



Growing pains: Small-scale farmer responses to an urban rooftop farming and online marketplace enterprise in Montréal, Canada

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Abstract

There is growing interest in the role of new urban agriculture models to increase local food production capacity in cities of the Global North. Urban rooftop greenhouses and hydroponics are examples of such models receiving increasing attention as a technological approach to year-round local food production in cities. Yet, little research has addressed the unintended consequences of new modes of urban farming and food distribution, such as increased competition with existing peri-urban and rural farmers. We examine how small-scale farmers perceive and have responded to a recently established rooftop greenhouse and online marketplace enterprise in Montréal, Canada. Drawing on interviews with key informants and small-scale farmers, we find that peri-urban and rural producers have been affected in three key ways that represent tensions, adaptations, and synergies arising from this new urban agriculture and food distribution enterprise. First, many farmers are concerned about increased competition and value conflation with the ideals of community supported agriculture (CSA) and organic farming. Second, some farmers have adapted by developing novel marketing strategies and working with local bridge organizations to collectively market their produce to urban consumers. Third, a few farmers have decided to wholesale their produce to this new enterprise, allowing them to specialize production and avoid marketing their produce directly to urban consumers. Our study suggests that the emergence of a new form of alternative food network in Montréal has created both positive and negative disruptions for existing small-scale producers. Advocates for the expansion of new urban food production and distribution models should therefore give greater consideration to the effects on other actors in the local food system.

Keywords Urban agriculture · Rooftop farming · Hydroponics · Community supported agriculture · Organic · Alternative food networks · Online marketplace

Abbreviations

UA Urban agriculture
CSA Community supported agriculture
AFN Alternative food network

“They are appropriating something that farmers have spent twenty-five years creating.”
—Organic farmer interviewee near Montréal.

Introduction

In North America, 80% of people now live in urban areas (Population Reference Bureau 2017) and city residents are increasingly reimagining how urban spaces can be used for food provision. In this context, recent interest in urban food production is often a response to concerns about the ability to meet growing and changing demands for food while reducing transportation and environmental impacts (McClintock 2010; Tornaghi 2014). Yet, the emergence of new forms of urban agriculture (UA) in many North American cities, including technological innovations and commercial expansion of new forms of rooftop farming, raises important questions about the social implications of different urban food production models (Specht et al. 2014, 2016). For example, UA projects can serve multiple functions beyond food, including opportunities for education, recreation, and community development (Saldivar-Tanaka and Krasny 2004;

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Duchemin et al. 2008; Vitiello and Wolf-Powers 2014; Pourias et al. 2016).

Alternative food networks (AFNs) have emerged in the past two decades, aligned with a growing awareness in North America and across the Global North of food production and sourcing. Advocates of such networks seek alternative pathways for food provisioning in the face of the perceived failures of the industrial food system (Marsden et al. 2000; Goodman and Goodman 2009; Maye and Kirwan 2010; Maye 2011). AFNs are commonly defined by four characteristics contrasting them to industrial food systems: first, shorter distances between producers and consumers; second, small-scale farms operating with sustainable practices; third, direct marketing through initiatives such as farmers' markets; and fourth, a commitment to the social, economic, and environmental dimensions of food production, distribution and consumption (Whatmore et al. 2003; Venn et al. 2006; Clarke et al. 2008; Jarosz 2008; Maye 2011). While AFNs were originally initiated by small-scale farmers, large-scale farm operators and corporations have begun to take advantage of the popularity of alternative food provisioning, such as with corporate organic food labels or by adapting other values related to localness (Born and Purcell 2006; Maye and Kirwan 2010; Blumberg 2014).

A specific form of AFN that has attracted strong support in North America is direct agricultural marketing. Direct marketing allows small- and medium-scale enterprises to receive a larger proportion of the income generated by their crops and reassert control over their production decisions, while consumers enjoy fresh and high-quality farm products (Lockeretz 1986; Welsh 1997; Hinrichs 2000; Maye and Kirwan 2010). Farmers' markets and community supported agriculture (CSA) programs are seen as central components of direct agricultural marketing, connecting consumers to producers through the direct purchasing of products. Often defined more precisely than farmers' markets, CSA is a form of "socially embedded agriculture" based on an alternative food distribution model that links producers with consumers and often draws on more agroecological approaches to farming (Hinrichs 2000; Galt 2013). While this model can still be highly variable, CSA is typically a subscription-based program in which a consumer registers for a regular installment of produce from a farm or group of farms in advance of the growing season. Receiving payment in advance of the growing season allows farmers to plan ahead while increasing overall equity through risk and benefit sharing among farmers and consumers as shareholders (Galt 2013). In recent years, CSAs have grown in number and shareholder size in North America, with successful models typically maintaining close farmer-consumer connections. Nonetheless, Woods et al. (2017) argue that the term CSA is becoming increasingly confusing, suggesting that farmers need to pay

particularly close attention to the role of 'community' as a means of differentiating themselves to their consumers.

Here, we argue that part of the confusion over CSA may have emerged with changes in the types of production and distributions systems that initially characterized it. On the production side, this includes UA typologies evolving away from traditional outdoor soil-based systems (e.g., Orsini et al. 2014; Goldstein et al. 2016) while on the distribution side this includes online food marketplaces and other forms of direct-to-consumer food businesses (e.g., O'Hara and Low 2020). Hydroponics—a method of agriculture in which plants are grown in a solution of water and minerals, rather than soil—and rooftop greenhouses are notable technological developments in UA that are quickly attracting media attention and financial investment in the Global North (Goldstein et al. 2016; Sanyé-Mengual et al. 2016). Well-known rooftop projects in North America include Brooklyn Grange, which grows more than 45,000 kg of organic produce every year in soil-based rooftop gardens in New York City and Gotham Greens, which operates hydroponic greenhouses across five U.S. states.¹ Both have firm commitments to sustainable growing approaches although Brooklyn Grange appears more directly integrated into CSA programs. There is limited research to date regarding the implications of new technology-based urban agriculture enterprises for existing CSA producers, particularly soil-based peri-urban and rural farmers (but see Sanyé-Mengual et al. 2016; Specht and Sanyé-Mengual 2017). These new forms of capital-intensive agriculture, alongside emerging direct-to-consumer marketing models using online marketplaces, represent new sources of competition to the traditional CSA model; the consequences of this competition have received limited attention to date (Galt et al. 2016; O'Hara and Low 2020).

