



# Planning for Uncertainty

*Adaptation Strategies for Agricultural Self-Reliance in  
the Lower Mainland of British Columbia, Canada*

**James A. MacDonald-Nelson**

TU Delft, Faculty of Architecture, Department of Urbanism  
EMU – European Post-master in Urbanism



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EUROPEAN  
POST-MASTER  
IN URBANISM

**EMU**

strategies and design for  
cities and territories



 **TU Delft**

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I don't think I can express enough how much my family, friends, colleagues, and mentors have helped get me through these last 7 months. Graduating under typical circumstances was a something I was prepared for but doing so during a global pandemic is something I never imagined.

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Here's to whatever the future holds!





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# Preface

The inspiration for this research project originally came from the notion that Canada has not yet taken progressive steps to adapt to the inevitable effects of climate change. While there is no doubt that the seriousness of climate change is mostly undisputed across the country, the practical steps necessary to address the climate transition and the adaptations we must begin making now are not happening at a scale that will truly make a difference. Despite relatively progressive policies put forth by the federal government to tackle the challenge of mitigation, cities and regions are only beginning to address the equally important task of adaptation. Typically, this conversation focuses on the spatial adaptability of shorelines, dense urban environments, or the enhancement of green spaces, and while these are important measures to implement, there is something missing in this discussion.

The agricultural landscapes that (supposedly) produce our food and sit on edge of most cities across Canada are already facing numerous challenges because of climate change and an over-reliance on an export driven economy is increasing the vulnerability of the food systems that we rely upon. Agriculture is a key part of the Canadian economy, both in the export of products grown in Canada as well as in the importation of fruits, vegetables, legumes, and nuts from the United States, Mexico, and Asia. Currently, this reliance on imported food is a consistent and functioning part of the food supply chain in Canada. However, with a changing climate affecting places like California (where a large portion of fresh produce is imported from) and global challenges such as the COVID-19 pandemic, these supply chains are becoming more vulnerable to unexpected disruptions. This, in turn, threatens the food security of all Canadians. With this in mind, the initial research focused on the most vulnerable parts across Canada and found that the Lower Mainland of British Columbia has striking parallels with the Netherlands and the Veneto region of Italy, which were the focus areas for 2 studio design projects during the last two years of study at TU Delft and IUAV. The Lower Mainland is an urbanized delta region - in fact, Canada's only such region. It sits between the Pacific Ocean and the Pacific Cordillera Mountain Range and is bisected by the Fraser River which flows out from the interior of the province. The region is recognized for its high quality of life and close connection with the tremendous extent of nature and vast beauty that surrounds the city, it is also one of the most agriculturally productive regions in Canada. But, as with all delta regions around the world, the Lower Mainland is already facing the pressure to adapt to rising waters, unpredictable fluvial flooding on the Fraser River, and increasingly common drought periods during the summer. Parts of the delta are also subsiding as urbanization continues to expand across the territory.

With these pressures and uncertainties comes the need to adapt where we live, and our food-producing regions, so that they can withstand sudden shifts in climate, public health, and the economy. This study therefore aims to advance current knowledge on how to reshape metropolitan regions in Canada - specifically focusing on the possible spatial changes for transforming our food systems to become more self-sufficient and climate adapted.



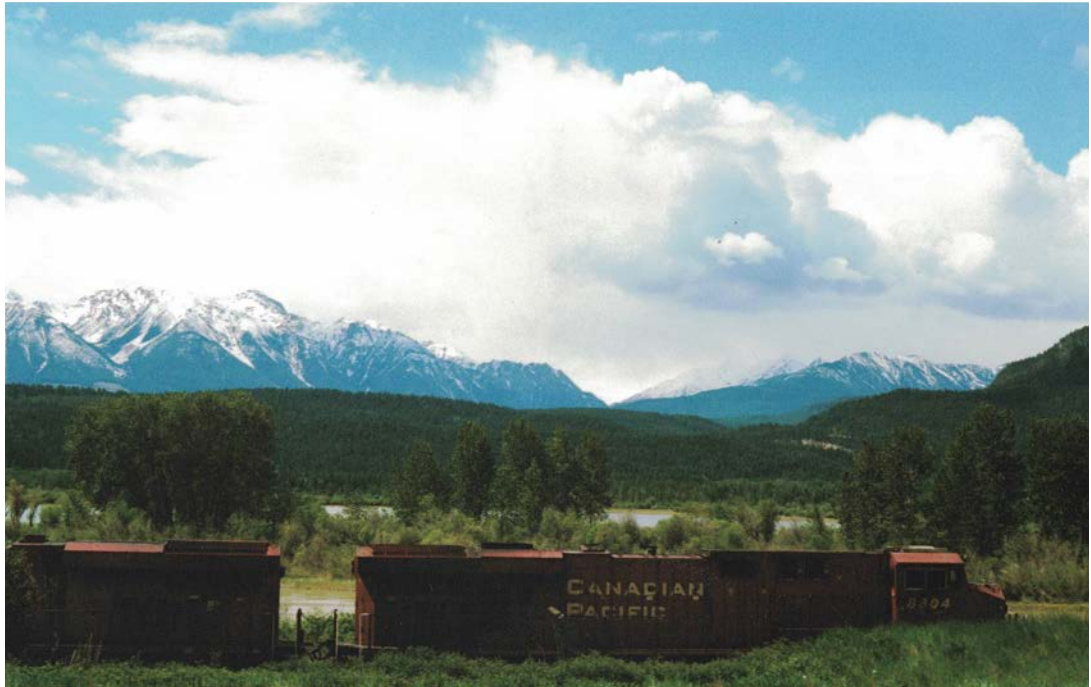


FIG. 1.1 British Columbia. Taken by author

PART 1

# RESEARCH DESIGN

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**“Only by knowing the nature, extent, and speed of changes as well as factors causing them can [humans] intelligently control [their] environment in the future,”** *(Dr. Eugene Odum, 1940)*

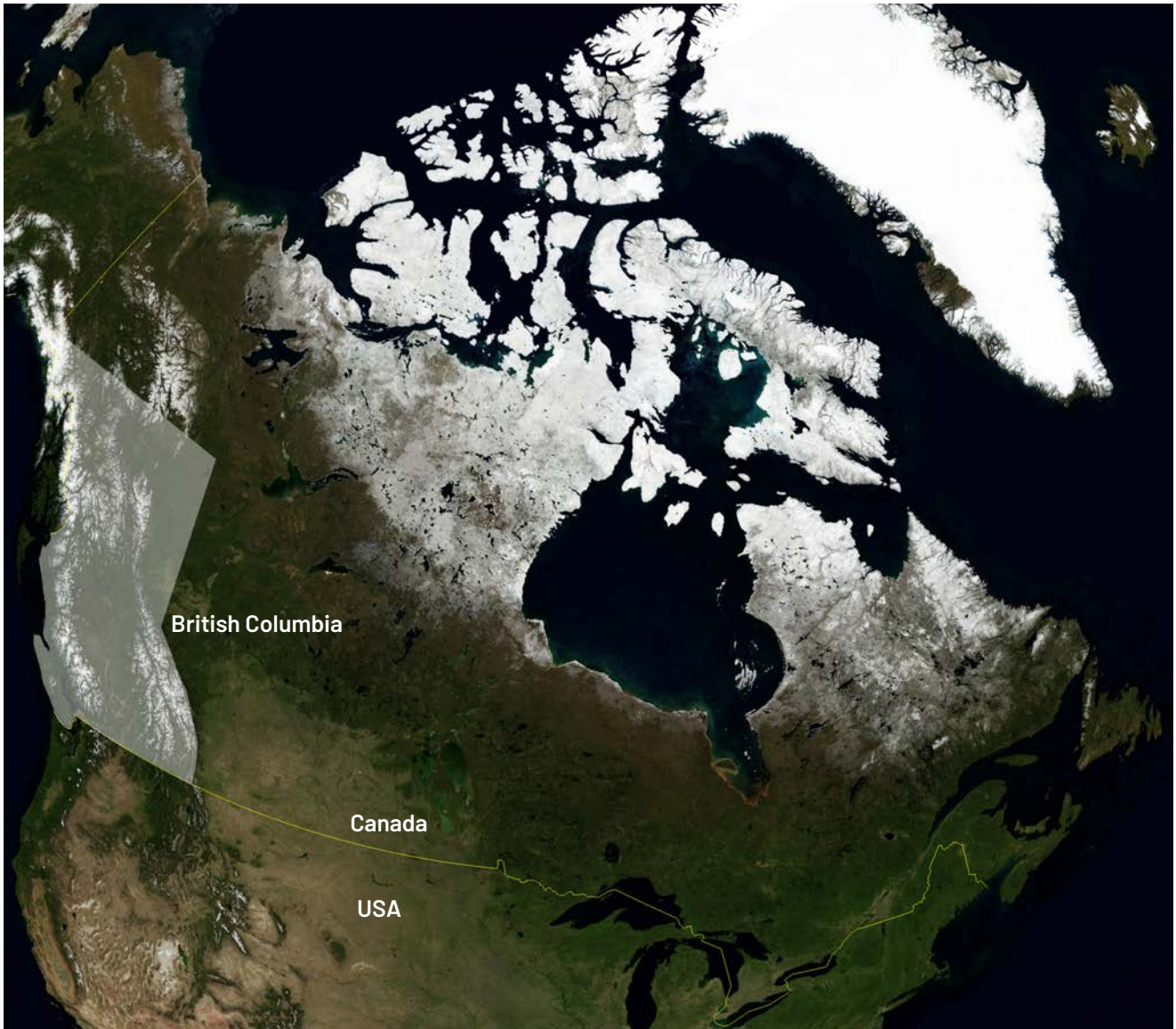


FIG. 1.2 Satellite image of Canada in June 2004. Source: Screenshot from NASA World Wind. <https://worldwind.arc.nasa.gov/>



# 1 – Introduction

---

As the second largest country in the world at 9.9 million km<sup>2</sup> (Britannica, 2020), it is daunting to envision the vastness of Canada. It is a country of only 38 million people, most of whom live within large metropolitan regions near the border with the United States. Urban settlements have developed over the last 300 years along historic trade routes, at the confluence of rivers or on the Atlantic, Pacific, and Arctic coasts.

British Columbia is the most western province of the country and home to around 5 million people, 60% of whom live in the Lower Mainland (Statistics Canada, 2020) – an area in the delta region located between the Pacific Ocean and the Pacific Cordillera Mountain Range – specifically the Rocky Mountains. Most of the province is comprised of vast mountains that range from the Yukon in the North all the way south to the border of the United States. Populations are dispersed throughout this dramatic landscape that is about 22 times as large as the Netherlands.

In fact, across the country, the majority of Canadians live within 100km of the US border and are mostly concentrated in a number of large and expanding urban centres. From Vancouver to Calgary, Winnipeg to Toronto, Montreal, and Halifax, more than 80% of the population reside in cities (Statistics Canada, 2017). Economically, many of these cities function as nodes in a vast network of infrastructure for resource extraction and food production, which has contributed to making Canada the 12th largest export economy in the world (OECD, 2020).

British Columbia is an essential part of this network and functions as a gateway to the United States and Asia. The Port of Vancouver is Canada's largest port (and third largest in North America), making the province a key part of the export-import oriented economy of the entire country.



FIG. 1.3 Size comparison of British Columbia with (from left to right) Belgium, The Netherlands, Austria, Italy and France. Source : <https://tapiquen-sig.jimdofree.com/english-version/free-downloads/europe/>

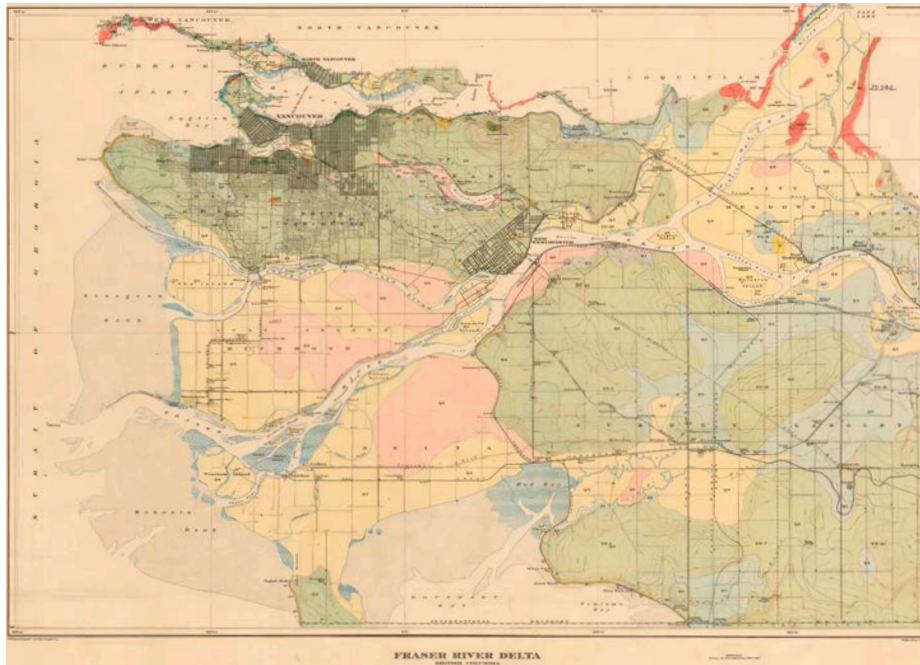


FIG. 1.4 The Fraser River Delta  
Source: Canada Department of Mines, 1923.  
Retrieved from: <https://searcharchives.vancouver.ca/fraser-river-delta-british-columbia-3>

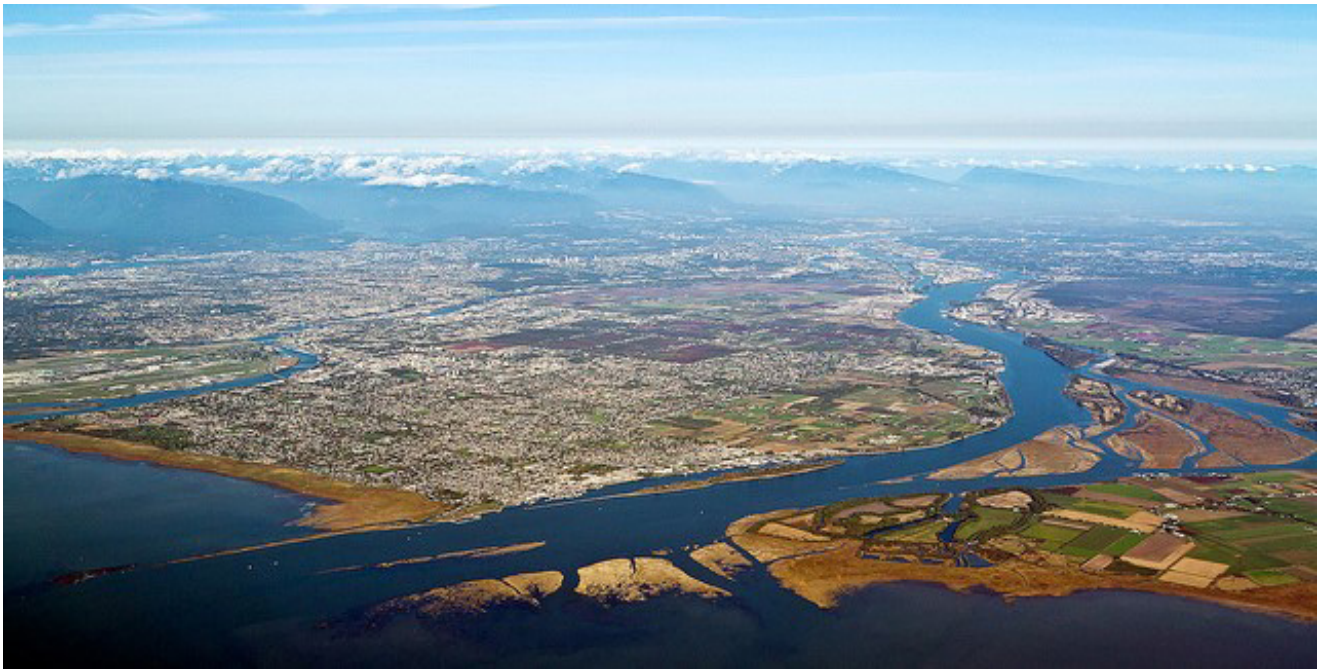
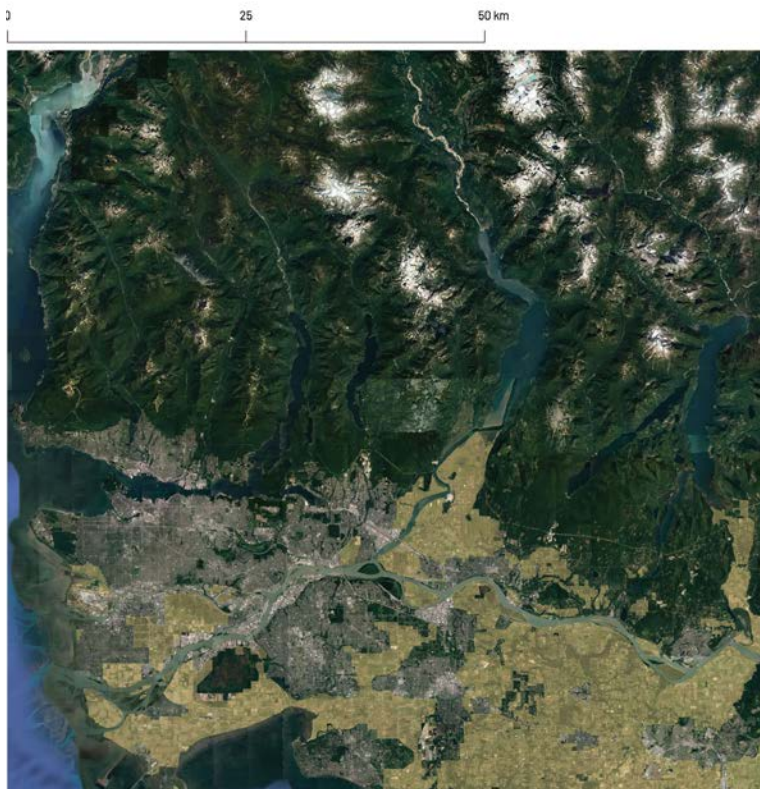


FIG. 1.5 Lower Fraser River: View of Steveston, Ladner, Canoe Pass, and Mt. Baker (Rees, 2007)





FIG. 1.6 Satellite image of British Columbia.  
 Source: Google Maps & <https://catalogue.data.gov.bc.ca/dataset>



Agricultural Land Reserve

FIG. 1.7 Satellite image of British Columbia.  
 Source: Google Maps & <https://catalogue.data.gov.bc.ca/dataset>

The Lower Mainland, seen at two scales on the left, is the most significant metropolitan region on Canada's West Coast. It is the economic engine of British Columbia and despite its relatively small size when compared to the rest of the province, is crucial for the production, processing and distribution of goods and services.

In the second map, the Agricultural Land Reserve (ALR), is highlighted in yellow - clearly showing significant presence of arable, cultivated land across the region. What is unique is the integration between the urban and 'rural' landscapes in the Lower Mainland. This spatial and functional organization of the region and the way in which agriculture occupies the territory is the starting point for this thesis.

**In short, this thesis will explore:**

The spatial transformation and adaptation of the region over 130 years by looking at how nature has receded over time to make room for the development and expansion of both cities and infrastructure across the Lower Mainland. In doing so, the intention is to explore the possibilities for further transformation considering current variables related to climate change and the economy and;

The role of the regional food system, agriculture, and its integration with urban areas, as well as the potential for transforming both the functional and spatial organization of agricultural land in light of the uncertainty related to climate change, public health, and the economy.

This will be explored by looking at the potential role that self-reliance in the region can play in increasing local/regional food security by diversifying and strengthening regional food supply chains, creating local processing facilities, and by establishing innovation and knowledge-sharing centres for agricultural innovation. This is especially important when considering the need for sustainable, reliable food systems and agricultural practises in the face of a changing economy and a changing environment.



FIG. 1.8 Aerial Photo of 1948 flood at the Hatzic Dyke along the Fraser River in Mission BC. Retrieved from: Maps & <http://vintageairphotos.com/BO-48-3111/>

## Problem Field

---

*Agriculture is a fundamental part of the regional economy in the Lower Mainland of British Columbia. However, cultivation is currently driven by an export/import-oriented supply chain model - relying heavily on the US and Asia for local food security. Nearly half of the food consumed in the region is imported while much of the food that is grown locally is exported and processed elsewhere. Furthermore, nearly a third of all agricultural land is found in areas vulnerable to sea level rise, seasonal flooding, and drought.*

*In a world where unpredictable and disruptive events related to climate change and global health pandemics are becoming more common, reliability on existing supply chains is decreasing and will have a profound effect on regional food security for many parts of Canada. Implementing a climate adaptive approach to the spatial and functional organization of agriculture and development will be essential to foster a resilient and self-reliant food system in the Lower Mainland.*

***Because the territory is vulnerable to climate change and lacks a self-reliant food system, there is deep uncertainty regarding local food security and the future of BC's agricultural landscapes***



**Problem Statement**

*Agriculture is a fundamental part of the regional economy in the Lower Mainland of British Columbia. However, cultivation is currently driven by an export/import-oriented supply chain model - relying heavily on the US and Asia for local food security. Nearly half of the food consumed in the region is imported while much of the food that is grown locally is exported and processed elsewhere. Furthermore, nearly a third of all agricultural land is found in areas vulnerable to sea level rise, seasonal flooding, and drought.*

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*Because the territory is vulnerable to climate change and lacks a self-reliant food system, there is deep uncertainty regarding local food security and the future of BC's agricultural landscapes.*

**Research Questions**

*How did the territory transform over time? What structural elements have remained constant? What functions does this structure support?*

*Why is the Lower Mainland not self-reliant? Where is the food produced? Where is the food coming from?*

*What are the trends/challenges/driving forces that are influencing the region?*

*How can we transform the region in an adaptive way to become more self-reliant?*

**Analysis**

**Methodology**

**Contextual Analysis**

*Physiographic elements  
+  
Historical Analysis  
+  
Current Reading of the territory*

**3x3x3 Layered Analysis**

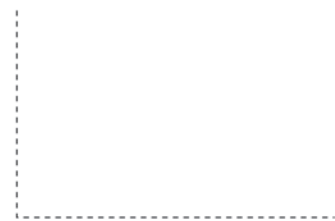
*1886, 1950, 2020  
+  
Regional, City, Local Scale  
+  
Occupation, Infrastructure, Nature*

**Food System Analysis**

*Supply Chain +  
+  
Production Methods  
+  
Crop Types*

**Conclusions**

**Test and Explore -  
Scenarios**

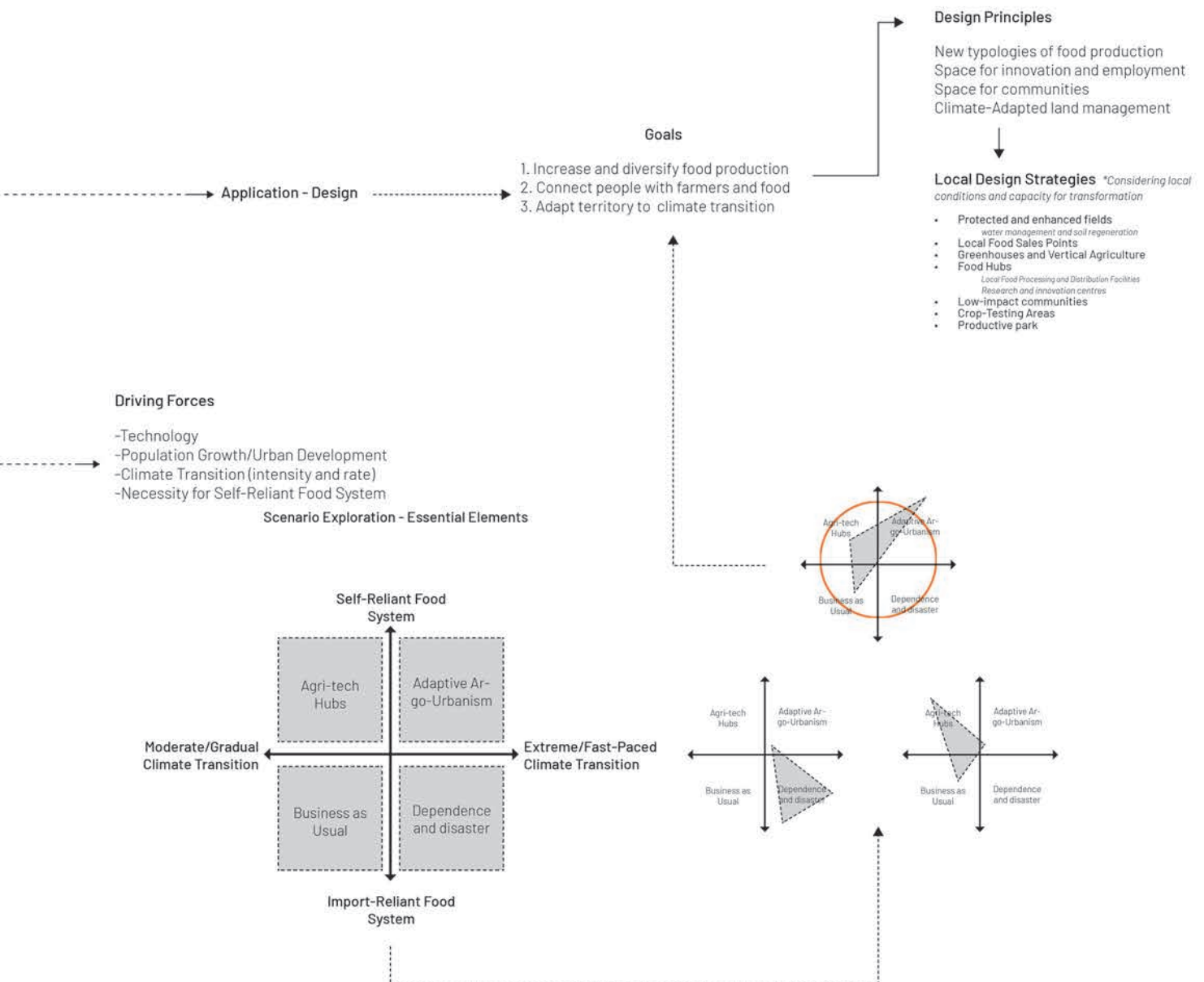




## Workflow

The general workflow for this research project is a linear process beginning with some of the general global challenges facing the human race at the moment. Self-reliance, population growth, food, systems, and the uncertainty of the future especially in consideration of the ongoing climate transition.

With this in mind, a location and a problem were identified, as were a series of specific research questions and an analysis methodology. From here a set of scenarios were considered before exploring, in full, the possibilities for design interventions.





# 2020 GLOBAL REPORT ON FOOD CRISES

JOINT ANALYSIS FOR BETTER DECISIONS

FIG. 1.9 Cover page of the Global Report of Food Crises 2020. Retrieved from: [wfp.org](http://wfp.org)



FIG. 1.10 Shorten your Food Chain. Retrieved <https://www.sandiseed.com/blogs/news/shorten-your-food-chain-infographic> (27-04-2020)



FIG. 1.11 The Young Agrarians 2020. Retrieved from: <https://youngagrarians.org/>

## Relevance of the Research

---

In a world where the climate transition is well underway, the necessity for further research on the future of our food systems and their vulnerability to shifts in once-predictable weather patterns is becoming more and more clear. Our food systems in Canada are also deeply embedded in a network of global trade where the food you consume is imported from warmer climates and is the end product of a long, complex chain of production, processing, distribution, marketing, and access.

However, an over reliance on this system creates inherent vulnerabilities for consumers. Furthermore, because of extensive free trade agreements such as the North American Free Trade Agreement between Canada the USA and Mexico, the cost of locally-sourced products is often undermined and reduces people's capacity to choose food that comes from their own region. By focusing on the Lower Mainland of British Columbia, it is possible to explore how this system manifests spatially. Farms in the region are large and need to produce large quantities of food products in order to participate in the global market and turn a profit. Their operations are oriented towards exportation while the majority of fruit and vegetables in the grocery stores throughout the Lower Mainland carry cheaper products from outside the region (from other parts of Canada or the USA in particular). Supply chains are also increasingly vulnerable to climate change and global disruptions such as the COVID-19 pandemic. In fact, a World Food Programme report released this year states,

*"the pandemic may well devastate livelihoods and food security, especially in fragile contexts and particularly for the most vulnerable people working in the informal agricultural and non-agricultural sectors. A global recession will majorly disrupt food supply chains." (p.3, 2020)*

In light of this, combined with the inherent vulnerability of the Lower Mainland, new forms of food production, supply, and distribution are needed if we are to build a future where agriculture is sustainable and resilient and contributes to increasing self-reliance for vulnerable urban regions. Fortunately, British Columbia is already taking some of the initial steps towards redefining their agricultural landscape. An active and growing organization called 'The Young Agrarians' "is a farmer to farmer resource network for new and young ecological, organic, and regenerative farmers." (The Young Agrarians 2020). This organization supports new, young farmers in establishing their businesses and is a small-scale approach to farming in a region dominated by large industrial farms. Additionally, the government of British Columbia has launched an initiative to create a Food Hub Network in the region to support the development of processing facilities for local farmers.

Given these immense and daunting challenges it is extremely relevant to continue seeking out new ways of understanding, interpreting, and reimagining how we can adapt in the face of an uncertain future. This is particularly important for delta regions such as the Lower Mainland where agriculture is both a vital part of the regional economy and severely threatened by climate change and disruptions to the global food supply chain. In conducting this research, it is my intention to offer another way in which to envision the future of local food systems, self-reliance, and adaptation.



FIG. 1.12 Model of Broadacre City by Frank Lloyd Wright. 1934–35

## 2 – Theoretical Framework

---

*“The exponential growth of demand for food results directly from the positive feedback loop that is now determining the growth of the human population. The supply of food to be expected in the future is dependent on land and fresh water and also on agricultural capital, which depends in turn on the other dominant positive feedback loop in the system - the capital investment loop.”(Meadows, 54)*

### **Abstract**

In the reading of a territory it is crucial to understand both its spatial and functional elements, not as separate phenomena, but as an intertwined relationship between the physical structuring of the land and the cultural processes this accommodates. This theoretical framework will therefore explore these concepts by first drawing on the work of James Corner and Joan Busquets on the history and motivations behind the rational organisation of the North American landscape and its metropolitan regions. Second, drawing on the work of Andrea Branzi, Ludwig Hilberseimer and Frank Lloyd Wright, the utopian ideas of integrated regions of agriculture and city are discussed to explore how these proposals, although never fully realized, are highly relevant in understanding how agriculture and urban areas are integrated in the case of the Lower Mainland of British Columbia. Finally, Meadows’s ‘The Limits of Growth’ is used here to frame the argument around seeking an equilibrium rather than pursuing endless growth. This is especially relevant in the reshaping of regions to become more self-sufficient and adaptive.



As researchers and designers in the field of urbanism, the ability to 'read' the territory is a crucial part of our practice. It is a fundamental part of understanding both the spatial and functional elements of a landscape, a region, a city, or a community. These spatial and functional features are not separate phenomena but are intertwined and form a relationship between the physical structuring of the land and the cultural processes embedded in it. This theoretical framework will explore these concepts by first drawing on the work of James Corner and Joan Busquets on the history and motivations behind the rational organisation of the North American landscape and its metropolitan regions. Second, drawing on the work of Andrea Branzi, Ludwig Hilberseimer, and Frank Lloyd Wright, the utopian ideas of integrated regions of agriculture and city are discussed to explore how these proposals, although never fully realized, are highly relevant in understanding how agriculture and urban areas are integrated in the case of the Lower Mainland of British Columbia. Finally, Meadows 'and Behren's The Limits of Growth' is used here to frame the argument around seeking an equilibrium rather than pursuing endless growth. This is especially relevant in the reshaping of regions to become more self-sufficient and adapt to the effects of the climate transition. In drawing upon these ideas as a theoretical basis for exploration, the intent is to consider how these concepts, related to the cultural making of the land and the representative power of a landscape, are inextricably linked to the way in which society continues to occupy and transform territories. Since change is a constant and accelerating element in the 21st century, there is no doubt that we must change the way in which we connect with the ground beneath our feet and the plants that sustain us.

James Corner, in his book 'Taking Measures Across the American Landscape' (1996), offers a way in which to understand the idea of the North American landscape as an infrastructure of pure productivity. Here, the hyper-regularized, rational organization of the land (particularly in the mid-west of the USA where agriculture is a dominant element) is seen as an extension of the industrial landscape of urban regions. He discusses this industrial landscape as an "immense expression of a pure and inexorable pragmatism that is spectacular in its banality, in its idealized realism, in its 'actualization of utopia'" (33). For Corner, these productive landscapes represent a particular way of relating with the earth – that it is simply a vast resource to be exploited by the systematic organization of infrastructure that enables this manipulation to carry on in an orderly manner. Indeed, the representative power of a landscape is one way to understand the cultural processes of land development and can help to further explain the spatial structure and quality of a place. The evolution of the landscape is indicative of other larger material practices in society and if we are to understand what processes are present today and what they might be in the future, looking to these practices, questioning where they come from and determining whether they are still relevant is of the utmost importance.

'Farming', 'agriculture' or the 'cultivation of the land' is a key component of this material practice and has deep cultural roots for the human race. Learning to predict, rely upon, manage and eventually control and manipulate how plant species grow is a skill we have developed for centuries and are still developing with the introduction of new cultivars, growing techniques, and the infusion of technology in food production. The gradual development of agricultural techniques and the numerous cultural experimentations of manipulating the landscape to produce food have resulted in an enormous variety of spatial consequences around the globe. One example, seen in

Canada, is the difference between the French and English traditions of dividing the land for agriculture. In French occupied Canada, land was divided by early colonialists into long, narrow strips along rivers to ensure that each landholder had equal access to the water. In British Canada, land was divided in a grid pattern and often did not follow the natural features of the landscape. (see images below)



FIG. 2.1 Google Earth images of farmland Southern Ontario (left) and Quebec (right) - Accessed on Google Earth

Throughout North America, this systematized method for ownership and control was first introduced during the colonial era, but in the period after the American War of Independence in the United States, a new form of land division was established. This was when the Jefferson Grid was introduced to distribute parcels of land for settlers. Thomas Jefferson, one of the founding fathers of the United States of America, led the creation of the National Land Survey and was concerned with “making land available, efficiently and equitably, for purchase and ownership by individuals” (Corner, 48). The resulting grid structure measured 1 sq. mile and was applied like a blanket over the land – dictating where roads would be built and where settlers could build homes. According to Joan Busquets, “[...] the abstract grid became a system of organization. It represented a milestone in control of the territory as an ortho-standardised landmark, but, most of all, the grid came to constitute a generic, universal spatial structure capable of providing a global logic for building the new Nation” (182). This organization, however, did not consider topography, subsoil conditions, water, or climate, nor did it consider the indigenous settlements already present in the territory. The establishment of the grid, to distribute the population and economic activities, was a utopian idea and “a concept which, in the 18th century, meant not an unrealizable vision but a project to be implanted in an empty immensity of space [...]” (Busquets, 183) While Canada remained under the power of the British Empire after the War of Independence, nation building was also a priority for the settlers living in the colony. The grid structure was adopted by some surveyors in growing urban regions, most notably on the West Coast in the Lower Mainland of British Columbia, an element that is still visible in the organization of the territory– in the form of land division and transportation infrastructure.

This rational organization of the landscape, originally embedded in ideas of territorial control, distribution, productivity, and progress, have had a lasting effect on the landscapes of North America. While the cultural process of creating this rationalization is one that has evolved over time, a few distinct ideas were formulated by particular designers and planners over the last 100 years. In fact, many 20th

century hypothetical planning projects focused on the idea of agrarian urbanism. In many of these projects, "agrarianism offered a counterpoint to the increasingly dense metropolises that grew with the great migrations from farm villages to industrial cities" (Waldheim, 2). Considering the relation between agriculture and urbanism – two elements that are inextricably tied to the organization of a territory – it helps to touch on the original notions and proposals in futurist (sometimes utopian) city and regional plans where agricultural production was regarded as a formative element of the urban structure. This includes Frank Lloyd Wright's 'Broadacre City' (1932) and Ludwig Hilberseimer's "The City in the Landscape" (1944). Wright's idea of a utopian reorganization of the territory that would grant each citizen (by birth right) 1 acre of land for living and cultivating food and Hilberseimer's New Regional Plan were both based on low density urbanization organized around transportation. Wright's Broadacre City included a network of transportation and communication infrastructure, with the Jefferson grid as its principal structural element (Waldheim, 3). As an antithesis to the existing conditions of the American city of the 1930s, Broadacre City incorporated a suburban structure interwoven with space to live and space to be self-reliant and cultivate the land. With the growing presence of the automobile during this time, the idea was that a family could live in an extremely low density, self-sufficient environment, only relying on the car for the occasional trip outside of their given plot of land. On the other hand, Hilberseimer, who promoted his ideas for the future of cities and agriculture in the 1949 'The New Regional Pattern: Industries and Gardens, Workshops and Farms', did not defer to the abstraction of a grid. Rather, his notion of a regional plan, including the organization of agricultural activities, was informed by the natural environment like topography, waterways, vegetation etc., and illustrated a system of relational forces and flows, instead of a collection of objects. (Waldheim, 6) In contrast to these ideas, Andrea Branzi and his 'Agronica' (1994) project also offers an insightful way to look at the future of agriculture and urbanism. His position is based on a more open-ended approach – form and fields that are mobile, flexible, and open to change but also technologically driven. For example, he includes the potential for a synergistic connection between agriculture and energy production and uses modular, mobile devices for growing food.

Although these proposals are from three different periods during the 20th century and represent distinct responses to the conditions of the time, they are relevant in today's discussion on the interrelationship between agriculture and the city. In the Lower Mainland of British Columbia, this interrelationship is unique in Canada and is the result of numerous functional and spatial changes over time. The 19th century organization of the landscape created the grid pattern that still exists today for example. This dictated where roads would later be built and where towns would establish and develop. During the early 20th century, agriculture was integrated even more closely with the small settlements of Surrey and Langley. These agricultural communities were of particular importance during the Great Depression of the 1930s when people moved away from the cities and occupied undeveloped land to cultivate their own food. But as the boom of the post-war era brought more immigrants and larger populations back to Canada's urban centres, farmland gave way to urban communities and this integration was gradually lost as sprawling suburbs of the Vancouver Metropolitan Region began to spread throughout the Lower Mainland. However, in the 1970s, during the height of this expansion and the loss of productive land for urban development, the government recognized that agriculture is precious and must be protected and established an Agricultural Land Reserve that excluded

arable land from further urban encroachment. This has resulted in a territory where the two functions of city and agriculture co-exist, albeit in a strictly divided structure. While the Lower Mainland does not embody the exact principles espoused by Wright, Hilberseimer or Branzi, there is an element of integration between city and agriculture that can be noted here. However, with the mounting pressure to expand the metropolitan region and provide more housing options, pressure on remaining open spaces like the ALR is growing. There is an opportunity here to reconsider how agriculture can be truly integrated into the region. A further adaptation of the territory that draws upon the ideas of Wright, Hilberseimer, and Branzi and modifies them to meet the contemporary challenges of modern agriculture, climate change, a growing population, self-reliance in food production, and the uncertainty of our collective future could truly benefit society.

