

Public Involvement in Green Infrastructure Maintenance on Local Streets

Case Study: Green Streets Program in the City of Vancouver



Capstone Report

Tadayori Nakao

Master of Community and Regional Planning (2019)
School of Community and Regional Planning
The University of British Columbia
April, 2019.

Preface

This report was produced as part of a Capstone Project for course 528A at the Master of Community and Regional Planning (MCRP) program at the University of British Columbia.

Acknowledgement

The author would like to thank the following people for all the support and kindness they offered throughout the duration of this project: Dr. Alex Bigazzi, SCARP Faculty Advisor; Liz Nowatschin, Green Streets Program Coordinator, Mike Zipf, City of Vancouver; Itzel Sánchez, Stella Zhou, and Devon Harlos.

Table of Contents

1. Executive Summary	4
2. Background	5
3. Purpose and Scope	7
4. Profile of Green Streets Program	8
4.1 History	9
4.2 Administrative Scope	9
4.3 Benefits from the Green Streets Program	9
4.4 Roles and Responsibilities of Volunteers	10
4.5 The City's Supports for Volunteers	11
5. Motivations for Residents' Sponsorship – Analysis of Feedback Survey	13
5.1 How Did Volunteers Hear about the Green Streets Program?	14
5.2 What about the Green Streets Program Works Well?	15
5.2.1 Positive Impacts on Community	16
5.2.2 Positive Impacts on Individuals	17
5.2.3 Positive Factors that Help Residents Participate in Green Streets Program	18
5.2.4 Summary of Volunteers' Feedbacks	18
6. Analysis of Current Status of the Green Streets Program	19
6.1 Garden Type	21
6.2 Garden Size	22
6.3 Relation of Sponsorship with Land Use	23
6.4 Relation of Sponsorship with Population Density	24
6.5 Regression Analysis	26
6.6 Summary of Analysis	26
7. Discussion	27
8. Recommendations	28
9. Conclusion	29
Limitation	29
References	30
Appendices	31

1. Executive Summary

In Vancouver, bikeway development plays an important role towards achieving urban sustainability. The installation of traffic calming infrastructure such as curb extensions, and traffic circles creates green space on local streets, benefiting the local ecosystem and aiding with stormwater management.

This professional research project conducted a case study of the Green Streets Program (“GSP”), a volunteer program of street garden maintenance provided by the City of Vancouver (“City”). The project sought effective ways to further promote public engagement in green infrastructure maintenance through the analysis of both qualitative and quantitative data.

GSP volunteers are motivated to sponsor street gardens on local streets for social benefits like community building, neighbourhood beautification, and the feeling of personal fulfillment and well-being that comes with gardening and frequent access to green space. The City promotes the GSP through physical assistance, supplying materials, and informative supports.

The project also found that population density and access to off-street community gardens might have a positive impact on sponsorship in the GSP. This finding implies that the GSP works well in highly urbanised areas where residents cannot easily access gardening opportunities, and that a pro-gardening culture can promote public engagement in maintaining on-street green infrastructure.

Finally, the project recommends that the City should facilitate access to green space in urbanised neighbourhoods, advertise and promote the GSP through various channels, and promote gardening culture overall.

2. Background

The City has been pursuing urban sustainability through The *Greenest City 2020 Action Plan* and The *Renewable City Action Plan*. The City's transportation master plan, *Transportation 2040*, promotes bicycling as a form of transportation that contributes to public health and benefits the environment and local economy. The 2017 mode share for bicycling in Vancouver was 6.9%. The Plan sets a target of 7% by 2020, and 12% by 2040. To encourage residents to ride a bicycle and help meet these targets, the City has developed bikeway networks. These networks began in the 1990s when greenway planning policies were created for urban landscaping in an effort to create a more pedestrian and bicyclist-oriented city. (City of Vancouver Landscape Task Force. 1992, City of Vancouver. 1995).

