Evaluating the City of Vancouver's Goal of Ensuring that 100% of Residents Live Within a 5-Minute Walk to a Greenspace

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Abstract

      Based on the initiatives set forth by the Greenest City Action Team in 2009, the City of Vancouver approved the Greenest City Action Plan in 2011, making it a city-wide mission to live sustainably. Hoping to surpass every country as the global leader in sustainable initiatives, the City of Vancouver established ten umbrella goals covering general areas of focus such as zero carbon, zero waste and healthy ecosystems. Key to achieving healthy ecosystems was improving access to nature for all residents whether that be through parks or community gardens. In 2010, 92.6% of the city land base was within a five-minute walk to a greenspace with the 2020 target set at 95%. As of 2016 that figure had only risen to 92.7%, leading some residents to question how little progress had been achieved. The 2016-2017 Greenest City Action Plan Implementation Update stated that a key challenge in achieving this goal was the metric used to measure the five-minute walk target. Until recently, the City of Vancouver had been measuring how close land bases were to greenspaces, not how close *residents* were – an error leading to misunderstandings of how the goal would be achieved given that Vancouver has exhibited high rates of unoccupied dwellings across its land base. Also mentioned in the update was the city's definition of a greenspace – is it a park, a green way, a community garden or a public pool? By evaluating their problematic metric through GIS, it will become evident that this was a planning error from the outset given that the potential influences of obstructions and unoccupied dwellings were never considered in improving resident access to greenspaces.

Description of Project, Study Area and Data

The City of Vancouver will be the primary study area, in addition to UBC, and its surrounding University Endowment Lands since residents not only live on the unincorporated lands but they also visit the greenspaces within the area. Given that Vancouver has increasingly urbanized over the last century with ongoing construction of high rise buildings and new roads, the 2020 goal was developed with intentions of reversing or offsetting the ecological impacts associated with urbanization. This study seeks to evaluate the five-minute walk target in order to establish viable recommendations that would benefit the city's ecosystems in addition to all Vancouver residents.

Over 600,000 residents, 230 parks and 110 community gardens call the city home, but only a fraction of these people and places are within walking distance to each other. Furthermore, many of these greenspaces lie in high traffic neighborhoods where the impacts of noise and pollution hinder the quality of the space. Conversely, many of these greenspaces are regularly maintained by the city, but lie in neighborhoods with high proportions of unoccupied dwellings. Urban greenspaces have been proven to positively impact human health through its benefits to physical activity as well as its influences on spiritual and mental health. Considering its advantages in improving the health of humans and the environment, it is essential that the city develop a better metric to analyze municipal greenspaces.

The 2016-2017 Greenest City Action Plan Implementation Update acknowledges that the city's current metric is inadequate in measuring the five-minute walk target in relation to obstructions that would prevent residents from accessing the space. Also mentioned are the absence of factors that make a greenspace a *quality* greenspace – area and distance to high traffic roads will be assessed through a geospatial analysis of current greenspaces to better understand what constitutes a "greenspace." The questions this study seeks to answer are:

1. *What makes a greenspace a quality greenspace?*
2. *What good does a greenspace serve if it is located near obstructions such as busy roads?*
3. *How useful is a quality greenspace in serving its purpose if it is located in a neighborhood with few users?*

The data used in this study was obtained mainly from the City of Vancouver's Open Data Catalogue available to the public through their website. Parks, greenways and community gardens were sourced through this catalogue. Administrative boundaries used to distinguish the University Endowment lands were obtained from DataBC while all data pertaining to census tracts and dwellings were obtained through Census Canada. The UBC G:drive available to lab students was additionally used to obtain specific city information such as the administrative boundary of Vancouver and arterial roads.

Methodology of Analysis

A series of maps were created through ArcMap software to display several analyses of municipal greenspaces. Every map includes an inset map of Downtown Vancouver to better display the denser core neighborhoods. Each map required a different set of tools and procedures to compile various sources of data into presentable visuals, therefore each map will be assessed separately.

Access to Greenspaces within the City of Vancouver

A similar map was created by the City of Vancouver in their initial Greenest City 2020 Action Plan, which was used to determine which spaces within the city required the most attention. It is likely that the data sourced for this study is different from the city's data, nevertheless the map created here is almost identical to that of the city's action plan. Layers used in this map include the Vancouver boundary shapefile, park polygons, community garden point data, the endowment land shapefile and the surrounding land base around Vancouver. Several online sources have confirmed that the average human can walk approximately 400 meters in five minutes, so this distance was used as the buffer around every community garden and park. Once the *Buffer* was applied, the original parks and gardens were layered above to display the source of the buffer layer. From this map, it is evident that most of Vancouver's land base is within a five-minute walk to a greenspace. The yellow symbolizes areas that are not within the walk target, which is likely where city efforts would be delegated. The purpose of this map is to show how simplified the city's initial metric was in displaying their access to nature goal.

Parks, Greenways & Community Gardens in the City of Vancouver

This map was created through layering community gardens, greenways, arterial roads and parks above the University Endowment Lands and the City of Vancouver land base. Although the Endowment Lands are not a part of the city, it will be used in part of this study given that Pacific Spirit Park plays a large role in offering greenspaces to nearby residents. The purpose of this map is to display data for observational uses since detailed analyses were not conducted during its design phase. The creation of this map was done merely through layering data files, and clipping them to Vancouver's boundaries.

The next step in analyzing these greenspaces was determining how large a park should be to quantify being a quality greenspace. Parks below one hectare were determined to be of low quality, given that the area is relatively small, and parks under this size offer few features or benefits that would satisfy residents' desire for nature. To identify which parks were below the standard, the *Select by Attribute* tool was used on the park layer to perform an SQL. "Area < 10,000m²" was the SQL used given that one hectare is equal to 10,000m². This tool yielded every red mark visible through the output layer. The next map in the series displays these undersized parks in red.

