

# Table of Contents

**EXECUTIVE SUMMARY.....2**

**INTRODUCTION.....3**

**BACKGROUND.....3**

GLOBAL FOOD INSECURITY .....3

FOOD INSECURITY IN CANADA .....5

INDIGENOUS HISTORY.....8

CURRENT COMMITMENTS .....9

**THE PROBLEM.....10**

HIGH COST .....10

CULTURAL ACCEPTABILITY .....12

LOW QUALITY.....13

**SOLUTION: GREENHOUSE ADVANCEMENT IN NUNAVUT (GAIN) .....13**

STEP 1: ESTABLISH GOVERNANCE MODEL.....14

STEP 2: PILOT PROJECT.....15

STEP 3: OPEN FOR BUSINESS! .....15

STEP 4: INCREASE UPTAKE THROUGH AN AWARENESS PROGRAM .....16

**FEASIBILITY .....18**

**SUSTAINABLE GREENHOUSE INFRASTRUCTURE.....18**

SHAPE AND ORIENTATION OF THE GREENHOUSE.....18

I. PHOTOVOLTAIC (PV) MODULE OPTIONS (SOLAR PANELS) .....19

II. OTHER MATERIALS TO CONSIDER .....20

**BUDGET .....21**

**CONCLUSION.....24**

## Executive Summary

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The common practice of grocery shopping for people in Nunavut, a territory in northern Canada, is dreadfully expensive. A bag of fruits and vegetables could easily cost someone over \$100, whereas that same bag would be 3-4 times cheaper in southern Canada. Prices are especially exorbitant in Nunavut which has contributed to high levels of food insecurity – 57.0% of the population in Nunavut is food insecure, more than three times the Canadian national average of 17.7%. In a territory where 85.9% of the population is Indigenous, food insecurity is a significant issue that blocks social inclusion of these marginalized groups. Due to socioeconomic gaps amongst Indigenous peoples and historical colonial practices of oppression, assimilation, and discrimination, Indigenous communities disproportionately face social exclusion, including food insecurity. There are three main issues at the core of the food insecurity crisis in Nunavut: high cost of groceries, lack of cultural integration with country foods, and low quality of foods.

GAIN (Greenhouse Advancement in Nunavut) is a robust policy that seeks to decrease the rate of food insecurity in Nunavut to the national average by building sustainable greenhouses in the territory that operate under an innovative community driven business model year-round, which would significantly reduce the cost of and increase access to the uptake of nutritious and fresh produce. This policy aims to not only reduce food insecurity in Nunavut, but to also empower Indigenous communities in Nunavut and foster social inclusion at the community level. By establishing a governance model whereby the Government of Nunavut is primarily responsible for building the greenhouse infrastructure and overseeing the implementation of the policy, GAIN aims to increase community driven resilience development through a sustainable business model run by Indigenous communities. By producing and sourcing fruits and vegetables from government and community-led greenhouses, the cost of produce would decrease while providing community members more nutritious foods. In order to facilitate the uptake of non-country foods, an awareness program will be launched by, for and with Indigenous communities.

The goal of GAIN is to construct, operate and maintain sustainable greenhouses. With that, the shape of the greenhouses will be either elliptic or uneven span as these allow maximum energy retention. Additionally, concentrating photovoltaic/thermal modules (CPV/T), a type of solar panel that is innovative in size and performance, will be used. Finally, there are other materials to consider and for those, sustainable and unsustainable sources also exist. This is the best attempt to preserve energy, heat and light throughout the year including during cold weather conditions. The use of diesel in the harshest months of the winter is unavoidable for the interim as the technology to conserve energy in batteries is not advanced enough. With an investment of \$205 million over the course of 10 years, GAIN is an economically viable and efficient use of public dollars, with a better return on investment than the current program.

Our feasibility assessment indicates that GAIN could realistically complete its aim of decreasing Nunavut's food insecurity rate to the national average by 2030. This would be beneficial for Canada, as it is in line with the Sustainable Development Goals 2 (ending hunger) and 10 (reducing inequality within Canada), among others. Moving forward, we will continue to collaborate with groups on the ground and various levels of government so that Nunavummiut parents no longer have to think whether or not they can put food on the table for their children.

# Introduction

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On a good day, a bag of grapes in Canada's largest and youngest territory, Nunavut, costs \$22, more than triple the price in southern Canada.<sup>1</sup> Most of Nunavut's population lives within the Arctic Circle, and the territory is the only region of Canada that is not connected to the rest of the country by highway.<sup>2</sup> Nunavut has a population of 36,000 residents who are of majority Indigenous heritage, spread across a land area of around 2 million km<sup>2</sup>.<sup>3</sup> According to a 2018 study, more than half of Nunavut's population (57.0%) is food insecure, which represents a 10.2% increase from four years prior.<sup>4</sup> The current COVID-19 pandemic is expected to increase the rate of food insecurity in Nunavut.

GAIN (Greenhouse Advancement in Nunavut) is a robust policy proposal that seeks to decrease the rate of food insecurity in Nunavut to the national average by building sustainable greenhouses in the territory that operate under an innovative community driven business model year-round, which would significantly reduce the cost of and increase access to nutritious and fresh produce. This policy aims to not only reduce food insecurity in Nunavut, but also to empower Indigenous communities in Nunavut and foster social inclusion at the community level.

## Background

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### Global Food Insecurity

The Food and Agriculture Organization of the United Nations (FAO) defines food insecurity as “a situation that exists when people lack physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.”<sup>5</sup> A FAO report on food security from 2019 found that more than 820 million people did not have enough food to eat in 2018. Although levels of hunger had been declining for previous decades, new data shows that numbers have actually increased.<sup>6</sup> When looking beyond severe levels, an additional 1.3 billion people have experienced food insecurity at moderate levels. This means that they did not have regular, steady access to nutritious food, and have had to compromise the quantity and/or quality of their food. An estimated total of 26.4% of the world's population - 2 billion people - suffer from food insecurity.

<sup>1</sup> Leanna Garfield, “Food prices are insanely high in rural Canada, where Ketchup costs \$14 and Sunny D costs \$29,” *Business Insider*, September 21, 2017, <https://www.businessinsider.fr/us/food-prices-high-northern-canada-2017-9>

<sup>2</sup> “About Nunavut,” Department of Executives and Intergovernmental Affairs, Government of Nunavut, accessed October 22, 2019, <https://www.gov.nu.ca/eia/information/about-nunavut>.

<sup>3</sup> Ibid.

<sup>4</sup> Valerie Tarasuk, and Andy Mitchell, “Household Food Insecurity in Canada, 2017-2018,” *PROOF*, March, 2020, <https://proof.utoronto.ca/wp-content/uploads/2020/03/Household-Food-Insecurity-in-Canada-2017-2018-Full-Reportpdf.pdf>.

<sup>5</sup> FAO, “The State of Food Insecurity in the World 2001,” FAO (New York, 2002): 28. <http://www.fao.org/3/y1500e/y1500e00.htm>.

<sup>6</sup> FAO, “The State of Food Security and Nutrition in the World, 2019” FAO (Rome, 2019): <http://www.fao.org/state-of-food-security-nutrition/en/>