In this paper, we examine how small-scale farmers in the agricultural region surrounding the city of Montréal, Québec, Canada, have perceived and responded to a recently established urban commercial rooftop greenhouse and online marketplace enterprise, Lufa Farms Inc. Founded in 2009, Lufa Farms has become a key player in Montréal's food distribution scene. With over 13,000 square metres of growing space by 2018, Lufa Farms has a growing network of rooftop hydroponic greenhouses and an online ordering system that allows customers to choose from products grown in the company's greenhouses and by partner farms that supply it with additional produce. While only some aspects of the company are 'alternative' (sensu Jarosz 2008), we classify the overall operations of Lufa Farms as an AFN based on its direct-to-consumer model that sources food from its own urban greenhouses as well several dozen partner farms or

¹ Web links: Brooklyn Grange (<https://www.brooklyngrangefarm.com>) and Gotham Greens (<https://www.gothamgreens.com/>).

food businesses in its network.² This produce is then marketed through ideals of sustainable food production and local food provisioning. Many small-scale CSA farmers in Montréal's hinterlands also focus on vegetable production and are therefore potentially vulnerable to competition from this new form of AFN.

Lufa Farms represents a markedly different type of farm operation with a different business model from small-scale CSA farmers nearby Montréal. Our aim in this study is to investigate the perspectives of small-scale, soil-based farmers regarding the emergence of this new source of competition: a hybridized model of urban rooftop hydroponic farming combined with online direct marketing. To do so, we first outline our conceptual framework building on critical urban agriculture and critical AFN literatures, before providing contextual details on the study region and summarising our methods. The commentaries and responses of small-scale farmers surrounding Montréal are then analysed, revealing a range of tensions, adaptations, and synergies. While often portrayed as an unproblematic tool for community development (Tornaghi 2014), our case study in Montréal shows how a profit-based model of urban food production and distribution with AFN characteristics can be conflated with values associated with grassroots movements, such as CSA and organics, while in reality very different food production, distribution systems, and community engagement might be at play. While our findings are not generalizable to all urban rooftop farming operations, we believe they could be pertinent to CSA in other regions where similar new high-tech UA enterprises or for-profit online marketplaces for local foods have emerged.

Conceptualizing critical urban agriculture

Critical urban theorists argue that urban environments are produced and controlled in ways that cater to elite interests at the expense of marginalized groups (Harvey 1999; Swyngedouw and Heynen 2003). Capitalism is a powerful force in the production of urban space, leading to the creation of unequal resource distribution (Heynen 2003). Individuals and groups who are able to control production, consumption, and exchange create, re-create, and maintain urban environments, while those who lack resources to control such processes often suffer social and environmental

injustices (Low and Gleeson 1998; Swyngedouw 1999). Yet, as a specific use of urban space, urban agriculture is rarely problematized due to its intended socioeconomic and environmental benefits (Tornaghi 2014). Tornaghi (2014) argues that a critical geography of UA is needed to expose the varying and conflicting motivations underpinning such projects. Such an approach can identify models of UA that are solely profit-driven and sometimes confused with community models that have more robust social benefits (Tornaghi 2014). McClintock (2014) adds that, in its many forms, UA may exemplify both a form of neoliberalism and a radical counter-movement. Critical scholars have thus engaged in debates over how both processes are linked in space and time (Darly and McClintock 2017). For example, Walker (2016) argues that municipal governments in Vancouver, Canada, and Detroit, U.S., have selectively used UA initiatives to further different economic development aims without necessarily acknowledging social justice dimensions. In this paper, we wish to contribute to this ongoing debate within critical UA literature focusing on how certain initiatives conflict with the grassroots, socially and environmentally embedded aspects of CSA farmers. Specifically, we use a case study of the emergence of a hybrid form of capital-intensive rooftop farming and direct marketing in a Canadian city.

Tornaghi (2014) identifies several other potential areas of concern regarding UA. She encourages us to consider how UA interacts and is shaped by urban forms and particularly the impact of the regulation, management, and the uneven distribution of land. She argues that UA is “the rhetoric of the sustainable city” (Tornaghi 2014, p. 559). While many projects have environmental benefits (Deelstra and Girardet 2000; Pinkerton and Hopkins 2009) and are tools for community development (Ferris et al. 2001; Shinew et al. 2004; Reid 2009), others exist within a specific framework of sustainability that is pro-growth and pro-capitalist (Tornaghi 2014). Critical research on UA should therefore consider the objectives of practitioners and the perspectives of multiple stakeholders through a food justice lens, rather than maintaining a sole focus on food production (as similarly argued by Walker 2016).

Various forms of power, exclusion, and inequality can thus be embedded in UA initiatives (Saed 2012; Tornaghi 2014; Reynolds 2015). In particular, critical scholars of UA argue that there are important differences between alleviating injustices in the food system and changing the social, political, and economic structures that underlie these injustices (Alkon and Agyeman 2011; Tornaghi 2014). Without paying attention to such structures, UA—like other local food movements—can reproduce the conditions that it may seek to improve (Guthman 2008). From a critical AFN perspective, there are also well-known examples of the ‘local trap’ in food systems, wherein different actors may perceive different benefits of direct marketing that assume local foods

² We observed from Lufa Farms' online marketplace (<https://monreal.lufa.com/en/marketplace>) that its partner network varies to some degree over time and by season. There were at least 39 participating farms providing fresh fruits and vegetables as of May 2019, mainly located in the province of Québec, but with several farms in Ontario, Canada, and Florida, U.S. Based on information provided about these suppliers, they included soil-based organic farms, as well as conventional greenhouse and hydroponic operations.

