

Diversifying Urban Agriculture Assets:

How Municipal Policies Encourage or Deter the Development and Adoption of Agritech Solutions

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The University of the Fraser Valley is located on the ancestral lands of the Halq'eméylem-speaking Stó:lō Peoples (People of the River), who have occupied this land since time immemorial.

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1. Summary

Global issues such as climate change and increasing geopolitical tensions have presented a need for municipalities to develop urban agriculture and local food systems. Agri-food innovations such as vertical farming and cellular agriculture have the potential to enable sustainable local food production while also shortening supply chain distances and processing and distribution times.

While societies have traditionally relied on rural agricultural areas to supply urban centres with food, emerging food production methods enable urban agriculture that can improve localized food system security and resilience in both urban and rural environments. However, as these are emerging food production methods, many municipalities have not yet determined how to appropriately plan and develop policy environments that effectively accommodate these forms of urban agriculture.

This study examines how local plans and policies may or may not support urban agriculture development, including vertical and cellular agriculture facilities. The research focuses on communities in British Columbia (BC), namely Vancouver, Victoria, and Langford. The research methods involve a thematic content analysis of the Official Community Plans (OCPs) of Vancouver, Victoria, and Langford and the regional food strategies of Metro Vancouver and the Capital Regional District.

Outcomes of the research provide insights into which plans and strategy documents are enabling and/or supportive of the growth of vertical and cellular agriculture in the case study communities. The research also revealed gaps in plans, policies, and strategies with respect to supporting the growth of urban agriculture. The research resulted in a series of seven recommendations:

1. Add specific language in OCPs related to vertical and cellular agriculture,
2. Implement flexible zoning for vertical farming,
3. Include vertical farming in policies related to urban farming,
4. Clarify where vertical and cellular agriculture products are able to be offered and sold,
5. Update regional strategies to account for recent agri-food technological progress,
6. Incentivize partnerships among agritech entrepreneurs, developers, local food purveyors, and non-profit organizations, and
7. Coordinate among levels of government to support the development and adoption of agritech in ways that may advance local food system sustainability and resilience.

2. Introduction

Agriculture has historically relied upon the conversion of vast tracts of natural lands to food production spaces. While advances in agriculture have led to improved yields and increased land use efficiency (Godfray et al., 2024), land extensification for agricultural uses has resulted in transgressions beyond the limits of Earth's boundaries for humans to live sustainably (Gerten & Kummu, 2021). The Intergovernmental Panel on Climate Change's Special Report on Land and Climate Change attributes between 21-37% of total greenhouse gas emissions to the food system, with these emissions being produced through a variety of activities from land use change to consumption (Mbow et al., 2019, pg. 439).

The most environmentally sustainable approach to land use for agricultural production is a topic of debate among scholars, policymakers, and agri-food sector stakeholders. The debate involves comparing the advantages and disadvantages of sparing land by intensively cultivating crops versus sharing land in ways that allow for both agricultural purposes and natural ecosystem functions (Sidemo-Holm et al., 2021). Arguments for land sparing include that agricultural yields should not be sacrificed for potential environmental benefits and that the application of advanced technologies can meet rising food demand while minimizing the need for (or even reversing) land conversion for agri-food production. A key contention of the argument for land sparing is that additional land conversion will be needed for agricultural use if yields do not increase or are decreased. In contrast, land sharing proponents argue that yields can be improved and ecosystems can be enhanced by creating multifunctional landscapes. These proponents seek to generate co-benefits on agricultural lands and are focused on more than solely yield improvements in agriculture.

Emerging agri-food production technologies may raise new considerations for the land-sparing versus land-sharing debate (Newman et al., 2023). Innovations such as controlled environment agriculture and cellular agriculture have the potential to enable sustainable food production while also shortening supply-chain distances and the time required for processing and distributing food products. While societies have traditionally relied on rural agricultural areas to provide agricultural products to populous urban centres, these emerging food production methods enable urban agriculture and food production that can improve localized food systems, food security, and resilience in both urban and rural environments. It is important to recognize that such technologies are currently not at the scale and technological readiness to make a significant short-term dent in conventional agri-food systems (see Glaros et al., 2022); nonetheless, these local high-yielding food production technologies portend substantial potential for scaling up and advancing local agri-food systems.

