duty shredder (in order to facilitate and accelerate the decomposition process), and the Northern Village of Kuujjuaq undertook the responsibility of ordering, shipping, assembling, and testing this machine. The Northern Village of Kuujjuaq also provided carpentry and welding services to help build compost bins, an equipment storage locker, and a loading dock/work space for this project (see Figure 55).

Preparation for compost collection began in earnest in mid-August with a series of small test batches in order to practise using the shredder and determine the right mix of organic waste and shredded office paper for optimal decomposition. The official collection of organic waste began on August 25th and continued until November 25th, 2012, when operations had to cease due to the onset of winter conditions.

In sum, a total of 4147.5 litres of organic food waste was collected during this three-month period. See Figure 56 for images of the composting process.

FIGURE 55 Compost project staff process organic waste at the worksite.

Photos: Author's personal collection

FIGURE 56 Raw organic material (left), different stages of composting (centre), and end product (right).

Photos: Author's personal collection

As in 2011, a data collection log was also created in 2012 in order to record the amount of organic waste collected from each pickup point. Waste was collected five days a week from the two food stores (Monday through Friday), three days a week from the construction camps

(Monday, Wednesday, and Friday), two days a week from the daycare (Wednesday and Friday), and one day a week from the research centre (Friday). The number of collection days per week was directly proportional to the amount of waste generated by these partners, the two food stores generating the most organic waste and the research centre the least. Table 4 outlines the amount of waste that was collected from each individual pickup point.

TABLE 4

Summary of Volume of Organic Waste Collected in Kuujjuaq in 2012

Pick-up Point	Volume of Organic Waste (Litres)
Northern	1680
Newviq'vi	1330
Laval Fortin Adams Camp	647.5
Makivik Construction Camp	245
Iqitauvik Daycare Centre	227.5
Nunavik Research Centre	17.5
TOTAL	4147.5 litres

In 2012, the compostable waste (food waste and shredded office paper together) that was collected in the village from the project's six partners yielded approximately three cubic metres of useable compost, which was incorporated into the greenhouse garden beds in the spring of 2013. This is a remarkably positive result, and all involved were very pleased with the way in which the project evolved that year.

This said, it is important to note here that a number of other organizations and local establishments were willing to contribute to this project (including the hospital cafeteria and the Kuujjuaq Inn), but the limits imposed by the project's capacity to treat all the available organic waste (as determined, for example, by the size of the shredder and the size of the available work space and composting location) meant that not all of the potential project collaborators in the village could be brought on board in 2012.

In closing this section it is pertinent to point out that, while the initial reason for starting a compost project was to create soil for the greenhouse garden beds, the project has in fact evolved much further. The Kuujjuaq Compost Project now also contributes to a waste reduction strategy (diverting waste from landfill); it serves as a way for companies (and employees of these companies) to give back and contribute to the community; and, last but not least, it provides a beautiful opportunity for the social re-integration of marginalized community members through the creation of non-conventional employment opportunities. In a report written by the manager of the Ungava Supervised Apartments, the positive effects of working on this project were underscored.

By actively participating in this project, residents of the group home learned and/or acquired the following personal attributes, skills, and abilities:

1. Self-esteem (through a job well done);
2. A capacity for teamwork;
3. A capacity for developing leadership abilities;
4. The ability to accept constructive criticism;
5. An understanding of the importance of sharing skills and knowledge with co-workers;
6. Learning to share skills and knowledge;
7. Learning to teach skills and knowledge;
8. Respect for co-workers;
9. Responsibility;
10. A capacity for interaction with project partners;
11. An increase in social interaction with community members.

(My translation) (Bertrand, 2013)

In sum, the Kuujjuaq Compost Project is a true example of a successful sustainable development initiative, generating positive outcomes in the realms of the environment, society, and the local economy. It has created a precedent in the North and is a testimony to the power of grassroots innovation.

5.4.5 Potato Production

Since the beginning of the first greenhouse project study in 2009, it was clear that potatoes were among the most appreciated and consumed vegetables in the North. It therefore comes as no surprise that there has been a great deal of interest in exploring the possibility of producing potatoes in Kuujjuaq, something that a number of local gardeners have already proven is possible in the sandy soil around town. To this end, with the help and advice of the Conseil québécois de l'horticulture and two bags of seed potatoes donated by Progest (a potato research centre in southern Quebec), preliminary trials were undertaken in the greenhouse in 2011.

Two experimental varieties were planted on July 20th. For the purpose of data collection, they were labelled Variety 1 (V1) and Variety 2 (V2). In the Variety 1 bag there were 20 big potatoes and 17 small potatoes that were planted (two rotten ones were discarded). In the Variety 2 bag there were 10 big potatoes and 110 small potatoes that were planted (one rotten one was discarded). The first shoots began to appear on July 28th (V1) and July 30th (V2), and by August 11th the V1 plants had an average of five leaves and were approximately 25 cm high. On the same date the V2 plants had an average of four leaves and were approximately 25 cm high as well. Overall, the V1 plants were slightly bigger and heartier that the V2 plants at this stage. By the 21st of August V1 had an average of six leaves and the V2 plants an average of five leaves. By the 29th of August the V2 plants had surpassed the V1 plants in height, but they also began showing signs of legginess (long, spindly stalks). By August 30th the first flowers began appearing on V2 plants, and the V1 plants followed several days later. It is important to note that fertilizer (20-20-20: 50 grams/5 litres of water) was applied to both varieties on the 9th, 19th, and 25th of August and on the 1st of September (see Figure 57).

FIGURE 57 Seed potatoes (left); young V1 and V2 (centre); mature plants (right).
Photos: Author's personal collection

The potatoes were harvested on the 8th of October, eighty days after having been sown. They were of very acceptable size and generally of good quality; however, it was impossible to evaluate the total weight of the harvest because a large number had been stolen! 3.85 kg of V1 and 41kg of V2 were left in the bed by our thief and, however disappointing it may be to not see the final results of this experiment, we can look at this from another angle: indeed, it seems that potatoes are a hit in Kuujjuaq, and this can only serve to positively reinforce the idea of growing potatoes in subarctic regions.

Unfortunately, due to a lack of time and labour, the potato project did not continue to advance on the crest of the wave that was the 2011 season. Initially, project partners had hoped to prepare a plot of land for field trials in 2012, but due to certain logistical constraints this was not possible. Nevertheless, no ground was lost, and a potato test bed was still planted in the greenhouse in 2012. Potatoes that had been harvested at the end of the 2011 season—and stored all winter—were used as seed and planted by volunteers in June. While no scientifically rigorous data measurements were recorded, anecdotal evidence suggests that the crop was once again a success.

Although field production was not undertaken in 2012, everything had nevertheless been put in place for this next stage of the project. For example, lime (a soil amendment that will be necessary to grow a respectable crop of potatoes in subarctic soil) was purchased and delivered, and the Honda rotary tiller (that had been discussed in 2011) for preparing the field was purchased and delivered and was ready to be put to use. As well, many gardeners continued to plant potatoes both inside the greenhouse and in outdoor plots around town, and the results were very respectable (see Figure 58).

FIGURE 58 Potatoes outdoors; potatoes (and other vegetables) from the greenhouse.
Photos: Author's personal collection; Courtesy of Harvey Mesher

5.4.6 Horticultural Therapy Project with Ungava Supervised Apartments

The supervised apartments are essentially a group home for men and women living with mental health issues in Kuujjuaq. In the fall of 2010 (during the community consultations), the coordinator of the apartments inquired about the possibility of mounting a small project to introduce gardening to the residents of the home as a form of horticultural therapy.

In July 2011 plans for a small indoor garden in the apartments began to take shape, and a simple project using indoor window boxes was designed. All the materials and seeds (fast-growing lettuces and herbs) were ordered, and when these were received at the end of August, the first boxes were planted and installed on the window sills in the apartments. As well, data collection sheets were created in order to collect the same types of data that were noted in the greenhouse (e.g., cultivar, date seeds sowed, total weight of harvest). Of the nine residents, two actively participated in the planting and four others looked on. There seemed to be genuine interest in the project as well as curiosity about it.

Future plans for expanding the horticultural therapy project at the supervised apartments were also discussed, and feasible options included constructing a shelving unit on a sunny wall in one of the living rooms in order to maximize growing space as well as installing window boxes on the outside of the home in order to grow flowers such as nasturtiums (which are fast-growing, hearty, and edible). Also, an ideal location in front of the apartments where some small cold frames could be constructed and used for growing other types of vegetables and/or flowers was identified.

While this initiative remains but a small part of the overall Kuujjuaq Greenhouse Project, it has nevertheless progressed remarkably well, due in no small part to the concerted, sustained efforts of staff at the Ungava Supervised Apartments. The plant boxes that had been prepared and planted with herbs and lettuce greens during the 2011 season were still in use in 2012, and a number of them were placed on window shelves that were specially installed in the apartments for this purpose. As well, several other types of containers were planted with different kinds of vegetables, including peppers and cherry tomatoes. Various kinds of potted houseplants were also brought into the apartments, and the residents definitely appreciated the new ambience in their home (see Figure 59).

FIGURE 59 Vegetables and herbs on window shelves at the Supervised Apartments.
Photos: Author's personal collection

In 2013 residents of the supervised apartments were allotted a garden bed in the greenhouse. Compost that they had produced the previous year was added to the bed and residents then planted and cultivated a successful garden. See Figure 60 for photos from their 2013 and 2014 seasons.

FIGURE 60 Residents of the supervised apartments tending to their garden.
Photos: Author's personal collection; Courtesy of Marc-André Lamontagne (right)

5.4.7 Youth Employment and Training

An issue that repeatedly came up in discussions about the greenhouse project was the importance of involving local youth in as many ways as possible. To this end, contact was made in the spring of 2011 with the coordinator of Youth Employment Services – Y.E.S. (formerly Carrefour jeunesse emploi), the youth office that is run out of the Sustainable Employment Department of the Kativik Regional Government. Over the summer two official meetings were held to discuss possible projects that would be best suited to local youth while at the same time meeting the overall goals of the greenhouse project.

The following is a list of "projects with youth" that were deemed feasible:

- Compost collection and manipulation;
- Building, planting, and maintaining window boxes and planters that could be installed on and around municipal buildings (flowers could include such cultivars as nasturtiums, sunflowers, and pansies, as well as local native plants);

- Maintaining an experimental hydroponic system (in the new greenhouse perhaps?);
- Planting and maintaining a collective garden (in the new greenhouse perhaps?) and possibly selling/donating produce (lettuce, herbs, etc.) to local stores or institutional kitchens (Elders' home/daycares);
- Building small-scale greenhouses (for sale to local residents or use by the CJE);
- Participation in the construction of the new greenhouse;
- Participation in the operation of the "potato production project"; and
- Growing and planting native tree, plant, and grass seedlings for revegetation of the village (i.e., around new construction sites).

While there was a great deal of potential in all of these ideas, the project was placed on the back burner for the 2012 season due to unforeseen circumstances. However, this organization did express continued willingness to be involved with the Kuujjuaq Greenhouse Project in the long term.

5.4.8 Kativik School Board

Ever since the Kuujjuaq Greenhouse Project began, community members have underscored the importance of getting children involved in gardening. As early as the fall of 2009, staff and administrators of the Kativik School Board (KSB) expressed interest in incorporating elements of gardening and greenhouses into the curriculum. It was noted that such things could mesh well with the schoolwork of any age group, from preschool to high school.

In the spring of 2011, several informal discussions were held with one of the KSB pedagogical counsellors, and one official meeting was held during the summer of 2011 to discuss the potential for incorporating gardening into the curriculum of Nunavik schools. Many models for this type of project exist. One of the most promising is "Earth Box Kids," a Canadian program that has already been implemented in Aboriginal communities in the West and that could be easily modified to fit realities in Nunavik.

Over the past few years several attempts were made to get a cooperative project with the school board off the ground. However, up until the summer of 2012, none of these initiatives came to fruition, mainly because the peak gardening season falls during the summer vacation, when most teachers are away from northern communities. In the summer of 2012, however, one of the garden beds was allotted to a teacher at Jaanimmarik School who undertook to plant a garden with the express purpose of introducing one of the Grade 4 classes to gardening in the fall of 2012.

On the morning of Wednesday, September 5th, the teacher, the Grade 4 students, and one of the project volunteers met at the greenhouse. They were joined by a community member who has been gardening with her young children in the greenhouse since 2011 and who volunteered to share her knowledge with the class. The students were first given a short tour of the greenhouse and were then each allowed to pick their own carrots. This was followed by a lesson in Inuktitut on how to plant radishes and the benefits of eating fresh vegetables. Students were then given the opportunity to water their newly planted seeds, as well as the lettuce in their garden bed. The morning was capped off by a picnic lunch outside the greenhouse, and then everyone was given the chance to harvest a few potatoes to take home (see Figure 61).

A small but telling example of the impact of this work is the fact that one of the students came back after school with some of his older and younger friends from other classes at the school with the express intent to sample some of the produce. To me this proves that we have gotten through to the kids and that there is a future in this type of endeavour.

FIGURE 61 The Grade 4 class visits the greenhouse.

Photos: Author's personal collection

5.4.9 Hydroponic Production

While the main focus of the Kuujjuaq Greenhouse Project has been horticultural development for community and social advancement, one of the long-term goals of this endeavour is to eventually produce fresh food on a reasonably large (i.e., village) scale. Since the challenges associated with soil and substrates are many in Nunavik, it was deemed logical to begin investigating the potential of hydroponic technologies for eventual use in a commercial-size venture. To this end, initial planning for a series of pilot projects (involving different scales and models) was begun in order to test these types of systems in Nunavik.

In 2011, Kuujjuamiut Inc. (a local Inuit organization) expressed willingness to participate in the maintenance and operation of one of these test systems. It was agreed that this system could be installed at the Kuujjuaq Forum,in a location where the public could easily view and learn about this type of horticultural technology. As well, it was proposed that the new greenhouse could also have space allocated for a hydroponic pilot project, and that this experimental system could perhaps be maintained by local youth.

Due to a lack of time and labour the hydroponic project did not advance as had been planned and expected in 2012. Nevertheless, project partners still saw much value in a small hydroponic experiment. It was just lack of time—to manage, maintain, and oversee this microproject—that kept this initiative on the back burner for several years. During the winter of 2013, however, a small Nunavik company called Qaujimautik Inc. partnered with Kuujjuamiut Inc. and, with financial support from the Regional and Local Development Department of the Kativik Regional Government, launched a small-scale hydroponic project in Kuujjuaq.

Rigorous testing of the hydroponic system and crop trials were carried out in the spring and summer of 2013 in Montreal. In the autumn, the first system was installed at the Kuujjuaq Forum in the offices of Kuujjuamiut Inc. By Christmas 2013 the first lettuce crop was harvested from the system and, since then, several new types of crops (cherry tomatoes, strawberries, cauliflower, and several varieties of herbs) have been experimented with (Aitcheson, 2014). Of special note is the fact that this system has a very comprehensive high-tech data collection mechanism in place. This mechanism monitors all aspects of the growing environment, including temperature, light, humidity, and nutrient load, in order to evaluate the performance of the system and determine best practices. All results to date support the idea that this technology is not only technically feasible in the North, but also socially acceptable. This initiative has generated a lot of curiosity (see Figure 62).

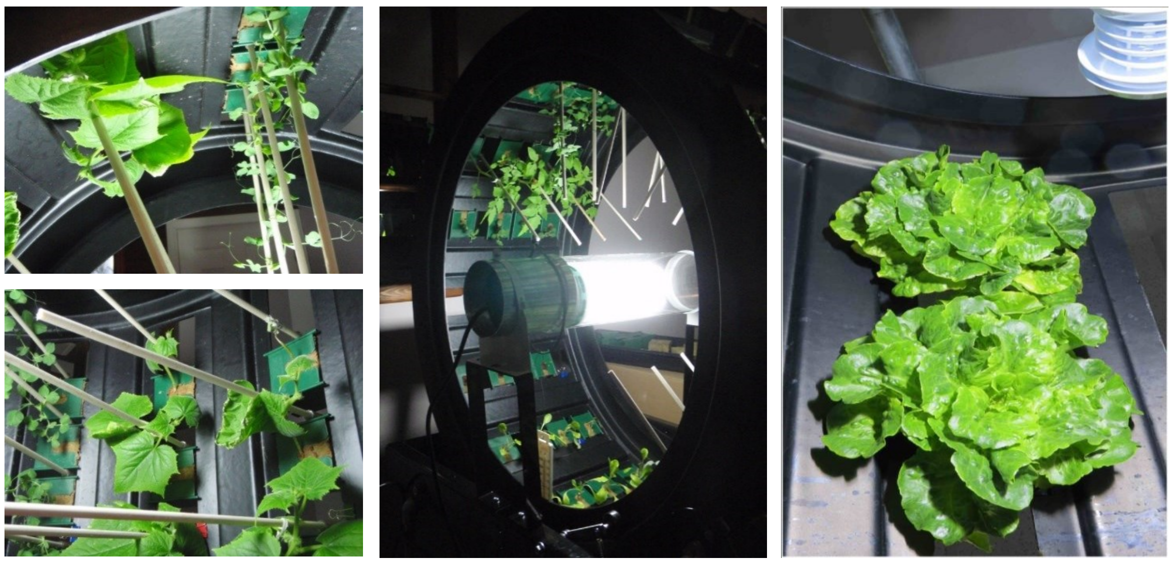

FIGURE 62 The hydroponic pilot project at Kuujjuamiut Inc.
Photos: Courtesy of Neil Sellors and Jason Aitcheson

5.5 Results of Concluding Study - 2013

The primary goal of this study, conducted in the spring of 2013, was to evaluate the situation of the Kuujjuaq Greenhouse Project. The secondary goal of this study was to gauge the interest in, and support for, northern greenhouse projects in general. In order to do this, thirty-two structured interviews with guidelines (see Appendix 2) and eleven semi-directed interviews were conducted with local and regional leaders, project stakeholders, and community members. Information was also collected through participatory observation. Using these three different methods of data collection was a very effective way not only to collect but also to corroborate information. For example, hearing the same types of responses and comments in formal interviews, semi-directed interviews, and in casual settings helped to establish what were (and were not) important elements to be considered within the scope of this research.

The following section is divided into a series of subsections in which the information (thoughts, opinions, suggestions, and recommendations) collected throughout the course of the concluding study is presented in the same general categories as those used in the study guidelines.[27]

5.5.1 Greenhouse-Based Social Projects

5.5.1.1 Community Garden (i.e., Kuujjuaq Greenhouse Project). Virtually everybody who was interviewed had heard about the Kuujjuaq Greenhouse Project at least to some extent. Overall, interview respondents were very much in favour of this project and comments such as the following were heard on multiple occasions:

- "This is a good idea!" (2, 8, 9, 10, 14, 16, 19, 24, 31, 41);
- "This is a great idea!" (13, 28);
- "It's a wonderful idea!" (5);
- "This is a good thing!" (20);
- "This type of project is long overdue." (11);
- "The bigger the better!" (11);
- "A bigger greenhouse would be good" (29); and
- "It is really needed" (29).

Many people commented that the vegetable selection in Kuujjuaq was already "pretty good" (8, 19, 22), especially when compared to other villages in Nunavik, so the real benefits of gardening in Kuujjuaq were the social ones; for example, learning how to grow your own food and the "sense of pride, self-worth, and accomplishment" (16) that comes with that. One respondent noted that "gardening helps with food costs—yes, but the real value is in the increase of personal well-being and the rewards on a personal level" (5). Others noted that

[27] Numbers in brackets following a statement or a quotation in this section refer to code numbers assigned to formal interviews or to documented conversations.

there were real benefits to be had regarding such things as “improved social skills” (16), and that gardening “helps address mental health issues” (16).

The former greenhouse at the Catholic Mission in Kuujjuaq was often mentioned in interviews and in conversation (11, 15, 27), and some respondents underscored the fact that gardening is an activity that is accessible to all as well as something that is “doable here in the region” (21, 35). One respondent mentioned that the greenhouse project is a “way to show people who have never seen a garden that it is possible in the North” (14).

Many respondents remarked that it would be nice to have fresh vegetables available locally, since not only would this have a positive impact on the freshness of the product (18), but it would also:

- “Create interest in healthy food” (5, 35);
- “Teach people where food actually comes from” (21);
- “Get people involved in the food process; reconnect with the process” (5);
- “Get types of vegetables that are not available in the local food stores at the moment” (8);
- Increase “exposure to new types of vegetables (try new things)” (19); and
- “Could be of good use in trying to reduce the high cost of food being imported from the South, even at least for the summer” (42).

The following quotations are representative of other common types of comments voiced by interview respondents:

- Gardening in the greenhouse could be “good for people who need help with groceries (i.e., single mothers, widows, Elders, those with few family ties in community)” (4, 23);
- Gardening is “a good hobby” (28) ;
- Gardening is “an interesting leisure activity” (16);
- Gardening is “a good family activity” (13);
- Gardening “teaches kids where food comes from” (19) ;
- Gardening “creates ties between generations” (16, 19); and
- Gardening encourages transmission of knowledge between not only Elders and youth but between experienced and beginner gardeners (19, 23, 25, 32).

Some respondents actually used the term “food security,” noting that a greenhouse project “will lead to greater food security in the community, and will help to plan for the future” (2). It was even mentioned by one leader that greenhouse projects are a good way to do research with citizens on this subject and that the Kuujjuaq Greenhouse Project is a “type of project to do action research with” (23).

Some respondents mentioned that the project is a “pretty good idea” or an “OK idea” but that “it needs keen people to keep it going” (7). This type of comment speaks to the fact that there are concerns that, for the project to continue to perform over the long term, “good people” (35) are needed to make sure that everything continues to run smoothly. Concerns were also expressed regarding vandalism, and some respondents noted that it will be important to “find ways to counter (potential) vandalism—as this has been a problem in the past, with kids breaking into both the community greenhouse and personal greenhouses” (15).

Finally, it was pointed out on more than one occasion that there is “more demand for plots in the greenhouse than there are places available” (22), and that this leads to a certain amount of tension (notably between Inuit and Qallunaat), but that overall this is a good sign since it demonstrates that there is real interest in this activity,

5.5.1.2 Children and Youth. With respect to the idea of including children and youth in greenhouse-based activities, the response from interviewees was overwhelmingly positive. Typical comments recorded included:

- “Good idea!” (3, 12, 20, 24, 25, 30);
- “Very good idea!” (29);
- “Great idea!” (27); and
- “It’s the best place to start (best model) if you want a project to catch on” (3).

Respondents spoke to the fact that it will be important to develop interest early on (12, 16, 26), and that it is “easiest with young kids, since older youth and adults are already set in their ways” (18). The general consensus was that the focus should be on the youngest children (i.e., daycare—aged one to five) (23), and one interviewee stated that it is a "good idea to start with the up-and-coming generation for the future" (29).

Many people spoke about how it would be very good to "teach them to grow vegetables" (9) and to have them learn to taste and appreciate fruits and vegetables (6). It was often mentioned that gardening can be used to teach all types of skills to all different ages (17, 35) and that it could have many positive outcomes, especially regarding youth. For example gardening could:

- "Create healthy habits without them even realizing it, i.e., while having fun" (19);
- "Be used to engage youth" (2);
- "Help them to be part of the community" (2);
- "Help to keep them occupied and keep them off streets" (7);
- "Create interest in possible career paths" (19); and
- "Can help give direction" (7).

Respondents also thought that, not only are projects with kids and youth "completely doable" (21), but kids will really enjoy cooking and eating stuff that they grow themselves (6, 8, 19) and kids will learn and then teach their parents (6).