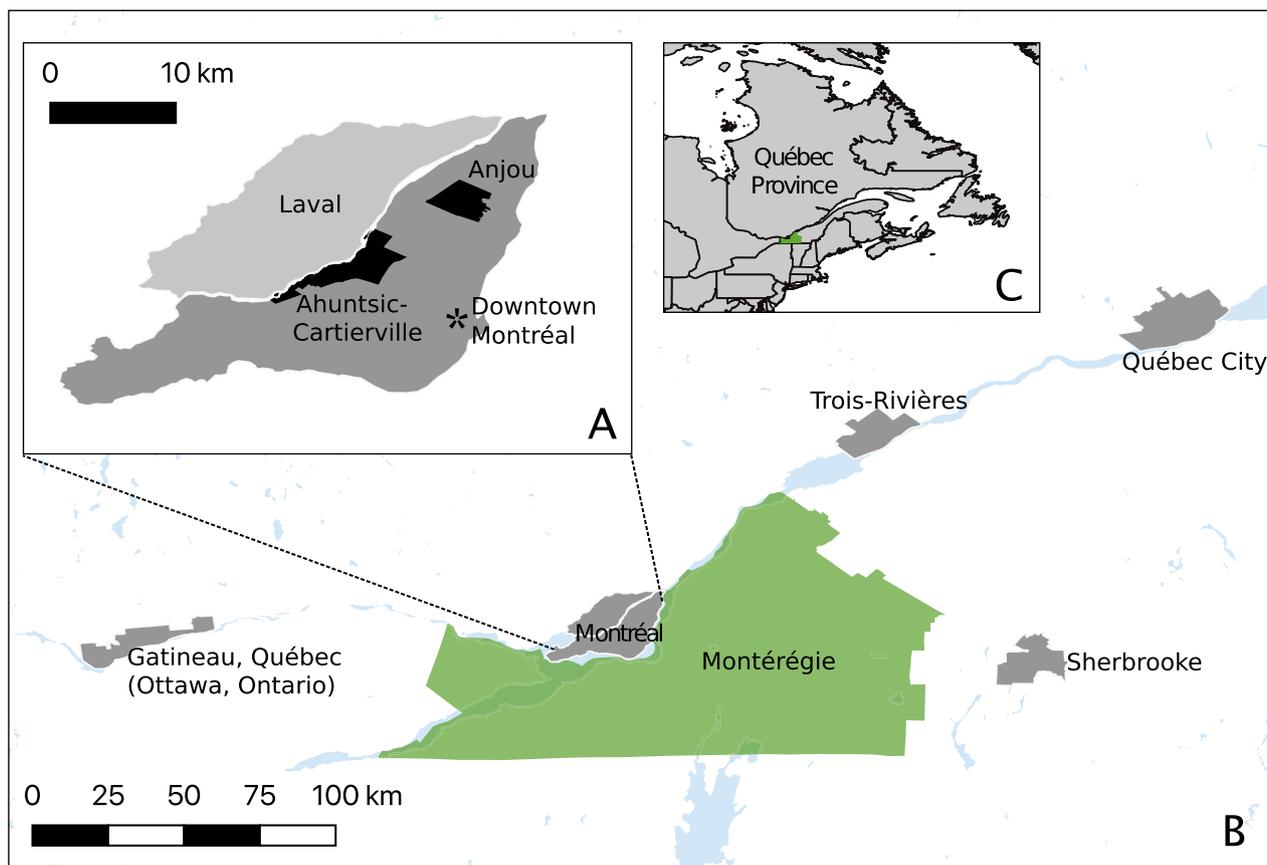


Fig. 1 Maps showing **a** the Montréal neighborhoods of Ahuntsic-Cartierville, Anjou, and Laval where Lufa Farms' three greenhouses are located; and **b** Montréal in relation to the Montérégie region

where most of the small-scale farmers we interviewed were located. Lufa now has pick-up locations in the cities of Trois Rivières, Québec City, Sherbrooke, and Gatineau, all in Québec Province (**c**)

are more socially just and ecologically sustainable (Born and Purcell 2006). It is with these concerns in mind that we examine what consequences a new commercial UA operation and online distribution system aimed at local sustainable food provision could have for other actors in Montréal's food system.

Context and methods

Agricultural production near the City of Montréal

With a population of ~2 million people, commercial farming activities have been nearly eliminated from the Island of Montréal, although there are relatively small permanent agriculture zones in suburban and peri-urban boroughs on the western-most part of the Island (City of Montréal 2012; Bhatt and Farah 2016). Over the past decade, many small farms have been established in the

surrounding peri-urban and rural areas—particularly in the Montérégie region within about 100 km to the south and east of the city (Fig. 1). Agricultural lands cover about 75 percent of the Montérégie landscape, which is a major producer of pork and dairy, field crops (e.g., corn, soy, other cereals), and hay (MAPAQ 2014; Renard et al. 2016). Of the 7077 farm enterprises in the Montérégie in 2012, 542 were associated with vegetable production and 190 with assorted fruits, which comprise relatively large shares of agricultural revenues (MAPAQ 2014). While fruit and vegetable production accounts for a small percentage of the farm operators in Province of Québec as a whole (less than 5%), 80% of fruit and vegetable farms reported using direct marketing, with produce sold directly to consumers at farm-stands, farmers' markets, or farm shares (Statistics Canada 2017).

Non-governmental organizations have played key roles in the development of CSA in the province of Québec. *Équiterre* is a non-profit organization that has operated

in Québec for more than two decades that manages a large CSA database linking consumers to farmers.³ More recently, in partnership with *Équiterre*, the *CAPÉ (Coopérative pour l'agriculture de proximité écologique)* has developed an expansive and self-governed organic farmers cooperative in the province. By 2015, roughly 2–3% of both farmers and total food production in Québec were from organic agriculture, but with a rapidly growing presence of organically certified producers in recent years (L'Union des producteurs agricoles 2015, 2020).

A new urban agriculture and food distribution enterprise: Lufa Farms

Lufa Farms Inc. is a private urban farming company that grows vegetables in an expanding network of rooftop greenhouses located to the north of downtown Montréal (Fig. 2). With an initial CAN\$2 million (~US\$1.5 million) investment, Lufa Farms established what has been described as the world's first “commercial-scale” rooftop greenhouse in the Montréal borough of Ahuntsic-Cartierville in 2011 (Elton 2012). This first greenhouse is about 3000 square metres and produces more than 70 metric tons of produce each year (Lufa Farms 2017a). The company's vision is to create a “city of rooftop farms, growing food where people live and growing it more sustainably” (Lufa Farms 2017a).⁴ Since opening its flagship greenhouse, Lufa Farms has attracted substantial media attention and additional financial investments. These private and public funds have allowed the company to construct two additional greenhouses in the Montréal neighborhoods of Laval in 2013 and Anjou in 2017 (shown in Fig. 1a). As of 2017, when we began our study, Lufa Farms was growing close to 50 varieties of vegetables and herbs in its greenhouses using hydroponic production methods. While after our data collection phase, it is interesting to note that Lufa opened what it describes as the world's largest rooftop greenhouse in the Saint-Laurent neighborhood of Montréal in August 2020—dramatically increasing its production capacity (Israelson 2020).

Lufa Farms began to partner with farms and artisanal producers in 2013 to offer customers a greater diversity of products. Subscribers can now choose from hundreds of products in an online marketplace, including vegetables, fruit, meat, cheese, seafood, and baked goods (Lufa Farms 2019). The company thus uses an online marketplace and

food basket approach, which mimics a CSA, to directly market both its own greenhouse production and that from both local and some non-local suppliers across its network. As of June 2020, these producers included farms, fishers, and food businesses elsewhere in Québec, as well as in other Canadian provinces (mainly farms in Ontario but also seafood or other products from Nova Scotia, Prince Edward Island, and British Columbia) and U.S. states (Florida, New York State, Georgia, and Maine) (Lufa Farms 2020). In 2018, media reports suggested that Lufa Farms grew about 25% of the food sold through its marketplace, although that proportion increases in the winter months when outdoor production by other farmers is limited (Treleaven 2018). The enterprise employs a team of more than 200 people planting, harvesting, packaging, and delivering food products to approximately 11,000 customers across Montréal (Bates 2017; Lufa Farms 2017a). While Lufa Farms does not use a pay-in-advance model common to CSA, it does operate on a subscription-based service where customers pay a fixed amount weekly for a food basket or a variable amount for custom food orders. Customers can choose from more than 300 pick-up locations to collect food baskets, including other cities in Québec Province, such as Trois-Rivières, Sherbrooke, Gatineau, and Québec City (Treleaven 2018; see Fig. 1b).