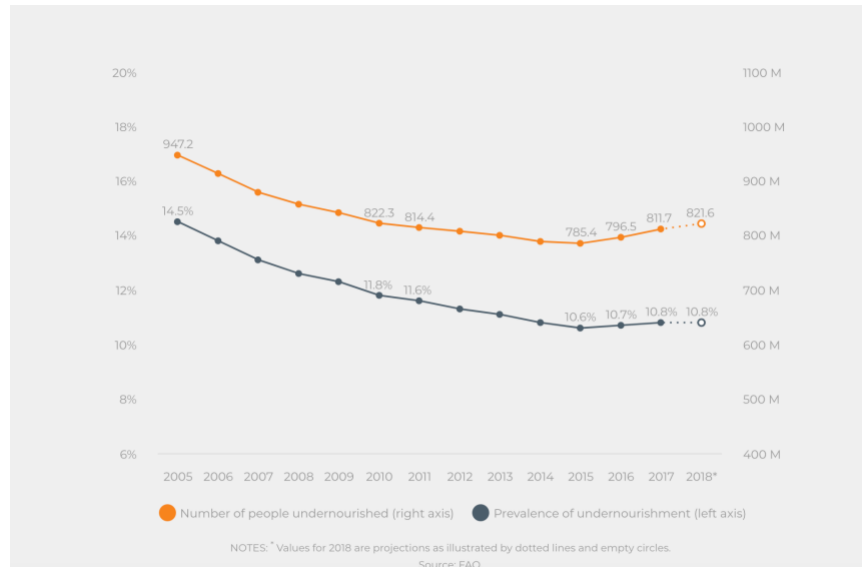


Figure 1: The number of undernourished people in the world.<sup>7</sup>

Establishing food security for all is more than “a moral duty or a policy choice”, rather, it is a human right.<sup>8</sup> The 1948 Universal Declaration of Human Rights recognizes the right to food in Article 25 stating that “everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food”.<sup>9</sup> The 1966 International Covenant on Economic, Social and Cultural Rights also outlined the right to adequate food which encompasses many different aspects. “Adequate food” refers to a food supply with foodstuffs (any substance that is food or used to make food) that is culturally acceptable, that meets nutritional needs both in quantity and quality, and that is safe and of good quality.<sup>10</sup> While having access to food is a major aspect of fighting food insecurity, ensuring that the food is of good quality and meets the needs of the dietary food culture of a population is as equally important.

There are many factors that contribute to food insecurity, and while poverty remains one of the most prominent factors, data has shown that even when world poverty decreased slightly in the first decade of the 2000s, world hunger grew.<sup>11</sup> Structural problems in the global food economy, a complex international trading system and persisting human rights issues all contribute to growing food insecurity in the world. Furthermore, as the world’s population is expected to grow to 9 billion by 2050, the global climate crisis is predicted to further exacerbate global food insecurity.<sup>12</sup> The 2015 UN Sustainable Development Goals (SDGs) call for action to combat global

<sup>7</sup> FAO, “The State of Food Security and Nutrition in the World,

2019” FAO (Rome, 2019): <http://www.fao.org/state-of-food-security-nutrition/en/>

<sup>8</sup> FAO & OHCHR, “The Right to Adequate Food: Fact Sheet No. 34,” FAO & OHCHR (Geneva, 2010)

<https://www.ohchr.org/Documents/Publications/FactSheet34en.pdf>

<sup>9</sup> United Nations, *The Universal Declaration of Human Rights* (New York, 1948). <https://www.un.org/en/universal-declaration-human-rights/>

<sup>10</sup> Asbjørn Eide, “The human right to adequate food and freedom from hunger,” FAO.

<http://www.fao.org/3/w9990e/w9990e03.htm>.

<sup>11</sup> Matias E. Margulis, “The Regime Complex for Food Security: Implications for the Global Hunger Challenge,” *Global Governance: A Review of Multilateralism and International Organizations*, vol. 19, no. 1 12 Aug. 2013, pp. 54, doi: <https://doi.org/10.1163/19426720-01901005>.

<sup>12</sup> Ibid, 54.

hunger and malnutrition. Precisely, the second SDG aims to “end hunger, achieve food security and improved nutrition and promote sustainable agriculture.” Despite the UN’s call to eradicate hunger by 2030, food insecurity continues to rise today, particularly as the global COVID-19 pandemic rages on.

Research has shown that food insecurity leads to poorer health outcomes and hinders economic and social development. The impacts of food security from the prenatal and early childhood periods are long lasting. Food insecurity is associated with higher numbers of diabetes, cardiovascular, dental and psychological outcomes in adults. There is also a gendered-dimension of food insecurity as studies show food-insecure women are more likely to be obese which can relate and contribute to further health problems.<sup>13</sup> Research has also shown that in addition to deeper mental and physical health issues, food insecurity comes with general experiences of “uncertainty, worry, and social exclusion”.<sup>14</sup> Those living in food insecure households must devote more time and energy to determining what they will put food on the table, and how they will be able to obtain this food. Lower access to food contributes to greater feelings of “distress, frustration, and despair,” and limits “participation in typical activities”.<sup>15</sup> Undoubtedly, high levels of food insecurity are associated with higher levels of social inequality.

## Food Insecurity in Canada

While food security is more prevalent in lower-income countries, Indigenous populations in many high-income countries like Canada have perpetually faced disproportionate levels of food insecurity – resulting from and reinforcing deep-seated social exclusion from Canadian society. In Canada, food insecurity is most severe in the territory of Nunavut, where 85.9% of the population is Indigenous. According to a 2018 study, more than half of Nunavut’s population (57.0%) is food insecure.<sup>16</sup> A similar study conducted four years prior found that 46.8% of Nunavummiut (people in Nunavut) lived in food insecurity.<sup>17</sup> Despite various government programs, NGO initiatives and grassroots projects that exist to tackle the issue, the 10.2% increase within just four years shows that food insecurity is a growing problem in the North. No other region in Canada faces the intersectional issues that confront communities in Nunavut. In fact, Nunavut’s level of food insecurity is three times more than the national average of 17.7%. After Nunavut, the second highest food insecure region in Canada is the Northwest Territories, with a rate of 21.6%. This extreme inequality in food insecurity between Nunavut and the rest of Canada has had serious implications on the social inclusion of Indigenous populations within Nunavut and Nunavummiut within Canadian society.

<sup>13</sup> Karen Rideout, and Tom Kosatsky, “FOOD INSECURITY: A PUBLIC HEALTH ISSUE FOR BC,” *BC Medical Journal*, vol. 55, No. 1, January February 2014, 29 <https://www.bcmj.org/bccdc/food-insecurity-public-health-issue-bc>

<sup>14</sup> “Food Security,” *Homeless Hub*, *Canadian Poverty Institute* <https://www.homelesshub.ca/povertyhub/basic-needs/food-security>

<sup>15</sup> Vivien E. Runnels, Elizabeth Kristjansson, Melissa Calhoun, “An Investigation of Adults’ Everyday Experiences and Effects of Food Insecurity in an Urban Area in Canada” *Canadian Journal of Community Mental Health*, 2011, vol. 30, no. 1, <https://www.cjcmh.com/doi/abs/10.7870/cjcmh-2011-0011>

<sup>16</sup> Valerie Tarasuk and Andy Mitchell, “Household Food Insecurity in Canada, 2017-2019,” *PROOF*, 2020, <https://proof.utoronto.ca/wp-content/uploads/2016/04/Household-Food-Insecurity-in-Canada-2014.pdf>.

<sup>17</sup> Valerie Tarasuk, Andy Mitchell, and Naomi Dachner, “Household Food Insecurity in Canada, 2014,” *PROOF*, April 5, 2016, <https://proof.utoronto.ca/wp-content/uploads/2016/04/Household-Food-Insecurity-in-Canada-2014.pdf>.

## Household Food Insecurity *BY PROVINCE & TERRITORY*

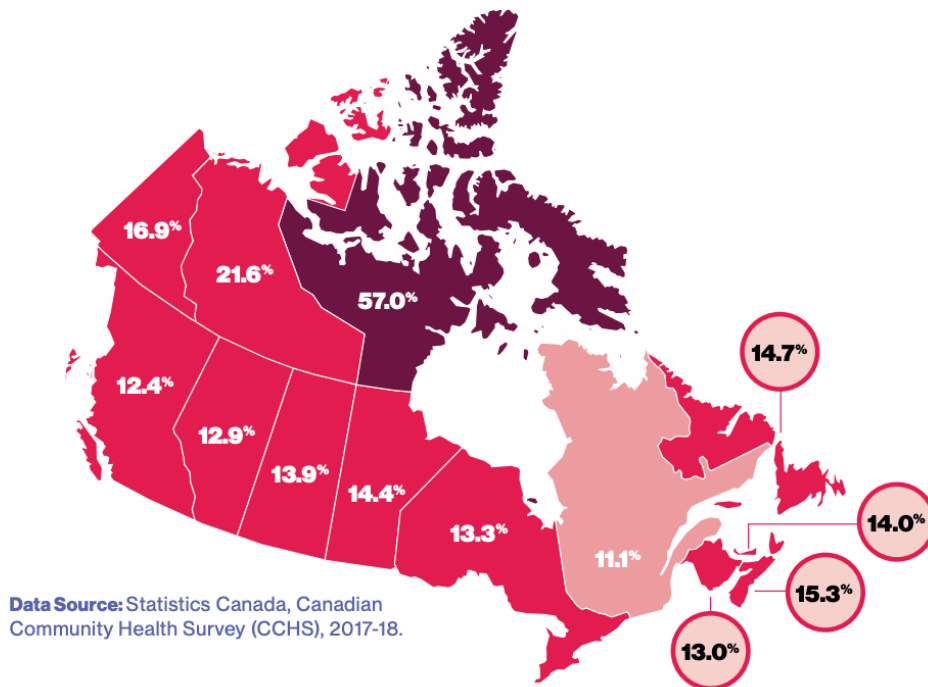


Figure 2: Household food insecurity by province and territory in Canada.<sup>18</sup>

Food insecure households in Nunavut have a statistically disproportionate impact on children, where 79% of Nunavummiut children are food insecure.<sup>19</sup> It is extremely concerning that in an economically developed country like Canada, three out of four children go to sleep hungry in one of its territories.