While it was often noted that it could be difficult to conduct gardening projects with kids during the school year (4), as gardening is traditionally a summer activity, a number of ideas for projects involving children and youth were mentioned by interview respondents. Possible projects that were discussed included 1) developing a greenhouse or a garden at the Old Chimo summer camp (1, 43), 2) including gardening activities in the program of the village summer day camp (1), 3) starting seeds in classrooms in the spring, transplanting them into the greenhouse, having them monitored over the summer by project staff or volunteers, and then harvesting them at the start of the school year in late August or early September (4, 5), 4) growing seedlings in classrooms in the spring and selling them to gardeners as a fundraiser, or using them for community greening projects, and 5) having the graduating class sell plants at the annual Christmas bazaar to raise money for their end-of-year events.

While the majority of respondents had only positive things to say about development of agriculture projects for children and youth, it is important to note that, while promoting these types of projects as a way to help children grow and develop has its merits, some feel that it would perhaps be more pertinent and appropriate to focus on traditional Inuit cultural activities; especially where the overarching goals of educational programs include mental and physical health as well as skills development and self-esteem (10).

5.5.1.3 Elders and Disabled Persons. While some respondents were not sure if Elders would be interested in greenhouse projects, as agriculture is not a traditional activity (11), some do think that it would be a good idea to offer them the opportunity to garden (20, 25, 27, 43, 30). Visits to the greenhouse, a garden plot of their own in the greenhouse, or having small projects at the Elders' home (e.g., window boxes or cold frames for horticultural therapy) were among the things that were suggested by interview respondents (1) and community members. As well, the idea of building a greenhouse at Old Chimo (the site of the youth camp and yearly Elders' retreat) was also voiced (43). The theme of distributing fresh food to Elders in the community (maybe even producing baskets of greens at the greenhouse, perhaps through a youth program) is one that came up time and again (5). Interestingly, it was also mentioned that Elders, who might not necessarily be interested in gardening themselves, would probably nonetheless be supportive of youth who are interested in and willing to engage in this new activity (1).

Regarding the possibility of creating, supporting, and promoting gardening projects for community members with mental and physical disabilities, all respondents were unequivocally supportive of the idea. Suggestions included horticultural therapy programs and/or social re-integration programs that involved working in the greenhouse (1, 6) or on related agricultural projects such as a compost program (1). It was also mentioned that it would be a very good way for marginalized members of society to interact with the community (1, 2).

5.5.1.4 Community Greening (i.e., planting native flowers, grasses, shrubs, trees around village; flower boxes to beautify municipal buildings; etc.). Many people noted that since this type of project had been “done before” (11) and had been the original reason for the first greenhouse in Kuujjuaq in the 1990s, it could be done again (22, 26, 27, 28, 29). All respondents were supportive of this idea, some even going as far as stating that it is a “wonderful idea!” (5, 6).

Almost all interview respondents noted that the most important outcome of this type of strategy would be the suppression of dust. This would not only keep houses and vehicles cleaner (and would allow windows to be kept open during the hot summer months), but would help address health concerns such as respiratory ailments. While respondents noted the practical benefits of this type of project, they also often took the time to elaborate on the fact that it would make things “look nicer” as well (12, 16, 17, 18).

Respondents (notably those involved in community planning and municipal government) also underscored the fact that the beautification of the community would have several important spin-offs. For example, it would influence the perspectives and feelings of both residents and visitors towards the town: “It has been documented that clean and pretty locations instill a greater sense of pride in residents as well as a feeling of welcoming in visitors” (2). As noted by one local leader, “Just putting flowers will make the community more beautiful…will lead to pride in the village” (21).

Many people noted that community greening would be most welcome, especially in the new section of town “where everything is brown, and where there is just dirt and gravel at the moment” (19, 28). People often spoke about planting trees around new houses (18, 19), and one person noted that “trees and plants around houses will help improve the look of the community, especially in the new developments” (3). Some respondents said that greening “should always be done after the construction of new homes” (4, 27), and others discussed the idea of implementing a protocol (with those who do the planning and construction work) to save the soil and/or existing vegetation around new housing sites in order to promote the greening of the area after construction is completed.

The idea that community greening can lead to positive development spirals also came up in conversation (2). People noted that it:

- "Could be a good project for school children and youth" (19);
- "Could lead to the creation of summer jobs" (16); and
- "Could be adapted and used as part of a community service program for 'jailbirds'" (8).

Many respondents spoke about installing window boxes and planters around the village, as well as the possibility of "beautifying the airport (e.g., with flower beds, planters, or hanging baskets)" (16, 17). The idea of beautifying the graveyards also came up in conversation on numerous occasions (3). Flowers of choice for all of these initiatives included marigolds (16), nasturtiums (25), pansies (4, 27), and "possibly snapdragons" (4). There was also an interest expressed in roses and different types of bulbs (e.g., crocuses, daffodils, and tulips) (17).

While a definite interest in southern flowers was expressed by many community members, many interview respondents also talked about the importance of using local species (6, 10, 13, 17). One leader noted that the focus should be on "local, climatically adapted species, as southern plants will not survive" (32). The following is a typical response to questions regarding community greening: "It would be good to encourage the use of native plants and flowers. For example, willows are indigenous to the area, they are easy to propagate and transplant, and they grow fast. Fireweed would be another ideal candidate" (10). A number of respondents (notably those that remembered the original community greening initiative in the 1990s) suggested that planting willows, spruce, and tamarack (as well as grasses and other shrubs) could be a good idea (3, 8, 10, 14, 18, 27, 28, 31). Two respondents also mentioned that it might be a good idea to distribute grass seed to homeowners "who want to plant and look after their yards themselves, similar to how things worked in 1995 with the first community revegetation project" (14, 27, 28).

5.5.1.5 Suggestions for Other Types of Social Projects. Throughout the course of many discussions on the subject of northern greenhouses and northern agriculture in general, a number of other types of potential greenhouse-based and/or horticulture initiatives came up in conversation. The following is a list of ideas and comments put forth by interview respondents, community leaders, and local residents:

- Personal Greenhouses: "Support the construction or purchase of greenhouses that residents could install at their homes (in yards or on balconies)" (4, 5, 20, 22). "Give options to people so that as many as possible will develop an interest" (16). "Create an inexpensive (possibly subsidized), simple, low-tech, robust greenhouse model that could be built or installed by homeowners—make the structure multi-use (e.g., could be used for storing Hondas (ATVs) during the winter months) (16)."
- Composting: "Maximize the use of local waste; transform it into a value added resource" (25, 31). "Support the construction or purchase of compost bins that residents could install at their homes (in their yards)."
- Community Kitchens and/or Community Cooking Classes: "Teach people how to cook new types of vegetables" (2, 5, 41). "Create opportunities for tasting—this will increase interest in gardening, since people can participate in the entire process of growing, cooking, eating, and sharing" (17). "Learn how to store and save; i.e., canning, preserves (jams and jellies), freezing, and drying" (2, 12). "Basic cooking classes with what you have grown will encourage more and more homemade dishes instead of buying ready-made" (21).
- Flowers and Houseplants: For Mother's Day, Valentine's Day, and Easter (1, 16, 17, 19).
- Animals: Chickens for both meat and eggs (2, 5, 6, 17, 26, 33), rabbits (for meat and fur) (6, 33), pigs (for meat) (19, 26, 30), sheep (for meat and wool) (6, 30, 40), muskox (for meat and wool)—"re-invent past project" (4, 26), pigeons (33), and partridges (33).
- Other Crops to Test and/or Promote: Potatoes, turnips, cabbage (14, 15); rhubarb (1, 5); sprouts, chives, and other easy to grow and care for perennials (5, 19); bedding plants (15); raspberries and blackberries (planted around buildings) (6); mushrooms harvested from the land ("The land around town is very rich in this resource") (11) or grown indoors (6); pumpkins for Halloween (13); and Christmas trees.
- Marketing and Selling of Produce: Hold a contest for best produce (similar to fall fairs down south), e.g., most beautiful tomato, biggest pumpkin, prettiest flowers, etc. (13); farmers' market, local market (1, 13, 26); selling at local events; sell produce at local stores (29) (NB: both local food stores expressed interest in buying local produce).
- Experimenting with Existing Berry Patches: Try to enhance (increase yields) of berry patches in the natural environment; e.g., through fertilization, modification of microclimate (32).

5.5.2 Greenhouse-Based Commercial Projects[28]

5.5.2.1 Hydroponics (soilless system). Overall, respondents who were already familiar with the concept of hydroponics were generally more favourable towards the idea, and those who were less familiar (or not at all familiar) with the concept viewed it less favourably. However, both groups of respondents provided valuable insight into the idea of operating hydroponic systems in the North.

Many of the positive comments that were recorded on this subject had to do with the possibility of growing fresh food all year. For example:

- "This would allow production of fresh food even in winter" (14);
- "Would be very good to have fresh food all year!" (23); and
- "Fresh food all year!" (27).

One respondent mentioned that "There would be no issues with the acceptability of this type of system, since people already eat hydroponic lettuce that is shipped in from the South" (10). Others mentioned that it is a "novel idea" (6) and that it is "worth exploring" (29**).**

The idea of involving children and youth came up on several occasions, and one participant noted that hydroponic production "lends itself well to in-class demonstrations, especially for those in higher grades" (32**).**

[28] Pictures of all of these types of commercial operations were shown to respondents during the interviews in order to familiarize them with these alternative forms of agriculture (see Appendix 2)

Many people had moderate views on the subject, neither opposing nor supporting the idea, but approaching it with cautious interest. Comments that are in line with this stance include:

- "It is a novelty for the moment (small-scale and experimental), but would generate curiosity" (6);
- "It could work, could be viable, could be a good opportunity for the community to get together to work on an idea" (21);
- "A community-owned project could work well" (32); and
- "Just growing things is a new idea, to jump to a new technology is perhaps 'too fast,' but it is good to know about the possibilities" (21).

Some positive responses regarding the technological feasibility of hydroponics in the North include: "We have lots of water here and not much soil, this type of technology therefore makes perfect sense here since we are capitalizing on local resources" (32), and "This is worth looking into, especially since good quality soil is an important obstacle/restriction in the North" (12).

There were three main concerns that surfaced repeatedly regarding hydroponic systems: 1) cost, 2) technological complexity and maintenance requirements, and 3) the availability of reliable, educated personnel to operate the systems. With respect to cost, concerns were voiced regarding "expensive start-up costs" (32), "expensive maintenance costs," and the cost and availability of energy, specifically lighting and heat (3, 20, 22). One respondent asked, "Would Hydro Québec allow such a project since it would require a significant amount of energy?" (22). With respect to technological complexity and maintenance, one person noted that "to get people to buy in to this, you must make it easy, low-cost, and simple" (19). Concerns were also expressed about the impact of intense freezing temperatures and the possibility of crop losses due to furnaces breaking down or pipes freezing (8, 28, 29). Regarding personnel, many people recognized that certain types of hydroponic systems need constant monitoring and tending, and concerns were expressed regarding the availability of reliable, skilled staff who would be committed to the development of this type of project over the long term (4, 7, 23). A related concern was that the knowledge needed to maintain and repair these types of systems was not available in the North, and that dependence upon Southerners for these services could be a problem (16).

Finally, one person mentioned that it might be better to stick with soil-based production methods, since they are relatively simple and do not require complex maintenance (16). However, in direct opposition to this comment, another person lauded the simplicity and ease of taking care of a small hydroponic system installed in a home in another Nunavik community. This example perfectly expresses the broad spectrum of opinion of Nunavimmiut towards hydroponics: some are all for it, some neither support nor oppose it, and some are not yet willing to back this type of project at all.

5.5.2.2 Aquaponics (combined aquaculture and hydroponic production). Many of the same thoughts and concerns expressed about hydroponics were repeated in the answers to questions about aquaponics. A commonly heard opinion was that "We should start with hydroponics, and if that works well, then we could expand into aquaponics" (19, 31). Many people discussed the fact that since fish is an important food source in the North (12), it would be worthwhile looking into this type of project, and it was often mentioned that an aquaponic project could potentially be integrated into the existing char hatchery in Kuujjuaq (7, 13, 18, 22, 27).

While much of the discussion about aquaponics was positive, the probability of some resistance to eating farmed fish was also noted, since fishing is an important cultural activity and fish harvested from the land are a quintessential traditional food. Some respondents commented on the difference between the taste of farmed char and the taste of wild char and considered the taste of the farmed variety off-putting (10, 32). Others, however, remarked that fish from an aquaponic system is better than no fish at all and that they would be "willing to try it" (30). Some also mentioned that the idea of integrating farmed char into locally prepared meals (served at restaurants or offered for sale in the frozen food section of the grocery stores) could be a good way to promote this type of healthy local product. People also underscored the fact that the fish could be smoked and turned into a locally produced value added product (5).

5.5.2.3 Indoor Farming (artificial lighting and heat inside warehouse-type buildings). The idea of growing food indoors was new to many people and generated quite a bit of positive interest and curiosity. Still, many of the same concerns that were expressed about hydroponics and aquaponics were repeated here (e.g., the need for start-up capital and infrastructure investment, maintenance requirements and costs, the complexity of the production systems, and the need for dedicated personnel) (11, 28, 29).

Questions about where this type of system could be located and in what kind of space also came up quite often, yet upon exploring the idea, it was discovered that most villages in Nunavik have abandoned buildings (with existing heating and lighting systems) that could be retrofitted (1, 13, 32). People mentioned that this type of operation "could prove to be very useful in the winter (though not so much in the summer)" (2) and could therefore be envisioned as a viable operation for eight months of the year. Possible solutions to energy challenges were also discussed, and those most often mentioned were wind and solar power (2, 12).

The idea of either constructing, or retrofitting existing Quonset huts also came up on a number of occasions (10). These are considered ideal buildings because they are relatively inexpensive and already commonly used in the North; it was noted that they could be easily modified to accommodate indoor agricultural enterprises. The idea of starting small, and joining together individual "plug-and-play pods" (possibly shipped up from the South) as an operation grows, was also brought up by some interviewees (10, 32).

5.5.2.4 Shipping Containers (for hydroponics and/or aquaponics). The idea of using shipping containers to house hydroponic and aquaponic systems generated a lot of interest from all respondents. Many noted that "there are a lot of shipping containers in the North already" (13, 27), and they are easily available. One of the most common responses was that they are "secure against the possible threat of vandalism" (15).

Respondents noted that hydroponic or aquaponic systems in containers were of interest because they are small-scale and portable (within a village and between villages), and they could also be transported "directly from the South already equipped (plug-and-play)." The fact that containers can be stacked or that a greenhouse could be installed on the roof (in order to maximize heat resources) also interested a number of people, since these options addressed concerns about space (18, 31).

Questions were raised about how best to insulate the containers against the winter cold and how to evacuate excess heat in the summer (22). As with indoor agriculture, it was mentioned that containers might be best used only eight months of the year. However, people believed that this type of project was definitely feasible, and it was generally felt that even if it might take a lot of effort to transform containers for these uses in the North, the work involved could provide a good learning opportunity for students.

Finally, it was mentioned on several occasions that containers "could be a good option for personal use" (17), although the price (around $3000.00) could be an obstacle for some (11, 19).

5.5.2.5 Field Production of food crops. The majority of respondents thought that growing crops in open fields made a great deal of sense, stating that "it would be acceptable to the community" (5), and that it "would definitely be worth a try, especially since it has been done in the past" (18). However, many respondents also noted that there were certain technical and economic challenges that would have to be overcome before something like this could be feasible in the long term. Challenges and concerns that were noted included:

- "Suitable locations for field sites" (11);
- "Quality of soil" (1);
- "Access to water" (20);
- "Length of growing season" (12, 18);
- "Economic feasibility of growing produce locally versus importing" (2);
- "Vandalism and theft" (7); and
- "Late (and early) snowfalls and frosts" (8).

The crop that was most often discussed was potatoes (1, 5, 6, 9, 13, 14, 15, 16); however, carrots, cabbage, turnips, onions, and rhubarb (1, 6, 9, 13, 15, 16) were often mentioned, and raspberries came up as well (6, 31). Interestingly, gardens in Newfoundland and Labrador were often cited as examples that could be emulated, since the climate and terrain are very similar (10, 16). The use of windbreaks (e.g., simple stone walls like those traditionally used in northern Newfoundland) to modify the microclimate around field sites was also mentioned as a possible solution to some of the technical challenges to field production (15).

The long summer days and increasingly warm temperatures in the North were cited as elements that could be favourable for field production in the Kuujjuaq area, and several people brought up the fact that "we could use locally produced fertilizers such as seaweed and fish concentrate" (4, 32). The use of "tunnels to cut wind and maximize solar input" was also mentioned (32).

Many people liked the idea of having field sites near the village; however, others suggested "doing it at Old Chimo or at the False River site, like in the past" (1, 11, 22, 27, 31).

5.5.2.6 Strawberry Production in Greenhouses/Tunnels. This option generated an all-round, resounding, positive response. For example:

- "I love strawberries!" (13);
- "Everybody in my family loves strawberries!" (19);
- "Children love strawberries!" (24);
- "Mmmm!" (2);
- "Yummm!" (18);
- "If this can happen—WOW!" (21); and
- "Great idea!" (28)

Virtually everybody who was asked for an opinion on this question heartily supported the idea of growing strawberries in the North. Growing in hanging baskets and in vertical structures was mentioned as an easy way to set up this type of crop (5, 35), and it was often stated that this type of thing "would attract a lot of attention" (21) and "would certainly be popular" (23).

While virtually everybody was in favour of this idea, several cautioned that rabbits and birds might prove to be aggressive pests (14, 15), and others questioned the technical complexity of growing such a crop in Nunavik (4, 31).

The idea of growing raspberries was also discussed by respondents on numerous occasions (6, 13, 14, 15, 17, 25, 31). This is significant, because raspberries do grow in the wild in Nunavik but quite a distance to the South of Kuujjuaq. People mentioned that plants could be transplanted from this area and reproduced in town (something that has been done on a small scale by local gardeners in the past). Many people also asked about the possibility of growing aqpik (cloudberries) (4, 12, 32). This is one of the most prized and loved local berries, yet it is not available in all of the communities in Nunavik, and even in those communities where it does grow, it does not always grow well every year.

Strawberries are sold year-round in the food stores in Nunavik, and many people buy them regularly. However, many respondents noted that they are not only expensive (8, 11, 12) but also "do not taste or smell very good" (20), hence the great interest in supporting a local strawberry growing operation. As mentioned by one respondent, "Strawberries are a very desirable commodity" (32).

5.5.2.7 Traditional Plant Cultivation (qunguliq "mountain sorrel" and malitsuagaq "seabeach sandwort"). Reaction to this option was split virtually 50-50. Many respondents mentioned that they thought it would be a little strange to cultivate plants that already grow naturally in the wild (7, 8, 10, 15), while others thought that it would be a good idea to try. For example:

- "Growing traditional plants would be a good way to get access to plants that are difficult to get (i.e., that grow only in places that are far away such as Dry Bay and Akpatok Island)" (9, 11, 27);
- "Could also be a good way to introduce children and youth to a type of traditional food that they are not necessarily familiar with (13, 32);
- "It would be a good way to help people get back in touch with their culture" (5); and
- "It would be a good way to 'hook' native clients" (21).

When it was mentioned that trials had already been done on growing traditional plants in greenhouses and that they grew significantly faster and bigger, most respondents expressed real interest, regardless of whether they were for or against this idea. It was also mentioned, however, that it would make more sense to "use valuable greenhouse space to grow plants or flowers that do not grow well here already" (12).

One interviewee noted that it "would be good to grow them in bigger quantities—and better quality—in a single area" (29), and another interviewee mentioned that "given the environmental pressures on the habitats of native plants (from construction, road building, mining, etc.), it would be a good thing to grow them in a greenhouse and then replant damaged sites afterwards" (27). Some respondents also mentioned that we "could also plant around communities—this would please people, because the plants would then be growing in nature and not in an artificial environment (i.e., a greenhouse)."

The idea of doing a project in conjunction with the Culture teachers at school was mentioned in several instances (6), as was the idea of using such a project to create links between Elders and youth (19). Several respondents also brought up the idea of growing plants specifically to make tea (15, 18, 19), and others thought that it would be interesting to try and grow traditional berries (in either greenhouses or in fields) in order to extend the growing season and "have fresh berries for a longer time" (12, 17). The idea of growing traditional plants alongside conventional lettuces or microgreens and serving salads of "mixed northern and southern greens" was also generally regarded favourably.

5.5.3 Social and Cultural Acceptability of Greenhouse-Based Projects

5.5.3.1 General Receptiveness to Greenhouse and/or Agriculture Projects in Nunavik. When asked the question, "Generally, do you think that Nunavimmiut would be receptive to greenhouse/agricultural projects?", eighteen respondents (more than half of those interviewed) definitively said yes, thirteen said yes but qualified their answer in some way (e.g., yes, but…; yes, maybe), and one person said "not yet." Comments such as the following came up a lot in discussion as well:

- "Hopefully" (27);
- "Eventually" (31);
- "I think so" (10);
- "I don't see why not" (26);

- "It's worth a try" (20); and
- "For sure! (11).

Many people said that they thought that people would like the idea because it is a "positive thing" (1), and others mentioned that people are also genuinely curious about the idea. It was noted by some that people will most likely be receptive to the idea, but that not everybody will necessarily be interested in actively participating in gardening or other types of agricultural activities (25).

Many people commented that it would probably be Qallunaat who would be most interested at first (7, 17), but that over time more and more Inuit would become involved. Some respondents noted that this is already happening, and others pointed out that the people who will be most likely to embrace this idea are people who have already come in contact with gardening and/or agriculture by having lived or spent significant amounts of time in the South or who have learned about gardening through family members (e.g., through marriage to a Qallunaat).

It was mentioned on several occasions that it would probably be Elders and older men (i.e., hunters) who would be least receptive to the idea (18), and others voiced the opinion that the population might feel that it would be "better to invest time, money, and energy into promoting country food instead" (10).

Many respondents said things like "it will take time, but it will be worth it in the end because it will lead to greater self-sufficiency" (5). Many people also remarked that even those who are initially against the idea of greenhouse and/or agriculture in the North will eventually come around, once they see the results and potential of such projects. It was also mentioned that since people are already buying and eating vegetables (6), it just makes sense to grow them locally, especially since "growing their own food would instill a sense of pride in their region amongst young people" (21).

Finally, as stated by one leader, “the regional population would be very supportive of any initiative which provides locally sourced food. The [food preference] survey undertaken in Salluit bears this out, and anecdotal information from the Parnasimautik consultations indicates that bio-food is a very popular concern. The public realizes, I believe, that food production has to diversify from hunting/gathering methods if the population is going to be fed” (32).

5.5.3.2 Ways to Get People Interested. Discussion on ways to get people interested in northern greenhouses (and gardening and agriculture in general) generated a lot of comments, and it was interesting to see that many of the same themes came up time and again. For example, the idea of getting people to actually taste locally grown produce was mentioned very often; for example:

- “Sell the produce in the village” (8, 20, 22);
- “Give plants and vegetables away for free” (23);
- “Share, so that people can taste and see for themselves how much better locally produced vegetables are” (17); and
- “Seeing and tasting for yourself” (21).

Some of the mechanisms and ideas that were proposed for doing this included:

- “Having a farmers’ market” or “local market” (26);
- “Visiting the local Kuujjuaq greenhouse (organized tours) (10);
- “Visiting other greenhouse projects in both the South and the North” (17);
- Getting “hands-on experience” (1);
- “Seeing is believing—teach and learn by example—people will eventually catch on” (14); and
- “You just have to show people; once they see that it is possible, and all the potential benefits that they can gain from this type of activity, they will begin to show interest and ’it will click.’ Show people that it is fun!” (11).