Methods

Between July 2017 and January 2018, the lead author conducted semi-structured interviews with 30 participants for this study: 25 interviews with farmers from 22 different farms⁵ whose operations are located near Montréal, Canada; and five interviews with key informants who work in the local agriculture sector.⁶ In total, we interviewed 11 male and 14 female farmers.⁷ We constrain our analysis here to data from 22 farmer interviewees from different farms and the five key informants in order to avoid over-representing the perspectives from specific farms. Consent

³ *Équiterre's Fermier de Famille* [Family Farmer Network] database varies in size over time; however, there were at least 113 participating farms in April 2019, almost exclusively in Québec Province. These farms are predominantly smaller in scale, soil-based, and often certified organic or practicing some tenets of organic management. Interactive map available at: <https://www.fermierdefamille.com>

⁴ Archived copies of some webpage content from previous years can be found at: <https://web.archive.org/>.

⁵ We use a fairly standard dictionary definition of ‘farm’ as a tract of land devoted to agricultural purposes, usually by a single owner or operator.

⁶ While it can be argued that this is a relatively small interview sample size, qualitative semi-structured interviews are not intended to represent large populations; rather they describe the everyday lived experiences and concerns of individual participants (Valentine 2005). In this study, we did not interview consumers, as our aim was to direct attention to the impacts of commercial rooftop farming on nearby small-scale rural and peri-urban farms.

⁷ For comparison, there were 31,050 male and 10,945 female farm operators province-wide in Québec in 2016 (Statistics Canada 2017). The greater proportion of women farmers in our study is perhaps due to the lead author being a young woman.

Fig. 2 Lufa Farms' original Ahuntsic-Cartierville greenhouse, constructed on a pre-existing building, seen from outside during its first year of operations in 2011 (top). A photo taken within the Ahuntsic greenhouse, showing the hydroponic production system (bottom). Photo credits: *Design + Environment* (CC BY 2.0) and the authors



forms were provided in both French and English, and all participants chose to speak English, with interviews taking between approximately 30 min to an hour. All participants were farm owners or managers; only one was a farm worker, who was approached when the farm owner was unavailable. We asked farmers about the characteristics of their farm operations (including the role of their farm in their livelihoods), challenges of small-scale farming, as well as their perceptions of and relationships to Lufa Farms.

Of the 22 farms in our study, four were currently in the Lufa supplier network, while five had previously been in the network but had since left. Because our emphasis was on farmers who might have been affected by the establishment and growth of Lufa Farms, we purposely targeted participants who were primarily CSA vegetable producers. These producers were either certified organic or indicated that they farmed with ecological integrity but without organic certification. The online *Fermier de Famille* [Family Farm] network map, created by *Équiterre* to allow consumers to identify nearby CSA pick-up locations, was utilized to generate a list of potential participants. Chain referral sampling was then used to identify other farmers who fitted our sampling frame and to help capture a diversity of farms. All farms were within 100 km of the Island of Montréal, which has a high density of CSA farms in the *Fermier de Famille* network and also increased the likelihood that farmers would be marketing their produce in Montréal.

Our five key informants all worked for non-profit or not-for-profit organizations that promote local sustainable agriculture. In addition, we requested an interview with Lufa Farms in November 2017 to which a company representative replied that an email exchange could be arranged instead. We provided four broad questions asking about the evolution of the company's business model over time, its partnership with food producers outside the city, its considerations when establishing these partnerships, and the role of urban farms in supplying food to urban areas more generally. One of the company's co-founders then responded to our questions over email, albeit without providing details beyond those already available on the company website, which was also used for our analysis. The lead author attended an open house and public tour at one of the company's greenhouses in October 2017, which provided further insights into the company's technology and operations. All participants agreed to be audio-recorded and these recordings were then transcribed and thematically coded by the lead author. The emerging themes were then cross-checked by the two co-authors for additional rigor (Cope 2010). Coding identified important themes, drawing from a priori and a posteriori codes such as livelihood challenges, access to resources, sentiments towards UA, and collective responses to changes in the

marketplace. Pseudonyms were assigned to interviewees to protect their confidentiality and we do not identify the location of individual farms.

Results

Farmer tensions, adaptations, and synergies

The interviewed farmers were located on average about 50 km from downtown Montréal, in the peri-urban and rural Montérégie region southeast of the city (Fig. 1). Several of the farms represented in this study were quite new. Six out of the 22 farms were less than five years old while nine were between 5 and 10 years old—therefore many of these farms were founded after Lufa's first farm was established in 2011. All participants reported that farming was their primary source of income; however, nearly one-fifth reported having a secondary income and two reported relying on federal unemployment insurance programs during winter months. On average, farms had three employees during the farming season (approximately May–November). Fourteen of the farms were certified organic, a further six were in the process of obtaining certification, while the two remaining farms could not be certified organic due to specific circumstances (but did not use chemicals or pesticides in their production). The farms grew a range of vegetables while many also grew fruit and raised free-range hens for eggs. Farmer interviewees primarily sold their produce to consumers in Montréal through direct marketing including farm stands, farmers' markets, and CSA baskets, with a small proportion of produce sold to their local peri-urban communities. On average, farmers cultivated 2.4 hectares of land (*maximum*: 4.5 hectares, *minimum*: 0.4 hectares) but many interviewees reported having additional land that they did not cultivate regularly.

Farmer tensions

Marketing and competition

Our interviewees stressed the rapidly changing agri-food sector in Québec Province. While a majority of participants in our study felt that the Montréal market was not yet saturated, all interviewed farmers expressed sentiments that the number of farms attempting to break into the Montréal market had increased notably in the past five years, with some indicating that this had generated greater competition. One farmer reflected on the increasing challenges to find consumers in the city:

It's very trendy right now to pursue small-scale farming, especially because of the book by Jean-Martin Fortier.⁸ There are many people going to study small-scale agriculture and many people creating more farms. So, I think there are more and more farms popping up around Montréal and aiming for the Montréal market. I've heard from other farmers who have been selling in Montréal for more than ten years that it's been harder and harder to find new customers. It's getting crowded (29 August 2017).

