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The background of the cover is a photograph of an urban garden. It shows several green leafy plants, likely chard or similar, growing in a patch of soil. The soil is interspersed with dry, brown leaves and some green grass. To the left, there is a dark, textured surface, possibly a concrete wall or a large rock, which the plants are growing against. The overall scene depicts a small-scale agricultural space within an urban environment.

An Investigation of Urban Agriculture on Residential Blocks in Vancouver

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All research was undertaken by undergraduate students in the Environmental Sciences program at
The University of British Columbia.
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Executive Summary

Urban agriculture, which encompasses growing food on residential land, community and school gardens, rooftop gardens and inner city farms and any other food growing that occurs within a city, is an increasingly popular activity in the City of Vancouver. Urban agriculture has many environmental and social benefits and this is recognized in recent publications by municipal governments of the region. The focus of this project was to investigate how land is partitioned on residential blocks, how much residential land is being used to grow food, and if there is space and willingness to increase food growing on residential blocks. We also investigated whether residents would be willing to share their yard space if they have it. To answer these questions, we analyzed aerial photos of one block randomly selected from each of Vancouver's twenty-two neighbourhoods and administered a survey to the residents of these neighbourhoods. We grouped the twenty-two neighbourhoods of our analysis into four categories based on their dwelling density.

Some important findings were that 77% of Vancouver residents believe it is important to eat food that is grown locally, 52% of Vancouver residents grow some food for some period of the year. There is a significant correlation between individual residents' responses relating to the importance of eating local food and whether they grow food. We also found that between 8-12% of the yard area of residential blocks is currently being used to grow food, which leaves space for food growing to increase. Our survey data indicates that there is not only available space, but also willingness on behalf of residents for food growing to increase. The data also indicates that given various conditions, at a minimum 26% of residents would be willing to share their yard space for others to grow food on. Based on the findings from our analysis of aerial photos and from our survey, we make the following recommendations:

- Increase education on the benefits of growing food and how to tend a food garden in Vancouver.
- Encourage and support Vancouver residents to grow food on residential spaces.
- Support the existing supply of local food in its many forms and preserve existing agricultural land.
- Provide more long lasting spaces for growing food for recreational and commercial purposes.
- Use data on current high density areas as predictors for the needs of low and medium density areas in the future.

Green space on residential blocks is an inventory of land that currently contributes to urban agriculture in the City of Vancouver. With appropriate action on behalf of residents and local governments, this inventory could be used to increase urban agriculture, which has the potential to benefit the City and its residents in various ways.

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Introduction

In the early 20th century, streetcar and interurban lines gave Vancouver city dwellers an affordable means of transport to farms and local food producers. The interurban lines also had trips designated for the transport of local produce and dairy from the Fraser Valley, fish from canneries in Steveston and other food products into the city (Conn & Ewert, 2003). At the time, a large portion of residents' diets consisted of locally produced food. Conversely, during the century that followed, Vancouverites increasingly relied on imported foods to meet their needs.

Now, in the early 21st century, Vancouver is part of an interconnected global food system. Recently, issues of malnutrition, hunger, famine, increasing fossil fuel emissions, and the uncertain impacts of global climate change, have led to global efforts to improve food systems at global, national and local levels. The Rome Declaration on World Food Security, adopted in 1996, outlined action to be taken by nations to achieve food security domestically and internationally, with food security being a state where "all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO, 1996).

National action in Canada includes the creation of food policies and/or food policy councils in cities like Toronto, Ottawa, Kamloops, Winnipeg and Vancouver (Mendes, 2008). Mendes (2008) describes urban food policies as decisions that "affect whether opportunities to grow food in the city are supported" and the implementation in 2003 of the Vancouver Food Policy Council was the result of over a decade of community organizing and lobbying.

Now there is evidence of increased urban agriculture in the city, which contributes to greater food security within the City of

Vancouver. "Urban agriculture", which encompasses community and school gardens, residential food growing, rooftop gardens, inner city farms, or any other food growing that occurs in the city, continues to expand. Evidence of expanding agricultural practices includes the increase in the number of community gardens and plots in the city, with 950 plots registered with Vancouver's Food Policy Council prior to January 2006, and 2029 new plots added between then and December 2009. Vancouver schools in collaboration with the Society Promoting Environmental Conservation (SPEC) are initiating gardening projects and as of 2010 have two staff members that work on projects in six Vancouver schools (SPEC, n.d.). Furthermore, farming on city land as a livelihood (entrepreneurial agriculture) is also on the rise (Stolhandske, 2011).

The City of Vancouver's Greenest City Action Plan and the Metro Vancouver Regional Food System Strategy of the City of Vancouver, along with the Food Policy Council, recognise that urban agriculture is beneficial and should be encouraged. The former aspires to reduce the carbon footprint of the food in the city by 33% by 2020, have the city become a global leader in urban food systems, promote urban farming initiatives, and offer grants to support urban food projects (The Greenest City Action Plan, 2011). Metro Vancouver's Strategy, while not specific to the City of Vancouver, aims to increase the capacity to produce local food, create a food system consistent with ecological health, and finally, encourage and increase the land available for urban agriculture in Metro Vancouver (Regional Food System Strategy, 2011).

There are environmental, social and economic benefits to this increasing urban agriculture trend. These support our claims that the City of Vancouver could benefit from increasing urban agriculture.

Benefits of Urban Agriculture

Environmental Benefits

Reduced Emissions

6,000 people move to Vancouver on a yearly basis, which is causing an increase in density and will cause further stress on the local food system (Bentley, 2005; Hild, 2009). Currently, approximately 25% of the average Vancouver urbanite's carbon emissions originate from food production and distribution (Greenest City Action Plan, 2011). Metro Vancouver can produce 27% of its food needs (Serecon Management Consulting Inc., 2009), leaving a large portion of food that must be imported. Because so much food must travel several miles before getting to our plates, (Food and Agriculture Organization of the United Nations (FAO), 1996) this large contribution to per capita carbon emissions can be greatly reduced through an increase in local food production and consumption. In addition, it is likely that the contribution to emissions that comes from "energy-intensive production practices, the heavy use of synthetic fertilizers and pesticides, processing, storage and packaging" (Greenest City Action Plan, 2011), can be lessened with an increase in the consumption of locally grown food.

Waste Reduction

Waste reduction is another benefit of local food production. When there is less need to store and transport food long distances without damaging it, the need for food packaging decreases (Garnett, 1996). Also, if residents are growing their own food, there is greater incentive to compost their organic food waste in order to enrich their garden's soil, thus decreasing the amount of organic waste being sent to landfills (Hancock, 2001). At the moment in Vancouver, food scraps are collected from single-family, duplex and row house dwellings for composting. The city also has a program to provide backyard composters to Vancouver residents at an affordable price to

reduce the volume of material to be transported and composted by the solid waste management department.

Preservation of Biodiversity

As urban environments continue to expand and replace natural ecosystems, the need to conserve biodiversity by having urban green spaces increases. The urban green spaces that do exist are underutilized and often are simply lawn space (Proksch & Roehr, 2010). Practicing urban agriculture assists in harnessing the potential of these urban green spaces. Urban agriculture replaces lawn space with productive, biodiverse regions. These spaces become habitats for birds, insects, and plant life and can encourage the growth of rare or endangered species as well as generating a more effective habitat for transient species (Miller, 2008). This not only has an impact within the city limits, but also on the rural areas surrounding the city (Miller, 2008). For the above reasons, the city of Vancouver could benefit ecologically and environmentally from an increase in local food production, which appropriately is a part of the Greenest City Action Plan.