The idea of doing projects with schools was also regularly mentioned, as was the idea of having formal knowledge transfer activities such as horticultural training classes (interested people could be sent for training down South) and evening classes (4). Creating “YouTube” videos in Inuktitut was also mentioned several times (18, 32), as was the idea of posting information on the Kuujjuaq Greenhouse Facebook page—advertising and showcasing projects on social media was seen as key to reaching a wide audience (12). Developing simple gardening guides in Inuktitut and talking about gardening on the radio were also suggested, especially as a means to reach out to older generations (18, 24, 27).

People mentioned that it would be important to "focus on the fact that gardening and eating (what you grow) is fun" (13), and several people mentioned that "creating simple, low cost gardening kits that can be either purchased inexpensively or distributed free of charge" would be a good way to get people interested (5, 19). Do-it-yourself kits would help make gardening accessible; as stated by one participant, "doable at home, on a window sill for example" (19). Crops could include lettuce, herbs, and cherry tomatoes—things that many Kuujjuamiut have already grown indoors. The idea of starting with houseplants and flowers was also suggested, as this "requires virtually no capital investment, plants can be propagated locally, and many of the cultivars are low maintenance" (32).

Some interesting alternative ideas that were also proposed included promoting things like guerrilla gardening and flower bombing or seed bombing in order to make agriculture appealing and interesting, especially to youth.[29] [30] Fireweed, a local plant, was noted as being a good candidate for these types of activities.

Knowledge transfer activities that promote not only planting and gardening but also other social activities (like the joining together of youth and Elders) were also mentioned, and

[29] Guerrilla gardening is the act of gardening on land that gardeners do not have the legal rights to utilize, such as an abandoned site, an area that is not being cared for, or private property. Land that is guerrilla gardened is used to raise food plants or plants intended for aesthetic purposes (i.e., flowers). Some guerrilla gardeners carry out their actions in relative secrecy (i.e., at night) and sow and tend vegetable patches or flower gardens in an effort to make the area of use and/or more attractive. Some people garden during more visible hours for the purpose of publicity and/or activism (Guerrilla Gardening.Org, 2014)

[30] Flower bombs, or seed bombs are essentially compressed balls of dried growing medium (usually a combination of soil, clay, and compost) that contain seeds. These materials are sometimes packaged in biodegradable containers such as paper bags, biodegradable balloons, and recycled paper shells, or simply formed into fun shapes (Gardenista, 2014 and Kabloom, 2014). Seed bombs (or green grenades) in whatever form they take are designed to enable seeds to be sown in hard to reach places and in locations where gardeners are unable to spend a significant amount of time preparing the ground for conventional sowing; gardeners simply throw the bombs into places that they wish to beautify (Guerrilla Gardening.Org, 2014).

projects such as "the establishment of an outdoor bed where local plants can be planted and described" (32) were seen as being ideal for this type of purpose.

Finally, one respondent noted that "if ethnic organizations (e.g., Makivik) supported agricultural projects, this would help people to believe in them" (31).

5.5.3.3 Agriculture – A Non-Traditional Activity. This topic generated a lot of very interesting discussion and several recurring themes emerged, most notably the idea that agriculture is very similar to berry picking. The following are a selection of typical comments that were expressed on the subject:

- "Picking berries is very similar…a type of passive agriculture" (6);
- "Berry picking focuses on harvesting, which is a component of agriculture" (35);
- "Agriculture is a logical extension of picking berries and therefore traditional to some degree" (13);
- "It [agriculture] is traditional in a roundabout way" (15);
- "Women often go back to their same berry-picking patches; in a way these represent their gardens" (35);
- "Agriculture projects would simply push gathering to another level" (23);
- "Before we depended on the land and natural environment for plants" (27); and
- "Seaweed and plants are also harvested" (2, 26).

Another theme that emerged is the fact that agriculture is not an unknown or unfamiliar concept in the North these days, especially in Kuujjuaq, where different agricultural projects have been implemented in the past. One respondent mentioned that "more and more Inuit know how to garden now" (20). As well, several respondents brought up the fact that agriculture is part of being sedentary, and "Inuit have not developed agriculture because they always moved about (lived a nomadic existence) in the past" (4, 5). Further to this, others noted that:

- "Just because they haven't done it yet, doesn't mean that they won't do it in the future" (17);
- "The reason why it is not traditional is because Inuit were never introduced to it" (22);
- "If there was an opportunity to do so, I'm sure that someone would grow things" (22); and

- "This is a non-problem. Just because [agriculture] is not traditional does not mean that people do not want to do it or do not want to try to do it" (29).

In response to the statement that agriculture is not a traditional activity, one participant stated: "Neither is living in towns and driving vehicles; people all over the world grow things, why not Inuit?" (6). Others also mentioned that "like it or not, diets have changed—market food is our main food now" (12). Some also pointed out that people have been eating cultivated fruits and vegetables in the North for many decades now, and that "potatoes, carrots, onions, and turnips are often used in traditional meals like caribou stew." One respondent also mentioned that agriculture "could be a way to get people together; a community activity" (28).

The notion of self-sufficiency was another theme that came up many, many times in the course of discussions on the subject of growing food locally. Many people talked about "bringing back self-sufficiency" (19), and others observed that growing food is just a "new approach to an old way of feeding families, just another method, [we are] able to relate" (1). Parallels were often drawn between agriculture and the fact that Inuit really value food from the land. The concept of sustainability was also often brought up at the same time as self-sufficiency, and comments like "food helps to sustain us" (26) and we would like to "produce food sustainably" (1) were common. The notion of pride in being able produce food for oneself was also very regularly associated with notions of self-sufficiency and sustainability.

Finally, as stated by one leader, "Inuit are amongst the most adaptable populations of the world. If there is some resistance initially, I believe it will melt away as the benefits (economic, gastronomic, and health-related) are realized" (32).

5.5.4 Benefits and Challenges of Greenhouse-Based and/or Agricultural Projects

5.5.4.1 Benefits. Some of the most common benefits of greenhouse and agricultural projects that were mentioned by interview respondents, leaders, and community members had to do with immediate and long-term mental and physical health benefits. Typical comments included:

- “Good for your mind and your body” (27);
- “Relaxing” (20);
- “Gets people out of their homes and interacting with others” (25);
- “Increases morale” (25);
- “Supports the transmission of knowledge” (19);
- “Eating better leads to an increase in health (e.g., lower rates of diabetes, heart disease, etc.)” (25); and
- Provides “social and economic benefits (e.g., job creation, educational opportunities, help for the less fortunate, the marginalized, and the disabled)” (17, 26).

”Pride” (21), “local pride” (32), and a sense of “accomplishment” (16) were mentioned as benefits by the vast majority of respondents. People really seemed to like the idea of being able to “grow [their] own food!” (28), and the idea of “autonomy in terms of food production, leading to greater food security” (5) was a common type of comment. A number of respondents mentioned that people will buy fruit and vegetables produced in the community (even if they cost more), simply “because it is from here” (14), and that “people will want to support local community initiatives such as this” (21). The idea of “less reliance on southern-produced food” (14, 32) was also often mentioned.

The increased availability of fruits and vegetables, as well as greater choice and variety, improved freshness, and higher quality were also listed as very important and notable benefits (3, 8, 9, 10, 12, 17, 22, 24, 29, 30, 32), and many hoped that locally produced fruits and vegetables would be “less expensive” (9, 12, 18, 24).

Being able to provide opportunities for children and youth was seen as a very interesting and promising spin-off of local agricultural projects, and the broader social benefits were also often discussed. For example:

- “Kids being able to learn [and] see where food comes from, from the beginning” (29);
- “Opportunity to socialize within the context of a community garden” (5);
- “Will lead people to interact with one another” (14);
- “Could bring people together and help build up a sense of community” (13); and
- “Will unite the village” (14).

5.5.4.2 Challenges. The challenges brought up by interview respondents, leaders, and community members fall under three broad categories: environmental, financial, and social.

The most commonly mentioned environmental concerns included weather (and particularly the length of the growing season) and the availability of good quality soil in sufficient quantities. The availability of suitable sites and appropriate locations for projects was also of concern to some, and the availability (or lack thereof) of garden plots in the greenhouse was mentioned on a number of occasions. The lack of pollinators (notably in the more northerly villages) was also underscored by experienced gardeners, and problems caused by lemmings (who can rapidly destroy entire crops) were raised. Respect for gardens and growing spaces in town and around homes was also discussed, as Hondas (all-terrain vehicles), snowmobiles, personal vehicles, and water trucks often drive very close to houses and buildings and could potentially runover or otherwise damage, gardens.

Financial concerns regarding start-up costs and who should be responsible for them (public or private organizations) were often brought up, as well as concerns regarding the high cost of transporting building materials to the North. The cost (as well as the availability) of energy for heating and lighting was also discussed by many respondents. Interestingly, however, many suggested exploring renewables (such as wind and solar) as a possible solution. Related to cost is the twofold difficulty of logistics in the North, with respondents mentioning that not only is it expensive to transport materials but one "must always account for considerable delays" (17). People also expressed concerns that "a commercial greenhouse operation might not be financially feasible" (11, 32), and that a "lack of (initial) profitability might lead to the unwillingness of funding organizations to support experimental projects" (10, 32).

While elements that fall into the first two categories of concern were brought up often, they did not seem to be the ones that most worried respondents. It was often questions that were social in nature that people spent more time discussing. For example:

- "Need a vision first, need political will and political capital at all levels" (2);
- "Generating interest and creating the belief that this can be done will be the biggest challenge—once this is achieved, and there is political backing, then things will move ahead" (5);
- Importance of "getting local people involved" (19);
- Ensuring that "people take the project seriously and are responsible about taking care" (4);
- Need to "understand the realities of the North, and to adapt projects to those realities" (2);
- Ensuring that projects are "locally driven" (25, 37);
- "Need a local manager/project coordinator that will stay with the project for a long time" (3, 10);
- "Reliable, trained staff—who would stay involved over the long term—need to be found and kept" (7); and
- "Need facilitators to make it happen" (27).

On an individual level, the fact that agriculture is not traditional was of course mentioned: "Not a traditional activity, so might not generate much interest" (21), and "lack of knowledge on the subject at the moment" (19) was also cited as being one of the main challenges. Others mentioned that "resistance to trying new foods, especially among youth" (32) could be a problem, as well as the limited cooking skills (of both men and women)." The "lack of knowledge about what is good for you and what is not (e.g., junk food is advertised as being good)" (23) could also make it difficult to get people to accept greenhouse projects. But as one leader pointed out, it may be "difficult to please everybody, but there could be ways to do so" (13).

5.5.5 Other Comments, Thoughts, and Suggestions

Many people had comments and suggestions about issues that I had not thought to address. The following are some of the comments and ideas that came up in discussion and that people thought were important for me to record in the context of this research.

Many leaders stressed the importance of starting small and going slowly; for example, "having a series of small pilot projects around town to generate and build interest over time" (12). One regional leader also discussed the importance of have a long-term vision (20+ years) (23). Many people also stressed that it "will be important that projects are locally driven and governed, that communities are consulted (ask people first!)" (24), and that projects are not "organized and run by and for Southerners!" (37).

Many people brought up the idea of "having greenhouse projects in other communities—even eventually in each community in Nunavik" (33). Also, the importance of "targeting underprivileged families (the poor), because they are the ones who would most benefit from help with food production" was underscored (23). As well, one person (14) suggested a number of relatively easy ways to increase gardening opportunities in town. For example:

- "We could have another greenhouse in the new part of town";
- "We could make soil available to people who show an interest in gardening"; and
- "[People] can start gardening with very simple means: old barrels and containers, scrap wood and plastic to make cold-frames, etc…."

Comments such as "We need to break through to the population, get information out there, show people what is possible; there is so much potential that we don't know about" (21); "This must be introduced properly to the next generation—must be instilled in peoples' minds that it is possible" (22); and "We must create a sense of ownership among Inuit—must get them hooked" (21) expressed sentiments felt by many. As well, the idea of making the greenhouse a whole community project often came up in discussion.

A number of people expressed cautionary remarks like "the success of the project will depend on how well organized it is" (7), but caution was also balanced by optimism: "if you have a good team (that has the support of leaders and politicians) it will work!" (14). Further to this, it was often suggested that in order to facilitate the transfer of knowledge between northern and southern partners, experienced supervisors could be paired with a local person (e.g., a youth) who would then be trained in a comprehensive manner over an extended period (27). Such a model would foster partnerships between the North and the South.

Some respondents also noted that, while greenhouses and other agricultural projects do have their place, it is also important to mention that the land around town is really quite productive in certain areas. For example, mushrooms and ptarmigan abound and are not being harvested to the extent that they could be, and it would perhaps make more sense to focus on these truly local resources before investing in a new type of local food production strategy (10).

While many people were intrigued with the idea of having fresh produce all year, it was mentioned on a number of occasions that perhaps it would be better to operate for only eight months of the year—March through to November—in order to avoid the high heating and lighting costs associated with the coldest months of the year (12, 22, 30). Stopping things over the Christmas break also avoids the problem of maintaining operations over the holidays when many people are on vacation.

Another interesting comment that came up on several occasions is the notion that Kuujjuaq is well poised to be a leader in the development of this type of northern agricultural initiative (northern greenhouses, northern agriculture). As noted by several people, Kuujjuaq is geographically central and could be a good place to create a knowledge hub for learning and sharing on this subject. Further to this, many people noted that there is a real need for some sort of knowledge-sharing platform on this subject, and the idea of creating a pan-Arctic, user-friendly website to exchange information was brought up multiple times.

On an encouraging note, initiatives like the greenhouse project that achieve multiple benefits, such as food production, job creation, and environmental sustainability, appear to have a good chance of attracting further funding. As one leader pointed out, "There is money available for projects such as this" (14).

Finally, the following comments typify the positive sentiment in Kuujjuaq towards greenhouse-based projects and northern agriculture in general:

- "Would be good to accommodate needs of population by using local resources" (18);
- "Happy that there is a greenhouse here in Kuujjuaq" (18);
- "Be sure it keeps going" (29); and
- "Great idea, would love to see it move forward" (26).

Overall, the process of turning the idea of the Kuujjuaq Greenhouse Project into a reality has been a very valuable learning opportunity for all involved. The first stage of this research—which was essentially a social acceptability study—established a baseline that identified the needs and wishes of the community regarding this project. The second stage, the consultation phase, laid out the groundwork and the foundation upon which to build the project, and the third and fourth stages (Phase 1 and Phase 2 of the Kuujjuaq Greenhouse Project) saw the development and implementation of of the eight microprojects that are the heart of this initiative. The final stage, the concluding study, took the pulse of the greenhouse project and collected information that is crucial to understanding how the community of Kuujjuaq feels about their greenhouse project specifically and about alternative agricultural strategies in general.

While the focus of this chapter has been the presentation and explanation of the concrete results of this research, the following chapters will draw upon these results in order to outline the challenges and resources for greenhouse development in Nunavik (Chapter 6), as well as presenting a detailed analysis and discussion of the practical and theoretical scientific contributions that have come out of this work (Chapters 7 and 8).

Chapter 6.

Greenhouse-Based Food Production in Nunavik—Challenges and Resources

Before we can begin to look at developing a practical framework for greenhouse-based projects in the North (to be discussed in Chapter 7), it is important to examine the challenges facing this type of food strategy as well as take stock of the resources available to support it. This will help to establish a baseline comprehension of the environmental, economic, and social context within which northern greenhouse projects could be elaborated.

The information presented in this chapter was collected in a number of ways over many years: for example, through a review of the literature, through information gleaned from experts and professionals, through participatory observation, and through formal and informal interviews and meetings with local leaders and residents. While the information presented here is detailed, it must be emphasized that it is specific to Nunavik. Consequently, certain challenges and resources that might be pertinent in other areas of the Circumpolar North might not necessarily be relevant here. The first section of this chapter will begin with a review of the challenges that promoters of northern greenhouse projects in Nunavik can expect to face. This will be followed by a section on the available resources that could be harnessed and used to overcome these types of challenges.

6.1 Identification of Challenges

Challenges for food system design in Nunavik can be divided into two main groups: *environmental challenges* and a range of *other challenges* that are largely sociocultural or socioeconomic in nature. The principal environmental challenges for food system design, as they pertain to northern greenhouse projects, are as follows: 1) length of growing season, 2) extreme weather, 3) photoperiod (number of sunlight hours), 4) lack of conventional substrate, and 5) low humidity levels and water accessibility. The principal other challenges relate to: 1) lack of cultural exposure to agriculture, 2) financial resources, 3) community buy-in, 4) political will and support, and 5) project champion(s). In the following subsections these challenges—and the influence that they could have on greenhouse project development—will be presented and discussed.[31]

6.1.1 Environmental Challenges

6.1.1.1 Length of Growing Season. In the North, the number of days when the temperature remains above zero degrees Celsius is much lower than in southern latitudes. Daily mean temperatures in Kuujjuaq are only above zero degrees Celsius for five months of the year; from May through to September (Environment Canada, 2013). In the existing Kuujjuaq greenhouse it is not recommended to sow seeds or plant seedlings before the middle of May, and, with the onset of below zero nighttime temperatures in early September, only the hardiest of crops survive until the end of September or beginning of October (Avard, 2012; Avard, 2013). Hence, the current growing season (in an unheated greenhouse) is only four and a half months. In the past, however, gardeners used an oil furnace to heat the community greenhouse, thus extending the growing season to six months, so we do know that it is possible to extend the growing season with the use of external inputs. With the increase in temperatures currently being witnessed in the North due to climate warming, it is also likely that in the near future the growing season will be "naturally" prolonged (Forest, 2010).

6.1.1.2 Extreme Weather. Extreme winter weather—characterized by subzero temperatures that regularly hover around the minus 20 mark (Bhiry *et al*, 2011) and that easily dip to the equivalent of minus 40–60 degrees Celsius when the wind chill is factored in—is the norm in Nunavik. This means that structures built to house horticultural initiatives (whether year-round or seasonal) have to be modified accordingly, and designers must seriously take into consideration factors such as prevailing winds and the position of the sun in order to maximize heat retention and energy efficiency. The accumulation of snow on and around horticultural structures is another factor that must be considered when designing in the North. While the total quantities of snowfall are often lower in the Arctic than in southern regions

[31] There are a number of other classes and types of challenges to greenhouse production that could be discussed here (e.g., pathogens, pests, and plant diseases). However, I have chosen to focus this section on challenges that are of greatest concern to northerners in the context of starting new greenhouse projects in remote villages.

of Quebec, high winds and blizzard conditions can create large hard-packed drifts and cause snow to accumulate to great depths.

However, while winter weather is often the focus of discussions surrounding extreme weather patterns, it is important to note here that in the original Kuujjuaq greenhouse temperatures regularly soared to above 40 degrees Celsius during the summer of 2011 (Avard, 2012), and so, with the spectre of continued climate warming on the horizon, it will also be important to consider strategies (such as the use of shade curtains and ventilation systems) for cooling greenhouses in the North during the summer months. It is also pertinent that climate change will almost certainly exacerbate extreme weather patterns, and so it will be important that all horticultural structures be built to even more rigorous standards than they have been in the past in order to withstand high winds and other types of previously unseen extreme weather events.

6.1.1.3 Photoperiod (Number of Sunlight Hours). The seasonal variation in sunlight is also a factor that must be considered carefully when it comes to designing food production systems in the North. In Nunavik, the days are much longer in summer than they are in winter; however, there is considerable variation between the communities in the south of Nunavik and the communities in the north. Those in the north of the region (such as Salluit, Ivujivik, and Akulivik) experience the midnight sun in summer as well as periods of complete darkness in winter, while those in the south (such as Kuujjuaq, Kangiqsualujjuaq, and Kuujjuaraapik) do not see such a range of extremes during the course of the year. According to data collected at the meteorological station in Kuujjuaq, there are just over 16 hours of sunlight in mid-May, when the threat of frost is generally past and temperatures allow for sowing and planting in the greenhouse. In late June (on the longest day of the year) there are 17.89 hours of daylight in Kuujjuaq. Towards the end of the frost-free growing season in late August and early September this number drops to around 13 hours, and when the hardiest crops are at the end of their life span in early October, there are roughly 11 hours of daylight in Kuujjuaq. On the shortest day of the year (December 22nd), the sun shines for only 6 hours.

For most of the crops that Northerners are likely to grow, the long hours of summer daylight are a benefit. The extra sunshine can compensate considerably for the shortness of the growing season. Some plants, however, require periods of darkness for optimum development. Under continuous sunlight, these plants might not do well in the open, but it is likely that they could be grown successfully in greenhouses, where the amount of light could be controlled by shades or industrial curtains.

If plans do go ahead to build year-round horticultural operations in the future, then the installation of sophisticated, energy-efficient lighting must also be considered in order to counter the lack of sunlight during the winter months.[32] It goes without saying then, that the farther north the horticultural project, the higher the costs of production, since (among other things) lighting needs will be greater in the winter, and there are chances that measures will need to be taken during the summer months to mitigate the effects of round-the-clock sunlight.

6.1.1.4 Lack of Conventional Substrate. The lack of conventional substrate (good soil) is another one of the big challenges for food system design in Nunavik and for the Kuujjuaq Greenhouse Project in particular. The soil in and around the village of Kuujjuaq is predominantly sandy, and rocky outcrops cover much of the landscape. In low-lying areas organic matter has accumulated over the years and forms a layer of dark black topsoil over the bedrock or sandy subsoil. However, using this soil means destroying fragile Arctic habitat that has taken centuries to form, and so this is not an ideal option. The one instance in which using this type of soil would be considered acceptable would be when it was available from construction sites, which are common enough these days in Kuujjuaq, as the village is rapidly expanding.

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[32] LED (light-emitting diode) technology is definitely worth considering for use in greenhouses in Nunavik, since this technology has come a long way in recent years and has also proven to be very successful in small and mid-sized commercial greenhouses and indoor farming operations. For example, positive effects on plant growth, as well as significant reductions in electricity costs have been documented in Alaskan operations (LumiGrow, 2014).

Other options for dealing with the lack of usable soil in the North are: 1) shipping bulk orders of soil by boat from the South (this option, while expensive, was used to provide soil for the new Kuujjuaq greenhouse), 2) composting organic waste material that is already available in the village and steadily increasing in volume (the potential for this low-tech solution, which, as previously noted, has already been used on a small scale in Kuujjuaq, is huge and will be discussed later in this chapter), and 3) using hydroponic technologies that do not require soil substrates (this seems to be the most economically sound alternative in a potential commercial operation and will also be discussed further in the following section).

It is important to note that as the population in the North increases so will the amount of available organic waste material. Consequently, the potential for composting will continue to increase. However, we must consider that, while this is a very promising avenue to explore, it will take a number of years to create a substantial volume of soil. Therefore, while this method is interesting from a hobby garden perspective, it would probably not be the best option for a commercial horticultural initiative.

Given the generalized lack of soil in Nunavik, the view of the project stakeholders at the moment is that potential commercial horticultural operations in the North should be developed around hydroponic or hybrid hydroponic systems. A one-acre hydroponic greenhouse can produce up to 600,000 pounds of food per year; in comparison, a one-acre field will produce 90 percent less. This is because a field, which is productive for no more than five or six months in the year, can only produce one crop, or at best two crops, per year, whereas a hydroponic greenhouse is capable of operating for a minimum of ten months per year (Elton, 2010: 99-100).

