Determining the Viability of Vertical Farming Practices in the Fraser Valley: A Spatial Approach

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Introduction

With a growing demand for locally produced food, the agriculture sector faces growing challenges due to the rising effects of climate change on local food systems. This calls for the need to research innovative ways of addressing food system vulnerabilities in order to increase agriculture resilience against climate change and economic shock as well as observe the food supply/distribution challenges associated with conventional agriculture practices.

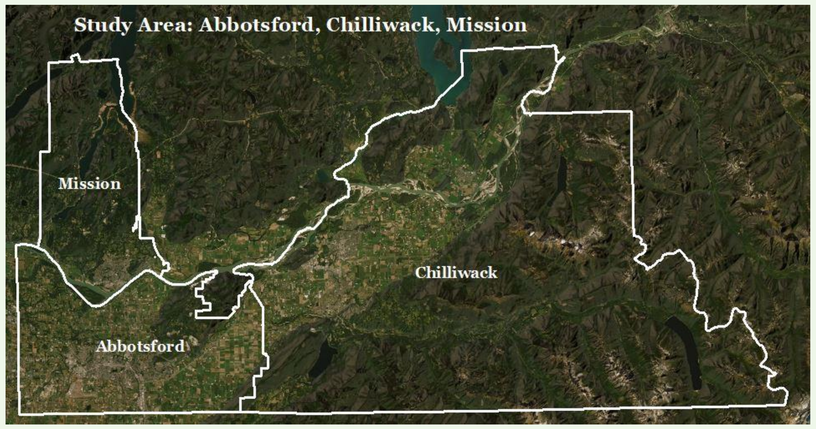
Vertical farms shows prospect, as it involves growing crops from inside a building. Stacks of shelves are used to grow multiple layers of plants vertically as opposed to traditional horizontal practices of growing. The growing conditions are manufactured using lights and temperature and humidity controls and is often done using methods such as hydroponics or aeroponics. The University of the Fraser Valley's Food and Agriculture Institute's project at the Chilliwack campus is the site of a demonstration vertical farm operated by QuantoTech Ltd., which experiments with growing lettuce using a hydroponic system. The Food and Agriculture Institute at UFV is collaborating with QuantoTech and I-Open Technologies I-Open Technologies's map-based program, Agrilyze to examining the role of and potential development patterns for vertical agriculture in communities in the Lower Mainland. This aspect involves integrating community-based data into the map-based program Agrilyze to identify to identify the environmental, social, and economic implications of vertical farms in different neighborhoods throughout British Columbia (University of the Fraser Valley, 2022).

With a rise of urban centers, vertical farming aids in growing food closer to home to reduce transportation costs as well as shorten the travel time between farm and table, reducing food waste and the overall carbon footprint (Ungvarsky, 2022). This method is an alternative avenue for providing sustainable food production, distribution and access that align with environmental, economic, and food security objectives.

Objectives

1. Utilize a geospatial approach to create a food miles mapping system to provide comparative data of vertical farm food miles distance in contrast to conventional farming practices.
2. Identify future potential urban vertical farm locations with distance buffers (1km, 5km and 10km) to determine neighborhood coverage
3. Identify existing and potential opportunities and limitations in visualizing/representing map-based information/data for future vertical agriculture development in the study area.