A wide integration of food production into cities requires municipal involvement in agri-food planning and practice; however, understanding how to engage in such work is a key gap in municipal policymaking and planning scholarship (Dring et al., 2023). Urban agri-food planning is an emerging area of practice, and robust and data-driven assessments of existing policies are needed

in light of new agri-food technologies and changing environmental realities. Accordingly, this report presents a study that examines challenges, opportunities, and considerations for approaches to local food systems planning and policy, which incorporate emerging technology-driven methods for producing food in urban spaces. The research focuses on the largest urban centres in British Columbia (BC, Canada), the Greater Vancouver and the Greater Victoria regions. The research elucidates considerations related to planning challenges, including those related to the role of provincial land use policies and priorities for land use and development. This report presents the outcomes of the research, including potential opportunities with respect to the development of supportive policy environments and incentives.

3. Context and Problem

Advances in science, engineering, data collection, and automation have propelled innovations in the field of agritech (also referred to as agrotechnology, agricultural technology, or agtech). Such innovations offer strategies to improve agricultural resource efficiency and yields. Agritech innovations have the potential to support effective approaches to feeding a growing global population while reducing the ecological footprint of agri-food systems. However, the environmental benefits of these technologies are not guaranteed (Attrée et al., 2025). Agritech innovations may be more or less beneficial (and socio-politically acceptable) depending on a place-based context, necessitating careful approaches for gauging and planning for their implementation (Specht et al., 2019).

Vertical farming, cellular agriculture (i.e., lab-grown animal products), and alternative protein production, such as mushroom farming for mycelium-derived protein, are among the emerging agritech food production methods that show promise for advancing sustainable food systems. These methods use controlled indoor environments to efficiently cultivate food products, thus differing from conventional soil-based approaches. Indoor controlled food production systems allow for precise management of growing conditions and inputs, such as light, nutrients, and optimal substrate. When compared to conventional agriculture, such high-tech systems can improve resource efficiency and deliver consistent, reliable food production. In addition, cultivating food indoors reduces the risk of crops being affected by pests, diseases, and extreme climate events.

Indoor controlled environment agriculture is well-suited to urban settings; thus, it can be used to develop hyperlocal food production, distribution, and consumption. In regions that generate power primarily through renewable means (e.g., geothermal, solar, wind, hydroelectricity), vertical and cellular agriculture are especially suitable, as these technologies can reduce water and land use while relying on energy sources with low carbon footprints. However, the proliferation of agritech has been slow thus far due to ambiguous or impeding regulatory policies. Land use and management policies, development and building regulations, and taxation and funding programs influence which types of

business ventures can flourish (Goodman & Minner, 2019). Municipalities have the potential to encourage or deter the development and adoption of these technologies in ways that contribute to or detract from food system goals related to climate mitigation, climate adaptation, biodiversity conservation, local employment, and other priorities.

Research has examined the potential of agritech and controlled environment agriculture to support the development of local food systems. For example, Glaros et al. (2023) modelled the outcomes of scenarios for developing vertical agriculture in Metro Vancouver to explore how mixed-use, commercial/industrial, and community food development approaches influence environmental and food security outcomes. Their research identified trade-offs. Mixed-use development patterns exhibited great potential for providing many people with farm-fresh food within walking distances, while commercial/industrial development patterns demonstrated greater environmental benefits in terms of greenhouse gas emissions and water consumption. These findings highlight the role of planning and policy in enabling and guiding the development of urban agriculture facilities to advance local sustainability goals and priorities.

3.1 Urban Agriculture in British Columbia

The potential benefits of urban agriculture are threefold. First, there are social benefits associated with increasing local food security, ensuring that people from different socioeconomic backgrounds have low-barrier access to healthy, nutritious food (Illieva et al., 2022). Second, local food production and distribution can contribute to environmental benefits, such as integrating green infrastructure into cities and reducing the time and resource waste involved in bringing food from farm to plate (see Dorr et al., 2023). Third, there is economic value in producing and selling products via urban agriculture as it boosts local economies by supplying fresh ingredients to restaurants, grocery stores and other retailers, non-profit food-focused organizations, and directly to residents. At scale, urban agriculture can provide these benefits beyond marginal food production (Morales-Jiménez & Newell, 2024).

The province of BC is a suitable region for experimenting with urban agriculture and adopting agritech in urban and peri-urban environments. Despite its large size, much of the province is not arable due to its mountainous geography and the relatively limited areas with soil conditions suitable for conventional agriculture. The province covers over 90 million hectares of land, but only 5% of this land base is suitable for agriculture, and approximately 1% of the land base is considered to be prime agricultural land (Nixon & Newman, 2016). Much of the province's agricultural land and activity is concentrated in a few valleys and delta regions, such as the Fraser Valley and the Okanagan. There are many remote and rural communities across the province with vulnerable (and expensive) food supply chains due to distance and mountainous terrain.