6.1.1.5 Low humidity levels and water accessibility. Another environmental condition that has proven problematic for gardeners in Kuujjuaq is the very low relative humidity level. In the spring, gardeners are confronted with desiccated soil in their garden beds, and vegetable matter in compost piles often dries out before beginning to decompose. While it would seem logical to simply keep garden beds and compost bins wet over the winter and into the spring, this is not as easy as one might think, since water accessibility is one of the other main environmental challenges to be overcome. While it might seem odd that communities in the North, which are surrounded by lakes, rivers, and streams, should have problems with water, it is not availability that is the problem but accessibility. Because of permafrost, water lines (and sewage lines as well) cannot be dug into the ground, and water therefore has to be delivered by tanker truck to each individual household and business on a daily basis (and sewage must also be pumped out of holding tanks).

In order to understand the challenge that this type of water management system poses for horticultural initiatives, it is helpful to consider the situation at the original Kuujjuaq greenhouse. This greenhouse has a water tank that is situated outside the building, and even though the soil inside the greenhouse thaws early in the spring (much earlier in fact than the soil outside, since there is no snow cover on the soil and there is a greenhouse effect present), the water in the outdoor tank is not thawed until many weeks later, so this delays the start of the gardening season. One solution to this problem would be to install a tank inside the greenhouse; however, this would mean heating the structure in order to protect the plumbing. Consequently, in order to address a seemingly simple environmental problem—water accessibility—it becomes necessary to transition from a very low-tech horticultural strategy (one with virtually no external inputs) to one that requires expensive external inputs (e.g., a furnace, electricity, and fuel oil) as well as multiple layers of management (e.g., someone to order and pay for the fuel, someone to fill the fuel tank, someone to do the maintenance on the furnace, someone to monitor the installation, etc.). This one small example illustrates the extent to which environmental factors in the North can cause rather large difficulties for project promoters.

6.1.2 Other Challenges

6.1.2.1 Lack of Cultural Exposure to Agriculture. One of the main challenges to mobilizing horticultural projects in the North is the generalized lack of exposure to all things agricultural among the population. Agriculture is simply not an element of traditional Inuit culture. As discussed previously, Inuit have expert knowledge of hunting, fishing, and gathering, but little technical knowledge or practical experience with agriculture. This is not a criticism, it is simply a statement of fact (as it is also a fact that many urban dwellers in southern communities are equally unfamiliar with agricultural practice). Therefore, it is clear that the development of human resources and technical expertise must be prioritized if any type of greenhouse project is to be successful in Nunavik.

6.1.2.2 Financial Resources. No project can get off the ground without a little seed money (no pun intended), and the real challenge here is that northern horticultural initiatives are significantly more expensive to start up, given, among other things, the high cost of materials, labour, and transportation in the North. It is therefore of utmost importance to secure sufficient funds to support start-up and carrying costs until a project becomes self-sustaining. As noted in a recent publication specific to northern greenhouse development:

> A significant capital investment will be required to build a greenhouse, be it a modest community solar greenhouse or a technologically advanced commercial greenhouse. Sometimes government grants or private donations are available to offset the capital costs of a community project; however, one must be mindful of the annual operating costs of running a greenhouse. For a community greenhouse to cover its costs, will it be selling fresh produce and flowers? Receiving a local or a government subsidy for the medium-long term? Getting ongoing support from the local council, school board, health authority or others? It's important to figure out a strategic plan, of at least five years, for covering operating expenses once the greenhouse is built.
>
> (Exner-Pirot, 2012: 6)

This said, given the heightened interest of late in northern and aboriginal food security issues—from all levels of government, as well as from NGOs and public interest groups—a very good case can be made for funding innovative horticultural initiatives, especially those that have other types of socioeconomic spin-offs (e.g., education, training, social re-integration, etc.) built in from the start.

6.1.2.3 Community Buy-In. Community support is the single most important factor for the long-term success of any type of new project. It is even more critical in the case of a project like a community greenhouse in the North, since so many of its aspects are foreign to northern communities. Community buy-in can be difficult to achieve, however, but a comprehensive communications strategy can be a very useful tool to help spread information, answer questions, and create interest and support for a new project. An ideal communications strategy would involve not only conventional methods, such as community radio, community meetings, local newspapers, and newsletters, but also a comprehensive social media campaign. Another way to create community buy-in is to involve local people in all significant steps of the process, by having groundbreaking ceremonies, for example, or "barn-raising" events where everyone helps with building and construction, as well as harvest markets or harvest festivals where produce can be sampled. As noted by Agriteam Canada Consulting Ltd. (2013: xiv), "It is equally important that the rest of the community be engaged throughout the entire process as well to ensure buy-in from the community."

6.1.2.4 Political Will and Support. Closely tied to the concept of community buy-in is the need for political will and support from all levels of government. As a general rule, governments are supportive of the idea of northern greenhouse projects, but given the many other pressing needs in the North, such as lack of adequate housing, substance abuse, family violence, access to education, and access to health care, there is often simply a lack of time, energy, and financial resources to devote to food security projects. Other files are often understandably more urgent and are consequently prioritized, which sometimes leads to greenhouse projects being relegated to the back burner.

Another challenge to securing and maintaining political support for projects is the high turnover rate of elected officials. As Agriteam Canada Consulting Ltd. (2013: 44) noted in its report on northern greenhouse technologies, "Any projects that are being managed … will be delayed due to [turnovers], but projects may also change direction if the new leadership has different objectives."

6.1.2.5 Project Champion(s). Even if the financial resources are in place, the community has gotten behind the project, and the political leaders are on board, nothing will move forward if there is no project champion. As noted by Agriteam Canada Consulting Ltd. (2013: 56):

> If the majority of the engagement and commitment for a community project comes from external sources, or is only from civic leadership, then the project is

less likely to succeed. Civic and political leadership is usually able to accomplish much for short-term projects, whereas motivated citizens are likely to endure the turnover during elections and therefore maintain more continuity in the project development.

In a recent study focusing on the Fort Albany First Nation Greenhouse Project, Skinner *et al* (2014) concluded that local project champions were critical to project success, and that community and school greenhouse projects required local champions to be successful. These authors also noted that supports for project implementation included the drive and positive attitude of project champions and their ability to access and utilize the resources needed to achieve the successful growth of plants in the greenhouse (*ibid.*). As well, these authors underscored the importance of local project champions being considered and identified during the planning stages of the project (*ibid.*). Depending on the type and/or scale of the project, the champion could be a volunteer or an employee (i.e. a manager or coordinator). This person need not necessarily have agricultural or horticultural experience; it is organizational and leadership skills that are of the essence. Whatever the type or scale of the project, the important thing is that this person is in charge and that they communicate effectively and efficiently with all parties involved. Ideally they would also commit to the project for an extended period of time because, as Poole (1985) noted, the abrupt departure of the person responsible for the initiative is a common ingredient in the failure of past greenhouse projects.

According to Agriteam Canada Consulting Ltd. (2013: 56-57), the following steps are necessary to ensure that there is strong, long-term community leadership to champion a greenhouse project:

- Start the project with a committed group or individual within the community and ensure that they are dedicated to the project to see it through to completion and to commit and incur risk;
- Gain support and backing from respected civic and political leadership in the community, which will enable governance decisions to be supported and passed; and
- Support the champion with the knowledge of resources, skills training, and partnerships they will need.

6.2 Identification of Resources

The following subsection will explore the resources available for food system design in Nunavik. Special attention will be paid to how these available resources can be used to counter some of the environmental, sociocultural, and socioeconomic challenges outlined above. The available resources can be divided into two main groups: natural resources and other available resources. The term natural resources generally refers to elements that are available in the natural environment (hydrocarbons, minerals, water, trees, fish, etc.) that humans can extract and then use for various things, such as energy, construction materials, or food. However, in the context of an ecological design approach it makes sense to enlarge the notion of natural resources to include all resources—both natural and anthropogenic—that are available in and around northern villages and could potentially be used (or re-used) in a greenhouse-based food project. Since greenhouses are at the heart of this project, it is pertinent to start with a look at the key inputs that are needed in this type of controlled agricultural system—heat, light, substrate, and water—and the resources that are available in Nunavik that could be harnessed to meet these needs. Following a discussion of these inputs and related resources, certain other available resources—without which a sustainable ecological design project could not function—will also be examined. These other resources are: economic and market resources, human/social resources, and physical (or built) resources.

6.2.1 Natural Resources

6.2.1.1 Heat (Energy) Resources. In order to thrive, plants need to grow in an environment with a relatively stable temperature. In the North, where extreme climatic conditions are the norm and outdoor temperatures are only consistently above zero degrees Celsius for several months of the year, it is important to consider ways to heat a controlled growing environment, such as a greenhouse, in an energy-efficient and cost-effective manner. In terms of energy resources for heat in Nunavik, there are two categories of resources: natural and anthropogenic.

The most obvious source of natural heat in Nunavik is sunlight, and it will be imperative to harness this abundant summer resource, since, with even the most basic of technologies (such as plastic sheeting over a frame), temperatures can reach important highs. As noted previously, temperatures in the original Kuujjuaq greenhouse (a comparatively low-tech, aging structure) regularly reach the thirty degree Celsius mark and sometimes even peak at over forty degrees Celsius (Avard, 2011). Given the potential for harmful heat levels in the Kuujjuaq greenhouse, improvements have been made to the ventilation system and this type of temperature spike (which, incidentally, is not healthy for plants) should not occur again. However, the fact that it did happen proves that there is enormous potential for the use of sunlight as a heat source in Kuujjuaq—at least during the summer months.

Since the number of sunlight hours varies with the seasons, it is important to consider ways in which we could capture and store the sun's heat and energy in the North—this would help mitigate temperature swings, and would be especially relevant at the beginning and end of the growing season when daylight hours are shorter. When considering solar energy design, it is important to consider both "active solar" and "passive solar" techniques. The example cited in the paragraph above is an example of passive solar technology; there is no electricity or high-tech equipment involved.

Another example of a low-tech initiative that harnesses not only heat from the sun but also uses other types of locally available resources is the construction of heat reservoirs based on the concept of trombe walls. Trombe walls can take many forms, but essentially they are masses of material (e.g., concrete, stone, sand, and even water tanks) that are built to form a south-facing wall that absorbs the sun's heat during the day and releases it during the night. The use of this type of design element in greenhouses is well documented and can be adapted to any design or scale of project, from the home garden to the biggest of commercial operations. What is especially interesting with this technology in the context of the Kuujjuaq project is that materials are inexpensive and readily available, and there is virtually no maintenance required once the structure is built. It is also interesting to note that natural features, such as cliff faces or large rock outcrops can also be put to use in this way if a structure is built close by, or if a rock surface is even directly integrated into a building's structure. Another example similar to the trombe wall is the concept of heat storage tanks. This technique—which involves harvesting summer heat during the day and storing it in insulated water tanks to be used at night—is commonly used in places such as the Netherlands (Elton, 2010) and could be easily adapted to the Canadian North. A solar greenhouse is a specific type of greenhouse model that maximizes the capture, storage, and release of heat using combinations of these passive solar techniques.

An example of an active solar initiative that could function well in Kuujjuaq (and elsewhere in Nunavik) is solar panels and their accompanying batteries. Solar panel technology is evolving at a rapid rate, and while using electricity generated by these systems to heat a greenhouse is probably not the cheapest way to use the sun's energy (due to high initial investment costs as well as continuous maintenance needs), it is still a viable alternative that must be considered, especially since it could be an effective way to power the electrical systems in greenhouses (i.e., lighting, water pumps, and ventilation fans).

An example of a solar technology that falls somewhere in the middle of the range between the low-tech and high-tech examples presented above is a system that is commonly employed for heating such things as residential swimming pools in the South. This relatively simple technology consists of a series of pipes or water reservoirs that are placed in the sun (usually on a rooftop). When water is pumped through the system, it heats up in the sun and then releases its stored heat inside of a cooler environment, such as a swimming pool, a building, or a greenhouse. In southern commercial greenhouses it is common to run heated pipes in or on floors (even directly under the roots in some cases) so that a maximum amount of heat can be captured by the plants. This system could be easily adapted for use in greenhouses in the North.

While opportunities for using naturally occurring heat sources in the Canadian North will most likely be limited to technologies that harness the sun's energy, the potential for using anthropogenic wastes to heat greenhouses is a little broader in scope. As well, using elements of the waste stream could also prove to be a relatively inexpensive and environmentally friendly way to reduce the ecological footprint of northern horticultural production, while at the same time contributing to the diversion of waste from landfill sites.

Used motor oil is an abundant and ever increasing source of potential energy in northern villages. In Kuujjuaq for example, the only vehicles in town twenty years ago were the municipal trucks used for water delivery and sewage removal, as well as a limited number of snowmobiles and ATVs. Nowadays, the rapidly growing population and geographic expansion of the village have meant that more and more vehicles (trucks and cars for personal use and large vehicles for municipal services) have been arriving in town every year. When the oil is changed on these vehicles it is presently stored in barrels on the outskirts of town; shipping it back down south for proper disposal is prohibitively expensive. The use of this waste oil (which, from an ecological design perspective is a resource—not a waste product) in specially designed furnaces could not only adequately heat greenhouses, but would also address the pressing issues associated with storing and disposing of this waste, waste that in some cases is leaking out of barrels and contaminating local soils. In Kuujjuaq, one of these types of furnaces has recently been installed in a municipal garage, and so far the experience has been deemed positive.

The burning of old pallets (used for transporting freight) and other types of used wood in special furnaces is also an option that is cost effective and would divert a significant amount of materiel from landfill. This energy source is commonly used in greenhouses in southern Quebec and has proven its worth.

Similar to this is the use of biomass (i.e., waste from the forestry industry) for generating heat in large specifically constructed furnaces. This technology is rapidly evolving and has been successfully implemented in greenhouses in the Subarctic in recent years (Exner-Pirot, 2012: 8-9). While this resource is not locally available in Nunavik and would have to be shipped in, it could be an environmentally and economically interesting option in the southern villages (particularly on the Hudson coast) that are closer to the Abitibi and James Bay regions where this resource is produced in abundance.

There also exists the option of capturing waste heat from the Hydro-Québec diesel generating stations that are present in every community in Nunavik. These stations provide 100% of the electricity in Nunavik since the provincial hydro-electric power grid does not extend into this territory. Presently, approximately 40% of the energy produced by these generators is waste heat that is vented directly into the environment, which is unfortunate because it could be captured (using proven cogeneration technology) and used to heat greenhouses year-round. Not only is this technology proven, but it is actually presently being used to heat the new residences of Hydro-Québec employees who work at the newly constructed generating station in Kuujjuaq. Given the considerable size of this station, there is still a significant amount of waste heat available that could be captured for use in another project.

It is also important to mention two other types of technology that could potentially be used to create heat through the valorization of waste in Nunavik: bio-digesters (and associated methane capture technologies), which decompose all types of organic matter and convert it into methane gas; and incinerators, which can transform a large percentage of household waste into heat. While these two options remain interesting, they are relatively large-scale initiatives and would probably only be viable in the context of a concerted and comprehensive regional waste management program.

Finally, a very low-tech option of note is the use of compost piles to generate heat. This has proven effective in southern greenhouses where significantly large quantities of compostable material can be amassed and manipulated (compost piles generate significant heat when the factors that regulate the decomposition process are optimal). It remains to be seen whether such an initiative would be feasible in a northern village, but it is worth considering, since composting will likely play an important role in northern greenhouse projects in any case.

6.2.1.2 Light (Energy) Resources. As discussed in the previous section, the sun is one of the most abundant and appropriate energy sources in Nunavik, providing not only heat but also light. However, since sunlight is only plentiful during the summer months, alternative sources of lighting must be developed for use during the winter months if year-round horticultural initiatives are to be successful. Since any form of artificial lighting needs electricity to function, and electricity is expensive in the North, lighting systems must use as little electricity as possible. That is why LED lights are presently being experimented with in northern greenhouses, since they not only provide an appropriate spectrum for healthy plant development but are also very energy efficient. This kind of energy-efficient technology is thus part of the solution to the energy needs of northern greenhouses, but how to provide the energy that powers these lights and other electrical equipment in a way that is both cost effective and environmentally sound remains an important question.

One option (that would, however, only make sense in the spring and fall) would be to use solar panels to charge batteries during the day and then run LED lights off the batteries in the early morning and late afternoon to extend daylight hours and thus increase plant production. Other options include installing wind turbines and microhydro stations (very small turbines placed in streams or rivers) in order to generate electricity that could be used not only for lighting but also to run other greenhouse equipment such as pumps, water heaters, and ventilation systems. Since wind and water sources are plentiful in Nunavik, these options are definitely worth exploring.

Even better than individual systems, however, would be a comprehensive energy production system made up of at least three complementary sources—a type of strategy that is regularly used in ecological design. Combining several sources of energy helps maximize output and system resilience. If, for example, lack of sunshine or equipment failure causes the output from the solar component of the system to drop, other components such as wind, microhydro, or an anthropogenic source can still maintain the steady source of power needed to avoid undue stress to greenhouse crops.

6.2.1.3 Substrate Resources. One of the fundamental requirements of all plants is support for their roots. This support can be in the form of soil or any other type of mineral or organic substrate. However, as discussed in the previous section, traditional substrate resources (i.e., good quality soil) are not readily available in Nunavik. Yet, this problem can be worked around, since there are other types of resources in Nunavik—both natural and anthropogenic—that can be used to create adequate growing mediums.

The simplest and most easily accessible substrate resource for use in a greenhouse project would be the natural topsoil (which, while rare, is still present in some places) that is bulldozed away from new construction sites. As mentioned previously, taking this soil from a pristine part of the land is not recommended, since this would disturb natural habitat that has taken millennia to form. However, since the land is already being disturbed during the construction process, it is best not to waste this precious resource but to put it to good use instead. To this end, there is discussion surrounding the tabling of a new bylaw that would require that all “good soil” be collected following the construction of new buildings or roads in Nunavik.

Because the most abundant type of local soil is very sandy and not at all rich in organic matter, it might not be the best choice for the majority of plants, but it is adequate for certain crops, such as potatoes. We know this because several local gardeners have already had success with potato crops out of doors over the years. At the moment, as mentioned in a previous chapter, there is a potato project underway in Kuujjuaq and there exists potential for other types of root crops as well.

As in any ecological design project, a great deal of emphasis is placed on the transformation of anthropogenic “waste” resources into “value-added” products. One of the most abundant and easily transformed waste resources in any modern society is organic matter (usually kitchen waste), and composting this resource in order to create soil has been on the minds of those involved with the Kuujjuaq Greenhouse Project since the beginning. As detailed previously (see Chapter 5, section 5.4.4), a composting project involving the collection of food waste from a number of local businesses has been put in place in Kuujjuaq, and to date the results have been encouraging.

When creating compost, it is necessary to combine a source of carbon (dry/brown organic material) with the wet/green vegetable waste in order for proper bacterial and chemical decomposition to occur. In the South, carbon is often added to compost piles in the form of leaves; however, this resource is very scarce in Kuujjuaq. As previously detailed, in order to meet the carbon needs of the Kuujjuaq compost project, shredded office paper (also a tree-based product) was substituted. Another potential source of carbon that could be easily collected in the future are the brown paper towels that are used in the washrooms in all of the public buildings in Kuujjuaq. The collection of this type of waste is common in institutional compost collection programs (including the program at Université Laval) and is relatively easy to implement.

While these two examples focus on organic waste from commercial operations and institutions, it is important to underline the fact that there is also a great deal of organic matter that could be collected from the household waste stream in Kuujjuaq. In order to address this in the short term (and on a small scale), two small compost bins were also constructed adjacent to the greenhouse in 2011 in order for gardeners (and other Kuujjuamiut) to compost their household food scraps as well as waste plant material from the garden beds (Avard, 2012). In the long term, a comprehensive municipal waste management strategy could include compost collection in its mandate, and it is important to mention that the Kativik Environmental Assessment Committee (KEAC) is presently evaluating this. To this end, the KEAC is closely following the development of the compost project associated with the Kuujjuaq Greenhouse Project. As well, it is important to reiterate that the Kuujjuaq Compost Project not only creates soil and diverts waste from landfill but also creates non-conventional employment opportunities for marginalized members of society, something that contributes directly to the building of social and human capacity in this community.

While the existing compost project in Kuujjuaq is using a relatively simple composting technique (simply layering the organic matter to create piles and then turning over the waste on a regular basis), there exist two other composting techniques that could prove interesting in a northern context. The first is vermicomposting (or worm composting). This technique is relatively well known and can be used anywhere and on any scale from individual households to large industrial complexes. Vermicomposting is a method of choice, since it is low-tech, requires minimal financial investment, and is relatively rapid. In typical vermicomposting systems, worms are fed a mix of organic waste (e.g., kitchen scraps) and used paper and/or cardboard. Other organic matter, such as wood residues and manure can also be treated in vermicomposting systems. The end product is a very rich, concentrated type of compost, called worm castings, that is commonly used as a soil amendment and organic fertilizer. Over the past few years a number of residents of Kuujjuaq have experimented with household vermicomposting, and the results have been very positive, proving that this type of low-tech system is definitely viable in the North.

The second alternative composting technology is not very well known yet. It involves composting with flies instead of worms.[33] What is interesting about this system is that not only is compost created out of organic waste, but fly larvae are also grown and harvested. These larvae can then be fed (either alive or frozen) to fish or chickens, for example, hence adding another value-added product—high protein animal feed— to the chain. The potential for the development of aquaponic (combined aquaculture and hydroponics) systems in the North is very interesting, and in Kuujjuaq there is already an existing fish hatchery project that could potentially be expanded into an aquaponic system. If this were to happen, and fish feed were also grown on site (as a by-product of a soil creation strategy), we would be looking at a real closed-loop system, one that could go a long way towards assisting in the food sovereignty goals outlined in Plan Nunavik and Parnasimautik as well as in the waste management strategy presently being developed by the Kativik Environmental Advisory Committee (KEAC) and the social reintegration and employment goals of the community.

Moving on to the other types of substrate resources available in Nunavik, we get into substrates that would be useful in hydroponic production systems. In certain types of hydroponic systems (there are hundreds of different types on the market), gravel and/or sand is used as a substrate to promote healthy root development. Luckily, these are two resources that are abundant in Nunavik and could both easily be collected for use in an ecological design project. Another type of hydroponic system (used notably in large commercial hydroponic operations in southern Quebec) uses a substrate composed of coco husk or Rockwool. However, recent research done at Université Laval and Université du Québec à Chicoutimi has proven that a substrate made out of birch bark (a waste product of the Quebec forestry industry) is just as effective as these conventional substrates and, in fact, even outperforms Rockwool (NAASZ *et al*, 2009). What is interesting about birch bark is that, while it is not available in Nunavik, it is produced in large quantities in the region directly to

33 One of the bigger trademarked names for this type of system is the "BioPod" (BioPod, 2012).

the south of it. For that reason, it would be a more environmentally responsible choice than either coco husk (which is usually imported from South-East Asia) or Rockwool (which is not biodegradable) if eventual commercial greenhouse promoters in Nunavik decide to adopt a fibre-type substrate system. Birch bark is also more environmentally sound than other substrates that are presently used in the greenhouse industry. Depending on the business model that is chosen for an eventual commercial operation, it could prove to be a wiser option than locally available gravel or sand, so it should not be excluded from consideration even though it is not a truly local resource.

6.2.1.4 Water Resources. The other fundamental element for plant growth is water. As mentioned in the previous section, while water resources are plentiful in Nunavik, accessibility is an issue. However, communities in Nunavik do have reliable water delivery strategies in place, so this issue can definitely be worked around. This said, it would be appropriate to examine other water collection strategies that could possibly circumvent the truck delivery option: for example, rain water capture during the summer months and possibly snow and ice capture and melt/storage techniques. It would also be important to examine the possibility of constructing eventual commercial hydroponic operations near water sources, since these types of greenhouses operations need higher volumes of water than soil-based greenhouses.