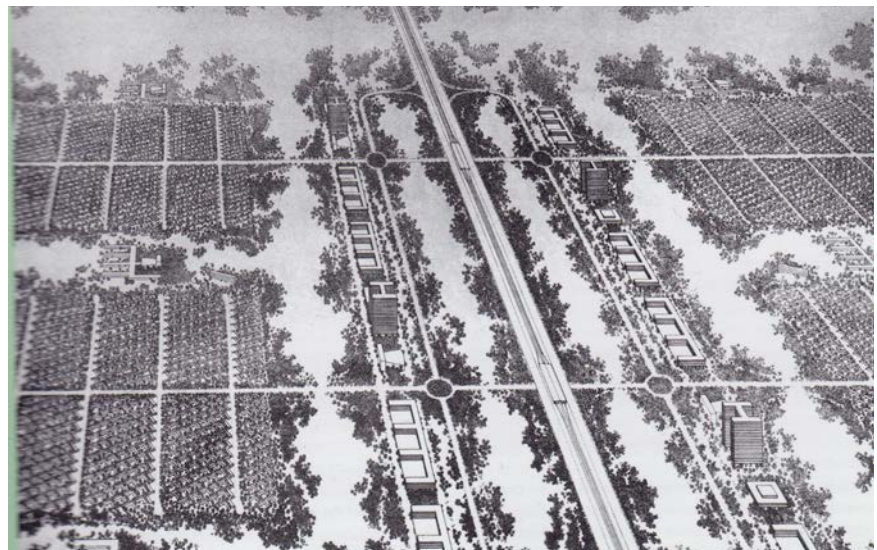


FIG. 2.2 Ludwig Hilberseimer. "The City in the Landscape". 1944

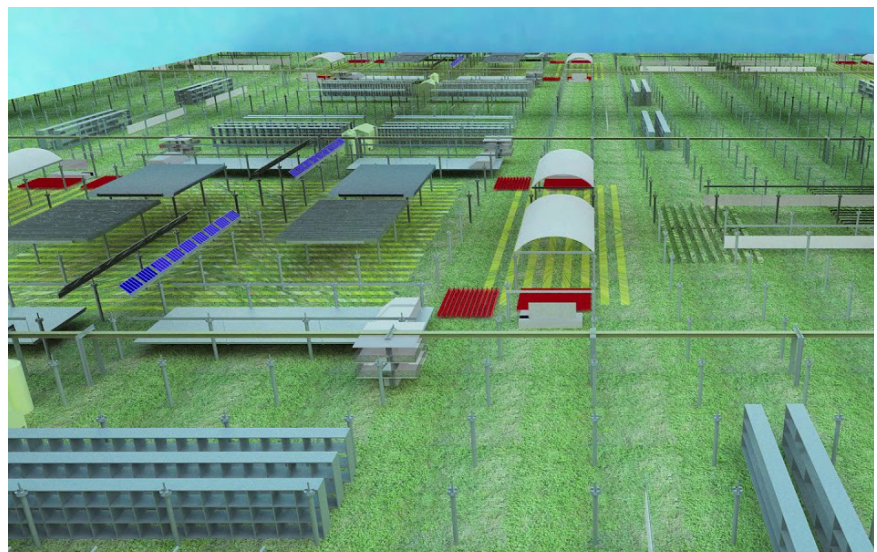


FIG. 2.3 Andrea Branzi's "Agronica" (1993-94), later, "Territory for the New Economy" (1999)

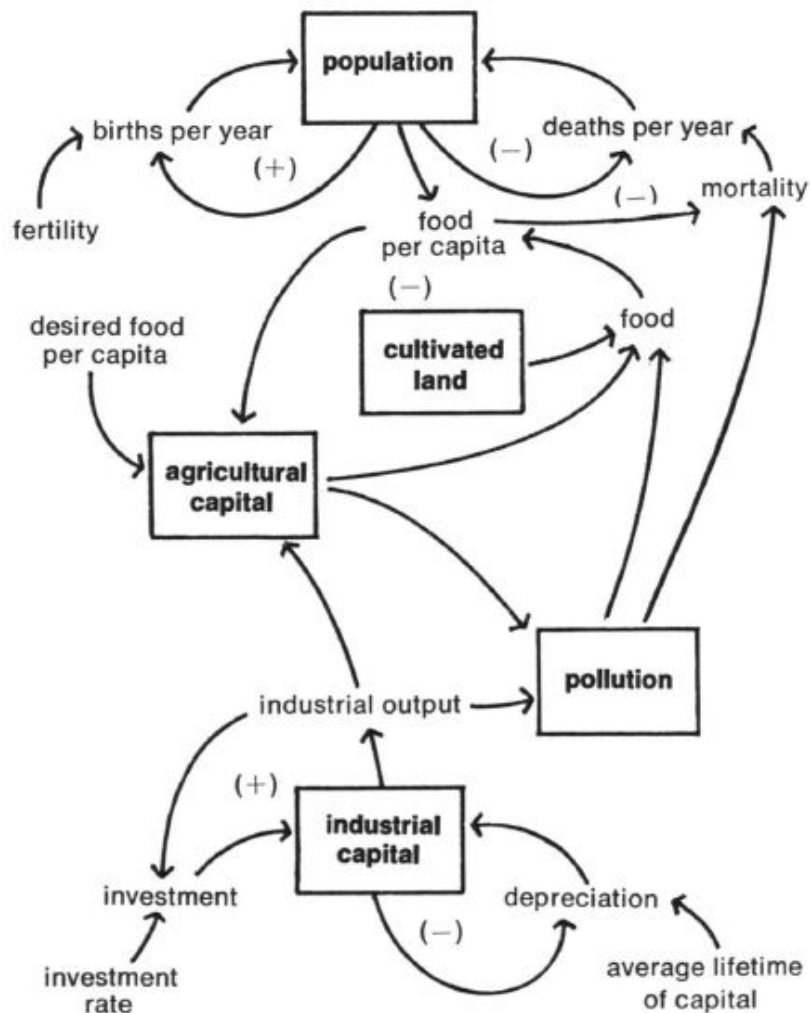


In fact, if we are to consider the seriousness of this task, we must draw upon the work of Meadows and Behrens and their writing on the 'Limits of Growth' (1972). They argue that there is an absolute necessity to search for new approaches to redirect society towards the goal of equilibrium rather than pure growth (193). In fact, the authors go as far as to say that "if the present growth trends in world population, industrialization, pollution, food production, and resource depletion continue unchanged, the limits to growth on this planet will be reached sometime within the next one hundred years. The most probable result will be a rather sudden and uncontrollable decline in both population and industrial capacity" (23). While this may seem like an extreme view of our future, the sense of urgency and the need to work on reaching greater balance in the world is absolutely vital.

Striving to attain and sustain this equilibrium is the fundamental challenge of the 21st century. In every facet of modern life which requires a further exploitation of resources and the consumption of products, balance is rarely, if ever, achieved. However, the search for new approaches that can begin shifting society towards this equilibrium can, and must, involve a reconsideration of the role food production plays in the spatial and functional adaptations of metropolitan regions. In fact, as Corner puts it, "in the landscape, measures of fit [can] structure a beneficial reciprocity between occupant and environment. Through a careful gauging of natural and cultural circumstance, some human communities have adapted their landscapes, buildings, and programs of occupancy [...]" (139). It is, possible to reach a level of adaptability and equilibrium if the means to do so are prioritised. Food production, especially, is essential in this process. It is a fundamental basic need for humans to eat and agriculture is a key component of urban regions. Ensuring that there is sufficient space to grow food and adequate support for innovation in agriculture, means that a structural shift is paramount. Not only are spatial changes necessary, but the way in which we grow and distribute food on a regional scale must change too. Because, as Meadows points out, "even if the choice were consistently to produce food as the first priority, [...] continued population growth and the law of increasing costs could rapidly drive the system to the point where all available resources were devoted to producing food, leaving no further possibility of expansion." (53) A focus on 'highly capitalized agriculture' leads to rapid soil erosion and low soil fertility, thereby threatening the stability of agriculture in the long-term (164)

This research project therefore takes the opportunity to explore an alternative to the current food system in the Lower Mainland of British Columbia – including its spatial and functional structure. The ideas discussed above serve as inspiration and motivation to propose these changes as the urgency of such a task has never been greater. The current character of the urban and metropolitan landscapes we inhabit are pure reflections of the historic choices made during a time of tremendous growth and progress. They are an imprint of the cultural values and perspectives that shaped the land we now inhabit. Now is the time, when faced with the extreme challenges of the 21st century, to work towards a greater equilibrium. As so eloquently stated in 'The Limits to Growth', "the transition, in any case, is likely to be painful, and it will make extreme demands on human ingenuity and determination. As we have mentioned, only the conviction that there is no other avenue to survival can liberate the moral, intellectual, and creative forces required to initiate this unprecedented human undertaking." (196)





*Some of the interconnections between population and industrial capital operate through agricultural capital, cultivated land, and pollution. Each arrow indicates a causal relationship, which may be immediate or delayed, large or small, positive or negative, depending on the assumptions included in each model run.*

FIG. 2.4 Feedback Loops of Population, Capital, Agriculture and Pollution. *The Limits to Growth* 1972

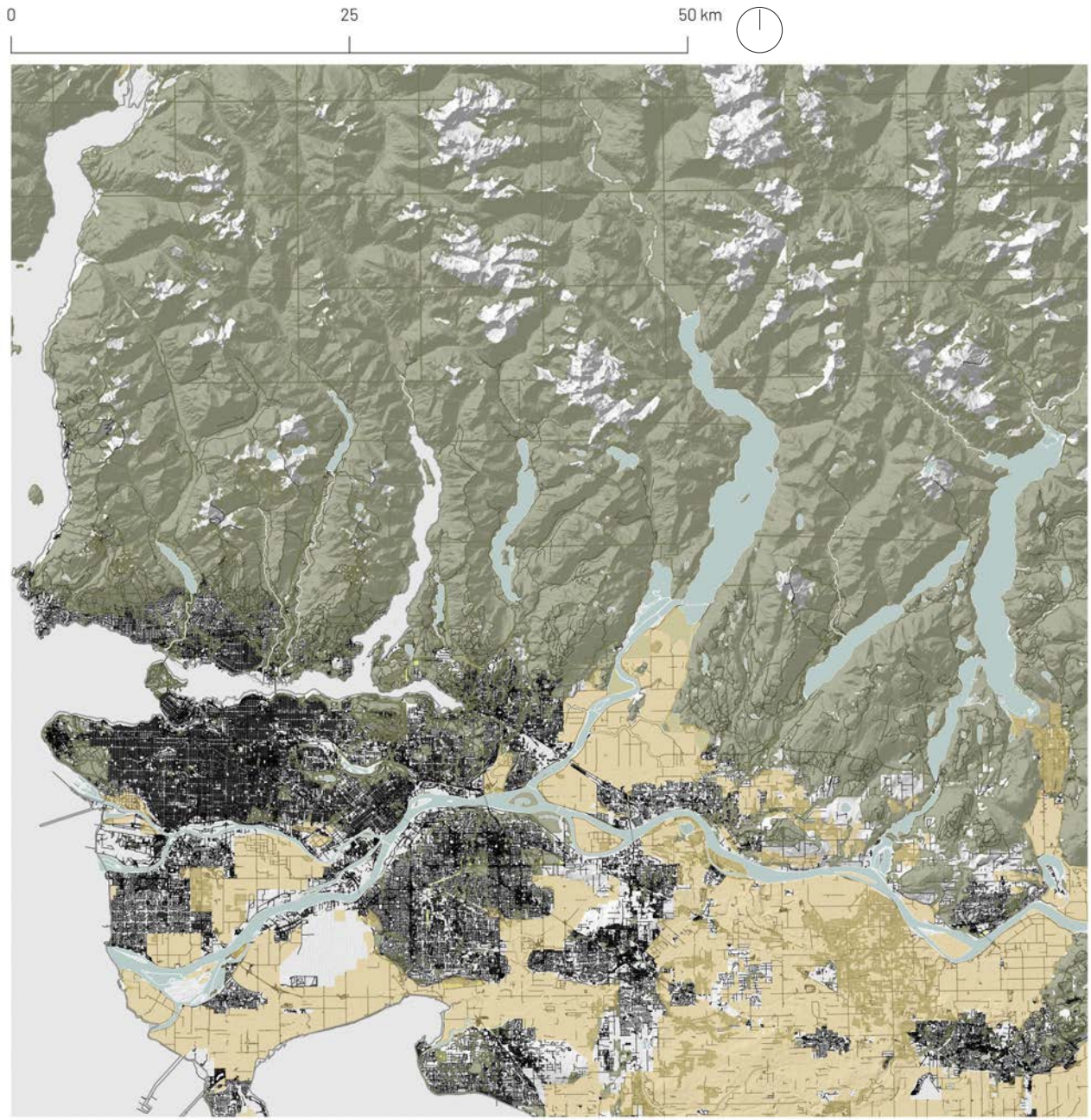






FIG. 2.5 Map by author - created using open source data from DataBC and the Government of Canada

-  Roads
-  Agricultural Land Reserve
-  Coniferous Forest Cover
-  Water Bodies

# 3 – CONTEXT & CHALLENGES

## The Lower Mainland Ecoregion

There's a reason why the Lower Mainland is one of the most prosperous and thriving regions to live in Canada. Not only is this delta surrounded by unimaginable natural beauty, it is diverse in its landscapes, abundant in food production, and boasts some of the warmest weather in Canada throughout the year. Because of these extremely favourable conditions, life thrives in the Lower Mainland.

The region is ranked number one in Canada for the production of blueberries, cranberries, and apricots and second in the production of grapes, floriculture, nursery products, greenhouse tomatoes, peppers and cucumbers, as well as mushrooms. Apples, dairy products, chickens, and eggs also rank high. (Statistics Canada, 2014).

Vancouver is consistently rated as one of the best places to live in the world (despite the extremely high cost of living) and the sprawling metropolitan region is home to numerous smaller cities and towns such as Surrey, Langley, Abbotsford, and Chilliwack.

Historically, the Lower Mainland would have more closely resembled the delineation of human occupation and activities shown on the next page in Patrick Gedde's 1909 Valley Section. Today, the urbanized metropolitan region is characterized by sprawling suburbs, massive industrial platforms along the Fraser River and inlets from the Pacific Ocean, a dense commercial city centre interspersed by agricultural land that sprawls further inland towards the mountains.

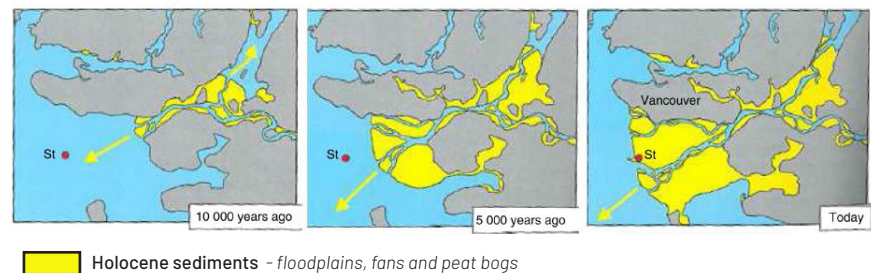
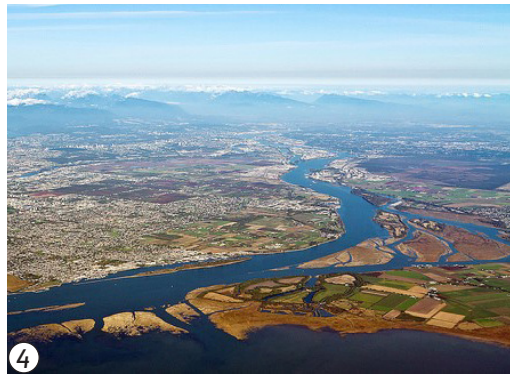


FIG. 3.1 Evolution of the Fraser River Delta during the Holocene (Clague & Turner 2003)





However, what Patrick Geddes' section reveals is a close relationship between the qualities of the territory and the functions that benefit from them. This still holds true for the Lower Mainland as you can see in the diagram below. While the functional elements in the Lower Mainland are much more diverse than those in Geddes' section, this presents a snapshot of the main economic drivers in the region today and where they are located in relation to the territory. Industry is strategically placed along the Fraser River for ease of access, international trade and transport hubs are located closest to the ocean in seaports and urban areas have sprawled around them. Agricultural areas are less common closest to these dense urban areas but as you move further inland agriculture is the primary territorial element.

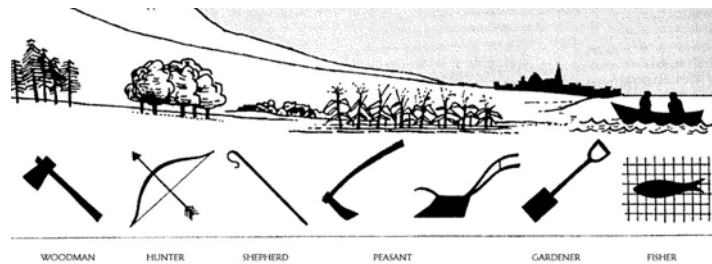


FIG. 3.3 Patrick Geddes, Valley Section, 1909

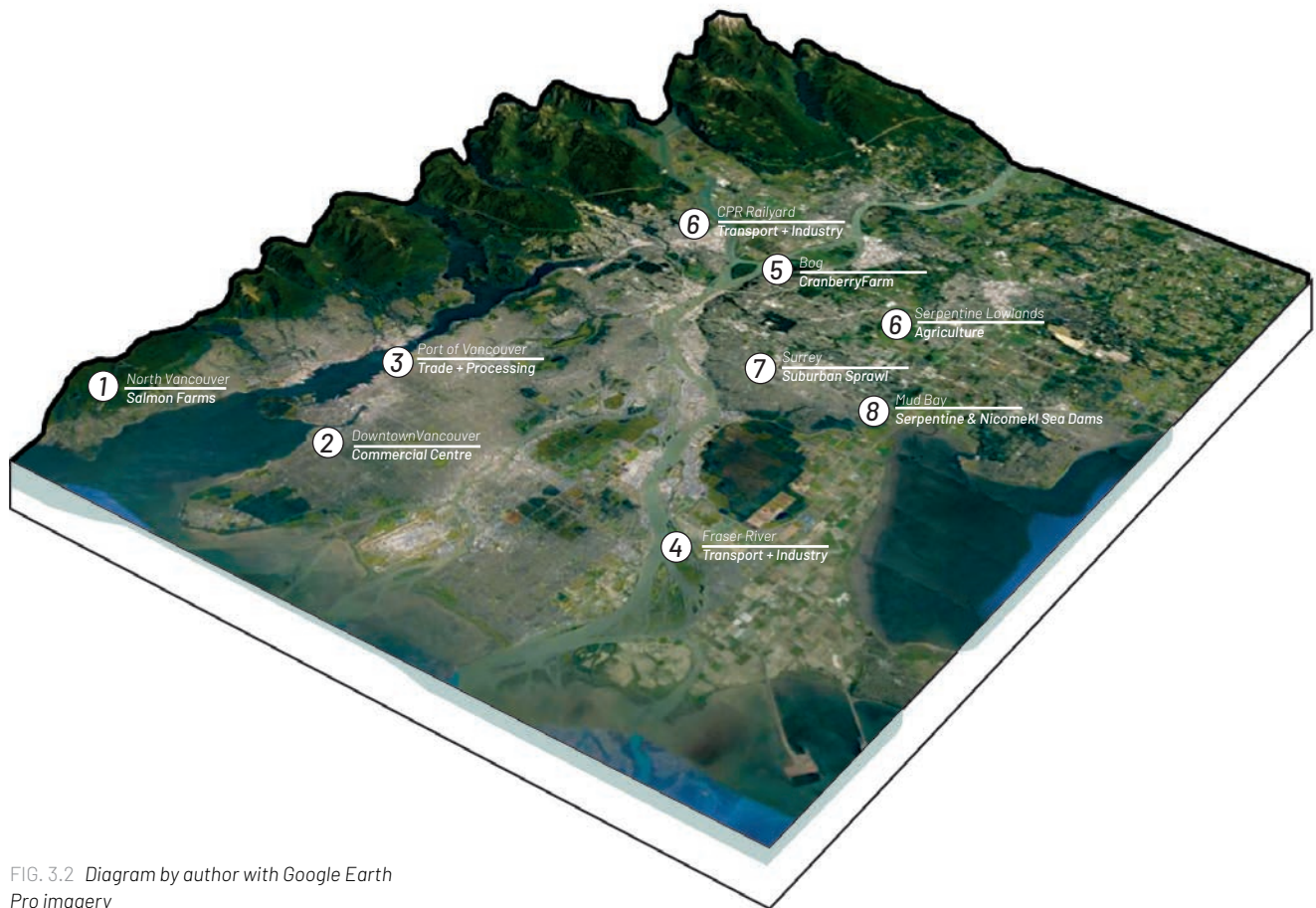


FIG. 3.2 Diagram by author with Google Earth Pro imagery



**WESTERN CANADA**  
THE NEW ELDORADO

HOMES FOR EVERYBODY  
EASY TO REACH  
NOTHING TO FEAR  
PROTECTED BY THE GOVERNMENT

WHEAT LAND  
RICH VIRGIN SOIL  
LAND FOR MIXED FARMING  
LAND FOR CATTLE RAISING

A WHEAT FARM - IN THE CANADIAN WEST

PERFECTING THE CROP IN WESTERN CANADA

THE OLD AND THE NEW HOME

WESTWARD THE STAR OF EMPIRE TAKES ITS WAY

THIS IS YOUR OPPORTUNITY  
WHY NOT EMBRACE IT?

FREE 160 ACRES  
WESTERN CANADA  
FARM LANDS

INFORMATION AND ADVICE  
CAN BE OBTAINED FROM  
**W.D. SCOTT**  
SUPERINTENDENT OF IMMIGRATION  
34th ST. OTTAWA, CANADA  
JOSEPH SMITH  
11-12 CHARING CROSS  
LONDON, ENG.

FIG. 3.4 Western Canada - The New Eldorado.  
ca. 1890-1920. [http://collectionscanada.gc.ca/pam\\_archives/index.php?fuseaction=genitem.displayItem&lang=eng&rec\\_nbr=2945432](http://collectionscanada.gc.ca/pam_archives/index.php?fuseaction=genitem.displayItem&lang=eng&rec_nbr=2945432)

## Settler Colonialism and the Structural Reshaping of a Region

Indigenous people have inhabited this part of present-day British Columbia for approximately 14,000 years. Until the 18th century, numerous Indigenous societies lived, hunted, gathered, and cultivated food in the delta region of the Fraser River. These lowlands were well connected by rivers, abundant in resources because of the temperate climate and supported many indigenous communities. The organization of food gathering was interconnected and spanned large areas across the delta and was more closely connected to the ebb and flow of seasonal and migratory processes of the territory. Pre-contact societies in the Pacific Northwest were complex, hierarchical, and diverse with numerous languages and a mixture of large and small settlements. (Canadian encyclopaedia, 2020)

However, with the arrival of Europeans in the region, a slow but complete transformation of the land began to take form. Not only did this contact bring foreign diseases that killed the Indigenous people in large numbers, the customs and values that brought Europeans here in the first place completely transplanted this society.

In 1858, gold was discovered in the Thompson River and prompted a gold rush in the Fraser Canyon - dubbed the 'New Eldorado' (Fig 1.6). The region was inundated with prospectors in search of gold which prompted the construction of infrastructure to allow for people to move through the territory with ease. With this transformation came the development of more permanent settlements and communities of Europeans. They set up businesses and took advantage of other resources that were in abundance such as lumber, fish, and arable land for farming.

In the late 19th and into the 20th century, the British Empire referred to and promoted Western Canada as the 'New Eldorado' again, but this time in reference to its agricultural potential. With rich, arable soil deposits stretching across the Fraser River Delta, the cultivation of the land became a tremendous opportunity for newcomers to the colony. Throughout the 20th century, farming shifted from its small-scale family sized farms to the industrial farming seen throughout the Lower Mainland today.



FIG. 3.5 The New Eldorado — A Complete View of the Newly Discovered Goldfields in British North America, 1858. *Library and Archives Canada, R9266-3470, Peter Winkworth Collection of Canadiana*



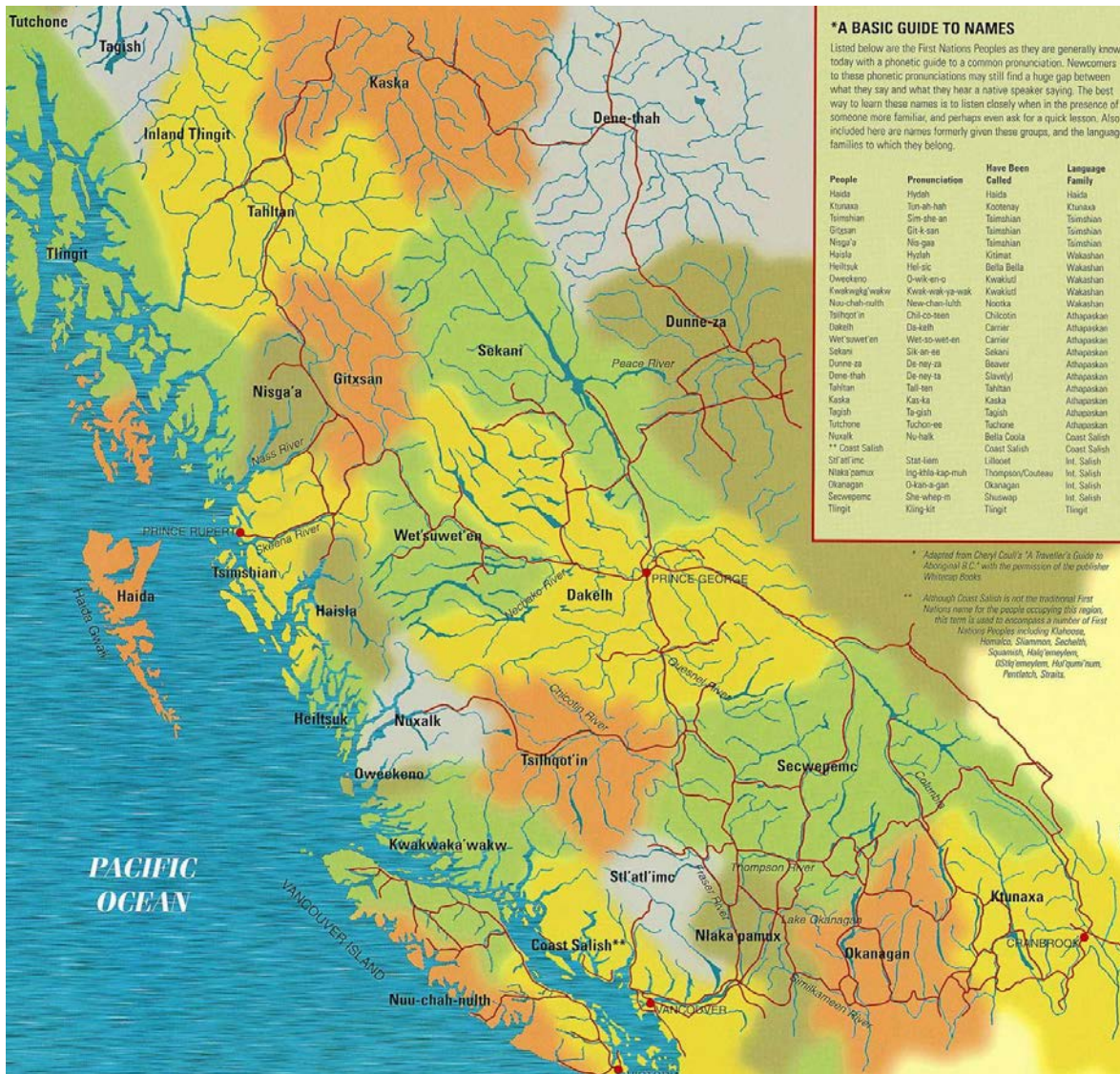


FIG. 3.6 First Nations Peoples and their Territories. British Columbia Ministry of Education Source: <http://www.firstnations.eu/> First



FIG. 3.7 Indigenous food-gathering map shows the geographic layout of villages, tribal watersheds and food-gathering locations before European contact. Source: <https://opentextbc.ca/geography/chapter/6-4-food-systems-in-british-columbia/>





FIG. 3.8 The Georgia Depression - Encompassing The Lower Mainland and Northern Washington state, USA. Satellite image rotated 90° to demonstrate another way of perceiving the territory - placing the outflow of water at the top of the image rather than the north direction. Retrieved from: NASA Goddard Space Flight Center from Greenbelt, MD, USA. Scale unavailable



## Lower Mainland Today – Canada’s only Urbanized Delta Region

Over the course of the 20th century, industry, agriculture, and a diverse and growing metropolitan delta region began to flourish. People from all over the world settled in Vancouver and the Lower Mainland as Canada opened its doors to immigration. Urban development initially concentrated along the coast and the banks of the Fraser River continued to push inwards. Agricultural land became protected and preserved in the 1970s in order to safeguard it from this development but regardless, the metropolitan region continued to densify and expand.

In light of this, spatial planning took on an important role in managing the development of the region and its 21 municipalities. This was an incredible task given that the population in the Lower Mainland increased by 102% between 1971 and 2006 (Statistics Canada, 2020). In comparison, Canada’s population grew by 47% during the same period. However, despite progressive planning approaches, the urban form took a typical North American approach to urban sprawl with a concentrated urban core in Vancouver and endless single-family homes.

This trend is projected to continue according to the Department of Geography at the University of British Columbia. As more people immigrate to Canada and its cities, urban regions such as the Lower Mainland will need to accommodate them.

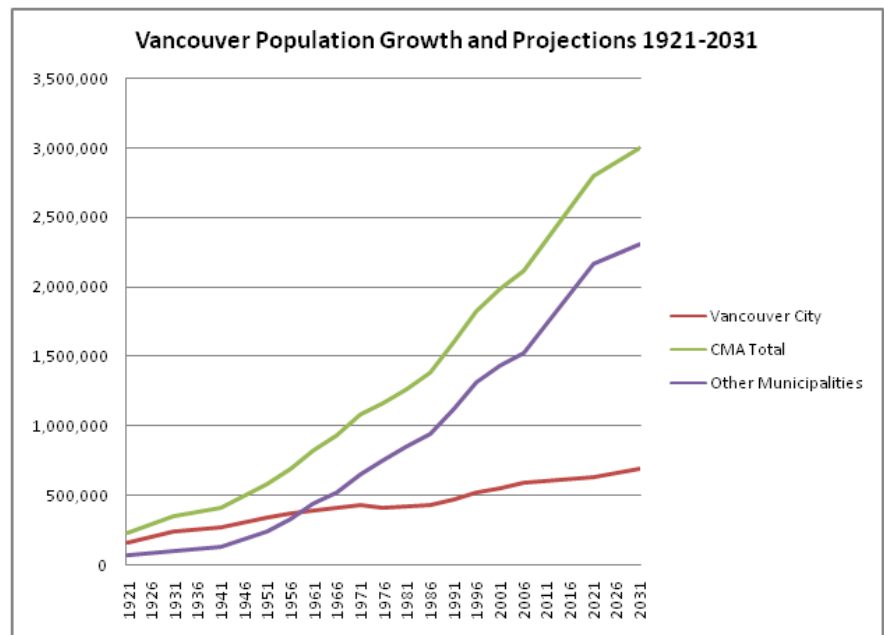
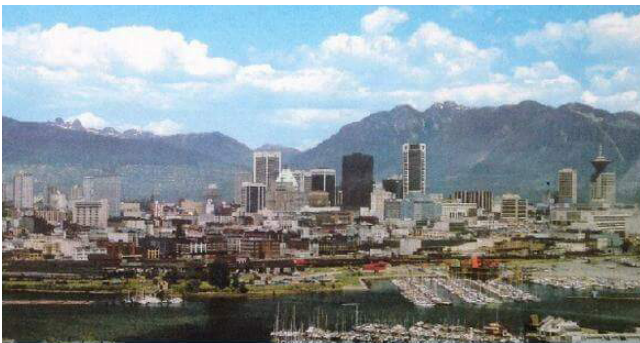


FIG. 3.9 Historic and projected population growth in Vancouver and the Vancouver census metropolitan area (CMA) Retrieved from: <https://ibis.geog.ubc.ca/courses/geob479/classof08/vandensify/introduction.html>



FIG. 3.10 Proposed density increase in downtown Surrey. Retrieved from: <https://dailyhive.com/vancouver/surrey-future-development-vancouver-oakland-san-francisco-bob-williams>



1970



2020

FIG. 3.11 50 year skyline comparison of downtown Vancouver. Retrieved from <https://i.pinimg.com/736x/97/f2/ae/97f2aeaf1af9e0a9fc55512f60c26559.jpg>

## Urban Development

In an attempt to accommodate this population growth, the government of British Columbia is trying to incentivize the development and densification of cities across the region, to refocus urban growth away from downtown Vancouver. For example, Surrey, a city of about 500,000 people is located just outside of Vancouver to the South-East. There are plans to densify the downtown core and some of the surrounding neighbourhoods adding about 185,000 people to the city. Langley, located just east of Surrey anticipates similar growth with a projected population growth of about 140,000 people by 2041. (Metro Vancouver, 2018)

With this decentralized urban development strategy, the provincial government has taken the opportunity to promote an 'innovation corridor' where new residential development is paired with investment into new business centres and office space within proximity of development projects. According to the 2019 report, A Framework for Improving British Columbia's Standard of Living,

*"While continuing to accommodate growth for technology businesses that have established a footprint in downtown Vancouver, we will configure government tools and programming to support an innovation growth corridor in Surrey Centre and the Fraser Valley, a model that follows the success of other major metropolitan regions that have grown their technology industries."*(29, 2019)

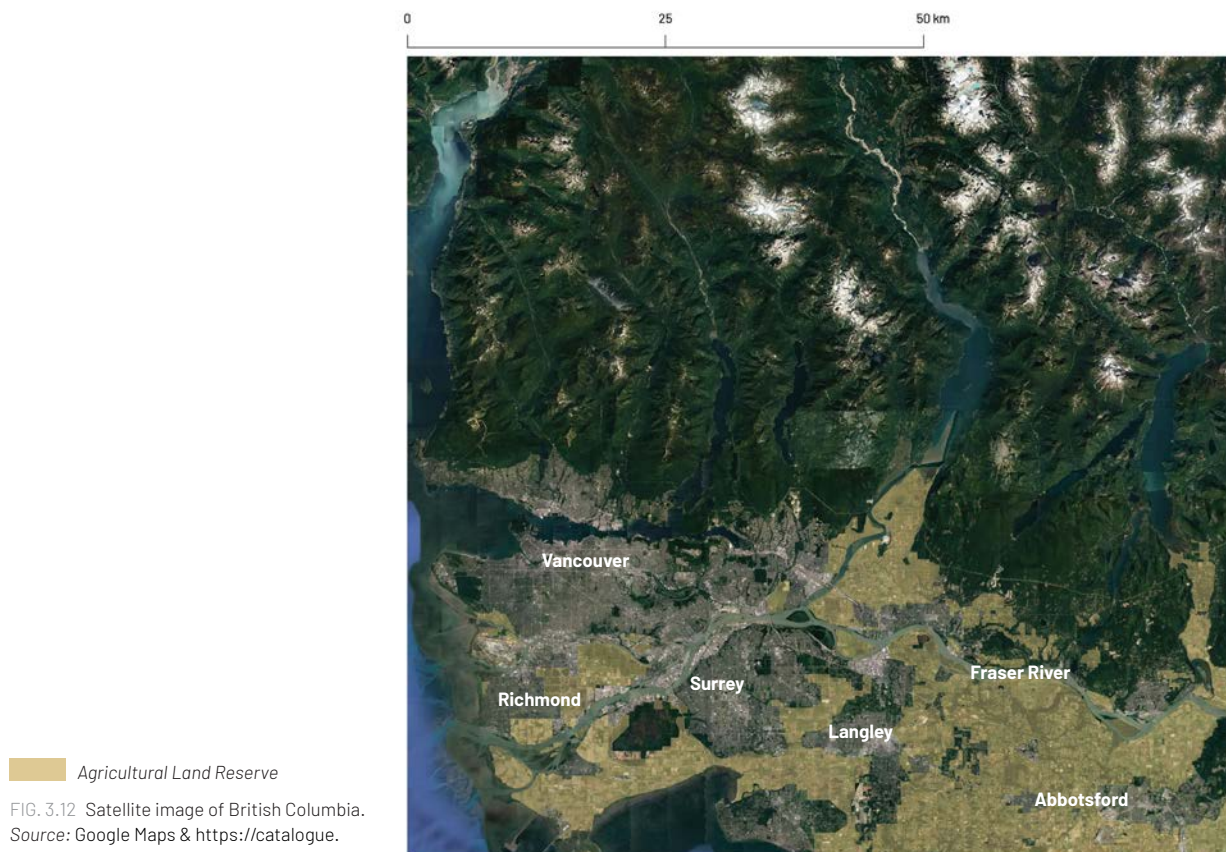


FIG. 3.12 Satellite image of British Columbia.  
Source: Google Maps & <https://catalogue.data.gov.bc.ca/dataset>



Agriculture is integrated with :



Infrastructure



with natural areas



with the river



with urban areas

FIG. 3.13 Satellite images of the Lower Mainland to demonstrate the integration of agriculture with urban areas Retrieved from: Google Earth Pro

### BC in National Rankings by Commodity

Blueberries	1
Cranberries	1
Raspberries	1
Appricots	1
Sweet Cherries	1
Grapes	2
Floriculture	2
Nursery Products	2
Tomatoes, greenhouse	2
Sweet Peppers, greenhouse	2
Mushrooms	2
Apples	3
Cucumbers, greenhouse	2
Dairy Products	3
Hens and Chickens	3
Eggs	3
Turkeys	3
Canola	4
Cattle	6
Hogs	6
Potatoes	7

Source: Statistics Canada, Census of Agriculture and BC Ministry of Agriculture *Fast Stats, Agriculture, Aquaculture & Food*, 2014

FIG. 3.15 Food commodities grown in BC and their national ranking. Retrieved from: BC Ministry of Agriculture, 2014

## Agriculture

As discussed previously, agriculture is integrated closely with the urban fabric of the Lower Mainland. In 1973, the Agricultural Land Reserve (ALR) was established to protect valuable agricultural areas from development and for over 40 years has mostly retained its original boundary limits. In some of the most populated parts of the region, agriculture coexists alongside residential and commercial areas. Further inland, the ALR bisects municipalities, creating a green, productive buffer between urban centres.

For example, as shown below and on the proceeding page, the ALR is nestled in the lowlands between Surrey and Langley. Here, agricultural land benefits from the richness of soil found in this shallow river valley, which mostly consist of silty clay soils with a high water retention threshold.

What's important to address is that despite the fact that agriculture is a key component of the delta, there is a large portion of arable land that is currently uncultivated and farming operations that do turn a profit do so because they export their products to the USA, overseas or to the rest of Canada.