Social Benefits

In addition to producing local food for residents and being environmentally beneficial, urban agriculture provides residents with benefits from the act of growing food. For example, growing food in community gardens can benefit a community by enhancing social interactions between the residents and fostering a community identity (Proksch & Roehr, 2010). A case study of community gardens in upstate New York found that the existence of community gardens in the region enhanced social networks within communities and strengthened the communities' ability to organize (Armstrong, 2000). This was particularly relevant in neighbourhoods of lower income housing, or where the population was mostly made up of minorities (Armstrong, 2000).

There are several health benefits associated with urban agriculture, the most

commonly cited being that gardening is an excellent form of physical exercise (Bellows et al., 2004). Evidence also shows that when a person produces some of their own food, their consumption of fresh vegetables increases (Bellows et al., 2004). This connection with plants and nutritious foods puts gardeners in a better position to make healthy food choices than non-gardeners and average consumers. Participation in gardening activities can also have mental health benefits (Bellows et al., 2004).

Urban agriculture can contribute to local job creation. Entrepreneurial urban agriculture, defined by Stolhandske (2011) as “private commercial urban agriculture enterprises”, is becoming a viable source of income. Agricultural land in the Vancouver region is quite costly. Urban agriculture is more accessible to young farmers who might not want to commit to a large property. Additionally, programs that provide professional agricultural education, job training and rehabilitation can provide transitional employment to the previously homeless and the incarcerated while providing a source of local food for the community (Proksch & Roehr, 2010).

In other models of entrepreneurial agriculture, there could be designated school gardeners or neighbourhood gardeners, people who tend to gardens and crops, in addition to the residents involved, to increase yields and success rates. For these reasons, as Vancouver’s residents become more involved in growing food, not only can the food system become more localized, but the community members can benefit as well.

Our Research

Given the benefits of urban agriculture, our research explored the land use of residential blocks as well as the attitudes of Vancouver residents towards urban agriculture. Our research was motivated by the following questions:

- 1) How is land partitioned on residential blocks
- 2) How much residential land is being used to grow food?
- 3) Is there space and willingness to increase food growing on residential blocks?

Methods

Approach

To answer our research questions we took a two-fold approach: we analyzed aerial photos of Vancouver and administered a survey. The aerial photo (orthophoto) analysis allowed us to constrain the potential growing space on residential blocks and to estimate the effect of shade, which effectively reduces the potential growing space. The purpose of the survey was to determine the current food growing habits of Vancouver residents, their perspective on growing food, and their willingness to participate in various urban agriculture initiatives (see Appendix 1 for survey). Our study sample included one block randomly selected from each of Vancouver’s twenty-two neighbourhoods.

Orthophoto Analysis

Land Partitioning

For each of our blocks we obtained orthophotos taken in 2009 from Vancouver’s Open Data Catalogue. Using ArcGIS 10 (Geographic Information System), we created a “land use” layer for each orthophoto with five attributes: building, cement, yard, city green space, and unknown. The spaces that corresponded to these land use designations were determined by looking at the orthophotos, as well as using Google Street View and outlined manually (Figure 1).

- The “building” attributes included garages, houses, and any stairwells or patios connected to these structures.
- “Cement” designated any paved region.

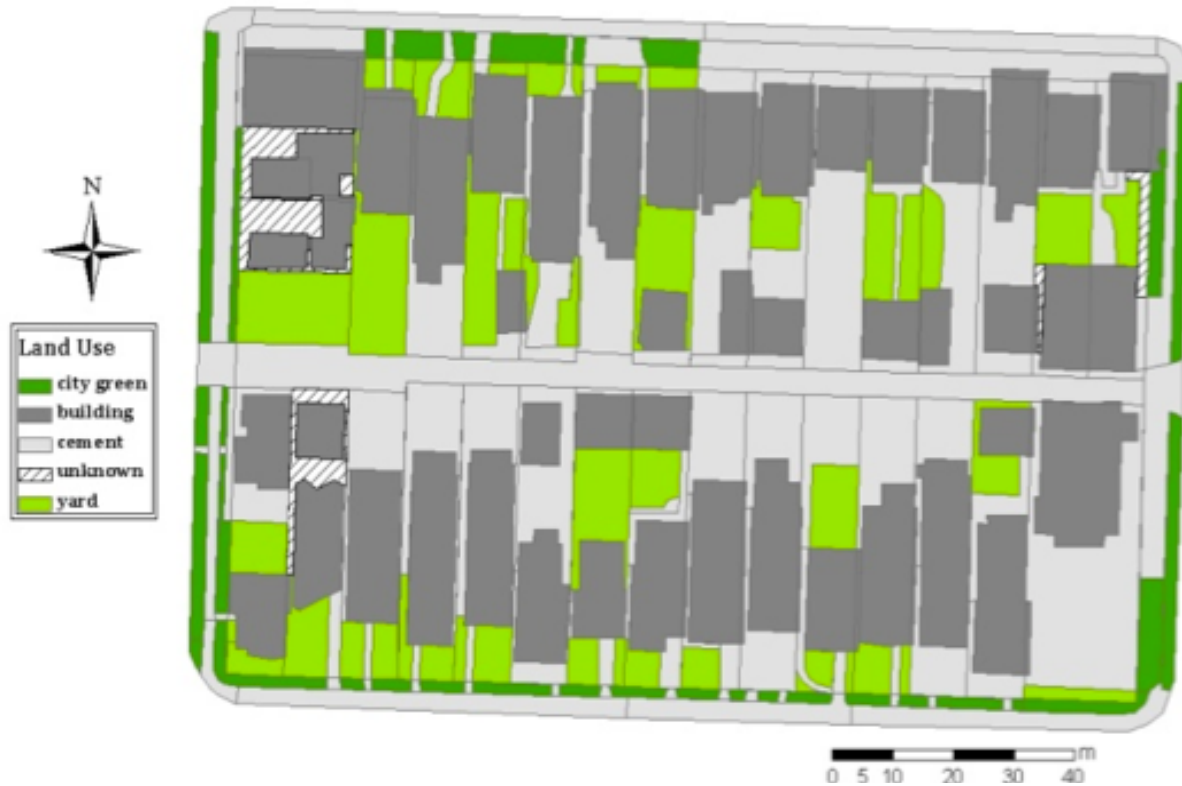


Figure 1. An example of one city block showing the land partitioned into city green (city owned green space), building, cement, yard and unknown.

- “Yard” space was any green region within property lines.
- The “city green space” attribute was assigned to the green regions between the sidewalk and the road, and between the sidewalk and property lines. To properly distinguish between private land and city owned land, we obtained property line information from Vancouver’s Open Data Catalogue. These regions are owned by the City of Vancouver.
- Regions that were unclear looking at the orthophotos or at Google Street View were given the attribute, “unknown.”

Partitioning of Sunny and Shady Areas

Solar radiation analysis was conducted using ArcGIS 10. An elevation point dataset was obtained from Vancouver Data Catalogue. Building heights were estimated using Google Street View by calculating ratios of the building

height to objects of known dimensions (e.g. a door). Heights of the buildings were then added to the Vancouver elevation layer, and this dataset was used as the input for the “Area Solar Radiation” tool. The ArcGIS tool calculates the total solar radiation (diffuse and direct) on a certain surface, during a specified duration of time in watt-hours per square metre (Wh/m^2) (Figure 2). We focused on the growing season: May 1st and September 1st, during which time Vancouver has an average of 8.4 hours of sunlight/day and an average of 15.5 hours of daylight/day. The solar radiation map was reclassified into three categories: “full shade,” “partial shade,” and “full sun” (Table 1). This reclassified layer was overlaid onto our “land use” layer allowing for the extraction of data where the solar radiation classification overlapped with yard, cement, and city green space.

