

## 5. Vegetable farming, climate change, and food security in the Arctic

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### Abstract

The last years have been witness to an increasing number of projects, initiatives, and farms in the Arctic, experimenting with a variety of techniques to grow vegetables (referring here to all plants used as food) to make the most out of the Arctic's often harsh conditions. In addition to the use of more traditional greenhouses for vegetable production, newer technologies such as hydroponics and geodesic domes help Arctic farms thrive. As infrastructure is often limited in many remote Arctic regions, the transportation of fresh, healthy food can be lengthy, inadequate, and difficult, rendering the supply unreliable or at times impossible. This greatly reduces the availability of healthy foods and food security in many Arctic communities. Removing the troublesome transportation from the equation, better quality produce, improved health and well-being, and increased food security are among the benefits of regional or local vegetable production in the Arctic. Another benefit of locally growing vegetables is decreasing greenhouse gas emissions stemming from the long transport routes of imported food. An important factor that presents opportunities as well as drawbacks for food procurement and vegetable production in the Arctic is climate change due to associated warmer temperatures in some areas, but also more extreme weather events. This contribution examines the linkages between Arctic vegetable farming, climate change, and sustainability, as well as vegetable farming's repercussions on Arctic communities' food security, health, and well-being. The example of 'Arviat Goes Green' illustrates the developments and effects of these linkages.

**Keywords:** agriculture, gardening, sustainability, health

### Introduction

Despite appearing unsuitable for growing vegetables (vegetables here refer to all plants used as food) due to its climate, soil quality and other conditions, the Arctic has a history of gardening and vegetable farming that reaches back into the late 18<sup>th</sup> century, when Russian settlers established colonies in Alaska (Loring and Gerlach, 2010). After some cycles of growth and decline, the blooming of a number of projects in various parts of the Arctic in the last two decades indicates a renewed interest (Nobel, 2013). Many of these projects arose from the desire to improve the health and well-being of Arctic communities, to increase their food security and independence, and to establish a more sustainable system of food production, both in terms of environmental and economic sustainability (S. Tagalik, one of the directors of Arviat's community organization 'Aqqiumavvik Society', and B. Vidmar, founder of 'Polar Permaculture', personal communications). As a result, communities and projects' originators researched and experimented with ways to grow vegetables in the highly diverse conditions of various Arctic regions (see, e.g. Gardens in the Arctic n.d.). In addition to fields outside, many have come to rely on greenhouses, growboxes and more novel technical solutions such as hydroponics, and vertical farming, sometimes in combination with urban agriculture (Naumov *et al.*, 2020). Despite the increasing numbers of vegetable farms and news articles reporting on many of the initiatives, relatively little scientific literature has explored and analysed the social and cultural aspects, reasons, and repercussions

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of gardening and vegetable farming in the Arctic (Chen and Natcher, 2019; Loring and Gerlach, 2010; Naumov *et al.*, 2020; Skinner *et al.*, 2014).

After examining the development of gardening and vegetable farming in the Arctic, this contribution will establish the link to food security, the overall well-being of Arctic communities, and climate change and sustainability.

### Development of vegetable farming in the Arctic

Vegetable farming has experienced a variety of development trajectories in different Arctic countries and territories. In the Arctic regions of European countries, agriculture developed already in the pre-industrial era. By contrast, in Alaska, Canada and the Arctic regions of Russia, the expansion of the oil and gas and mining industries and the associated sharp population increase incited the development of agriculture only a few decades ago (Naumov *et al.*, 2020), with the exception of the often overlooked earlier small-scale farming of Indigenous people and settlers (Loring and Gerlach, 2010). Nowadays, the value and importance assigned to agriculture also varies greatly, which Naumov *et al.* (2020) gauge by the surface area dedicated to agriculture and its contribution to the economy. Northern Canada's provinces of Saskatchewan and Alberta have the highest share of agricultural surface of territories in the Arctic with 36.1 and 28.9% respectively.