The University of Toronto’s Department of Nutritional Sciences identifies three types of food insecurity: marginal, moderate and severe. Marginal food insecurity refers to when a person has a “limited food selection due to a lack of money for food,” moderate refers to when a person “compromises in quality and/or quantity of food due to a lack of money for food.”<sup>20</sup> To be severely food insecure is to “miss meals, reduce food intake, and at the most extreme go day(s) without food.”<sup>21</sup> As shown in Figure 3, from 2017 to 2018, 7.6% of Nunavummiut were marginally food insecure, while 25.8% and 23.7% of the total were moderately and severely food insecure, respectively.

<sup>18</sup> Valerie Tarasuk and Andy Mitchell, “Household Food Insecurity in Canada, 2017-2019,” *PROOF*, 2020, <https://proof.utoronto.ca/wp-content/uploads/2016/04/Household-Food-Insecurity-in-Canada-2014.pdf>.

<sup>19</sup> Valerie Tarasuk and Andy Mitchell, “Household Food Insecurity in Canada, 2017-2019,” *PROOF*, 2020, <https://proof.utoronto.ca/wp-content/uploads/2016/04/Household-Food-Insecurity-in-Canada-2014.pdf>.

<sup>20</sup> “Household Food Insecurity in Canada,” *PROOF*, last modified February 22, 2018, <https://proof.utoronto.ca/food-insecurity/>.

<sup>21</sup> *Ibid.*

### Household Food Insecurity in Canada By **PROVINCE & TERRITORY**

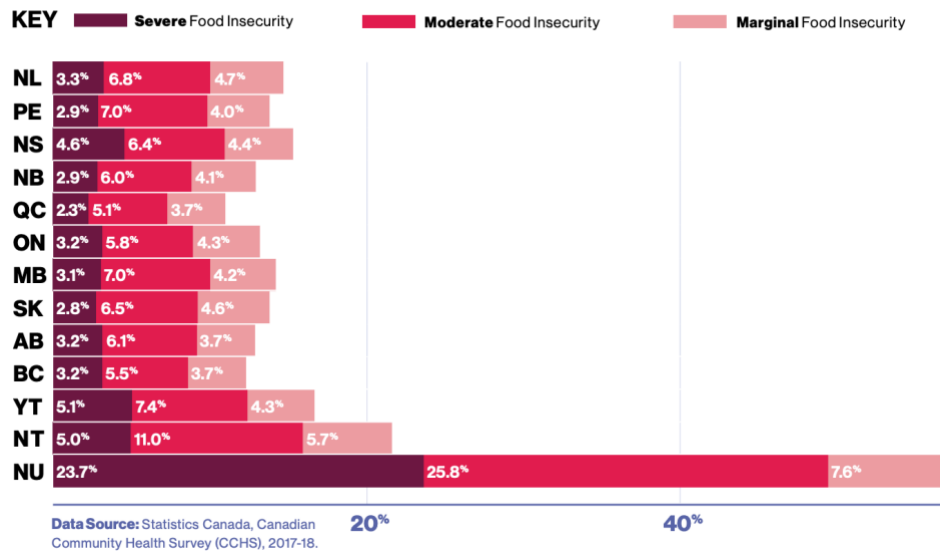


Figure 3: Household food insecurity in Canada by province and territory from 2017-2018.<sup>22</sup>

Moreover, studies show that food insecurity in Canadian households has a direct impact, *inter alia*, on a person’s education, employability and health.<sup>23</sup> For children, even a slight level of food insecurity “can have devastating and irreversible developmental effects and reduce a child’s learning capacity.”<sup>24</sup> Food insecurity is a public health issue as it can lead to both short and long term health implications. As Subnath explains,

*this paradoxical relationship between food insecurity and obesity is due to poor diet quality. Many low-income individuals often meet their adequate caloric intake by purchasing low-cost, energy dense foods which contain added sugars and fat. Obesity is linked to several chronic health problems, including coronary heart disease, high blood pressure, stroke, type 2 diabetes, metabolic syndrome, cancer, osteoarthritis, sleep apnea and reproductive problems.*<sup>25</sup>

A comprehensive study conducted in the Province of Ontario showed that health care costs increased as the severity of household food insecurity increased. In fact, when comparing total annual healthcare costs between food secure and insecure houses, costs in households with: marginal food insecurity were 16% (+\$235) higher, moderate food insecurity were 32% (+\$455) higher, and severe food insecurity were 76% (+\$1092) higher than food secure houses.<sup>26</sup>

<sup>22</sup> Valerie Tarasuk and Andy Mitchell, “Household Food Insecurity in Canada, 2017-2019,” *PROOF*, 2020, <https://proof.utoronto.ca/wp-content/uploads/2016/04/Household-Food-Insecurity-in-Canada-2014.pdf>.

<sup>23</sup> Melissa Subnath, “Indigenous Food Insecurity in Canada: An Analysis Using the 2012 Aboriginal Peoples Survey” (MSc diss., University of Western Ontario, 2017), 1.

<sup>24</sup> Emily Lecompte, James McKinnon, and Elizabeth Kristjansson, “Food Insecurity in Aboriginal Urban Households,” (University of Ottawa, 2009), p. 11.

<sup>25</sup> Subnath, “Indigenous Food Insecurity,” 2.

<sup>26</sup> Valerie Tarasuk et al., “Association between household food insecurity and annual health care costs,” *Canadian Medical Association Journal* 187, no.14 (October 2015): E432, doi:10.1503/cmaj.150234.

The costs for Nunavut, although not studied, would likely be much higher due to its geographic remoteness and lack of access to medical services.<sup>27</sup> Hence, a policy intervention designed to reduce household food insecurity is economically strategic for the government, as it “could offset considerable public expenditures in health care.”<sup>28</sup>

Ultimately, as previous studies conducted in Canada show, income is a major predictor of household food insecurity.<sup>29</sup> When healthy and nutritious groceries are too expensive, purchasing foods that are cheaper and less nutritious is a more likely outcome for Nunavummiut. As such, policy interventions should aim at reducing the cost of healthy and nutritious foods and increase their accessibility.

## Indigenous History

There are three groups of Indigenous peoples that are formally recognized by the Constitution of Canada: First Nations, Métis, and Inuit.<sup>30</sup> These groups have distinct “histories, languages, cultural practices, and spiritual beliefs. The Inuit, “the Indigenous peoples of the Arctic,” comprise 98.7% of Nunavut’s majority Indigenous population.<sup>31</sup>

Throughout history, Indigenous communities in Canada have been socially, economically, and politically marginalized. Due to the lack of access to health care, sufficient incomes, education, and economic opportunities for Indigenous communities, these groups have been significantly more susceptible to food insecurity than non-Indigenous communities in Canada. Inequalities experienced by Indigenous peoples are rooted in historical colonial practices of oppression, assimilation, and discrimination, which have led to social problems over time and intergenerational traumas experienced by Indigenous communities until this day. For example, the forced separation of children from their families to attend residential schools in order to force assimilation and influence their families, traditions and cultures and have long lasting impacts on Indigenous populations as many children faced trauma, isolation, malnourishment and abuse, while others died and never returned home.<sup>32</sup> These institutions played a significant role in contributing to the many intersectional social issues faced by Indigenous communities in Canada today.