Farmers also stressed the vastly different (lower) amounts of private capital available to small farms compared to larger enterprises that could result in economies of scale. Some farmers specifically pointed to the presence of such larger food businesses making it more difficult to sell their produce. One farmer reflected that breaking into the Montréal market could be particularly difficult for new producers, due to these large competitors: "It's possible, you can do it, but having large players with a lot of money who can appeal to a really large mainstream population is cutting down on the people we have access to" (11 August 2017). Indeed, by investigating the supplier network listed on Lufa's website (as of June 2019), we observed that some of Lufa's partner farms are relatively large enterprises that typically specialize in one or two products. For instance, *Serres Royales*⁹ is a family business that provides Lufa with extra tomatoes from its 60 greenhouses totaling ~28,000 square metres in Saint-Jérôme, Québec, while *Serres Lefort* produces bell peppers in 300 greenhouses with more than 100 employees. Therefore, while Lufa sources from a diversity of local farms in Québec, some of these farms are relatively large operations compared to the small-scale producers who participated in our study.

Nonetheless, two participants felt that increased competition, be it from relatively large or small farms, might be good for small-scale farmers who must learn to adapt their models. One farmer explained: "A little bit of competition is good for everybody, especially when you have the same standards and goals" (14 October 2017). He elaborated: "If there is a bit of competition, it makes both parties try to be more efficient and be better at what they do. In the end, the consumer wins because they have better choices." The

second farmer added: "When Lufa arrived, it was like an earthquake for the [CSA] model. I think it accelerated the fact that traditional CSA farmers had to adapt and change the model" (9 November 2017).

A key tension relating to the emergence of rooftop hydroponic farming and online direct marketing in Montréal among small-scale CSA farmers was a concern that consumers could be confused about the degree of local food sourcing in hybridized distribution models. In particular, some farmers expressed unease that Lufa supplements its own produce with products that increase consumer appeal despite not necessarily being locally sourced. Unless consumers specifically check the suppliers (information is available when users click on the supplier name), they may remain unaware of where the product is sourced from and could potentially equate products with Lufa's own greenhouses. One farmer explained with irony that there was a great deal of misunderstanding among Lufa's customers regarding produce sourcing. He added that a customer had insisted that Lufa farms' network included only local and organic farms, to which the farmer had responded "but there are no local organic grapefruit in Québec, that's not a thing" (15 August 2017). Another farmer similarly expressed, "the fact that they [Lufa] seem like farmers is frustrating" (14 September 2017).

The fact that Lufa offers a diversity of food products is perceived as particularly challenging for the competitiveness of small-scale farmers as it 'raises the bar' for convenience and choice. One farmer explained:

If people want more choice and other farms are giving more choice, then you have to do that. You have to become as good as everyone else. Lufa is setting the bar with choice, and then you have to choose to do that if you want to maintain your customer base. It increases the need for performance, which I think is not that sustainable for farmers (15 July 2017).

Further emphasizing this sentiment, another farmer explained that when customers realized that his farm did not offer the same choices as Lufa, some were no longer interested:

When we were trying to get people signed up [for our CSA baskets], four or five said 'you do Lufa-style' and we said, 'no, we don't resell, we just produce.' I could tell that Lufa was not totally clear to them and they weren't very interested in us when they learned about more of the details of how they have to be there every week, that we just have vegetables. Sometimes we have fruit, but we don't have bread, or milk, or avocados (14 September 2017).

⁸ Jean-Martin Fortier is a Québécois farmer specializing in organic and biologically intensive cropping practices. In 2014, Fortier released a popular book called "The Market Gardener," which provides horticultural techniques and innovative growing methods. His book includes practical information on setting-up a small but profitable farm by designing intensive cropping system based on Fortier's experiences at *Les Jardins de la Grelinette*, a farm in Saint-Armand, Quebec.

⁹ Details on these individual farming operations can be found at: *Serres Royales* (<https://www.lesserresroyales.com/en/>); *Serres Lefort* (<https://culturevog.com/en/serres-lefort/>).

Farmer perceptions about co-opting of the CSA model and its values

In addition to potential consumer confusion about local sourcing, more than half of farmer interviewees were concerned that Lufa's distribution model could conflate values inherent in the CSA model in the eyes of consumers. In both models, customers sign-up ahead of time and received a weekly basket of produce. Despite these similarities, farmers were upset that many of the core values of CSA are missing from Lufa's model, expressing a sentiment that Lufa co-opted the CSA model without maintaining the original CSA values. One participant explained:

As soon as you move outside of the circles, people don't know what CSA is, and Lufa was very quick to capitalize on all of the good will that was associated with Community supported agriculture. That's part of the reason I think that farmers feel 'oh my god, this is terrible' and that Lufa are appropriating something that we have spent twenty to twenty-five years creating (29 July 2017).

Given the historical significance of the CSA model, farmers expressed frustration at seeing a corporation benefiting from a movement aimed at creating lasting change in the food system.

Farmers felt protective of the CSA model because it was born out of a movement to help make farming a more sustainable livelihood and to strengthen the connection between farmers and consumers. Or, as one farmer put it: "No one who is getting into farming [in Québec] is doing it to get rich. You get into farming because you are passionate and because you believe in a certain way of life—it's values driven ... This is a counter movement. It's entirely values driven" (15 August 2017). Another farmer explicitly stated that her CSA farming values are not embraced by many commercial farming enterprises, noting: "I don't think these deeper values I strive for as a CSA farmer, that I share with other CSA farmers, are shared by companies like Lufa, and because of this I personally wouldn't want to sell to a place like Lufa" (16 January 2018).

In direct marketing and particularly in CSA, a reciprocal relationship exists between farmers and consumers. Such a relationship can only exist when business is conducted at an individual scale, as one farmer elucidated:

The whole point of CSA is that I want to know where it came from. Meeting the farmers and really knowing is easier when buying from one small farm. I feel like buying from Lufa doesn't necessarily create a better connection between farmers and consumers. That's not to say it doesn't make it easier for consumers to buy ecologically sourced food; but I think it's really important that people understand where their food comes from (20 July 2017).

Another farmer stressed that Lufa's online presence disrupts the possible connections and interactions between farmers and consumers that direct marketing can create: "this [CSA] model is being falsified by Lufa because you aren't linking farmers to people, you are linking a business to people. There are no farmers behind Lufa, there's an IT guy" (15 July 2017).

Several farmers emphasized how the CSA model generated added value beyond local food provisioning through its potential for connecting customers to farmers and the source of their food. As one farmer noted regarding the potential for feedback and response:

The [CSA] model was based on a lot of hard work and it's really what distinguishes us: being farmers that direct market and know their clients. Your clients directly influence your choices of production. If they are unhappy, you have to change something. You can have a conversation with your customers and change something. (15 August 2017).

Opportunities for such personal connections arising from direct marketing and how it enabled farmers and customers to get to know each other was described by a few participants in terms of family. As one participant explained: "I think people really crave the relationship that farmers build with them. We get to watch peoples' kids grow up, it's very special" (29 July 2017).