Currently, the total length of the bikeway network is 322 km (at the end of 2017). On-street bikeways make up 80% (265 km) of the total network and 65% of on-street bikeways are local street bikeways (M. Zipf, personal communication, Jan. 12, 2019). On local street bikeways, bicyclists and motorists share lanes, and traffic calming infrastructure, such as curb extensions, diverters, and traffic circles, are installed to enhance bicyclists' safety and to discourage a high volume of vehicles from entering the streets.

Local street bikeway infrastructure provides opportunities for the integration of green infrastructure. Green infrastructure not only helps reduce motor vehicle speed and manage traffic volume, but also provides other public benefits such as stormwater management, beautification, community building, improvement of air quality, reduction of urban heat island effect and many other positive impacts (NACTO. 2014).

A significant issue of green infrastructure is its maintenance. Jin (2016) reports that green stormwater infrastructure such as absorbent infiltration swales and rain gardens are faced with challenges of limited funding and maintenance. In general, the landscaping and maintenance of this green infrastructure is complaint-based, as opposed to a regular maintenance schedule being in place.

Many groups outside of municipalities play an important role in the operation and maintenance of green stormwater infrastructure in North America. Jin (2016) reports that while private developers or institutions and neighbourhood property owners tend to be more engaged in the US than in Canada, citizen stewardship or volunteer groups are more likely to be involved in Canada than in the US.

Many studies report the benefits and issues associated with the gardening activities of residents in urban environments. For example, Kingsley et al. (2009) describes that community gardens allow participants to enjoy benefits such as the escape from daily stresses, a setting for learning and social connectivity, being a part of a supportive community, access to nature, a sense of achievement, and physical health. Wakefield et al. (2007) points out concerns and challenges of continuous gardening in urban environments due to increasing redevelopment and the reduction of garden space.



3. Purpose and Scope

The purpose of the research project is to develop recommendations for effective ways to promote public engagement in green infrastructure maintenance on local streets. The project looks at the GSP provided by the City, a volunteer program which allows residents to take care of vegetation on street infrastructure (street gardens) such as bulges on curb extensions or traffic circles. The project received information about the program scope, volunteers' feedbacks, streets garden locations and sponsorship status from Liz Nowatschin, Green Streets Program Coordinator, Street Activities, Engineering Service, City of Vancouver (personal communication, Dec. 3, 2018, Feb. 7, 2019).

The project firstly will review volunteer motivations for being a part of the GSP. The project collected data on GSP volunteers, including how they joined the program and anecdotal comments about what factors they think work in the program. The project will code volunteers' responses, and through this analysis will investigate what is essential or helpful for the GSP moving forward.

Next, the project will analyze the current status of the GSP. The project also collected data on the street gardens' status, including location, size, type, and residents' sponsorship. Using other available demographic data and GIS, the project will examine what factors are related to the sponsorship, including a regression analysis.

Finally, the project will discuss implications from the results of the analysis and give recommendations for further promotion of the GSP.

4. Profile of Green Street Program

4.1 History

4.2 Administrative Scope

4.3 Benefits from the Green Streets Program

4.4 Roles and Responsibilities of Volunteers

4.5 The City's Supports for Volunteers



4. Profile of Green Streets Program

4.1 History

The GSP began as a pilot program in the Mount Pleasant neighbourhood in 1994, when a series of traffic circles and corner bulges were built to slow traffic in the area. A neighbour scattered spent seed husks for his bird feeder on a curb bulge and sunflowers grew and blossomed there. Neighbours asked City Hall if they could plant the traffic circles and corners bulges near their homes or maintain the street gardens the City planted. This led to the pilot project for the GSP with 15 volunteer street gardeners. (City of Vancouver. 2009)

Over 20 years, the number of volunteer gardens has increased, and around 500 volunteer gardeners take care of over 500 street gardens today. (L. Nowatschin, personal communication, Dec. 12, 2018)

4.2 Administrative Scope

The GSP is part of the Street Horticulture Program which includes approximately 2,000 planted areas. Around 1,000 areas along local streets are eligible to be cared for by GSP volunteers. About 50% of the eligible areas are currently sponsored (November 28, 2018). The number of sponsored gardens fluctuates as volunteers join and leave the program throughout the year.