Fourth in the map series is a visual of major problems the initial five-minute walk target purposely left out. Since the road layer has an attribute table including road type, *Select by Attribute* was used to identify main arterial roads given that these roads are major commuter routes. Using the *Intersect* tool, all parks and arterial roads were joined, which resulted in the yellow park boundaries. These boundaries represent the edges of parks that lie at major intersections known for high traffic volumes. Since road and park data are available for the University Endowment Lands, this same process was repeated for the areas around UBC. Community Gardens and arterial roads were also joined using the *Intersect* tool to display which gardens lie at busy intersections. These are displayed through the yellow circles, while gardens located at parks under one hectare are symbolized with red circles. These red circles represent an even more problematic location for community gardens given that small parks are generally equated with fewer users.

Parks and Community Gardens in the City of Vancouver

The final choropleth map displays the proportion of private dwellings that are regularly unoccupied in Vancouver. The data was manually classified to best represent the values within every census tract. Census tracts were chosen as the unit of space given that they represent population numbers almost evenly. Dwelling data is not available for the Endowment Lands, nor two census tracts in the downtown core, so these areas are displayed in grey as "No Data". To better highlight which census tracts would hinder quality greenspaces, *Select by Attribute* was used to identify those with greater than 10% unoccupied private dwellings. Parks and community gardens were then joined with these bright red census tracts through the *Intersect* tool to determine which parks and community gardens could be underutilized by their surrounding neighborhoods.

Discussion and Results

First glance at the "Access to Greenspaces within the City of Vancouver" map, it seems intuitive what the map is trying to say. Community gardens and parks are greenspaces while 400 meters is what the average human walks in five-minutes. Yellow areas are either densely populated with residential homes or industrial/commercial businesses since these areas lack greenspaces. That is particularly true around the Oakridge neighborhood, which can be easily observed through aerial photos available through Google Maps. Nevertheless, most of the city is shaded with pastel green, meaning Vancouver has plentiful parks and community gardens within walking distance, right? A similar map was published by the City of Vancouver nearly six years ago – it was the inspiration behind this study given that this method of displaying resident access to greenspaces is overly simplified and does not consider external factors influencing quality greenspaces.

The second in the map series displays every community garden and park the city data catalogue has to offer. Parks ranging from small to massive are evident across the entire city's land base, while community gardens are somewhat concentrated towards the northern portions of Vancouver. Stanley Park and Pacific Spirit Park stand out as the largest urban parks, covering almost the same area as every other park combined. These city treasures are contrasted against the tiny green speckles that are also considered "parks" under the city's standards. There are a number of these microparks that raise questions of how cities, not just Vancouver, determine what a "park" is. Bearing this thought in mind, the next logical step was to determine how many of these microparks Vancouver offers to its residents as greenspaces. The third map in the series displays 100 parks under one hectare, conveniently highlighted in red. To put that into perspective, 100/230 parks or 43.5% of Vancouver's parks are smaller than a football field. That hectare may seem sizable from a distance, but recall that the average human can walk 400 meters in five-minutes. Now imagine a perfect square with 100 meters length and 100 meters width – that is also a way of displaying one hectare. It would take the average human five minutes to walk the perimeter of our perfectly squared park.

There is a fundamental problem in the way parks are loosely defined given that the city is essentially proposing that its residents spend five minutes walking to a park that would likely take less than five-minutes to enjoy. This point provides some reasoning towards the question of "What makes a greenspace a quality greenspace?" Here, we have determined that a micropark cannot be defined as a park given that its miniscule size does not contribute much to human health. Additional features of small parks that could support this would be its features such as sports amenities or greenery. Small parks are likely unable to support a wide range of features such as forests,

basketball courts, soccer fields, playgrounds, running tracks or picnic tables, meaning this idea of microparks is beginning to look less desirable as a greenspace.

The next question this study sought to answer was "what good does a greenspace serve if it is located near obstructions such as busy roads?" Busy roads are considered a major obstruction in this study given that Vancouver has some of the highest traffic volumes in all of North America. Almost every road downtown becomes congested during rush hour, along with major commuter routes such as Oak Street (which connects Vancouver to Richmond, Delta, New Westminster, the U.S border, etc.) and Kingsway. By intersecting parks with these major arterial roads, it has been determined that 54 or 23.5% of Vancouver's parks face constant road disturbances throughout the day. This is not to say that these yellow boundaries deem these parks as low quality, but it does speak to how urbanized Vancouver has become. In large parks like Queen Elizabeth or South Memorial, noise pollution can be mitigated by moving further into the park, but environmental consequences cannot be physically moved like humans. Pollution through waste, road salt and constant moving vehicles yield serious consequences on ecological processes within parks. Animals are more susceptible to death through heavy traffic, while pollution has grave impacts on plant growth and the water filtering abilities of grass and forests. Ecological services are threatened through direct exposure to anthropogenic effects, thereby influencing the ecological viability of these parks.

Likewise, 34 community gardens lie at busy intersections raising questions of whether humans can really enjoy gardening during rush hour traffic. Similar to parks, community gardens are most visited during daylight hours, but these hours also coincide with periods of the day with the most traffic. Community gardens are significantly smaller than parks but offer the benefit of gardening that has been proven to provide relaxation and tranquility through its benefits to spiritual and mental health. Not only are benefits to humans questioned here, but the environment as well. Being located near busy intersections means higher foot traffic as well. Not that an increased volume of visitors is negative, but more people is generally equated with more pollution. Whether that be through garbage, noise or wind, plants cannot thrive in stressed environments – especially fruits and vegetables that are the main crops grown at these community gardens. Even worse than having a community garden at a busy intersection is developing one at a micropark where disturbances are significantly heightened. This is demonstrated through the red circles which amount to 13. In theory, constructing community gardens all over the city is ideal, but the viability of crops needs to be taken into consideration. Given that smaller parks generally have fewer features thereby providing less incentive for visitors to swing by, community gardens in small parks could be threatened by the lack of care from the community – defeating the purpose of a community garden in the first place.