In keeping with the ecological design principle of waste as a resource, it will be very important to examine the possibility of harnessing the ecological potential of sewage (which is presently collected from all households and businesses by truck on a daily basis and transferred to a sewage lagoon on the outskirts of town). Advanced Ecologically Engineered Systems (AEES)—or "Living Machines"—have proven to be exceptionally efficient at cleaning wastewater to standards higher than those required by municipal law, while at the same time producing economically interesting byproducts such as young trees, flowers, and bait fish (Todd, Brown, and Wells, 2003). AEESs are essentially constructed wetlands that are assembled in greenhouses (or outdoors in mild climate zones) that use the natural abilities of living organisms to break down macromolecules and metabolize organic nutrients typically found in wastewater and polluted water bodies (*ibid.*). Such a system installed in a northern village could not only address sewage treatment needs (and the environmental concerns associated with its disposal in Arctic ecosystems), but could also create economic gains through the production of plants. While many are queasy about eating food plants grown in these types of systems, they are safe to eat; the water after treatment is, after all, generally cleaner than that in the surrounding environment. Even if the end products of such systems were only flowers, trees, and shrubs that could be used for village revegetation or beautification projects, the abundant and ever-increasing amounts of sewage in the North could still become a valuable resource.

6.2.2 Other Resources

6.2.2.1 Economic and Market Resources. Since, at the moment, we are in the exploratory/research stages of greenhouse projects in Nunavik, all of the funding thus far has been supplied by the Kativik Regional Government and the Northern Village of Kuujjuaq. However, since this project is a pilot initiative that could be replicated elsewhere in Quebec in the near future, the provincial government (through the MAPAQ) also pledged funding in 2011, and the federal government (through a partnership agreement with Agriculture and Agri-Food Canada and the Rural and Cooperatives Secretariat) will also likely fund certain aspects of project development in the coming years. For the moment, all of the project stakeholders agree on the fact that horticultural initiatives in Nunavik should be elaborated within a socioeconomic model and operated by an Inuit organization. As described by Boulianne (1999: 62-63), “the social economy is an ensemble of enterprises whose end goal, contrary to capitalist enterprises, is not the production of surplus but instead the provisioning of goods and services for a group or community at large. The objectives of social economy enterprises relate, above all else, to the reinforcement of social cohesion and to the creation of employment opportunities” (my translation).

In the English literature, this notion is synonymous with the not-for profit sector, and encompasses primarily NGOs and charities. In the French literature this notion (“économie sociale et solidaire”) is extended to include the cooperative movement, which, while profit driven, still has an express social mandate at its core. According to Markell (2009: 25), “Some of the most vibrant community-based local food initiatives in Canada’s local food movement are organized as cooperatives." In Quebec, all of the community and collective gardens created after the year 2000 partake (to differing degrees) in the Chantier de l'économie sociale, an amalgamation of NGOs and cooperatives that represent and promote the social economy movement at the regional level (Boulianne *et al*, 2010: 12). Organizations involved in this sphere of activity work towards the sustainable development of local initiatives through the coordination of resources as well as the coordination of market-based and non–market-based economic activities (*ibid.*). This way of operating parallels many of the elements that the Kativik Regional Government promotes through its Department of Regional and Local Development, the department that provided the bulk of the support for the initial development of the Kuujjuaq Greenhouse Project. Given the history and strength of the cooperative movement in Nunavik, this seems like a good type of operational model for commercial greenhouse projects in this region to adopt.

While it it is obvious that capital investment is crucial to project development, a market and distribution network for the sale of produce is also key to the long-term health of any ecological design project. Luckily, there are many possible options and strategies that could easily be developed in Nunavik. In Kuujjuaq the two food stores (Northern and Newviq'vi) have already expressed interest in purchasing and distributing fresh produce, and there also exists the possibility of selling produce to the restaurant at the Kuujjuaq Inn and the hospital cafeteria. The idea of a local market (where youth can sell the produce that they have grown in the context of a gardening project) has also been mentioned, as has the donation of food to institutions such as the Elders' home, the daycares, the youth centre, the women's shelter, and the supervised apartments. The possibility of the sale of fresh vegetables produced in eventual greenhouses in Kangiqsujuaq and Salluit to the Raglan mineselling fresh vegetables to the Raglan mine from greenhouses that are eventually to be built in Kangiqsujuaq and Salluit has also been evoked. Given the likelihood of the increase in the number of mines in Nunavik in the future, the development of corporate partnerships for this type of greenhouse-based horticultural project is a very promising avenue that needs to be explored. It is also important to mention that the development of onsite greenhouses, as well as composting initiatives, could not only serve to provide fresh produce to mine employees but could also create other types of employment opportunities for Inuit workers in the mining industry, while at the same time reducing the ecological footprint of the mines. What is really interesting about this model is that the very institutions that produce organic waste—which is transformed into soil and then used to grow vegetables—will actually be purchasing the end product. This is a basic example of a type of closed-loop system that Todd, Brown, and Wells (2003: 430-431) call Eco-Industrial Parks (EIPs). EIPs, as they describe the system, are "a community of businesses that cooperate with each other, and with the local community, to efficiently share resources (information, materials, water, energy, infrastructure and natural habitat) leading to economic gains, improved environmental quality, and equitable enhancement of human resources for business and the local community" (*ibid.*).

6.2.2.2 Human Resources. Human resources are another key to the healthy, long-term success of any ecological design project. In Nunavik there are many different potential partnerships that could be developed with local and regional organizations that could supply labour to a horticultural initiative. Possible partners include the Youth Employment Service (Y.E.S.) program of the Kativik Regional Government, the supervised apartments, the Kativik School Board, the summer youth camp in Kuujjuaq, and volunteer employees from mines operating in Nunavik.

While at the beginning of any northern horticultural initiative, expert knowledge and guidance will have to be provided by external professionals and consultants, one of the long-term goals of the project stakeholders is to make Northerners independent of external expertise. This would be accomplished by establishing a horticultural technology transfer and training centre in Nunavik that would have the express mandate to develop the necessary human resources in the North. A major advantage of having a training centre in the North is that it would provide a way not only to get youth involved but also to incorporate local and traditional ecological knowledge into a new type of local food strategy in Nunavik.

6.2.2.3 Physical (or Built) Resources. While much new infrastructure will need to be built if any large-scale greenhouse-based ecological design project is to be elaborated in Kuujjuaq, there are existing resources that could be upcycled or modified to accommodate certain types of new horticultural initiatives. The most obvious of these are unused or underused warehouses that could be converted into indoor farms. These are horticultural installations that are similar to greenhouses in all aspects of their operations except one: they are entirely reliant on artificial lighting. Indoor farms, while having specific lighting requirements, could possibly prove to be more efficient than greenhouses in Nunavik, especially if the cost of constructing new structures is taken into account. Warehouses could also shelter compost initiatives, including those using vermicomposting or BioPod equipment, which need steady, above-zero temperatures to function adequately.

A Kuujjuaq-specific project that could capitalize on existing infrastructure might involve the modification and expansion of the existing fish hatchery into an aquaponic system. Aquaponics, as previously mentioned, is a technology that meshes aquaculture and hydroponic systems for the production of both fish and fresh vegetables, and Quebec is a world leader in this type of technology.[34] This business model could easily be transposed to the North and, while arctic char (the most coveted species of fish in Nunavik) are more complicated to grow in a controlled system than trout or tilapia, for example, it is technically possible.

Finally, as those who live in northern communities know, the local landfill site is often referred to affectionately as the "Canadian Tire" (the name of a national home and building supply store chain in the South). While not usually the first place that comes to mind when planning greenhouses or other horticultural projects, the northern Canadian Tires are a great place to source materials that can be upcycled into component parts for simple new structures. Wood (from pallets and packing crates), old windows, and plumbing materials are common landfill items that can easily be transformed into small-scale structures such as cold frames,

[34] A good example is a small company in Ste-Agathe-des-Monts (Arc-en-Ciel Aquaponics) that has developed a mid-size enterprise that employs mentally handicapped persons to produce trout and Boston lettuce that it then sells to a well-known restaurant in Quebec City. This enterprise also smokes a certain percentage of the fish they harvest, thus creating a value-added product that brings in greater revenue.

small greenhouses, and compost boxes; in fact, many of the existing personal greenhouses in the North (and the South, it must be said) are made from recycled materials.[35]

Plastic milk crates are another commonly discarded item in the North that can easily be transformed into effective modular planters or compost bins (see images below). One of the principal benefits of using milk crates as planters is that they are easily transportable and can be moved around from year to year as desired, or stacked and stored for the winter. This is an interesting option not only for protecting the crates themselves from snow removal equipment but also for sheltering perennials (such as herbs or strawberries) from the harshest of the winter elements.

In sum, many of the challenges to greenhouse development in Nunavik, particularly those that are environmental in nature, are significantly more robust than those present in southern regions of this province. This said, a number of the challenges listed above are common to any new farming or business venture, and there exist proven ways to rise to and overcome them. As reflected in the section on available resources, there also exist many elements in the North that can be exploited in both old and new ways in order to overcome challenges and encourage innovation in a meaningful way.

[35] Of note, many construction companies leave new unused materials (lumber, hardware, tarps, etc.) at landfill sites when contracts are finished. It is too expensive to bring them back down south, and it is poorly viewed to give them to individuals, so the practice of leaving unused materials in plain sight for others to "scavenge" is common.

Chapter 7.

Framework for Developing a Greenhouse-Based Food Production Strategy in Nunavik

Drawing inspiration from the information and results presented in previous chapters, this chapter will present a comprehensive development framework for a new type of greenhouse-based local food strategy in Nunavik, a framework that represents one of the principal end results of this research. An increasing number of northern communities and project promoters have expressed a need for basic guidelines for this type of alternative northern agriculture project,[36] and this framework has been developed as a direct response to that need. It is in developing this aspect of this research (the framework) that I am able to give back the results of this research to the community of Kuujjuaq in a way that is practical and useful, not only to them but also to others who may wish to emulate them in the future. This transformation of results into practical, applicable, and accessible information is one of the final steps of this comprehensive community-based participatory research project. It is of note that this type of practice is the foundation upon which the most recent International Polar Year (IPY) scientific program was built—the now famous slogan of the closing conference being "From Knowledge to Action" (IPY, 2014).

As outlined in previous chapters, Inuit have historically relied almost exclusively upon local food systems for sustenance, yet in recent decades (for various reasons) they have to a large extent moved away from a reliance on local foods and now regularly incorporate Euro-Canadian foods into their daily diets. The framework presented on the following pages draws inspiration from this tradition of procuring food from a local source, while at the same time incorporating modern elements of northern life (i.e., non-traditional foods and non-traditional ways of producing these foods) into a new type of hybrid food system for the North. It is important to point out that this framework is in no way meant to challenge the place of traditional food systems; it is simply a response to the fact that Inuit communities in the North

[36] In just 2014 I have received requests for this type of information from the communities of Whapmagoostui-Kuujjuarapik, Chisasibi, Radisson, and Senneterre, as well as from two consultant groups, two regional organizations, and NGOs from both the agricultural and community development sectors.

are now concretely expressing their desire for fresh, good quality, affordable fruit and vegetables—produce that many professionals agree could go a long way to improving food security and overall health and well-being in the North.

As earlier chapters have made clear, producing fruit and vegetables locally in the North can have numerous other benefits beyond food security. These benefits are extremely important, and they are reflected in the three overarching, long-term goals of the Kuujjuaq Greenhouse Project, and by extension, the principal goals of the framework that I am proposing. The first of these goals is that the project must address the issue of food security in the North, notably through the production of good quality fresh fruit and vegetables. The second is that it must provide sustainable economic, social, and environmental benefits to the community. And the third is that the project must address the social challenges that are present in the community, especially those that affect children and youth.

Inspired by the concepts of local food, ecological design, and community capacity (presented in Chapter 3), and drawing upon results obtained during the years that I worked on the development of the Kuujjuaq Greenhouse Project, this section presents what is essentially a how-to model, a sort of step-by-step guide that outlines the key things that need to be done in order to effectively develop and implement a greenhouse-based local food strategy in a northern community.

It is important to mention that there are already a number of really excellent guidebooks and complementary resources available that explain how to start and operate community and collective gardens (see Food Security Network of Newfoundland and Labrador, 2011; Stiegman, 2004; Pedneault and Grenier, 1996). For the most part, however, these guides are tailored to southern and/or urban regions. My emphasis, therefore, will be on those tasks and elements that need to be addressed in order to ensure successful greenhouse projects in northern communities. It is also important to note that the points outlined in this section remain relatively general in nature. This is because each new project must absolutely be tailored to the individual needs of the community in which it is being developed.

7.1 Principal Elements

The following is a list of sixteen principal elements that need to be considered when undertaking a new northern greenhouse or northern agriculture project. While they are presented here in an order that is more-or-less sequential, a number of these elements (or steps) can happen concurrently or in a slightly different order, depending on the circumstances particular to each community. It is also important to keep in mind that any process that uses a participatory approach is by nature iterative—meaning that there is perpetual consultation, verification, and validation (leading to change and adaptation) throughout the entire duration of the project, from planning to implementation and continuing throughout the operational phase.

1) **Initial Idea:** First and foremost there has to be the suggestion of an idea to start a project. This idea can come from either inside or outside of the community, but the important thing is that the person (or persons) with the idea is able to effectively promote it and sell it to other stakeholders and potential backers.
2) **Type of Project**: The next step is to identify what type of horticultural/agricultural project will be developed: a community garden, a collective garden, a school garden, a horticultural therapy project, a commercial initiative, or a hybrid of two or more of these.
3) **Project Champion(s):** The following step is to identify a person or team of people to mobilize and develop the project idea. In many cases this person (or group of people) will most likely be the same as the one(s) who had the initial idea, but this is not always the case; it could be that a regional or local leader puts things in motion and then hires a project manager or team leader to carry on. It is important to mention that, ideally, the project champion should be a member of the local community, yet anybody who is willing to commit to the project long-term can be an effective and successful project champion. Also, while knowledge of gardening and/or agriculture is an asset, the most important skills needed by a project champion are good organizational, managerial, and communication skills.
4) **Project Plan:** The main job of the project champion at this beginning stage is to develop ideas that can be incorporated into a preliminary plan (or draft outline) of the project. This involves brainstorming and doing research on other existing projects to identify things like potential crops, appropriate infrastructure and technologies, and management models.
5) **Consultation with Community:** Once a project plan has been drafted, the project champion needs to consult with leaders, and the general public to concretely identify the needs and wishes of the community regarding the project. A project that does not have the support and backing of the community will be harder to mobilize, so it makes sense to spend the necessary time to carry out this step in a comprehensive and thorough manner. Individual meetings with leaders, community meetings,

community radio, and social media are all effective tools that can be used for this process. The political process of consensus decision making is often used in the North, and although applying this process might take longer than other methods (many months or even more than a year in the case of this type of project), it does have a proven track record.

Taking the time to do things properly at the beginning is more than worthwhile, because finding out later that certain groups are not in favour of the way that a project has been designed—and having to make changes when a project is already at an advanced stage—is even more frustrating and time consuming than having to invest extra time at the beginning. However, it is also important to point out that, as a general rule, it is impossible to please everybody in all things, so there might come a time when hard decisions have to be made in order to simply move forward with the project.

6) **Evaluation of Local Capacity for Project Development:** This step involves identifying the resources that exist in the community for developing the project as outlined in the project plan. This step also involves identifying the challenges that exist and the resources (inside or outside of the community) that are available to overcome these challenges. A simple tool that can be used for this exercise is the following schematic based on the five classic types of capital (see Table 5):

TABLE 5

Evaluation of Local Capacity for Project Development

Five types of Capital	Local Equivalent	Available (describe)	Needed (describe)
Human	Project Champion(s)		
	Project Staff		
Social	Political Support		
	Community Support		
Economic	Financial Support		
	In-kind Support		
Built	Infrastructure		
	Materials		
Natural	Natural Resources		

7) **Building a Support Team:** The next step involves building up a formal support team. This is essentially a group of people and/or organizations who will be there to provide information, advice, and all types of support throughout the life of the project. This step simply involves concretizing the organic process of creating relationships, networks, and partnerships that will have already begun during the course of the preceding steps. Supporters can be involved in the project to varying degrees, playing the roles of anything from key players (active partners) to simply interested observers. Supporters can—and should be—from diverse milieus in order to ensure that all aspects of the project are backed.

   Some key areas from which to draw support include:

   - all levels of government (municipal, regional, provincial/territorial, and federal) and departments within them (e.g., agriculture, health, economic development, public works, renewable resources, employment and training);
   - non-governmental organizations, such as community development and youth development organizations;
   - para-governmental organizations, such as agricultural unions and horticultural councils;
   - northern ethnic and non-ethnic organizations active in the area of Aboriginal development;

- universities, colleges, vocational schools, and other research institutions (and personnel from these institutions, such as researchers, graduate students, and interns);
- health boards and health departments (and personnel from these agencies, such as nutritionists, mental health experts, social workers, and community health nurses);
- school boards (and board personnel, such as curriculum development officers, teachers, and special education teachers); and
- community volunteers and local gardeners, as well as other people, groups, and organizations working on similar projects.

8) **Creation of a Committee or Board:** This is the stage at which the project begins to acquire a formal structure. The project champion, while able to fulfill many of the essential roles and accomplish many of the day-to-day tasks, cannot be responsible for all of the big decisions related to the project. He or she needs not only the help and support but also the legitimacy of an elected or appointed group, especially when it comes to big or sensitive decisions, such as those involving money. Depending on the type or the scale of the project, the type of committee or board that is chosen will vary, as will the number of people involved. The committee could be something as simple as a few community members (volunteers) meeting around a kitchen table in the evening or as complex as an official corporation with a board of directors and all the associated legally binding obligations that that involves. It could also involve the creation of a small cooperative or an NGO. Regardless of the type of committee or board, in every situation terms of reference (TORs), bylaws, or equivalent documents outlining the committee mandate and the roles of all principal stakeholders and partners must be drafted at this stage and adhered to throughout the process.

   An example of a simple way to address this need for an official management structure is to create a consultative committee (made up of project champion(s), community members, and other stakeholders) that reports to the municipal council or other existing recognized body that agrees to sponsor the project (e.g., landholding corporation, school board, etc.). Such a body, already legally structured and operational (and composed of elected officials who are recognized as legitimate representatives of the community), thus acts as the official decision-making body, although the day-to-day details are looked after by the consultative committee. This "incubator method" is a relatively simple and straightforward option, especially in the beginning stages of a community project when energies need to be focused on project development, not paperwork. Another benefit of this model is the ability to take advantage of the existing banking and accounting services of the larger body, thus eliminating the need for the committee to invest time and resources in an aspect of project development that can be challenging and time consuming for emerging organizations.

9) **Ownership of Infrastructure and Equipment:** This element will be closely tied to the outcome of the previous element, since whichever institution oversees the project will probably wish to own the related infrastructure and equipment. It is important to point out here that in many cases it is advantageous to partner with an existing organization at this stage (rather than creating an NGO or cooperative), since the project can benefit from the administrative support that the organization can supply.

In addition, many organizations are willing to offer in-kind support in the form of such things as construction and maintenance services, office space and office services, property insurance, heat and electricity, and water delivery and sewage removal. If project promoters were to chose the NGO or independent cooperative route, the cost and management of all of these elements would have to be considered, and where these types of things could be costly and complicated for a new organization to implement and administer, they can be relatively simple for a larger organization to deliver through existing facilities and capabilities.

10) **Project Manager or Project Supervisor:** This is also the point in time where—if the project is big enough to warrant it—an official manager or project supervisor should be appointed by the committee or board of directors. This person will perhaps be the project champion who has been involved from the beginning, but there also exists the possibility of hiring someone else to fulfill this specific role. This is a good opportunity to hire someone locally (who perhaps doesn't yet have the skills) who could be paired for an extended period of time with an experienced supervisor (or expert consultant) in order to learn on the job. If the budget allows for it, having more than one person in the role of manager is a good idea, since this will help ensure smooth operations year-round.

11) **Selection of Crops:** Identifying the crops (and the most appropriate cultivars of those crops) that will be grown within the context of the project is the next important step, because this will inform the exact nature of the type of infrastructure and equipment that is needed. For example, if a standard array of market garden crops will be grown by individuals and families in a community garden, then a conventional greenhouse is best; however, if hydroponic lettuce is to be grown, then different types of advanced systems must be researched and evaluated. Community preferences (i.e., what people want to eat and buy) and technical and economic viability (i.e., what grows best—fastest, biggest, and tastiest—and what can turn a profit or at least break even) will be the biggest elements to consider when identifying which crops to grow. This said, it will be important to consider the merits of cultivating crops that might not necessarily be simple to grow or economically profitable but could generate interest in, and excitement about, the project (e.g., strawberries and flowers).

12) **Planning Infrastructure:** Planning the exact nature of the infrastructure that will be needed to meet the needs of the project comes next, and will, of course, be informed by the type of project (e.g., community, school, commercial) that will be implemented and the types of crops that will be grown. However, before planning of the building itself can begin, a site must be identified and planning permission from local authorities must be secured. It is also important to point out that starting small and organizing things so that buildings can be renovated and expanded (as interest grows, proof of concept is established, and more money becomes available) is a good way to proceed. It is also important to involve all the stakeholders as well as the community at large in this process. This is essentially a citizen design process, and it has great

potential for harnessing innovative ideas, such as developing non-conventional infrastructure that is locally and culturally appropriate.[37]

If a greenhouse is to be constructed, the position of the structure in relation to the sun, as well as in relation to the prevailing winds must be taken into consideration. The idea of constructing windbreaks (for outdoor gardens) and trombe walls for both inside and outside gardens must be evaluated, as well as the location of the site in relation to the village (accessibility issues). The design of a head-house must also be considered at this stage. A head-house is a building that is often built immediately adjacent to greenhouses as a place to install mechanical equipment and set up work space. Head-houses for northern community initiatives could include space for water tanks and pumps, furnaces, a phytotron (a small climate-controlled room for starting seedlings), work space (potting bench, work sink), classroom space, kitchen, washrooms, storage (space for communal tools and lockers for individuals), as well as processing and packing areas for preparing produce for sale.

13) **Securing Financial Support and In-Kind Support:** The creation of a robust, detailed business plan is the key to successfully completing this step. Based on all the planning done during the previous stages, the overall financial needs of the project should be clear at this stage. A business plan, along with a list of all the possible benefits of the project as well as the results of a whole-cost accounting exercise, will provide proof to funders that the project is not only worthwhile but also a good risk that will provide them with good visibility in return for their support.

While it might be possible, it is probably unlikely that the totality of the funds needed will be supplied by one single sponsor or investor. The reason for this is twofold: 1) the majority of projects will need a substantial amount of money, too much for one organization alone, and 2) most funding organizations wish to see that others (including the primary promoter) are involved in supporting the project and prefer to provide only complementary funding. Consequently, it is important to approach several different organizations for financial support, stressing to each that others will be involved.

While at first glance it may not seem that there are a lot of funding options available for northern agriculture projects, there are actually quite a few places where one can apply, especially if one considers the many different aspects of the project (e.g., social, environmental, public health, etc.).

The first places to apply for money to support the initial development of such projects are within the previously mentioned group of supporters—governments, NGOs, paragovernmental organizations, northern ethnic and non-ethnic organizations, universities, colleges, vocational schools, and research institutions, health boards and departments, and school boards.