BC is also a favourable province for exploring innovative, technology-driven ways to localize food production and shorten supply chains due to its energy grid. BC is supported by an energy grid

that is primarily powered by low-carbon sources, with hydroelectricity comprising the majority of the power supply. By way of illustration, approximately 89% of BC's power in 2021 was supplied by hydroelectric sources (Canada Energy Regulator, 2024). The province is thus a prime candidate for rapid adoption of agritech solutions, as it can support the growth of indoor, energy-intensive food production with a relatively low carbon footprint.

In BC, there are multiple examples of local urban agriculture operations of varying technological degrees. Sole Food Urban Farm operates urban farms on otherwise underused lots in and near Vancouver's urban centre. Another example of urban agriculture can be found at Victoria's Dockside Green, a mixed-use development built in 2011 on a former dockyard site. Dockside Green has provided space for FED Urban Agriculture to operate raised-box urban farms. During the 2024 season, FED produced 7,470 pounds of food using 25,000 square feet of growing space at their urban farm (FED, 2024). BC also hosts agritech companies, including Maia Farms (mycelium and mushroom-based protein), QuantoTech (vertical farming and retailer of vertical farming systems), and UP Vertical Farms (commercial-scale vertical farming), which are advancing local high-yield technologies in the province.

3.2 Current Policy Contexts for Urban Agriculture

BC currently imports a significant amount of fresh produce from the United States and Mexico. The Canada Food Flows map developed by researchers at the University of British Columbia shows that 81% of BC's spinach, 70% of BC's lettuce, 31% of tomatoes, and 75% of BC's onions came from the US in 2022 (www.canadafoodflows.ca/DataPortal). In the same year, 97% of BC's avocados were imported from Mexico, and 92% of BC's strawberries were imported from the US and Mexico (Wickramasinghe, 2025). This trend is evident on Vancouver Island, where only around 10% of food consumed is produced locally, with the rest of the food supply relying heavily on imported products (City of Langford, 2025).

The current geopolitical landscape includes circumstances in which historic trade relations with Canada's largest trading partner, the United States, have become strained. In these circumstances, adopting policies that encourage urban agriculture and agritech can improve local access to affordable food by creating an environment in which local agri-food businesses are economically viable and supported in their growth. While some crops (e.g., tree fruits such as avocados and root vegetables such as carrots and potatoes) may not be well-suited for controlled environment agriculture, products such as spinach, lettuce, microgreens, and even strawberries and tomatoes can be cultivated through such methods. Municipal policies can be designed to effectively integrate agritech into local food systems in ways that help feed communities, encourage the development and growth of sustainable entrepreneurship, and reduce the impact of both climate change and economic shocks.

The multiple levels of government involved in land use policy and regulation can create confusion and challenges for agri-food system planning and development. In BC, the provincial government is responsible for policies and regulations for the Agricultural Land Reserve (ALR), which is land that is protected primarily for agricultural use. The ALR was created in 1973 under the Land Commission Act, and it is an early example in North America of implementing zoning laws for the long-term protection of agriculture and the promotion of farming (Green et al., 2014). Since the establishment of the ALR, urban and population growth around ALR land has substantially increased. Changes to ALR zones have been slow to adapt to the high levels of urbanization, as evidenced in the areas surrounding Vancouver and Victoria.

In 2010, only about half the ALR was actively farmed, and evidence suggests that percentage has decreased since (Gemino, 2025). In the Greater Victoria Area, Eagle et al. (2014) indicate that increased residential development pressures lead to further reductions in land actively farmed, with the ALR increasingly shifting toward rural estates and hobby farms with limited agricultural production. Such shifts are incentivized by ALR regulations, which lower land valuations to reduce property taxes. Accordingly, if the ALR designation does not guarantee food production, additional policies must be developed and implemented to strengthen local and regional food systems across the province, including land outside the ALR.

Agri-tech innovations, such as vertical and cellular agriculture, can be deployed to improve food production across BC, including areas outside the ALR. However, access to capital and funding programs for agri-tech startups is a challenge that hinders the adoption and proliferation of urban agriculture innovations. The federal and provincial governments have an opportunity to deliver programs that can help finance agri-tech entrepreneurship and provide proof of concept for emerging ventures. Over the last decade, the federal and provincial governments have launched funding programs, including the Agricultural Clean Technology Program, the AgriInnovate Program, the Local Food Infrastructure Fund, and the BC Agriculture and Food Export Program. However, these programs are still relatively new, and it remains to be seen whether they will effectively support the establishment and growth of new agribusinesses over the coming years.