The final choropleth map was the end goal for this study – to display spatial data effectively with hopes of further refuting the City of Vancouver's initial metric in measuring the five-minute walk target. Since they had not considered how close people were to greenspaces, this map yielded the most useful information in terms of urban planning. As mentioned, census data was not available for two census tracts downtown, so these areas are not included in the analysis. The areas with the greatest proportion of unoccupied dwellings are exhibited in the downtown area, the west end near point grey, and south Vancouver. Unoccupied dwellings mean that the owner of the private dwelling is not the primary resident for most of the year. This could be due to foreign ownership resulting in vacant homes, or it could mean that many of the residences are rented out. The purpose of using this data is that it reflects non-permanent residents thereby implying high turnover rates for many of these neighborhoods. Whether the dwelling is vacant or has new tenants moving in every

year is besides the point. Census tracts with high proportions of unoccupied dwellings means that these temporary/absent residents are unlikely to experience their surrounding greenspaces. Here, we have determined that many of these parks and community gardens are likely underutilized by their surrounding neighborhood. This is not to say that people outside the census tract also underuse these greenspaces, but the takeaway here is that they are not being used to their full potential.

Two census tracts stand out on the choropleth map – one on the north end of downtown near Coal Harbor and another one in south Vancouver. This would make sense given the downtown tract is mainly composed of high rise buildings rented out throughout the year, while the south Vancouver tract is where the new Marine Gateway community has formed. This new development has resulted in plentiful condos and townhomes for rent. Unfortunately, when these census tracts were intersected with parks and community gardens, there yielded several parks and community gardens that were likely underutilized. This process of intersection was also performed on census tracts with 10-11% and 12-18% unoccupied dwellings. Coincidently, 34 parks and 34 community gardens fall within these census tracts with high proportions of unoccupied dwellings. Of the parks, 26 are also below one hectare in size. 76.5% of the parks in these non-permanent census tracts are micro sized, leading us to question if that is merely coincidence or rather a pattern we could observe overtime – is it possible that there is a correlation between neighborhoods with vacant homes and smaller parks? Unsurprisingly, this study has raised more questions than it has answered; perhaps a sign that urban greenspaces are worth studying given our new foreign home owner tax. The last question this study sought to answer was "how useful is a quality greenspace in serving its purpose if it is located in a neighborhood with few users?" Not only does this map make greenspaces and vacant homes look wasteful, but there also lies implications for all Vancouver residents that further its negative effect on urban planning. Landowners support the city through property tax which provide the funds necessary to maintain these parks year-round. Are these greenspaces seeming extra wasteful now that money is mentioned? Good.

This study was not conducted to provide definitive answers for these three focal questions, but rather to engage people in understanding greenspaces better, beyond its recreational and leisurely uses. The City of Vancouver has laid out a seemingly impossibly goal to achieve given that urbanization has limited the amount of land available to develop greenspaces. Furthermore, this study shows that constructing a park is not without its challenges. Size and distance to arterial roads impede the positive experience humans and the environment are supposed to benefit from visiting parks and community gardens. The number of visitors in the surrounding area also play a role in how valued or utilized a greenspace is. Here, we have used unoccupied dwellings as an indicator of potential underutilization, but park features such as sports amenities and greenery are also critical factors in park design.

Approaching this urban problem through GIS provided an effective means for analyzing spatial data. By determining what the most important factors were in park development (size and distance to roads), this study was able to yield logical and reasonable findings to partly answer some of the questions proposed. Through spatial analysis tools such as intersecting, clipping and SQLs, the output maps were all able to take the City of Vancouver's access to greenspace map one step further in data analyses. The addition of more detailed analysis tools allows these maps to challenge the city's initial metric of the five-minute walk target while demonstrating that a simply buffer of greenspaces is not enough in determining how to best achieve the target goal. Moving forward, it is hoped that the city will better develop a metric that incorporates factors beyond land base distance to holistically identify what is needed to become the world's greenest city.

Error and Uncertainty

There are assumptions made in this study that are not meant to persuade reader interests, but rather to foster a new way of thinking about urban greenspaces. It is assumed that small parks will yield less features and visitors. It is assumed that larger parks would have the opposite effect. With that being said, there are likely errors in geoprocessing and spatial analysis that have either been calculated improperly or not been calculated at all. This series of maps represent an effort to better understand the City of Vancouver's access to nature goal, but there are many uncertainties that cannot be ignored. Although its been attempted to include all relevant information, additional layers could have been added to better make the point, such as population figures, more details on area and other greenspaces such as greenways.

The choropleth map was classified manually, meaning there is inherent subjectivity in the way unoccupied dwellings are displayed. Data manipulation cannot be avoided but it is conducted with caution and ethical concerns in mind. Although the natural breaks method did classify the data similarly, a sixth class was added to better represent the data distribution. Statistics played a small role in this study, but could have been used to further understand population dynamics as well as park information such as mean visitors per month and traffic data counts. The data sourced for this study ranges many years from the park data in 2009 to the dwelling data in 2016. These figures have likely changed over the years with the addition of new parks, community gardens and roads. With the implementation of the foreign home owners tax, it is likely that unoccupied dwellings will exhibit a change in the near future.

Further Research and Recommendations

Moving forward, it is important that Vancouver residents not take the city's words at face value since it has proven to be misleading and insufficient in terms of greenspaces. As this study has demonstrated, their initial metric led to a failing goal for over five years. Further GIS research will be necessary as we close in on the 2020 goal. With any hope of meeting our targets, it is critical that all greenest city goals are analyzed to determine their potential in benefiting the city, its residents and the surrounding environment. The next series of maps that could supplement this study would dig deeper into population dynamics and park usage. Factoring in park features and average visitor counts would strengthen the point made being that urban parks combined with urbanization are complex processes that influence each other. It is insufficient and inappropriate to merely buffer parks to determine which areas need the most attention. The findings from this study could improve urban planning to better utilize what this city has to offer, in addition to providing residents with a better idea of how their city operates.