[37] A pertinent example of one such initiative is the small greenhouse that was built in a Cree village in northern Quebec a few years ago. Instead of using metal, project promoters constructed the greenhouse frame from saplings, exactly the same way as a traditional shelter is constructed. They then covered the structure with conventional greenhouse-grade plastic sheeting, creating a new type of structure that was not only inexpensive to build but also incorporated local resources and traditional knowledge into a modern community project.

Other potential supporters include:

a. Industry (e.g., mining, construction, and hydro-electric companies): many companies have corporate social investment (CSI) programs or simply need to green their image;

b. Gardening suppliers, seed suppliers, greenhouse manufacturers, and soil suppliers: many are open to giving rebates or selling supplies at cost for a good cause;

c. Food stores, such as the Northern Store (North West Company) and the Coop Store (FCNQ): these companies are very aware of food security issues in the North and are willing to get involved in community initiatives;

d. Local private companies: these are often willing to contribute in-kind support;

e. National philanthropic organizations; and

f. Crowdfunding or crowdsourcing websites.[38]

It is important to be creative with the approach to funding and especially to remember that not all support needs to come in the form of dollar bills. In-kind support (in the form of materials, transportation of cargo, volunteer hours for construction and repairs, etc.) can be just as valuable as money. In fact, in-kind support often creates stronger ties and longer-lasting relationships with funders. More than one company that contributed to the Kuujjuaq Compost Project emphasized the satisfaction of increasing their involvement with the community and giving back.

14) **Building (or Renovating) Infrastructure:** At this stage the majority of the groundwork or background work has been completed, and it is now time to begin the concrete phase of construction (or possible renovation in the case of an indoor operation). How exactly this step will unfold will be largely based on the infrastructure plan elaborated in step number 12, as well as the type and amount of financial and in-kind resources secured in step number 13. Virtually all new construction in the North will need some sort of foundation pad, however, and this is something that should be built the year before so that it can settle and stabilize over the winter. This will lessen the risks of shifting and cracking (something that happens when buildings are erected too soon on not yet stable pads). The organization and installation of water, heating, and electrical systems is also something that will have to be planned for in advance. As well, if soil is to be used as the principal substrate, this must be sourced and delivered on site.

The two conventional options for appropriate community greenhouses in the North are: 1) importing ready-made greenhouse kits from the South (this option is generally more costly, though quite fast and simple), and 2) building a conventional structure from scratch with either new or locally available reclaimed materials (this method is less expensive and more time consuming; however, it is one of the best ways to get the community interested and involved in the project). A third option is to investigate the possibility of creating a new type of northern greenhouse model that is

[38] For example, a new American website called Barnraiser focuses on raising funds through crowdsourcing to help sustainable agriculture projects get off the ground (Barnraiser, 2014).

environmentally and culturally specific to the community, for example, a greenhouse shaped like an igloo or a quarmaq (traditional tent). If there is a desire to do something of this sort, it could make good sense to enter into a partnership with a school of architecture and/or a school of engineering, so that students and researchers could work with the community to plan something that is both environmentally and socially innovative as well as adapted to the northern reality.

One final note regarding the construction of the project infrastructure: it is important to make it look attractive and inviting. While this might seem like a trivial thing, gardening and composting can be a messy business, and this is something that could easily turn off people who are new to the activity or discourage future investors and potential supporters. It is therefore important not only to make the building and site look nice but also to make it possible to keep things clean and organized. Remember that bad news travels faster that good news and can do a lot of damage to a fledgling initiative.

15) **Starting to Grow:** This step is where all the months (and perhaps years) of planning and hard work begin to pay off. It is the end of the preparation phase and the beginning of the implementation and production phase. Project champions, a committee, managers, and staff or volunteers are all in place, the infrastructure is completed, and seeds are on hand; it is time to start. How exactly things will now unfold will depend on the type of project itself, whether it's a community or collective garden, school garden, horticultural therapy project, or commercial operation, and each situation will be different.

    However, one thing that is common to all types of projects is the need for a comprehensive operational plan. This plan can include things like detailed job descriptions and task lists, crop and cultivar lists, planting calendars, watering schedules, and harvest logs, as well as daily records of temperatures and soil conditions. While this might seem like a lot of unnecessary work, the importance of such a thing becomes evident in the event of staff or project champion turnover. Ideally, project stakeholders will stay with the project over the long term; however, high rates of turnover are a common reality in the North and a mechanism needs to be put in place to deal with this, since it is more than likely that all projects will experience it at some point in time. Planning and documenting daily operations and project history is therefore an essential aspect of any northern agricultural project, so that in the event of staff turnover new workers can easily access information on how to function effectively, thus efficiently maintaining operations.

    Having an opening ceremony or community feast to commemorate the official beginning of the project is something else that definitely should be considered. While to some it may seem like an unnecessary waste of time and money, it gives promoters the chance to showcase the project to those who would not necessarily otherwise be aware of it, and this can lead to an increase in community participation and community buy-in over the long term.

16) **Communications Strategy and Promotional Campaign:** While at first glance it might not seem essential, a communications strategy is a key element of a successful project. Not only will a communications plan serve to support a continuing dialogue

with the local community, but a well thought-out, beautifully branded, and trendy communications plan will also help to engage youth, especially if it can be demonstrated that gardening is not just "good for you" but also "cool."

A good communications plan can also be transformed into a campaign pitch that can be used to sell the project to potential promoters and supporters. As discussed in previous sections, the use of multiple types of conventional media (newspaper, radio, television) as well as social media (project website, email distribution list, Facebook) is key to the success of any communications strategy[39]. Partnering with the communications departments of local or regional organizations in order to access in-kind support for the development of this strategy, or working with students who study in this field (possibly through internships), can be a good way to get professional support for this. Finally, inviting the community to participate in this aspect of the project through a contest for the design of a logo or a name, for example, can also promote community engagement and support for the project.

7.2 Implementation Model

While the previous section detailed the steps to be taken in order to develop a project, this section will outline the types of projects that can be implemented at various stages in the development of a community food production program. The following model groups these projects and activities into a series of phases, beginning with the simplest projects in the first phase and broadening in scope to include more ambitious and complex projects in the later phases. It is important to note, however, that not every community that wishes to implement a new type of local food production strategy will go through all of these phases or will even necessarily start with the first phase. As well, many of the elements presented here make sense for Kuujjuaq, but other northern villages might wish to pick and choose or interchange and adapt these elements for a better fit with their local realities.

[39] The following are links to the websites of two successful northern community greenhouse projects:
- http://www.inuvikgreenhouse.com/
- http://iqaluitgreenhouse.com/

Phase 1: Small-Scale Community Projects (small organization and management structure)

- *Community Greenhouse*
  - Would focus on providing garden beds to community members for personal use.
  - Could provide educational opportunities for community members to learn about gardening.

- *Small-Scale Compost Project*
  - Could operate as a social reintegration program for people with disabilities.
  - Organic waste could be collected from food stores, daycares, construction camp cafeterias, hospital cafeterias, and restaurants.
  - Shredded paper (to mix with organic waste) could be collected from offices.
  - Bins could be provided for collecting compost from gardeners and other community members.

Phase 2: Larger-Scale Community Projects (need concerted organization and management)

- *School Gardening Program*
  - Plants would be grown inside, with an emphasis on lettuce and microgreens production (in soil and/or hydroponically).
  - Students would cook and eat the food that they produced.
  - Students could be involved in manufacturing and strategic throwing of flower bombs.
  - Flowers, houseplants, seedlings, flower bombs, and other products could be sold for fundraising.
  - A partnership could be established with the IPL program (Independent Program for Learning for special needs students).
  - The project could work in partnership with Culture teachers to teach students about topics such as traditional plants.

- *Collective Garden Program with Youth*
  - Garden beds could be provided in a community greenhouse or at a field site.
  - Students could design and build their own greenhouse.
  - Students could construct small greenhouses to sell to community members.
  - Food could be donated to Elders and those in need.
  - Flowers could be produced for occasions such as Valentine’s Day, Mother’s Day,and Easter.
  - Pumpkins could be produced for Halloween.
  - Students could participate in guerilla gardening around town.
  - Students could engage in manufacturing and strategic throwing of flower bombs.

- *Community Greening Program with Youth*
    - Program could focus on the constructionof window boxes and planters.
    - Window boxes, planters, and hanging baskets could be installed, planted, and maintained at the airport and municipal buildings.
    - Revegetation could be undertaken at new housing sites (using reclaimed soil from construction sites, compost, and native vegetation).
    - Youth could participate in a cemetery beautification project (e.g., installing planters at the entrance, mowing, planting, and maintaining flowers at plots).

- *Summer Camp Gardening Program*
    - Campers could tend a garden bed in the community greenhouse or at a field site.
    - Campers could engage in manufacturing and strategic throwing of flower bombs.
    - Campers could participate in a community greening program.

- *Daycare Gardening Program*
    - Small greenhouses could be constructed at daycares.
    - Plants would be grown inside, with an emphasis on lettuce and microgreens production (in soil and/or hydroponically).
    - The food produced would be cooked and eaten at the daycare.

- *Elders' Gardening Program*
    - Indoor gardening activities could be used for horticultural therapy.
    - A greenhouse or cold frames could be built for the production of vegetables at the Elders' home.
    - Elders could visit the local greenhouse.

- *Community Kitchen Program*
    - Produce from gardening programs could be cooked and preserved.
    - Meals could be distributed to Elders and those in need.
    - Partnerships could be formed with the wellness centre and the women's shelter.

Phase 3: Knowledge and Technology Transfer (essential step before considering commercial production)

- *Ties could be formed with training institutions (universities and technical schools) to develop:*
    - Training programs for northerners
    - Student exchanges

- *Ties could be formed with horticultural councils, agricultural producers' unions, agricultural ministries, and research centres to provide:*
    - Support with crops (cultivar selection, cultivation techniques, etc.)
    - Support with infrastructure development

Phase 4: Commercial Production (need serious promoters, managers, and trained staff)

- *Training and certification from federal and provincial food inspection agencies would be required.*

- *Ties could be established with local restaurants and food stores for the purchase of produce.*

- *Field Production*
    - Possible crops include potatoes, carrots, turnips, cabbage, onions, beets, rhubarb, and raspberries.
    - Cold frames or low tunnels could be used to produce fast growing cool crops such as herbs, lettuce, radishes, and bok choi.
    - Trombe walls and windbreaks such as low walls could be built to shelter crops and modify the microclimate.

- *Hydroponic Production*
    - Possible crops include lettuce, microgreens, herbs, strawberries, tomatoes, and cucumbers.
    - Alternative heat and energy generation strategies could be utilized.

- *Aquaponic Production*
    - The project could build on existing fish hatchery expertise.
    - Lettuce and trout production would be the easier and faster option.
    - Lettuce and char production would take longer but provide a more valued product.

- *Animal Production*
    - Chickens could be produced for meat and eggs, rabbits for meat and fur, and pigs for meat.
    - All of the above could be fed with organic waste from food stores.
    - All of the above could also be fed with lesser quality (non-saleable) produce from greenhouses.
    - Waste (manure, bedding materials) can be incorporated into compost.

- *Large-Scale Compost Operation*
    - An indoor vermicomposting operation would allow year-round production.
    - An outdoor windrow type operation could increase capacity significantly.
    - Shredding of paper and cardboard waste would divert significant amounts of waste from landfill.

7.3 Keys to Success

While there are many things that go into the creation of a successful northern greenhouse project or other northern agricultural initiative, there are five key elements that a project needs if it is not to struggle. They are:

1) Project champions;
2) Local governance;
3) Community engagement and support;
4) Good communication; and
5) Slow and steady pace.

There are also four other key things that project promoters can focus on in order to increase their chances of success. They are:

6) Partnerships;
7) Winning crops;
8) Focus on youth; and
9) Acceptance of mistakes.

Finally, there is one last thing without which no project will succeed in the long term, and that is:

10) Appropriate Timing.

This section will elaborate on each of the keys to success listed above.

7.3.1 Project Champions

As discussed in section 6.3.1, project champions are absolutely essential to project success. For example, even if there is no money and no community support, a project champion can still mobilize alternative resources and find other ways of pushing a project forward. Alternatively, even if all the financing is in place, the infrastructure is complete, and the community is on board, the project will not reach its full potential if there is no key person to organize and run things.

7.3.2 Local Governance

It is absolutely necessary that any new project be led, administered, and governed from the North. While there are many well-intentioned Southerners (based at southern institutions) who want to lead projects in the North, history has proven that the majority of southern-run projects fail in the long term. Locally governed projects, while perhaps more difficult to start, will not only lead to an increase in community capacity in the long term but will also generate community pride, something that no southern organization (no matter how well intentioned) can ever do.

7.3.3 Community Engagement and Support

It is a well-known fact that northern villages have strong community pride and community spirit. This is, therefore, a type of social capital that project promoters owe it to themselves to tap into. While it must be admitted that involving the community in the process of designing and creating a project can sometimes be time consuming, frustrating, and generally cumbersome, the end results are well worth the effort, as it will greatly increase the chances of the project's success, since the rate of community buy-in and community adoption and appropriation of the project will be much higher.

Examples of ways to engage the community through more than just feedback on project development include public outreach events, such as ground-breaking ceremonies and community feasts, harvest events, and volunteer days to help build infrastructure, as well as tasting tours and open-house days. Engaging the community can also involve having demonstration projects or viewing galleries (this is especially pertinent for commercial projects). Partnerships with local restaurants (which can cook and serve local produce) will also increase visibility and interest for both locals and visitors alike.

As noted almost thirty years ago by Romer (1987: 128) in his report on the Pond Inlet solar greenhouse project:

> It has been clearly demonstrated that the success of new northern ventures is contingent upon active community acceptance and participation. It is strongly recommended that subsequent projects undertake a collaborative approach to development with existing community organizations and local residents. Involvement should include employment and training of native residents, encouragement and assistance of local gardeners and educational tours and courses.

7.3.4 Good Communication

As discussed in previous sections, good communication is the best way, not only to engage the community, but also to ensure that the needs and wishes of all project promoters and stakeholders are being met. Miscommunication and lack of communication are the root cause of many, many problems, so it is logical to conclude that spending time on the development of comprehensive internal and external communication strategies can help avoid pitfalls that could impede project development.

Further, and as mentioned before, a good, strong marketing campaign that makes growing and eating local foods cool and fashionable (not just healthy) will go a long way towards generating interest in the project. An example of an inspiring strategy that targets the growing problem of food waste is the "Inglorious Fruits and Vegetables" campaign in France. A fabulously trendy campaign, it has enchanted young and old alike, while at the same time addressing a very serious food security issue and getting the public to engage in changing things for the better. It is also worth noting that this campaign has increased the overall patronage of participating stores, so there is a good economic argument as well as a social one in support of this initiative.[40]

[40] See the following link for further information on the Inglorious Fruits and Vegetables campaign: https://www.youtube.com/watch?v=p2nSECWq_PE (Intermarché, 2014).

7.3.5 Slow and Steady Pace

One of the most commonly heard pieces of advice from local leaders during the course of this research was the importance of starting small, going slowly, and planning for the long term. The importance of not imposing ideas on a community that is not ready for such a project was also stressed. It is therefore pertinent to perhaps envision starting with small pilot projects (e.g., growing peas or potatoes outdoors in cold frames made from recycled materials or growing lettuce and microgreens indoors on windowsills) to not only establish proof of concept but also generate interest and support concurrently. It is also important to remain patient and not necessarily expect things to move ahead as quickly as desired. It is very common for a community-based project to take longer to evolve than other types of initiatives, and this is especially true in a northern context where extra challenges and difficulties may be encountered.

7.3.6 Partnerships

The importance of developing partnerships cannot be stressed enough. Northern greenhouse and northern agriculture projects are multifaceted initiatives that need input and expertise from many sectors to be successful. Depending on the scale of the initiative, they can also be costly to implement. Therefore, there are many arguments for building and maintaining a strong network of project supporters and backers. It is important to remember that, while it may seem daunting to begin the partnership building process, northern agriculture projects are novel and appealing, and if properly presented, they will definitely generate curiosity and motivate potential partners to join the team.

7.3.7 Winning Crops

Deciding which crops to grow in the context of a new northern greenhouse or northern agriculture initiative can be daunting, since there are so many factors to consider. For example, even though the most regularly consumed vegetables in the North are onions and potatoes, it might make more economic sense to grow fragile, highly perishable produce (e.g., strawberries, lettuce, micro-greens, or herbs) and to continue to import less expensive and long-lasting vegetables (e.g., potatoes, onions, carrots, cabbages, and beets). This said, the long lasting vegetables are the ones that would grow well in fields, and if there are enough spin-offs from a whole-cost accounting perspective (e.g., job creation, social re-integration, and education) then it would still make sense from both a community development perspective and an economic perspective to engage in the field production of vegetables.

As well, given the resounding positive response to the question of strawberry production during the course of this research, I think that this would be an ideal crop to use to promote any new greenhouse or agriculture project. Growing strawberries would be a very good way to generate motivation and interest in new projects. We know that this is already a very prized food crop (they fly off the shelves as soon as they arrive in the food store), kids love them, and they grow well in soil, as well as in hydroponic and hybrid growing systems both indoors and out. Since this is a berry we are talking about, there are also parallels to be drawn with traditional cultural activities. Finally, there is much expertise in growing strawberries in Quebec; therefore, the potential for technical support and partnerships is very real.

Growing native plants such as “Qunguliq” (mountain sorrel) and “Malitsuagaq” (seabeach sandwort) is also something that needs to be considered, since not only is it technically possible (and they grow bigger and faster in a greenhouse environment), but there is much cultural significance to doing so. As noted in one of the first technical reports on the subject:

> …the use of native plants as cultivars in the Arctic has distinct cultural, nutritional and horticultural advantages over the use of conventional cultivars and should be thoroughly examined.
>
> (Romer, 1983)

Growing native plants would be an innovative way to combine traditional culture with modern technology, something that is very appealing to many Northerners.

7.3.8 Focus on Youth

Previous sections have noted the value of engaging youth in all aspects of project development, not only to ensure the future of the project but also to realize a variety of positive spin-offs, such as skills development and the bolstering of confidence, pride, and a sense of self-worth among those participating. As with engaging adult community members, engaging youth will involve communicating in a way that avoids patronizing and authoritative attitudes on the part of project organizers. Young children and youth will have to want to come towards the project on their own. When they have shown an interest, involving them from the beginning will be important, so that they know that their contributions are valued.

Making each step of project development a training opportunity can be a way to directly involve youth. This could be done, for example, by having students partner with mentors to work on the communications strategy or aspects of construction, such as the installation of heating and plumbing systems. The creation of exchange programs (possibly with 4H clubs or vocational schools), through which northern students could spend several weeks in the South learning about farm life or urban gardening and southern students could get the chance to participate in a community greening project in a northern village, could also be very effective strategies for involving youth. Also, programming with countercultural overtones (e.g., guerilla gardening and flower bombing) can be a very good way to interest and motivate youth.

7.3.9 Acceptance of Mistakes

One of the most difficult things for project promoters to accept is that mistakes will happen. In all new initiatives problems will occur, especially when least expected. Yet, if one plans for this, and accepts that the development of a new project is a fluid process and that it will almost never evolve exactly in the way that it was planned, it is sometimes easier to avoid getting discouraged and to get back on track after problematic events. It is important to remember that things such as transportation delays, technical problems, and personnel issues are all entirely normal, especially when doing new and innovative things. While it may sound trite, problems must be faced with grace and patience and looked upon as learning opportunities. In sum, one must remember that mistakes are all a normal part of the process when developing new and innovative initiatives.

7.3.10 Appropriate Timing

The final key to getting any new project to last is an ephemeral element that no one has any control over: appropriate timing. In other words, all of the previously listed elements have to be in place and/or come together at the right time. There is not much else to say on the subject, except that no amount of hard work or goodwill can overcome certain larger forces that sometimes conspire to work against even the best intentioned project promoters—sometimes one just has to put the project on the back burner and wait until all the key elements fall into place before trying again. This comment is in no way meant to discourage; on the contrary, it is meant to show that it is natural that not every project will get off to a perfect start. Sometimes it is best to just wait and relaunch when the timing is right. Adopting this approach will help guard against disappointing failures and will ensure long-term success.

I want to end this chapter with an observation made by Loring and Gerlach (2010: 1). These authors suggest that northern agriculture should not be viewed "as an exclusive means of subsistence, but as one of many equally important components in a flexible and diversified subsistence strategy." I am entirely in agreement with this statement, since it would be unwise to rely on just one approach to food security. I would argue further that policy planners should still put a good deal of energy into promoting and supporting country food acquisition strategies in the North. This is especially true in an Inuit context because of the cultural significance and many health benefits of traditional food. It is also important to remember that traditional food is the *ne plus ultra* of local food strategies.

This said, it should be recalled that Inuit in Nunavik currently meet 80% of their dietary requirements through the consumption of market food, a significant percentage of which could, in theory, be produced locally. I am not advocating a complete ban on "imports"; it would be unreasonable to assume that all types of food that are currently enjoyed by Nunavimmiut can be produced locally (especially flour, tea, milk, apples, pasta, etc.), but I do think that a well-planned, well-executed local food production strategy could produce significant volumes of certain types of vegetables, as well as some fruit (perhaps strawberries and raspberries) and eventually, maybe, eggs and some types of meats (for example, chicken, rabbit, and pork). As well, not to be overlooked are the significant social and economic benefits that a local food industry could bring about, as well as the educational and environmental spin-offs—all things that could lead to a definite increase in the overall community capacity of northern villages. As noted in a recent report: “A commercial or community greenhouse is not *the* solution to northern health and food security, but it is certainly *a* solution. A local greenhouse can contribute not only to improved health through better quality and nutritious foods, but also science education, skills training and community pride and well-being” (Exner-Pirot, 2012: 1-2).

Chapter 8.
A Future for Northern Greenhouses?

The idea of developing northern greenhouses is receiving more and more attention every day. The reason for this interest is twofold: first, the harsh realities relating to food security in Canadian Aboriginal communities have received increased attention in recent years (the "Feed My Family" campaign and the report of the UN Special Rapporteur on the Right to Food are two prominent examples), and second, the federal government and the Quebec provincial government have both demonstrated a significant interest in the North of late. Given this context, more and more organizations are demonstrating interest in exploring ways to address food security in northern and remote regions. Consequently, many people are now seriously starting to consider producing food in the North as an alternative to the costly and complicated air, sea, and overland shipping strategies upon which northern communities presently rely to meet the bulk of their food needs.

One of the threads that has run through this entire research project—from the very beginning until this day—is the question of whether or not Inuit will accept and embrace agriculture as a response to food security concerns. Inuit are of course hunters and gatherers (who still regularly practice these traditional activities as part of their daily lives), and agriculture, while it has been present to differing degrees in the North for generations now, has never been considered a traditional activity by Inuit. This said, the results of this research show that more and more northerners—Inuit included—are demonstrating curiosity about and manifesting support for agricultural projects, notably greenhouses and gardening. Drawing upon the information and results presented previously, the first section of this chapter will examine the issue of the social acceptability of agriculture in Inuit communities as well as the idea of cultural syncretism as it relates to the evolution of food strategies in the North. The second section of this chapter will examine the principal outcomes of this PhD project by summarizing the results of the research and revisiting the original research question upon which this work was based. This will be followed by a discussion of areas of interest for further work and some concluding thoughts.