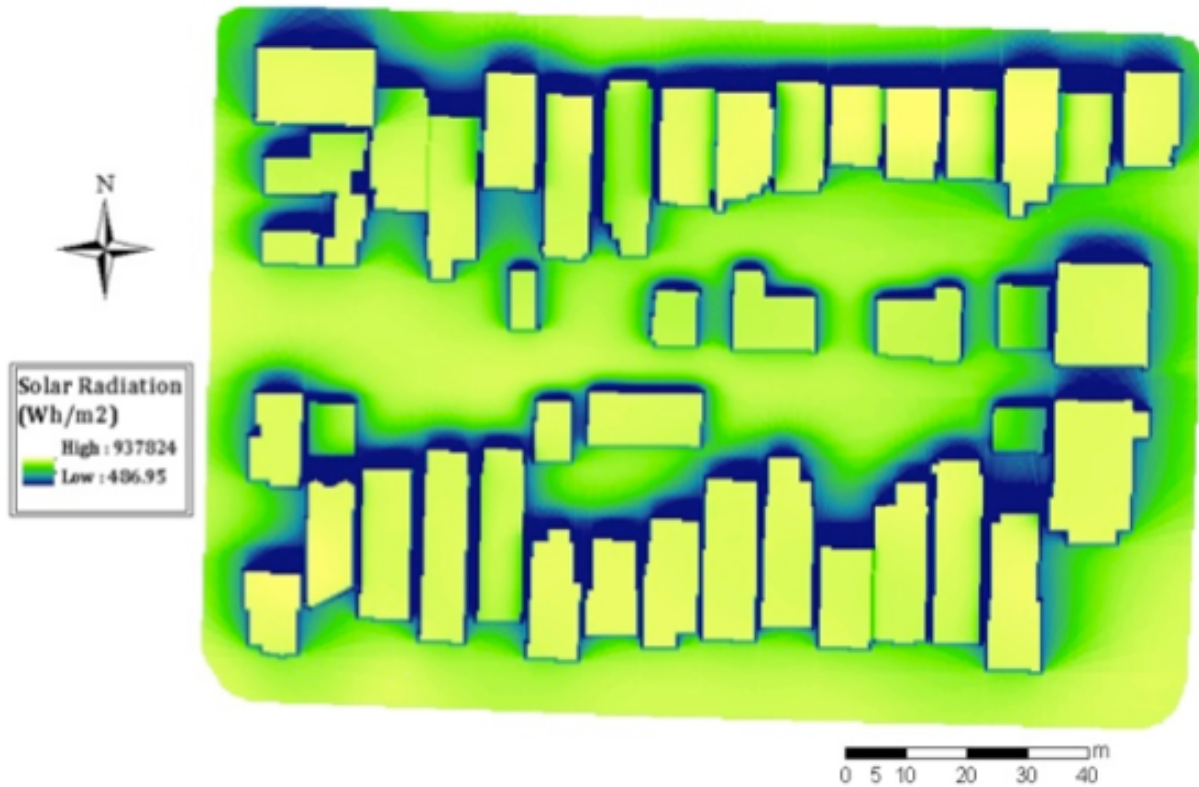


Figure 2. An example of the same city block (Figure 2) showing the total solar radiation (diffuse and direct) in Wh/m^2 taking into account the shade generated by buildings.

Table 1. Range of hours of direct sunlight for each of the solar radiation categories.

Solar radiation category	Hours of direct sunlight
Full shade	<3
Partial shade	3-6
Full sun	>6

Uncertainties in Orthophoto Analysis

Some obstructions in the orthophotos (e.g. trees with large cover, shade) prevented accurate classification and resulted in a small percentage of land attributed as “unknown”. For the shade analysis it was not feasible to take into account the shade created by trees, hedges and obstructions other than buildings. For this reason, our estimate of shade is probably lower than what actually occurs on a block.

Survey Methodology

Survey Creation and Execution

The survey was constructed so that the sequence of questions allowed the participant to answer with low bias and to account for variability in answers. Bias was also avoided by providing participants with a standard list of definitions corresponding to the terminology of the survey. This list helped avoid potential confusion so that participant responses were standardized.

The survey (Appendix 1) was validated and then submitted for approval to the UBC Undergraduate Behavioural Research Ethics Board, part of the Research Information Services (RISe) at UBC. Surveys were primarily targeted at residents within the blocks corresponding to the orthophotos, but we also surveyed other neighbourhood residents,

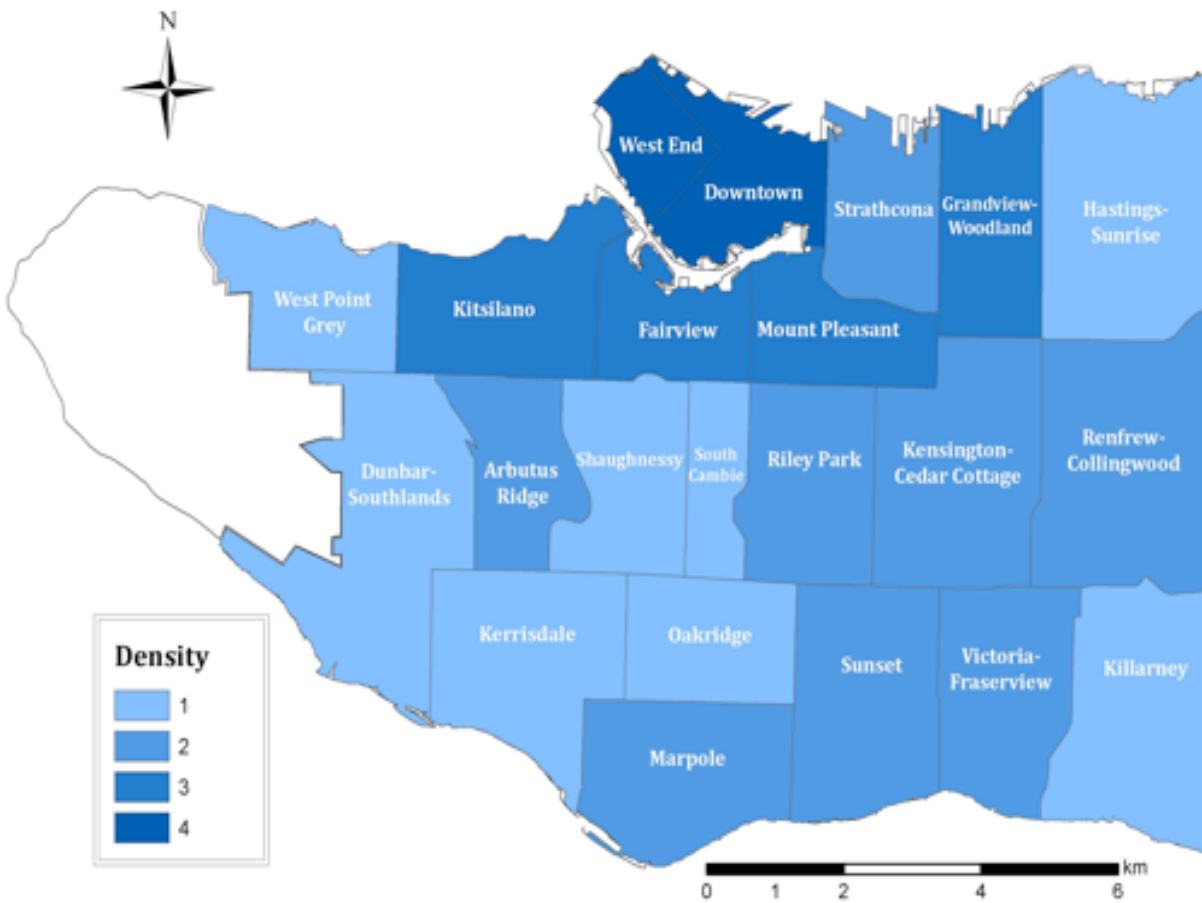


Figure 3. Map of Vancouver's neighbourhoods showing density categories in light to dark shades of blue (low to high density). The unit of density is dwellings per square kilometer. Low (<1480), medium (1480-2250), high (2250-5300) and very high (>5300).

including some online respondents. In total 147 surveys were conducted.