The City of Vancouver provides traffic counts through their VanMap application but has yet to publish usable data in their catalogue. A recommendation for the next study following this current one would be to account for traffic data to better distinguish arterial roads since not every single one of them exhibits the same traffic patterns. There are many topics to explore within the urban planning field that has great potential in improving the city. Looking into the future, it is likely that this topic will be further explored to better analyze the geography within the city limits while accounting for external influences such as greenspaces in other cities that Vancouver residents frequently visit. This raises questions of a more holistic study that goes beyond our city limits. To fully understand greenspaces within the city, it is necessary to consider the ones outside the city that are likely to impact how residents view and use the greenspaces here. Good luck to Vancouver.

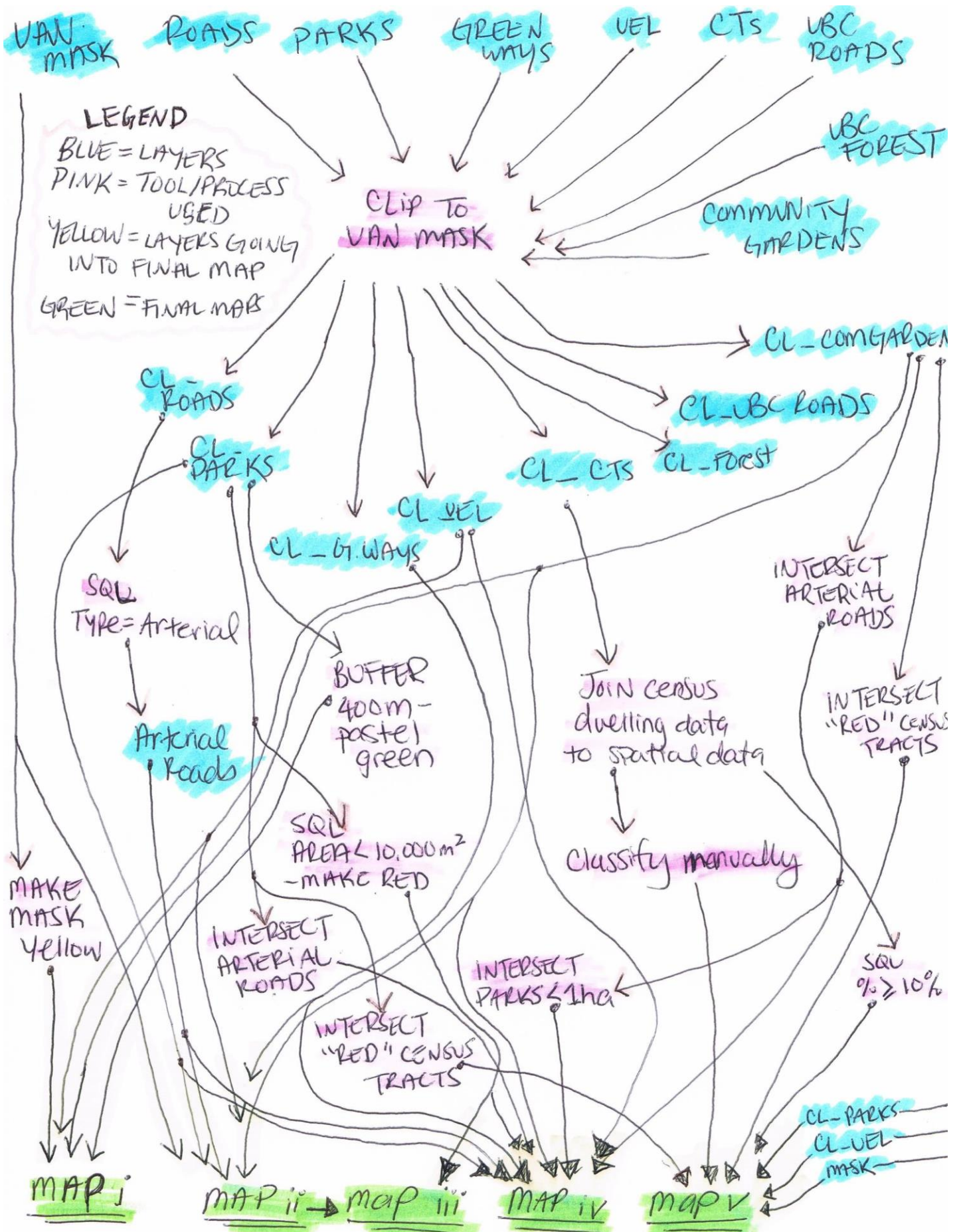*Appendices – Works Cited, Flowchart and Maps*

Works Cited

Greenest City 2020 Action Plan 2016-2017 Implementation Update. Vancouver, City Of

    Vancouver, 2016, http://vancouver.ca/green-vancouver/39764.aspx.

Greenest City 2020 Action Plan. Vancouver, City of Vancouver, 2011,

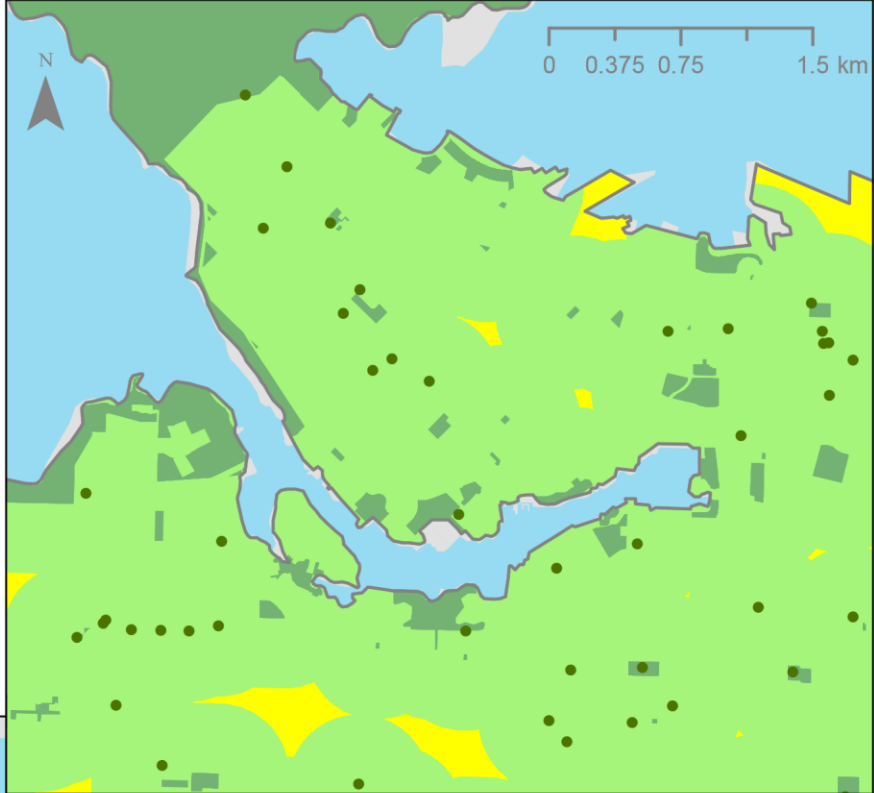   http://vancouver.ca/files/cov/Greenest-city-action-plan.pdf.