8.1 Northern Agriculture and Northern Culture

8.1.1 Social Acceptability of Northern Agriculture

When I first began working on this subject in the spring of 2009, the primary research question that I began with was: "Is the building of greenhouses in Inuit communities a socially and culturally acceptable way to augment food security in the Canadian Arctic?" At the time, I was also wondering if new food strategies could help communities to reconcile traditional mores with modern needs. As well, these types of questions that I was asking myself were also being asked of me by virtually everybody with whom I spoke to about my new research project. For example, I was regularly asked whether Inuit would be interested in such a project, would they become involved, and did Inuit even eat southern types of fruit and vegetables? The question of whether or not agriculture (and by extension a greenhouse project) was socially and culturally acceptable to Inuit thus became fundamental to answer. However, obtaining this answer was neither quick nor easy, nor is it what I now have to say on this subject definitive. Rather, the only answer that I am comfortable putting forth is that I think that northern agriculture *will become* acceptable to Inuit over time.

Agriculture is not a traditional activity, and some Inuit—especially Elders and hunters—are reticent to support the idea. Nonetheless, many Inuit do support the development of agriculture in the North. As shown in the results section, Inuit have slowly begun to integrate increasing amounts of agricultural produce into their daily diets. This process began as long ago as the beginning of the fur trade, when Inuit began making bannock with flour (a wheat product imported from Europe and/or southern Canada) and drinking tea, which is grown in Asia. This continued with the incorporation of hearty, long-lasting vegetables—such as onions, potatoes, turnips, and carrots—into traditional meals like caribou stew. It continues to this day with the ever-increasing consumption of things like lettuce, tomatoes, bananas, oranges, and strawberries grown in as faraway places as California, Florida, Mexico, and the Caribbean. So, without actively practising agricultural activities, Inuit are today nonetheless participating in the modern agricultural system. It takes no great stretch of the imagination, therefore, to envision that Inuit will soon become more and more interested in physically producing the foodstuffs that they already consume, just as they have always procured food from their land through traditional harvesting activities.

Because a large part of Inuit traditional knowledge is anchored in territory, this idea of creating food through agriculture can be contextualized in terms of maintaining a balance between the development of new food resources and the preservation of the cultural heritage associated with territory. In this way, the growing of fresh produce blends harmoniously with the tradition of "food craft," a tradition that has always concretely linked Inuit to their environment and fostered the sociocultural development of communities. However, in this context the main difference between traditional ways of producing food in the North (going on the land) and this new alternative way is that, in engaging in agriculture, food can now be produced much closer to communities, even directly inside the community in many cases. This means that, in addition to new ways of producing food, there will also be the creation of new places and new spaces where food is crafted, essentially leading to the creation of new landscapes—and new geographies—of northern food production.

For this to happen however—for Inuit to begin practising agriculture in a concerted way, and to begin actively building new types of spaces dedicated to food craft—a certain amount of knowledge sharing and knowledge transfer must happen. While this is an essential step, it is also a step that is fraught with the possibility of pitfalls, notably due to cultural differences between Qallunaat agricultural experts and Inuit. If the process of knowledge transfer happens slowly, through intermarriage for example (where one spouse or extended family member teaches the other how to garden, and then children and grandchildren learn from their parents), then the potential for tension and conflict is relatively small. However, if there is a desire to move forward with larger-scale, concerted, and strategic agricultural projects (e.g., community greenhouse projects, commercial operations), then the potential for tension between Northerners and Southerners increases. This is simply because the amount of time for all actors to get to know each other is compressed, and the knowledge transfer process—instead of remaining organic, fluid, and slow—becomes instead formalized and in some cases forced, thus setting the stage for possible tension and conflict as we saw described in Chapter 5 during the early phases of the development of the Kuujjuaq Greenhouse Project.

An event that happened during the course of this research illustrates well the type of misunderstanding that can lead to conflict between Qallunaat and Inuit, even when all actors involved are well intentioned. During the summer of 2011 in Kuujjuaq, certain Southerners who had recently moved to Kuujjuaq became frustrated with the fact that some Inuit gardeners did not adequately weed their garden plots in the greenhouse—something that is accepted horticultural practice—and this led to a certain amount of tension between some individuals. However, some weeks later, a theory as to why some Inuit garden differently than Southerners was put forward by a community leader. Upon discussion of the subject, it was pointed out that Inuit do not weed the land of non-useful plants—instead they simply pick berries from among the many different plants that grow on the land. Why would you clean nature from nature after all?

This small conflict speaks to the fact that if Southerners want northern agricultural projects to be successful, they have to accept the fact that Inuit will change and adapt horticultural strategies so that they make sense in their own cultural context; only then will agricultural practices begin to be truly accepted and adopted into the daily lives of Northerners.

8.1.2 Cultural Syncretism and the Development of New Northern Food Strategies

Many have commented on the adaptability of Inuit in the face of change, most notably on the challenge of successfully integrating new technologies into their lifestyle while continuing to protect the integrity of traditional ways of living. Nowhere is this more evident than in the realm of food preparation and consumption. As discussed previously, certain meals labelled as traditional today contain foods that are not indigenous to the Arctic (e.g., carrots, turnips, potatoes, onions, rice, flour, and pasta), yet because they have been available to Inuit for decades, even centuries in some cases, they have become integrated into Inuit culture. Food, a necessity of life, is one of the defining elements of culture. It not only helps identify and bind together people who share the same roots, but it is also one of the elements that distinguishes and differentiates one group of people from another. No one culture lives in a vacuum, however. Cultures have always come into contact with one another, and in the present era of globalization that contact is now much more frequent. Whether through positive reciprocal encounters (trade, intermarriage, etc.) or negative domineering ones (war, colonial occupation, etc.), these contacts have always led to different aspects of culture (food, tools, clothing, religion, etc.) being shared—and in some cases adopted from one culture and integrated into the other. This act of adopting and integrating something useful from another culture into one's own is called cultural syncretism, and it is a phenomenon that has been documented the world over all through history.

The term syncretic behaviour is also often used to describe situations where people combine elements from two different cultures, and Inuit in Canada are no different than any other group of people in this regard. When one looks closely at modern-day Inuit culture, many examples become obvious—some very recent, some hundreds of years old, and many relating to food. For example, as mentioned in Chapter 1, eating traditional food while sitting at a table instead of on the ground is considered syncretic behaviour (Searles, 2002: 73). Other examples specific to Inuit food practice include using guns, snowmobiles, and sea canoes to hunt, or using snowmobiles and helicopters to herd reindeer (ICRH and AWRH, 2014). As mentioned in the previous section, the adoption of bannock and tea—now considered traditional Inuit food—is also a classic example of syncretic behaviour. Using and applying scientific knowledge and new technologies concurrently with traditional knowledge while practising land-based activities (i.e., hunting, fishing, berry-picking) is another example of how Inuit have syncretized the traditional and the modern in order to best adapt to current realities in the North.

A very recent example of cultural syncretism as it relates to Inuit and food is the preparation and consumption of sushi in Nunavik. While at first glance it might seem completely incongruous, upon reflection the parallels between this quintessential Japanese food and traditional Inuit food become obvious; notably, the use of raw fish, but also the use of seaweed. Today, Inuit of all ages regularly use local fish that they have harvested in order to make this highly regarded treat, which is regularly eaten at special occasions. It is also common for sushi to be sold on Facebook, at community events, and even as fundraisers for school events.

Examples of cultural syncretism and syncretic behaviour are also present in other aspects of Inuit daily life today. For example:

- Traditional Inuit music and dancing (i.e., fiddle and accordion accompanying square dancing). These arts have been adapted and adopted from Euro-Canadian culture introduced by Qallunaat traders and missionaries;
- Modern Inuit music that melds traditional throat singing with electronic instruments;
- Crocheting traditional Inuit wool tuques and sewing traditional wool duffel boot and mitten liners (wool has always been imported; there are no sheep farms in the Canadian Arctic);
- Sewing traditional-style clothing with modern tools (sewing machines) and modern materials (e.g., cotton/polyester blends and synthetic insulation) instead of using natural animal skins and eiderdown;
- Sewing traditional-style parkas and emblazoning them with brand-name logos such as “Nike,” “Puma,” and “North Face” (now a common practice among Nunavik teenagers);
- Dying sealskins vibrant colours and using them for the creation of handbags, wallets, cell phone cases, and jewellery (e.g., earrings, bracelets., broaches and hair clips); and
- Integrating elements from traditional Inuit games into conventional forms of martial arts.

All of these examples are things that have happened slowly, over time, and the development of these practices have all been driven by Inuit themselves, not by Southerners. However, while the focus of this section is on cultural syncretism in an Inuit context, it is important to underscore the fact that this phenomenon works in both directions. Many elements of Inuit culture have in fact been integrated into mainstream Canadian culture. For example, the dog sled and the igloo are icons of the Canadian brand, and the inuksuk was used as the official symbol of the Vancouver Olympics. It must also be mentioned that cultural syncretism is taking place every day across Canada; it is not a phenomenon unique to small ethnic groups. One has only to think of the ubiquity of such food items as coffee, orange juice, pasta, pizza, spring rolls, and, of course, sushi in southern Canadian towns and cities. Virtually all Canadians of my generation have tasted these foods, and likely consider them common fare today, yet the appearance of these food items on the shelves of our food stores and in restaurants is actually relatively recent. Cultural syncretism is an ongoing, ever emergent phenomenon that happens in all societies. With the increase in global travel and global connectivity I posit that it will only continue to increase, affecting all aspects of the daily lives of all Canadians, Southerners and Northerners alike.

It is for this reason that I think that northern agriculture will become acceptable to Inuit over time. As has happened throughout history the world over, people look at what is happening elsewhere, and adapt and adopt elements of other cultures that they find useful, subsequently making way for the creation of new traditions. I believe that as food security issues become more pressing in the North, and as Northerners begin to realize that they can effectively address these issues in alternative ways, we will begin to see a new type of cultural syncretism in the North, something that I would term "northern agri-cultural syncretism". As illustrated in the schematic below I foresee four principal steps in the process of northern agri-cultural syncretism.

TABLE 6

Process of Northern Agri-Cultural Syncretism

INTRODUCTION

Agriculture and agricultural techniques are introduced to Northerners by Southerners.

⇩

ADAPTATION

Agriculture and agricultural techniques (including crops and cultivars) are adapted by Northerners to their environmental and social realities.

⇩

ADOPTION

Appropriate agriculture and agricultural techniques are adopted into the northern lifestyle (i.e. new types of education and employment opportunities are created and new types of food are included in the northern diet).

⇩

INTEGRATION

Agricultural production and consumption of locally grown and/or raised food become a normal part of daily life in the North. While never to be labelled traditional in the classic sense of the term, new types of food will become conventional and will be integrated into new types of meals that may eventually be labelled traditional.

I believe that this process of northern agri-cultural syncretism is something that will happen in Nunavik, no matter what, since it is already happening on a small scale at a natural pace today. Many Nunavimmiut have already been introduced to agriculture through friends and family members and have begun practising the art and science of horticulture at their homes or at community greenhouses. However, in some cases, Inuit have begun experimenting with cultivation on their own terms, without input from Southerners. Alasie Joamie is an Elder from Nunavut who did just that. The following is an excerpt from her book, in which she describes her long relationship with plants, both Arctic plants and Qallunaat plants:

> I would make mental notes about which [tundra] plants were edible. I would remember places where they were found. I would always have plants that I liked with me. I was around ten or eleven when I first began experimenting with cultivating plants. I would use old tin cans for potting them. We lived in an area where there were no Qallunaat, so I only found tin cans once in a long time. My mother often prepared skins while I planted flowers. She would always say to me, if you appreciate them, they will grow. If you like what you are doing, they will grow well. Then I began to plant flowers in the moist soil. … I would keep *malikkaat* (mountain avens) for flowers. It wasn't long before they would bloom. Throughout my life, I have been interested in plants. I have always inquired about them. When I am walking by myself, I feel thankful for all the plants. I appreciate that they are food. As an elder, I have turned to the flowers of the Qallunaat as well. It is as if I am unable to live without plants. I really like plants.
>
> (Joamie and Ziegler, 2009: 7-9)

This quotation is a beautiful example of agriculture being slowly woven into traditional Inuit mores. If concerns about food security were not increasing on a daily basis in the North, it would make sense to leave well enough alone and just let the process of cultural syncretism continue at this type of natural pace. However, food security in the North is a very real, very urgent problem that needs to be addressed now. Where leaders and politicians can make a difference here—if they are serious about addressing food security needs in a comprehensive and timely manner—is by putting in place policy and programs in order to speed up this natural process. For example, if training programs are developed, if community greenhouses are built, and if support is made available to northern entrepreneurs, we can shorten the time it will take for agriculture to become solidly implanted in the North. This said, while certain things can be done to speed up the natural process of agri-cultural syncretism, it will be important to not push ahead too fast, because there is always the danger of creating a space where tension and conflict can emerge. As stated by Nunavut Elder Alasie Joamie:

> Our parents taught us not to rush into making decisions. They told us to take our time and to have clear minds. This is how I kept my composure through the many changes that occurred. I am telling the younger people now that they must be prepared for change. Do not get lost in the rapid changes in our lives. Many things come from the Qallunaat that are not in our traditional customs. We must be prepared for these changes. Be prepared as we have been taught to be prepared.
>
> (Joamie and Ziegler, 2009: 14)

What is called for in this case is balance, something that is one of the founding tenets of the sustainable development strategy put forth by the First Nations of Quebec and Labrador (FNQLSDI, 2006: 11). This idea of balancing the new (or southern) with the traditional (or northern), and going ahead, but going slowly, is not new and it not only resonates with Alasie Joamie's philosophy but resonates with conclusions from a study on Inuit management training commissioned by the Inuit Tapirisat of Canada in 1976. The authors of the study make the point that southern ways of doing things will not be successful in the long term in the North and "will not allow for real Inuit control over the future" (Styles and Lloyd, 1976: 49). As noted by Fr. Le Chat, who was interviewed for this study:

> While southern management principles can be incorporated into a training program for Inuit, it should not be expected that Inuit businesses or management would be run as they are in the south. One must give a man the material to make a suit of clothes for himself. One must not expect the man to fit the suit that is already made.
>
> (Styles and Lloyd, 1976: 49)

Making a suit of clothes by oneself, with the material given, parallels the idea of adapting agriculture to the Inuit reality. Southern experts can introduce techniques and knowledge (and be there to offer advice and support), but it will have to be Inuit who take the lead in adapting agriculture to the North if ever it is to be truly adopted and integrated in a way that will have a positive and lasting impact.

8.2 Principal Outcomes of this Research

8.2.1 Summary of Results

While this research focused on the evolution of the Kuujjuaq Greenhouse Project, notably during the summers of 2011, 2012, and 2013, it is important to emphasize that this project is ongoing. The community has most definitely adopted the idea, and not only are there several local project champions backing the project, but there is an active committee in place and a strong network of supporters. Indeed, the 2014 season saw a number of important successes. Both community greenhouses were filled to capacity, with over forty beds in use and a small collective garden was set up in the old greenhouse; some garden beds, maintained by the committee, were set aside to produce vegetables for Elders; a cabbage test bed was started; the compost collection program continued into its third year; and greenhouses were constructed at both daycares. See Figures 63, 64, and 65 for images from the 2014 Kuujjuaq Greenhouse Project season.

FIGURE 63 Interior view of new greenhouse; collective garden in old greenhouse.
Photos: Author's personal collection

FIGURE 64 Summer cabbages did well in 2014, as did strawberries.

Photos: Author's personal collection

FIGURE 65 Interior and exterior views of new greenhouses installed at both daycares.

Photos: Author's personal collection

The goals of the Kuujjuaq Greenhouse Project included examining and addressing three main issues:

1. Food Security;
2. Economic, social, and environmental sustainability; and
3. Social challenges, especially those that affect children and youth.

After five years of concerted community-based participatory research, I feel that we have thoroughly examined these issues and that the outcomes of the research point definitively to six key reasons why the development of northern greenhouses and northern agricultural projects should be supported. These reasons can be summarized under the following headings:

1. Food Security and Food Sovereignty;
2. Social Benefits;
3. Environmental Benefits;
4. Economic Feasibility;
5. Technical Feasibility; and
6. Social Acceptability.

In terms of food security and food sovereignty, we know that both of these can be substantially enhanced through the local production of healthy, good quality, fairly priced fresh fruit and vegetables. Regarding social benefits, there are many, the most significant being job creation, education, social reintegration, enhanced nutrition, and positive impacts on mental health. The environmental benefits of northern greenhouse projects are manifold as well; however, the most notable are the reduction of food-miles and the carbon footprint associated with transportation, as well as the diversion of waste from landfill sites through the creation and implementation of compost projects. Northern greenhouses can also be economically feasible. We now know that they can be economically competitive if alternative heating methods are used (e.g., use of biomass as fuel and capture of waste heat), and if they are elaborated in larger villages and/or the produce distribution networks encompass several villages. We also know that northern greenhouse projects can be very advantageous from a whole-cost accounting perspective. The technical feasibility of northern greenhouses has also been proven. We know that low-tech options that operate only during the summer season (and have no external inputs such as extra heating or lighting) can be very effective for community gardens and small personal projects. As well, medium-tech options which require only a few external inputs (i.e., minimal heating and lighting) can be very useful for extending the northern growing season to between six to eight months. Also, high-tech options, such as indoor agriculture, hydroponics, and aquaponics are technically possible and would enable the year-round production of certain types of fresh vegetables in northern communities. We also know that many crops grow well in different indoor and outdoor situations. Thus, a relatively wide selection of fruits and vegetables could be envisioned in any new northern agricultural production strategy. Finally, the social acceptability of northern greenhouses has been proven. Certain types of vegetables have been part of the northern diet for generations (e.g., onions, potatoes, and carrots). Nunavimmiut also identify parallels between agriculture and traditional food procurement strategies: for example, obtaining food from the land and pride in being able to produce food for one's family. As well, many Nunavimmiut (especially youth) are open to trying new things, and more and more communities are now asking for greenhouse projects. There is support from residents, from all levels of government, and from local, regional, and national businesses for these types of alternative food production initiatives.

In sum, change in the North is happening rapidly and is affecting all aspects of society in Nunavik. This change, that is being imposed mostly by externally generated pressures, requires an appropriate endogenous response. This type of situation can set the stage for innovative solutions that not only facilitate adaptation but also enhance resilience. Projects that revolve around food are perfect places for innovative ideas to emerge, because food touches everybody and food projects can generate multiple valuable spin-offs. As with the Kuujjuaq Greenhouse Project, any new innovation will start small. Ideas will be tested and proven. Once proven, ideas will start to spread and catch on and interest and support for new things will grow. The point when something starts to spread, when it is impossible to stop, is the point at which a need is being met in an appropriate way and the technical feasibility and social acceptability of an innovation have been proven. I believe that this will be the case with northern agriculture, and that we will see many different, community-specific, types of agri-cultural syncretism evolve in northern villages in the years to come.

8.2.2 Re-Examination of Research Question

In examining the outcomes and results of the Kuujjuaq Greenhouse Project, it is evident that the results presented here fully respond to the initial research question. It now genuinely seems as though "a new type of greenhouse-based local food strategy in Nunavik can be a sustainable, culturally appropriate initiative (that can contribute to community capacity development) if it is informed by ecological design, grounded in Inuit praxis, and developed in a manner that meets the distinctive current and future needs of Inuit communities."

Because northern greenhouse projects address not only food security issues but also many other issues of concern (e.g., socioeconomic challenges), and because they have very little environmental impact and indeed address pressing environmental concerns, they are truly sustainable endeavours. As evidenced by the increasing interest and support for northern agriculture and northern greenhouses specifically, as well as the emerging trend towards agricultural syncretism, we can also say with certainty that northern agriculture will become socially acceptable to Inuit over time. We also know that by addressing challenges through the use of local resources, we will be able to create projects that meet the standards of ecological design and, in this way, concretely contribute to the development of community capacity. Finally, by providing the time and the space for Inuit to adapt agriculture to northern realities—by making room for the creation of new community-based landscapes for crafting food—we can be sure that northern greenhouse projects will be developed in ways that will meet the distinctive current and future needs of Inuit communities. Overall, what this research shows is that the process of developing and implementing alternative (greenhouse-based) food security strategies in Nunavik is one that has resulted in a type of budding social innovation that is leading to positive community development in multiple overlapping and complementary spheres.

8.3 Areas of Interest for Further Research

While this first exploratory phase of research on northern greenhouses has been conclusive, it has come to an end. This said, research on the development of new food strategies in the North is far from complete. There is still much work to be done and, judging from the interest that is manifesting itself from all sectors, there is a willingness to invest in and to support such ongoing research.

Based on the results of the first phase of this research, the following is a shortlist of subjects that I feel merit further in-depth research and development in a northern context, as work in these areas could go a long way to furthering not only food security but also community development goals.

- Community kitchens;
- Horticultural therapy;

- Community greening and revegetation;
- Indoor Farming;
- Hydroponics;
- Aquaponics;
- Strawberries and raspberries;
- Microgreens;
- Fresh herbs;
- Field production of root crops and cabbage;
- Identification of best market garden cultivars for northern initiatives;
- Identification of options for fertilizers and soil amendments (e.g., seaweed, fish waste);
- Composting and vermicomposting;
- Advanced Ecologically Engineered Systems ("living machines") for wastewater treatment and flower production;
- Methane capture from landfill sites for energy production (heating greenhouses);
- Methane digestion of sewage and organic waste for energy production (heating greenhouses);
- Co-generation (burning waste biomass) for energy production (heating greenhouses); and
- Capture of waste heat from diesel generating stations for heating greenhouses.

As well as targeted research on specific subjects, there are two other things that would greatly assist in the development of new northern food systems. One is a comprehensive, user-friendly database, and the other is a dedicated research centre.

The creation of a user-friendly database in order to comprehensively document current and past northern agricultural initiatives is a tool that many people (both researchers and community members) have expressed a desire for. The idea of a database has come up in discussion multiple times over the years, notably in conjunction with the phrase "there is no use re-inventing the wheel." Because information on previous initiatives is not readily available, new project promoters are always having to start from scratch instead of simply building upon the knowledge of previous northern gardeners and researchers. For this database, I envision a virtual platform where information would be classified not only by geopolitical boundaries (Nunavik, Nunatsiavut, Greenland, etc.), but also by geophysical region (boreal forest, subarctic, permafrost zone, etc). This database could serve not only as a platform for discussion and knowledge sharing, but also as a repository for a virtual library of documents and internet links pertaining to northern agriculture.

The idea of a dedicated "Institute for Arctic Agriculture" or other similar organization has also come up in discussion, notably among researchers and experienced gardeners and farmers who are already working on northern agriculture projects. While many small initiatives exist, notably in Alaska, Greenland, and the Northwest Territories, it is rapidly becoming obvious that it would be very useful for there to be a more comprehensive, pan-Arctic institution to facilitate collaborative research and knowledge sharing across borders. A specialized training institute for those interested in developing and pursuing agriculture in the North would also be of great service. The Circumpolar Agriculture Association as well and the UArctic Thematic Network on Northern Food Security could perhaps be good places to start building up a research network that could eventually form the core of such an institute.

8.4 Conclusion

Inuit are experiencing rapid change in all aspects of their lives, including changes to their traditional and conventional food provisioning strategies. A rapidly growing population, as well as the numerous socioeconomic challenges in the North, mean that new ways to address the increasingly urgent question of food security must be imagined. In the present context of rapid climate change and accelerated development in the North, it is now also becoming increasingly evident that concerted action must be taken to ensure not only the food security of all Northerners but also the sustainable socioeconomic development of northern communities, so that capacity and resilience in the Arctic can be maximized.