<sup>27</sup> CBC, “Nunavut leads Canada in health care costs per person,” *CBC News*, October 31, 2013, <https://www.cbc.ca/news/canada/north/nunavut-leads-canada-in-health-care-costs-per-person-1.2303315>.

<sup>28</sup> Tarasuk et al, “Association between food insecurity and health care,” 432.

<sup>29</sup> Subnath, “Indigenous Food Insecurity,” 55.

<sup>30</sup> Government of Canada, “Indigenous peoples and communities,” December 4, 2017, <https://www.rcaanc-cirnac.gc.ca/eng/1100100013785/1529102490303> (accessed July 12, 2020).

<sup>31</sup> Government of Canada, “Inuit,” August 14, 2018, <https://www.rcaanc-cirnac.gc.ca/eng/1100100014187/1534785248701#sc1> (accessed July 12, 2020).

<sup>32</sup> Government of Canada, “Statement of apology to former students of Indian Residential Schools,” September 15, 2019, <https://www.rcaanc-cirnac.gc.ca/eng/1100100015644/1571589171655> (accessed July 12, 2020).



In addition, throughout history, many Indigenous peoples were forcibly relocated to remote locations including to the Arctic region in the northern territories.<sup>33</sup> These relocations took many forms and created major disruptions to traditional modes of life. For example, in the 1950s Inuit families were relocated by the federal government from Port Harrison (Inukjuak), Quebec and Pond Inlet, Baffin Island to High Arctic communities in Nunavut for administrative and development reasons.<sup>34</sup> Indigenous families were displaced from their communities and from lands which provided sustenance as they relied on specific migration paths of animals (such as caribou).<sup>35</sup> Once relocated, many Indigenous families lost these important sources of food. Without being provided adequate information, shelter, or resources, these families were forced to adapt to their new environment and colder climates.<sup>36</sup>



Figure 4: High Arctic relocation of 1950s from Port Harrison (Inukjuak) to Grise Fiord and Resolute Bay in Nunavut.<sup>37</sup>

## Current Commitments

The Canadian government has taken steps towards tackling food insecurity in Canada through policy action and collaborating with provincial and territorial governments, Indigenous peoples, and other communities. In Chapter 4 of Budget 2019, the federal government recognized the need to reduce food insecurity in the country, specifically for those disproportionately affected, including Nunavummiut, as household food insecurity is 3.7 times higher among Inuit.<sup>38,39</sup> In Budget 2019, the Canadian federal government committed to launching *A Food Policy for Canada* to helping communities' access healthy food and bolstering food security in both Northern and

<sup>33</sup> Melissa Subnath, "Indigenous Food Insecurity in Canada: An Analysis Using the 2012 Aboriginal Peoples Survey" (MSc diss., University of Western Ontario, 2017), 5.

<sup>34</sup> Royal Commission on Aboriginal Peoples, *Looking Forward Looking Back* (Ottawa: Canada Communication Group Publishing, 1996), 395.

<sup>35</sup> *Ibid.*, 413.

<sup>36</sup> Government of Canada, "Inuit," August 14, 2018, <https://www.rcaanc-cirnac.gc.ca/eng/1100100014187/1534785248701#sc1> (accessed July 12, 2020).

<sup>37</sup> "High Arctic Resettlement Experiment," *Canadian Museum of History*, June 20, 2017, <https://www.historymuseum.ca/blog/high-arctic-resettlement-experiment/>.

<sup>38</sup> "Chapter 4, Delivering Real Change," Budget 2019, Government of Canada, last modified March 19, 2019, <https://budget.gc.ca/2019/docs/plan/chap-04-en.html>.

<sup>39</sup> "Inequalities in Food Security in Canada," Pan-Canadian Health Inequalities Reporting Initiative, Public Health Agency of Canada, accessed October 22, 2019, <https://www.canada.ca/content/dam/phac-aspc/documents/services/publications/science-research/phac-food-en.pdf>.

Indigenous communities. The policy officially launched in June 2019. It includes \$134 million in funds to strengthen food policy initiatives with a \$50 million Local Food Infrastructure Fund to support projects that “improve access to safe, healthy and culturally diverse food.”<sup>40</sup>

## The Problem

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There are three main issues at the core of the food insecurity problem in Nunavut: cost, cultural acceptability, and quality.

### High Cost

Due to Nunavut’s physical geography and limited modes of transportation, costs of store-bought groceries in the territory are extremely high relative to southern Canada. The Canadian federal government has tried to reduce the costs of food for Northern Canadians through its Nutrition North Canada program which provides subsidies to food retailers to reduce costs of particular food items. However, Nutrition North Canada has thus far been unsuccessful in achieving this despite more than \$100 million a year in contributions by Canadian taxpayers. The Canadian government has expanded the program to provide more necessities such as baby diapers, but food insecurity continues to persist, with studies showing that it has actually increased in Northern Canada under the program.<sup>41</sup>

Estimations show that a healthy food basket in Nunavut cost six times higher than one purchased in southern Canada.<sup>42</sup> Jo Ellen Pameolik, a mother of four residing in Iqaluit said, “It hurts to know that a child my daughter’s age, who’s only five, is actually hungry. It doesn’t feel like we’re a part of Canada.”<sup>43</sup>



<sup>40</sup> “‘Everyone at the Table!’ Government of Canada announces the first-ever food policy for Canada,” Agriculture and Agri-Food Canada, Government of Canada, last modified June 17, 2019, <https://www.canada.ca/en/agriculture-agri-food/news/2019/06/everyone-at-the-table-government-of-canada-announces-the-first-ever-food-policy-for-canada.html>.

<sup>41</sup> Nutrition North, *Government of Canada*, 2016, [https://www.nutritionnorthcanada.gc.ca/DAM/DAM-NUTRIN-NUTRIN/STAGING/texte-text/nnc\\_dicussion\\_guide\\_1470659977822\\_eng.pdf](https://www.nutritionnorthcanada.gc.ca/DAM/DAM-NUTRIN-NUTRIN/STAGING/texte-text/nnc_dicussion_guide_1470659977822_eng.pdf).

<sup>42</sup> Angel Chen and David Natcher, “Greening Canada’s Arctic food system: Local food procurement strategies for combating food insecurity,” *Canadian Food Studies* 6, no.1 (January 2019): 141.

<sup>43</sup> Ibid.

Figure 5: “Jo Ellen Pameolik, a mother of four in Iqaluit, says she struggles to afford the groceries her family needs.”<sup>44</sup>

Locally grown produce is extremely limited given the territory’s non-arable land. Nunavut’s physical geography is characterized by tundra and is composed mostly by the Canadian Shield. It is also the coldest and driest region in Canada, with long gruelling winters making it hard to grow produce.<sup>45</sup>

Transporting food to Nunavut and Northern Canada is difficult, expensive and harmful to the environment. Typical delivery methods include airlifts, cargo ships and ice trucks. In Nunavut, residents and businesses sealift non-perishable and large non-food items only in the summertime due to the frozen Arctic Ocean in the winter. Air cargos typically bring perishable food items like fruits and vegetables. Ice trucks can also transport goods, but because the journey is long and dangerous, this mode of transportation is also infrequent and requires a convoy carrying extra gas for the trip to be completed. Because of infrequent shipments and poor connection to electricity grids, Nunavut relies on costly diesel generators to power freezers to hold and preserve the food shipments that arrive in the summer.

Poor transportation methods and additional costs for storage have led to a drastic increase in the prices of food products.<sup>46</sup> As a result, for Nunavut residents, both the availability and accessibility are significantly reduced. The limited quantity of food shipments, in conjunction with expensive modes of transportation and storage, significantly drive up costs of groceries making it unaffordable for Nunavut residents. Groceries are so expensive that many families are often forced to survive without food. Traditional hunted country foods such as caribou, narwhal, and seal can be inaccessible to many families due to high costs associated with hunting including gas, snowmobiles or boats, guns, bullets, sleds, and other maintenance costs.