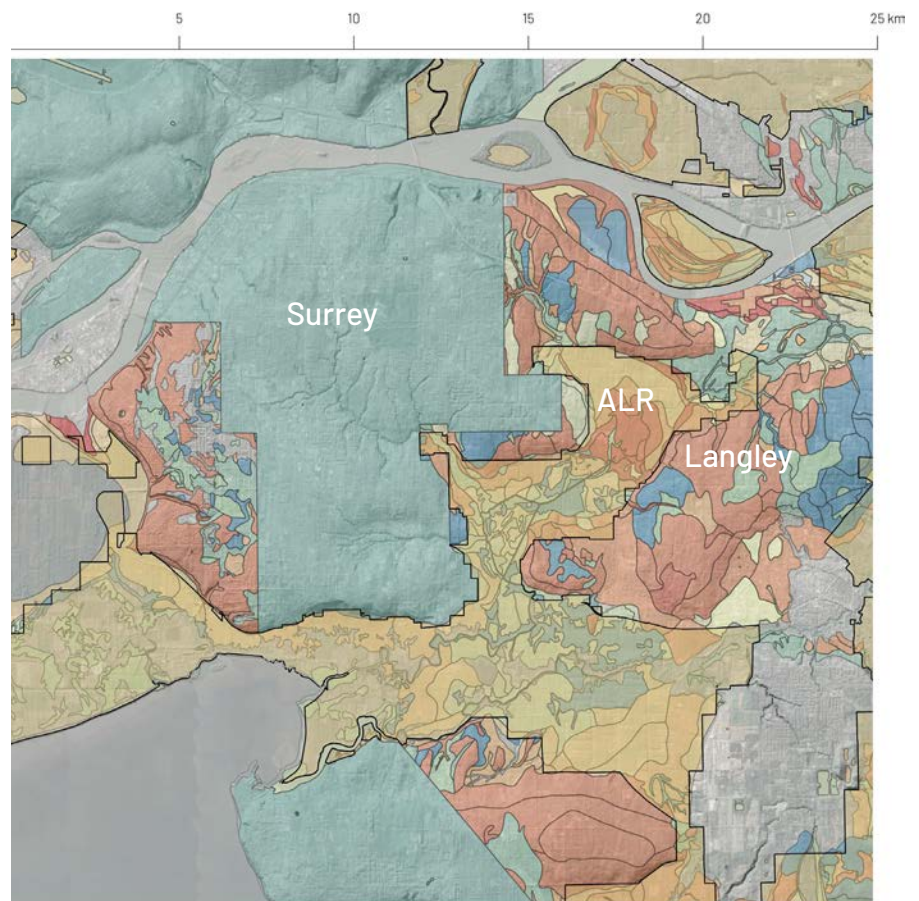
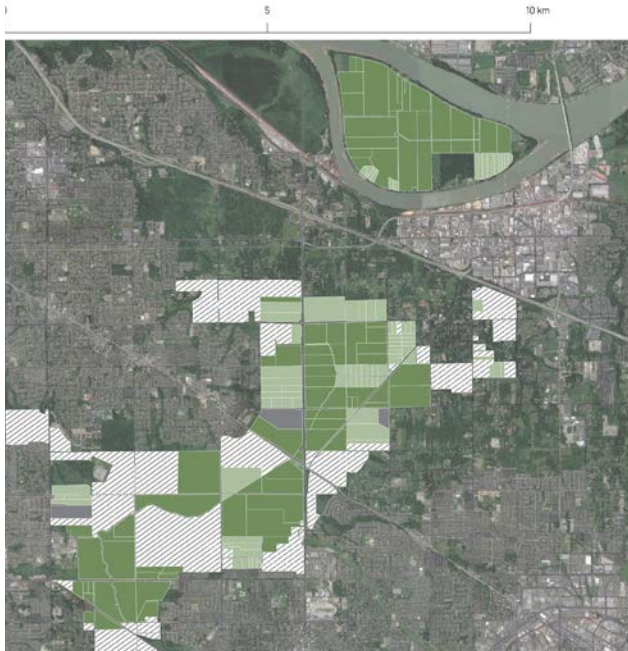


FIG. 3.14 Soil Typologies and boundaries of the ALR depicted to demonstrate the richness of the soil in agricultural areas of the Lower Mainland. Map created with data retrieved from DataBC <https://catalogue.data.gov.bc.ca>






### Room to Grow

**Region:**  
 165,000 hectares of arable land in the region.  
 101,000 hectares currently in production


**Site:**  
 3200 hectares of arable land  
 2200 hectares currently in production

-  greenhouses
-  small-scale farms
-  non-agricultural landuse (aprox. 1000 hectares)
-  large-scale farming




 greenhouses




 small-scale farms



 large-scale farming



 non-agricultural landu

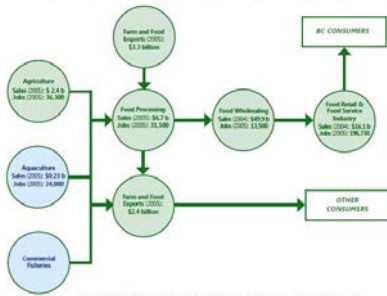






FIG. 3.17 Estimated economic impact of the BC agri-food system. Retrieved from the BC Ministry of Agriculture, 2006

Currently, food consumption based primarily on imports must be equal to 1.8 million tonnes (\$1.6 billion) worth of food in order to meet outstanding food need (not met by local production). Because of these conditions, current agricultural self-reliance in the Lower Mainland sits at approximately 40% and is projected to decrease to 28% as the population grows (if import-oriented production/consumption patterns continue)(ISFS, 2016).

As discussed previously, there is greater uncertainty regarding global supply chains as they are affected by climate change, disasters and pandemics and reliability on crops grown in regions that are experiencing greater risks due to climate change. This makes for a stronger argument to shift towards greater local self-reliance in BC's food system. The first step in reshaping agriculture in the region is to carefully work with the available land in order to yield more produce and innovate new ways to grow and cultivate food.

### Export-Driven Production

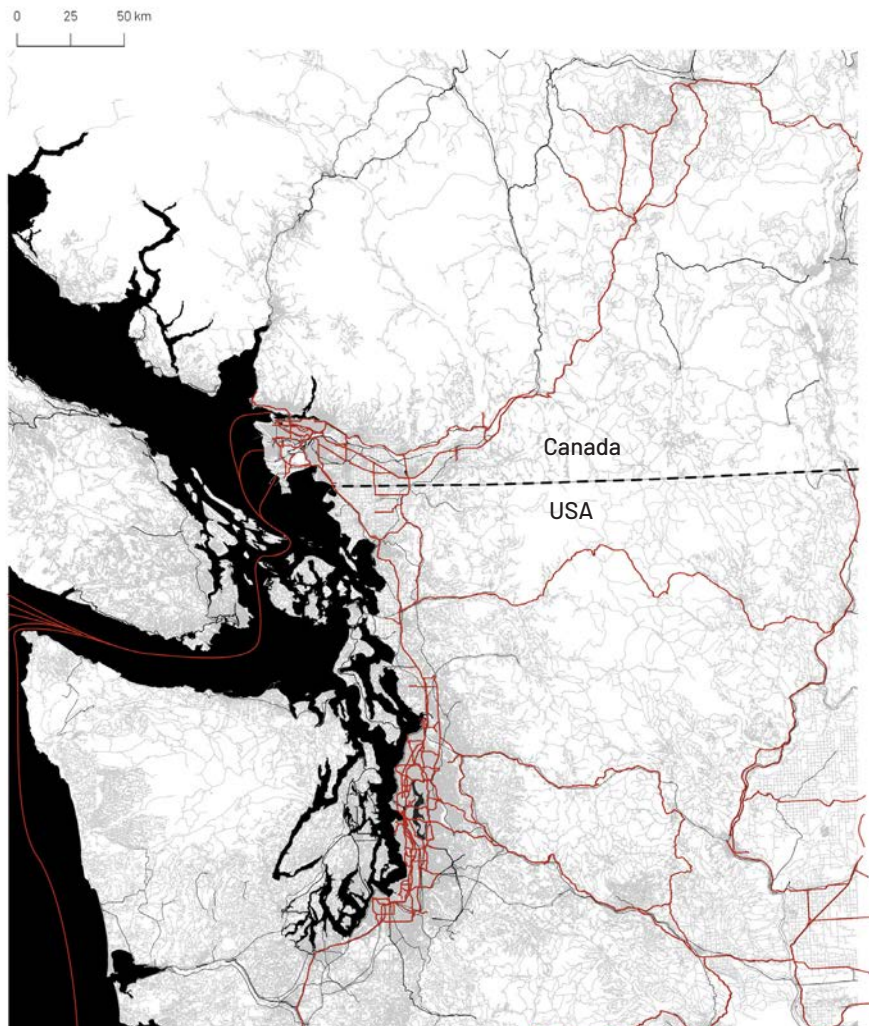
\$3.9 billion to 157 markets worldwide

-  **United States 71.7%**
-  **China 10.1%**
-  **Japan 5.2%**
-  **South Korea 1.8%**
-  **Hong Kong 1.7%**

Year	Proportion imported
1946	3%
1955	29%
1970s	60%
1990s	40%
2008	45%

(Furuseth and Pierce, 1982; Statistics Canada, 2008)

FIG. 3.16 Map of primary trade corridors in the Pacific Northwest. Map developed by author with data from DataBC and the State of Washington Geospatial Open Data Portal





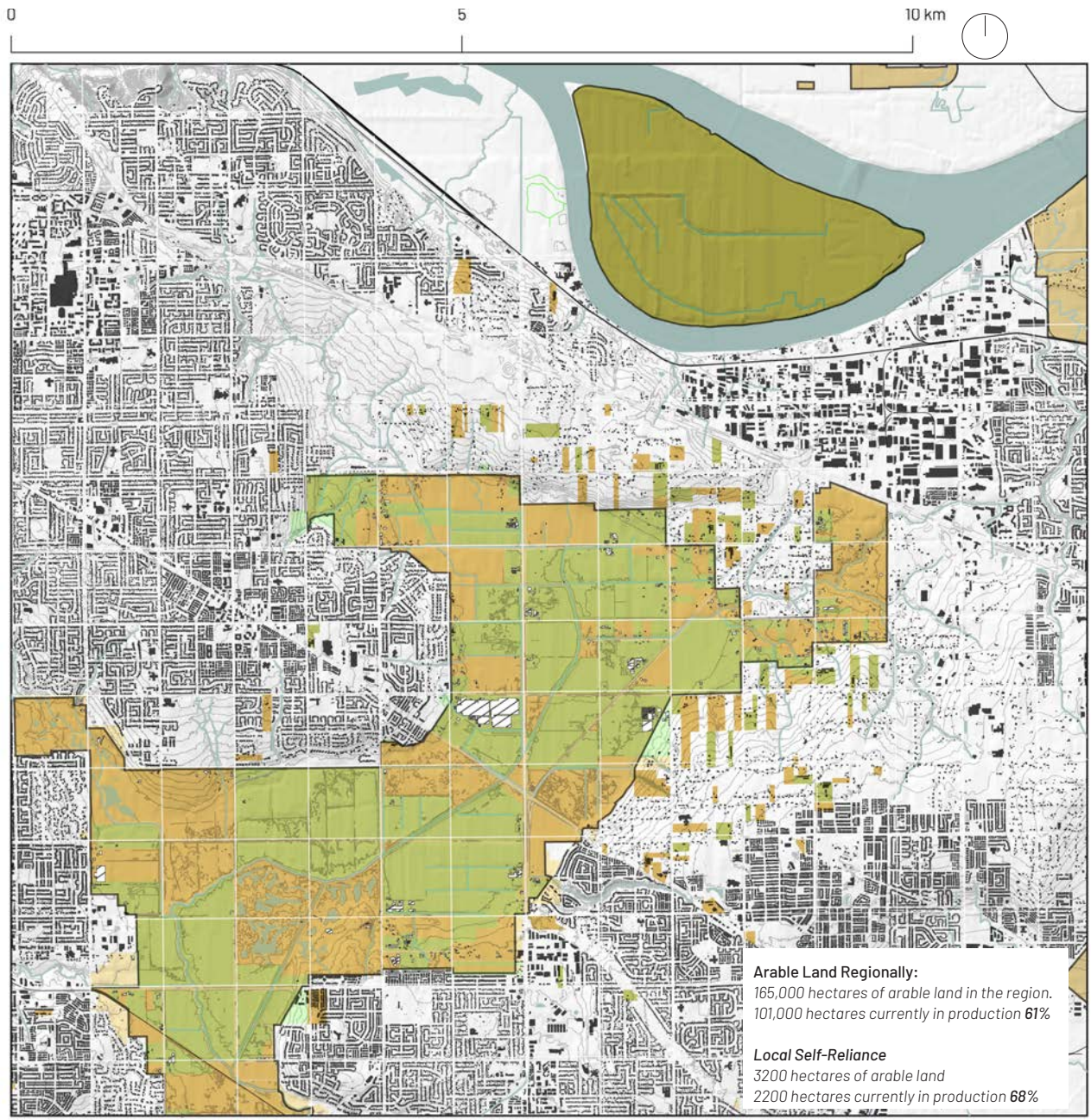


FIG. 3.18 Inventory of used and unused farmland in Serpentine Lowlands. Map developed by author with data from Surrey Landuse Inventor 2017

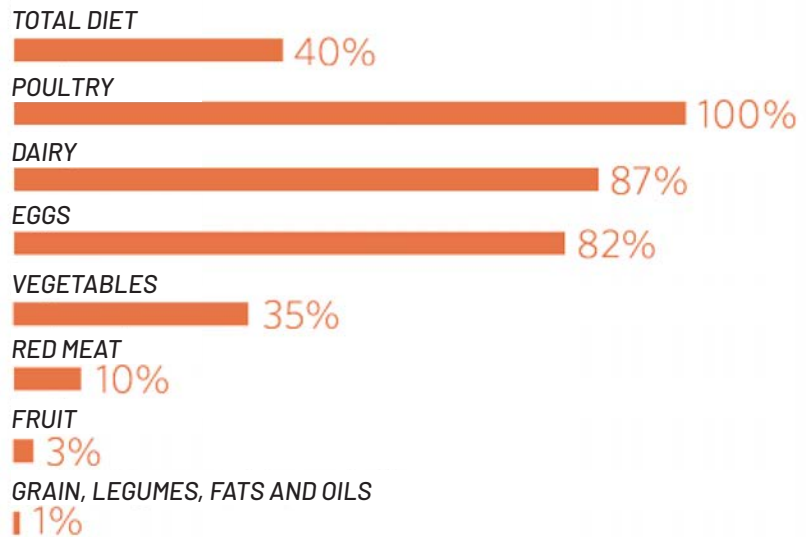
## Measurement of Self-Reliance in the Region

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Given how the current food system functions, self-reliance is undoubtedly low across the Lower Mainland particularly in vegetable, fruit, grain, legumes, fats, and oil production. Certainly, not all of these products can be 100% produced locally, but an increase in self-reliance on vegetables, legumes, and certain fruits is possible.

Given that not all of the available designated agricultural land is currently used for cultivation (as shown on the adjacent map of ALR land in Surrey) there is an opportunity to begin increasing local self-reliance by re-activating these plots of arable land.

### Regional Self-Reliance





Berries, Tree Fruit and Field  
Vegetables



Floriculture, Nursery Plants &  
Greenhouse Products



Oil Crops and Livestock Grazing



### What is cultivated in British Columbia?

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The Lower Mainland is an agricultural hub in Canada. The warmer climate and soil conditions of the region have enabled farming to flourish over the last century and, today, the Lower Mainland is one of the most productive, diverse, and profitable agricultural regions in the country. It is renowned first and foremost for its berries - blueberries, cranberries, blackberries, strawberries, and numerous others grow perfectly in these conditions. Fruit trees, field vegetables, and vegetables grown in greenhouses are typically cultivated for export. Further inland, away from urban areas, large tracts of agricultural land is designated as pasture for grazing animals which makes up a large portion of the agricultural activities in BC.

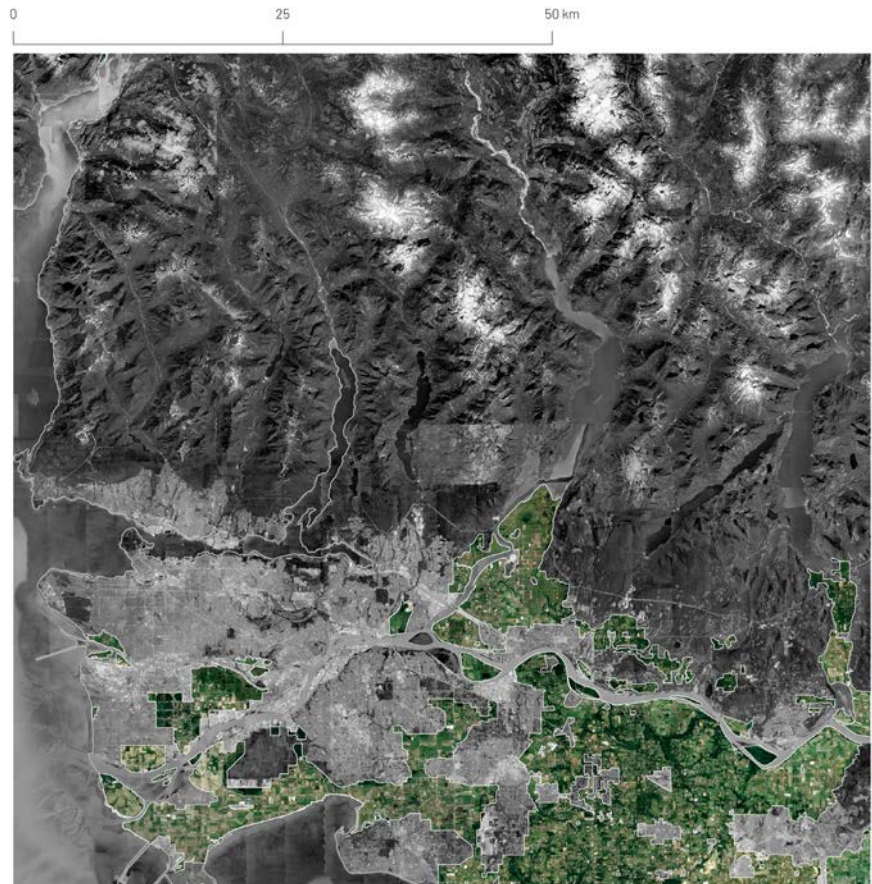


FIG. 3.19 Map of cultivated land in the Lower Mainland. Map developed by author with data from DataBC



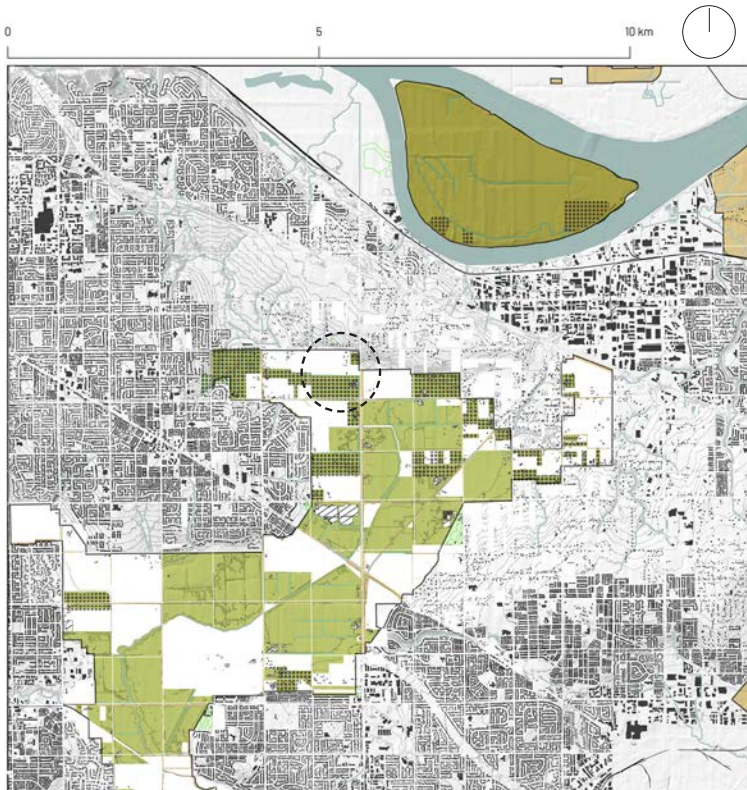


FIG. 3.20 Map of active small-scale farms in the Serpentine Lowlands, Surrey. Map developed by author with data from DataBC <https://catalogue.data.gov.bc.ca> and Surrey Landuse Inventory 2017

## Berries, Tree Fruit and Field Vegetables

---

Smaller farms typically cater to the production and sale of field vegetables, fruit, and berries. These include:

- Blueberries
- Cranberries
- Blackberries
- Strawberries
- Blackberries
- Cherries
- Apricots
- Peaches
- Nectarines
- Potatoes
- Peppers
- Zucchini
- Cucumber
- Lettuce

This type of local production is seasonally driven which plays a large role in the availability of these types of food. Even though the region boasts a temperate climate, for nearly half of the year, these local products are not available (in large quantities anyway) and are typically imported from the USA and Mexico during the winter. Furthermore, this type of production is not always connected to the larger commercial sale of fruits and vegetables in the region and often farmers set up their own shops or roadside fruit and vegetable stands to sell their products.

Vegetables, on the other hand, while also seasonally available, are grown both outdoors and inside greenhouses, making their availability throughout the year much greater. However, much of what is grown in greenhouses are sold to foreign markets.

Heaven Fresh Choice Farm



Small-scale



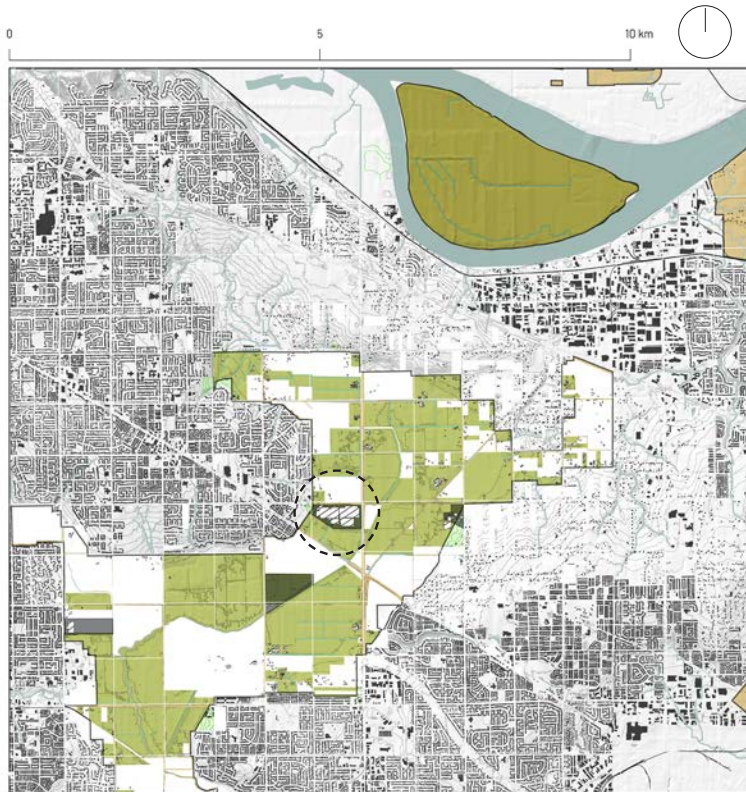


FIG. 3.21 Map of active greenhouses in the Serpentine Lowlands, Surrey. Map developed by author with data from DataBC <https://catalogue.data.gov.bc.ca> and Surrey Landuse Inventory 2017

## Floriculture, Nursery Plants & Greenhouse Products

---

Greenhouse production, though not a dominant spatial element in the agricultural landscape of the Lower Mainland, accounts for 93% (Ministry of Agriculture, 2016) of all greenhouse production across the province of British Columbia. With an extensive infrastructural network concentrated in the region and numerous ports and points of entry between the USA and Canada, this type of high-volume production can access the commercial market with ease. This type of production results in a high quantity of food - most of which is exported. These include:

- Tomatoes
- Cucumbers
- Peppers
- Eggplant
- Greens

There is potential here to increase greenhouse-grown produce with the intention to supply more directly to supermarkets and favour local distribution over global.

Burnaby Lakes Greenhouses Ltd.



Greenhouse/Nursery

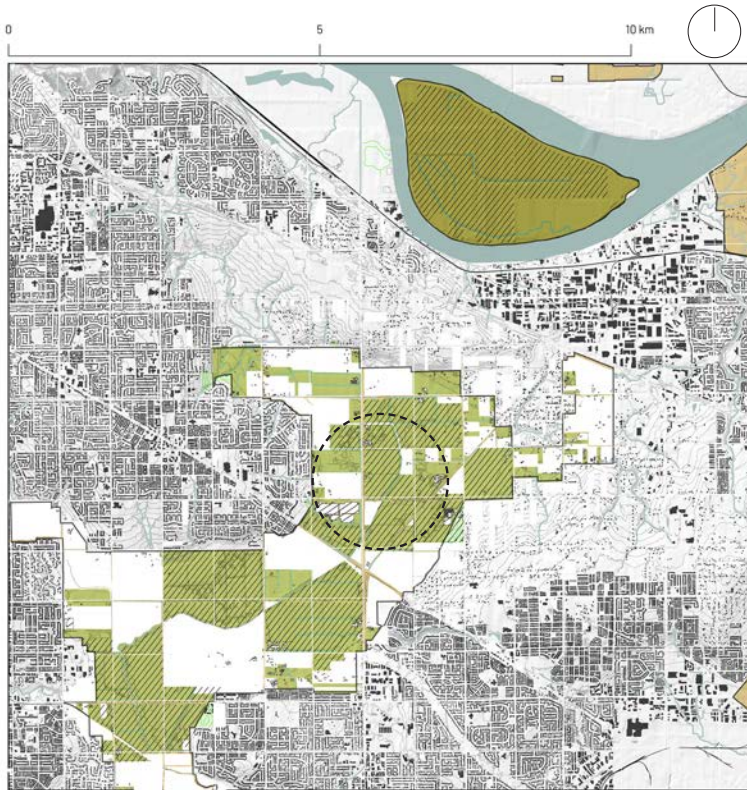


FIG. 3.22 Map of active large-scale farms in the Serpentine Lowlands, Surrey. Map developed by author with data from DataBC <https://catalogue.data.gov.bc.ca> and Surrey Landuse Inventory 2017



## Oil Crops and Livestock Grazing

---

Seed oil crops do not represent a large portion of the agricultural activity in the region but it does represent one of the commodities that the Lower Mainland is dependent on importing from the USA and Asia.

The crops that are grown in the region include:

- Canola
- Wheat
- Barley
- Oats
- Peas

Grazing animals include:

- Cows
- Goats
- Sheep
- Bison
- Deer
- Horses

Again, there is an opportunity here to increase self-reliance by designating large unused agricultural plots to be used for these crops.

Lindrian Farms



 Large-scale

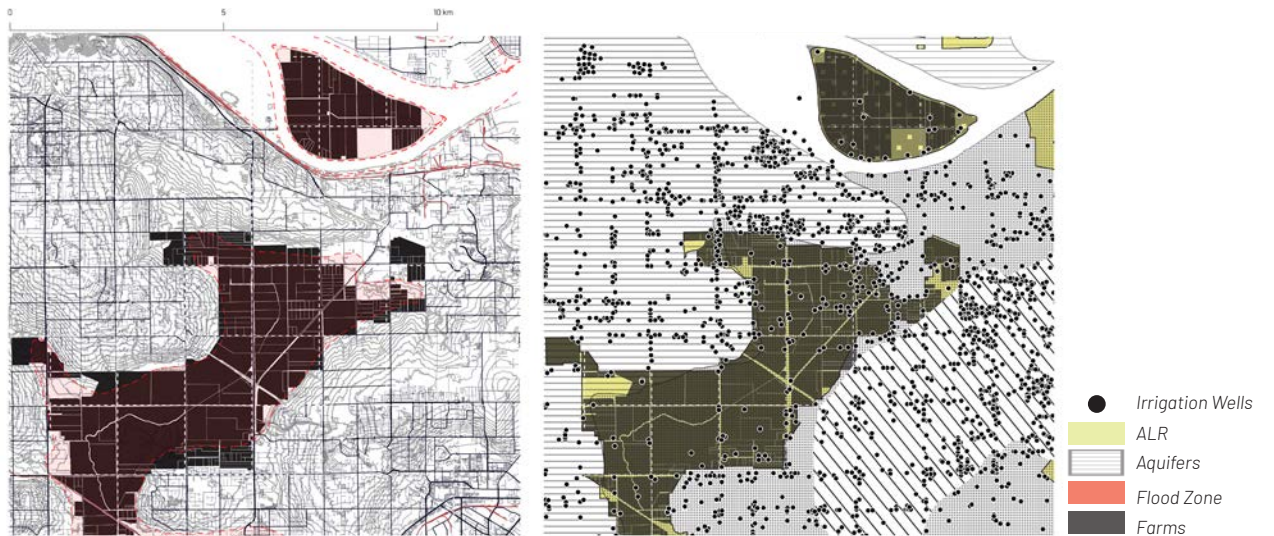
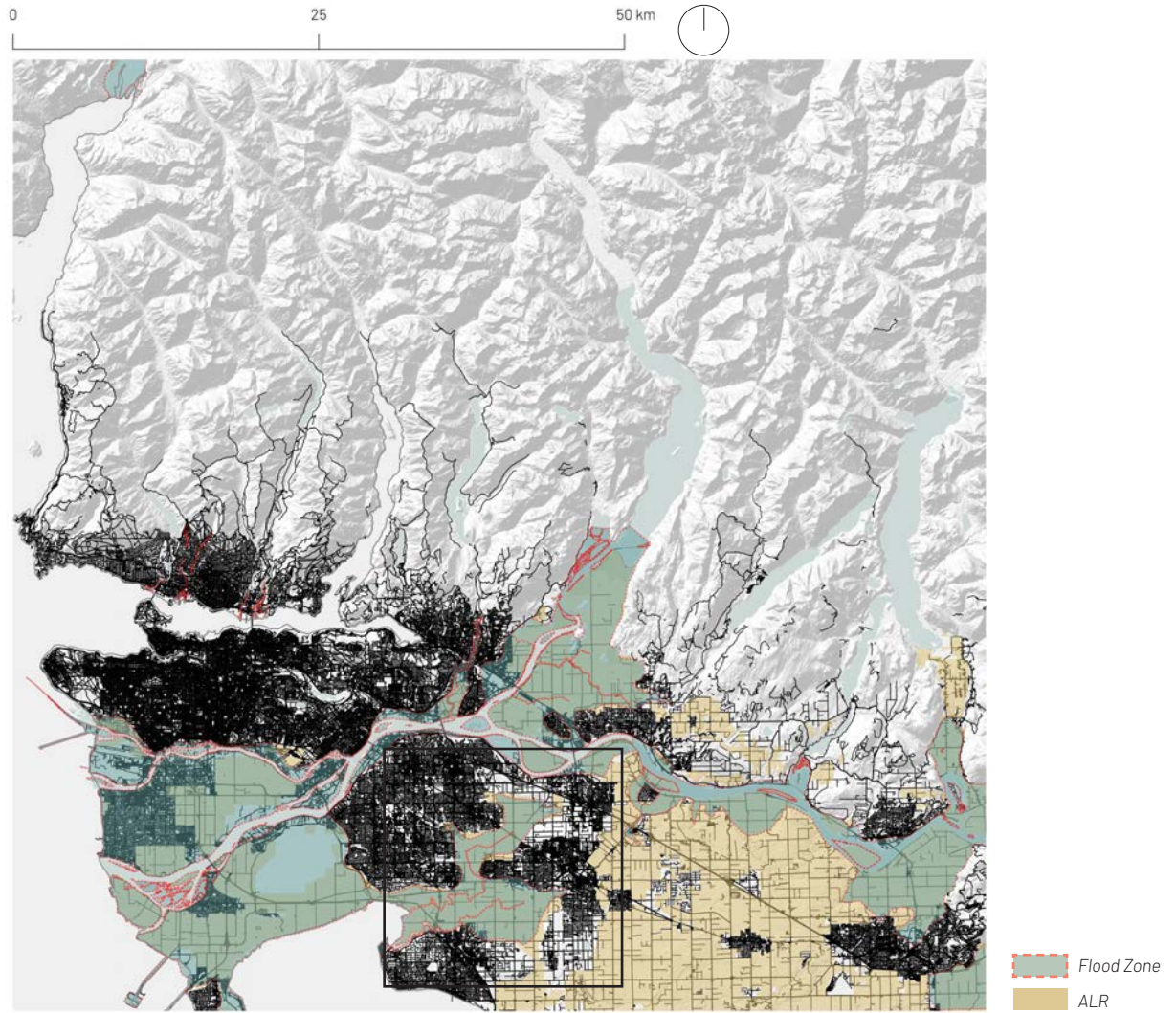


FIG. 3.23 Flooding extents, aquifers, and irrigation wells. Regional and local scale. Maps by author with data from DataBC

## Climate Change in British Columbia

The local and regional impacts of natural disasters and the vulnerability of the territory are numerous in the Lower Mainland. The maps on the left demonstrate a number of these. First, flooding, from the Fraser River and from the Pacific Ocean, pose an incredible threat not only to urban areas but also to agricultural land. This is because much of the agricultural land lies below sea level and in the event of excessive rain or sudden flooding, these areas will inevitably inundate first. Contributing to this is subsidence, an effect exacerbated by increasing urbanization and the extraction of ground water for irrigation.

According to the Federal government, the West Coast of Canada will be impacted the most by climate change. With sea level rise, melting glaciers, river flooding, and wildfires, there are numerous risks that pose a significant threat to people and their livelihoods in this region. However, in the same report, the level of adaptation potential was ranked high for the West Coast as it already possess the tools and skills to incorporate sustainable adaptation plans and policies across the province. If these tools are applied to agriculture as easily as they would be to cities and infrastructure, there is an opportunity to safeguard and increase local food production while also managing and adapting to the risks associated with climate change.

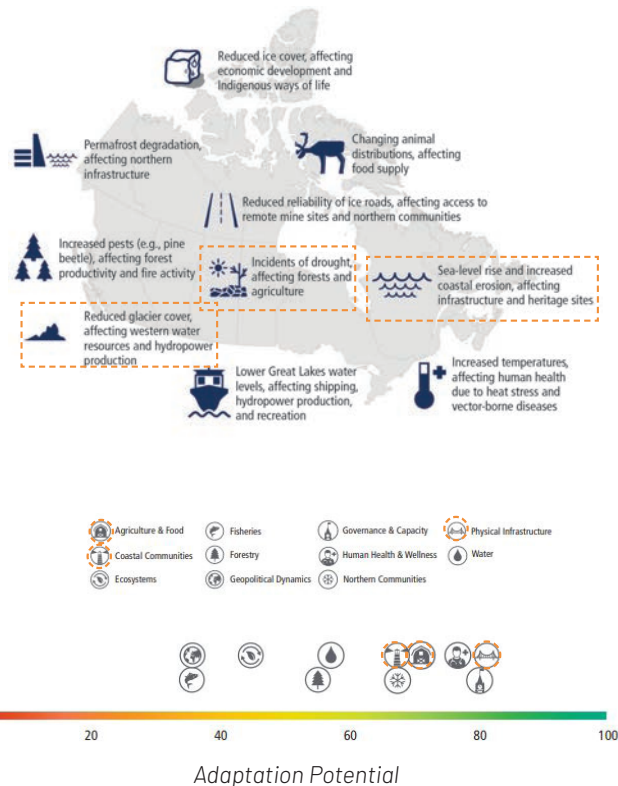


FIG. 3.24 "Canada's Top Climate Change Risks - The Expert Panel on Climate Change Risks and Adaptation Potential" 2019. p. 29 Source : Council of Canadian Academics



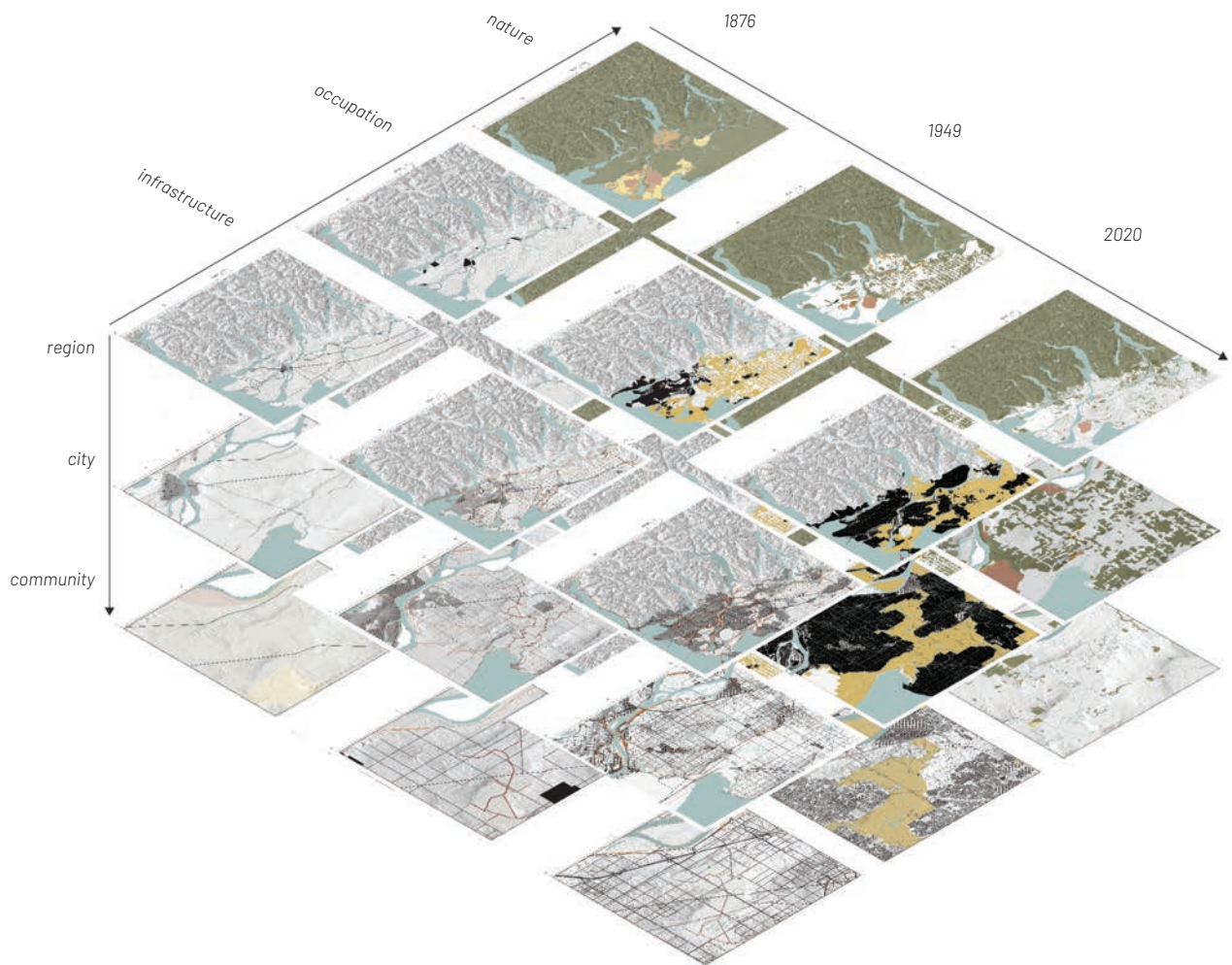


FIG. 3.25 Diagram developed by author with data from DataBC

## 4 – LAYERED ANALYSIS – 3x3x3

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### The Layered Approach: Transformations in the Lower Mainland

The 3x3x3 layered analysis is employed to reveal the primary spatial elements and current trends of the Lower Mainland by examining 3 layers at 3 scales over 3 times periods. In this way it is possible to uncover the most important spatial transformations that have taken place across the region. The analysis uses the year of 1876 to begin the analysis as this marks the beginning of significant European colonization in the Lower Mainland. This was around the time that the town of New Westminster, located on the banks of the Fraser River began to take shape and expand as settlers moved into the region to profit from the natural resources found in the delta and on the slopes of the Rocky Mountains. Lumber, gold, and animal fur were typical commodities during this time and their exploitation was a key factor in the initial urban growth across British Columbia. The year of 1949 was chosen as it marks a moment when the first comprehensive regional plan was developed for the Lower Mainland. By this time, the region had already developed significantly since the end of the 19th century and planners sought to create a vision that would guide the future growth of the Lower Mainland as a whole. In fact they placed a strong emphasis on the importance of expanding the agricultural industry in the region due to the abundance of high quality arable soil. Finally, a present-day analysis was conducted to explore how the key transformations that occurred between 1876 and 2020 are still present and relevant in the spatial structure of the territory.