4. Methods

This research involves conducting a document analysis of Official Community Plans for Vancouver, Victoria, and Langford to understand how urban food strategies and policies could be applied in the context of trying to develop an agri-tech park. The research question explored is: **How do urban plans, policies, and strategies enable or hinder the implementation of technology-driven indoor farming, such as vertical and cellular agriculture?**

This report provides recommendations for local planners and policymakers on how to create favourable policy environments for developing diverse urban agriculture assets, including agri-tech.

This study is part of a larger research project that developed an interactive visualization tool that features a hypothetical agritech park in the Langford Heights neighbourhood of the City of Langford. The current study examines the potential of developing such a park in Victoria and Vancouver, as well as the feasibility of developing the park as depicted in the Langford Heights neighbourhood. The visualization of the agritech park can be accessed here: www.triaslab.ca/agrigenomics#visualization

4.1 Case Studies

4.1.1 Victoria and Vancouver

The Victoria and Vancouver areas were settled as colonies in the mid 1800s. Victoria was the first colonial city in BC, established as a trading and military post in 1841 on land that was inhabited and stewarded by the Songhees First Nation. New Westminster was settled as the capital of the colony of BC in 1859. Vancouver was established as an economic centre in 1862. When established, the colonies' economies were primarily based on forestry, fishing, and wildlife trapping; however, the settlements began to undergo rapid urbanization following the discovery of gold in Haida Gwaii and the lower Fraser River (Green et al., 2014).

Urban planning became an important aspect as the urban centres of BC grew over the decades, with much of this planning based on zoning regulations. Industrial, commercial, and residential zoning are under the jurisdiction of municipal governments. Such zoning dictates land use in urban centres but often does not specifically account for technology-enabled urban agriculture within those zones.

As is the case with municipalities across BC, planning in Victoria and Vancouver is guided by their respective Official Community Plans (OCPs). In addition, regional food system strategies have been developed by Metro Vancouver and the Capital Regional District. As climate change impacts on food production and arable land intensify, new approaches to food production policy are needed to capitalize on the opportunities presented by urban agriculture, specifically controlled environment agriculture (Glaros et al., 2023).

4.1.2 Langford Heights

The Langford Heights agritech park was designed (and visualized) in different ways to explore different possible land use configurations for such a development. Three different development scenarios for the park were created, involving varying types and amounts of different urban agriculture assets:

- **Scenario 1** involves only food production facilities, including a vertical farm system, a mushroom farm, and a cellular fish farm.

- **Scenario 2** contains everything in Scenario 1, with the addition of a farm-gate stand where visitors can sample and purchase products, public amenities for community gatherings and recreation, and educational interpretive signage that helps visitors learn about the agritech facilities and their production processes.
- **Scenario 3** includes everything in Scenario 2, with the addition of soil-based community garden plots and an apiary to provide additional food production, engagement, and education opportunities.

The Langford Heights agritech park scenarios represent three different land use planning approaches, and (as noted above) these scenarios were represented via an interactive visualization tool. The visualization tool was created to assess whether community members would be more or less receptive to different land-use configurations of the agritech park that emphasize yield, public gathering places, or diverse food assets. The visualization allows the user to actively see (from a first-person perspective) and assess the trade-offs and co-benefits of each scenario. For example, Scenario 1 provides the most parking space and is perhaps the best use of urban space for creating an economically productive, industrial agricultural zone; however, it has no features for community gathering spaces, such as seen in Scenarios 2 and 3.