The GSP is managed by Liz Nowatschin, a full-time Program Coordinator with Engineering Services at the City of Vancouver. Currently, the program accounts for around one third of the Coordinator's workload. The City has a service provider who maintains gardens that do not have a sponsor or are not eligible to be sponsored beside planting and renovation projects. The number of dedicated Street Horticulture Operation crew members is season-dependent. The GSP is primarily promoted to residents through posting signs in the gardens with either a Sponsored or Available sign and by word of mouth. (L. Nowatschin, personal communication, Dec.3, 2018)

4.3 Benefits from the Green Streets Program

Nowatschin introduces many benefits of the GSP for neighbourhoods' living environments. It beautifies and enhances public space, provides more green space and habitat for wildlife such as birds and beneficial insects. For residents' enjoyment, the GSP provides gardening opportunities for residents who do not have their own yard, and allows residents to contribute to making their neighbourhoods more vibrant and beautiful.

4. Profile of Green Streets Program

The GSP also has social benefits. It creates opportunities for community engagement and interaction, and provides a way for residents to develop and show neighbourhood and civic pride.

Furthermore, the GSP plays an important role in stormwater management. Regular gardens help reduce runoff because they are more absorbent than if the area were paved or planted with turf grass. Bio retention gardens help reduce runoff volume and help improve quality from streets and sidewalks by capturing, filtering, and absorbing rainwater.

Nowatschin also recognizes that the GSP helps maintain road infrastructure. Having eyes on the street helps monitor the traffic safety of intersections. For example, GSP volunteers will contact the City if they require help pruning or passersby will see the GSP “Sponsored” sign and contact the City if there are visibility concerns. (L. Nowatschin, personal communication, Dec.3, 2018)

Moreover, a study conducted by Kristensson in 2011 reviewed volunteers’ motivation for joining the GSP through interviews with volunteers. The study revealed the GSP’s physical and mental health benefits, amongst other benefits identified by the City.

4.4 Roles and Responsibilities of Volunteers

Residents sign up for the GSP online. They can find out if a streets garden is available or not through the signs posted in the gardens; a garden currently sponsored has a “Sponsored” sign, while a streets garden not sponsored has an “Available” sign.

Both individuals and groups can sign-up. In registering for the GSP, applicants agree to care year-round for the garden including weeding, pruning, and other routine maintenance. GSP volunteers are supposed to take extreme caution and be visible to traffic while gardening because street gardens are close to vehicle traffic. The GSP provides safety vests to all gardeners who need one. (City of Vancouver. 2018b, L. Nowatschin, personal communication, Dec. 3, 2018, Feb.7, 2019)



Source: City of Vancouver.(2018b)

Figure 1. Green Streets Program Signs

4. Profile of Green Streets Program

The GSP volunteers agree to follow the Boulevard Gardening Guidelines. The guidelines include standards such as the maximum depth to which volunteers can dig to avoid interference with underground utilities (15cm), the recommended level of mounting up compost or soil above the original ground level to encourage plants to root (approximately 20cm; not more than 10cm above tree roots), minimum setbacks along the curb edge to allow pedestrians to easily open and close vehicle doors and to cross to the sidewalk (30cm), plant height to keep the sightlines of vehicles, cyclists, or pedestrians (approximately 1m; 60cm closer to intersections, driveways, curbs, sidewalk edges and/or where visibility is a concern). The guidelines also encourage gardeners to choose drought-tolerant plants that are within the height guideline and do well in the harsh conditions. (City of Vancouver. 2012b, 2015)

GSP volunteers are not expected to remove leaves from the street, but they do often clean-up the garden. Some of the gardens are bioretention gardens that have a catch basin located within them. GSP volunteers typically keep these catch basins clear of debris. (L. Nowatschin, personal communication, Feb. 7, 2019)

4.5 The City's Supports for Volunteers

Material Supports

The City provides GSP volunteers with material supports. The City organizes a bulb pick-up, as two of the large destination gardens (Queen Elizabeth and VanDusen Botanical Garden) donate their spent spring bulbs. The program also supplies compost twice a year¹, has a plant swap event every spring where GSP volunteers bring their own plants to trade with each other, and holds an annual plant sale where the volunteers can get plants at wholesale prices. (L. Nowatschin, personal communication, Dec. 3, 2018).