The three layers that are mapped to demonstrate these transformations are 'occupation' (including both urban and agricultural areas), 'infrastructure', and 'nature'. By exploring these changes through time, referring to the three layers, it becomes clear what are the primary structural elements in the region that have persisted over time. Finally, to understand how these transformations impact the region and the people that inhabit it, three scales were chosen to conduct the analysis. Doing so makes it possible to see how large-scale transformations manifest at the scale of the community and impact the spatial quality of the city and its surroundings.

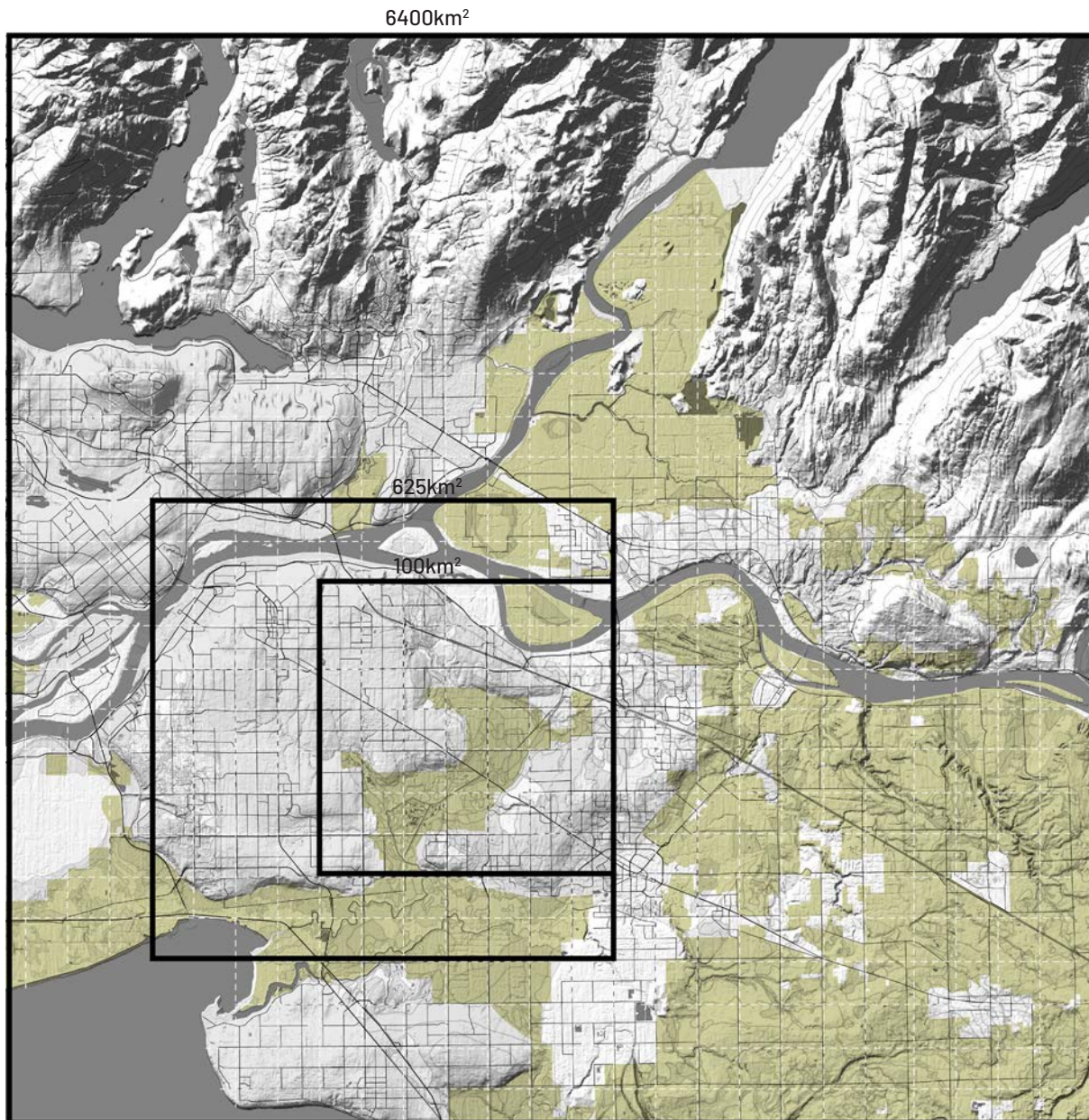


FIG. 4.1 Map of the Lower Mainland showing the existing grid structure, the Agricultural Land Reserve (in green), the Fraser River and a Digital Elevation Model of the region. Developed by author with with data from DataBC



## Selected Frames

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These particular frames were chosen for a few reasons. The first gives a regional perspective of the territory - allowing for a greater understanding of the larger scale dynamics and spatial patterns visible in the frame of 80km x 80km. The following sections demonstrate what is visible at this scale, but overall, it is clear how the metropolitan region sits within a much larger context of immense natural elements such as the Pacific Ocean, the Fraser River Valley and the Rocky Mountains. At this scale the delta is also more visible when placed against the backdrop of these other elements.

The second frame, which is 25km x 25km focuses on an area that is at the centre of the metropolitan region. This frame also centres on a part of the territory that excludes the most dense and populated parts - including Vancouver. This is an intentional choice, carried out so that the focus of this research looks at the urban threshold where it encounters agricultural spaces. This frame also includes New Westminster - one of the oldest inhabited parts of the region and present the opportunity to look at how the region has developed since the establishment of this first urban settlement.

The final frame - the chosen frame for the design - sits at the crossroads between urbanity and agriculture, is crossed by key infrastructural lines and is particularly vulnerable to flooding. As seen in previous sections, this project has already used this frame to investigate the state of agriculture on a local scale, so a further analysis of its historical transformation is essential.



FIG. 4.2 Township of New Westminster surveyed by Britton, Reye & Company 1876

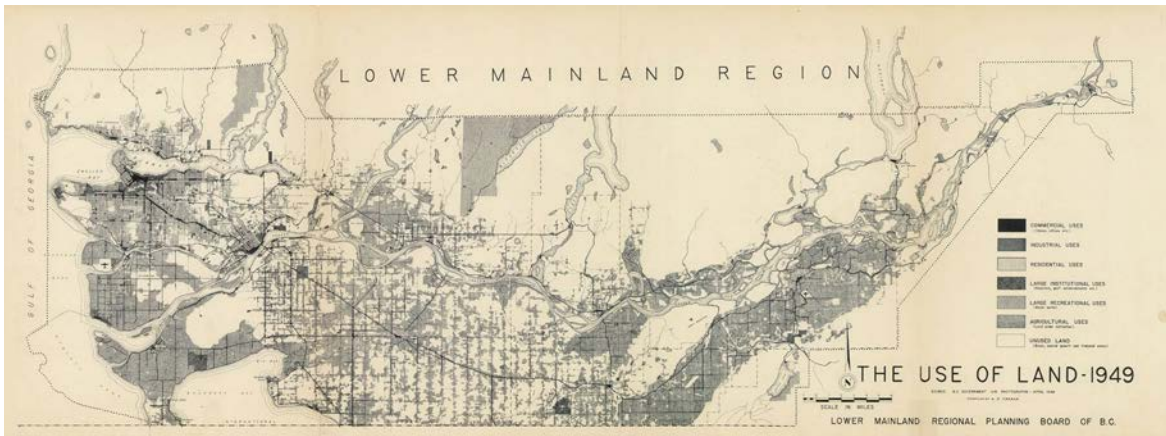
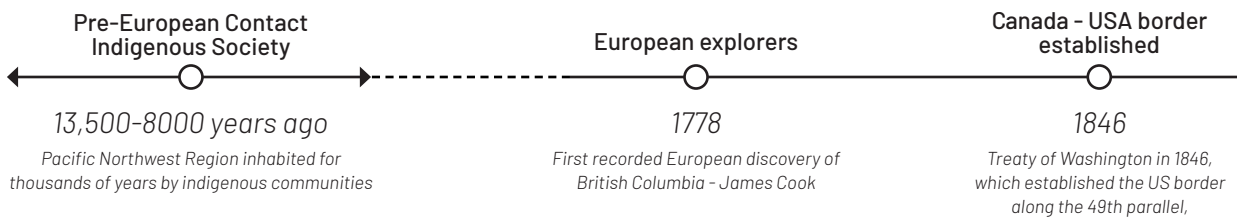


FIG. 4.3 Excerpt from 'The Lower Mainland Looks Ahead' (1949) by the Lower Mainland Regional Planning Board



## Occupation Transformations

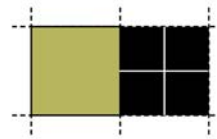
From the end of the 19th century, the Lower Mainland was consistently occupied by European settlers, predominantly the British who pushed further West from Upper and Lower Canada (present-day Quebec and Ontario). The Pacific coast was far removed from the rest of the country and offered tremendous opportunities for a better life in what they called the 'New World'. It was not long after the establishment of the Canada-US border along the 49th parallel that surveyors were hired by the government to draw up a district plan for the entire region in 1859. Joseph Trutch initially carried out a Block and Range survey based on the system used in Washington Territory. Later, however, in 1876 the Township of New Westminster was surveyed by Britton, Reye & Company using both the Block and Range Survey and the Jefferson Grid. The Jefferson Grid refers to the systematic and regular division of the land into exactly 1 square mile parcels. This was first introduced after the American War for Independence by one of the founding fathers of the USA, Thomas Jefferson. It was a way for the government to divide, appraise, and sell land to settlers across the American landscape and was also used in parts of Canada, including the Lower Mainland.

This structure, imposed onto the landscape by lines on a map, first demarcated where roads would be built and where plots of land would be sold. For example, in the excerpt of Britton, Reye & Company's survey map below, the Coast Meridian (starting further south where the US-Canada border meets the Pacific Coast) extends from the Fraser River, into the land. This line was of vital importance during the 19th

1886 Jefferson Grid\*

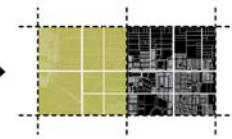


2020



Agriculture  
1 sq. mile  
(2.59 km<sup>2</sup>)

Residential  
0.25 sq. mile  
(0.65 km<sup>2</sup>)



Agriculture Residential

Discovery of gold on  
the Fraser River and  
establishment of New  
Westminster

1857-1858

*New Westminster becomes  
a major outfitting point for  
prospectors coming to the  
Fraser Gold Rush*

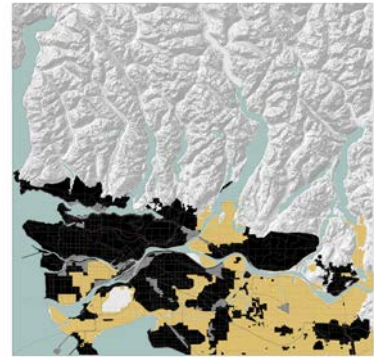
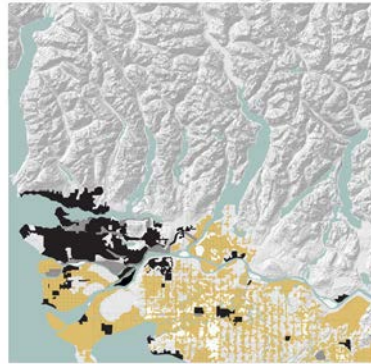
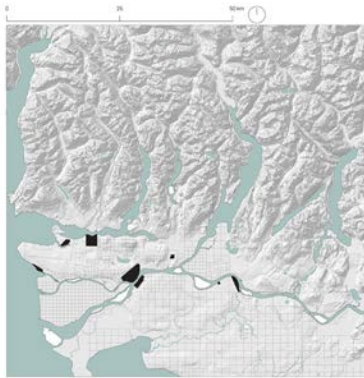
Block and Range survey of  
Joseph Trutch

1859

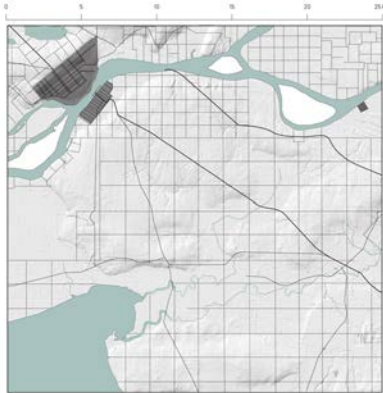
*The first Block and Range survey of Joseph Trutch  
in 1859 - which survey covered Brownsville - to the  
township plans of the Colony of British Columbia*



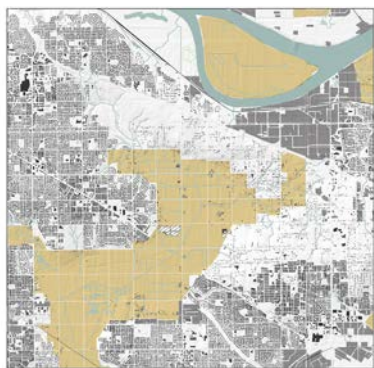
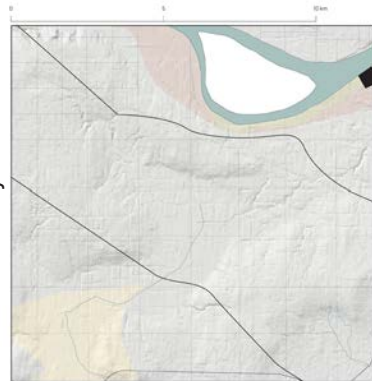
Regional Scale



City Scale



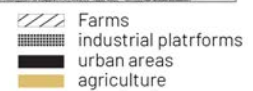
Community Scale



1876

1949

2020



Township of New Westminster surveyed by Britton, Reye & Company using both the Block and Range Survey and Jefferson Grid

Lower Mainland Regional Planning Board publishes 'The Lower Mainland Looks Ahead'

Designation of the Agricultural Land Reserve (ALR)

1876

1949

1973

Intended to aid settlers in selecting land,

First comprehensive planning document for the region that laid out priorities for the development of the region in the 20th century - emphasizing the importance of preserving agricultural land

ALR is one of the earliest examples in North America using regional zoning laws to permanently preserve farmland and promote local food production.

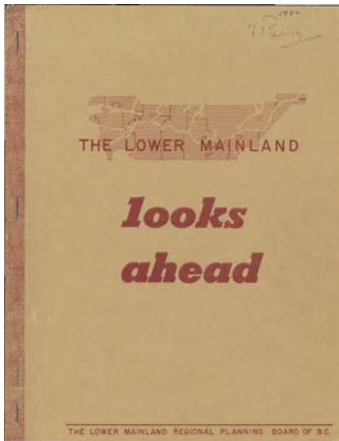


FIG. 4.4 Cover page of planning document from 1952 Retrieved from [http://www.metrovancouver.org/about/library/LibraryPublications/The\\_Lower\\_Mainland\\_Looks\\_Ahead\\_1952.pdf](http://www.metrovancouver.org/about/library/LibraryPublications/The_Lower_Mainland_Looks_Ahead_1952.pdf)

century as an access point for travellers to reach interior settlements from the river. This road also connected further inland to the Westminster and Yale Wagon Road, a vital East-West connection in the territory that existed before the introduction of the grid (it is presently called the Fraser Highway). Connective lines (following the grid) such as the Coast Meridian allowed for a gradual clearing of forests and meadows and the eventual establishment of towns, villages, and small-scale agriculture.

Eventually, into the mid-20th century, after decades of rapid urban and industrial growth brought on by the expansion of Canada's resource-based export industries and waves of post-war immigration to the West Coast, the Lower Mainland was facing many challenges. Two of these included how to guide the future of residential development and how to make better use of the arable land available in the region. In the mid-twentieth century, agriculture was even more integrated with urban areas (refer to multi-scalar analysis maps from 1949 on adjacent page). This was due to the fact that farming was largely still family-owned and small in scale. However, it was in the 1970s that the provincial government instated legislation to create an Agricultural Land Reserve (ALR) across the entire province to protect prime areas for cultivation. In urban areas like Vancouver and its sprawling suburbs, this indirectly created an urban containment boundary where residential areas were mostly confined to areas on higher ground, on less desirable soil for farming and where urban settlements were already concentrated. The designation of the ALR also meant that farmers could not sell their land to developers, (limiting their ability to make a profit in years when crops had not done well) a move that was met with both praise and criticism. Furthermore, after the introduction of the ALR, concentrated, large-scale industrial farming across the region began to form.



FIG. 4.5 Excerpt from Agricultural Land Reserve Historical Binder On the Agricultural Land Reserve 1973 (1995)

Today, the ALR is relatively intact, though various provincial governments over the last 50 years have altered legislation here and there - allowing parts of the ALR to accommodate golf courses for example or selling parts of it to land developers. Today, where the ALR is closest to urban areas, development pressure is mounting as the Lower Mainland boasts some of the highest property prices in the country and a lack of affordable housing (particularly single-family style homes) means that 'unoccupied' land is seen as prime real estate. This dichotomy is visible in the analysis maps on the adjacent page, where it is clear how the ALR designation in the 1970s created this striking division of land use throughout the territory and confined urban development to particular areas of the region.

**Fastest Growing Region in Canada**

1971-2001

In only 30 years, the Lower Mainland doubles in population size from 1.1 million to 2.2 million - resulting in sprawling urban development throughout the region

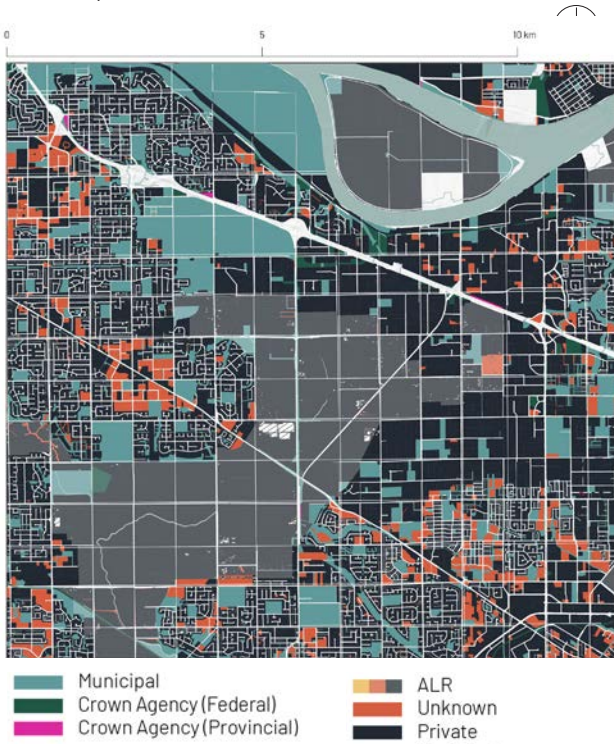
**The Lower Mainland is now one of Canada's largest metropolitan regions**

2020

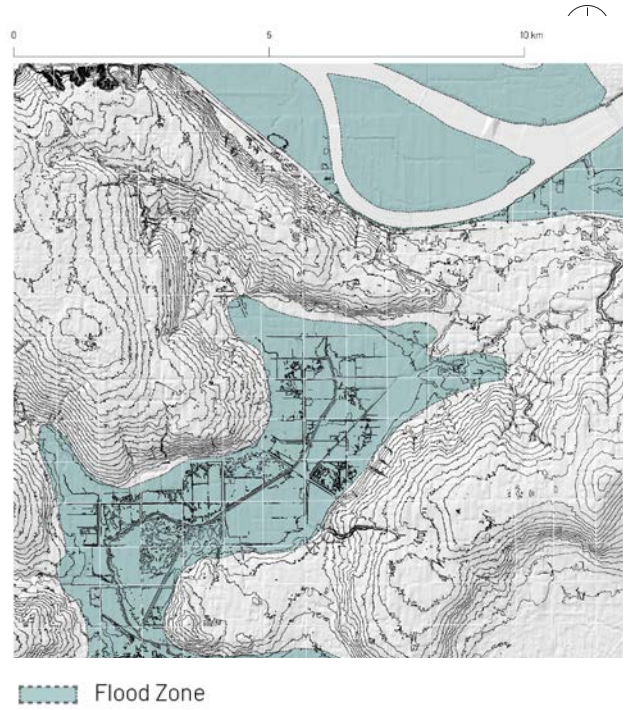
Current population is 2.4 million (Representing 60% of British Columbia's total population)



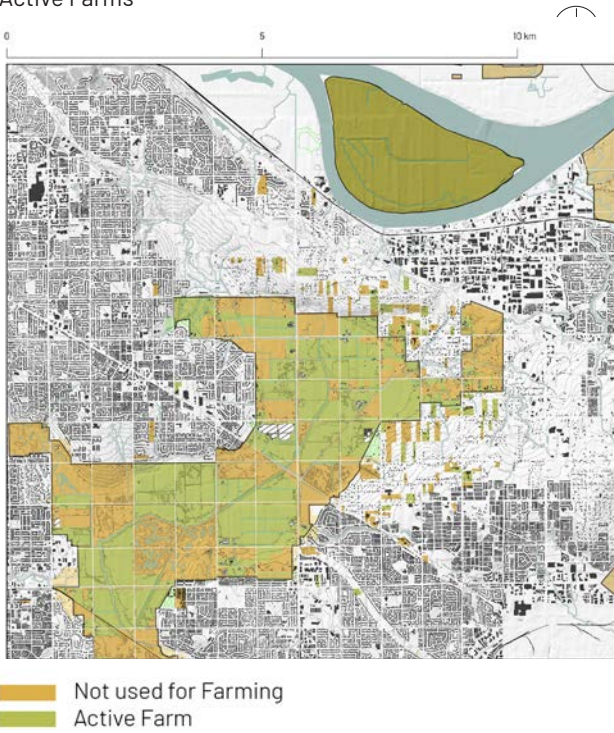
### Ownership



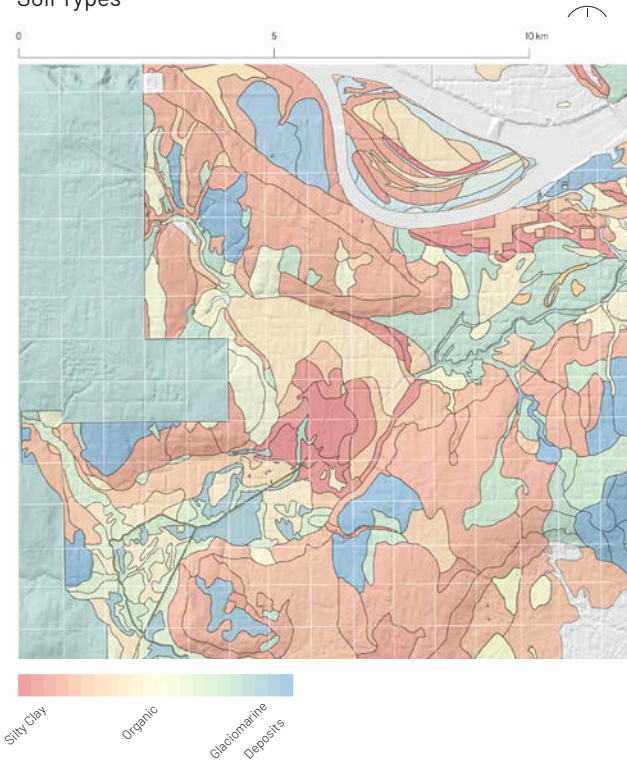
### Flood Risk



### Active Farms



### Soil Types



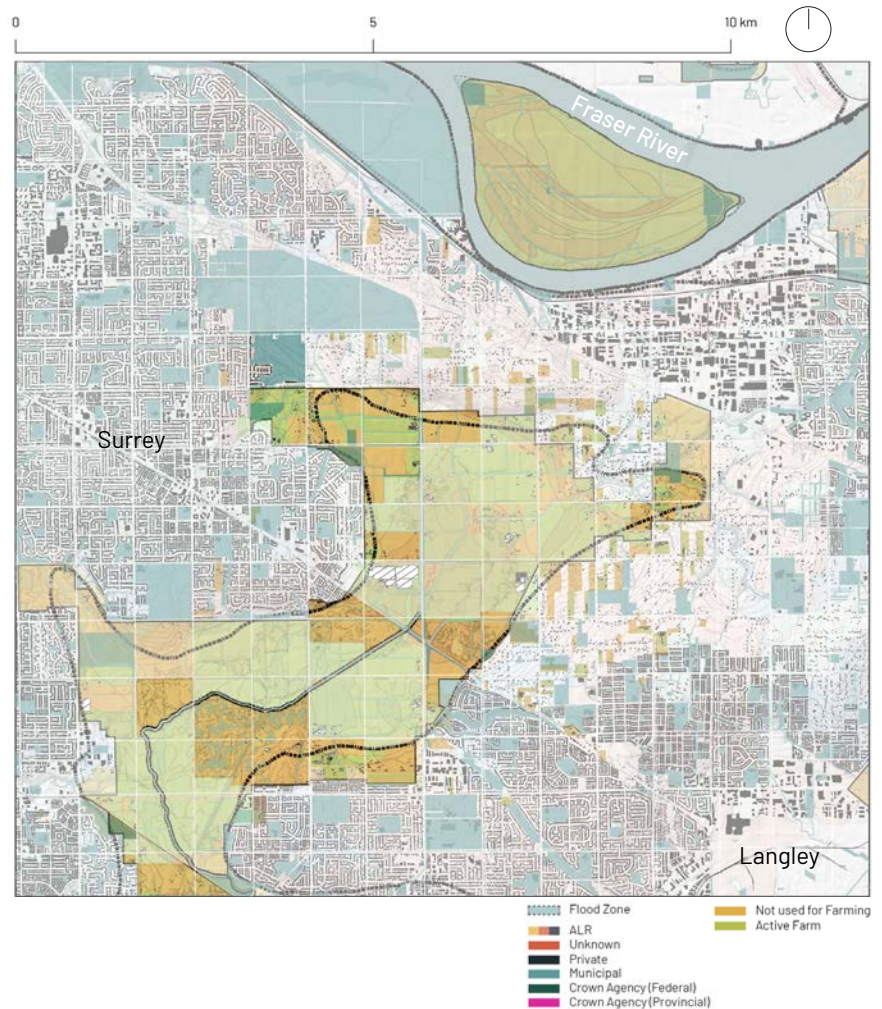
Source: Spatial data from DataBC



## Main Conclusions

There are several challenges facing the region today regarding the ongoing development of the Lower Mainland, the ALR, and the future of food production. Currently, productive land is constricted - confined to the boundaries set out by the government. This may not pose a problem for productive areas located outside of the Lower Mainland, but within the province's urban regions, this land is highly valued as potential space for new communities. The pressure to develop, rather than to cultivate these spaces is growing. When you consider this, combined with the decreasing level of self-reliance in food production and the unpredictability of disruptions in food supply chains and weather patterns, it becomes necessary to reevaluate how the region can balance these factors.

Ensuring that people are capable of feeding themselves, especially during times of disruptions and disasters, requires building resilience while also increasing the capacity for self-reliance. A design proposal must therefore reimagine this strict division of land-use, urban sprawl, and confined agricultural areas.



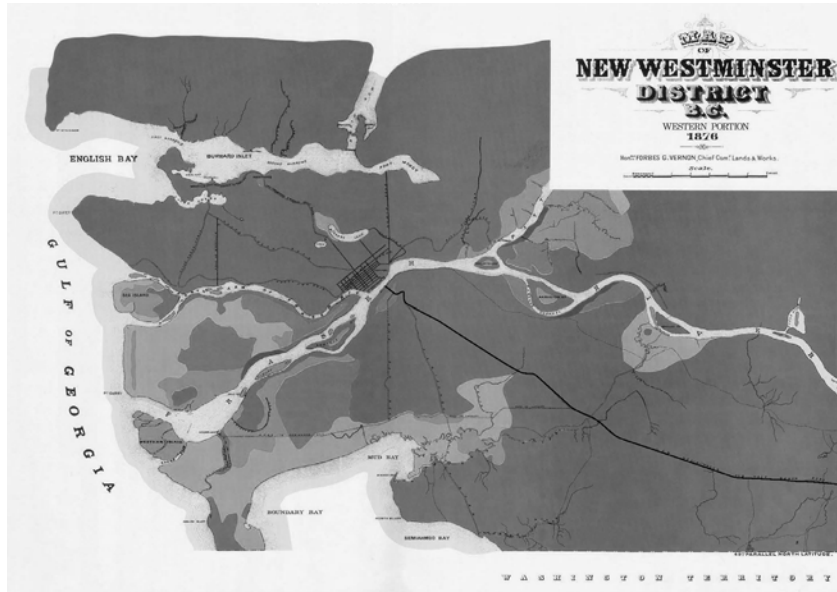
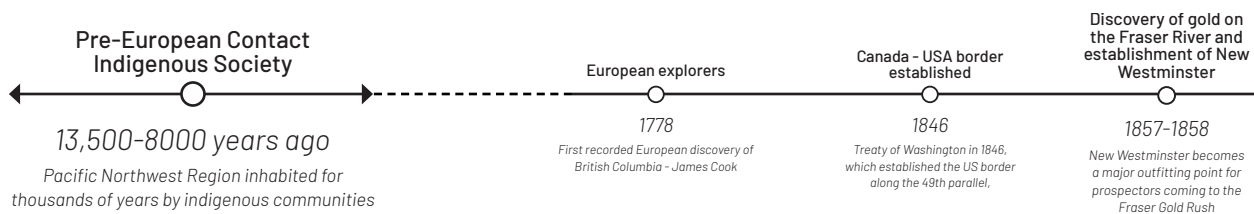


FIG. 4.6 New Westminister District (1876)



FIG. 4.7 Canadian Pacific Railway Crew at Lower Fraser Valley (1881)



## Infrastructure Transformations

As colonial settlement expanded across the Lower Mainland, connections in and out of the region have remained of vital importance. Throughout the 20th century, rail and road infrastructure grew tremendously as the Port of Vancouver became a significant gateway for goods coming in and out of Canada.

Furthermore, in response to several major fluvial floods in the delta, a system of dikes was created to protect both urban areas and agricultural land. In particular, the Serpentine River Lowlands, which experienced regular flooding, were safeguarded against inundation by diking the entirety of the river.



FIG. 4.9 Fraser River Flooding 1948



FIG. 4.8 The Serpentine River Dike in 1950

Old Wagon Road between  
New Westminster and Yale  
constructed

1875

*This road was built to transport people and goods into the Fraser Valley (particularly gold prospectors) and was intended to relieve the pressure on the Fraser River which had been used by steam river boats to transport people into the valley*

Canadian Pacific Railway  
constructed

1881-1885

*This milestone in Canadian history connected British Columbia with the rest of the country and made it possible for people and goods to travel between the east and west.*

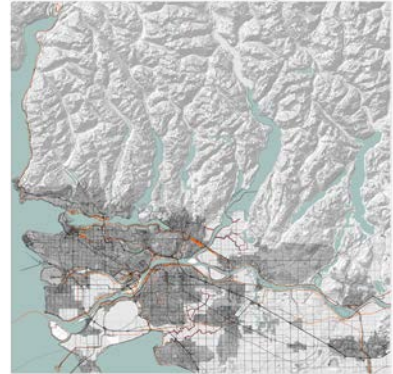
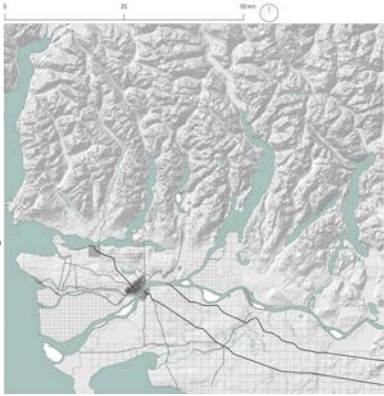
Fraser River Floods

1894

*The flood was the largest on record however, property damage was limited because settlement was sparse.*



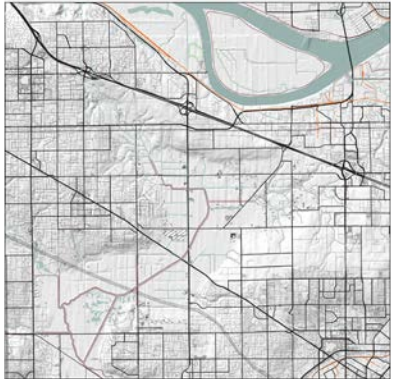
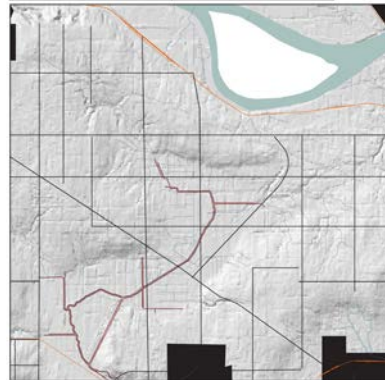
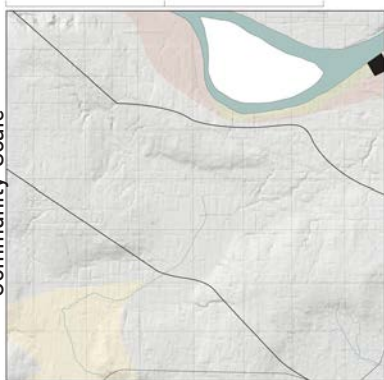
Regional Scale



City Scale



Community Scale



1876

1949

2020

- transmission lines
- ..... shipping
- dikes
- rail
- roads

Surrey Dyking District Established

1911

Trans-Canada Highway 1 completed

1941

Fraser River Floods

1948

The reason for the formation of the Surrey Dyking District was to provide a taxing authority to enable the construction of a dam across each river with six sets of tide activated flood-gates

Because of increased development and population growth in the floodplain, the impacts were much greater than in 1894

More recently, the region and the province have been making efforts to both improve existing infrastructure (seen in projects like the Coastal Flood Adaptation Strategy for Surrey - 2019) and utilize existing transport corridors to promote residential and commercial development along the Lower Mainland's existing highway and rail networks (refer to 'A Framework for Improving British Columbia's Standard of Living' - 2019). With these initiatives it is clear what some of the key priorities are in the region. Safeguarding prime agricultural and residential areas from flooding and facilitating innovation while accommodating urban development along strategic corridors.

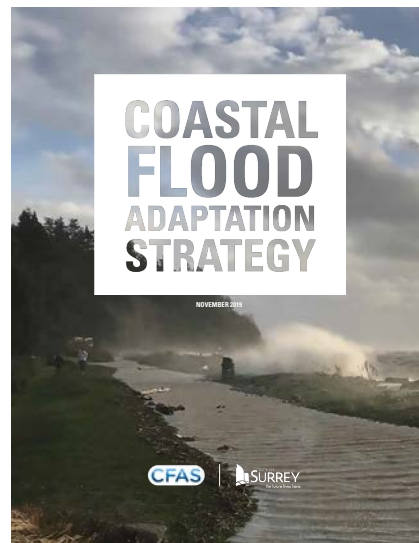


FIG. 4.10 Cover page of Coastal Flood Adaptation Strategy for Surrey BC Retrieved from <https://ecoplan.ca/featured-projects/surrey-coastal-flood/>

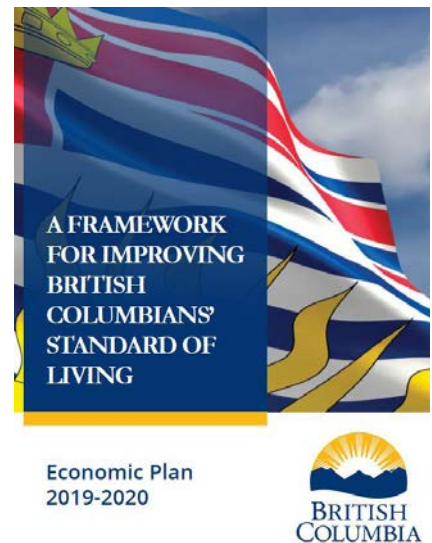


FIG. 4.11 Cover Page of 'A Framework for Improving British Columbia's Standard of Living' 2019. Retrieved from the Province of British Columbia

Regular dredging of the  
Serpentine River by the Surrey  
Dyking District

1957

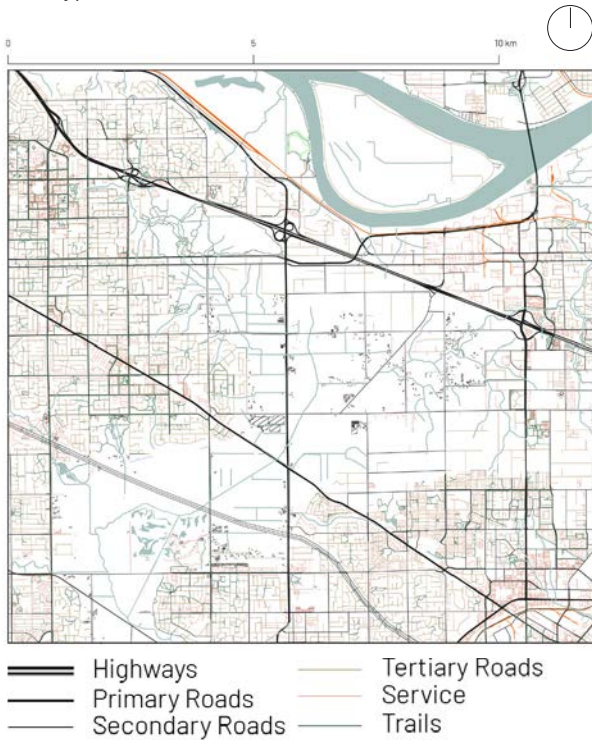
Surrey Coastal Flood  
Adaptation Strategy  
implemented

2019

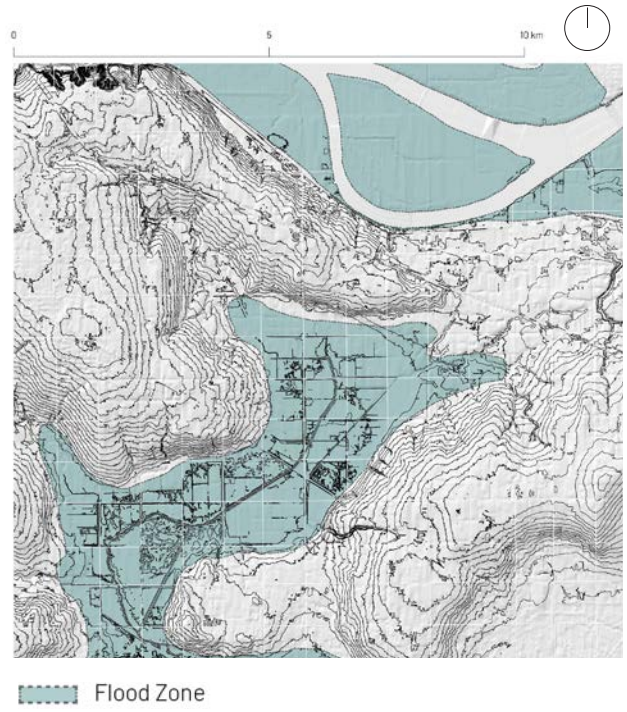
*One of the first programs of its kind in Canada, CFAS was a multiyear undertaking that identified the current and potential impacts of climate change on Surrey's large coastal floodplain area*



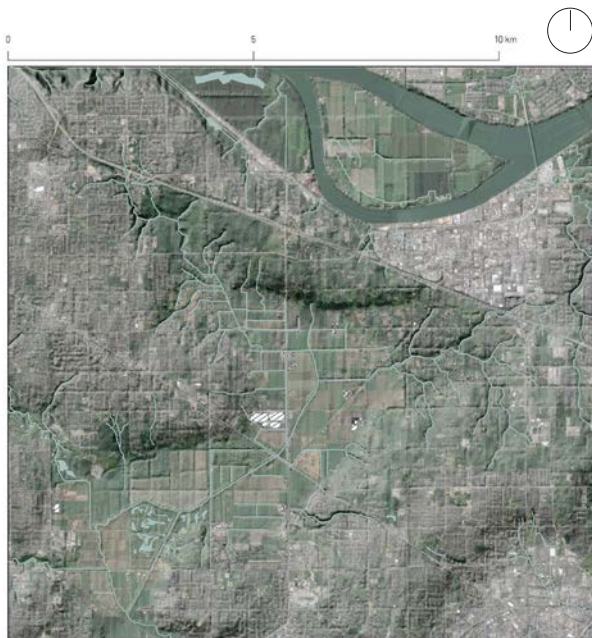
Road Types



Flood Risk



Topography





## Main Conclusions

The layer of occupation (whether urban or agricultural) is directly reliant on these layers of infrastructure that connect and protect the region. They are a vital framework for the future of development in the Lower Mainland.