On the basis of the results of this research, I believe that greenhouse-based local food production strategies can be a way to help achieve these multiple goals, not only in the North, but in any remote community that wants to address social, economic, and environmental concerns through food-based projects. I think that there is no question that the impacts and outcomes presented in this thesis have resulted in significant and positive impacts in Nunavik, and I believe that these could definitely be repeated elsewhere.

Within this context, I feel that there is indeed a future for northern greenhouses. The proof is the interest in this type of endeavour that is manifesting itself in multiple sectors of Canadian society. This research—and the research of others before me and of other colleagues working on similar subjects in diverse northern regions—has proven the technical feasibility and social acceptability of northern greenhouse initiatives. Now we must continue mobilizing political will and community support for this new type of innovative and sustainable food strategy. However, it will probably not be necessary for researchers to lobby too hard for this, because communities themselves are now actively mobilizing and asking for help in starting new projects. In 2014 in northern Quebec alone, interest in northern greenhouses and northern hydroponics is growing fast, and this phenomenon is being paralleled in other regions across the Canadian North. This steady growth in interest is concrete proof that there is definitely a future for northern greenhouses and northern agriculture in general.

This said, it is important to take a minute to address one of the most commonly voiced concerns regarding new types of greenhouse-based food projects in the North; the question of whether it would not be more environmentally sustainable and culturally appropriate to focus on traditional foods instead. As I stated previously, I am not advocating replacing country food. I am simply advocating for a new type of local food strategy that would complement traditional activities. I am doing this for two main reasons. The first is that Nunavimmiut already consume fruit and vegetables that they purchase at food stores, so it simply makes sense (where technically possible) to grow them locally, since this could generate many environmental and socioeconomic spin-offs. The second reason is that if everybody in Nunavik increased their consumption of country food, it would be impossible to meet all the food needs of the entire population, because there are simply no longer enough animals and plants available to do so. The carrying capacity of the lands around the villages in Nunavik has already been exceeded (Haché, 2009). Also, climate change and environmental contaminants are increasingly affecting the accessibility and safety of what country food is still available. Thus, while traditional food sources must certainly be prioritized in any northern food security strategy, they must now be considered as only one element in a multifaceted and comprehensive approach to food security, an approach that should be broad in scope and include not only traditional and conventional food procurement strategies but also the local production of fruit and vegetables.

While this research has focused on the technical feasibility and social acceptability of northern greenhouses, it is important to mention that we have also made important gains in the field of community-based participatory research. Throughout the course of the development and implementation of the Kuujjuaq Greenhouse Project—which involved concerted horizontal and vertical coordination across multiple sectors—we proved that it is possible to achieve not only research goals but also community development goals. Through the co-construction of knowledge by interested parties from both North and South, this research has contributed to the creation of viable strategies that could help address not only future food security needs in remote communities but also environmental, social, and economic development goals across the North.

In conclusion, sustainable, community-based agricultural projects in the North have much potential. Whether they take the form of community gardens, vocational centres, or commercial operations, greenhouses and other northern agricultural initiatives are places where community capacity and resilience can be fostered and strengthened, and this, in turn, can lead to the creation of positive development spirals across the North.

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Appendix 1.

Questionnaire - Preliminary Study

<u>Questionnaire</u>

Greenhouses in Arctic Communities:

The Social and Cultural Acceptability of Alternative Systems of Food Production in Nunavik, Quebec.

Project Approved by the Laval University Ethics Committee (CERUL).
CERUL Approval # 2009-190 / 25-09-2009

CODE NUMBER assigned to RESPONDENT for PURPOSE OF STUDY: ________

<u>Respondents' Profile (Individual and Household)</u>

1- **Respondents' self-identification:** Inuk_____ Other__________ (please specify)

2- Gender: Female_____ Male_____

3- Age group: under 20__ 20-29__ 30-39__ 40-49__ 50-59__ 60-69__ over 70 __

4- **Length of time lived in Kuujjuaq:**

Less than 5 yrs ____ 5-10 yrs____ 10-15 yrs_____ over 15 yrs_____ all your life_____

5- **Role of respondent in the household (single, mother, father, etc.)** ______________

6- **Composition of respondent's household:**

Please list all members (for example: grandparents, parents, children, aunts, uncles, etc.)

1) ________________________________	2) ________________________________
3) ________________________________	4) ________________________________
5) ________________________________	6) ________________________________
7) ________________________________	8) ________________________________
9) ________________________________	10) ________________________________

7- Total number of people living in the household now (excluding visitors) _____
8- Number of dependent children _____
9- Number of adults _____
10- Number of elders _____

Section 1. Household Diet

Eating Habits

11- **Has diet changed in your household during your lifetime?**

Not very much ____ a little bit____ quite a bit_____ a lot _____ quite a lot _____

If your households' diet has changed, please state how. ______________________________

____

____

Please indicate any impacts that this change has had. ______________________________

____

____

____

12- **What foods are usually eaten in your household now?**
(Please list typical food items, and indicate the approximate time spent preparing each meal)

Breakfast: ____

____

Preparation time: less than 1 hour ( ) 1 hour ( ) 2 hours ( ) more than 2 hours ( )

Lunch: ____

____

Preparation time: less than 1 hour ( ) 1 hour ( ) 2 hours ( ) more than 2 hours ( )

Dinner: ____

____

Preparation time: less than 1 hour ( ) 1 hour ( ) 2 hours ( ) more than 2 hours ( )

Snacks: ____

____

Preparation time: less than 1 hour ( ) 1 hour ( ) 2 hours ( ) more than 2 hours ( )

Desserts: ____

____

Preparation time: less than 1 hour ( ) 1 hour ( ) 2 hours ( ) more than 2 hours ( )

Food budget

13- **Approximately how much of your households' income is spent on food?**

Not very much _____ a bit _____ quite a bit_____ a lot _____ quite a lot _____

Fruits and Vegetables in household diet *

*For the purpose of this study the term "fruits and vegetables" will be used to refer to market fruit and vegetables (including herbs and spices), as well as berries and plants from the land, in all their forms including: fresh, frozen, canned, dried, etc.

14- **Approximately how much of your food budget do you spend on fruits and vegetables?**

Not very much _____ a bit _____ quite a bit_____ a lot _____ quite a lot _____

15- **Do you, or members of your household, collect berries and/or other plants from the land?**

No_____ occasionally _____ quite often_____ very often_____

If you answered YES, please specify which ones: ___________________________________
____
____

16- **What fruits and vegetables are usually purchased and/or consumed in your household? Please list the principal ones:**

1) **Type of food:** ____

Members of household who usually eat it: ______________________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

2) **Type of food:** ____

Members of household who usually eat it: ______________________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

3) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

4) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

5) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

6) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

7) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

8) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

9) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

10) **Type of food:** ____

Members of household who usually eat it: ______________________________

How often consumed: every day ( ) a few times a week ( ) once a week ( ) once a month ( )

17- **Are there fruits and vegetables that you would like to have that you do not, or cannot, get?**

Yes____ No____

If you answered YES, what is it and why can't you get it?

Type of food	Reason
1) ______________________________	______________________________
2) ______________________________	______________________________
3) ______________________________	______________________________

Comments:
____

18- **Overall, please rate the general availability of fruits and vegetables in Kuujjuaq.**

Not often available___ sometimes available___ regularly available___ always available ___

What fruits and vegetables are <u>most</u> readily available?	What fruits and vegetables are <u>least</u> readily available?
1) ______________________________	1) ______________________________
2) ______________________________	2) ______________________________
3) ______________________________	3) ______________________________

Comments:
____

19- **In general, please rate the quality of fruits and vegetables available in Kuujjuaq.**

Very poor ____ poor ____ acceptable ____ good ____ very good ____

What fruits and vegetables are of the <u>best</u> quality?	What fruits and vegetables are of the <u>worst</u> quality?
1) ______________________________	1) ______________________________
2) ______________________________	2) ______________________________
3) ______________________________	3) ______________________________

Comments:
____

20- **In general, how do you feel about the price of fruits and vegetables in Kuujjuaq?**

Inexpensive ____ acceptably priced ____ expensive____ very expensive____

What fruits and vegetables cost the most?
(please include quantity/price)

1) ______________________________
2) ______________________________
3) ______________________________

What fruits and vegetables cost the least?
(please include quantity/price)

1) ______________________________
2) ______________________________
3) ______________________________

21- **In general, do you think that eating fruits and vegetables is good for your health?**

No, not really _____ yes, a little bit _____ yes, quite good _____ yes, very good _____

Comments: ____
____

22- **Overall, please rate how much members of your household like fruits and vegetables?**

Not very much _____ a little bit _____ quite a bit_____ a lot _____ quite a lot _____

Comments: ____
____

23-**What are the principal factors that influence what types of food members of your household chose to eat?**

Please list in order of importance:

1) ____
2) ____
3) ____
4) ____

Section 2. Greenhouses - Acceptable Food Production Systems?

Familiarity with Gardening and Greenhouses

24- **In general, how much do you know about gardening?**

Not very much ____ a little bit____ quite a bit_____ a lot _____ quite a lot _____

25- **Have you ever gardened before?** Yes____ No____

If you answered YES, where did you garden and what did you grow:

Location: ____

Plants grown: ____
____
____

26- **In general, how much do you know about greenhouses?**

Not very much ____ a little bit____ quite a bit_____ a lot _____ quite a lot _____

27- **Have you ever visited a greenhouse?** Yes____ No____

If you answered YES, please specify where: ____

28- **Do you know that several greenhouses already exist in the Arctic?**

Yes____ No____

If you answered YES, how did you hear about it/them?

Name of greenhouse	How heard about it
1) ______________________________	______________________________________
2) ______________________________	______________________________________
3) ______________________________	______________________________________
4) ______________________________	______________________________________

Degree of interest in having a greenhouse project in the community:

29- **Overall, what is your opinion on the idea of having a greenhouse dedicated to the production of fresh fruits and vegetables in Kuujjuaq?**

Very poor idea ___ poor idea ___ acceptable idea ___ good idea ___ very good idea ___

Comments: ____
____

30-**What conditions would have to be met in order for you to support a greenhouse project in Kuujjuaq?**

Condition 1: ____
Condition 2: ____
Condition 3: ____
Condition 4: ____

31- **Which members of your household do you think are most likely to be interested in a potential greenhouse project? (please check all applicable)**

Children	girls ____	**Adults**	women ____	**Elders**	women ____
	boys ____		men ____		men ____

Comments: ____
____

32- **Would you be interested in growing your own fruits and vegetables in a community greenhouse?**

Yes____ Maybe _____ No____

Comments: ____
____

33- **If jobs were available in a greenhouse, would you be interested in working there?**

Yes____ Maybe _____ No____

Comments: ____
____

34- **Do you think that it would be a good idea to get school-children involved in a greenhouse project?**

Very poor idea ___ poor idea ___ acceptable idea ___ good idea ___ very good idea ___

Comments: ____
____
____

35- **Who do you think should own/operate a greenhouse in Kuujjuaq?**

Please name: ____

Comments: ____
____
____

<u>Degree of interest in incorporating greenhouse produce into household diet:</u>

36- **Do you think that members of your household would be interested in eating fresh, greenhouse grown fruits and vegetables?**

No, not really _____ yes, a little bit _____ yes, quite a bit _____ yes, very much _____

Comments: ____
____
____

If you answered YES to the previous question please continue.
If you answered NO to the previous question please skip ahead to Section 4.

37- **What types of greenhouse grown fruits and vegetables would members of your household want to eat?**

Please list in order of preference:

1) ______________________ 2) ______________________
3) ______________________ 4) ______________________
5) ______________________ 6) ______________________

38- **Would you be willing to spend more time preparing meals in order to incorporate greenhouse grown fresh produce into your households' diet?**

Yes____ Maybe _____ No____

Comments: ____

39- **Would you be willing to restructure your household food budget in order to buy greenhouse grown fresh produce?**

Yes____ Maybe _____ No____

Comments: ____

Section 3. Additional Comments

40- **If you have any other additional comments or statements that you feel are pertinent to this research, please feel free to elaborate here.**

____
____
____
____
____
____

41- **Would you be willing to be interviewed again for a further study on the same subject?**

YES____ NO____

Your collaboration has been very much appreciated.
- The information that you have provided is invaluable!
Thank-you for your time

Appendix 2.

Guidelines - Concluding Study

INTERVIEW GUIDELINES

Greenhouses in the North:

Developing a New Type of Local Food System in Nunavik

Project Approved by the Laval University Ethics Committee (CERUL) - Approval # 2012-158 / 06-07-2012

CODE NUMBER ASSIGNED TO PARTICIPANT FOR PURPOSE OF STUDY: _______

1) What are your thoughts and/or suggestions on the following types of possible greenhouse-based community/social projects?

1a) Community Garden (in existing Kuujjuaq greenhouse and new greenhouse)

1b) Projects with Children, Youth, Elders, etc...

1c) Community Greening Project (i.e. planting native flowers, grasses, shrubs, trees around village; flower boxes to beautify municipal buildings, etc.)

1d) Suggestions for other types of community/social projects...

2) What are your thoughts and/or suggestions on the following types of possible greenhouse-based commercial style projects? (*Show pictures to participant*)

2a) Hydroponics (soil-less system)

2b) Aquaponics (combined aquaculture (fish) and hydroponic production)

2c) Indoor farming (artificial lighting and heat inside a warehouse-type buildings)

2d) Shipping containers (for hydroponics and/or aquaponics)

2e) Field production (i.e. potatoes, onions, carrots, turnips, beets, rhubarb, etc.)

2f) Strawberry production in greenhouses/tunnels

2g) Traditional plant cultivation (i.e. Qunguliq "mountain sorrel" and malitsuagaq "seabeach sandwort")

3) Generally, do you think that Nunavimmiut would be receptive of greenhouse/agricultural projects?

3a) If not, what do you think would be the best way to get Nunavimmiut interested/involved in greenhouse/agricultural projects?

4) Do you have any thoughts on the fact that agriculture is not a traditional Inuit activity?

5) Overall, what benefits do you think that greenhouses (and other associated horticultural/agricultural projects) could bring to Nunavik?

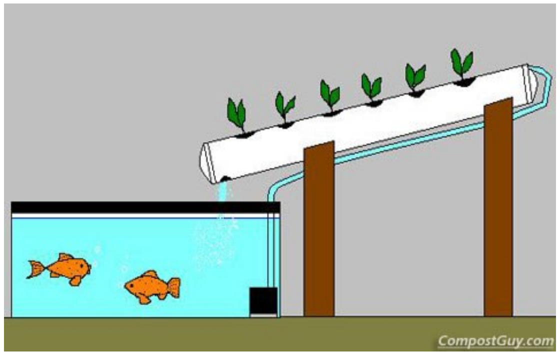
6) Overall, what challenges do you foresee in implementing greenhouses (and other associated horticultural/agricultural projects) in Nunavik?

7) Do you have any other comments, thoughts or suggestions?

- *Thank-you for your time!*
- *Nakurmiik!* -

HYDROPONICS (growing plants without soil)

AQUAPONICS (growing fish and plants together)



INDOOR FARMS (artificial lighting and heat)

SHIPPING CONTAINERS (for hydroponics & aquaponics)

GREENHOUSE STRAWBERRIES

TRADITIONAL PLANTS (possible to cultivate)

Qunguliq

“Mountain sorrel”

Malitsuagaq

“Seabeach sandwort”

Appendix 3.

Greenhouse Data Collection Forms

(See following pages)

GARDEN DATA COLLECTION FORM

KUUJJUAQ GREENHOUSE PROJECT – PHASE 1 (2011)

GARDEN BED #:_______

NAME OF GARDENER(S):____

NAME OF VEGETABLE (and CULTIVAR)	

Date Seeds Sowed *Note where sowed: **A** = at home in tray/pot **B** = at greenhouse in tray/pot **C** = directly in garden bed	**Date Small Plants Transplanted into Garden Bed** (If applicable)	**Density of Plantation in Garden** For example: - How many seed packets/ how many plants/how many rows	**Use of Fertilizers or Amendments (compost)** *Note type of product *Note date applied

DATE HARVESTED							
WEIGHT (gr)							

* If you run out of space on this form for recording the weight of crops that are harvested often (i.e. lettuce), please attach another form to this one.

* If you sow/plant the same crop a second time (i.e. lettuce, radishes, coriander, etc.) please start a new form.

GARDEN TIMELINE

KUUJJUAQ GREENHOUSE PROJECT – PHASE 1 (2011)

GARDEN BED #:________

NAME OF GARDENER(S):____

TYPE OF VEGETABLE (CULTIVAR)	**Date Seeds Planted** *Note where planted: **A** = at home in tray/pot **B** = at greenhouse in tray/pot **C** = directly in garden bed	**Date Small Plants Transplanted into Garden Bed** (if applicable)	**Date of FIRST Harvest**	**Date of LAST Harvest**

TEMPERATURE LOG

KUUJJUAQ GREENHOUSE PROJECT – PHASE 1 (2011)

DATE			DAILY TEMPERATURES		DAILY WEATHER	GENERAL OBSERVATIONS
	MONTH	DAY	MINIMUN	MAXIMUM	For example: mostly sunny/sunny with clouds/mostly cloudy/rainy/windy/etc.	For example: comments on unusual events that could affect temperature
Mon						
Tues						
Wed						
Thurs						
Fri						
Sat						
Sun						

Appendix 4.

Minutes - Kuujjuaq Greenhouse Meeting September 5th, 2012

Minutes:

- Preliminary Meeting -

Kuujjuaq Community Greenhouse

Wednesday September 5th, 2012 – 7:00pm

Present:

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

- The purpose of this meeting was to hold preliminary discussions about how to organize the Kuujjuaq Community Greenhouse. Figuring out how to fairly and equitably manage the greenhouse is especially important right now because gardening is becoming very popular in Kuujjuaq (there is much demand for garden beds) and a new greenhouse is being built.

- Several key points were identified during the meeting, however, it was agreed upon that no important decisions or votes would be taken without having further discussions and meetings with the community.

- The next meeting has been tentatively planned for Wednesday, October 10th (7pm), and will be held at the NV Town Hall (to be confirmed).

The following items were discussed:

1) It was proposed that the vision for the community greenhouse should be:
"To provide a well organized, safe place for Kuujjuamiut to garden".

2) In order to attain this vision, a greenhouse committee needs to be created. This committee will take care of developing, operating and fairly managing the greenhouse.

   a. It was stressed that local, long-term, residents of the community should play an important role in the greenhouse and that the committee should make decisions together with local representatives.

   b. It was proposed that a set of rules and regulations (based on examples from other community gardens) be elaborated before next spring in order to ensure the smooth operation of the committee and the greenhouse.

   c. One of the most important things that the committee will have to do is establish how the garden beds will be fairly allocated and distributed in the greenhouse. It was proposed that some lots be set aside for community organizations (for example: daycare, elders, youth, etc.). It was mentioned that no garden bed be should left unused, or under-used, since there is such a high demand for them.

   d. The following committee positions were identified (see below) and several community members volunteered to undertake the tasks associated with these positions for the next little while. It is important to note that this constitutes a *transitional committee* that will take care of the day-to-day tasks and responsibilities until an official "Founding General Assembly" can be held. It was agreed upon that each position would ideally be held by two people, thus ensuring that someone would always be present at meetings and/or available to complete tasks. * See attached for "Job Descriptions".

i. Administrative Executive: [redacted] & [redacted]

ii. Logistic Executive: [redacted] & [redacted]

iii. Communications Executive: [redacted]

iv. Representative - Northern Village of Kuujjuaq: _________

v. Community Liaison Officer: _________________________

3) Since the common goal of all gardeners in the greenhouse is to grow fresh vegetables, the following objectives and goals for the greenhouse were identified:

- promote the greenhouse project throughout the community

- maximize the growing space (i.e.: new greenhouse, outdoor garden beds between greenhouses, hanging baskets, shelves along walls, etc.)

- get training and promote knowledge transfer activities

- develop growing techniques specific to the north (i.e.: experiment with different vegetables)

❖ In order to help attain these objectives and goals it was proposed that an experienced person be hired to train a community member to become a greenhouse project coordinator. This person could eventually be responsible for not only the greenhouse, but also the other associated horticultural projects that are happening in the village (i.e.: the compost project, potato field, getting kids involved in gardening, etc.).

4) It was deemed important that the greenhouse/community garden have a name as well as a logo that could be put on a sign at the greenhouse. The name Pirursiivik WD3¥[4 (the word for garden/greenhouse in Inuktitut) had been previously suggested, however, it was proposed that a contest (with a cash prize for the winner) be launched in the community in order to find the best name and logo. How to organize this contest (who will be in charge of it) will discussed at the next meeting.

Administrative Executive

Tasks - Responsible for:

- Greenhouse committee email ("kuujjuaqgreenhouse@gmail.com")
- Contact list of gardeners - maintain/update (name, phone number, email, Facebook)
- Greenhouse plan - maintain/update (name, garden bed number)
- Keys - distribution
- Individual "Sign-up sheets/Yearly Contracts"
- Waiting list/sign-up list for new gardens beds
- Storage of paper-work, data sheets, office supplies, etc., at Nunavik Research Centre Library
- Coordinating data collection
- Convening meetings, preparing agendas
- * Work with other committee executives and village organizations to ensure the smooth operation of the greenhouse garden (i.e.: on occasion, do other things that are not specifically written on this list of tasks, but that are essential to the overall success of this initiative)
- *NB: Upon agreement by all executives, one or more of the previously listed tasks can be distributed differently, for an agreed upon time that does not surpass the length of the mandate.

Logistic Executive

Tasks - Responsible for:

- Greenhouse repairs and maintenance
- Water delivery
- Equipment (i.e.: hand tools)
- Ordering seeds (group order ??)
- Small compost bins
- Data collection (temperature)
- Coordinating work involved in opening and closing the greenhouse at the beginning and end of the season.

- * Work with other committee executives and village organizations to ensure the smooth operation of the greenhouse garden (i.e.: on occasion, do other things that are not specifically written on this list of tasks, but that are essential to the overall success of this initiative)
- *NB: Upon agreement by all executives, one or more of the previously listed tasks can be distributed differently, for an agreed upon time that does not surpass the length of the mandate.

Communication Executive

Tasks - Responsible for:

- Maintaining greenhouse Facebook page (new pictures, etc.)
- Create and maintain greenhouse members “list-serve” email address list
- Transmitting information (from the Administrative Executive) via electronic media to greenhouse members and to the community as needed
- Taking minutes at meetings
- * Work with other committee executives and village organizations to ensure the smooth operation of the greenhouse garden (i.e.: on occasion, do other things that are not specifically written on this list of tasks, but that are essential to the overall success of this initiative)
- *NB: Upon agreement by all executives, one or more of the previously listed tasks can be distributed differently, for an agreed upon time that does not surpass the length of the mandate.

Representative – Northern Village of Kuujjuaq

Tasks - Responsible for:

- Represent the NV at all committee meetings

- * Work with other committee executives and village organizations to ensure the smooth operation of the greenhouse garden (i.e.: on occasion, do other things that are not specifically written on this list of tasks, but that are essential to the overall success of this initiative)

- *NB: Upon agreement by all executives, one or more of the previously listed tasks can be distributed differently, for an agreed upon time that does not surpass the length of the mandate.

Community Liaison Officer:

Tasks - Responsible for:

- Be available to meet and speak with community members who have ideas for/ about the greenhouse

- Make sure that the community's voice is heard at all committee meetings

- * Work with other committee executives and village organizations to ensure the smooth operation of the greenhouse garden (i.e.: on occasion, do other things that are not specifically written on this list of tasks, but that are essential to the overall success of this initiative)

- *NB: Upon agreement by all executives, one or more of the previously listed tasks can be distributed differently, for an agreed upon time that does not surpass the length of the mandate.