Farmer concerns surrounding organics and local foods marketing

As noted earlier, 14 farms represented in our study were certified organic and six were in the process of gaining organic certification. Many of these farmers were protective of the organic label due to the time and resources required to obtain certification. In Canada, this certification process requires producers to complete one year of pre-certification before obtaining full certification (EcoCert Canada 2018), while the fees are based on acreage and type of production; the basic fee for less than 10 acres of production being CAN\$400 plus the inspectors' travel fee (Pro-Cert Organic Systems Ltd. 2018). Our farmer interviewees expressed a strong sense of pride that comes from growing food organically and likened it to a 'philosophy'. Because of the values and logistics embedded in organic management, farmers were concerned that Lufa could be misperceived as an organic operation by some consumers.¹⁰

¹⁰ Future research will be needed to address concerns identified by farmer interviewees regarding potential consumer confusion over rooftop hydroponics and organic production in the North American context. For example, Specht et al. (2016) surveyed consumers in Berlin about their preferences related to UA production and found that initiatives that fused social and ecological goals were more desirable than production-oriented initiatives that focused on technology.

While some of the food that Lufa distributes through its marketplace is organic, its own hydroponic greenhouse production is not. The company states that it grows its own greenhouse vegetables without pesticides, using biological pest control for pest and disease management. For example, beneficial insects are released into the greenhouses in order to protect plants from harmful pests such as aphids (Lufa Farms 2017b). Organic regulations vary considerably across jurisdictions in terms of allowing hydroponic production (such as in the U.S.; see Gilmour et al. 2019 for discussion), but currently the standards for organic certification in Canada do not allow hydroponics, which Lufa relies on for its own greenhouses. To meet organic standards in Canada, soil must “provide the bulk of the nutrients to the plant throughout the crop cycle” (Canadian General Standards Board 2015).

While Lufa does not use the term ‘organic’ on its website for its own greenhouse production, farmers noted Lufa’s use of similar words or phrases— “sustainability”, “a local food system”, “farming responsibly”— that everyday consumers may equate with organic agriculture (confirmed by our own review of the website). There was a strong sentiment amongst farmers that some consumers may not fully understand the distinction between sustainability benefits of hydroponic production and organic standards. One farmer noted: “I distinctly remember *Radio Canada* [a Québec public radio station] doing an interview and asserting that they [Lufa] were organic. Even the media didn’t do its homework in understanding the difference between greenhouse growing and organic growing!” (29 July 2017). Farmers argued that consumers cannot necessarily distinguish the nuances between terms such as ‘organic’, ‘sustainable’, and ‘ecological’ used in the company’s marketing. Another farmer added:

People think Lufa is organic and local. Lufa gets grouped in with us and doesn’t make it super clear that they aren’t organic. They don’t say that they are organic, but they say, ‘We are sustainable, have sustainable pest management...’ and so forth. (13 September 2017).

Another farmer expressed similar concerns: “I really dislike the ‘almost-organic’ perception because you’re organic or you’re not. When you’re doing hydroponics, you’re not” (10 October 2017).

Farmer adaptations

Emphasising marketing

Given the tensions arising for local farmers due to a new corporate player in the local food system, we found a number of examples of small-scale farmers adapting their business

models to be more competitive. At the individual farm level, many farmers are now offering increased choice in their weekly produce baskets. At basket pick-up locations, we observed that customers were often able to choose between different vegetables and sometimes had the option to purchase additional products that were not included in the basket, whereas farmers in Montréal traditionally determined the contents of CSA baskets themselves. One farmer had successfully transformed his basket program into a market stall program where customers subscribed ahead of time, as they would in CSA, but were able spend their credit at any point during the season on any products at the farmers’ market. His operation reached capacity well before the beginning of the season. Increasing the flexibility of basket content thus made the model more appealing to consumers with diverse tastes.

Despite having limited resources, many small-scale farms had recognized that strong marketing was worth the investment. One farmer interviewee explained that he and his business partner had chosen to divide their responsibilities accordingly:

Marketing is one of the most important things as a farm. The farmer always says ‘I don’t have time. I have to work’ and the marketer will always say ‘but you can’t do anything without marketing’. The challenge is that the middle-man [sic] will then come into the picture and say ‘I’ll give you 30 percent on that item and I’ll make 70 percent’. Getting [all the produce] to market is the most important challenge that farmers face. So, the way we solved this is by putting everything in-house (27 July 2017).

Many farmers chose to sell through direct marketing because they enjoyed the connections they established with customers. However, this is a large investment in time and energy. One farmer explained that the additional effort required of farmers who chose to directly market their produce was sometimes overwhelming, forcing some farmers to pursue other business models:

There are many farms that choose this type of production but after a couple of years, they quit because it’s so demanding. Even when the network exists and provides its services to farms, it’s really hard. It’s a choice of a production model that requires so much from the farmer: administration, knowledge of every different aspect of production, and it’s based on diversity (11 November 2017).

Similarly, another farmer reflected that this model of production, while it has a strong set of values, it might not be appropriate for all farms:

It takes a lot of energy to maintain subscribers from year to year and to cultivate that relationship. Unless you can find an economically efficient way to cultivate that relationship, it might not make sense. It's a great philosophical point of view, but at the end of the day the farmer needs to make a living. If they can more efficiently sell to a couple of restaurants than to 200 households, then it's an easy choice (14 October 2017).

The role of bridge organizations

Because maintaining a subscriber base can be difficult for farmers with little time to dedicate to marketing and administration, initiatives that facilitate these aspects play an important role in relieving the demands of running a direct marketing model. Farmer interviewees suggested that two non-governmental organizations, *Équiterre* and *CAPÉ (Coopérative pour l'agriculture de proximité écologique)*, have played key roles in supporting small-scale farmers in terms of overcoming financial, knowledge, or time barriers needed to market their produce online. A farmer in his first year of cultivation noted how important *Équiterre* had been in helping him establish a consumer base in Montréal:

We work with organizations that already do marketing and have other things going on, such as *Équiterre*. We are still selling directly to consumers but we are shepherded by other organizations that already have experience. We got into a network that's already established and that's been very helpful (20 July 2017).

Farmers explained that via *Équiterre* they had been able to tap into a larger network of consumers, particularly important for new farmers who had yet to develop a stable consumer base. *Équiterre* has been expanded considerably from a network of seven farms when the organization launched in 1996 to over a hundred farms by summer 2017 (*Équiterre* employee interview, 16 August 2017). The organization helps farmers and producers develop specific delivery points so as to minimize competition amongst farmers and hence create equal opportunities for all farmers involved (ibid., 16 August 2017). Through *Équiterre*'s website, customers can locate the CSA basket drop-off points close to them and are then redirected to a farm's website to register directly with the farm. One farmer described how *Équiterre* helped him bridge the connection with potential consumers, allowing him to establish his first basket drop off in Montréal city:

We wouldn't have been able to have this drop-off point without *Équiterre*. I just asked someone there if they had any future drop-off points, as that would be really great and would help us double in size really fast. They said, 'we might have a lead' and I said, 'that sounds perfect'! A day after, I had the number of the guy and

a week after I was meeting him. He was really into it, but *Équiterre* made the connection possible and made it really great for us (14 September 2017).