Infrastructure development throughout the region has enabled access to Canada's Pacific coast and, over time, infrastructure in the Lower Mainland has become the vital link between Canada's resource extraction sites and the global market. On a local scale, infrastructure in the form of roads, rails, and dikes are the lifeblood of maintaining a strong economy and safeguarding people from sea level rise and fluvial floods. Interwoven within the territory, infrastructure is a defining element in the Lower Mainland - both urban areas and agriculture are deeply reliant on these layers of infrastructure that connect and protect the region. They are vital for the future of development in the Lower Mainland and a design proposal will need to make use of these essential components. If increasing self-reliance in food production is a goal for the region, the efficiency of and connection to local infrastructure will need to be strengthened.

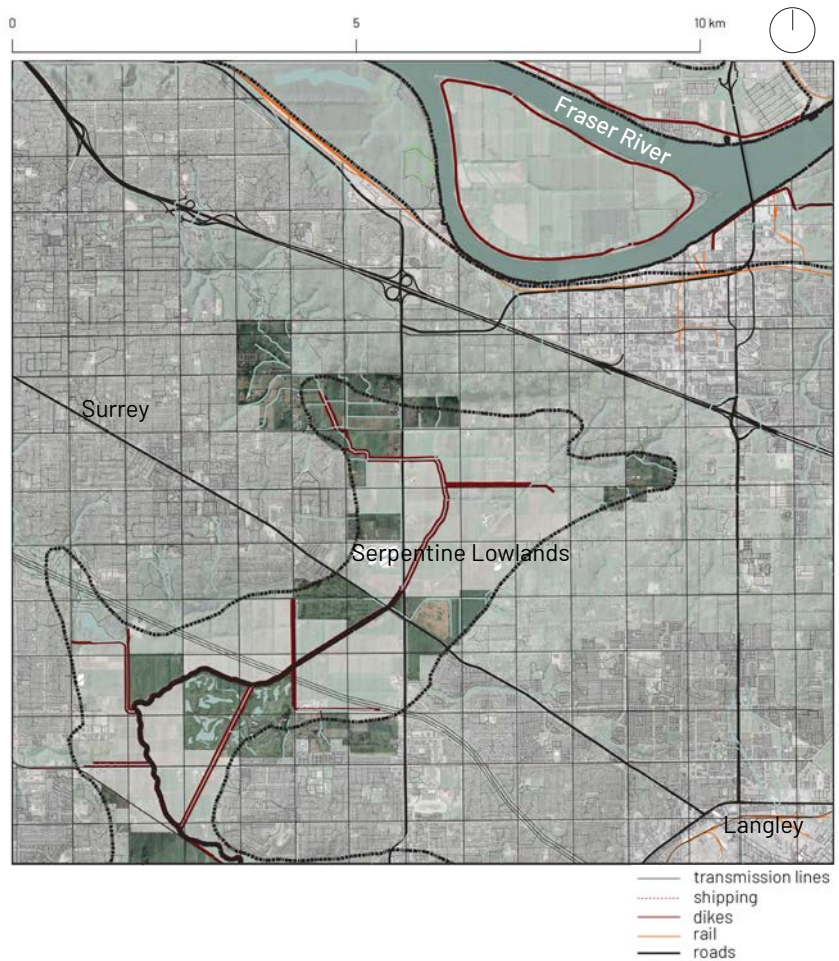
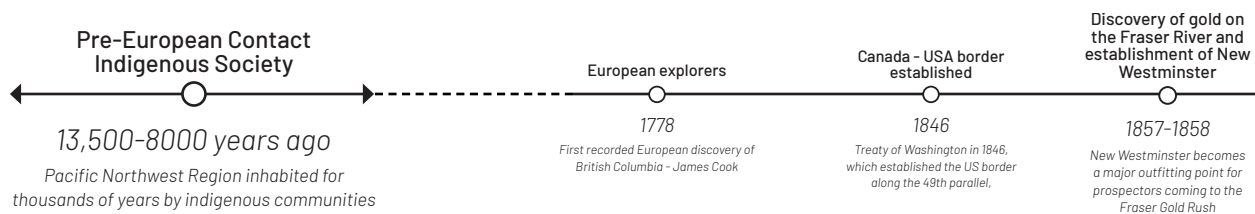




FIG. 4.13 South Vancouver (near 37th ave and north arm road)  
c. 1895. City of Vancouver archives strp16



FIG. 4.12 The View of New Westminster from the Fraser River, 1865.



## Nature Transformations

With the expansion of urban areas and infrastructure in the Lower Mainland came the gradual exclusion and destruction of nature. Most of the delta region was covered in coniferous forest and low grasslands and bogs in the lowest parts of the territory.

This extensive forest was swiftly cut away as lumber was used in British Columbia and across the country to build new homes for settlers. With every new road, port, town, and city came the slow degradation of nature. Over time, agricultural production replaced grasslands and forests as well.

However, in the late 19th century, the preservation and protection of some areas began to take place. In 1888, Stanley Park was designated as a protected area on the edge of what is now, downtown Vancouver. Unlike many large urban parks, Stanley Park was not designed by a landscape architect, but actually evolved as a forest and urban space over many years. Today it is a well-loved urban oasis for residents of the city.



FIG. 4.15 Stanley Park, 1926



FIG. 4.14 Stanley Park, 2020

Old Wagon Road between  
New Westminster and Yale  
constructed

1875

*This road was built to transport people and goods into the Fraser Valley (particularly gold prospectors) and was intended to relieve the pressure on the Fraser River which had been used by steam river boats to transport people into the valley*

Canadian Pacific Railway constructed

1881-1885

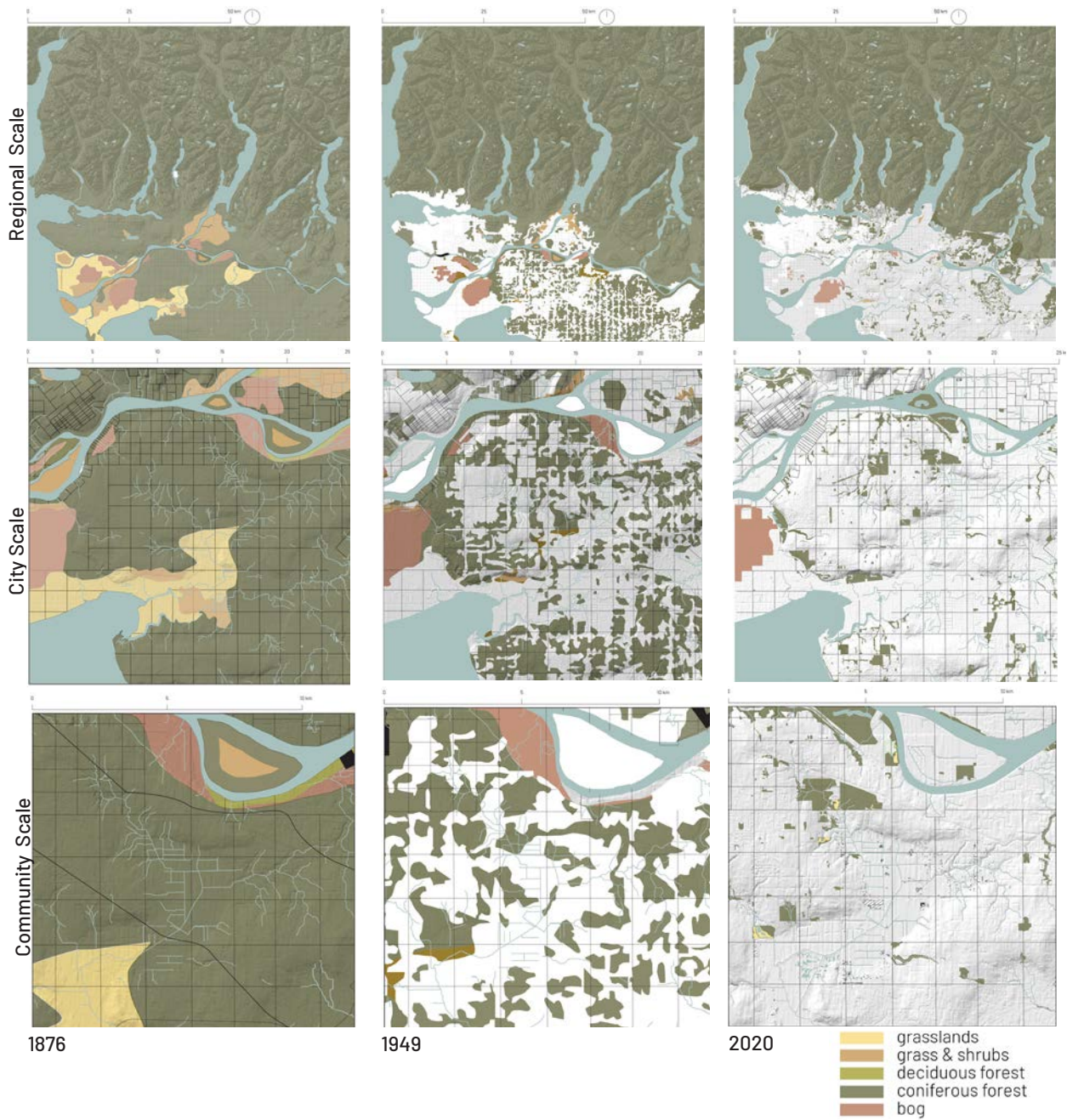
*This milestone in Canadian history connected British Columbia with the rest of the country and made it possible for people and goods to travel between the east and west.*

Stanley Park  
Designated

1888

*Unlike other large urban parks, Stanley Park is not the creation of a landscape architect, but rather the evolution of a forest and urban space over many years*





**Green Timbers Fores**

1875-1930

Green Timbers Forest in Surrey is the 'last piece of virgin forest from San Diego to Vancouver'

**Felling of Green Timbers**

1930

Felling of 5000 acres of trees in Surrey's centre + Reforestation of the site begins

**A Regional Parks Plan for the Lower Mainland Region**

1966

A Regional Parks Plan for the Lower Mainland Region is created to meet the outdoor recreation needs of Lower Mainland residents

Later, however, in the 1930s, a 5000-acre parcel of land in the centre of Surrey called Green Timbers Forest, was felled for construction material. This forest had managed to withstand development over the many decades of development in the region but in a matter of days it was completely removed. Fortunately, this was one of the first times that a concerted effort to replant a culled area of land took place in the region and today the forest has regrown tremendously.

These are only two (of many) examples of how nature has been managed historically in the Lower Mainland - sometimes as pure preservation or as a managed and replenished resource.

Today, the Lower Mainland is dotted with hundreds of formally and informally preserved and managed natural spaces that serve as habitats, local and regional parks, recreational areas, and green 'veins' woven into the urban fabric. From an environmental perspective they are valuable resources for the health and wellbeing of all members of the ecosystem.



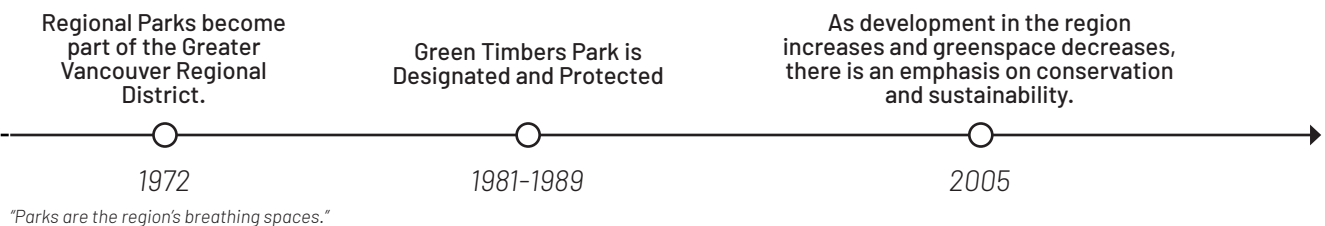
FIG. 4.16 Green Timbers 1925



FIG. 4.17 Felling of Green Timbers 1930

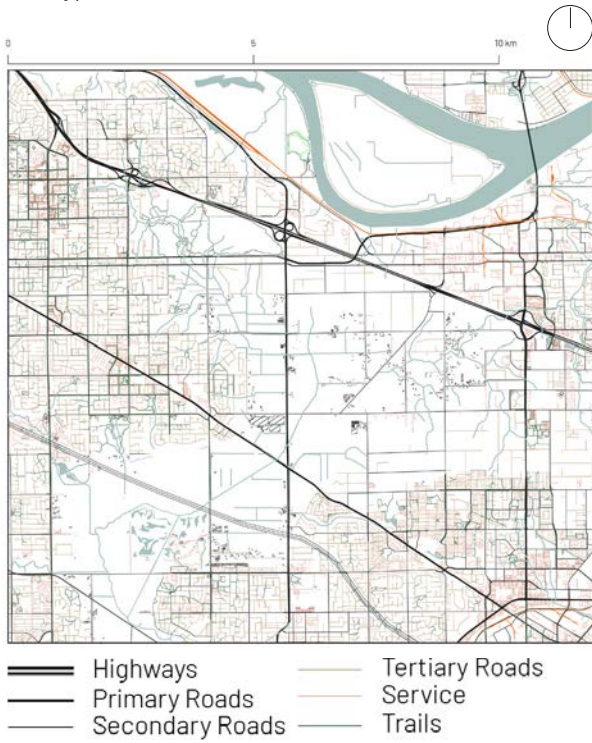


FIG. 4.18 Green Timbers Urban Forest 2020

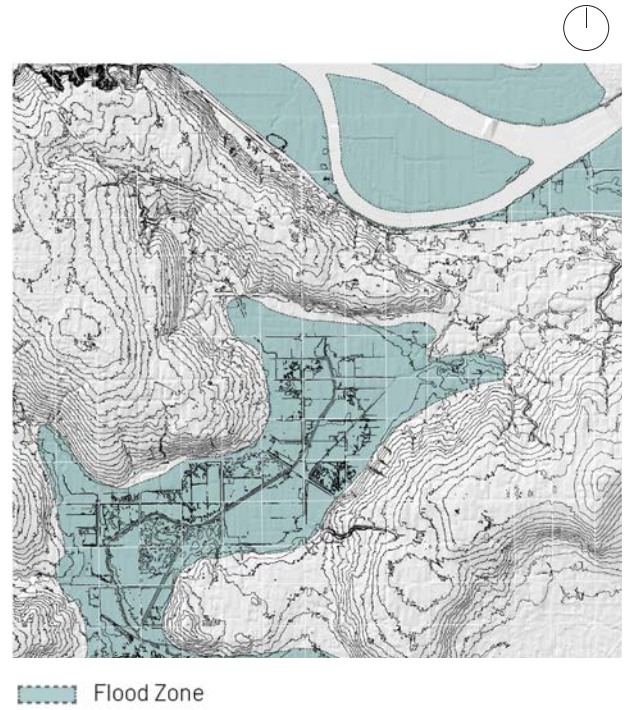




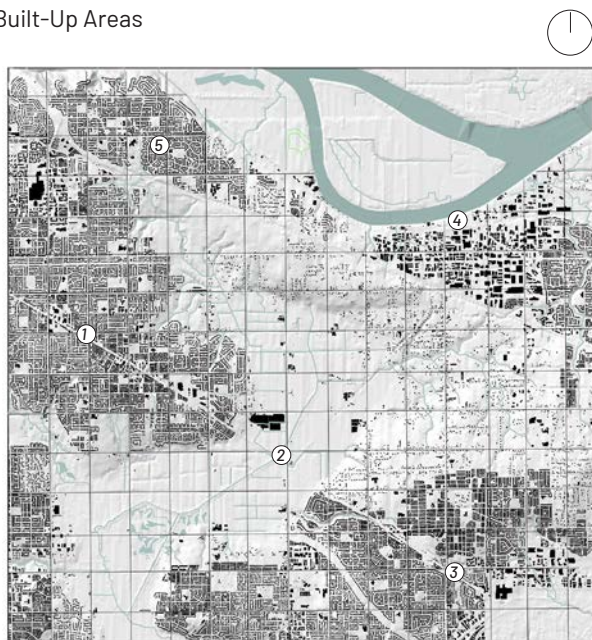
### Road Types



### Flood Risk

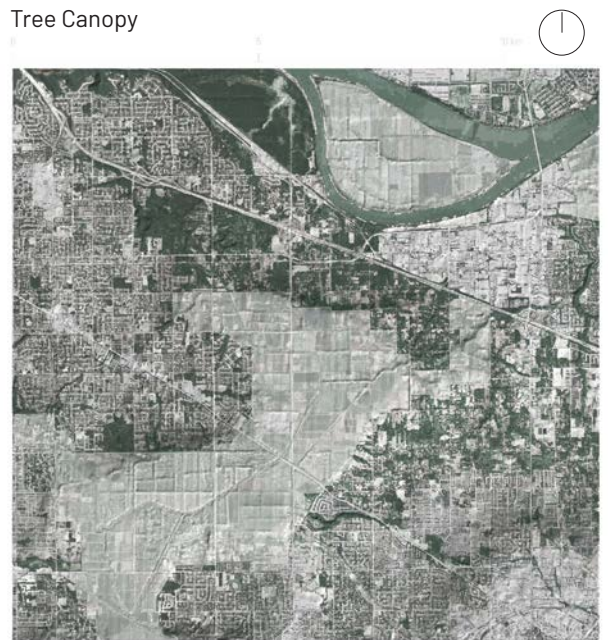


### Built-Up Areas



- ① Surrey - Neighbourhood of Fleetwood
- ② Serpentine Lowlands
- ③ Langley
- ④ Port Kells
- ⑤ Fraser Heights

### Tree Canopy

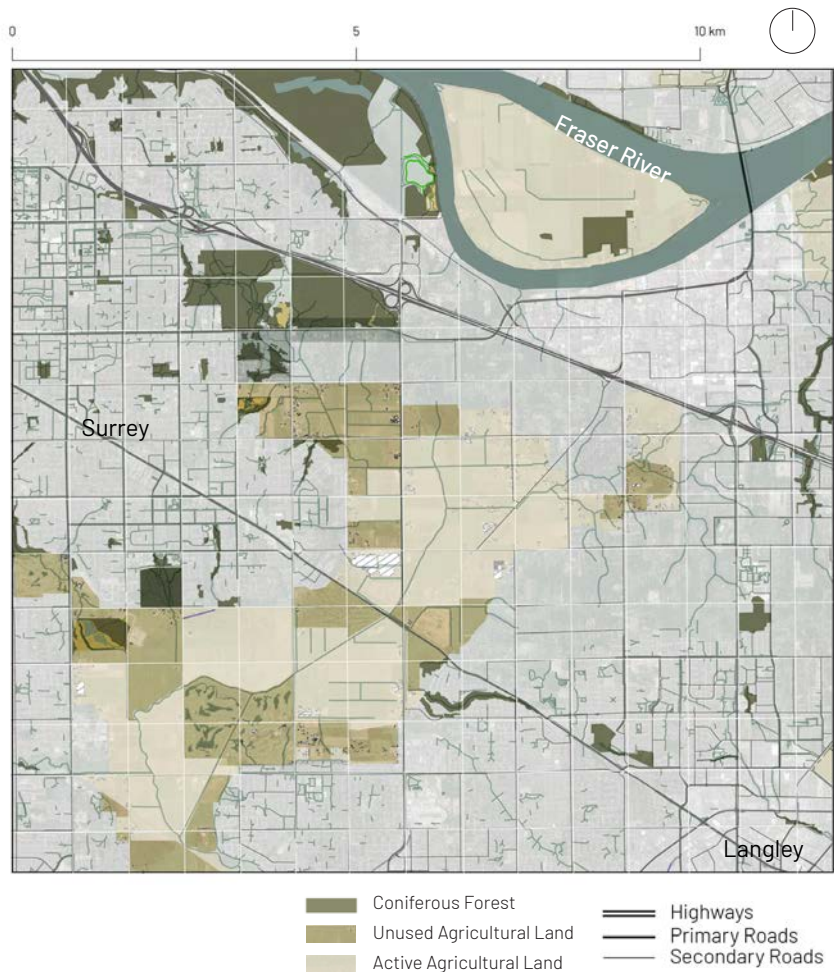




## Main Conclusions

While nature certainly remains a vital and present part of the current landscape in the Lower Mainland, it is also excluded to the fringes of urban areas or exists purely as a line in through the urban fabric (usually because it is a stream or a creek where building would not be possible). These areas are often loved and visited by the surrounding community.

There is an opportunity here, as the region grows, to integrate nature into new development and connect it to existing networks and patches of preserved natural areas. Furthermore, these natural areas - forests, meadows, ravines, and bogs - provide an opportunity to cultivate or manage small-scale foraging food for local communities. Natural areas are, of course, a resource in that they provide recreational and health benefits, but beyond that, they provide a vital opportunity to connect more closely with food that grows wildy. Spatially, areas that are already adjacent to the ALR (as shown below) have the most potential to be designated for this.



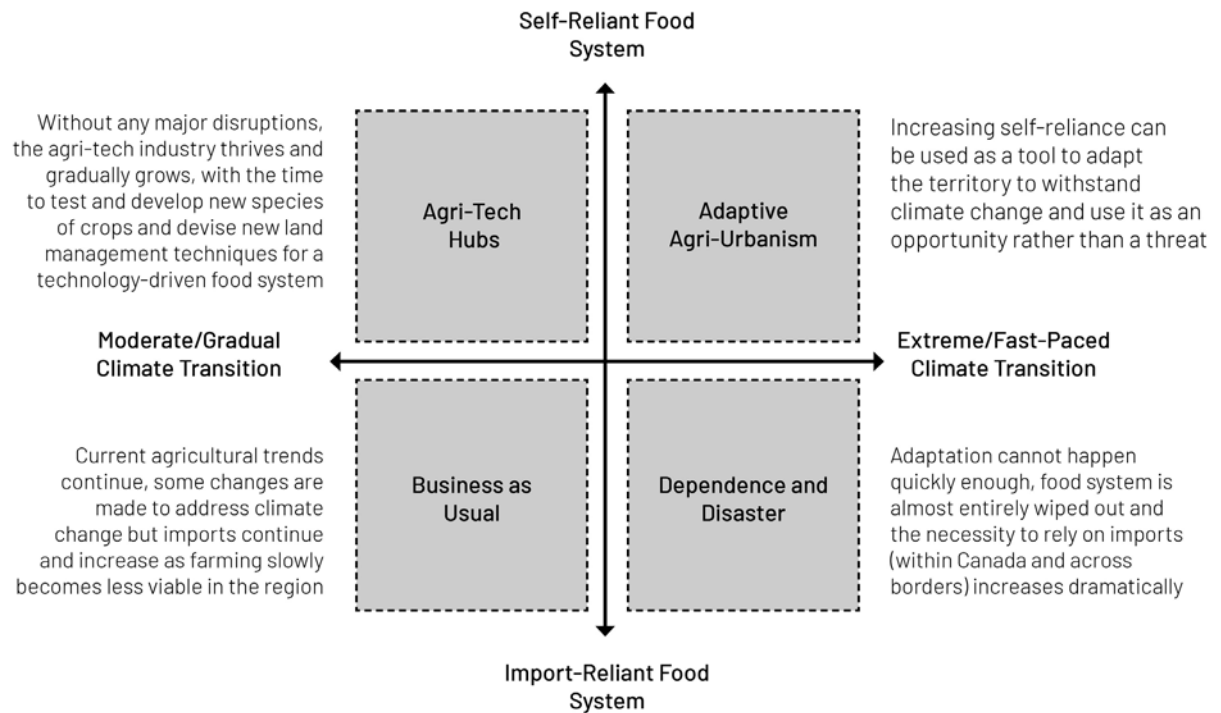
## Driving Forces

- Necessity for Self-Reliant Food System
- Population Growth - Food demand
- Climate Transition (intensity and rate)



## Scenario Exploration - Essential Elements

Which elements of each scenario are desirable or unavoidable? How can these set the goals for design?



# 5 – DESIGN CHALLENGE

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*“Evolution is like a game, but a distinctive one in which the only payoff is to stay in the game. Therefore, a major strategy selected is not one maximizing either efficiency or a particular reward, but one which allows persistence by maintaining **flexibility** above all else.”* C.S. Holling, in his article *Resilience and Stability of Ecological Systems* (1973)

In gaining an initial understanding of the region through the lens of the 3x3x3 approach and an analysis of the regional food system of the Lower Mainland, there are numerous opportunities for design. Given the inevitable shift in climate, the increasing and unpredictable threat of natural disasters and shifts in global supply chains, compounded with a growing population and a decreasing level of regional self-reliance, the Lower Mainland faces the challenge (and more importantly an opportunity) to begin adapting the territory to these changes.

In fact, if one considers the uncertainty facing the Lower Mainland (especially related to unpredictable and sudden changes in the environment or the economy (brought on by pandemics, natural disasters, conflict etc.)), it is imperative that the region begin making changes immediately. This must include strategies to:

- Increase food production and improve regional self-reliance
- Protect and enhance the agricultural landscape to withstand shocks and stresses from climate change
- Connect people to cultivation beyond the borders of the ALR
- Innovate and develop the agri-tech sector through partnerships with local businesses and institutions

## Scenario Building

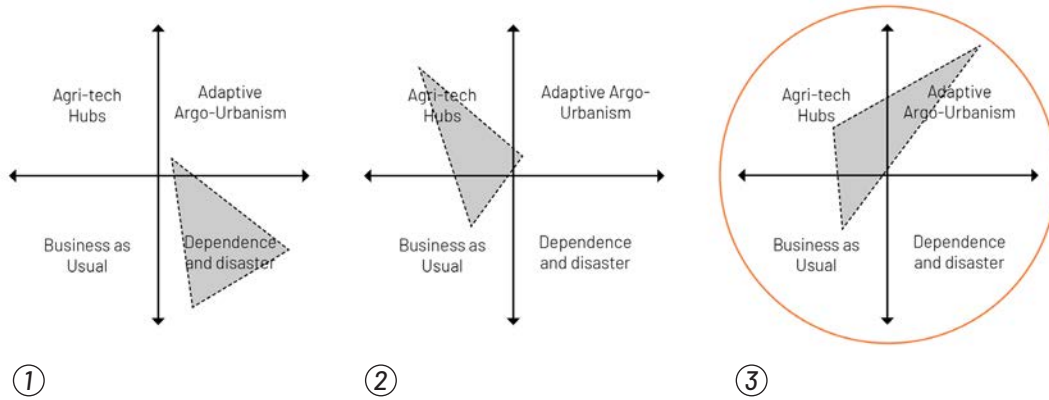
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In considering what type of future is possible and how we might respond to it, it was important to make the first step of identifying certain possible scenarios. As shown on the adjacent page, 4 scenarios were developed based on two simple variables, first, whether the effects of climate change would be experienced rapidly and dramatically or slow and gradual; second, whether the region would become more or less self-reliant in food production and processing. This axis of variables was chosen because it represents two entirely different phenomena. On the one hand, self-reliance in regional food production is a factor that, fundamentally, people have the choice to demand and build together. Despite the challenges related to becoming more self-reliant as a region (related to diet changes, international trade partnerships etc.) it is a goal that can be tangibly achieved over time. On the other hand, the severity and frequency of storm events, extended drought, forest fires, and fluvial flooding are happening with much more intensity and with much less predictability. The predicted rate of sea level rise is also changing each year making this matter even more urgent.

In building these scenarios further, three possibilities were chosen in order to explore the future of agriculture in the Lower Mainland. The first one takes an



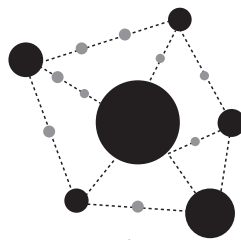
## Scenarios



How can the region become more self-reliant?



*With a regional agricultural network that shortens the food supply chain in the Lower Mainland*



How?

*Increase production, processing and distribution capacity in the region*

extreme perspective and supposes that self-reliance decreases to almost zero while sudden and extreme disasters put the region at great risk and possibly unable to adequately feed the 3+ million people that live in the Lower Mainland. The second scenario takes an optimistic view that climate change won't, in fact, be experienced as extremely in the Pacific Northwest and that the region will be able to withstand these minor changes by adapting to a more technology-driven form of agriculture, almost eliminating the need for field crops as most of our food will come from greenhouses and laboratories.

The third scenario, which serves as a basis for the design proposal, sees the future of agriculture in the Lower Mainland as a combination of partially maintaining business as usual (ie. dependent on foreign imports from the USA and Asia), the growth and development of a successful agricultural technology and innovation sector, and the preservation, expansion and transformation of existing agricultural land for increased food production. It also considers that the shocks and stresses associated with a changing climate are experienced gradually over time with the occasional severe event that can be withstood through preparation and an already adapted infrastructure of landscape. But considering that this scenario builds on the adaptive capacity of the region to withstand these shocks, it can remain largely self-reliant. So how does this guide the design of such a territorial and functional transformation?

## Design Proposal

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*"[Humans] thrive best when [they] function as a part of nature rather than as a separate unit that strives only to exploit nature for [their] immediate needs or temporary gain (as might a newly acquired parasite). Since [humans] [are] a dependent heterotroph, [they] must learn to live in mutualism with nature; otherwise, like the 'unwise' parasite, [they] may so exploit [their] 'host' that [they] destroys [themselves]."* (Odum, 1963)

The design proposal begins with a conceptual exploration of the spatial opportunities for self-reliance in food production. Presumably, this can be achieved through a more dynamic, efficient, and shortened regional food supply chain, but in doing so, these strategies must be built into the existing network and spatial organization of the territory. This will need to take on a new functional strategy, in the form of cultivation practices, crop types, processing, and distribution, and the management of landscape and water.

## Goals

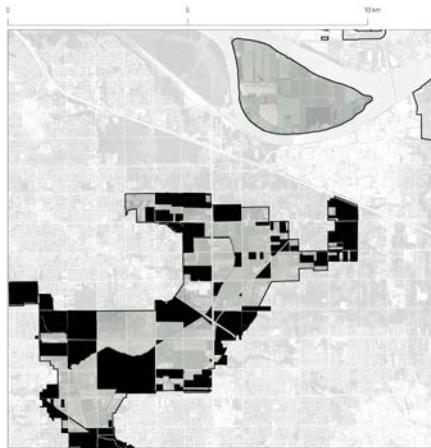
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Increase and diversify food production **through** new typologies of agriculture

Connect people with farmers and food **by providing** space for communities, employment, and technological innovation

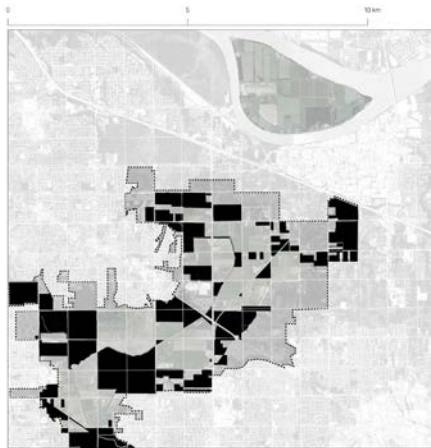
Adapt territory to climate transition **by transforming** how land and water is managed

① Concentrate



Clustering of highly productive agricultural practices

② Expand and Disperse



Dispersion of productive activities outside of the boundaries of the ALR and into the urban fabric

③ Connect

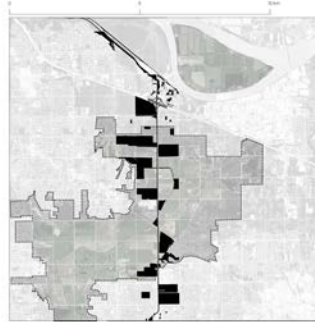


Connection brings these two interventions together through specified corridors that bridge them through a threshold and a series of smaller community-oriented interventions

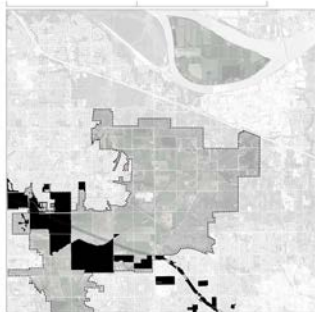




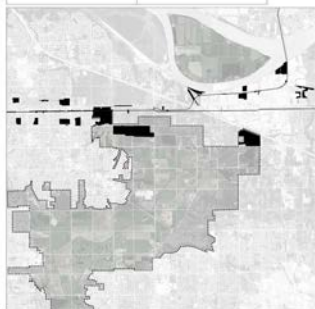
Fraser Corridor



Pacific Corridor



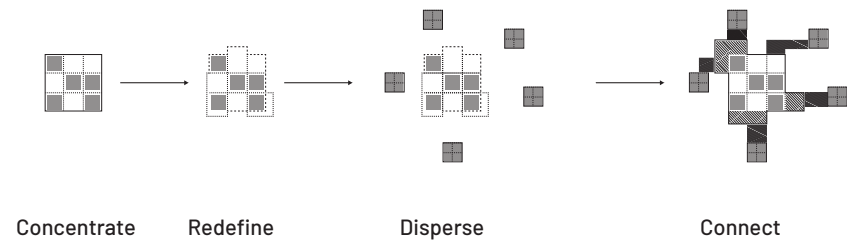
Cloverdale Corridor



Green Timbers Corridor

FIG. 5.1 Proposed agri-corridors

## Conceptual Approach

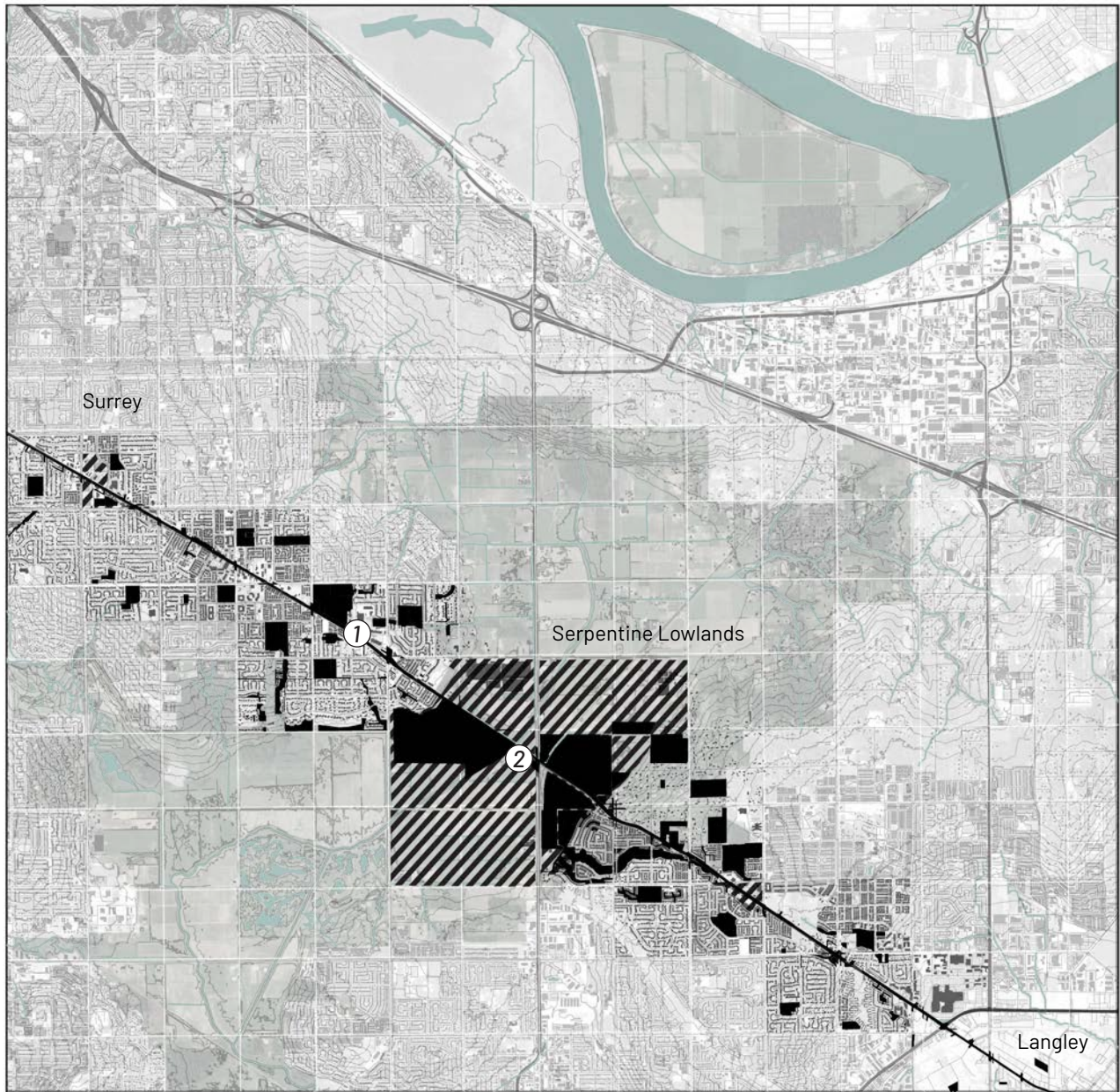


Conceptually, the design begins with the ideas of concentrating, dispersing, and connecting the proposed design interventions. First, concentration refers to the clustering of highly productive agricultural practices (primarily in the form of greenhouses and agro-forestry) in the existing ALR where land is currently uncultivated. Dispersal refers to the dispersion of productive activities outside of the boundaries of the ALR and into the urban fabric. Finally, connection brings these two interventions together through specified corridors that bridge them through a series of smaller community-oriented interventions and a coherent public space network.