To avoid expensive groceries, some residents rely on private enterprises such as Amazon to deliver non-perishable foods as well as essential non-food items.<sup>47</sup> Amazon offers more affordable prices relative to grocery store prices as well as free and faster delivery with a subscription to Amazon Prime for \$80. However, Amazon does not offer its services in Nunavut’s smaller communities and it is inaccessible to residents without credit cards and internet access. As a result, it is not a viable alternative for most Nunavut residents.<sup>48</sup>

<sup>44</sup> Katie Pedersen, Greg Sadler, and David Common, “Why millions of dollars in federal grocery subsidies haven’t lessened food insecurity in the North,” *CBC*, March 29, 2019, <https://www.cbc.ca/news/business/north-food-prices-nutrition-north-marketplace-1.5074520>.

<sup>45</sup> “Nunavut,” *The Canadian Encyclopedia*, last modified July 11, 2019, <https://www.thecanadianencyclopedia.ca/en/article/nunavut>.

<sup>46</sup> Julie De Meulemeester, “In Nunavut, a land of plenty, food security abounds,” *The Globe and Mail*, November 16, 2018, <https://www.theglobeandmail.com/opinion/article-in-nunavut-a-land-of-plenty-food-insecurity-abounds/>.

<sup>47</sup> *Ibid.*

<sup>48</sup> *Ibid.*

## Cultural Acceptability

Traditional Inuit diets have been compromised due to a number of factors including “social, economic, cultural, and environmental changes.”<sup>49</sup> The traditional Inuit diet is made up of “country foods,” which include “marine life such as shellfish, whales, seals and arctic char; birds and land animals, such as ducks, ptarmigan, bird eggs, bears, muskox and caribou; and plant life, including roots and berries.”<sup>50</sup> For some Indigenous folks, country food goes beyond nourishment, it gives them a chance to emotionally and socially connect with their culture and community.<sup>51</sup> Traditional diets that are made up of country foods have been associated with increased rates of food security, nutritional intake, and overall physical and mental well-being.<sup>52</sup> This was demonstrated by a 2015 study which found that among the Inuit population in Nunavut, those that relied on traditional diets had greater nutritional intakes and “achieved better dietary adequacy” than those that did not.<sup>53</sup>

Currently, hunting for country food is a common substitute for price-inflated groceries. However, traditional diets are now less accessible to the Inuit population and instead, more store-bought foods are incorporated into their regular diets.<sup>54</sup> Indeed, due to climate change in temperature and the change in migratory patterns of arctic species, the safety of travel routes is negatively impacted, as well as contaminants in traditional food sources.<sup>55</sup> In addition, access to country foods is limited for many including those with full-time employment, families without hunters and who are not members of “food sharing networks,” and/or those without proper hunting or fishing equipment.<sup>56</sup> While traditional country foods remain an integral part of Inuit food systems, modes of food procurement have transitioned over the past decades to include more store bought or “southern” foods. However, Nunavummiut often do not have a cultural preference for many of the food products sold at grocery stores, which are limited in availability and accessibility in themselves.

<sup>49</sup> James D. Ford et al., “Food policy in the Canadian North: Is there a role for country food markets?” *Social Science & Medicine* 152, January 25, 2016, <https://doi.org/10.1016/j.socscimed.2016.01.034>, 35-26.

<sup>50</sup> Amanda Robinson, “Country Food (Inuit Food) in Canada,” *The Canadian Encyclopedia*, July 19, 2018, <https://www.thecanadianencyclopedia.ca/en/article/country-food-inuit-food-in-canada>.

<sup>51</sup> Lecompte, McKinnon and Kristjansson, “Food Insecurity,” 50.

[https://www.indigenousfoodsystems.org/sites/default/files/policy\\_reform/Aboriginalfoodinsecurity%20report\\_University%20of%20Ottawa%20finalversion.pdf](https://www.indigenousfoodsystems.org/sites/default/files/policy_reform/Aboriginalfoodinsecurity%20report_University%20of%20Ottawa%20finalversion.pdf).

<sup>52</sup> James D. Ford et al., “Food policy in the Canadian North: Is there a role for country food markets?” *Social Science & Medicine* 152, January 25, 2016, <https://doi.org/10.1016/j.socscimed.2016.01.034>, 35.

<sup>53</sup> Tony Sheehy, Fariba Kolahdooz, Cindy Roache, and Sangita Sharma, “Traditional food consumption is associated with better diet quality and adequacy among Inuit adults in Nunavut, Canada,” *International Journal of Food Sciences and Nutrition* 66, April 9 2015, <https://doi.org/10.3109/09637486.2015.1035232>.

<sup>54</sup> Sophie Wirzba. “COVID-19 Is Worsening Food Insecurity in Nunavut.” Accessed July 12, 2020.

<https://www.mironline.ca/covid-19-is-worsening-food-insecurity-in-nunavut/>.

<sup>55</sup> *Ibid.*

<sup>56</sup> James D. Ford et al., “Food policy in the Canadian North: Is there a role for country food markets?” *Social Science & Medicine* 152, January 25, 2016, <https://doi.org/10.1016/j.socscimed.2016.01.034>, 37.

## Low Quality

The lengthy transportation distances and infrequency of deliveries often lead food products to deteriorate in quality or to be compromised, reducing consumer acceptability.<sup>57</sup> In addition to challenges with accessing affordable foods, Nunavummiut also face challenges with accessing fresh and nutritious products, resulting in more frequent purchases of non-perishable, highly processed foods which are high in sugars, carbohydrates, salt, and fat contents. Fresh, nutritious foods usually don't retain their quality over long transportations and are generally too expensive for Nunavut residents, making them inaccessible.

Since store bought foods are often the main source of foods for many Inuit communities now, there has been a “nutritional transition” where the nutritional intake is increasingly compromised by poor food preferences. Foods that are generally accessible tend to have low nutritional value. A 2013 study of Inuit diets in Nunavut showed that there is a “high prevalence of inadequate nutrient intakes among Inuit” which may cause increased health risks.<sup>58</sup> In fact, over recent years, there have been increased levels of obesity and diabetes in northern communities.<sup>59</sup> This shows a serious lack of availability and access to healthy, nutritious foods in Nunavut.

## Solution: Greenhouse Advancement in Nunavut (GAIN)

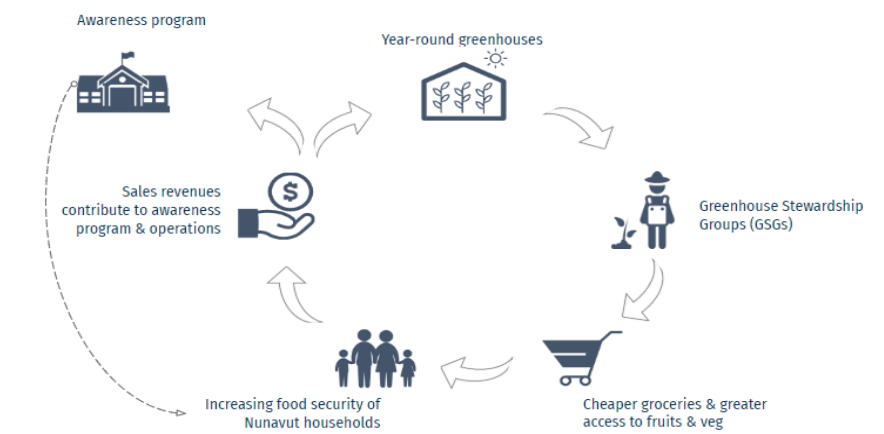


Figure 6: Solution: GAIN in action

<sup>57</sup> Chen and Natcher, “Greening Canada’s Arctic,” 141.

<sup>58</sup> S. Sharma, B.N. Hopping, C. Roache, and T. Sheehy, “Nutrient Intakes, Major Food Sources and Dietary Inadequacies of Inuit Adults Living in Three Remote Communities in Nunavut, Canada,” *J Hum Nutr Diet* 26, 2013, doi:10.1111/jhn.12091.

<sup>59</sup> James D. Ford, “Vulnerability of Inuit food systems to food insecurity as a consequence of climate change: a case study from Igloolik, Nunavut,” *Reg Environ Change*, August 22, 2008, DOI 10.1007/s10113-008-0060-x, 85.