Such organizations and networks have become crucial to the collective success of small-scale farms in the Montréal region, particularly with the entry of new competitors. Initially, Lufa had a web presence and online ordering system that small farms could not replicate given the costs of developing and managing such systems. However, when *Équiterre* developed its web tool to allow clients to sign up for baskets online, small farms were immediately able to reach more consumers. In addition to ordering baskets online, consumers can now order extra produce and organize their scheduling of pick-ups (for example, cancelling or rescheduling baskets due to vacations); this added convenience has started to match the services that Lufa provides. While farmers have to pay for this service, the 16 interviewees who were doing so overwhelmingly thought it was a worthwhile investment.

Another similar response to increased competition is *Les Bio Locaux*, a collective of organic farmers in the Greater Montréal area and members of the *CAPÉ* cooperative who have joined forces to sell their local produce together all year long. This collective of farmers invests in marketing for summer and winter vegetable baskets. By offering collective winter baskets, farmers are able to retain CSA customers during the winter months when many consumers begin to purchase imported vegetables. A farmer who is a member of the collective explained:

Many farms do baskets during the summer season but stop in November and their customers then have to look for other options to eat local, and many go to Lufa. So that's why the co-op decided to do the winter baskets: so that we could continue selling year-round. We are about twenty farms who sell baskets together in the winter. We are aiming for 2,000 baskets every two weeks (29 July 2017).

Another *Les Bio Locaux* collective member stated that pooling resources has not only allowed farmers to offer greater diversity and flexibility to customers but has allowed farmers to enter the market with less risk. He stated: "The point of doing baskets together was to be able to penetrate the market. For a single producer, it can be too big or risky to enter the market. To do it all together puts less pressure on individual producers; putting all of our energy and resources together we can reach more customers" (9 November 2017). Members of this collective now pay part-time employees to organise the distribution system and sell produce at farmers' markets, while all members of *Les Bio Locaux* continue to sell produce directly to consumers as well. However, all produce is sourced from local farms in its network (*Les Bio Locaux* 2020).

Such collaborative models have been a key adaptation strategy for small-scale farmers in response to Montréal's changing food system, and in particular the arrival of Lufa Farms. As one farmer noted: "It's like David and Goliath. Lufa had the opportunity to access so much funding. We didn't have access to that amount of funding!" (9 November 2017). By pooling their resources through collaborative models, small-scale farmers are able to level the playing field to compete with larger establishments—at least to some degree. *Les Bio Locaux's* cooperative strategy highlights that the interpretations and practices of CSAs are evolving even amongst soil-based farms and possibly in response to increased competition. This is similar to the changes in CSA seen in other regions of North America, such as California (Galt et al. 2016).

Synergies: partnering with the Lufa supplier network

Finally, there were four interviewees who had decided that the best way forward was to partner with Lufa. For farmers who were either continuing to connect with Lufa, or who had done so in the past, they noted that this approach allowed them to specialise, or to cut on marketing time and costs. One supplier explained:

I sell to Lufa because I can deliver a good volume every week. It suits my business model—I'm only growing a few types of vegetables, but a lot of them. I have to have clients who can buy in big quantities. The reason for choosing a few vegetables is that I think I'm much better at growing a few vegetables instead of growing fifty of them. I'm more efficient and better at it because I can concentrate on them, I can lower my production costs (26 October 2017).

Another core benefit of supplying to Lufa that was noted, was the ability to avoid spending time or money on marketing. One farmer remarked:

In my experience, there aren't many people who go into small-scale farming who also want to do the marketing for their farm. There are lots of farmers out there who I think are happy with the option that Lufa provides because they can still farm with integrity and ecological morals in mind, but they don't have to do all the fancy marketing that goes with it, since Lufa does it for them (6 July 2016).

Thus, for these four farmers actively involved in the Lufa supplier network there were clear benefits that they had deemed to outweigh concerns or tensions that many other farmers in our study felt or pushed back against.

Discussion: Reflecting on farmer responses through a critical urban agriculture lens

Both urban hydroponic rooftop farming and online food marketplaces that source from local farms can be viewed as new forms of alternative food provisioning with parallels to alternative food networks. In the case of Lufa Farms, parallels include "values of proximity, quality, transparency, and sustainability" across its partner network (Lufa Farms 2020), while differences include its growing scale of production, technological focus, profit model, and predominantly online presence (following characteristics outlined by Jarosz 2008). The motivations of this hybrid model are sometimes mistakenly paralleled to those of small-scale farmers whose efforts were the basis for grassroots developments in the first place, such as community supported agriculture. Perceptions of UA as benevolent and unproblematic can conceal such contrasting and at times conflicting motivations (Tornaghi 2014). In the Global North, UA initiatives have been promoted in large part due to their potential to increase local food production; however, the dominant UA narrative has lacked critique of the social and political structures in which urban farming initiatives are embedded. Without paying attention to underlying social, political, and economic structures and processes, UA may reproduce the very conditions that practitioners seek to improve (Guthman 2008; Alkon and Agyeman 2011). It should be acknowledged that UA is not homogenous, with a diversity of typologies ranging from outdoor ground-based systems to building-integrated systems such as rooftop greenhouses (Goldstein et al. 2016), each with different objectives, purposes, and actors involved. Our critical perspective here focuses on relatively large-scale rooftop farming using hydroponic growing systems with much higher yields than comparable soil-based UA, whether on the ground or rooftop (Haberman et al. 2014).

By adopting components of the CSA model and then hybridizing and expanding it by selling products from other producers, we found that a new corporate urban agriculture and distribution enterprise has resulted in numerous tensions with nearby small-scale farmers. As a result, two contrasted systems of production and direct marketing co-exist today in the Montréal area that share some actors (small-scale farmers participating in both Lufa's supplier network and the CSA network) and ideals of sustainable food production but that otherwise differ dramatically in the social embeddedness of their business models. Lufa Farms' technology-based model and online presence has spurred the evolution of the CSA farmer network with new mechanisms for collaboration among farmers facilitated by bridge organizations that provide logistical support to help meet changing customer expectations. This echoes findings of past work on the role of non-profits as supporting organizations in developing

UA policies (e.g., Campbell 2016). On the other hand, the negative perceptions held by some small-scale farmers in our study are similar to the effects of increased competition between CSAs and other produce channels (e.g., retail outlets emphasizing localness) in Galt et al.'s (2016) study of California farmers.