Figure 1. Street Map of Langford Heights, in relation to Victoria, BC

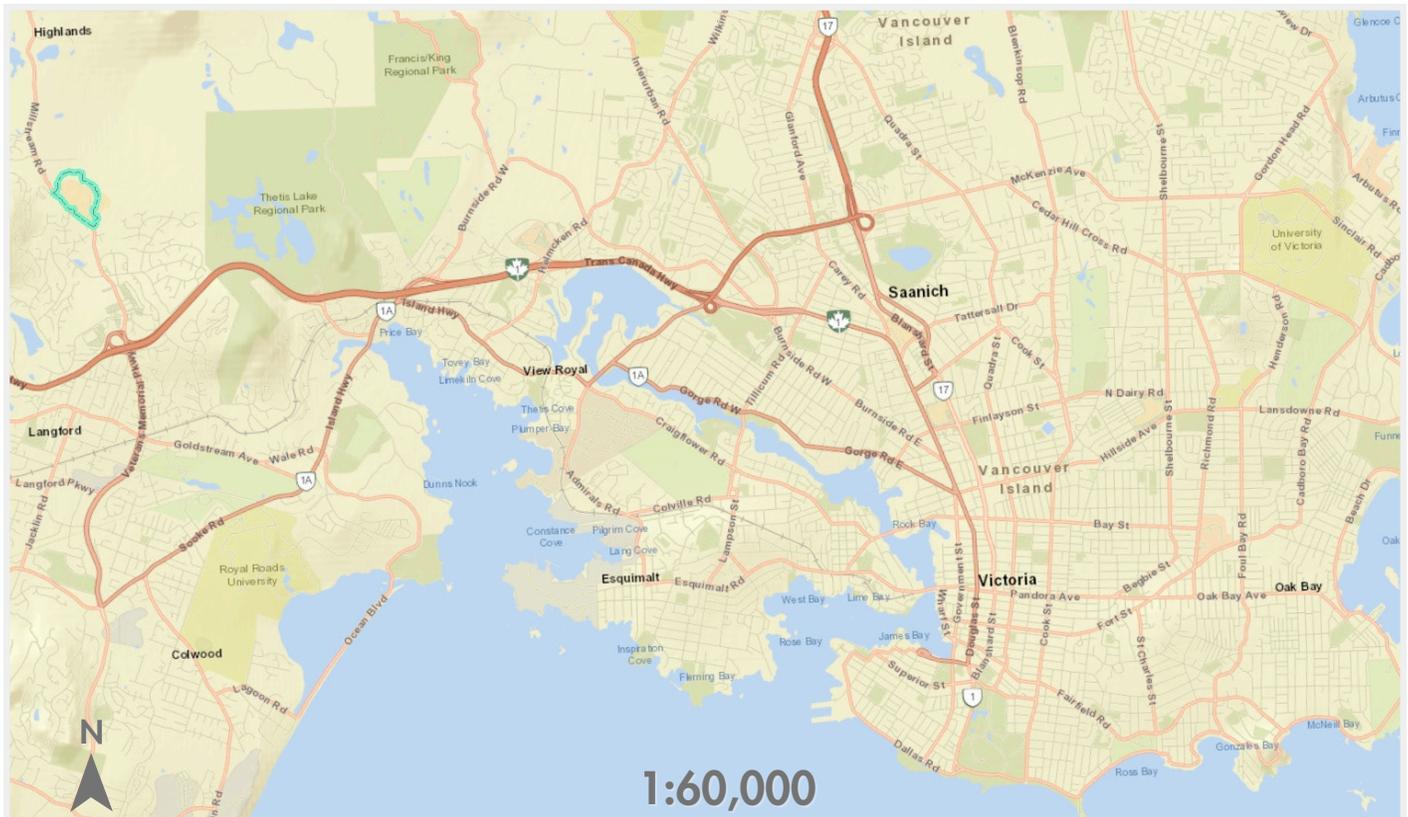


Figure 2. Satellite view of Langford Heights, the proposed location of the AgriTech park



Figure 3. Digital model of the proposed Langford agritech park, with urban agriculture assets described in Scenario 1



Figure 4. Digital model of the proposed Langford agritech park, with urban agriculture assets described in Scenario 2



Figure 5. Digital model of the proposed Langford agritech park, with urban agriculture assets described in Scenario 3



4.2 Analysis

The research involved a thematic content analysis of municipal plans and regional strategy documents to assess their alignment (or lack thereof) with the development of a local agritech park. The themes of urban agriculture, local food system development, local food production strategies, and local food distribution were used as an analytical lens for the content analysis. Then, the documents were examined to determine whether they explicitly include or exclude language and considerations related to food system strategies, urban agriculture, vertical agriculture, cellular agriculture, financial incentives for urban agriculture, other development incentives, and other supports for urban agriculture development. The results of this inclusion/exclusion analysis were tabulated and are presented below.

This research examined the OCPs of Vancouver, Victoria, and Langford, and the regional food strategies of Metro Vancouver and the Capital Regional District. The analysis reveals how planning objectives and policies may or may not support the types of facilities and developments in the hypothetical Langford Heights agritech park. Outcomes of the research provide insights into which plans and strategy documents are enabling and/or supportive of the growth of vertical and cellular agriculture in the case study communities.