It is important to stress that in most if not all of the Indigenous communities in the Arctic regions where gardening and agriculture developed, they disrupted the communities' way of life and, what might seem counterintuitive at first, with it their possibilities to meet their nutritional needs (Lamalice *et al.*, 2018).

### Food security and vegetable farming in the Arctic

Food insecurity can be defined as the 'inadequate availability and access to healthy food of sufficient nutritional quality' (Lamalice *et al.*, 2018: 327). In Arctic regions, store-bought food imported from more southern regions makes up a great part of people's diets. As a result of a poorly developed infrastructure and unreliable connections, including inadequate storage facilities, and the associated high import costs, bought food is often expensive, of inferior quality and/or simply unavailable at times. These challenging conditions have a particularly pernicious effect on fresh, perishable foods, which is why supermarkets in isolated Arctic communities heavily rely on non-perishable, highly processed foods of low nutritional value (Chen and Natcher, 2019). These are some of the reasons why food insecurity is prevalent in Arctic communities that are easily cut off from imported supply (De Schutter, 2012; Nobel, 2013), an issue also raised by the northern Canadian grassroots advocacy group 'Feeding Nunavut'. In 2014, 60 and 29%, respectively, of children in Nunavut and the Northwest Territories lived in food insecure households (Tarasuk *et al.*, 2016).

Producing food locally can make the supply more dependable and reduce food insecurity. The risk of damage during transport or storage can also be greatly diminished through faster harvest-to-shelf cycle of locally produced vegetables, resulting in better food quality (e.g. Friedrich, 2018; Schreier, 2019). Loring and Gerlach (2010: 183) argue that even though not an exclusive means of subsistence in the past, small-scale so-called outpost gardening in Alaska was nevertheless 'one of many equally important components in a flexible and diversified subsistence strategy.' According to Lamalice *et al.* (2018), complementing the current food supply with the local cultivation of crops increases the resilience of Arctic food systems.

Therefore, gardening initiatives help to lessen the dependence on imported food and external economic actors and processes, as well as the associated vulnerability, which is a motivating factor for many

communities (Loring and Gerlach, 2010). However, striving towards increased food security must take into account and prevent possible trade-offs with environmental issues and happen in a sustainable, climate-friendly way, while also alleviating poverty (Poppy *et al.*, 2014). Some initiatives pay attention to these interconnections and take care of the environmental impact of cultivating vegetables, as well as reducing poverty and food insecurity within the community by distributing vegetables to people in need (e.g. Varga, 2014).

## Health and well-being

Health is another paramount reason for many communities to start gardening initiatives, in order to steer away from unhealthy food in Arctic supermarkets and counter the rise of obesity and type 2 diabetes (Loring and Gerlach, 2010). For the community of Arviat, the push came from finding out about the children's poor eating habits. To address this concern, the community decided to focus on two areas of nutritional promotion – improving access to nutrient-rich country foods and 'eating green' – which is why Arviat started looking at the local potential for producing food, such as a community greenhouse. In addition, knowledge about the potential benefits of climate change for plant growth, such as warmer and longer growing seasons, combined with local observations of a 'significant change in the quantity and diversity of plants' encouraged the community on this path (S. Tagalik, personal communications).

For Rainey Hopson in Alaska, health issues also gave the impulse to improve her diet and go on a quest to find out how to grow vegetables in the Arctic, as she recounts on her website (Gardens in the Arctic n.d.): 'In 2008 or thereabouts I was confronted with my age and health. Like most residents on the North slope [sic] I was on a path to diabetes, lung issues and other health problems stemming from my diet and lifestyle. At the time I (...) ate a weird mix of about 15% wild caught food and about 85% pre-packaged food from the store or take out.' As she moved from North Slope to Anaktuvuk pass, her decision to quit smoking and the helpful change of scenery led to a series of realizations, including that she should 'eat better'. However, she 'found almost instantly that it was near impossible to eat a healthier diet here in the village' (Gardens in the Arctic n.d.). From there, she started researching how to grow vegetables and experimenting with different growing techniques.