Informative Supports

For informative support, the City provides the volunteers with a recommended plant list. There is also a Green Streets newsletter and a Facebook group where gardeners can connect with each other. The newsletter is issued every 2 or 3 months. It contains feature plants each season, gardening tasks, feature gardening activities, and upcoming events.

The City invites GSP volunteers to an annual garden party at VanDusen Botanical Garden where the City has gift bags for the gardeners, lots of draw prizes, food, garden-related entertainment and free admission to the garden for the day. (L. Nowatschin, personal communication, Dec. 3, 2018)

¹ The City piloted offering mulch instead of compost in fall 2018.

4. Profile of Green Streets Program



Provided by City of Vancouver

Figure 2. Green Streets Program Newsletter

Physical Assistance

The City also provides physical support for GSP volunteers. The City provides plants and installs the initial planting for all new traffic circle and landscaped curb bulge gardens with input on plant selection and layout from the sponsoring volunteer/s.

On a case by case basis, the City will order new plants if an older garden is in need of a renovation. Sometimes a City horticulture crew will replant an entire garden; other times they will deliver the plants for the volunteer/s to add themselves.

On occasion, the City will organize a horticulture crew to do some maintenance of a sponsored garden if the volunteer/s need/s extra help. Although the City does not recognize that it is a significant problem, vandalism and theft of plants, litter, or damage from vehicular traffic occur on occasion. In the case where the damage is to the vegetation, GSP volunteers usually contact the Program Coordinator directly; the program coordinator often meets the volunteers at the garden to assess the damage and then the City makes a plan depending on the extent of damage and to what degree the volunteer would like to be involved. The City orders plants, and then either the street horticulture crew or the volunteer will plant them. (L.Nowatschin, personal communication, Dec. 7, 2018)

5. Motivations for Residents' Sponsorship - Analysis of Feedback Survey

5.1 How Did Volunteers Hear about the Green Streets Program?

5.2 What about the Green Streets Program Works Well?



5. Motivations for Residents' Sponsorship - Analysis of Feedback Survey

In this chapter, the project will analyze the results of the Green Streets 2018 Survey the City conducted at the beginning of 2018 to gather feedbacks about the GSP from volunteers. The project will review what factors can motivate residents to participate in the GSP.

5.1 How Did Volunteers Hear about the Green Streets Program?

For the question “How did you hear about the Green Streets Program?”, the City received 257 answers. Some respondents chose multiple options. “Green Streets Garden Sign” gathered the most (137); the second most answer was “Friends, Neighbour, or Relative”, collecting 59. “Other” includes the case where a sponsor has been engaged in the GSP for a long time, heard from a community group, directly contacted the City or complained to the City about street maintenance. It seems that the GSP sign works well to gain new sponsors, while the beautification of neighbourhoods through the program can encourage residents to participate in it.