Statistical Analysis of Survey

For questions 0, 2 and 9 of the survey (Appendix 1), the standard error and confidence limits were calculated for the average using stratified random sampling where each neighborhood is a stratum. This method allows precise estimates for each stratum to be obtained separately, while still allowing the differences among the strata to be evaluated (Rao, 2000).

Some limitations of the survey include low response rates in some neighbourhoods

(West End, Downtown, Oakridge and Strathcona) resulting in low confidence and inadequate representation. Not all residents were interested in answering the survey and the response rate may have varied according to whether residents were interested in gardening or not. Also, some respondents did not answer all the questions they were supposed to resulting in gaps in the data. For questions 3, 7, 10, 12 and 13 (Appendix 1), some respondents selected only one most relevant choice while other respondents selected multiple relevant choices. This gives differential weight to respondents' selections. For question 8 (Appendix 1), some choices were omitted from the analysis because

of suspected confusion on behalf of the respondents.

Neighbourhood Grouping

Using neighbourhood dwelling density values calculated from Vancouver census data (Statistics Canada, 2006), we divided the neighbourhoods of Vancouver into four density categories (Figure 3). The neighbourhoods were split into four groups, two above the mean density (2250 dwellings/km²) and two below the mean density. The result was four density categories: low, medium, high and very high (Table 2).

The very high density category was comprised of two neighbourhoods: Downtown and the West End. As these neighbourhoods have significantly higher dwelling per area density than the other neighbourhoods, we omitted this category from our analysis.

Table 2. Density ranges (dwellings/km²) for each density category.

Density category	Density ranges
Low	<1480
Medium	1480-2250
High	2250-5300
Very High	>5300

Results

Land Use Results

ArcGIS analysis of the blocks illustrates how land is partitioned and the shade created from buildings. The average block area for our sample was 18,637 m². We represented the land use data as proportions of the total area we analyzed for each density category in our sample (Figure 4). A comparison of land use as dwelling density changes indicates that the proportion of buildings and cement increases with density. Conversely, the proportion of yard space decreases from low to high density.

Our solar radiation analysis illustrates how the amount of shade from buildings on yard green space and city green space varies between density categories. The proportion of

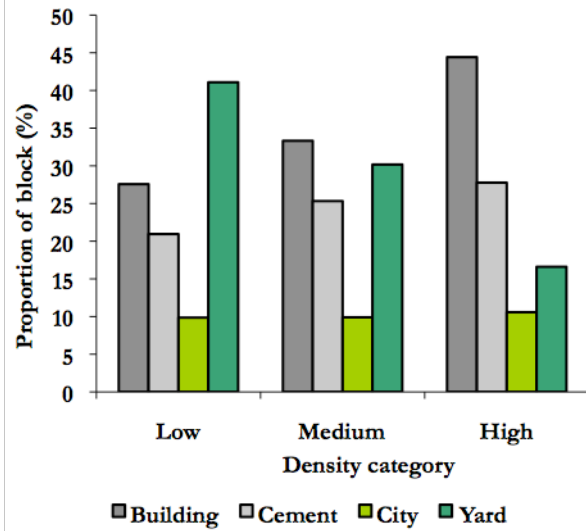


Figure 4. Within each density category the area of each landuse category as well as the area of each block was summed. This shows the proportion each landuse category represents from the total area. The unknown category is omitted and was always less than 1.5%.

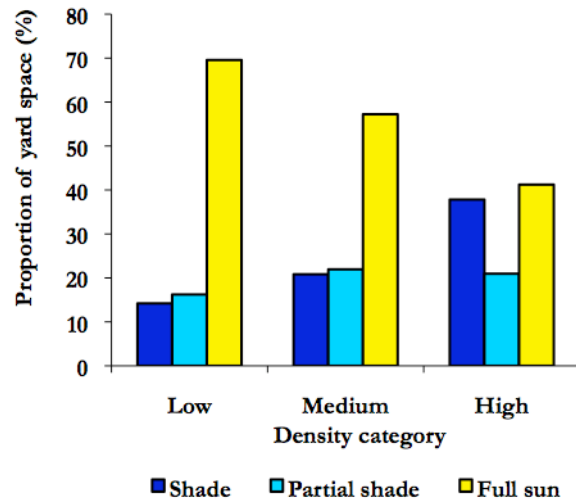


Figure 5. Within each density category the area of yard in each solar radiation category (shade, partial shade and full sun) was summed. This shows what the proportion each solar radiation category represents of the total yard area.

yard space that is “shady” and “partially shady” (Figure 5) is similar for low and medium density areas, but in the high density area the proportion of “shady” yard space is greater than the proportion that is “partially shady”. The proportion of space that gets full sun decreases with increasing density and in high density areas,

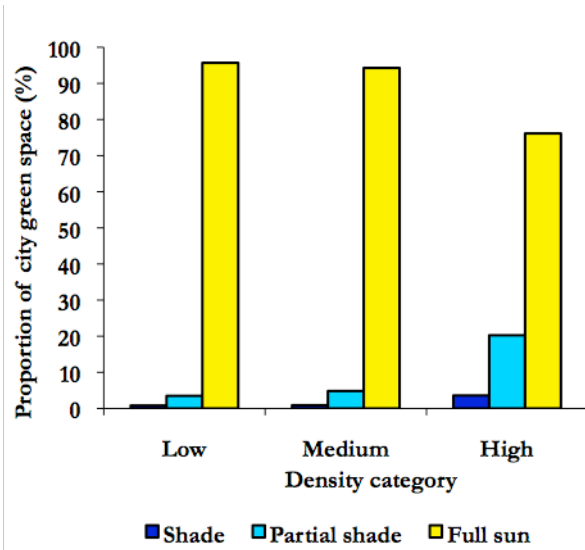


Figure 6. Within each density category the area of city green space in each solar radiation category (shade, partial shade and full sun) was summed. This shows what the proportion each solar radiation category represents of the total city green space area.

the shaded area is nearly equal to the fully sunny area. In general the city green space that is sunny and optimal for growing outweighs the space that is shaded (Figure 6).

We generated scenarios, drawing on both the land use analysis and the survey data, to quantify the area currently being used to grow food. We also generated estimates for the potential for that area to increase. Currently the yard space being used to grow food represents a small proportion (less than 12%) of total yard space available across all density categories (Figure 7). However, since the total yard area decreases with increasing density, the total yard area that is being used to grow food is greater in the low density category.

Incorporating the solar data, we determined the proportion of combined sunny and partially sunny yard space that is currently being used to grow food (Figure 8). The decreasing trend in the average total yard space with increasing density persists.