Study Area

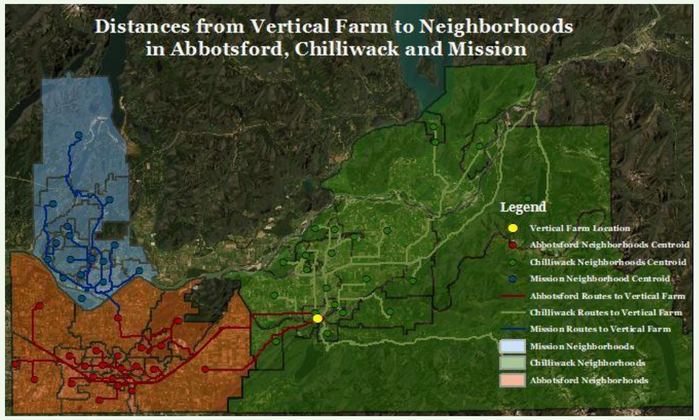


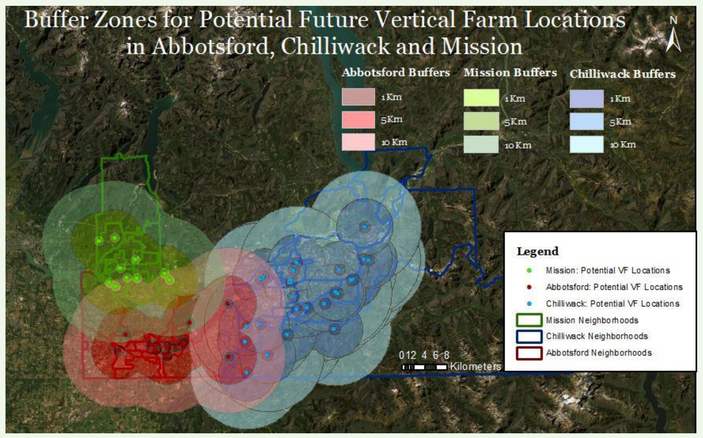
Procedure

1. Utilizing the ArcMap platform, polygon Census Tract polygon with attribute data and the road network shapefile from BC Data Catalog, Canada Statistics and CHASS servers was downloaded.
2. Utilizing ArcMap application, manually modify Census Tract polygons to encompass local neighbors within Abbotsford, Chilliwack and Mission District.
3. Join additional Census Tract attribute data to modified neighborhood polygons for population and dwelling numbers.
4. Convert data to QGIS platform to calculate centroid point of each neighborhood polygon.
5. Using QGIS's network "Point to Layer" tool, determine shortest distances following a road network from vertical farm to local neighborhoods.
6. In ArcMap platform perform additional analysis regarding road ligament length and polygon areas.
7. Prepare a trial map for the vertical agriculture research project that the research participants utilized/tried to assess the role of food miles using a map-based interactive tool.
8. Perform secondary research of realtor sites to develop a point layer file of future potential vertical farm location with attribute data regarding cost and size.
9. Create buffers around potential future fam locations (1km, 5km, 10km) to provide neighborhood coverage to all areas.

Map Results

- It should be noted that the results are still being compiled and therefore the research is in its preliminary stages





Results of Distances between Vertical Farm and Neighborhood Regions

Abbotsford

Neighborhood	Population	Dwellings	Distance to Vertical Farm
Bradner-Mt. Lehman	6765	2057	44
Clayburn	9975	3198	28
Whatcom	8142	2918	24
Sumas Prairie	4651	1660	18
Aberdeen	4696	1376	40
McKee	4918	1522	24
Sumas Mountain	1296	394	25
Fairfield	10123	2825	32
South Clearbrook	7406	2323	31
Townline	17777	4668	35
South Poplar	3237	903	31
Clearbrook	9997	4379	32
City Centre	14054	6585	30
Marshall-McCallum	9604	4157	28
Historic Downtown	10084	4949	28
uDistrict	2600	1058	28
Sumas Way	2422	893	27
Immel-McMillan	7445	2475	26
West Abbotsford	2638	754	40
Peardonville	1187	426	34
Hazelwood	1248	488	30
Matsqui Prairie	4362	1413	32

Chilliwack

FID	Neighborhood	Population	Dwelling	Distance to Vertical Farm
0	Tzeatchen	2358	1205	4
1	Agassiz	6100	2361	34
2	Chilliwack	28294	13113	9
3	Island 22	25	8	13
4	Greendale/South Sumas	3036	1000	8
5	Industrial/Village West	146	80	7
6	Shxwhá:y	544	282	10
7	Yarrow	3464	1179	8
8	Promotory	9959	3479	5
9	Fairfield Island	3897	1344	13
10	Popkum	1741	676	55
11	Seabird Island	767	231	34
12	Sardis	13612	5701	4
13	Chilliwack Mountain	1493	616	14
14	Cultus Lake/ Chilliwack Lake	3387	2129	31
15	Ryder Lake	3181	1322	13
16	Vedder Crossing	11187	4443	1
17	Rosedale	4537	1493	17
18	East Chilliwack Southside	1071	351	9
19	Harrison	1468	928	36
20	Little Mountain	998	378	14
21	Soowahlie	247	76	4
22	Eastern Hillsides	3181	1322	13

Mission

FID	Neighborhood	Population	Dwellings	Distance to Vertical Farm
0	Stave Falls	932	361	52
1	Keystone	1010	439	46
2	Silverhill	337	118	47
3	Ferndale	7593	2231	43
4	Steelhead	971	400	50
5	Hatzic	3106	1180	41
6	Israel Bench	112	46	41
7	Fraser Corridor	337	118	42
8	Silverdale Community	112	46	44
9	Cedar Valley	7593	2231	41
10	Mission Core	4408	1616	39
11	Silverdale	1011	334	44
12	Silver Creek	112	46	43
13	Upper Stave Lake	103	43	62
14	Matsqui Island	1384	511	39
15	Unpopulated Area	0	0	47

Results

It was found that in total 22 Neighborhood districts were developed within the City of Abbotsford, 22 in Chilliwack and 16 residing in Mission. With a minimum traveled distance between the vertical farm and Neighborhood being 1km in the Vedder crossing neighborhood of Chilliwack and the maximum distance traveled being 62 km traveled for the Upper Stave Lake neighborhood of Mission. In comparison to convectional farming practices which often has produce traveling from across the across the continent, vertical farming keep travel distances low and in turn reduces food waste and carbon emissions.

For future potential vertical farm locations, 31 potential spots were identified in Chilliwack, 13 in Abbotsford and 15 in Mission utilizing realtor listings. These locations were selected based on farm and vacant land status that reside near the neighborhood zones.

Feedback from the focus group, suggested the integration of calculating greenhouse gas emissions for vertical farming practice would provide additional insight on its overall carbon footprint. They further found that with the neighborhood zones originally being divided by Census Tract zones (Max 900 hectares) it was found that with such precise zones, users found it difficult finding their own residence and suggested the utilization of neighborhoods zones which was integrated into the final map project.

Acknowledgements

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References

- Ungvarsky, J. (2022). Vertical farming. *Salem Press Encyclopedia of Science*.
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