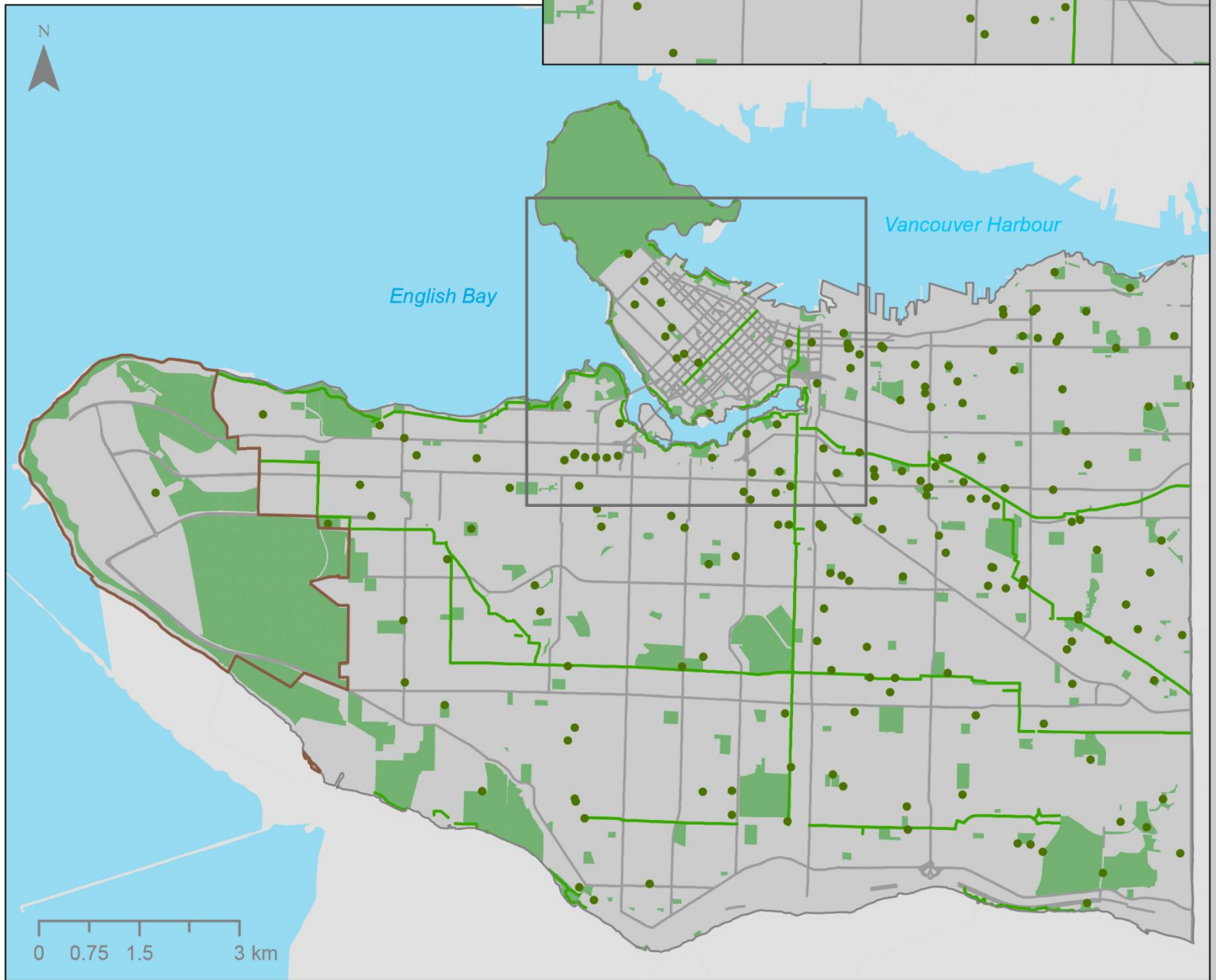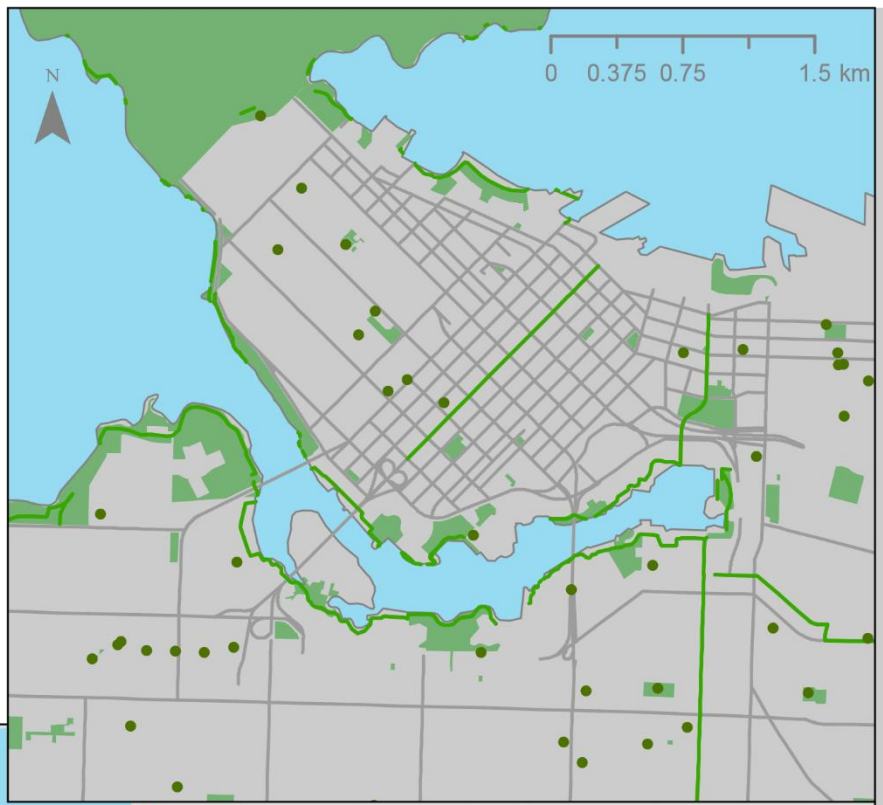Flowchart of Analysis
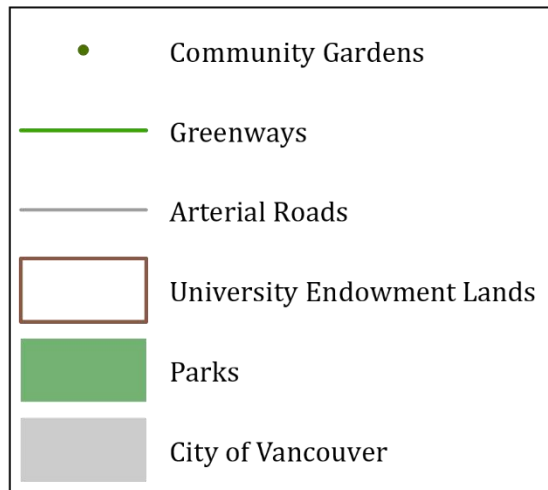
Following Maps:

- *i.* Access to Greenspaces within the City of Vancouver
- *ii.* Parks, Greenways & Community Gardens in the City of Vancouver
- *iii.* Parks, Greenways & Community Gardens in the City of Vancouver – version with parks smaller than one hectare
- *iv.* Parks, Greenways & Community Gardens in the City of Vancouver – version with busy intersections, park boundaries and detailed community gardens
- *v.* Choropleth Map – Parks & Community Gardens in the City of Vancouver

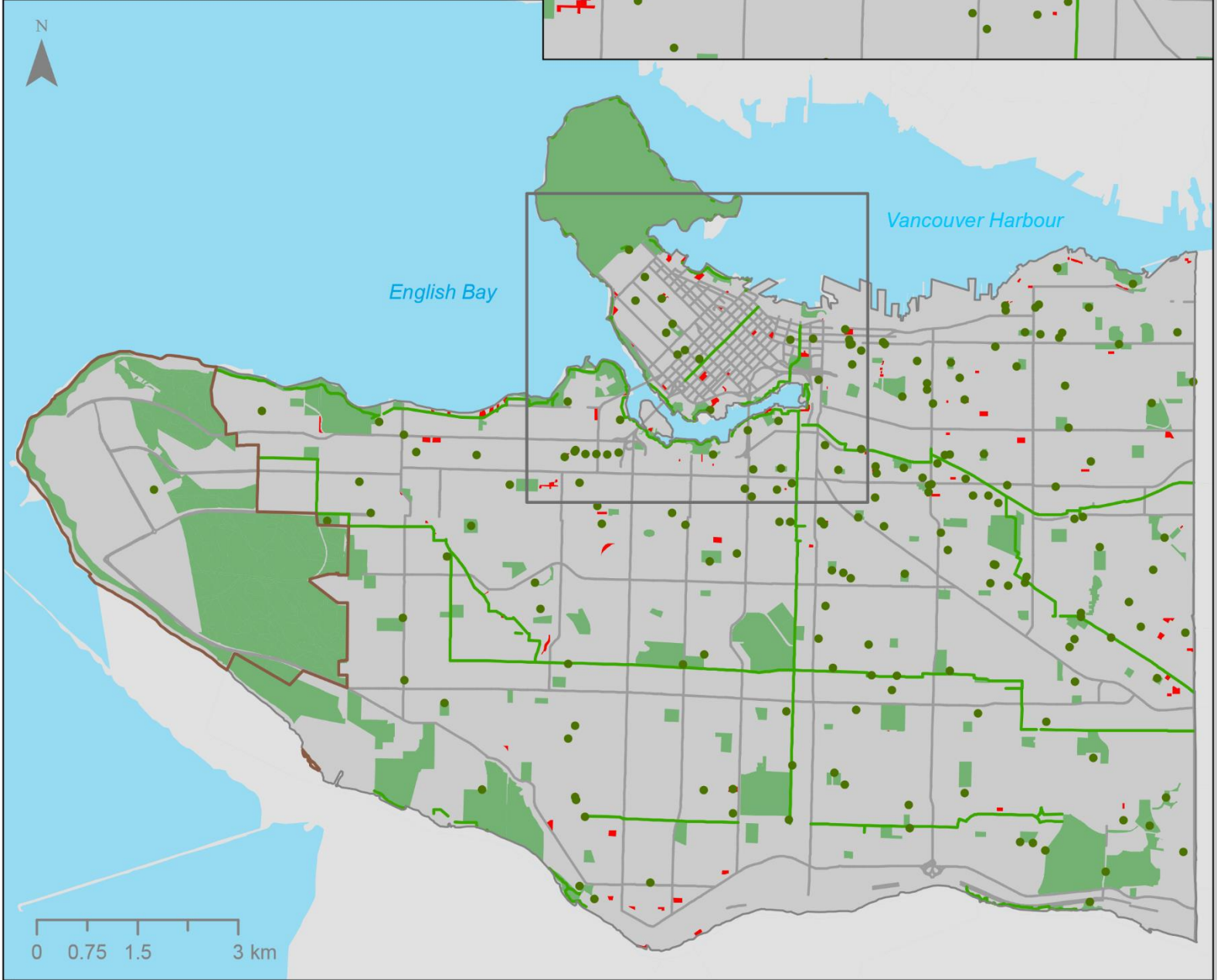# Access to Greenspaces within the City of Vancouver
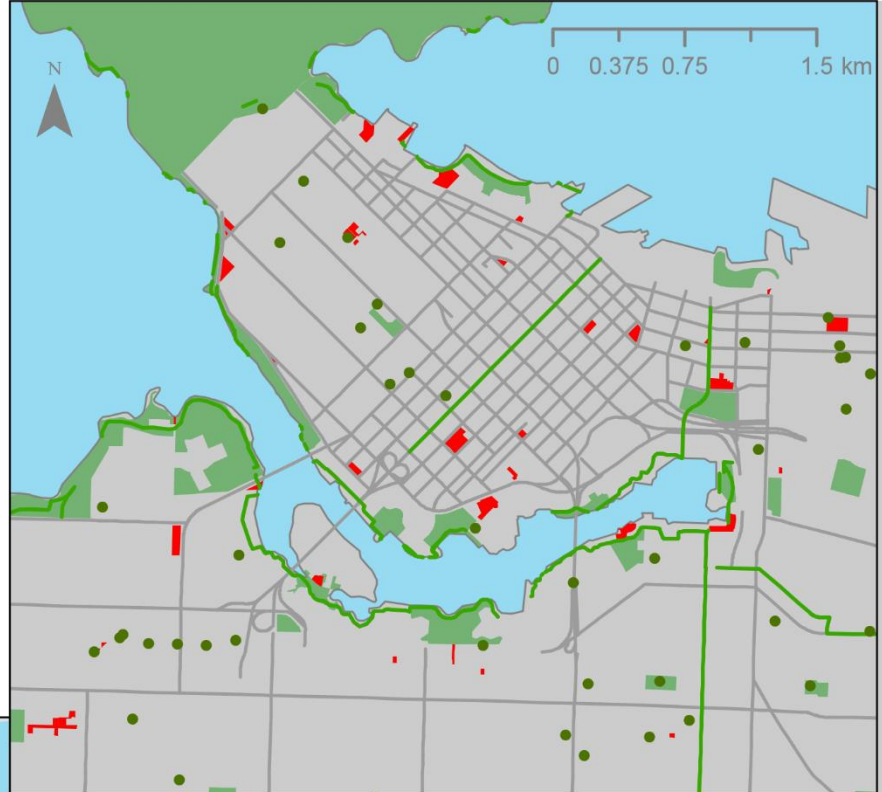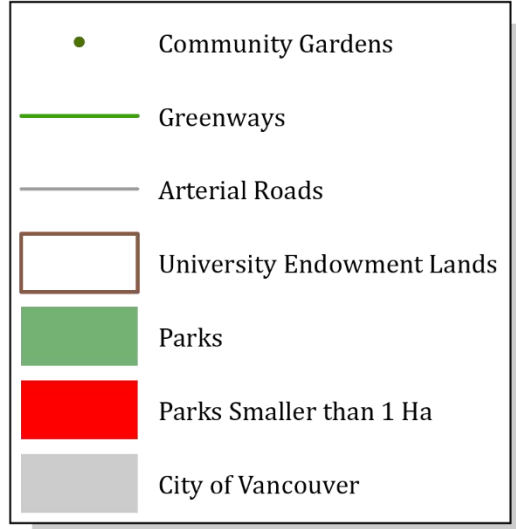
Legend

- Community Gardens
- Parks
- Access to Greenspace within 400m
- No Access to Greenspace within 400m
- University Endowment Lands
- Vancouver Boundaries

0   0.375 0.75   1.5 km

Vancouver Harbour

English Bay

0   0.75   1.5   3 km

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Source: City of Vancouver Open Data Catalogue, G:drive, DataBC

Parks, Greenways & Community Gardens in the City of Vancouver

Legend:
- Community Gardens
- Greenways
- Arterial Roads
- University Endowment Lands
- Parks
- City of Vancouver

English Bay

Vancouver Harbour

0   0.375   0.75   1.5 km

0   0.75   1.5   3 km

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Parks, Greenways & Community Gardens in the City of Vancouver

Legend:

- Community Gardens
- Greenways
- Arterial Roads
- University Endowment Lands
- Parks
- Parks Smaller than 1 Ha
- City of Vancouver

0 0.375 0.75 1.5 km

Vancouver Harbour

English Bay

0 0.75 1.5 3 km

Parks, Greenways & Community Gardens in the City of Vancouver

Legend

- Community Gardens
- Community Gardens at Busy Intersections
- Community Gardens at Parks Smaller than 1 ha
- Greenways
- Arterial Roads
- University Endowment Lands
- Parks
- Park Boundaries at Busy Intersections
- Parks Smaller than 1 ha
- City of Vancouver