Finally incorporating the survey data, we asked residents if they were willing to increase the proportion of their yard space used to grow food, which they answered as a proportion of their entire yard space. We found that on

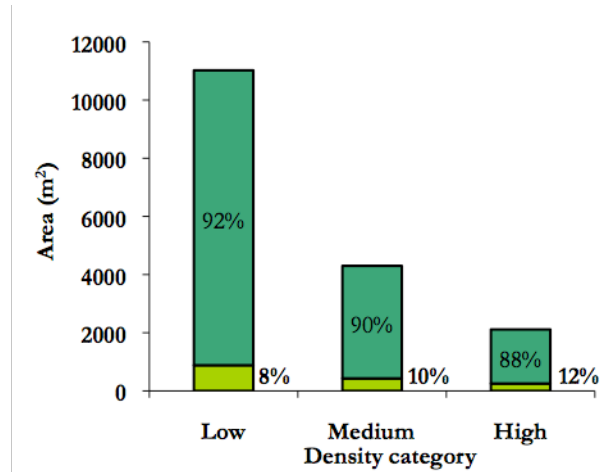


Figure 7. The total height of the bars represents the average yard area in each density category. The light green portion is an estimate of the proportion of yard area currently being used to grow food and the dark green portion is the remainder.

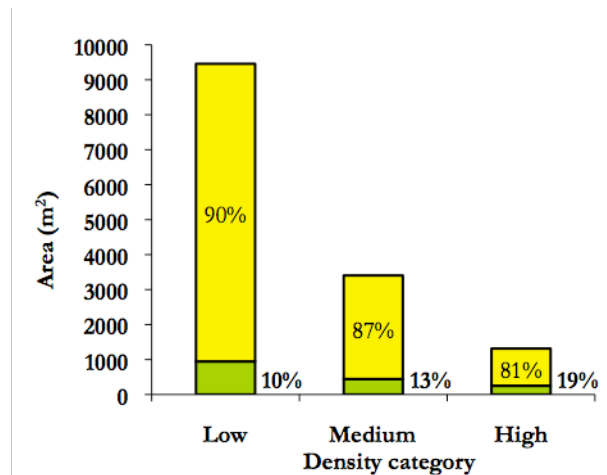


Figure 8. The total height of the bars represents the average yard area that is sunny or partially sunny in each density category. The light green portion is an estimate of the proportion of yard area currently being used to grow food and the yellow portion is the remainder.

average residents are willing to increase the area used to grow food but not to cover the entire available area. The residents of the low density category are willing to increase the proportion of sunny and partially sunny yard space in food production from 10% to 20% (Figure 9), the residents of the medium density category are willing to increase from 13% to 19% and the residents of the high density category are willing to increase from 19% to 44%. This large

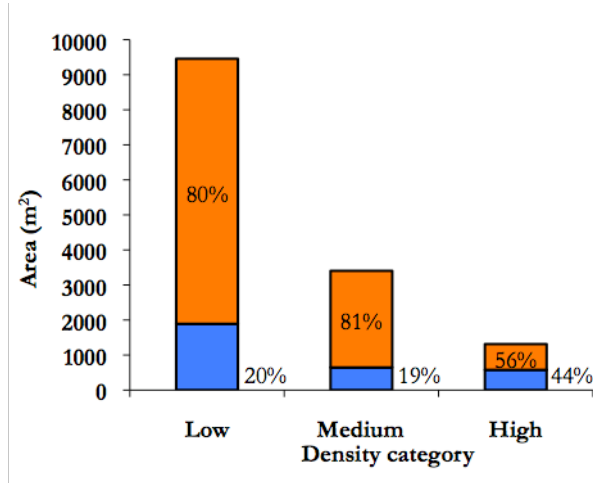


Figure 9. The total height of the bars represents the average yard area that is sunny or partially sunny in each density category. The blue portion is an estimate of the proportion of yard area currently being used to grow food plus the proportion by which residents would be willing to increase the yard area used to grow food. The orange portion is the remainder.

increase reported for the high density category still is a proportion of the smallest total yard area.

Survey Results

The survey results indicate that $77\% \pm 11\%$ of Vancouver residents think it is important to eat food grown near where they live (local food) and $52\% \pm 9\%$ of Vancouver residents grow some food for some period of the year (Figure 10). This includes residents growing food in their yards or in other spaces such as community gardens, a yard that is not their own, or non-yard spaces such as indoors, rooftop, or balcony gardens.

We calculated the correlation between the importance of eating local food and whether residents grow food (Figure 11, $\chi^2=10.14$ from $N=144$; $DoF=1$, $P=0.0015$). A higher proportion of residents who think it is important to eat local food also grow some of their own food. Within the group of residents who do not grow some food, there is also a greater proportion of residents who consider eating local food important, however, this proportion is not as high.

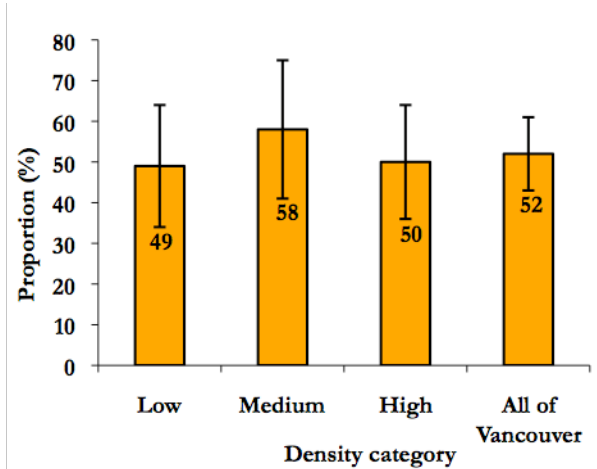


Figure 10. The height of the bars represents the proportion of Vancouver residents currently growing food with error bars showing the standard error.

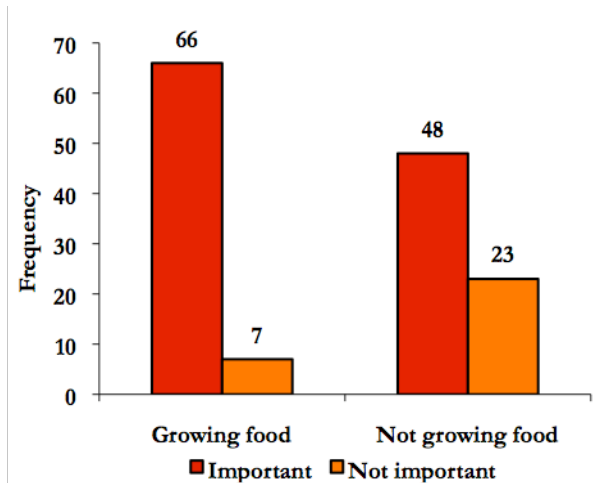


Figure 11. Frequency of residents who do or do not grow food with whether or not they think eating local food is important.

We asked the respondents who do grow food to select the choice that best describes their reason for growing food. Those were (in decreasing order of importance): it is a hobby, to grow organic food, to grow local food, to save money, and other reasons which include to grow fresh produce, because it tastes better and for convenience (Figure 12).

We asked the respondents who do not grow food to select the choice that best describes their reason for not growing. The most frequently selected answer was that residents have no time to garden (Figure 13). Three other

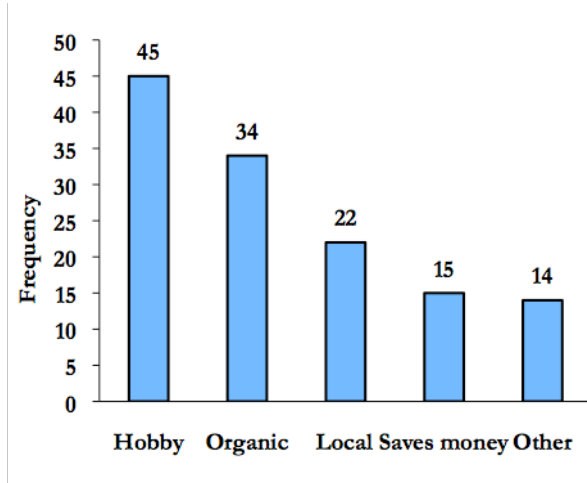


Figure 12. Reasons residents grow food in Vancouver as reported by survey respondents.