Given the analysis and identification of unused agricultural land, primary infrastructural corridors and occupational patterns, the design first begins with available land in the ALR. By concentrating new agricultural production on plots that are currently unused, there is an opportunity to create new crops and intensify greenhouse production. The boundary of the ALR is therefore redefined in areas where municipally owned (green) spaces abut its current threshold. These spaces are proposed as extensions of the ALR with a slightly different designation. Here the land must be cultivated but can be done so using smaller-scale techniques such as permaculture or agro-forestry and in some cases can be inhabited by low-impact community development. This threshold must also serve a public function so that people can access these productive spaces through pathways and gathering areas. Finally, along the corridor, dispersed agriculture is woven into communities using commercial spaces, municipal land, and areas slated for development.

This approach yields four primary corridors, the Fraser, Pacific, Cloverdale and Green Timbers corridors. Each can serve a different function in relation to their context and relation to the wider region, but together they have the potential to form a new network of agricultural production, innovation, and community-focused food production in order to increase self-reliance through adaptation and resilience-building.

The design scope in this thesis considers one of these— **The Fraser Corridor** — and explores the potential for transformation. Each intervention along the corridor is designed to link directly to its community context while also relating directly to the larger network of existing infrastructure and natural features. Starting at this scale allows for the establishment of a set of general design principles that can be upscaled — taking on a different form depending on the characteristics of each corridor.



-  Existing Commercial areas and active farms
-  Primary Areas of intervention

## Design Focus - Fraser Corridor

The Fraser Corridor, defined by the Fraser Highway, passing through Langley and Surrey but also extending West into the Vancouver Metropolitan Area and East into Abbotsford and Chilliwack, is located along one of the region's original roads that connected the interior of the Rocky Mountains with the shores of the Fraser River in New Westminster. The connection is still a key route for regional travel and bisects some of the Lower Mainland's primary urban centres and agricultural areas. What's more, the corridor runs directly through the middle of the Serpentine Lowlands which form a part of the ALR.

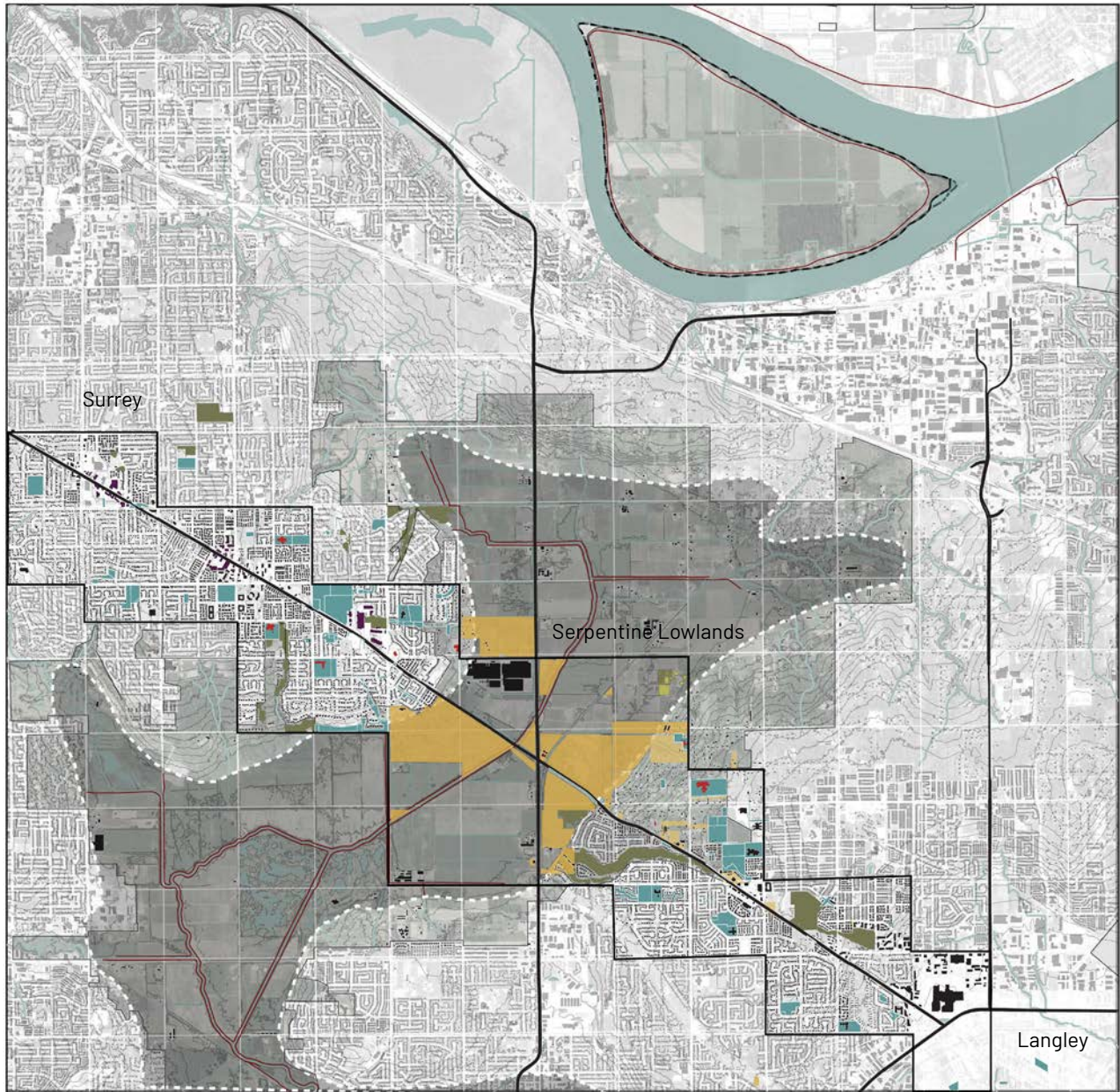
The corridor is characterized by two low- to medium-density urban areas divided by a wide, shallow river valley where agriculture has been maintained due to the high quality of the soil and availability of aquifer fed irrigation wells. As shown in the section below and as explained in the previous chapter, the division of land-use is strong and a defining feature of the landscape.

From a bird's eye view, the quality of the environment along the Fraser Corridor is more evident - where suburban sprawl gives way to open fields and golf courses. While at the street level, these spaces have very little relationship with the Fraser Highway. The design begins with the premise that production can be dispersed throughout the length of the corridor through a variety of interventions that range in scale and function.



FIG. 5.2 Google Earth and Streetview images accessed July 2020





- Not used for Farming
- Municipal Property
- Existing Farms
- River Dike
- Natural Areas
- Primary Roads
- Commercial Centres
- Institutional Buildings
- Flood Zone

## Fraser Corridor - Factors to Consider

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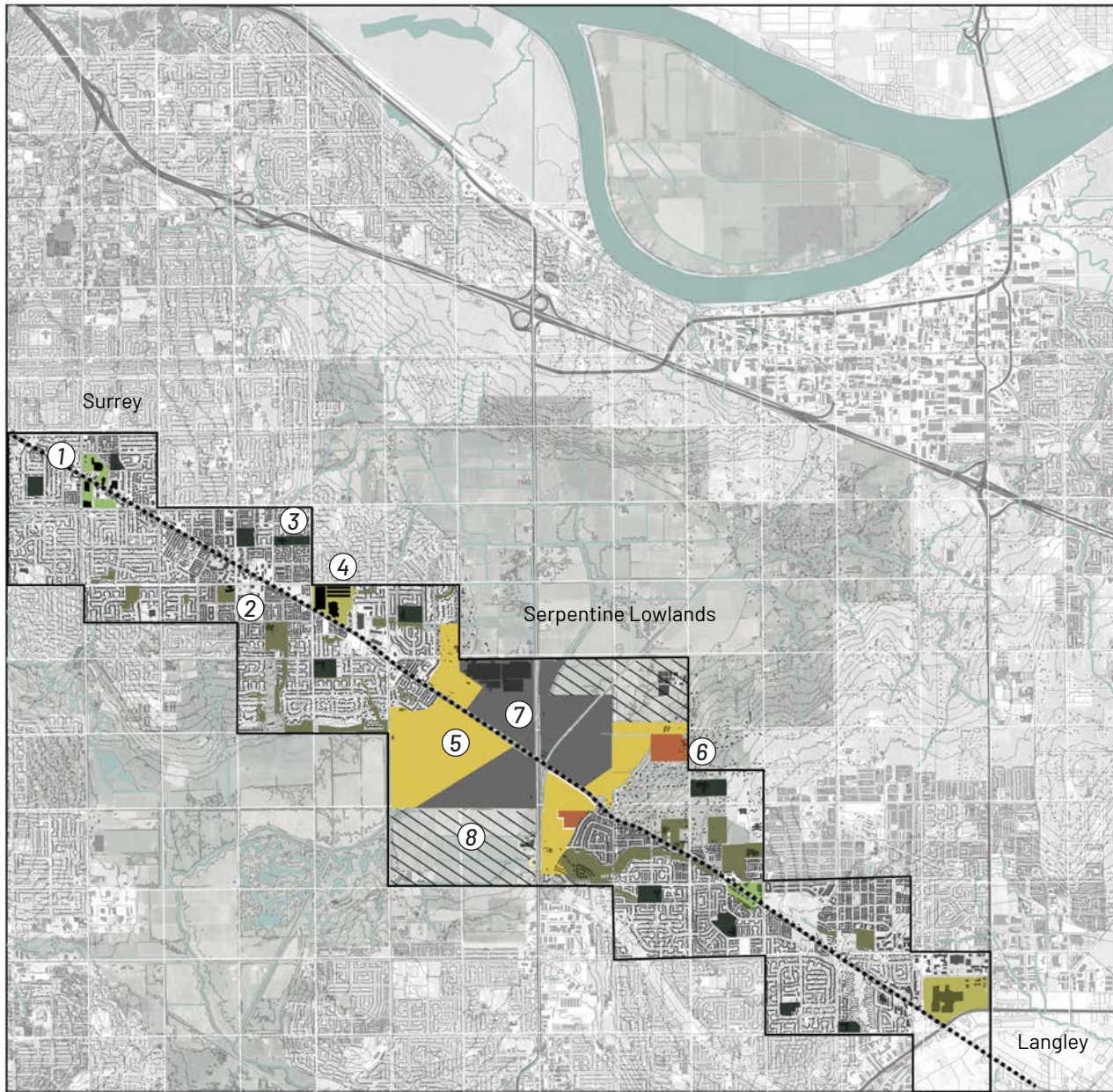
To construct a proposal for the corridor, several factors from the analysis are used to specify where interventions are most suitable along the Fraser Corridor. Here is a synthesis of the primary conditions that will determine how each intervention is placed along the corridor and in which way it will interact with its context.

The first consideration is the availability of land for productive purposes. This begins with land found within the ALR that is currently uncultivated (unused or land that is occupied by activities other than agriculture) - this you can see in yellow. Second, land that is municipally owned is considered as first priority for integrating small-scale productive sites and are indicated on the map in blue and, in some cases, institutional buildings located on this land are included (indicated in red). Commercial centres are considered spaces of opportunity for their potential to integrate productive activities into the existing supermarkets and the available space often found in large 'box store' sites in Canadian suburban areas.

From the 3x3x3 analysis, the layers of infrastructure - including the Fraser and Pacific Highways and the Serpentine River dikes - are considered fundamental in the consideration of design interventions. Green space is also considered an asset for its potential to connect and support productive activities - these are indicated in green. While the occupational patterns of sprawling suburban areas and their interface with large agricultural areas provide a challenge of further integration between the two territorial forms. Additionally, the grid is considered an important part of the territorial organization. However, a lack of permeability within the grid in the ALR presents the possibility to invite permeability into these large blocks.

Finally, the site's topography and inherent vulnerability to flooding are considered important features to account for in the design proposal.





- ① Urban Agri-tech Hub
- ② Food Forest
- ③ Community Gardens
- ④ Community Food Hub
- ⑤ Agro-forestry Crops
- ⑥ Low-Impact Communities
- ⑦ Greenhouse Production
- ⑧ Existing Active Farms



## Fraser Corridor - Design Overview

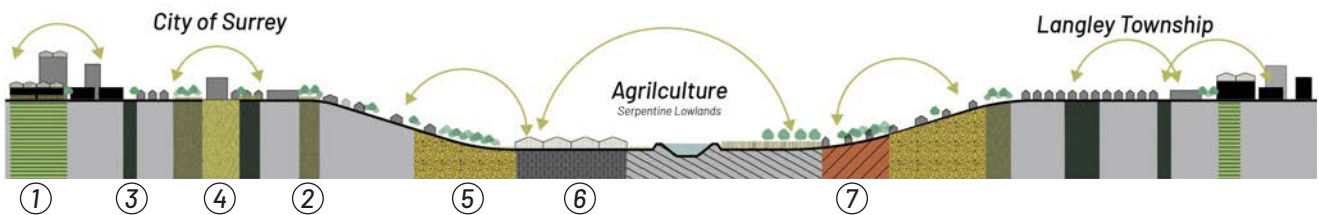
Based on this concept of the concentration and dispersal of agricultural activities along the corridor, the design employs several key interventions that will be described in further detail in the following sections. However, what is important to highlight here is how the various design strategies are integrated throughout the corridor creating a network of interventions that function differently but for the common purpose of connecting people with cultivations, increasing agricultural production and adapting the territory for a resilient form of agriculture.

Without this intervention, farming activities remain constricted to the specific boundaries of the ALR, but the design argues for a loosening of regulations in order to allow diverse forms of food production to take place throughout the region - first by concentrating them along specific corridors.

Before



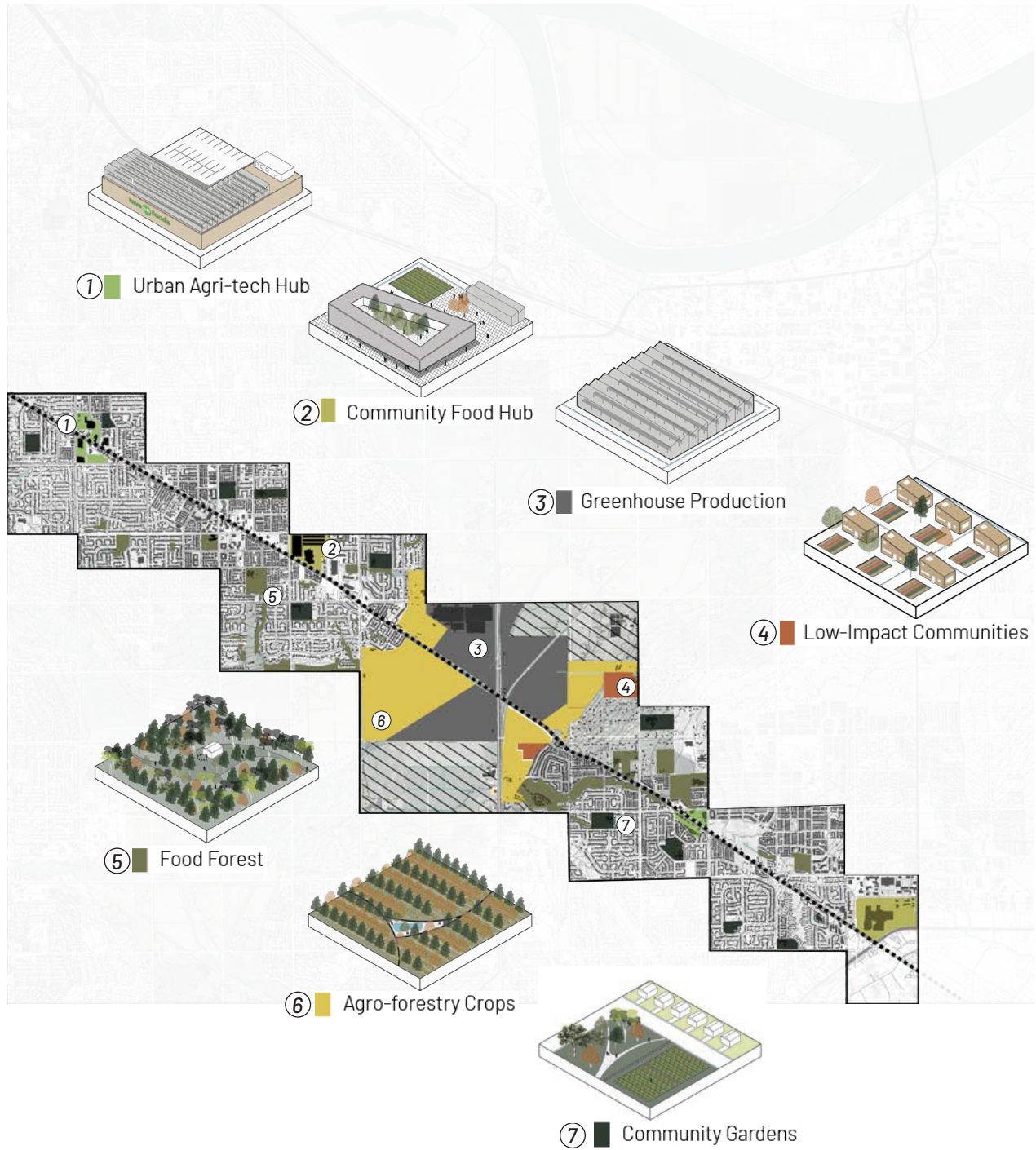
After



0

5

10 km



## Agricultural Typologies

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**1. Urban agri-tech hubs** are connected directly with existing commercial areas along the corridor where food production is hyper-localized through the production and direct supply to local supermarkets. The products grown would need to be suitable for greenhouse production and would include staple fruits and vegetables that can be sold, at first, alongside globally-supplied products, but overtime can become the primary products sold in commercial grocery store chains.

**2. The Community Food Hub (CFH)** is an essential link in the development of the Fraser corridor. Here, the CFH acts as an anchor for both farmers and community members. It is a public space for education, innovation and provides facilities to process and distribute locally grown food. There are greenhouses and small field crops that act as testing labs for new agri-tech and the establishment of new cultivars.

**3. Greenhouse** production is expanded in low-lying areas, clustered around the existing Burnaby Lake Greenhouses. Regional production potential is increased tremendously through the expansion of greenhouses as they provide an efficient, year-round cultivation of some fruits and vegetables. The introduction of more greenhouses also provides an opportunity to create new public spaces.

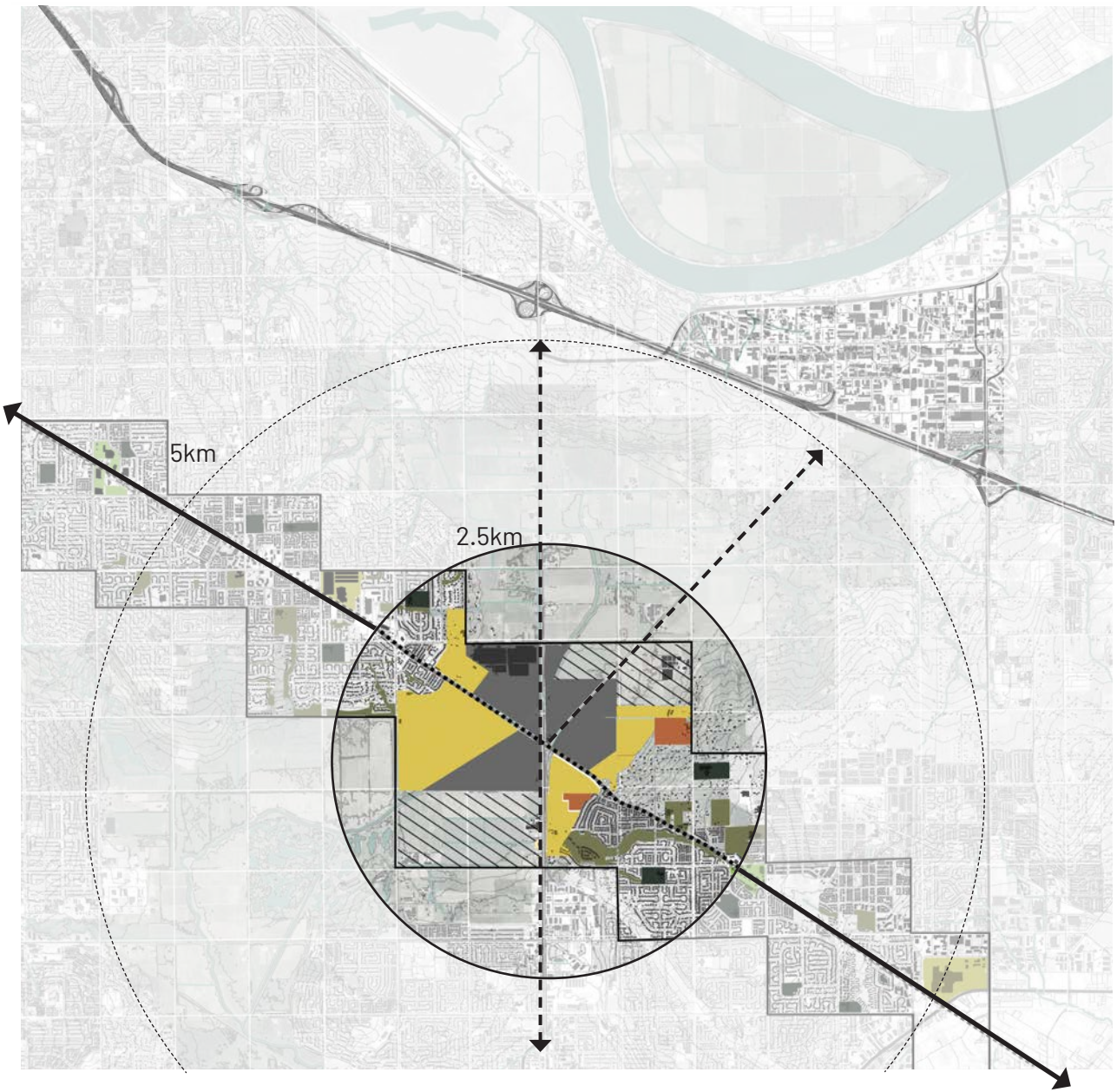
**4. Low-impact communities (LICs)** are also established along the threshold to provide alternative community living choices for people wishing to live a more sustainable lifestyle while cultivating much of their own food. These communities only allow small, mobile, modular or 'earthship' style homes and at least one third of the available land must be cultivated.

**5. Food forests** are designated and established in existing green spaces with dense forest cover or ravine environments that are safe and publicly accessible. This intervention is community driven and requires a stewardship program to cultivate and manage the micro-production of forage-able food such as mushrooms, wild greens, nuts, berries, and fruit.

**6. Agro-forestry crops** fall within the gentle slopes of the Serpentine Lowlands and in the Fraser Corridor, it replaces an existing golf course. Agro-forestry (the practice of combining the cultivation of trees with field crops) is placed within the sloped threshold to manage erosion but also to create a productive area that can be semi-public and provide space for people to pass through and observe how food production can take on many forms. .

**7. Community gardens** are established alongside existing educational facilities, in parks, or in partnership with places of worship. These gardens are intended to facilitate small-scale food production that would be sold in small community markets or traded amongst neighbours.





## **Step #1 :Concentrate - Stimulate a Productive Centre**

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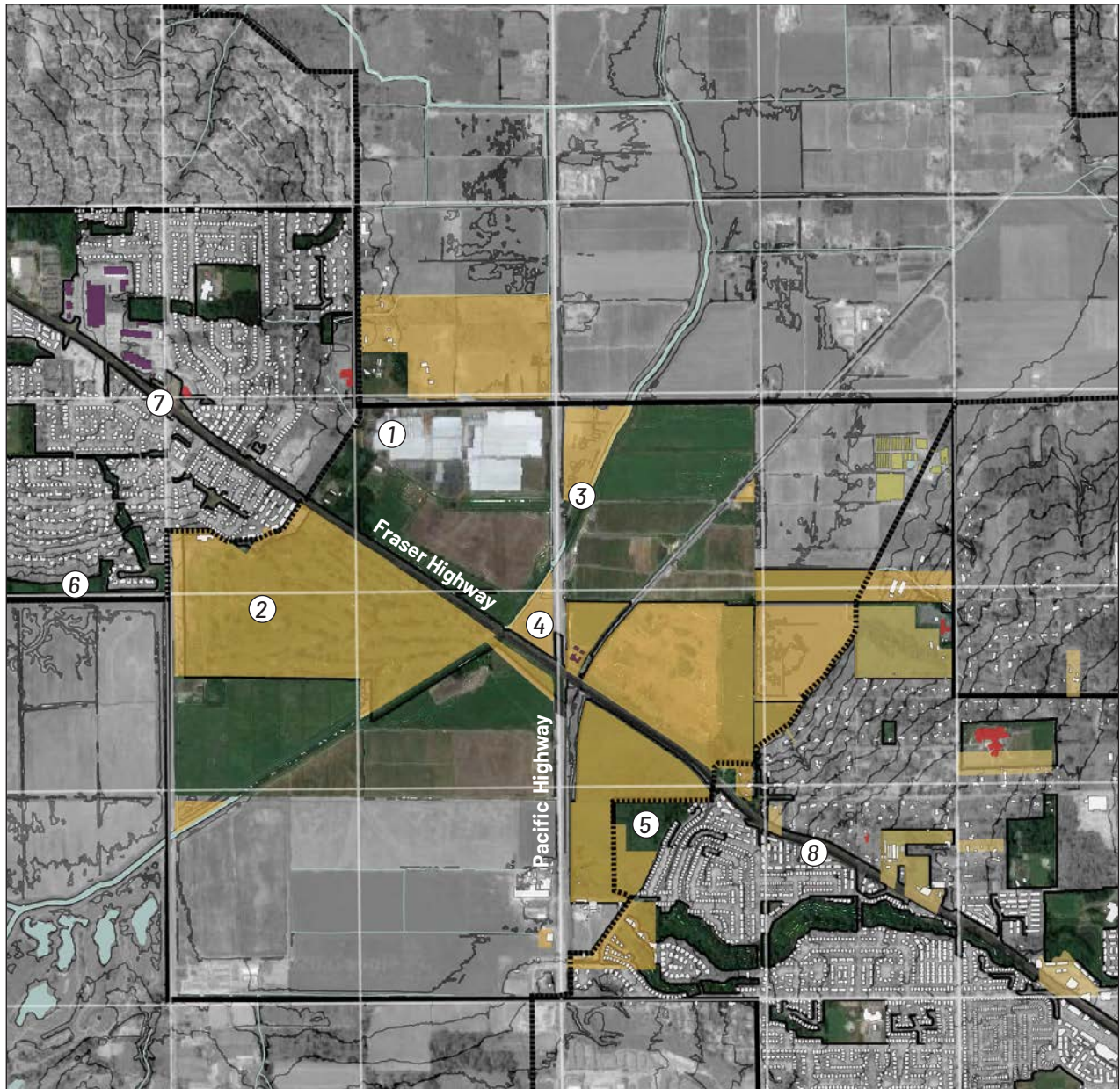
The first phase of establishing this corridor is to stimulate a productive centre in the existing boundary of the ALR. This area, within a short drive or cycle ride of the surrounding neighbourhoods, acts as the catalyst for developing the rest of the corridor. As an area that is less than 3km from the nearest residential areas, the potential for recreational access from these communities – particularly in the form of cycling and, for some, walking, this productive centre has the potential to become a significant community asset for Surrey and Langley. Furthermore, this centre sits at the intersection of numerous significant roads that connect to local industrial areas, regional, and national highways which directly link to the metropolitan region.

Activating this productive centre is a vital aspect of the design as it has the most potential to transform - in terms of both space and function. creating a stronger identity for the ALR by creating these nodes will connect people more closely to cultivation - especially by integrating this space into the existing public realm network.

It also becomes a place of significant, year-round agricultural production meaning that this productive centre also attracts opportunities for employment. This creates a distinct centre that people relate to and can identify.

As the primary element of the Fraser Corridor it serves as a hub and a connective device between the other proposed design interventions. For example, The Community Food Hub (described in subsequent sections) maintains a close relationship with farmers and employees working in the greenhouses as it provides space for training and educational workshops.





- |                                  |                         |                                      |
|----------------------------------|-------------------------|--------------------------------------|
| ① Burnaby Lakes Greenhouses Ltd. | ⑤ North Creek Park      | Uncultivated Farmland                |
| ② Surrey Golf Club               | ⑥ Neighbourhood Forests | ALR boundary                         |
| ③ Serpentine River               | ⑦ City of Surrey        | Educational and Religious Facilities |
| ④ Honeybee Centre                | ⑧ Langley Township      | Commercial and Office Centres        |
|                                  |                         | Existing Farms                       |
|                                  |                         | Residential Neighbourhoods           |



## Existing Conditions - Local Scale

---

The existing conditions of the productive centre are characterized by the intersection between large open green spaces and a variety of edge conditions between the urban and 'rural'. Here you can see clearly how in some parts, agriculture is a dominant part of the landscape and where it is either not present or has been replaced by other recreational functions.

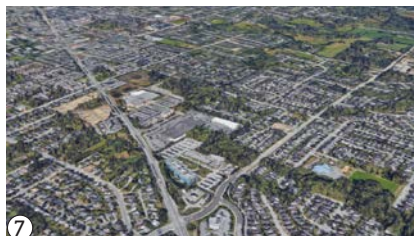
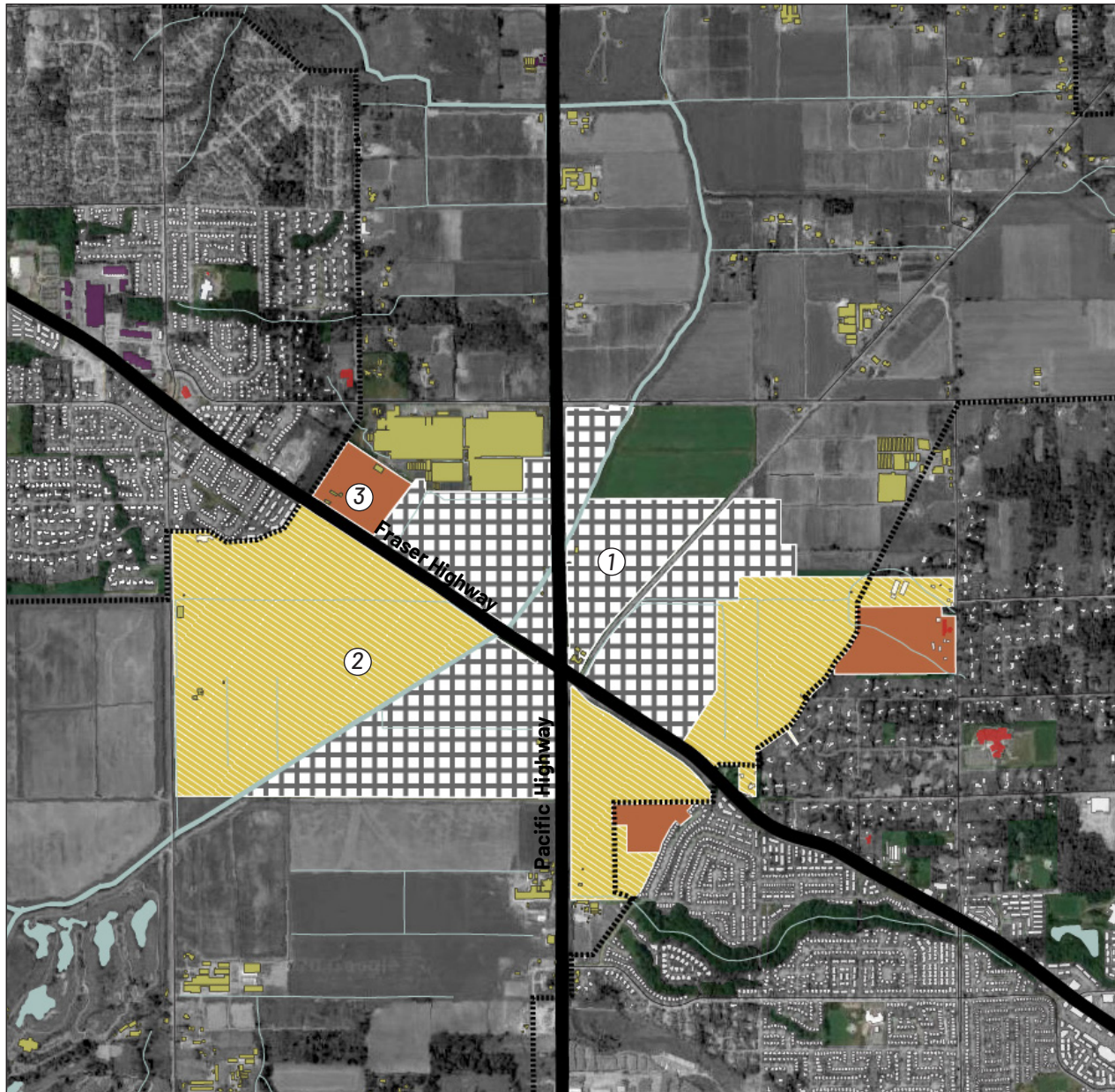



FIG. 5.3 Google Earth and Streetview images accessed July 2020



- |   |                        |  |                                      |
|---|------------------------|--|--------------------------------------|
|  | Greenhouses            |  | Uncultivated Farmland                |
|  | Agro-forestry Crops    |  | ALR boundary                         |
|  | Low-Impact Communities |  | Educational and Religious Facilities |
|   |                        |  | Commercial and Office Centres        |
|   |                        |  | Existing Farms                       |
|   |                        |  | Residential Neighbourhoods           |



## Strategic Interventions

Considering the existing conditions and the proposal to create a distinct productive centre, the design employs three main strategic interventions.

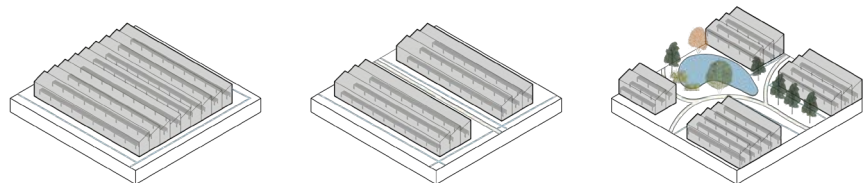
Greenhouses, agro-forestry crops, and micro-farming located in low-impact communities are used at three different scales to activate the productive potential of this landscape. In terms of productive capacity, there is significant available land for cultivation and the opportunity to transform an existing golf course (located with ALR designated land) into a space for agro-forestry crops.

To benefit from the connection to the grid and its infrastructural arteries, greenhouses are located along these primary roads to allow for ease of access. They also connect directly to the existing greenhouse area located near the corridor.

Agro-forestry crops are located along the threshold of the ALR and occupy the gentle slopes of the river valley. Here, a buffer is created between the existing urban communities and the proposed density of the greenhouses and provides an opportunity to weave public right of ways through these fields.

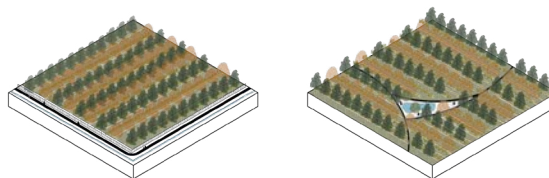
Finally, low-impact communities are proposed for the areas located directly between the agro-forestry crops, greenhouses, and the adjacent urban areas. These are communities that allow for small, moveable, modular, or passive solar earth shelters (ie. earthships) to be built so that they leave a minimal impact on the land. However, these communities will be required to maintain a level of self-sufficiency in terms of food production and will need to cultivate the land on a small scale in order to inhabit it.

FIG. 5.4 Greenhouse typologies range from structures that are large and singular, long and narrow with minimal public accessibility to small and dispersed with a dominant public realm and water network.