Another issue that should not be underestimated is the psychological well-being and advantages that people can gain from growing their own food. In their study of community greenhouses in Nunavik, Canada, Lamalice *et al.* (2018) found that for many people (27% in one study site, 14% in another), gardening is relaxing and pleasant and in some cases a family activity. In line with this, gardening and farming programmes can enhance well-being and mental health and offer a safe communal space. They can also be seen as an opportunity for training revolving around food cultivation, preparation, storage, and use. Thus, several researchers (e.g. Chen and Natcher, 2019; Skinner *et al.*, 2014) argue that gardening initiatives' provision of community social services plays a crucial role, even beyond community gardens' and greenhouses' production of food. Skinner *et al.* (2014: 15) further point to the possibility of greenhouse projects as 'avenues for building individual and community empowerment, whereby program champions and community members are able to take control over initiatives that they feel are worthwhile.'

## Climate change and food procurement in the Arctic

The Arctic is warming twice as fast as the global average, which is why climate change in the Arctic deserves special consideration (Hassol and Corell, 2006). There are several ways in which climate change affects the procurement of food in the Arctic.

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Firstly, the changing climate impacts the availability and access to some country foods, for instance by altering the growing conditions and range of wild plants and the migration routes of game animals (Seebacher and Post, 2015). Moreover, some transportation modes that rely on secure ice and that are required to hunt seals or other animals become more dangerous and unreliable (Berkes and Jolly, 2001; Ford, 2009).

Secondly, more frequent extreme weather events, including droughts, floods, and unpredictable rainfall, are potentially challenging for plant growth (see, e.g. Bardalen, 2016; Hansen *et al.*, 2014; Nobel, 2013). In addition, warmer temperatures allow plant diseases and animals considered as pests to expand further north (Bardalen, 2016). According to Willsrud (co-director and farm manager of Calypso Farm in Alaska, personal communications), more extreme conditions and especially the unpredictability of weather and seasons is a challenge for agriculture and renders farmers vulnerable.

Thirdly, a warmer climate does present opportunities and makes some Arctic regions more conducive to growing plants and a wider variety of them. The long hours of sunlight during the summer are an advantage that can result in several harvests, if temperatures are high enough (Friedrich, 2018; Gewin, 2016). The melting of permafrost frees soil that can be used for agricultural purposes. For these reasons, Bardalen (2016) estimates Arctic regions' potential for food production at 20% or more in the next 30 years.

Conversely, the cultivation of vegetables can have a positive impact on the environmental (and economic) sustainability of Arctic communities. With an environmentally friendly choice of materials and techniques used for gardening and agriculture, such as fertilized and limed local soil instead of imported soil, Arctic communities can reduce their carbon footprint that stems from the transport of food items, which often have amassed many kilometres on their way north (Lamallice *et al.*, 2018). What is more, it allows for more diversified economies that are less dependent on the oil and gas industry, even though it is questionable how big these effects are and can be.

In addition, the focus on a sustainable, local food production can also shed light on other aspects of the economy and their potential for improvement when it comes to being environmentally friendly. In Svalbard, Norway, the establishment of the world's northernmost greenhouse, 'Polar Permaculture', led to the rethinking of the local waste management, recycling practices, resource management, and pollution (B. Vidmar, personal communications; see also Friedrich, 2018). This is also the case in other initiatives (see, e.g. Skinner *et al.*, 2014). In Arviat, the community organization Aqqiumavvik, which offers programmes aiming amongst others at increasing food security, has published a Community Climate Change Manual to inform people about additional ways to act environmentally friendly (Aqqiumavvik n.d.).