5. Results

5.1 Vancouver's Official Community Plan

The Vancouver Plan recognizes the role of food systems as a powerful connector of people, cultural values, and environmental factors such as land and water. The plan also identifies the food system as a major driver of climate change and that current food supply chains are vulnerable to disruptions from global climate, economic, health, and political events and shocks. The plan acknowledges the roles of different levels of government in food system development, noting that higher levels of government have jurisdiction over many components of the food system, while municipal roles relate to their responsibilities in land-use planning. It is worth noting that Vancouver is a global leader in urban agriculture policy development and among the first cities to have regulations mandating the inclusion of food assets in prospective developments (City of Vancouver, 2024).

The Vancouver Plan identifies actions and interventions for supporting the development of an equitable and resilient food system, using “a holistic approach to sustain and grow food supply chains and community-based food initiatives.” (City of Vancouver, 2024, pg. 145). While the plan mentions urban farms and urban agriculture (i.e., policies 11.1.2, 11.1.3, and 11.1.5), it does not specify a role for vertical farming or cellular agriculture as possible components of urban agriculture. This represents a missed opportunity to clarify the role of, and attract interest from, ventures that focus solely on growing food products in controlled indoor environments. Organizations that are early adopters of creative urban agriculture strategies, such as local food banks, restaurants, and developers of residential, commercial, and industrial buildings, may be deterred from investing in these food production methods if permitting and regulatory requirements are unclear.

5.2 Victoria's Official Community Plan

The Victoria 2050 Plan identifies eight actions toward supporting a healthy and resilient urban food system. These actions range from better management and expansion of food production activities on public and private lands (including in multi-unit residential and mixed-use buildings) to supporting the integration of urban farming into local blue-green networks. The plan also mentions coordination with the regional food and agriculture strategy and piloting innovative approaches to urban food production, processing, and food waste recycling. This being said, the actions identified in the plan primarily focus on soil-based outdoor spaces to develop edible landscapes that include food-bearing trees, food gardens, and pollinator habitats in urban spaces such as rooftops, balconies, and patios.

The Victoria 2050 Plan calls for fostering a resilient food and agriculture system by encouraging partnerships between developers, vendors, and the community to integrate local food production into community nodes through farmers' markets. “All together, this integrated approach to food systems, land use and mobility planning advances the [Regional Growth Strategy] goal of fostering a

place-based food economy that enhances local food security while helping to avoid urban-agricultural land use conflict at the regional scale.” (City of Victoria, 2025, pg. 178)

As with Vancouver’s plan, Victoria’s plan includes language aimed at encouraging the increase of urban agriculture, but it is limited in that it primarily focuses on conventional soil-based approaches to food production (e.g., urban farms, community gardens, rooftop gardens, etc.). Incorporating agritech innovations in the plan to specify how vertical and cellular agriculture fit into local food systems development would help companies in the agritech sector progress from concept to growth. Including such details in plans would also encourage developers of residential, commercial, and industrial buildings to partner with agritech companies in efforts to incorporate these food production methods into their development designs.

5.3 Langford’s Official Community Plan

The Langford OCP identifies urban agriculture as an important aspect of the community’s food system. The city was the third-fastest-growing in Canada between 2016 and 2021, and it may reach a population of 100,000 within the next two decades, based on current growth and development trends. As a rapidly growing community with limited access to farmland, the municipality’s current food system includes a farmer’s market, small-scale farms, co-operatives, food distributors, and food retail; however, this collection of food businesses and assets is insufficient for local food system self-reliance (City of Langford, 2025).

Langford’s OCP was adopted by Council on June 25th, 2025, and it includes objectives and policies aimed at increasing local food production and supporting urban agriculture throughout the city. However, no specific targets have been set to increase agricultural and food production land, aside from plans to establish a community garden in each neighbourhood in Langford.

A series of “Desired Outcomes” are included and articulated in Langford’s OCP. Under Desired Outcome #1, the OCP aims to incentivize the inclusion of food-growing opportunities in new multi-family developments, which could be a good fit for smaller-scale vertical farming systems. Under Desired Outcome #2, the plan aims to support the development of greenhouses, vertical agriculture (indoor crop growing using stackable shelves), and other advanced agricultural methods. Much of the language related to urban agriculture in the OCP refers to soil-based community gardens or small residential plots; however, the plan also explicitly mentions vertical agriculture as part of agricultural lands integrated with urban development (Langford OCP, 2025).

Unlike the Vancouver and Victoria plans, which focus on time-based implementation goals (e.g., by 2050), Langford’s implementation goal is linked to a projected population of 100,000 residents. This approach ensures implementation is completed by the time Langford matures into a medium-sized city, rather than basing it on an arbitrary timeframe.