Despite increasing demand for local and organic food, many economic and environmental challenges remain for small farms in Québec Province. Finding points of sale and developing a dedicated customer base can be significant challenges for small-scale farmers. While such farmers' livelihoods may not yet be threatened by cultivation in cities (as urban production is quite limited to date), they are increasingly affected by the resale of food products by larger enterprises with a competitive advantage. Interviewees explained that this is particularly the case when their competitor appears to uphold the same values in the eyes of consumers. Farmers repeatedly noted that their primary concern was that Lufa mimics CSA and organics models; models driven by values that farmers were adamant the company does not embrace. Yet, Lufa has placed itself in direct competition with small players by targeting the same customer base and using a similar marketing strategy—namely, a weekly food basket program. While some farmers we interviewed were curious about Lufa's innovative technology, they were more concerned by the company's distribution approach that appears similar to CSA despite drawing from new production and marketing models.

We are unaware of other studies that have specifically investigated the impacts of rooftop greenhouses on farmers beyond city limits; as such, our study raises important questions regarding the roles and impacts of new UA production models in local food systems. Comparing our case to another in the Global North, Specht and Sanyé-Mengual (2016) interviewed UA-stakeholders regarding rooftop farming and greenhouse production in Barcelona and Berlin. In Barcelona, they found that competition with peri-urban and rural farmers was perceived as a potential 'high' economic risk, but that perceptions of risk varied among stakeholders. In our case study of Montréal, study participants reflected that Lufa has used its legitimacy and resources to promote local food to consumers who might otherwise remain disconnected altogether from food production. This sentiment echoes results from a USDA report in which rural farmers expressed that they benefited from increased interest in local food that their competitors helped to create (Woods et al. 2017). In terms of its hybridized distribution model, Lufa has also provided a convenient option for rural farmers who are eager to streamline their production by specializing in a couple of products, then selling their products to the company rather than seeking dispersed marketing outlets.

Yet, the lack of financial resources that many small-scale farmers struggle with makes it difficult for them to invest in equipment and marketing that would improve a perceived uneven playing field. Despite the positive implications of Lufa's production and distribution model, our interviews suggest that peri-urban and rural farmers view commercial-scale rooftop greenhouses predominantly as competitors that benefit from favorable economies of scale. This allows them to offer increased flexibility to consumers, thus diminishing the competitiveness of small-scale farms. Rooftop greenhouses also have the benefit of being able to produce food year-round in the city, while outdoor cultivation is otherwise limited in Québec due to cold winters. Study participants worried that companies like Lufa Farms, with more capital-intensive urban greenhouse production and food distribution, could potentially alter expectations of urban consumers in terms of CSA (e.g., in terms of year-round local food production, flexibility, customization, and delivery)—at the detriment to smaller farmers who may not be able to compete, particularly during winter months.

Technology was also a key factor distinguishing the farming models considered in this study. Lufa embraces technological innovation as the core of its operations, including its online distribution system. When Lufa built its first rooftop greenhouse in 2011, some peri-urban and rural farmers were interested in the company's technology but became more concerned about widespread misconceptions surrounding the company's operations over time. "It spread like wildfire that there were these newcomers who were doing rooftop growing with very innovative technology—all of that is very interesting, but we very quickly became alarmed at what was clearly false representations to the public" explained one farmer (29 July 2017). Rather than offering a grassroots urban farming solution, one could argue that rooftop greenhouses and online marketing offer more of a technocratic solution that involves substantial capital investment. Furthermore, while commercial-scale rooftop greenhouses can provide urban consumers with fresh, local food, they do not necessarily provide consumers with a realistic understanding of the realities facing local agricultural producers, nor do they forge a greater connection between producers and consumers.

Urban agriculture is multifunctional, providing a range of social and ecological benefits beyond its food function (Lovell 2010; Pourias et al. 2016). A critical geography of UA therefore recognizes these different forms and functions can conflict with one another. While models such as rooftop greenhouse farming can challenge conventional and potentially unsustainable farming practices, their actions can perpetuate neoliberal restructuring despite good intentions. With more capital-intensive production methods and by mimicking marketing strategies, a neoliberal market logic of improved performance, increased outputs, and economic

efficiency comes to mind in the case of large-scale rooftop hydroponic farming. Such initiatives could ultimately also transform the food system to exclude marginalized populations as demand and prices rise (Alkon and Mares 2012)—highlighting McClintock's (2014) suggestion that UA can serve both as a social movement and a reinforcement of neoliberal structures.

Conclusions

A critical geography of UA exposes the varying (and sometimes conflicting) motivations of urban farming projects. New technology-based urban food producers such as Lufa Farms present a unique opportunity for education and engagement with urban consumers who may otherwise remain disconnected from food production altogether. Lufa provides tours of their greenhouses and a slick marketing website. However, an uneven playing field exists between small-scale farms competing for consumers in Montréal with a relatively large-scale new urban rooftop farming enterprise that also incorporates an online marketplace sourcing from local and non-local producers. This unevenness is exacerbated by a relative lack of resources for small-scale farmers to communicate their values or organic principles and the ease by which consumers potentially misinterpret concepts such as organic and CSA in the context of urban rooftop hydroponic greenhouse production and online marketing.

Our interviews and observations suggest that the emergence of commercial-scale rooftop farming in Montréal has influenced the supply and demand of local food, creating both positive and negative disruptions in the food system. The tensions that have arisen for small-scale farmers in the peri-urban region around Montréal with the establishment of commercial-scale rooftop farming are numerous and cannot be dismissed. The situation is further complicated when a company mimics the CSA approach and the values that small-scale farmers use to differentiate themselves. For many small-scale farmers, the result has been the need to adapt and to do so creatively. While some have strengthened their own marketing strategies, others have formed collectives to pool resources. In this study, we found that bridge organizations and cooperative networks that help small-scale farmers compete with new, large-scale corporate players have been crucial to many small farm success stories, reducing the vulnerability of small-scale farmers who chose not to supply to larger distributors.

The ways food is produced, distributed, and consumed in North American cities and those across the Global North will continue to change and many of these changes are likely to be driven by technological innovation. As an innovative urban rooftop UA operation and alternative food network,

Lufa Farms has created disruptions in the local food system that can be perceived as both positive and negative for small-scale farmers. Like two of our farmer interviewees noted, competition can be positive, creating innovation and improvements. However, the majority of small-scale farmer interviewees were working extremely hard with adaptation approaches, being deeply concerned about a perceived imbalance in the playing field. Urban agriculture can serve many positive functions beyond food production, including a role in community development and sense of place (Keeler et al. 2019) and rooftop farming may be a promising option for resource efficient farming in cities (Orsini et al. 2014; Goldstein et al. 2016). However, our on-the-ground investigation of how urban food provisioning is playing out in a North American city has shown that the picture is not necessarily ideal for all, highlighting the importance of considering the broad range of actors involved, certainly not just those with the latest technology and marketing ideas.

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