GAIN aims to reduce the household rate of food insecurity from 57.0% to the national average of 17.7% in 10 years by building sustainable and durable year-long greenhouses that serve communities across the territory through an innovative business model. In doing so, the territorial government will collaborate with the various levels of government (federal, municipal and Indigenous). In order to minimize bureaucratic hurdles and potential red tape, the Government of Nunavut will be responsible for initiating and overseeing the implementation of the project.

Due to the sensitive history between the federal government and Indigenous communities and in order to avoid a top-down approach, it is more suitable for the territorial government to administer GAIN, with funding provided by the federal government. Indeed, the federal government’s current Nutrition North Program is a top-down approach that has yet to decrease rates of food insecurity in the territory. Nunavut operates by consensus circular government, where there are no political parties. Indigenous communities have traditionally used circular models of governance, so this critical attribute of the territorial government could potentially strengthen the partnership between the territory and the Indigenous communities, regarding this project. GAIN’s business model operates through a community driven resilience development lens, where it seeks to create employment for members within marginalized communities as part of “Greenhouse Stewardship Groups.”

The main department focusing on this project will be Nunavut Infrastructure, under their community-based infrastructure initiative, which aims to provide essential service needs. We argue that accessible food is an essential service need. However, the aim of the greenhouses is not only to reduce food insecurity, but also to invest in the communities in Nunavut with the vision of empowering them to be self-sufficient.

**Step 1: Establish Governance Model**



*Figure 7: Governance model of GAIN*

The territorial government is primarily responsible for building the greenhouse infrastructure and overseeing the implementation of the policy, which would only be possible through federal funding. Accordingly, a request must be made by the territorial government to the federal government outlining the project and its beneficial outcome for a better value-for-money

than the current project. Realizing that the capacity of the Nunavut government is not solely limited to capital, the territorial government must maintain contact and seek labour when needed from federal departments, such as Infrastructure Canada, Agriculture and Agri-Food Canada, Environment and Climate Change Canada, and Indigenous and Northern Affairs Canada. However, only the Government of Nunavut will collect and keep track of data so that it is possible to evaluate the impact of the greenhouses.

**Step 2: Pilot Project**

In the pilot year, the territorial government will conduct an environmental assessment on the permafrost, and thereafter build three greenhouses in Iqaluit, and one in Pangnirtung. Iqaluit was selected as it is the largest city in the territory and Pangnirtung was selected because it has the highest measure of the Revised Northern Food Basket in Nunavut, which indicates how expensive a basket of groceries would be in the area.<sup>60</sup> The purpose of the pilot year is to build institutional knowledge, consult with local communities, and derive best practices before expanding the policy throughout Nunavut. What differentiates this greenhouse policy from community-led greenhouses is its ability to operate throughout the year, including winters. The challenge, then, is to produce light and thus energy for the plants during Nunavut’s long and dark winters. This will be tackled further below. In addition, the territorial and federal governments have the resources and funding to implement the policy for the long-term. Oftentimes not-for-profits rely on generous financial contributions and volunteers to operate greenhouses in the North, which is unsustainable and unreliable. By collaborating with the other levels of government, the territorial government can coordinate the operational management of the greenhouses in a sustainable and efficient manner.

**Step 3: Open for Business!**

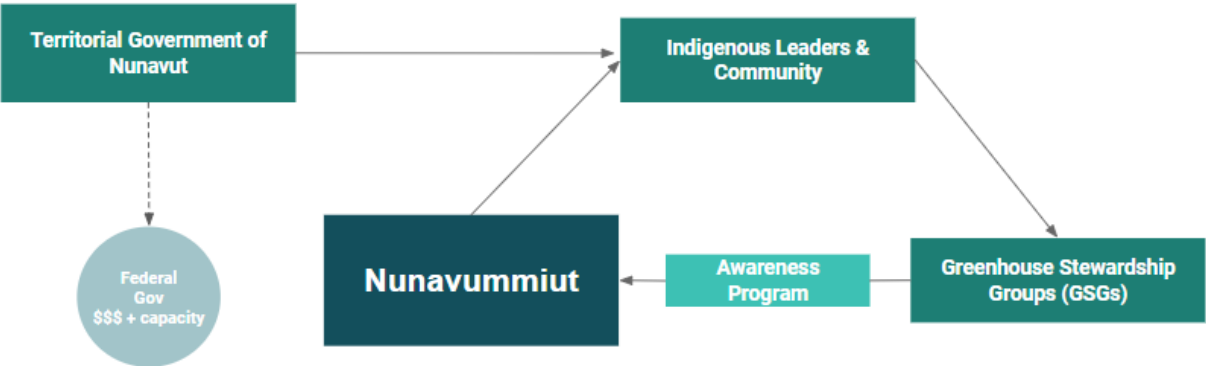


Figure 8: Policy model of GAIN

<sup>60</sup> “Cost of the Revised Northern Food Basket in 2017-2018,” Nutrition North Canada, Government of Canada, last modified February 18, 2019, <https://www.nutritionnorthcanada.gc.ca/eng/1548078467819/1548078497301>.

Due to capacity restrictions of the territorial government, it should seek help from other levels of government (namely municipal townships and Indigenous communities) to manage the daily operations of the greenhouses, once they are built and in full operation. These governments will form the Greenhouse Stewardship Groups (GSG) that will be composed of different stakeholders, including community leaders, Indigenous groups, greenhouse farming experts and sales employees. This community driven resilience development is in line with the Government of Nunavut's Community Development Fund Policy, which aims to "assist communities in undertaking activities that increase capacity in local decision-making authority." Indeed, this holistic approach includes employment, education and empowerment, especially by involving the community throughout the whole process.

Not only will building the greenhouses create job opportunities, the GSGs will also facilitate economic growth in the marketplace. In practice, the fruits and vegetables will be planted, and the greenhouses will be managed (i.e. watering, fertilization etc.) by paid staff. Once harvested, the produce will be sold by the GSGs at the national average market price in GSG-run shops built near the greenhouse. Moreover, the greenhouses could supply grocery stores so that locals are able to go to a point of sale that is most accessible to them. This critical element in GAIN is expected to solve the problem of fresh produce being costly because they will be sourced locally, without needing to pay egregious import fees. Moreover, since the produce will be grown in these greenhouses, they are expected to be as nutritious and healthy in quality as foods grown in the South. This will also increase the consumer's acceptability of the food.

The revenues raised from the sales will be used to cover future operational costs and any profits realised will be invested in awareness programs to be run in collaboration with existing initiatives and Indigenous groups. By 2030, it is expected to be a circular financial model that is self-sustainable, in line with the SDGs. Apart from funding the awareness program and self-sustainability, another important reason why the produce should be sold for a fee (instead of free) is because of the shame associated with food insecurity and poverty. Studies show that individuals do not like being seen going to a food bank because they feel responsible for being hungry and feel ashamed to need help. Hence, adding a nominal fee gives people in need autonomy over their produce and their conditions, instead of feeling like they "need" the state for help. Accordingly, we have reason to believe that if the produce was given out for free, it would not be claimed to its full potential.

The GSGs are responsible for creating a strong team of support staff to manage the greenhouses and the sales of produce. In other words, their main responsibility is to run the daily operations of the greenhouses while working closely with the three levels of government, especially Indigenous chiefs.

#### **Step 4: Increase Uptake through an Awareness Program**

Now that the infrastructure is built and the innovative business model is running, how can GAIN ensure that local communities will buy the products grown in the greenhouses? An awareness program, which will be administered by, for, and with local Indigenous communities, is pivotal. This program has two aims: the first is to explore how best to pair Inuit country food with the food produced in the greenhouses, and the second is an "arctic farmers program" run in



collaboration with Green Iglu, a community-based farm. This crucial step tackles and addresses the problem of cultural acceptability.

Primarily, it is crucial to integrate any products that are produced in the greenhouses with country food because many experts agree that “even if cabbage costs \$2, there’s no guarantee that the Inuit mother would buy it” as it is not part of her traditional meal preparation.<sup>61</sup> As mentioned above, ‘country food’ refers to traditional Inuit food consumed by most Indigenous peoples in Nunavut. Most importantly, GAIN’s aim is to preserve and promote Indigenous culture, so it is necessary for the territorial government and GSGs to work in tandem with local Indigenous communities to develop this awareness program. For example, the GSGs can run workshops on building recipes that pair southern and country foods together. It is essential to not be too specific with the awareness program, as it could be run differently in each community, as per its needs.