Langford’s population-based approach to implementation and achieving planning goals aligns the City’s implementation of policies, actions, and development strategies with its growth trajectory (Langford OCP, 2025).

5.4 Regional Strategies

The regional food and agriculture strategies identify urban agriculture as a key component of the food system. The Capital Regional District (2016) includes different forms of food production in its definition of urban agriculture, including small-scale aquaculture, hydroponic greenhouses, and closed-loop food production systems. The inclusion of these different, technology-driven food production approaches indicates potential support for the development of vertical and cellular agriculture in the region.

Metro Vancouver’s strategy defines urban agriculture as soil-based cultivation, noting it as the practice of producing food within cities in backyards, on rooftops, and in community garden plots (Metro Vancouver, 2011). Metro Vancouver’s strategy includes language indicating openness to new technologies for producing food in cities; however, it primarily focuses on municipal support and management of small-scale conventional agriculture in residential, commercial, and industrial areas. The strategy’s soil-based focus and future-facing discussion of agri-food technologies may be due to its 2011 production date, when food production methods such as vertical farming were novel and not yet part of urban agricultural landscapes.

5.5 Plan and Policy Alignment

Table 1 provides an overview of the research findings. The table presents if and how the municipal OCPs and regional agri-food system strategies align with urban agriculture and local vertical and cellular agriculture development.

Only Langford’s OCP identifies vertical agriculture as a specific component of urban agriculture. This being said, the language in the other plans is vague enough that this approach to farming and food production may fit within the plans, policies, and objectives. Cellular agriculture is not mentioned in any of these planning documents (nor are other alternative protein production, such as mushroom-based proteins).

Incentives that encourage the development of urban agriculture were identified in the documents, including grant programs and tax incentives. Other incentives include those related to development, such as flexible zoning, density bonusing, and streamlined permitting processes. Victoria and Langford both include mention of financial and development incentives in their OCPs; however, these are absent from Vancouver’s OCP. Instead, Vancouver’s OCP adopts a different policy approach, expanding the use of public lands, buildings, and infrastructure to encourage more urban agriculture.

Table 1. Local plans and regional strategies support of urban agriculture

	Includes food system strategy	Includes urban agriculture as part of food system	Includes vertical agriculture as part of urban agriculture	Includes cellular agriculture as part of urban agriculture	Considers financial incentives (such as grants or tax reductions) to encourage development	Considers other incentives (such as rezoning, density bonusing, simplified permitting, etc.) to encourage development	Considers other types of support (such as expanded use of public lands, buildings, and infrastructure) to encourage development
Vancouver OCP							
Victoria OCP							
Langford OCP							
Metro Vancouver's Regional Food System Strategy							
Capital Regional District Food & Agriculture Strategy							

The regional food and agriculture strategies identify urban agriculture as a key component of the food system; however, the strategies differ in what is included in their definitions and understandings of urban agriculture. The Capital Regional District (2016) includes agritech-centric food production methods in its discussion of urban agriculture, such as small-scale aquaculture, hydroponic farms, and closed-loop systems. In contrast, Metro Vancouver's strategy frames urban agriculture as the practice of producing food in cities via backyard, rooftop, and community gardens and farms, while discussing technology-driven, indoor methods of food production as potentially part of future urban agriculture systems (Metro Vancouver, 2011).

6. Conclusions and Recommendations

The analysis of existing community plans shows that Vancouver and Victoria are lacking policies to enable urban agritech, despite being among the most proactive and progressive urban centres in terms of climate action in Canada. Both the Vancouver and Victoria OCPs have implementation timelines that extend to 2050, and the objectives, strategies, and targets of the plans will require continuous updating to account for new forms of food production technologies and approaches. As the plans are written now, opportunities to encourage the development and local implementation of agritech solutions are being overlooked. This is especially true for vertical agriculture, as the versatility and flexibility of vertical farming systems make it particularly fitting for a variety of residential, commercial, and industrial spaces (Glaros et al., 2023).

In terms of cellular agriculture, local development of facilities is less flexible and versatile than vertical farming. Accordingly, food systems planning should enable and make space for these developments to occur in industrial zones that can accommodate footprints large enough for a series of bioreactor production tanks. The facility footprints (as well as energy and water requirements) will likely be comparable to those of beer breweries (see Mattick et al., 2015), and municipalities can draw upon their experience in accommodating local brewing industries when planning for cellular agriculture. Proactive policies for such facilities can anticipate potential planning opportunities and challenges by reflecting on the emergence of local craft breweries.