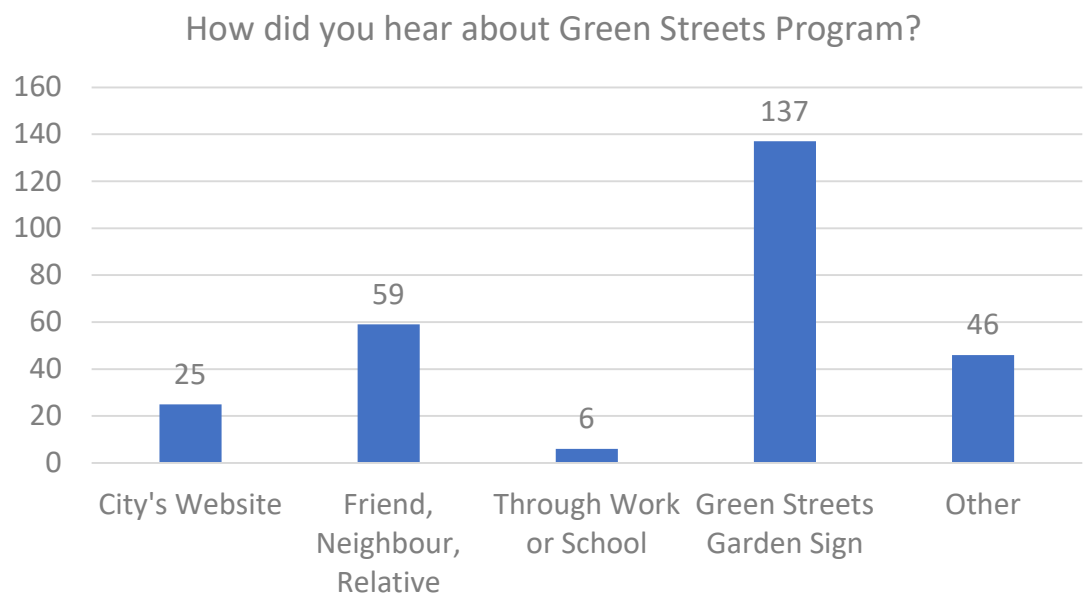


Figure 3. How Volunteers Hear about the Green Streets Program

5. Motivations for Residents' Sponsorship - Analysis of Feedback Survey

5.2 What about the Green Streets Program Works Well?

The City asked respondents what they thought worked well with the GSP and collected 202 answers in total. Responses were analyzed and coded into three categories:

- Comments that emphasize positive impacts on community
- Comments that emphasize positive impacts on individuals
- Comments that positive factors that help residents participate in GSP

Table 1. Categorization of Feedbacks from Volunteers

Impacts on Community	Community Building	41
	Neighbourhood Beautification	27
	Traffic Calming	2
Impacts on Individuals	Volunteers' Autonomy / Self-fulfillment	25
	Sense of Being Part of Community	13
	Providing Gardening Opportunities for Residents without Gardens	10
Factors that Help Residents Participate in the Program	Support from City	71
	Interaction with Other Volunteers	25
	Green Streets Garden Sign	2



5. Motivations for Residents' Sponsorship - Analysis of Feedback Survey

5.2.1 Positive Impacts on Community

Community Building

The GSP has had a largely positive impact on community building. The study found 41 comments that the program allows people to meet and have conversations in their neighbourhood while gardening. The program seems to lead to gardeners feeling more connected to their community. The following are examples of comments that are coded as community building:

"Brings a lot of enjoyment to people in the neighbourhood."

"Creates a feeling of belonging to a citywide community and also feeling connected to a neighbourhood."

"I love that Green Streets has given me the opportunity to meet the people of my neighbourhood and allowed me to get my hands dirty doing what I love."

"It is a great community builder. While I have been working on the garden, I have spoken to many of my neighbors as they walked by. ... I feel that people are inspired to volunteer as they can see and experience the rewards of a culture and community of volunteers."

Neighbourhood Beautification

There are also many comments (27 in total) about how the program works to beautify neighbourhoods. Because GSP volunteers can arrange the garden how they like, the program allows for creativity. In addition, there are several comments that the program can keep the street clean, preventing litter and vandalism. Comments coded as neighbourhood beautification include:

"Helps add colour, greenery and visual interest to what would otherwise be unattractive spaces."

"Creativity of gardeners displayed, neighborhoods look beautiful, ..."

"I see evidence of spaces where there is a garden instead of garbage because of this Program."

Traffic Calming

There are 2 comments about the traffic calming effects of street gardens. For example, one respondent noted that the street gardens may help slow traffic near an elementary school. This indicates that those who maintain green infrastructure on local streets recognize the significance of its traffic calming.

5. Motivations for Residents' Sponsorship - Analysis of Feedback Survey

5.2.2 Positive Impacts on Individuals

Volunteers' Autonomy and Self-fulfillment

While there are many comments about the positive impacts of the program on the neighbourhood and community, many reported feelings of autonomy and freedom in gardening. GSP volunteers can enjoy taking care of street gardens because they can work when and how they like. In addition, gardening at their own pace and in their preferred manner seems to bring joy to GSP volunteers and even sense of ownership. Samples of this finding include:

““Being allowed to create our own gardens.”