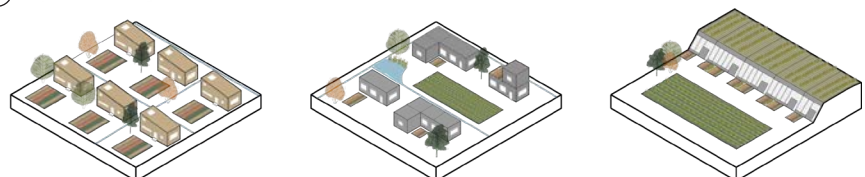
① Greenhouse Production

FIG. 5.5 Agro-forestry crops require large, open, and relatively undisturbed spaces to flourish so the public realm and the water management network either outline the field edges or weave through the crops with minimal intervention



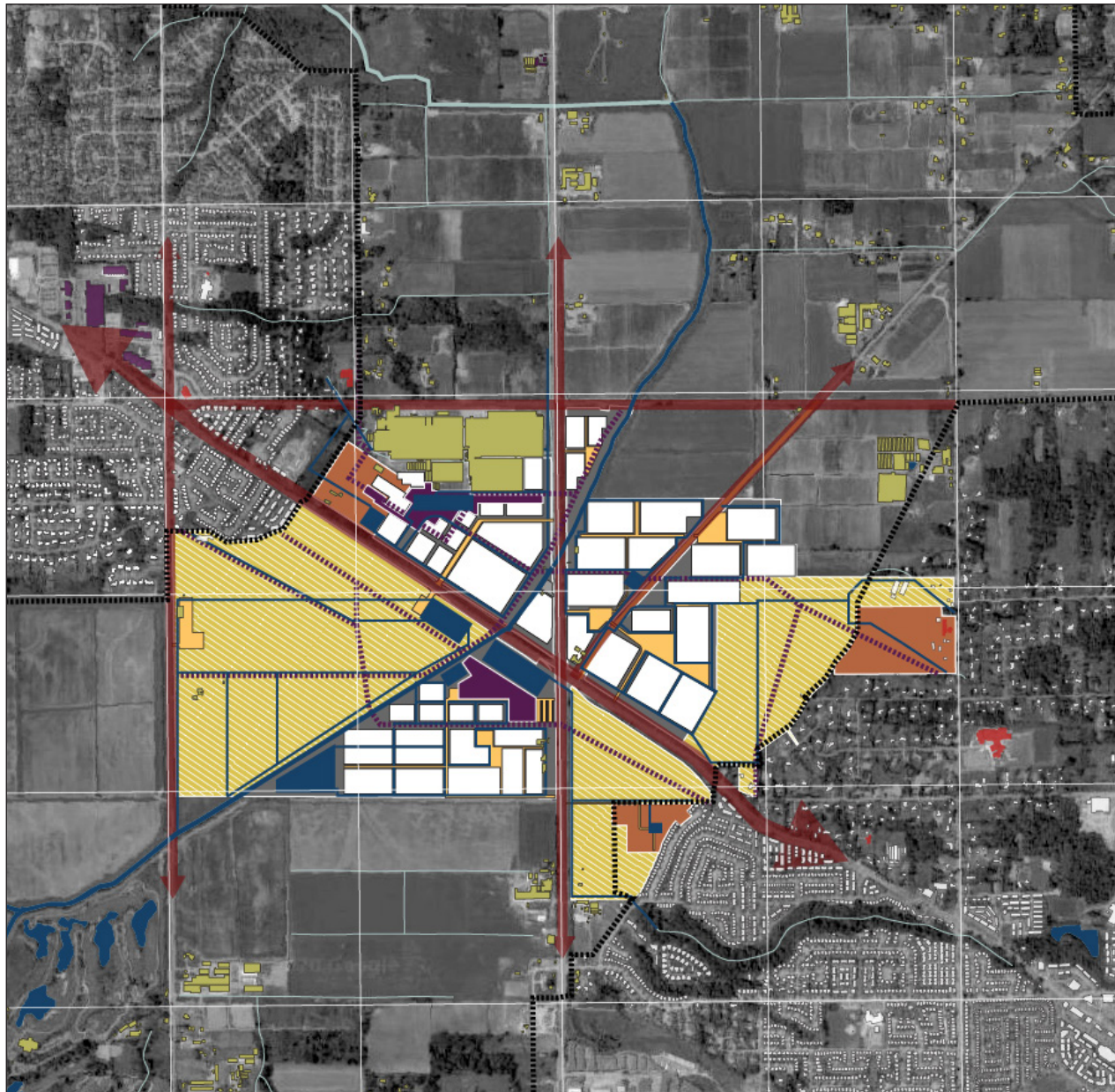
② Agro-forestry Crops













FIG. 5.6 Low-impact communities are proposed in three forms - small, moveable, modular, or passive solar earth shelters (ie. earthships)



③ Low-Impact Communities

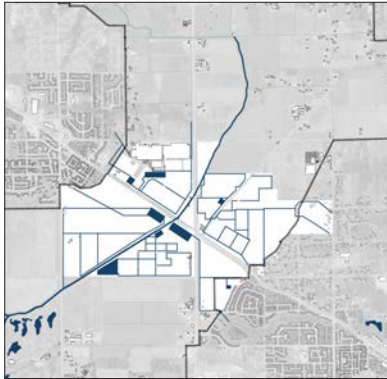




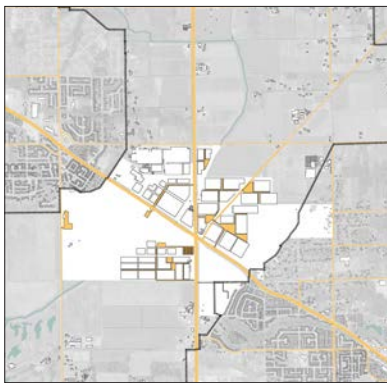
- |   |                                      |  |                                      |
|---|--------------------------------------|--|--------------------------------------|
|  | Agro-forestry Crops                  |  | Uncultivated Farmland                |
|  | Low-Impact Communities               |  | ALR boundary                         |
|  | Water Management Network             |  | Educational and Religious Facilities |
|  | Public Space                         |  | Commercial and Office Centres        |
|  | Greenhouses                          |  | Existing Farms                       |
|  | Infrastructural and Grid Connections |  | Residential Neighbourhoods           |

## Strengthening and Expanding the Network

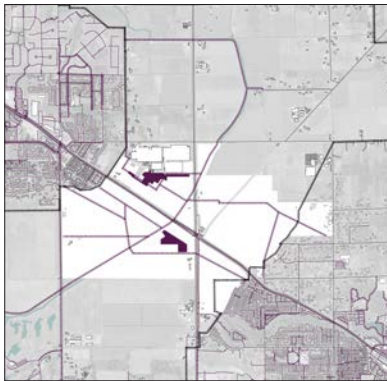
0 2.5km



Water Network



Logistics Network



Public Realm Network

In order to activate these proposed spaces a series of networks are identified here to connect the design proposal to the surrounding community and wider region.

First, as shown in the previous analysis section, the lowlands are vulnerable to flooding and subsidence. For this reason, a system of water retention and filtration is proposed to capture excess stormwater - particularly in areas where greenhouses are proposed. This offers an opportunity to mitigate damage from minor flooding and also enables the creation of aquarian habitats within the ALR.



The logistics network is essential to ensuring that increased food production is accompanied with the capacity to transport food, employees, and other related services. In doing so the proposed logistics network expands from the existing grid and breaks through to provide access.



To complement these systems, a public realm network is proposed to connect directly to existing communities in Surrey and Langley and provide access across the ALR while also creating central open spaces within the productive centre.

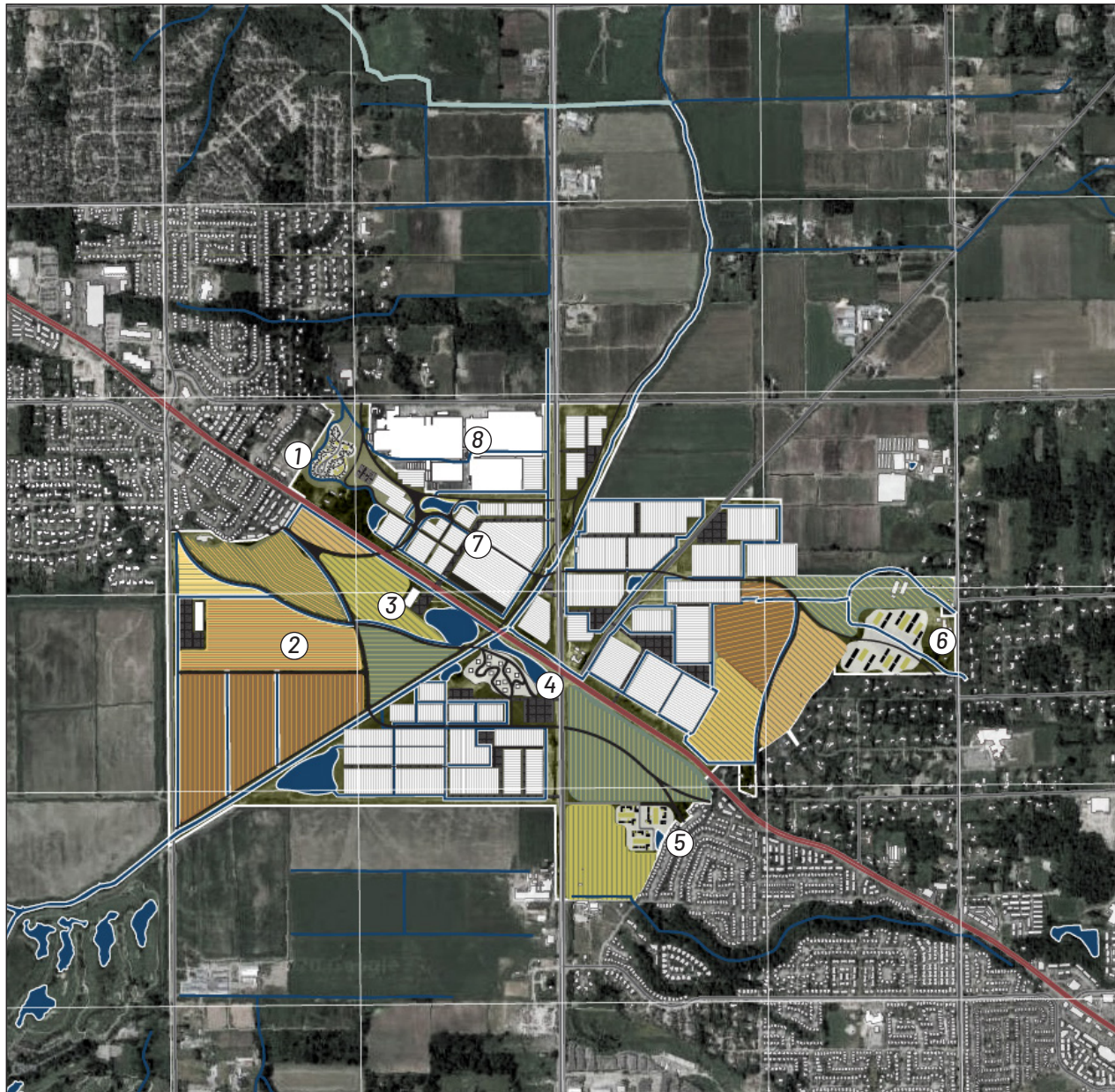


Water Network

Logistics Network

Public Realm Network





- |  |                                    |
|--|------------------------------------|
| ① LIC - Moveable Tiny Homes                      | ⑤ LIC - Modular Houses             |
| ② Agro-Forestry Crops                            | ⑥ LIC - Earthships                 |
| ③ Logistics Point for harvesting and maintenance | ⑦ Greenhouse Hub with Public Realm |
| ④ Public Market Space                            | ⑧ Existing Greenhouses             |



## Establishing a Productive Centre

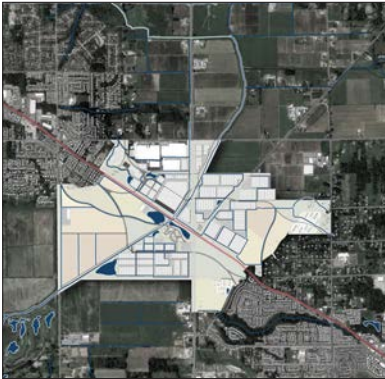
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Beginning within the existing agricultural core and threshold of the ALR, production activities are concentrated, increased, and diversified through a number of measures. Public space and water management are also interwoven, and a number of agricultural typologies are employed through specific interventions with a number of distinct iterations. In relation to the Jefferson Grid, the parcels of land have remained larger and are more or less impenetrable since the roads follow the original grid structure. This proposal not only demonstrates the productive potential of these areas but also reveals the public value of the ALR by inviting permeability into the grid for people and for a diversity of food cultivation.

First, in order to concentrate and increase production potential, a greenhouse hub is proposed for the area adjacent to the existing Burnaby Lake Greenhouses. Here three approaches are taken. Following the logic of the grid and its delineation of road and transport infrastructure, loading areas and other logistics access points for greenhouses are located along the edge of the grid. Within the interior of this concentrated area, the greenhouses are smaller and dispersed to allow for public space and water management and infiltration ponds. As part of the larger proposed network of public accessibility, space is provided for access into and out of the greenhouse hub.

To diversify food production, two more agricultural typologies are proposed for the productive centre of the Fraser Corridor. In place of an existing, unproductive golf course located in the ALR, on the slopes of the Serpentine River Valley, agro-forestry cultivation is proposed in order to increase the (bio)diversity of food production in the ALR and create opportunities for both resilient agriculture and soil/water regeneration. Again, public space is integrated into this typology by creating a system of pathways and small gathering spaces within the agro-forest for educational and recreational purposes. This area does not necessarily connect directly to the structure of the grid, but rather to the Fraser Highway which will allow food to be transported from the fields to processing and distribution centres further along the corridor. Furthermore, adjacent suburban neighbourhoods have a direct relationship with the agro-forest and access to the rest of the productive centre.

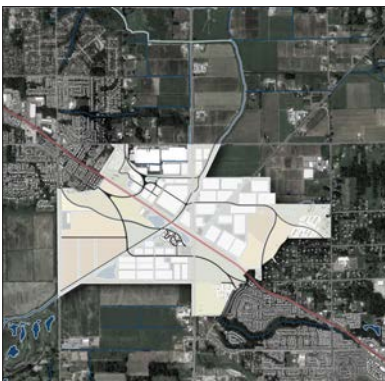
Finally, as a way to begin addressing the challenge of affordable and available housing in the Lower Mainland, areas are designated within the threshold of the ALR that will allow for a mixture of small-scale agricultural production and low impact living. LICs (Low-Impact Communities) are proposed in three iterations to allow for a range in flexibility and productive capacity. Three areas are located near the main transects of the grid structure for accessibility and relate closely to the edge of the existing urban areas.



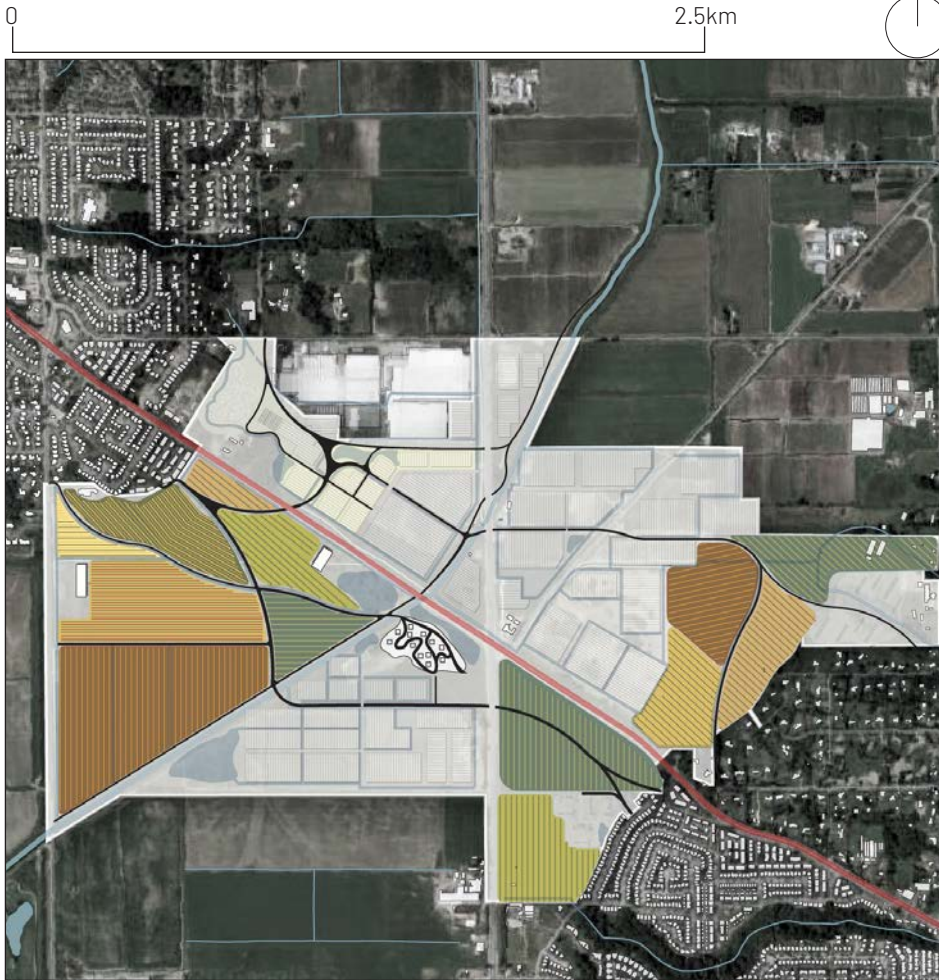
Water Network



Logistics Network



Public Realm Network



## Food Production Potential

**135ha of Agro-Forestry**  
 Aprox Yield: **50 ton/ha/yr**  
 6,750 tons of produce/year

*\*Recommended vegetable consumption per day by the WHO/FAO is of 400 grams*  
 It is possible to feed aproximately  
 40,000 people per day with this yield

### Horticulture crops:

Eggplant  
 Peppers  
 Zuchinni  
 Sweet potato  
 Squash/pumpkin

### Field crops:

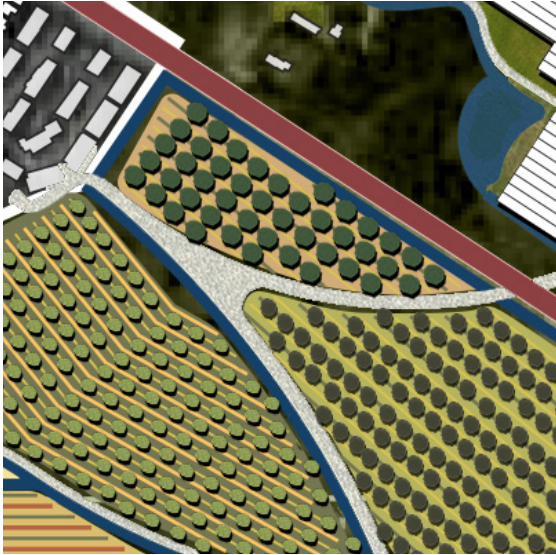
Barley  
 Oats  
 Wheat

## Agro-Forestry Crops

Agro-forestry is defined by the Food and Agriculture Organization as “a dynamic, ecologically based, natural resource management system that, through the integration of trees on farms and in the agricultural landscape, diversifies and sustains production for increased social, economic and environmental benefits for land users at all levels. Agroforestry systems are multifunctional systems that can provide a wide range of economic, sociocultural, and environmental benefits.” (FAO, 2015). It involves the implementation of a land-use system where woody perennials (trees, shrubs etc.) are intentionally used on the same plots as agricultural crops in some form of spatial arrangement or temporal sequence.

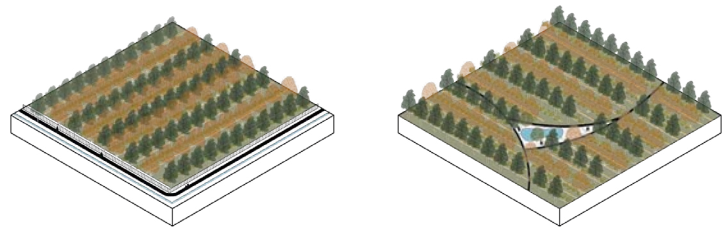
As an alternative to typical mono-cropping found across the Lower Mainland, agro-forestry has the potential to transform how farming practices are structured in order to promote a more biodiverse form of cultivation. Furthermore, integrating public space into these areas provides an opportunity to connect people more closely with this dynamic form of food production and can teach the public about the benefits of growing food in a way that benefits the environment.



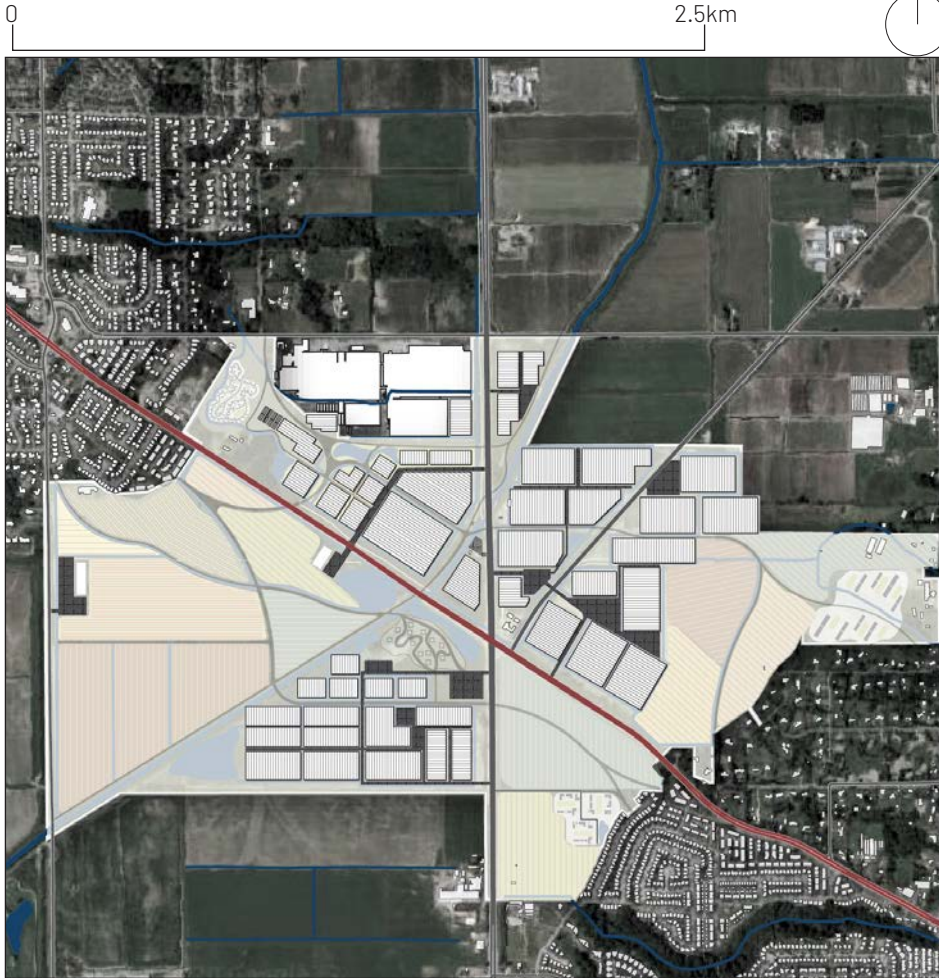


## Spatial Quality of Agro-Forestry Production

The potential to transform the land to enable this type of production also presents the opportunity to embed space for people to interact with cultivation in a different way. Wide public right of ways are provided through the agro-forestry crops and link to surrounding communities. Functioning as a massive agricultural park for residents in Surrey and Langley, these spaces would be used for people to go jogging, to take their dogs for a walk, and to admire the natural beauty of a form of food production. These paths also link directly to the greenhouse hub and therefore provide an alternative connection to an employment hub in the community.







## Food Production Potential

**82ha** of Greenhouses

Aprox Yield: **200 ton/ha/yr**

16,400 tons of produce/year

*\*Recommended vegetable consumption per day by the WHO/FAO is of 400 grams*

It is possible to feed aproximately 97,000 people per day with this yield

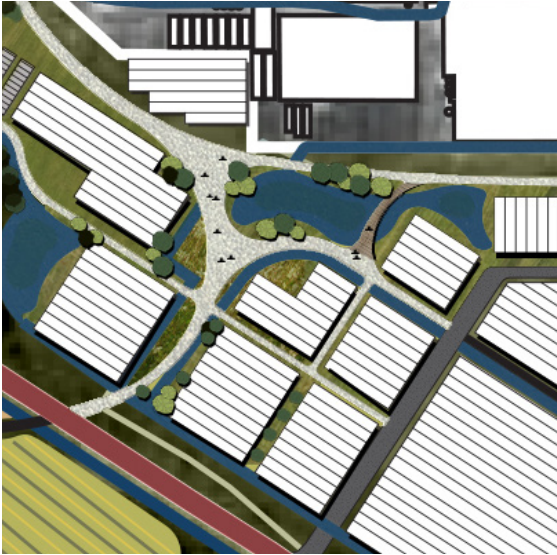
### Food Grown:

- Tomatoes
- Strawberries
- Raspberries
- Greens (kale, lettuce, arugula etc.)
- Sprouts

## Greenhouse Hub

In order to concentrate and increase production potential, a greenhouse hub is proposed for the area adjacent to the existing Burnaby Lake Greenhouses. Here three approaches are taken. Following the logic of the grid and its delineation of road and transport infrastructure, loading areas and other logistics access points for large greenhouses are located along the edge of the grid. Within the interior of this concentrated area, the greenhouses are smaller and dispersed to allow for public space and water management and filtration ponds. As part of the larger proposed network of public accessibility paths space is provided for access into and out of the greenhouse hub.

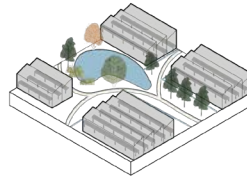
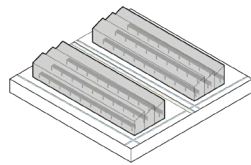
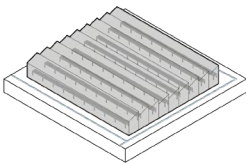
This hub has the potential to integrate technology, including advanced sensors, lighting, efficient growing mediums, and consistant monitoring in order to produce high yields of vegetables and some fruit. This can significantly contribute to increasing regional self-reliance if implemented on a larger scale.



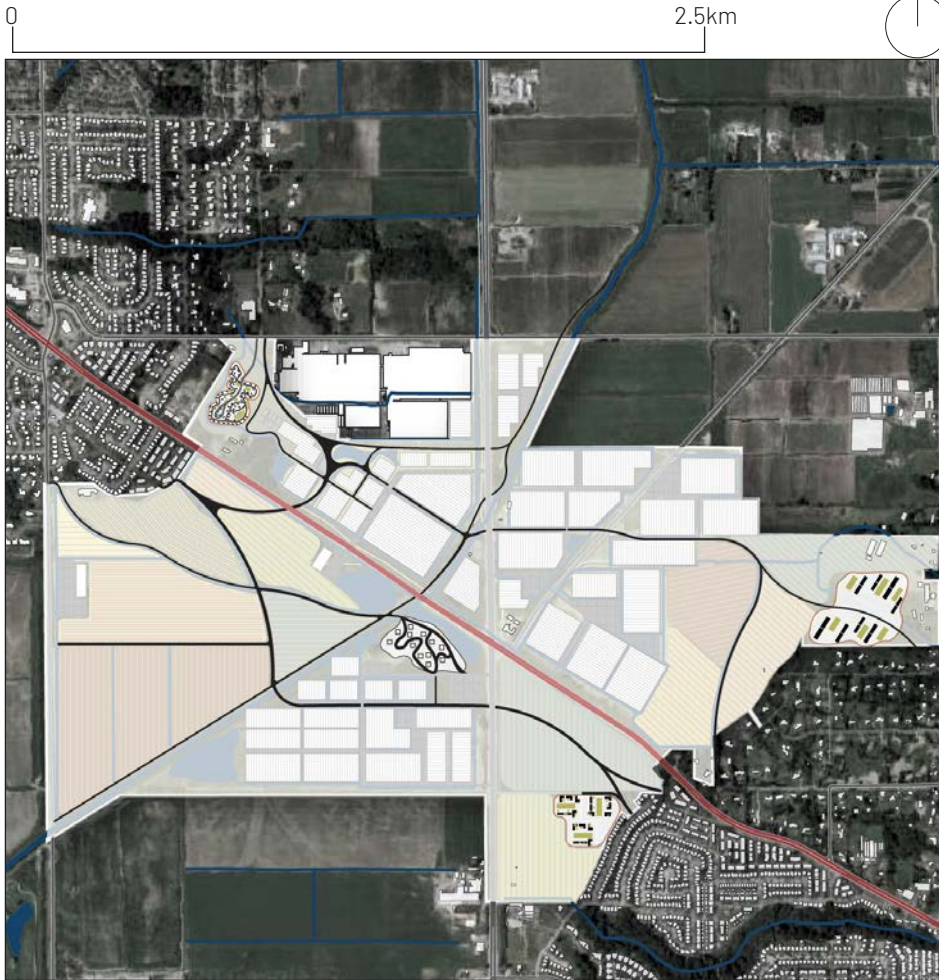
## Spatial Quality of Greenhouse Production

Introducing this highly productive centre to the ALR presents the challenge of creating a closed zone, unreachable and unattractive to the public. However, with the creation of this greenhouse hub, a special consideration is given for its potential to host public life.

With a central public space connected to the surrounding path system, the greenhouse hub becomes part of the public realm. It can function as a space to pass through when out for an evening cycle ride or as a gathering space for farmers markets, educational tours of the greenhouses or simply as a place to have a picnic by the pond. This acts as a space that invites people to observe where food is grown and connect them to the process by placing it on display in a public setting.







## Dwelling Potential

Space for **65-100** tiny homes

Space for **18-50** modular homes

Space for **16-20** earthships

**Total:** 170 new low-impact community households

## Low-Impact Communities

The introduction of Low-Impact Communities responds to the need to provide space for people who wish to live in a more sustainable, self-reliant manner in a region where urban sprawl is the norm and the average price of a family home will cost you as easy \$1 million.

There is a growing movement of people who want to live in smaller, self-built spaces (particularly in the Pacific Northwest) but the typical problem they run into is finding a place to park their homes or begin a community. This part of the design proposal specifically allows for low-impact living to inhabit a small portion of the ALR with the condition that the inhabitants must cultivate the land. This food can be grown solely for their own use or can be sold to the local community at the community food hub or at the local markets. Three types of communities or living styles are imagined for these spaces. First are typical 'tiny

homes' - towable homes on wheels with the typical dimension of 8x3m. The second are modular homes - where people can decide how many units they wish to purchase in order to build their houses. The modular pieces can be bought separately and added over time as the family grows for example. The third type of low-impact living comes in the form of an 'earthship' or a passive solar earth shelter that is built into the side of a small hill, facing south to benefit from the natural light - eliminating the need for conventional heating and cooling technology.

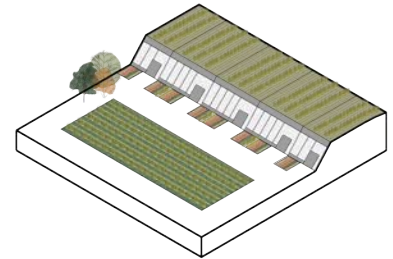
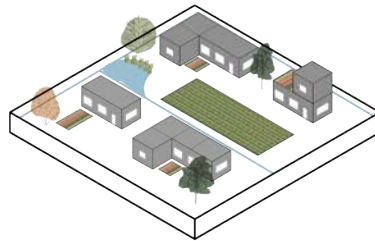
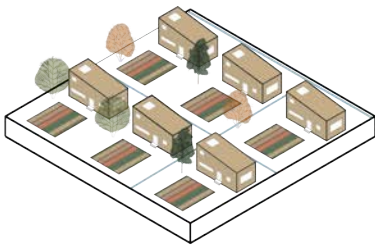
These homes are typically constructed with recycled material and have a low impact on the earth as water is reused, vegetation covers the roof and the dwelling requires little energy to function. Overall, it is the intention of this proposal to provide opportunities for alternative housing choices in a region that has the highest cost of living in Canada.

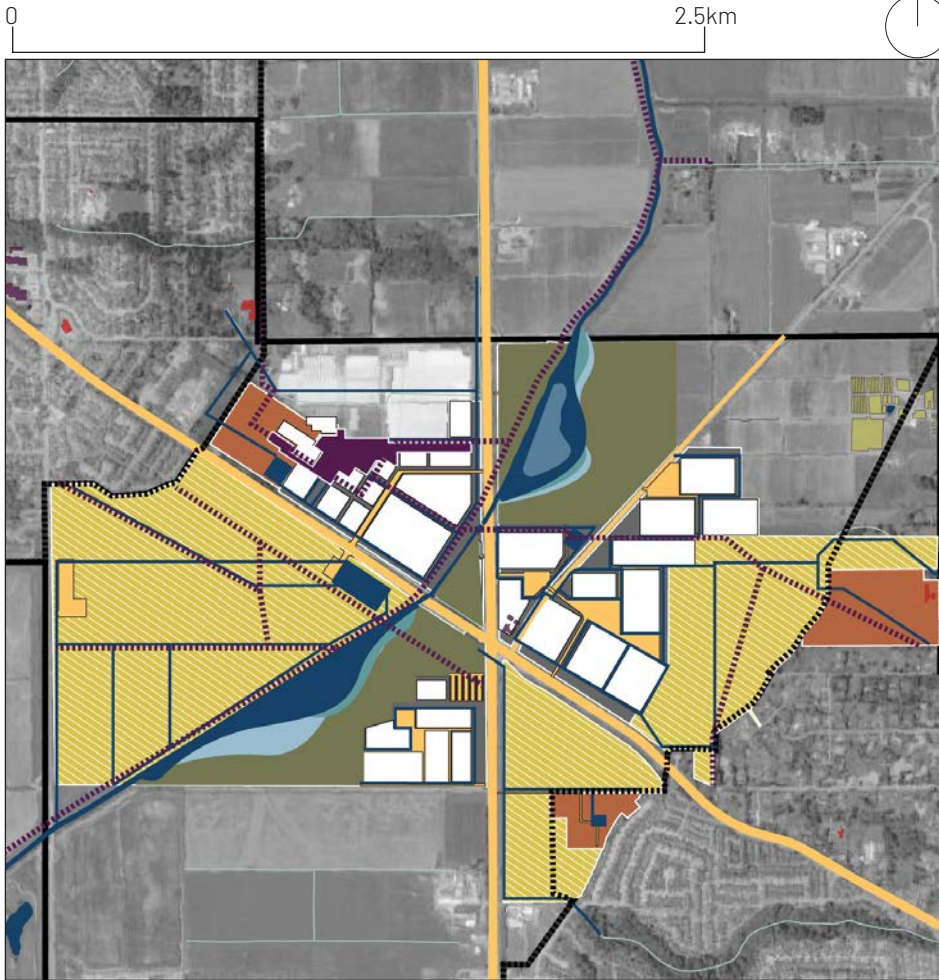


## Spatial Quality of Low-Impact Communities

The spatial quality of these communities varies but the overall notion is that each community has the ability to host numerous households and cultivation techniques. Each community can integrate a mixture of individual gardens and centralized, community gardens so that cultivation of fruit and vegetables can happen at a couple of different scales.

In all cases, the public realm network connects closely to the communities providing passive connections through each.





## Alternative Iteration

*Decreased space for greenhouse production but more room given for the river to expand*

## Conclusion and Reflection

In creating this design proposal, the intention was to demonstrate one of the potential ways in which to transform the ALR along the Fraser Corridor. Considering the extent of unused agricultural land, the accessibility to major regional infrastructure and the necessity to safeguard the land from flooding in this particular part of the corridor, the potential for restructuring is greatly needed.

This iteration of the design prioritises and benefits the potential for productivity and demonstrates the impact of concentrating, diversifying, and upscaling agricultural activities. In terms of the benefits for the community, this proposal would stimulate greater economic activity for the region and employment opportunities for local residents.

However, it is important to acknowledge that while this iteration proposes a massive increase in food production and a comprehensive public realm, the main driver for change does not lead with landscape as the primary organizational element. While some space is created for habitat and water, flood resilience is not as high as it could be.

In another iteration, it's possible to consider a more naturalized river edge and a spill over zone for water in the event of flooding. This would reduce the overall productive potential but would add an adaptive value to the corridor - protecting other parts of the ALR from damage during a flood event while creating more robust opportunities for wildlife habitat.

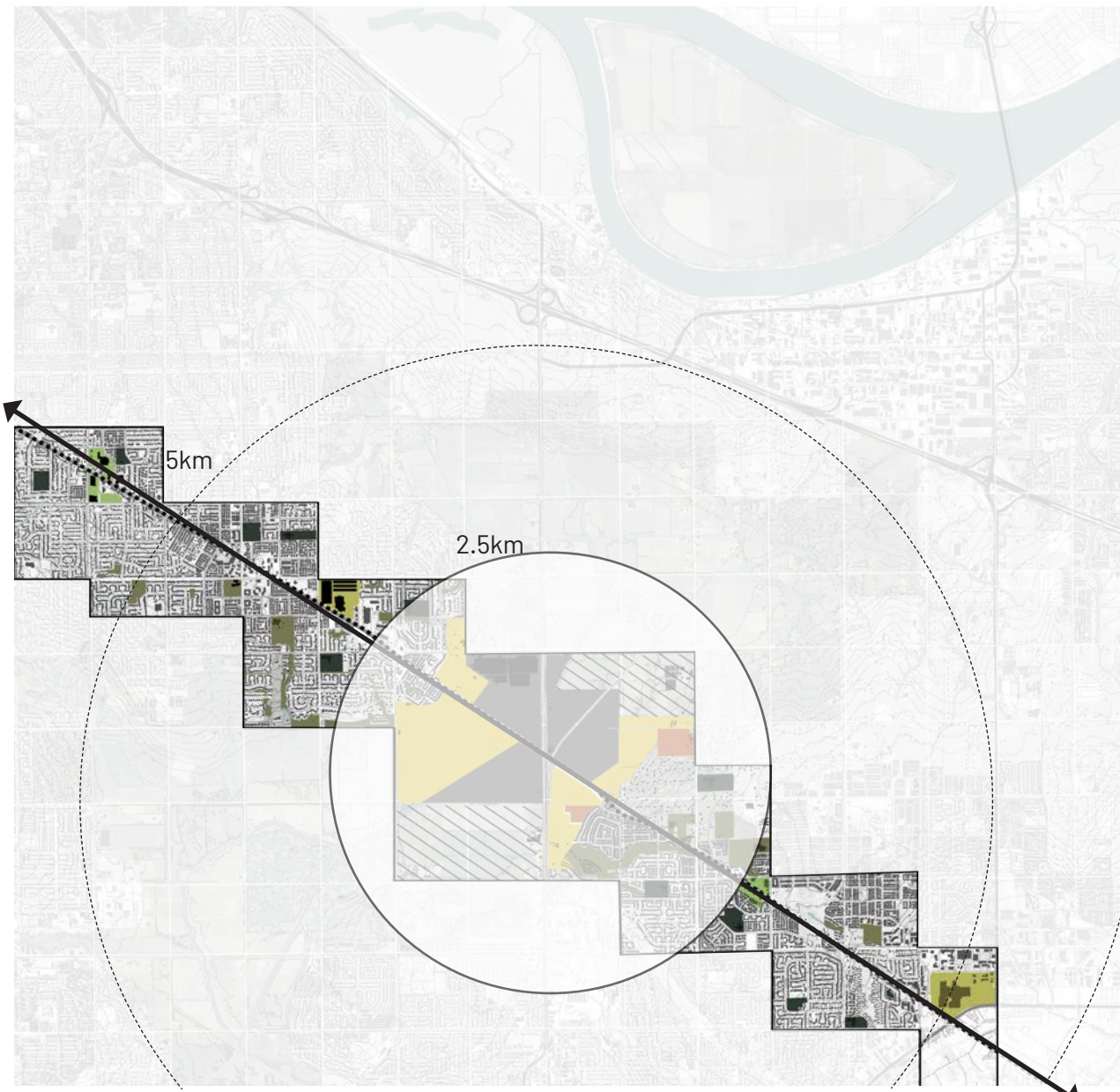




0

5

10 km



## **Step #2: Disperse - Extend the Corridor**

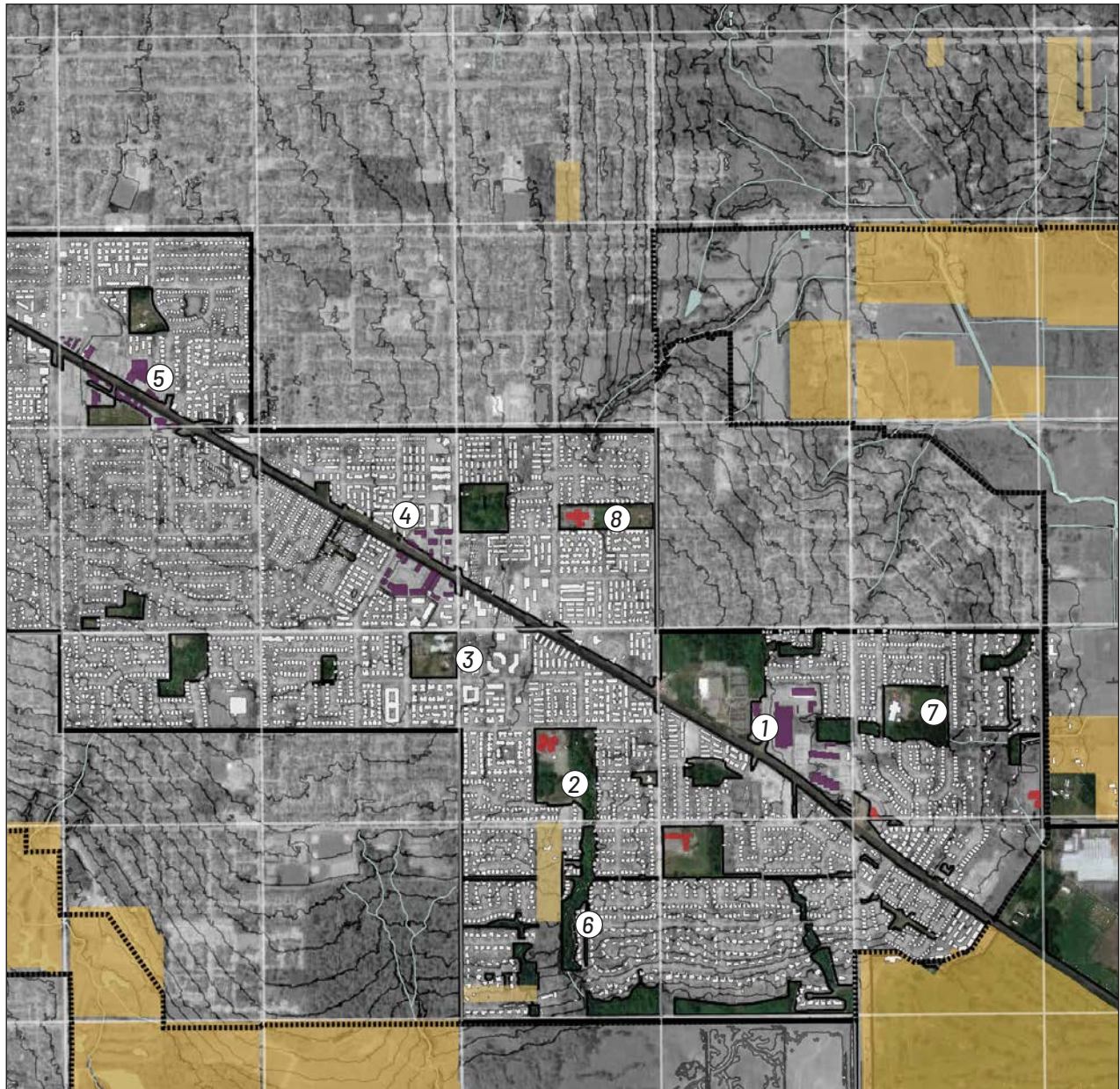
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The second portion of the design proposal focuses on the concept of 'dispersal', where agricultural activities are introduced through several design strategies throughout the corridor in direct relation with their surroundings. This strategy is intended to create a continuous line of various cultivation techniques that, when seen in conjunction with the productive centre, form an agricultural corridor. Design interventions are dotted throughout communities adjacent to or directly found along the corridor and mostly fall within walking or cycling distance of each other (1500m or less).