As a community resilience factor, the awareness program should also be extended to children (6-18 years old) in school. As part of field trips and excursions, the children could visit their local greenhouse to learn about the history of food insecurity in the territory, how the food is



grown, and how to integrate the produce into their everyday lives. The territorial government’s education department should form a partnership with GreenIglu, as it runs an Arctic Farmer program that is “dedicated to educating both students and local community members alike who are interested in becoming a part of GreenIglu.”<sup>62</sup> This partnership could develop a greenhouse education program for primary and high school classes, which can create jobs and opportunities for future generations. With all that said, adult uptake is the primary focus in the beginning of the awareness program, so that the current problems can be addressed. Indeed, educating students about how southern foods are grown could be rightfully seen as problematic. Hence, GAIN will first focus on an awareness program for adults and then children, in order to not inadvertently create intergenerational tensions and differences in food preferences.

Figure 9: A group of students learning about greenhouses on an excursion to Six Nations of the Grand River Greenhouse in Ontario, Canada.<sup>63</sup>

<sup>61</sup> Justin Nobel, “Farming in the Arctic: It Can Be Done,” *Modern Farmer*, October 18, 2013, <https://modernfarmer.com/2013/10/arctic-farming/>.

<sup>62</sup> “Food Insecurity in the Arctic,” Green Iglu, accessed October 22, 2019, <https://www.greeniglu.com/story>.

<sup>63</sup> “Robertson Program visits Kayanase, Mohawk Chapel and Woodland Cultural Centre at Six Nations of the Grand River,” *The Robertson Program*, November 13, 2019,

## Feasibility

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Traditionally Indigenous ways of life have been fundamentally disrupted by colonialism and its transgenerational traumatic impacts.<sup>49</sup> The aim of this policy is not to impose food policies or disrupt Indigenous traditions, but rather to support the food sovereignty of Indigenous communities by increasing food accessibility and affordability all while respecting Indigenous cultural practices. Acknowledging the history, culture, traditions, and autonomy of Indigenous peoples in Nunavut is vital in crafting this policy. Food sovereignty is defined as “the ability and the right of people ‘to define their own policies and strategies for sustainable production, distribution and consumption of food that guarantee the right to food for the entire population.”<sup>50</sup> Inuit health and well-being are viewed holistically – it is integrally connected to “relationships with the land and cultural, land-based practices.”<sup>51</sup> This policy supports this through its focus on growing fresh produce and its supplemental awareness program enabled by Indigenous knowledge. **In addition, the policy model is based on Indigenous consultations and stewardship.** The goal is to promote food security in conjunction with existing stakeholders.

## Sustainable Greenhouse Infrastructure

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A greenhouse infrastructure system has the potential to reduce food insecurity in Nunavut, Canada. This is partly because the government would be able to: provide land which is conducive for fruits and vegetables to grow and develop, protect plants from severe weather conditions, pests and diseases, and improve the quality of the crops. We will construct efficient and eco-friendly greenhouses. In greenhouses, plants need light, warm temperatures, air, water and nutrients to grow. These require energy in order to be produced or maintained. Solar energy is safe, abundant and an attractive substitute for other sources of energy. It is worth implementing solar technologies for most cold climatic conditions.<sup>64</sup> We will use appropriate retrofits to allow for increased energy savings.<sup>65</sup> The goal of GAIN is to remain as sustainable as the weather conditions in Nunavut permit.

### Shape and Orientation of the Greenhouse

Some of the simplest ways to valorize solar energy is by using the greenhouse effect and optimizing greenhouses through solar radiation. This can be maximized by selecting a good and eco-friendly facade and by modifying the inner design. Some common facade materials considered in greenhouses include glass, polyethylene, semi-rigid plastic and the plastic film. Almost all greenhouses use plastic or glass which have high transmissivity but poor overall heat

<https://wordpress.oise.utoronto.ca/robertson/2019/11/13/robertson-program-visits-kayanase-mohawk-chapel-and-woodland-cultural-centre-at-six-nations-of-the-grand-river/>.

<sup>64</sup> Mussard, M. (2017). Solar energy under cold climatic conditions: A review. *Renewable and Sustainable Energy Reviews*, 74, 733-745.

<sup>65</sup> Cuce, E., Harjunowibowo, D., & Cuce, P. M. (2016). Renewable and sustainable energy saving strategies for greenhouse systems: A comprehensive review. *Renewable and Sustainable Energy Reviews*, 64, 34-59

transfer. Therefore, 40% of the total energy used in a building is used for heat with the greatest heat losses occurring through the wall and roof. In terms of modifying the inner design of the greenhouse, one way to do this is by installing shallow ponds inside the greenhouses that store the heat during the day and reduce the heating needs at night; this can result in heating savings between 20% and can go up to 100% in the summer months.

The simplest way to optimize greenhouses is by adjusting its structure, inclination angle and shape of roof as these are the main effective parameters on solar energy gaining rates. The elliptic and uneven-span profiles (see b) and e) in Figure 10) achieved the best performance in cold climates. In essence, the elliptic type and uneven-span type are effective, though for yearly greenhouses, a longer length and smaller width is more economical. In general, the main goal in constructing a greenhouse is to optimize its exposition to the sun throughout the summer months with increased exposure to the sun in order to collect as much energy as possible and maximize the greenhouse effect.

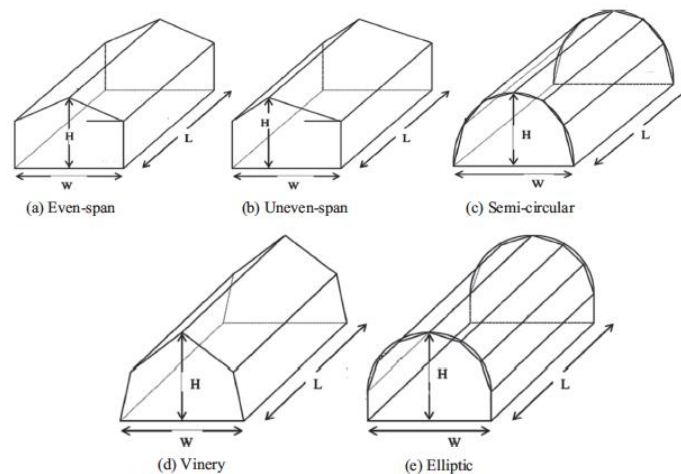


Figure 10: Different shapes of greenhouses.<sup>66</sup>

## i. Photovoltaic (PV) Module Options (Solar Panels)

The use of solar photovoltaic (PV) modules is an eco-friendly way to supply heating, cooling, ventilation and lighting to a greenhouse in cold temperatures. This is because combining PV panels and crops on the same unit area could alleviate the dependency on grid or fossil fuels. PV panels can be considered as one of the easiest and cheap ways of producing electricity from sunlight although enhancements are needed for them to become widespread. They are easy to access, durable against extreme conditions, improve efficiency, and become more affordable as the production grows. The modules convert incoming sunlight into electricity due to the photovoltaic effect. This energy can then be used or stored in batteries for later use such as powering a lamp, heater, cooler, etc.

<sup>66</sup> Çakır, U., & Şahin, E. (2015). Using solar greenhouses in cold climates and evaluating optimum type according to sizing, position and location: A case study. *Computers and Electronics in Agriculture*, 117, 245-257.

The main challenge with PV modules is to maintain low cell temperature as high heat adversely affects its efficiency. There are three types of PV modules to choose from, including conventional, concentrating and photovoltaic/thermal modules. The one that is best suited for greenhouses in Nunavut is the photovoltaic/thermal (PV/T) module. These modules enable both thermal and electrical energy generation and a shorter payback period compared to the others. Generally, the PV/T arrangement consists of a PV module, heat sink, ventilation and insulation sequentially. In order to manage cell temperatures, air conditioners or water is used. Water based PV/T modules are more appropriate to reduce PV module temperatures especially in extreme weather conditions. This energy can then be used or stored in batteries for later use such as powering a lamp, heater, cooler, etc. **Concentrating photovoltaic/thermal modules (CPV/T)** are preferred in rural areas where grid electricity is expensive and difficult to access. The integration of a concentrator in a PV/T module enhances its thermal and electrical energy output, especially with the use of Fresnel lenses. As they are more compacted, these can easily be placed on a small section of the greenhouse roof and they are resistant to extreme weather conditions such as the harsh winters of Nunavut, Canada. Thus, it follows that the CPV/T module will be installed in the new greenhouses in Iqaluit and Pangnirtung.