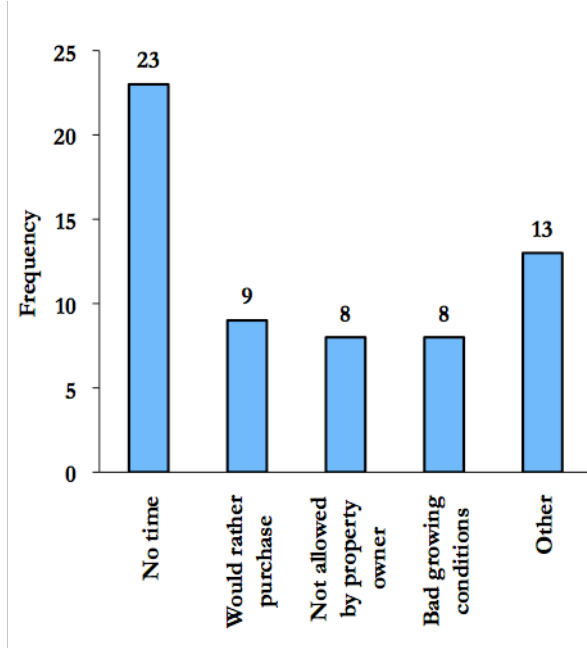


Figure 13. Reasons residents don't grow food in Vancouver as reported by survey respondents.

choices were preferring to purchase their food, their property owner does not allow them to grow food/garden and the growing conditions in their yard are inadequate, were equally chosen with approximately 8 respondents each.

Of those survey respondents who do not have yard space to grow food, we asked if they are using alternate food growing venues and if so what those venues were (Figure 14). On a citywide scale, the most common

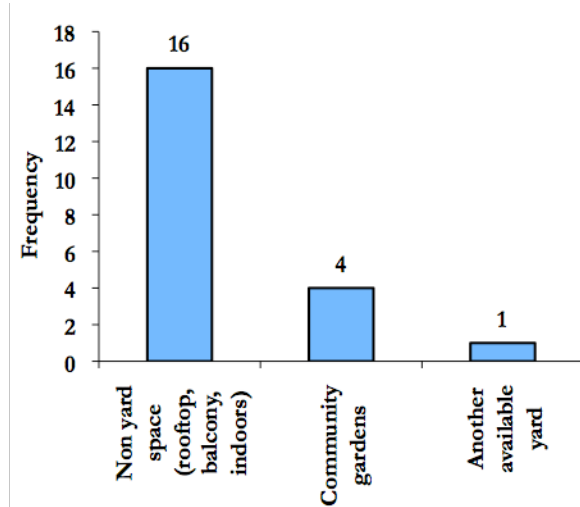


Figure 14. Frequency of the use of spaces other than one's yard to grow food as reported by survey respondents.

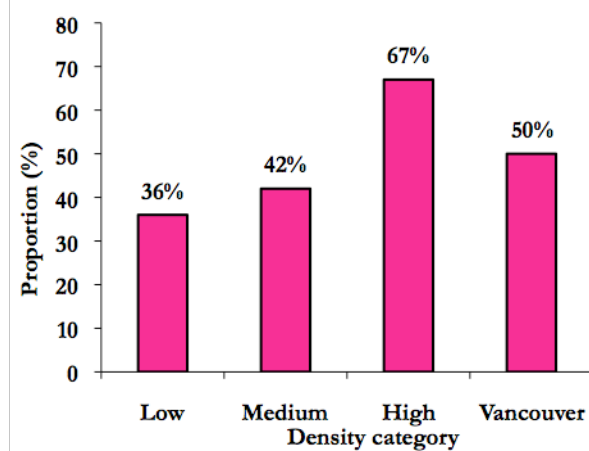


Figure 15. The height of the bars represents the proportion of Vancouver residents who would like to have another place to grow food.

alternatives to using one's yard to grow food are balconies, rooftops or indoor gardens, followed by community gardens. A less frequent alternative was to use a friend/relative/neighbor's available yard.

All survey respondents were asked if they would like another place to grow food. All density categories expressed a demand for additional space to grow food, with the residents of the high density category, at 67%, having the greatest demand (Figure 15). Of those respondents wanting additional space, we asked where they would like it to be. The highest demand for space is for community

gardens (Figure 16). The residents of the high density category show a nearly equal preference for indoor/rooftop/balcony gardens, community gardens and the garden of a friend/relative/neighbour.

We asked the residents that do have space if they would be willing to share their yard to grow food given various conditions for sharing space: the landowner receives some portion of the food, the gardener pays all expenses and the labor on the plot is shared between the gardener and the landowner (Figure 17). It was found that the residents of the low density category are least likely to share their yard under all sharing conditions, their willingness was always below 26%. The willingness was greater, up to 44%, amongst residents of the medium and high density categories.

Discussion

Importance of Local Food

We determined that 77% of Vancouver residents believe it is important to eat food that is grown locally. Although we did not ask respondents to elaborate on their reasoning, the outcome of greater support for local agriculture is beneficial socially and environmentally.

We explored the correlation between individual responses relating to the importance of eating local food and growing food and found it to be significant. Ninety percent of respondents who are growing food also think it is important to eat local food (Figure 11). However it is interesting to note that only 17% of those growing food cited their desire to produce local food for themselves as their primary reason for growing (Figure 12). While we do not have data on the yield from residential food growing, it is likely that food growing in residential spaces serves purposes separate from supplying local food. Our survey data indicates that the most popular reason for growing food was to provide residents with a hobby (35%).

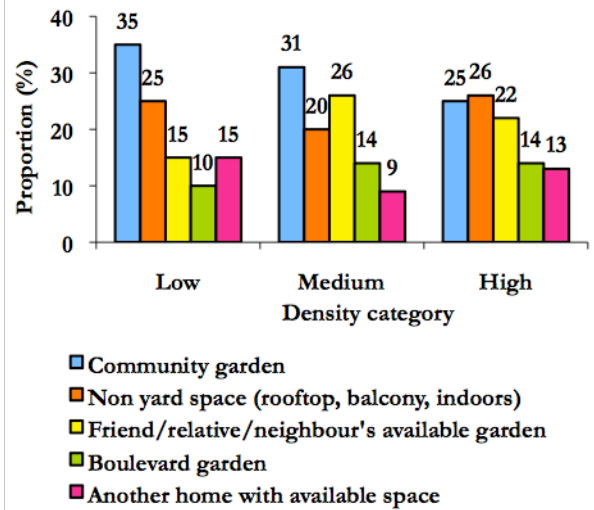


Figure 16. The height of the bars represents the proportion of Vancouver residents who would use various spaces other than their own yards to grow food.