These spaces, described in the follow sections also share programmatic functions with the other interventions along the corridor. For example, the Community Food Hub acts as a facility for education, training, and testing of new agricultural techniques and practices - something that would be shared amongst all points of intervention.

The focus of this part of the design proposal will look, in detail, at the transformation potential of one site along the corridor where a Community Food Hub is proposed while the remaining design interventions will be shown in brief.

2.5km



① Surrey Sport & Leisure Complex

⑤ Commercial Centre

Uncultivated Farmland

② Walnut Road Elementary School

⑥ Existing Forest

ALR boundary

③ Surrey Libraries - Fleetwood Branch

⑦ Coast Meridian Park

Educational and Religious Facilities

④ Commercial Centre

⑧ Frost Road Elementary School

Commercial and Office Centres

Existing Farms

Residential Neighbourhoods



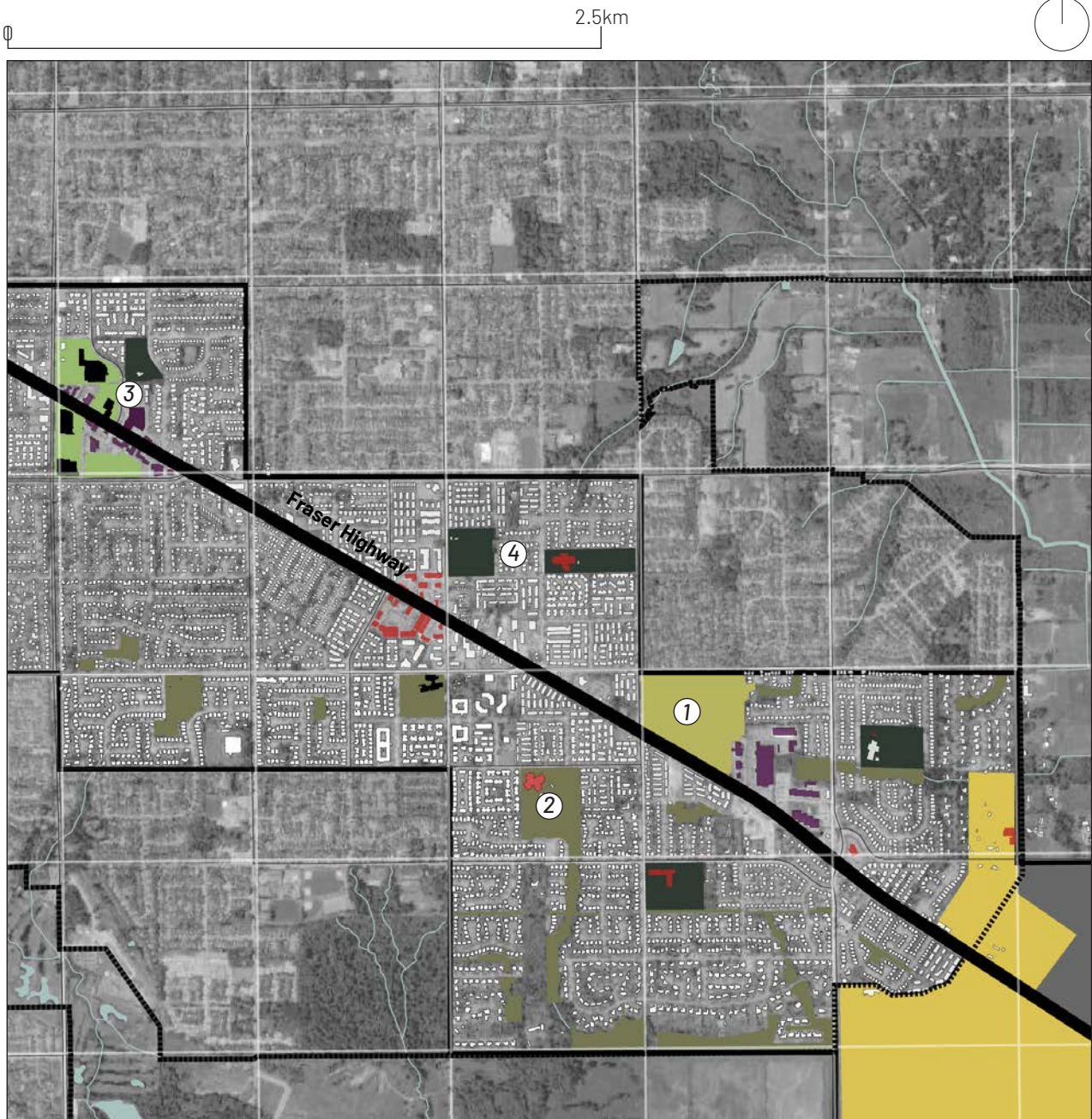
## Existing Conditions - Corridor Scale

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The Wester portion of the Fraser Corridor passes through a neighbourhood called Fleetwood where numerous commercial centres are dotted along the highway while suburban communities with large green spaces surrounding facilities like schools and libraries are scattered throughout the residential areas.



FIG. 5.7 Google Earth and Streetview images accessed July 2020



- Urban Agri-tech Hub
- Food Forest
- Community Gardens
- Community Food Hub
- ALR boundary
- Educational and Religious Facilities
- Commercial and Office Centres
- Residential Neighbourhoods



## Strategic Interventions

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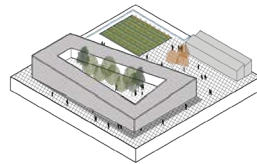
The design interventions found along the corridor range in their impact on the community. Some of these act as neighbourhood anchors that have a dominant and visible presence on the corridor while others are embedded more lightly into the community.

First the Community Food Hub acts as an anchor for local food production, education, innovation and community gathering, the CFH is an essential element in the development of the corridor and the larger agricultural network across the region. Proposed for unused sites along the corridor, it has the potential to catalyse development and become a new centre for the community.

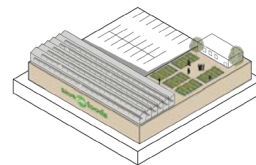
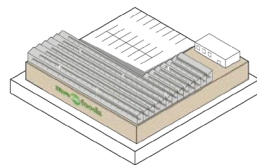
Agri-tech hubs are built in existing commercial areas, and where possible, are retrofitted greenhouses built onto supermarkets for the production of food to be sold in local grocery shops. These hubs can take on two iterations - one that includes space for educational programming and another that is purely for production. These hubs are also embedded along the primary spine of the corridor and are visible anchors of food production.

Food forests and community gardens are proposed for the existing greenspaces found throughout the neighbourhoods adjacent to the corridor. They are community-managed interventions and would act as small-scale food producing sites. For example, food forests would be planted in existing forests found throughout Fleetwood and would be managed by a local stewardship program to ensure that wild food sources remain abundant and available for foraging.

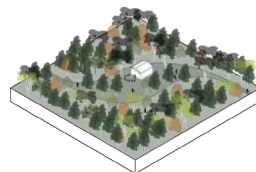
Community gardens would be placed in existing public green spaces and would be managed by local schools and community organizations.



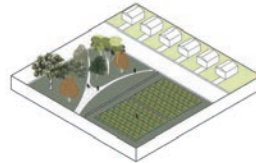
① Community Food Hub



② Urban Agri-Tech Hubs



③ Food Forest



④ Community Gardens



0

1km



① *Unoccupied Site*

③ *Surrey Sport & Leisure Complex*

■ Educational and Religious Facilities

② *Currently under development*

④ *Bonnie Schrenk Park*

■ Commercial and Office Centres

□ Residential Neighbourhoods



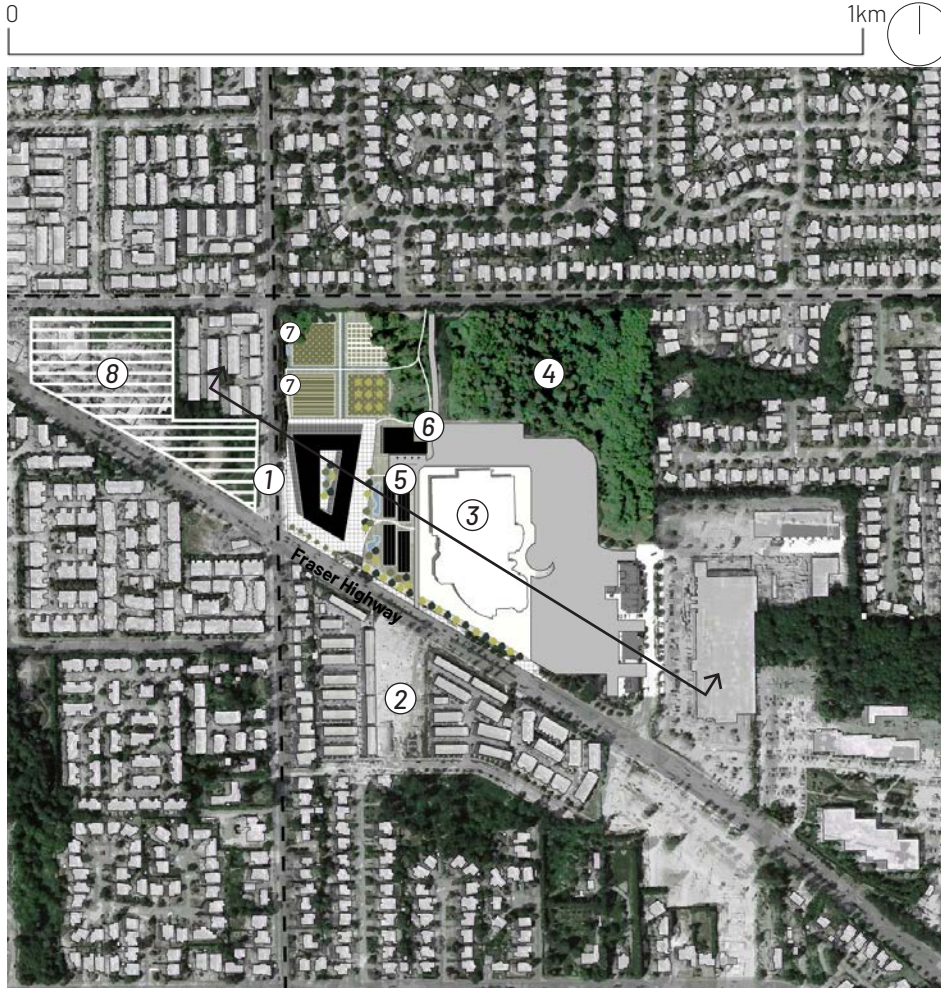
## Existing Conditions - Local Scale

---

The location of the proposed Community Food Hub is currently unoccupied and sits adjacent to a recreation centre and a community park and sits within a neighbourhood that is experiencing residential development along the Fraser Highway.

There is great potential to connect to the existing functions found around this site and establish this as a multi-functional community hub for Fleetwood.





## CFH Functional Elements

- ① Community Food Hub - Education and Innovation Centre
- ② Currently under development
- ③ Surrey Sport & Leisure Complex
- ④ Bonnie Schrenk Park
- ⑤ Greenhouses
- ⑥ Processing and Distribution Centre
- ⑦ Crop Testing Fields
- ⑧ Potential for greater density



Space for collaboration between farmers, researchers and citizens



Educational facilities for the University of the Fraser Valley



Space for crop production



Processing and Distribution facilities

## Community Food Hub

The CFH functions as a local ecosystem providing a large outdoor public space for the community, productive space for greenhouse production and small field crops, testing labs, educational, food processing and distribution facilities. In this sense, the community food hub acts as an agricultural campus in the centre of Fleetwood, Surrey.

As an anchor for food production, education, innovation, and community, the CFH is an essential element in the development of the corridor and the larger agricultural

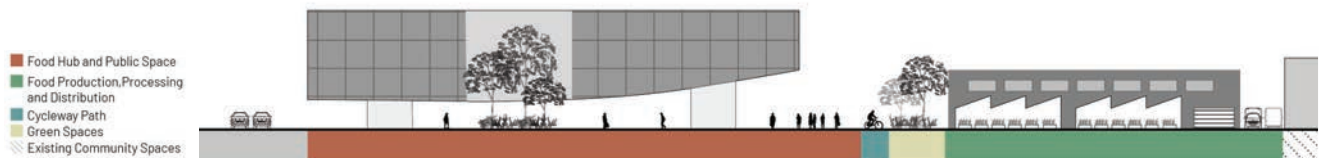
network across the region. There is an opportunity to use this space for collaborations between local research organizations and higher education institutes and food producers. The campus facilities like the greenhouses, processing and distribution centre and field crops can all be used in these collaborations to monitor plant growth, test and develop new cultivars and do so in the heart of the community.





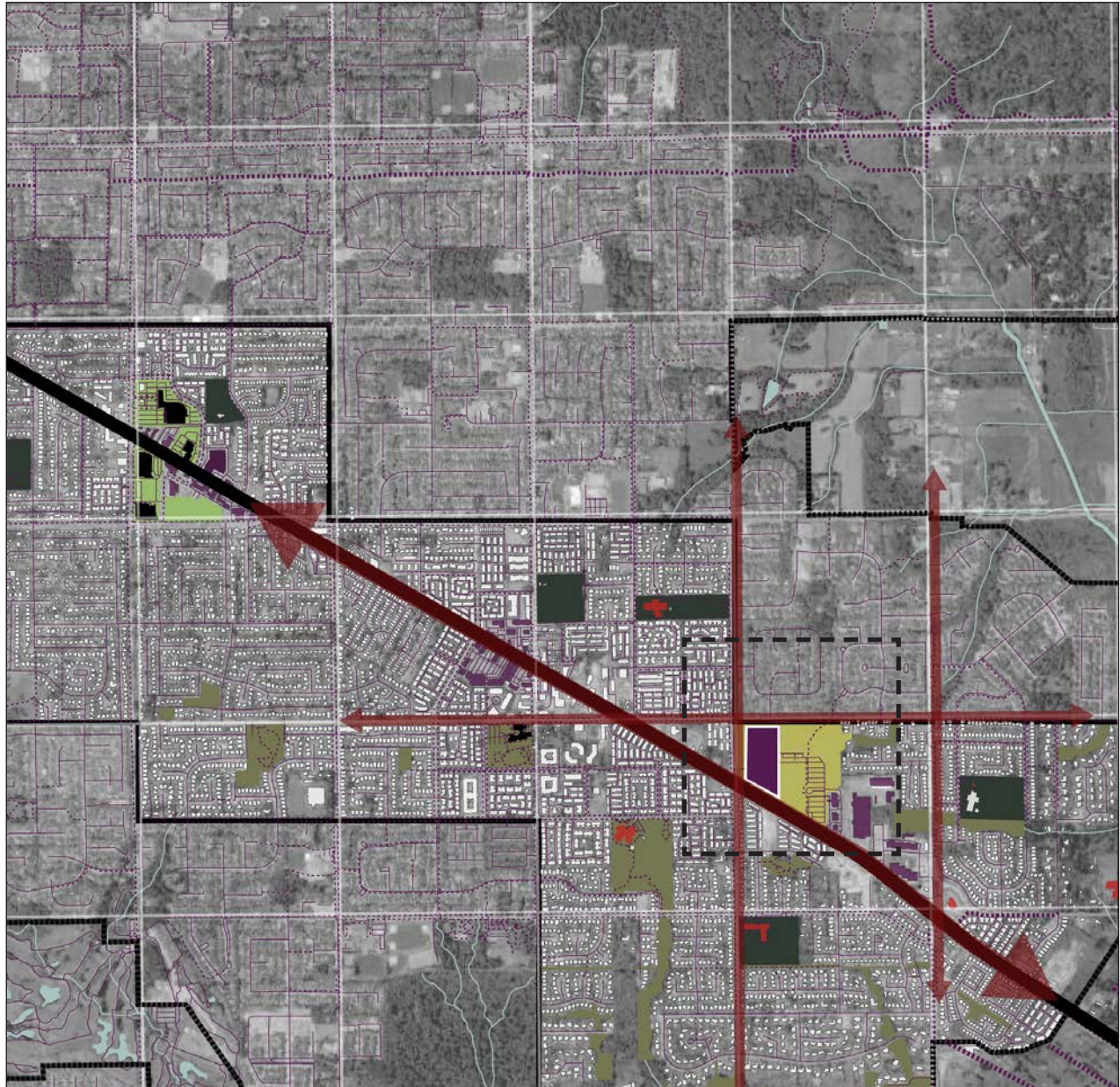
## Spatial Quality of the Community Food Hub

The proposed CFH is intended to include a wide open public space in order to create cohesion between the surrounding community and the activities in the hub. Inviting the public to enter this space opens up endless possibilities for further education and unplanned collaborations. It makes embeds agriculture and agri-tech innovation at a community level making it accessible to the wider public.





2.5km



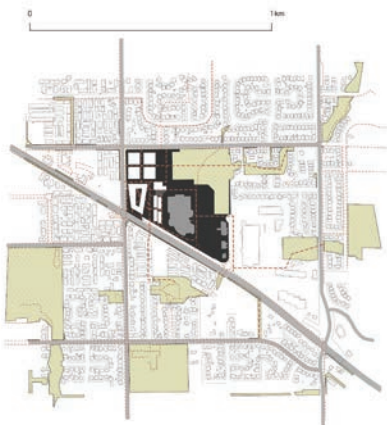
- Urban Agri-tech Hub
- Food Forest
- Community Gardens
- Community Food Hub
- Public Space
- Infrastructural and Grid Connections

## Network Connections

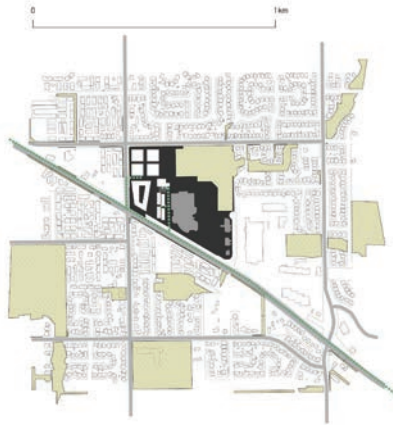
Creating this new anchor for the community also presents the opportunity to tie it into the existing bicycle, pedestrian and public transit network as shown on the maps below and adjacent. By expanding on existing connections in the community, the CFH becomes both a new destination and a part of the existing network.

Here the CFH sits at a junction between the grid and a crossroad with the Fraser Highway, presenting an opportunity to create a hub in a location where multiple lines of infrastructure intersect. This allows for the CFH to be well connected but also strengthens its position as a community hub. This close relationship with existing infrastructure also provides ease of access for the transportation of goods to the processing and distribution centre.

Pedestrian Network



Logistics Network



Bicycle Network



- Existing Greenspace
- Primary Roads
- Cycle Lane
- Existing Footpaths
- Proposed Footpaths
- Logistics Network



**Reflection:** *Potential for Growth*

---

As an anchor, the CFH also presents an opportunity to trigger further development in order to further address the shortage of housing in the region. By creating a community hub with large-scale facilities, a denser urban environment surrounding the CFH seems like a logical way forward. It can serve as a catalyst for greater densification along the corridor. As a key transit link across the region, the Fraser Corridor also holds this potential but with the activation of spaces for community and food production, micro-densifications along the same corridor can become part of this transformation. Below is a very brief exploration of how the adjacent land to the site of the proposed CFH has the potential to experience such a transformation.



### Next Steps - Incorporating Additional Agricultural Typologies

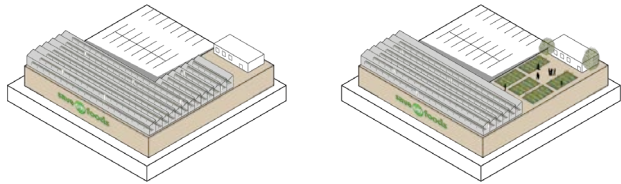
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These two vital steps in of concentrating and dispersing agricultural activates along the Fraser Corridor are envisioned as part of a larger transformation across the region that employs all of the strategic interventions discussed at the beginning of the design challenge. Although not designed in detail in this thesis project, urban agro-tech hubs, food forests, and community gardens would ideally play an important role in disseminating cultivation throughout the corridor at different scales.

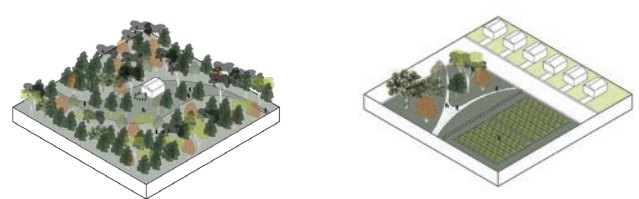
The agri-tech hubs would be an experiment in creating a partnership with the supermarket industry (who are not typically in the business of growing food) but could benefit in the long-term if growing some fresh produce on-site could ultimately become profitable. This could possibly be feasible if vertical agriculture techniques were employed and if they stuck to certain, high quality, high yielding plant species.

Community gardens and food forests, on the other hand, would be a hyper local activity, not requiring enormous space, but rather a clear stewardship and community-led program to maintain the vitality and productivity of such activities.

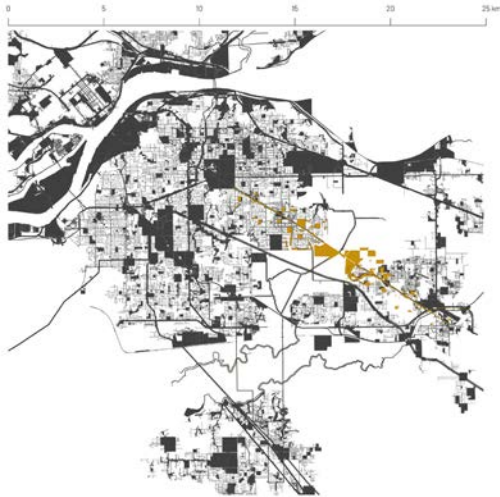
Urban Agri-Tech Hubs



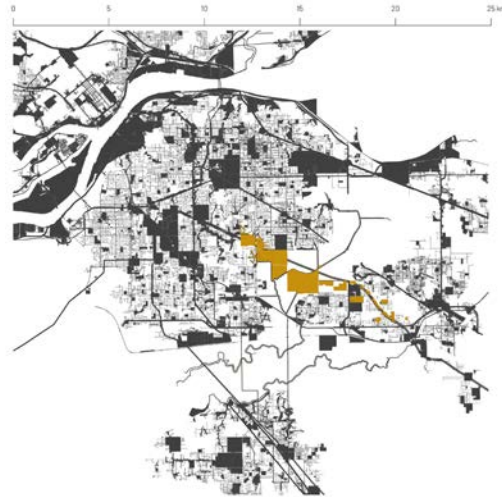
Food Forests and Community Gardens



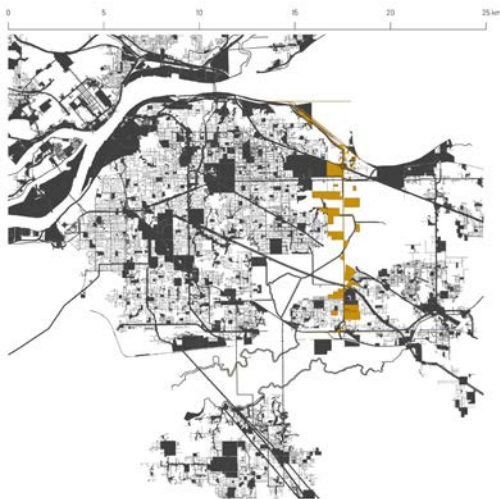
Fraser Corridor



Cloverdale Corridor



Pacific Corridor



Green Timbers Corridor

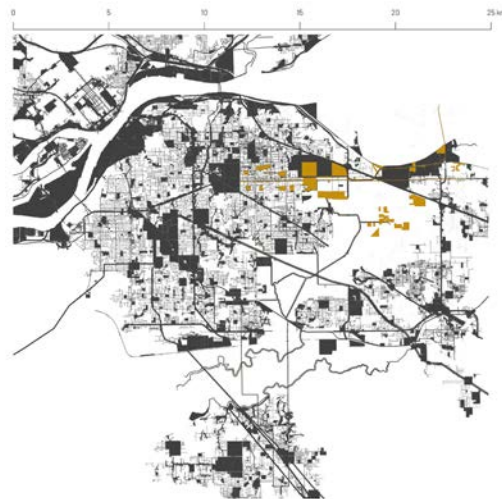


FIG. 5.8 Diagrams of each corridor embedded into larger regional network to demonstrate possibility for extending the corridors further across the region



## Design Conclusions : *Potential to Scale Up*

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The research and design explorations conducted in this thesis sought to look at how the structure and vulnerabilities of Canada's only urbanized delta region not only affect the built and densely inhabited environment of the Lower Mainland, but has deep repercussions for the agricultural landscapes that sustain our economy and our appetites. In discussions around climate adaptation, productive landscapes such as the ALR are not always central to the discussion. Certainly, work has been done to emphasize the importance of safeguarding and increasing the productivity of these spaces, but few experimentations have been done to demonstrate the spatial consequences. This design proposal has made a first attempt to do this.

In a further elaboration of the project, each intervention (urban agri-tech hubs, community gardens, food forests, agro-forestry, greenhouses, and low impact communities) proposed for the Fraser Corridor would be applied throughout the territory. Each productive space has a role to play to ensure greater self-reliance and together they would form several linear networks that extend beyond the limits of Surrey and Langley.

The next step would be to explore the design opportunities for the Cloverdale, Green Timbers and Pacific corridors. Each would be characterized by their unique context, but would follow a set of design principles derived from the small scale interventions proposed for the Fraser Corridor.

These design principles could include:

- **Multi-scalar food production** to ensure a continuous supply of food at all levels of the community. This can range from food forests to community gardens, field crops to greenhouses and agro-forestry. This multi-scalarity and diverse range of food production mitigates vulnerability in the regional food system and adapts cultivation to be more resilient to shocks.
- **Spaces for cultivation are accessible and visible to the public.** Embedding productive spaces into communities allows for a greater sense of connection with our food supply and the seasonality of cultivation in the Lower Mainland
- **Education, innovation, and community spaces are partnered with and/or integrated into new productive areas.** This maintains that people are directly connected with food production, not only as consumers, but as gardeners, employees, students, and collaborators.

By applying these set of rules to each corridor and interpreting them based on the given context, a regional agricultural network can become diverse, productive, resilient and self-reliant.

On a regional scale the corridors extend to connect with other industrial, commercial, and municipal parcels of land that have the potential to be part of the network. These possible connections can be seen on the adjacent map.

## Design Conclusions : *Final Thoughts*

---

The spatial transformation and adaptation of the Lower Mainland over 130 years demonstrates the rational organization of a territory that is the result of productive efficiency and extensive urban development. While large open tracts of land have remained protected throughout the region, they are reserved for agriculture and arguably, are as urban as the rest of the Lower Mainland.

The analysis of agriculture and spatial transformations in the region demonstrated a gradual development of infrastructure in response to the local economy or natural disasters and the incremental division of land-use along strict lines (ie. the Jefferson grid). Productive land is clearly designated by the ALR boundaries while urban areas are constricted to its borders, nature is excluded to small parcels of undeveloped land and the grid, defined by roads and highways, maintains a regularized urban pattern across the region. In carrying out this research, the intention was to explore the possibilities for further transformations that would consider current variables related to climate change and the capacity for the region to become more self-reliant in food production. Working within these parameters called for a renegotiation of these strong divisions in the land and a reliance on the existing infrastructure to justify a design response

The intent of this design proposal was, therefore, to demonstrate a way in which the Lower Mainland can begin making structural, spatial changes to the regional food system in order to increase the potential for greater self-reliance. Certainly, this transition requires a greater shift in policy, trade agreements, buying power and even a shift in the typical diet of inhabitants across the region. This is a process that cannot happen over a short period, but incremental changes can undoubtedly build momentum over time. In choosing one corridor and a handful of multi-scalar design interventions, the intention was to demonstrate how agriculture can be integrated into the region more seamlessly, breaking out of the boundaries of the ALR.

Furthermore, this project explores only one iteration of reorganizing the territory - for the purpose of increasing productivity - although there are numerous possibilities. The design proposal takes the position that diversifying production methods through several agricultural typologies along specified corridors (which can coherently connect to each other and the region as a whole) increases the ability to become self-reliant and an opportunity to create a more robust and resilient food system. This iteration shows what is possible if we intensify the productive centre and inject multiple crop typologies to the fullest extent. Space for people and water is created, but a 'building with nature' approach is not applied here. As mentioned in the previous section, this iteration does not propose a design that allows an abundance of space for the river. Instead, the argument is that if production can be concentrated along specific corridors, additional space for nature can be integrate elsewhere.

Productive space is not the only method applied in the design proposal. The ability to process food and distribute it is shown with a logistical network of proposed for the greenhouse and community food hub for example.

Finally, these design interventions play a role in integrating public space, water management (to adapt to the greater risk of flooding) and alternative community living environments in order to avoid repeating the existing divisions identified in the analysis. Only then can people have the chance to re-connect, in a more tangible way, with the processes of cultivation and the importance of sustaining and enhancing our productive landscapes.

With these pressures and uncertainties comes the need to adapt where we live and re-imagine our food-producing regions, so they can withstand sudden shifts in climate, public health, and the economy. This study aims to advance current knowledge on the role of food production and the spatial quality of agricultural areas in the metropolitan regions of Vancouver- focusing on the possible ways in which to transform our food systems to become more self-sufficient and resilient.

Planning for the uncertainty of our collective future is one of the most pressing challenges that humanity faces today. In 2020, we are experiencing the aftermath of what it means to be unprepared for dramatic shifts in a global order we have come to heavily rely on. While Canada certainly has the ability to make the crucial changes and adapt to these challenges, there is a lack of urgency when carrying out the necessary steps to do so. Moving forward, incremental changes in how we produce food - such as the restructuring of our agricultural landscapes with diversified agricultural typologies - can begin to make the shift towards greater self-reliance in the face of unpredictable disasters and a more sustainable way to manage our valuable land and its resources.





# 6 – Reflection

## Project Topic

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The inspiration for this thesis project originally came from the notion that Canada has not yet seriously responded to and taken progressive enough steps to mitigate or adapt to the effects of climate change. While there is no doubt that the seriousness of climate change is mostly undisputed across the country, the practical steps that we must take to slow and mitigate this climate transition and the adaptations we must begin making now are not happening at a scale that will truly make a difference.

Despite relatively progressive policies put forth by the government to tackle the challenge of mitigation, cities and regions are only beginning to address the equally important task of adaptation. However, this conversation typically focuses on the spatial adaptability of shorelines, dense urban environments and the enhancement of green spaces. There is no doubt that these are important measures to adopt, however, there is a lack of discussion regarding how our regions, particularly the agricultural landscapes that sit on edge of cities across Canada, must also adapt.

Agriculture is a key part of the Canadian economy, both in the export of products grown in Canada as well as the importation of fruits, vegetables and nuts from the United States, Mexico and Asia. This reliance on imported food has, until recently, been a normal part of the food supply chain in Canada. However, with a changing climate affecting places like California (where a lot of fresh produce is imported from) and global challenges such as the COVID-19 pandemic, these supply chains are becoming more vulnerable to unexpected disruptions. This, in turn, threatens the food security of all Canadians.

With this in mind, I began by looking at most vulnerable regions across Canada and found that the Lower Mainland of British Columbia had striking parallels with the Netherlands and Veneto, Italy which were the focus areas for 2 studio design projects during my last two years of study at TU Delft. The Lower Mainland is an urbanized delta region – in fact Canada's only such region. It sits between the Pacific Ocean and the Pacific Cordillera Mountain Range and is bisected by the Fraser River which flows from the interior of the province.

It is known for its quality of life and close connection with the tremendous extent of nature and vast beauty that surrounds the city and it is one of the most agriculturally productive regions in Canada. But, as with all delta regions around the world, the Lower Mainland is already facing the pressure to adapt to a rising ocean, unpredictable fluvial flooding on the Fraser River and increasingly common drought periods during the summer. Parts of the delta are also subsiding as urbanization continues to expand across the territory.

With these pressures and uncertainties comes the need to adapt not only our cities but also our food-producing regions, so they can withstand sudden shifts in climate, public health, and the economy. This study therefore aims to advance current knowledge on how to reshape metropolitan regions in Canada in order to be more self-sufficient and climate adapted.

### **Scientific Relevance and Transferability**

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Exploring the spatial role of agriculture in a metropolitan region and the capacity for adaptation has as much to do with urbanism and planning as it does with the hard science behind crop production, resource management and soil science. These topics are highly transferable as each should, in theory, inform the other. Decisions regarding the spatial reorganization of agricultural production, for instance, should be deeply connected with the science behind crop production and water management. The relevance of these functional aspects in the spatial organization of a farm plot is considerable and should always be taken into account.

### **Societal Relevance**

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The societal relevance of exploring the topic of regional self-reliance in food production and climate-adapted agricultural practices is extremely high given the circumstances we find ourselves in today. With global pandemics, disruptions in food supply chains, unexpected and disastrous storm events and a growing urban population, it is paramount that we reconsider the design of the systems that we have built and rely upon. These systems can be related to regional food production, infrastructure that safeguards communities from flooding, or policies that protect natural areas and vital agricultural land from development.

### **Ethical Issues and Dilemmas**

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When discussing local self-reliance in food production for example, it is often thought that local = more expensive and thereby excludes those who cannot afford to access it. This ethical issue of access to healthy, sustainable food is often the main critique of local food movements. This is always a tough subject to approach because, indeed, it is true that the cost of producing locally and at a small scale is typically more than the cost of producing food on an industrial scale. Access to food and ensuring food security for everyone, regardless of social class or buying power, is of great importance when considering the implications of creating greater self-reliance.

### **Methodology and Limitations**

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The methodologies used in this thesis project are useful for gaining a deeper understanding of the transformation of the territory through time. Moving through multiple scales and using three 'layers' to understand these transformations provides further insight into the development of the region. Given the limitation of time to complete this thesis, this methodology is useful for gaining a first reading of the territory.



## 7 – References

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- Benke, K., & Tomkins, B. (2017). Future food-production systems: Vertical farming and controlled-environment agriculture. *Sustainability: Science, Practice, and Policy*, 13(1), 13-26. <https://doi.org/10.1080/15487733.2017.1394054>
- Boswell, M. R., Greve, A. I., Seale, T. L., Boswell, M. R., Greve, A. I., & Seale, T. L. (2012). Climate Change Adaptation Strategies. *Local Climate Action Planning*, 153-182. [https://doi.org/10.5822/978-1-61091-201-3\\_6](https://doi.org/10.5822/978-1-61091-201-3_6)
- Curry, C. L., & Zwiers, F. W. (2018). Examining controls on peak annual streamflow and floods in the Fraser River Basin of British Columbia. *Hydrology and Earth System Sciences*, 22(4), 2285-2309. <https://doi.org/10.5194/hess-22-2285-2018>
- Fujita, M. (2010). The evolution of spatial economics: From Thünen to the new economic geography. *Japanese Economic Review*, 61(1), 1-32. <https://doi.org/10.1111/j.1468-5876.2009.00504.x>
- Kostrowicki, J. (1977). Agricultural typology concept and method. *Agricultural Systems*, 2(1), 33-45. [https://doi.org/10.1016/0308-521X\(77\)90015-4](https://doi.org/10.1016/0308-521X(77)90015-4)
- Meadows, Donella H. *The Limits to Growth: A Report for the Club of Rome's Project on the Predicament of Mankind*. New York: Universe Books, 1972.
- Mendes, W., Balmer, K., Kaethler, T., & Rhoads, A. (2008). Using land inventories to plan for urban agriculture: Experiences from Portland and Vancouver. *Journal of the American Planning Association*, 74(4), 435-449. <https://doi.org/10.1080/01944360802354923>
- Napawan, N. C., & Burke, E. (2016). Productive potential: evaluating residential urban agriculture. *Landscape Research*, 41(7), 773-779. <https://doi.org/10.1080/01426397.2016.1151487>
- Portugali, J. (2011). *Complexity, Cognition and the City*. <https://doi.org/10.1007/978-3-642-19451-1>
- Salingeros, N. A. (2005). *Principles of Urban Structure (Design/Sci)*. Techne Press.
- Van der Zanden, E. H., Levers, C., Verburg, P. H., & Kuemmerle, T. (2016). Representing composition, spatial structure and management intensity of European agricultural landscapes: A new typology. *Landscape and Urban Planning*, 150, 36-49. <https://doi.org/10.1016/j.landurbplan.2016.02.005>
- Waldheim, C. (2013). Notes toward a history of agrarian urbanism. *Sustaining Cities: Urban Policies, Practices, and Perceptions*, 63-75.
- Government of Canada. (2011). *Federal Adaptation Policy Framework*. 1-8.

BC Ministry of Environment and Climate Change Strategy. (2019). Preliminary Strategic Climate Risk Assessment for British Columbia. July, 429.

CCA. (2019). Canada's top climate change risks: the expert panel on climate change risks and adaptation potential. <https://cca-reports.ca/wp-content/uploads/2019/07/Report-Canada-top-climate-change-risks.pdf>

McMillan, T., Causley, D., Hanna, K., Lulham, N., Seasons, M., & Boddy, S. (2019). Local adaptation in Canada: Survey report. June, 16. <http://ok-ccar.sites.olt.ubc.ca/files/2019/06/Local-Adaptation-in-Canada-Full-web.-1.pdf>

Yang, Dingliang & Busquets, Joan & Keller, Michael. (2019). Urban Grids: Handbook for Regular City Design.