0   0.375   0.75   1.5 km

English Bay

Vancouver Harbour

N

0   0.75   1.5   3 km

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Source: City of Vancouver Open Data Catalogue, G:drive, DataBC
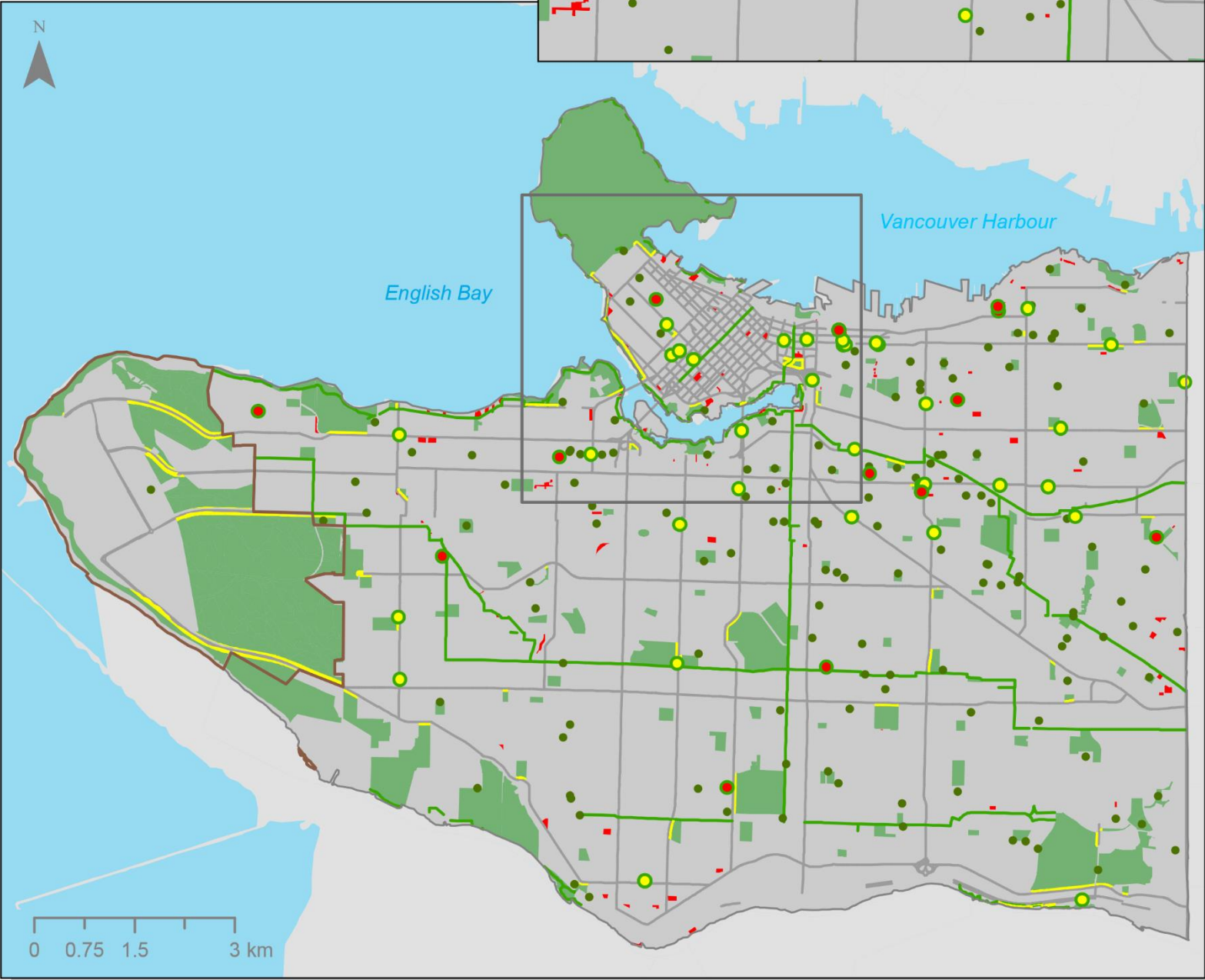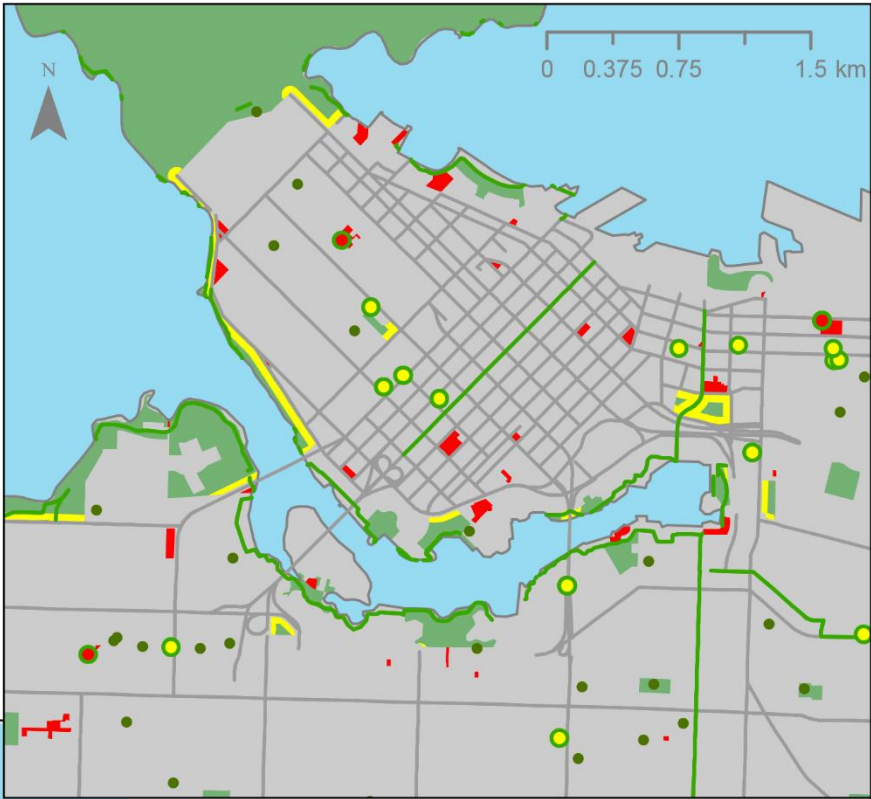
Parks & Community Gardens
in the City of Vancouver

- Underutilized Community Gardens
- Underutilized Parks
- Parks
- > 10% of Private Dwellings are Regularly Unoccupied
- City of Vancouver
- University Endowment Lands

Proportion of Private Dwellings Regularly Unoccupied
By Census Tracts

- 1% - 2%
- 3% - 6%
- 7% - 9%
- 10% - 11%
- 12% - 18%
- 19% - 24%
- No Data

0   0.5   1   2 km

Vancouver Harbour

N

English Bay

Vancouver Harbour

N

0   0.75   1.5   3 km