The findings from this study reveal ambiguity in whether the types of facilities proposed for the Langford Heights agritech park are permissible in the case study communities. The lack of clarity on how these food production methods may (or may not) fit into the local urban food systems makes it difficult for entrepreneurs and developers to plan for and build these types of facilities. With 2030 decarbonization targets fast-approaching and BC being behind on its progress toward these targets (Government of British Columbia, 2024), a proactive adoption of food production solutions that can contribute to climate change mitigation objectives is important. Such adoption requires amendments in OCPs and regional strategies that account for technological advancement and holistic design in local food system planning and development.

At the provincial level, policies should be developed and/or amended to leverage the land sparing potential of vertical and cellular agriculture. Specifically, farmers can be provided financial support for developing vertical and cellular agriculture facilities if they protect much of their farmland for ecological functions and ecosystem services. Guidance for such policymaking can be taken from Europe's Common Agricultural Policy, which incentivizes multifunctional agricultural landscapes that promote food production alongside tourism, conservation, and agricultural heritage preservation. In the context of this study, applying this type of policy approach to emerging food production methods is based on the understanding that indoor agriculture methods offer high yields per land area; thus, farmers theoretically need to use less of their land to achieve economically viable levels of production

when using such agricultural methods. However, ensuring that land spared is actually used for conservation purposes requires regulatory and compliance mechanisms that complement and enforce land sparing policies.

At the federal level, funding programs and frameworks can be developed to facilitate the growth of emerging indoor food production approaches. The federal government should work with municipalities to create pan-Canadian municipal policy frameworks and support programs that help communities design place-based, locally relevant policies and plans for emerging agritech innovations. Similarly, provincial governments may also support the development of indoor food production approaches by structuring incentives and regulations. Closer collaboration across governments and communities, including with First Nations, could help identify culturally relevant alternative food sources and align development strategies and policies with sustainable local food system objectives.

Cities play a significant role in shaping how development impacts land, water, and energy use. Increasingly in the agri-food context, local planners and policymakers bear significant responsibilities for enabling local food production and ensuring that access to food remains affordable and abundant, particularly in the face of uncertainties in global food systems and supply chains. Novel methods such as vertical and cellular agriculture provide opportunities for urban centres (and rural communities) to adopt agri-technologies that can alleviate some of the burden of food production, storage, transportation, and consumption associated with conventional agricultural systems. The following recommendations have been identified to encourage favourable policy environments for diversifying urban agriculture assets:

1. Add specific language in OCPs for urban agriculture that includes vertical farming and cellular agriculture (as well as other alternative protein production, such as mushroom-based proteins), with such language clarifying where these types of food production methods fit within existing zoning regulations and bylaws.
2. Implement flexible zoning in residential and commercial areas to enable and encourage small-scale vertical farming setups.
3. Include vertical farming in urban farming policies to streamline permitting processes and assess incentives, such as density bonuses or expanded use of public lands, buildings, and infrastructure, to facilitate wider adoption.
4. Clarify where products grown in vertical and cellular farms can be sold or offered (such as in farmers' markets and/or other local distribution points like food-focused organizations, restaurants, and grocery stores).

5. Update regional strategies to account for the past decade of technological progress in agri-food systems, particularly the potential of agritech solutions to significantly enhance urban agriculture.
6. Incentivize entrepreneurs in agritech to partner with developers, local food purveyors, and non-profit food-focused organizations to design, integrate, and build agritech facilities within urban centres through targeted funding programs, grants, tax reductions, and other benefits.
7. Coordinate between levels of government to align policies that support the emerging fields of agritech in ways that address local food security, food system resilience, and climate action priorities simultaneously.

Implementing the above recommendations could lead to changes that optimize the use of resources, such as land and water, in food production systems. BC's renewable-based energy grid is especially appropriate for controlled environment agriculture. Renewable green energy sources enable low-carbon urban agriculture that can contribute to progress toward greenhouse gas emissions reduction targets by minimizing energy-related emissions and (through supporting the growth of indoor agriculture) reducing the use of nitrogen-based fertilizers in food production.

Advancements in cellular agriculture and other alternative protein technologies have the potential to reduce the demand for land and water used to raise cattle and other ruminants for food production. The land sparing potential of these technologies (with appropriate policies in place) can lead to greater preservation and protection of ecosystems and biodiversity, which provide essential ecosystem services such as carbon sinks. By working together across levels of government, regions and municipalities can develop agri-food approaches to reach greenhouse gas emissions targets and adapt to changing climate conditions, while also ensuring safe, reliable local food production, distribution, and consumption in populous urban centres and remote rural communities.

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