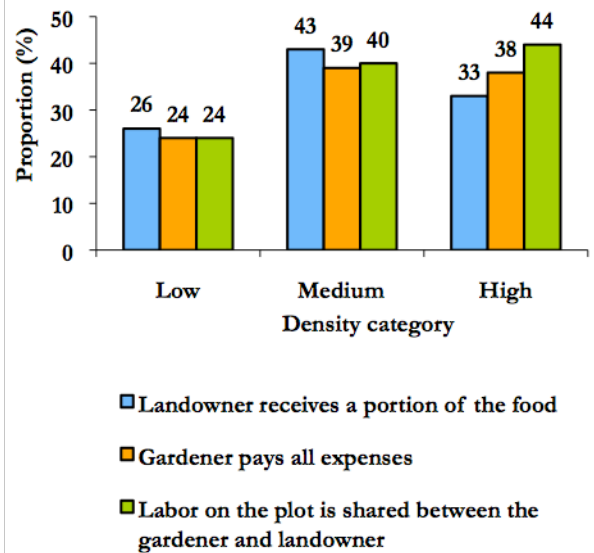


Figure 17. The height of the bars represents the proportion of Vancouver residents who would be willing to share their yard space for other gardeners to use given various sharing conditions.

While we have established a correlation, the importance of local food production is not necessarily residents' motivation for growing food, and furthermore some residents do not grow food but do think it is important to eat local food. This implies that there is a demand for local food that is not met by residential food growing. Currently, residents can obtain local food from farmer's markets, certain shops,

community shared agriculture (CSA) programs and farms in and around the city (e.g. UBC Farm, Southlands Farm, farms of the Agricultural Land Reserve (ALR) and farms of the lower mainland). These sources likely constitute a more significant source than residential food growing.

Recreational Urban Agriculture

While the average resident is not growing food to increase the supply of local food, it remains that Vancouver residents enjoy growing food themselves for other reasons. Of our respondents, 50% cited that they would like a place other than their yard to grow food (Figure 15), and community gardens were the most popular desired location (Figure 16). Currently, existing community gardens are at capacity with some waitlists having over 100 people at any given time (Pine Tree Community Garden). Therefore, efforts should be made to create more community gardens to meet this demand.

While conducting our survey, several respondents informally expressed that if they participate in food growing it should be in close proximity to their homes. This suggests city green spaces, including boulevards, medians and roundabouts, are ideal existing venues for growing food. For residents who would prefer to garden on larger plots, it is important that existing community gardens be preserved and expanded upon, allowing residents to grow food near their homes. This preference for home-garden proximity is of particular relevance in the high density category (Fairview, Grandview-Woodland, Kitsilano and Mount Pleasant), where 67% of our respondents cited they would like a place other than their yard to grow food. As the dwelling density is increasing in high density neighbourhoods (Table 1), it is increasingly important to plan for and allocate space for urban agriculture alongside plans for future development.

Currently, the information from highly dense neighbourhoods can be used to anticipate the future needs of the medium and low density

neighbourhoods which are also exhibiting growth (Statistics Canada, 2006).

Table 3. Density (dwellings/hectare) for the neighbourhoods in the high density category (Statistics Canada, 2006).

Year	1996	2001	2006
Mount Pleasant	33	35	35
Grandview-Woodland	30	32	32
Fairview	47	51	52
Kitsilano	36	40	40

On residential blocks in Vancouver there is a small proportion of sunny or partially sunny yard space being used to grow food in all density categories (10%, 13%, 19% for low, medium, and high densities respectively), which leaves a large proportion of land unused. Residents also reported a willingness to increase this proportion (Figure 9).

In general, the majority of respondents were unwilling to share their yards with others to grow food (always greater than 56%, Figure 17). Through statements, not directly pertaining to our survey questions, it was apparent that some respondents were unconvinced of the benefits of yard sharing programs. Despite the question not explicitly stating the level of familiarity between the gardener and the land owner, one of the most commonly quoted rationales for not wanting to share one's available yard space is that residents would not feel comfortable allowing a stranger access to their land. However, some residents did report a willingness to share their yard space for other gardeners to use. Given these results it is possible that yard sharing could be another source of land for those seeking additional space. If this occurs within a neighbourhood with a model similar to that of a community garden, it also could satisfy the home-garden proximity preference as well as have some of the social benefits of community gardens. Once again this is particularly relevant in the high density category, where allowing the possibility for yard sharing to increase requires

heterogeneity in dwelling types (e.g. a mix of dwelling types are more conducive to backyard sharing than a block of apartments in a high density area). This could ensure that residents that do not have yards are in proximity to some residential space.

Entrepreneurial Urban Agriculture

To complement the local food needs of residents who do grow food but do not grow all of it, as well as residents who do not grow for various reasons, the entrepreneurial urban agriculture community could be expanded. Where residents are willing to share their yards, these entrepreneurial urban farmers could use available residential land. In some cases the resulting yield would be larger than if the residents were growing food themselves (Stolhandske, 2011). Furthermore, this movement satisfies the city's goals for creating "green jobs", as well as strengthens the role of local food initiatives within Vancouver's markets (Greenest City Action Plan, 2011).

Recommendations

Based on our research, we recommend the following:

1. Increase education on the benefits of growing food and how to tend a food garden in Vancouver

Approximately half of Vancouver's dwellings are involved in some form of food growing. In order to increase residents' involvement in food growing, we recommend programs for Vancouver's residents that outline the benefits of food growing. This could take the form of workshops, demonstrations and lessons offered at community gardens, schools and distributed online.

Also, for those residents who do not grow in their yards due to poor soil quality, we recommend the provision of resources on how to improve soil quality (e.g. enriching the soil using compost and/or building raised beds)

2. Encourage and support Vancouver residents to grow food on residential spaces

We recommend the City highlight the variety of spaces available for urban agriculture in Vancouver and encourage food growing on these spaces. Since there is an unmet demand for public spaces on which to grow food, such as community gardens, the City can highlight the large inventory of land that lies in residential blocks. Our research shows there is a lot of city green space that is often not shaded by buildings and can be used for growing food. The City can also encourage yard sharing programs for those gardeners desiring larger areas on which to grow food.

We also recommend the City continue to provide certain materials that are useful in a home garden (e.g. affordable compost bins) and educational resources that assist gardeners in creating a successful food garden.

Finally, it would be helpful to know what it would take for residents to increase the area currently being used to grow food to the proportions they cited. This information could allow the City or other interested parties to better target their efforts in assisting food growers.

3. Support the existing supply of local food in its many forms and preserve existing agricultural land

This is important because Vancouverites want to eat locally but might not grow any or all of it themselves. We recommend that municipal and provincial governments protect existing agricultural land that surrounds the city that acts as a source of local food. Such areas are often encroached upon by developing urban centres (Smart Growth BC, 2004) like the UBC Farm or farms on the ALR that face developing pressures. The City of Vancouver should also protect existing agricultural land within the city.

In addition to protecting the land on which local food is grown, there should be support for those who grow it as a livelihood. Of particular relevance here we recommend support for entrepreneurial urban farmers such that they continue to have venues for the sale of their produce.

4. Provide more long lasting spaces for growing food for recreational and commercial purposes

There is high a demand for space on which to do recreational urban agriculture, especially in community gardens. It is important to devote some space on fertile land for recreational urban agriculture, and to ensure it can be used for that purpose well into the future. This is especially important for those whose yards provide inadequate growing conditions and for transient demographics that rent space or move frequently, don't have permission to garden in their yards and would like a space that they can tend for longer periods of time. This is also particularly relevant in high density neighbourhoods where blocks have a small proportion of yard space.

5. Use data on current high density areas as predictors for the needs of low and medium density areas in the future

The needs of the current high density areas should be considered as predictors for the future needs of the other neighbourhoods. Currently, residents in high density areas want additional space to grow food, and this should be a consideration for other neighbourhoods as they densify. We suggest planning mixed density neighbourhoods, as well as planning and preserving public green spaces, to ensure that there is land available for those that desire it for food growing.