## ii. Other Materials to Consider

In terms of space heating and drying purposes, solar thermal collectors using Fresnel lenses are the best option in terms of affordability and available energy. Furthermore, thermal energy storage will be used to maintain a microclimate in the greenhouse that matches the natural environment of the plant. Soil based thermal energy storage systems are the most ideal as they are able to maintain the temperature in the greenhouse at 20 degrees Celsius which is ideal for most plants.

Additionally, heat pumps can be used as a heating device when required in cold weather or at night as these are good at maintaining the temperature stability in the greenhouses. Geothermal heat pumps are preferred to conventional heat pumps due to lower operational costs and higher coefficient of performance (COP) ranges. However, the heat pumps systems' compressor consumes a lot of power (84% to be precise) thus, its efficiency should be a priority in order to reduce electricity consumption. Furthermore, windcatchers need to be installed as a wind control system is needed for ventilation purposes.

Finally, lighting options should be considered in addition to the natural light produced by the sun. To this, there are two options including sodium lamps or Light Emitting Diodes (LED) lights. LED lights are best as they have three colours (red, blue and green) that are commonly used in greenhouses. They positively affect the plant growth and have a remarkably long lifetime. The speed of growth and harvest can also be obtained faster. Compared to sodium lamps, "LEDs can provide lightning related energy saving up to 75% per year".<sup>67</sup>

<sup>67</sup> Ibid, 66.

# Budget

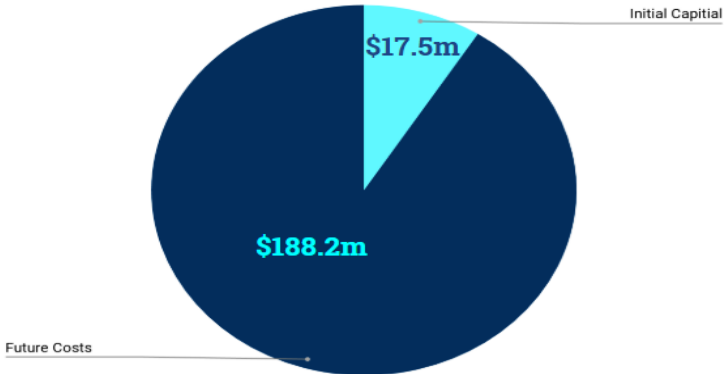


Figure 11: Overview cost of GAIN (2020 - 2030)

As an initial capital investment, the federal government will put forward \$7,500,000 to kick off the pilot projects in Iqaluit and Pangnirtung. Additionally, there are initial investments of ~\$1.7M, ~\$3.3M and ~\$5M that will go towards the awareness program for non-adults, awareness program for adults and the Green Stewardship Groups (GSGs), respectively. Therefore, the total investment needed in the pilot year amounts to ~\$17.5M.

	CAD	
Initial Capital Investment	7 500 000,00	
Awareness program: non-adults (10 to 19 years old)	1 703 025,00	
Awareness program: adults (19 years old and above)	3 324 720,00	
Greenhouse Stewardship Groups (GSGs)	5 000 000,00	
<b>TOTAL INVESTMENT</b>	<b>\$ 17 527 745,00</b>	<b>SUM</b>

Table 1: Summary of Total Investment for pilot year

The total estimated costs of ~\$16.6M is based on costs of greenhouses that currently exist and projections made with available information. As any new project, there will be multiple unforeseen costs and obstacles hence the buffer of ~\$1M (see Budget “Consolidated Budget” & “Notes”). The initial investment will go towards setup costs, operating costs, and administrative costs.

The setup costs total ~\$5.1M and includes land, greenhouse equipment, construction costs, PV modules (solar panels), air, water, and heating. It is important to note that the Government of Nunavut has a policy of providing free land for economic and community developments,<sup>48</sup> however, the cost of land is still considered as part of the initial financial analysis. The annual operating costs are currently estimated at ~\$633K and pertain to the following: seeds, nutrients such as fertilizer, electricity, water, repairs and maintenance.

Furthermore, the administration costs, which are set at 15% of total operating and setup costs, total ~\$860K and include: salaries and wages, and cleaning and maintenance costs. Finally, there are consulting, and setup fees related to the awareness programs and GSGs that amount to ~\$10M. In total, the implementation of the policy in its pilot year is estimated to cost ~\$16.6M.

<b>COSTS**</b>	<b>CAD</b>	
Setup costs	<b>\$ 5 102 666,00</b>	<b>{calc}</b>
Operating Costs	<b>\$ 633 600,00</b>	<b>{calc}</b>
Administrative Costs	<b>\$ 860 439,90</b>	<b>{calc}</b>
Consultations, set up + staff education programs and GSG	10 027 745,00	<b><i>linked</i></b>
<b>TOTAL ESTIMATED COSTS</b>	<b>\$ 16 624 450,90</b>	<b><i>SUM</i></b>
<b>Buffer</b>	<b>\$ 903 294,10</b>	

*Table 2: Summary of total estimated costs*

In addition to the consolidated budget is the prospective budget (See Budget “prospective budget”) that begins after the pilot year (i.e. in 2022/23) and goes until 2030 in alignment with Agenda 2030 for the SDGs.

In particular, the aim is to have to have built a greenhouse in each of the communities in Nunavut; 25 in total. Iqaluit is the exception with three greenhouses therefore, the total goal is to build 27 greenhouses.

The approximate total cost is \$50.6M based on the cost of building one greenhouse (~\$1.87M). The implementation timeline is set at 6 years to end in 2028 and provide 2 years before 2030 to observe the impact of the policy; thus, the approximate cost per year for building greenhouses is \$7.18M. Additionally, ~\$1M will be topped to the awareness programs each year such that by 2030, the total investment will be ~\$48M and ~\$63M for the non-adults and adult programs, respectively.

Furthermore, the GSGs expenditure will be capped at \$3M per year after the initial \$5M investment such that by 2030, a total of ~\$29M would have been invested in these groups. One last thing is the "other costs" which are set at 5% of initial investment such that by 2030, it would potentially add up to \$15.2M. In the end, constructing greenhouses across Nunavut is estimated to cost ~\$206M over the course of 10 years.

	2021 - 2022	2023 - 2030	TOTAL
<b>FIXED COST:</b>			
Initial Capital Investment	\$7 500 000,00	\$43 125 000,00	\$50 625 000,00
<b>VARIABLE COSTS:</b>			
Awareness programs:			
Non-adults (10 to 19 years old)	\$1 703 025,00	\$46 624 200,00	\$48 327 225,00
Adults (19 years old and above)	\$3 324 720,00	\$59 597 760,00	\$62 922 480,00
Greenhouse Stewardship Groups	\$5 000 000,00	\$24 000 000,00	\$29 000 000,00

Other Costs (maintenance etc.)	\$375 000,00	\$14 859 375,00	\$15 234 375,00
<b>TOTAL INVESTMENT</b>	<b>\$17 527 745,00</b>	<b>\$188 206 335,00</b>	<b>\$206 109 080,00</b>

*Table 3: Summary of prospective budget 2021 - 2030*

## Conclusion

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As established in this proposal, food insecurity in Canada disproportionately affects Indigenous peoples, particularly those who live in Canada’s Northern territories such as Nunavut. The lack of a nutritious diet causes others to go hungry and critically, prevents Nunavummiut from fully participating in society. This challenge to social inclusion is what the policy GAIN is aiming to solve because it is critical to address such an extensive issue of food insecurity that exists in a high-income country like Canada. By implementing this policy, not only is Canada contributing towards SDGs 2 and 10, but it is also demonstrating how solving inequality is best achieved in a collaborative manner. In addition, this policy presents an opportunity to implement a solution that takes into account the intersectional issues at play such as the social issues and environment. With an investment of \$205M over the course of 10 years, Canada is able to solve one of its contentious issues and hopefully, able to heal from its painful history with the Indigenous peoples of Canada.