The changing climate, the mitigation of its negative effects and the exploitation of its advantages for food procurement has been the reason behind some initiatives, such as Iqaluit's Piruqsiavut greenhouse in Canada (George, 2008). Another example is Arviat's research, which led to the initiative 'Arviat Goes Green' and successful experiments with greenhouses and growboxes. On the other hand, the reduction of communities' environmental impact, among others their greenhouse gas emissions, was the driving factor of a number of projects focused on growing food in the Arctic (e.g. Skinner *et al.*, 2014), including 'Polar Permaculture'.

### Case study: food insecurity in northern Canada and 'Arviat Goes Green'

Colonialism had and still has a profound impact on many isolated Arctic Indigenous communities. Some of the changes accompanying colonial processes were the intertwined transitions of energetic

and nutritional systems (Martin, 2003). In Arctic Canada, many developments affected the Indigenous peoples' access to food, among them the depletion of important wildlife species due to their commercialization, the forced settlements, and changes in infrastructure, including the development of air traffic. While this facilitated access to food items imported from southern regions, many of them highly processed, the access to country foods was hampered and became more expensive, effectively 'westernizing' Indigenous diets. As a result, a substantial part of the nutritional intake in many communities in northern Canada nowadays comes from store-bought, low-quality, high-sugar, high-fat foods (Blanchet and Rochette, 2008), thereby contributing to a severe food insecurity that is even more pronounced among Indigenous peoples (De Schutter, 2012; FNIGC, 2018; Tarasuk *et al.*, 2016). The First Nations Regional Health Survey recognizes this link between the food insecurity in Canada's Arctic and colonial structures (FNIGC, 2018), which adds an ethical and justice dimension to food procurement. Following a United Nations Report that highlighted the rampant food insecurity (De Schutter, 2012), Canada established a number of programmes focusing on northern agriculture and agricultural training (Chen and Natcher, 2019). A recent example is the Indigenous Agriculture and Food Systems Initiative, whose goal is to support Indigenous communities and entrepreneurs in the agricultural or agri-food sector (AAFC, 2020).

In 2018, Chen and Natcher (2019) counted 36 community gardens and 17 greenhouses across northern Canada, the majority of them in small communities in the Northwest Territories. One of the initiatives in northern Canada is the programme 'Arviat Goes Green', which has a strong focus on the local cultivation of produce in Arviat, a community situated in Nunavut at 61° North. The driving force behind the programme was the concern about the unhealthy eating habits of the community's youth, as well as the search for ways in which to adapt to a changing climate. Together with observations on the shifting quantity and diversity of plants, these factors encouraged the community's research on and experimentation with techniques to locally produce vegetables and other food (S. Tagalik, personal communications). The initiative had a positive impact on the community's food security and intake of healthy food. In addition to an increased consumption of country foods, which include wild plants, growboxes already planted with a variety of vegetables and accompanied by generous information and support gained a long-lasting popularity with families. Eventually, the community realized the potential stemming from the high demand of fresh vegetables and established two successful commercial hydroponic greenhouses (S. Tagalik, personal communications).

## Conclusion

Vegetable farming and gardening in the Arctic thus have a longer and more varied history and hold more promise than usually assumed. In addition to their positive outcomes for Arctic residents' health, well-being, and food security, they can further support Arctic communities in their adaptations to climate change while potentially mitigating their contribution to it by cutting down on greenhouse gas emissions. Despite the growing interest in gardening and vegetable farming in the Arctic in the last two decades, research on the reasons for this trend and its impacts on Arctic communities is severely lagging behind, a gap that this contribution seeks to reduce.

While limited through its reliance on the few academic studies available and through a lack of empirical research with the exception of interviews conducted with three projects leaders, this contribution can serve potential project initiators, policy makers, as well as customers as an introduction to the potential of vegetable farming in the Arctic and its ramification on communities' well-being, sustainability, and climate change. It further shows that the local production of vegetables has a number of benefits and can foster the development of other valuable ramifications, setting in motion a virtuous circle.

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