Conclusion

We found that $77\% \pm 11\%$ of Vancouver residents feel that eating local food is important and $52\% \pm 9\%$ grow some food for some period of the year. We have recommended that education on the benefits of gardening and growing food take place in order to increase the proportion of Vancouverites taking part in urban agriculture.

Our research suggests that between 8-12% of yard area of residential blocks is currently being used to grow food. This indicates there is space for food growing to increase, and from our survey, we have determined there is willingness for food growing to increase.

We have made recommendations that pertain to residents' desire for space on which to grow food based on the information from our survey. The city should highlight the inventory of land available on residential spaces as well as actively encourage the use of it for urban agriculture. Furthermore, the City should continue to provide more space for community gardens. It is important that such space be located in proximity to people's homes. We have also made recommendations that pertain to residents' desire for locally grown food. This includes preserving agricultural land of the region and supporting local rural and urban farmers.

References

- Armstrong, D. (2000) A survey of community gardens in upstate New York: Implications for health promotion and community development by Armstrong. *Health and Place*, 6, 319-327.
- Bellows, A.C., Brown, K. & Smit, J. (2004) Health Benefits of Urban Agriculture. Community Food Security Coalition. Retrieved from <http://www.foodsecurity.org/UAHealthFactsheet.pdf>
- Bentley, S. (2005). Community Garden Background Paper. Social Planning Department, City of Vancouver.
- Conn, H. & Ewert, H. (2003). Vancouver's Glory Years: Public Transit, 1890-1915. North Vancouver, NV: Whitecap Books.
- Food and Agriculture Organization of the United Nations (FAO). (1996). Rome Declaration on World Food Security and World Food Summit Plan of Action. Rome.
- Garnett, T. (1996). Growing Food in Cities. A Report to Highlight and Promote the Benefits of Urban Agriculture in the UK. National Food Alliance & SAFE Alliance. Retrieved from <http://www.peoplesgrocery.org/brahm/wp-content/uploads/2006/10/growing%20food%20in%20cities.pdf>
- Greenest City Action Plan (2011). Vancouver 2020: A Bright Green Future. The City of Vancouver. Retrieved from <http://vancouver.ca/greenestcity/PDF/Vancouver2020-ABrightGreenFuture.pdf>
- Hancock, T. (2001). People, Partnerships and Human Progress: Building Community Capital. *Health Promotion International*, 16(3), 275-280. doi:10.1093/heapro/16.3.275
- Hild, C. (2009). The Economy of Local Food System in Vancouver. Vancouver Economic Development Commission. Retrieved from <http://www.vancouvereconomic.com/userfiles/file/Local-Food-in-Vancouver-webversion%281%29.pdf>
- Mendes, W. (2008). Implementing social and environmental policies in cities: The case of food policy in Vancouver, Canada. *International Journal of Urban and Regional Research*. 32(4), 942-967.
- Miller, J. (2008). Conserving Biodiversity in Metropolitan Landscapes: A Matter of Scale (But which scale?). *Landscape Journal*, 27, 114-126. doi:10.3368/lj.27.1.114
- Pine Tree Community Garden. (2011). Pine Tree Community Garden Waitlist. Vancouver, B.C. Retrieved from <http://pinestreetgardens.org/questions/#3>

Proksch, G., & Roehr, D. (2010). *Urban Cultural Greenways: Thee Potential of Urban Agriculture as Sustainable Urban Infrastructure*. Tulane University, New Orleans, LA.: 98th Association of Collegiate Schools of Architecture (ACSA) Annual Meeting.

Rao, P. S. R. S. (2000). *Sampling Methodologies with Applications*. Boca Raton, FL: Chapman & Hall/CRC.

Regional Food System Strategy. (2011). Metro Vancouver. Retrieved from <http://www.metrovancouver.org/planning/development/RegionalFoodSystems/Documents/RegionalFoodSystemStrategy.pdf>

Smart Growth BC. (2004). State of the Agriculture Land Reserve. Retrieved from http://www.smartgrowth.bc.ca/Portals/0/Downloads/State_of_the_ALR_Report_final.pdf

Serecon Management Consulting Inc. (2009). Food Secure Vancouver Baseline Report. Vancouver Food Policy Council. Retrieved from http://vancouver.ca/commsvcs/socialplanning/initiatives/foodpolicy/tools/pdf/FoodSecure_Baseline.pdf

Statistics Canada. (2006) Census Data for City of Vancouver, 2006. Retrieved from <http://vancouver.ca/commsvcs/planning/census/2006/localareas/index.htm>

Stolhandske, S. (2011). Urban Farming in Vancouver. Faculty of Arts and Social Science, Simon Fraser University. Retrieved from <http://www.cityfarmer.org/UrbanFarmingVancouver.pdf>

The Society Promoting Environmental Conservation (SPEC). (n.d.) School Garden Project. Retrieved from SPEC BC: <http://www.spec.bc.ca/school-gardens>

Appendix 1. Finalised Survey

Q0. How important is it for you to eat food grown near where you live? → Go to Q1
a. Very Important b. Important c. Not Important

Q1. Do you own or rent your place of residence and does it have a yard/garden?

- a. Rent with a Yard/Garden → Go to Q2
- b. Own with a Yard/Garden → Go to Q2
- c. No yard (own/rent) → Go to Q9

Q2. Do you currently grow food items in your garden/yard during any season of the year?

- a. Yes → Go to Q3
- b. No → Go to Q7

Q3. Why? → Go to Q4

- a. It's my hobby
- b. It saves me money
- c. It's organic
- d. I prefer eating food grown near where I live
- e. Other _____

Q4. From the list, what percentage of your total yard area is used to grow food?

- a. 1-25% → Go to Q5
- b. 26-50% → Go to Q5
- c. 51-75% → Go to Q5
- d. 76-100% → Go to Q5

Q5. By what percentage are you willing to add on to the total area you mentioned in Q4?

_____ → Go to Q6

Q6. What do you grow (please list)? → Go to Q8

- a. Herbs: _____
- b. Vegetables: _____
- c. Fruits/berries: _____
- d. Other (eg. Nuts): _____

Q7. Explain briefly why you don't:

- a. Inadequate growing conditions (weather, small growing area, soil)
- b. No time
- c. Not allowed by property owner (if rented)
- d. Rather purchase from store
- e. Using another space to grow food (Go to Q8 and then Q10)
- f. Other _____

→ Go to Q8

Q8. How likely would you be to share your front or back yard for others to grow food, if...
(1 = highly likely, 2 = likely, 3 = unlikely, 4 = highly unlikely)

→ If you answered Q7, this is the end. Otherwise, go to

a. You received some portion of the food in return	1	2	3	4
b. Someone else paid the expenses	1	2	3	4
c. Someone else did all the labour	1	2	3	4
d. You shared the labour with someone	1	2	3	4
e. You paid all the expenses, including labour	1	2	3	4

Q11

Q9. Do you grow any of your own food?

- a. Yes → Go to Q10
- b. No → Go to Q11

Q10. Where are you growing any of your own food? → Go to Q11

- a. Community gardens
- School Private Public Other _____
- b. Friend's/Relative's/Neighbour's available yard
- c. Non soil based space
- Indoors Rooftop Balcony Other _____

Q11. Would you like to have another place to grow food?

- a. Yes → Go to Q12
- b. No → Go to Q13

Q12. Where would you like to grow your own food? → The end!

- a. Community gardens
- b. Friend's/Relative's/Neighbour's available yard
- c. Another home that has space available
- d. Indoors/rooftop/balcony

Q13. Why not: → The end!

- a. Have no interest
- b. I tried but I failed
- c. It's inconvenient to me
- d. Other: _____

Thank you for participating!