“It’s voluntary and we can work at our own pace.”

“Makes our entrance more appealing.”

“Not really familiar with it, I maintain ‘my’ garden because it's in front of my house and would otherwise fall into disrepair.”

Sense of Being Part of Community

The GSP also leads to the volunteers' sense of achievement through contribution to the community. Thirteen responses are coded as “sense of being part of community”. Some GSP volunteers comment both on the feeling of individual achievement through gardening and on feeling part of and contributing to the community. For example, one respondent stated that *“It provides an opportunity for residents to contribute to their community while reaping the benefits of gardening.”*

Providing Gardening Opportunities for Residents without Gardens

Though there are just 10 comments that the program gives residents who do not own their gardens an opportunity to enjoy gardening, this impact is important considering that the population will keep growing and there will be less space for gardens in the region in the future. This finding is supported by the fact that the sponsorship rate is higher in areas with higher population density. An example from coding says;

“It's a good system to get some of the cities land gardened for free and it give people like me who don't have access to land, a place to garden. Everyone wins.”

5. Motivations for Residents' Sponsorship - Analysis of Feedback Survey

5.2.3 Positive Factors that Help Residents Participate in Green Streets Program

Supports from the City

Supports from the City are essential for the GSP; 71 comments were coded as conveying appreciation for supports from the City. There are 12 comments which specifically convey appreciation for the supports of the Green Streets Program Coordinator (L. Nowatschin); who provides help if GSP volunteers have a problem. Technical Information including regularly issued newsletters are mentioned in 36 comments. Material supports are also helpful for GSP volunteers; free bulbs or plants swap events are reported in 16 comments, and free compost service in 26 comments.

Table 2. Types of Supports from the City in Volunteers' Comments

Green Streets Program Coordinator	12
Information (e.g. Newsletter)	36
Free Bulbs/ Plant Swap	16
Free Compost	26

Interaction with Other GS Volunteers

There are 25 comments that show appreciation to interaction with other GSP volunteers. While GSP has a positive effect of community building, volunteers enjoy building connections with other GSP volunteers, especially in an annual garden party at VanDusen Botanical Garden. For example, one respondent said that "the annual parties are an excellent way to keep in touch with you and other gardeners". A total of 20 comments mentioned this party.

Another comment showed appreciation for the Facebook group as a good source for information and plant exchanges.

5.2.4 Summary of Volunteers' Feedbacks

The review of GSP volunteers' feedbacks showed that, many volunteers experience social benefits by participating in the GSP such as community building and interactions with other gardeners, as well as its aesthetic impacts. GSP volunteers also appreciate that they can produce their "own" gardens in the public infrastructure, and that the program provides residents who do not have their own yard with an opportunity to enjoy gardening. To allow GSP volunteers to maintain their sponsorship, supports from the City including both materials and consultation are essential, especially consistent information-sharing through the newsletter.

6. Analysis of Current Status of the Green Streets Program

6.1 Garden Type

6.2 Garden Size

6.3 Relation of Sponsorship with Land Use

6.4 Relation of Sponsorship with Population Density

6.5 Regression Analysis

6.6 Summary of Analysis



6. Analysis of Current Status of the Green Streets Program

The project received a snapshot of data on the location, size, type, and sponsorship status of all the street gardens in the GSP from the City. The project will analyze the data by the garden type and the garden size and investigate whether there are any quantitative similarities of street gardens. The project will also put the location data in GIS and examine if there are any traits in relation to demography and land use.

Based on the master list of the street gardens shared by the City, the project will analyze the current status of the GSP. As of November 28, 2018, there are 1,008 street gardens (24,857 m²) eligible for GSP, and 545 gardens (14,247 m²) are sponsored by GSP volunteers. All the eligible gardens are along local streets, and 609 eligible gardens (60%) are along bikeways endorsed by the City. Of the 514 intersections which have eligible gardens, 312 (61%) are on bikeways. The number of sponsored gardens fluctuates as GSP volunteers join and leave the program throughout the year.

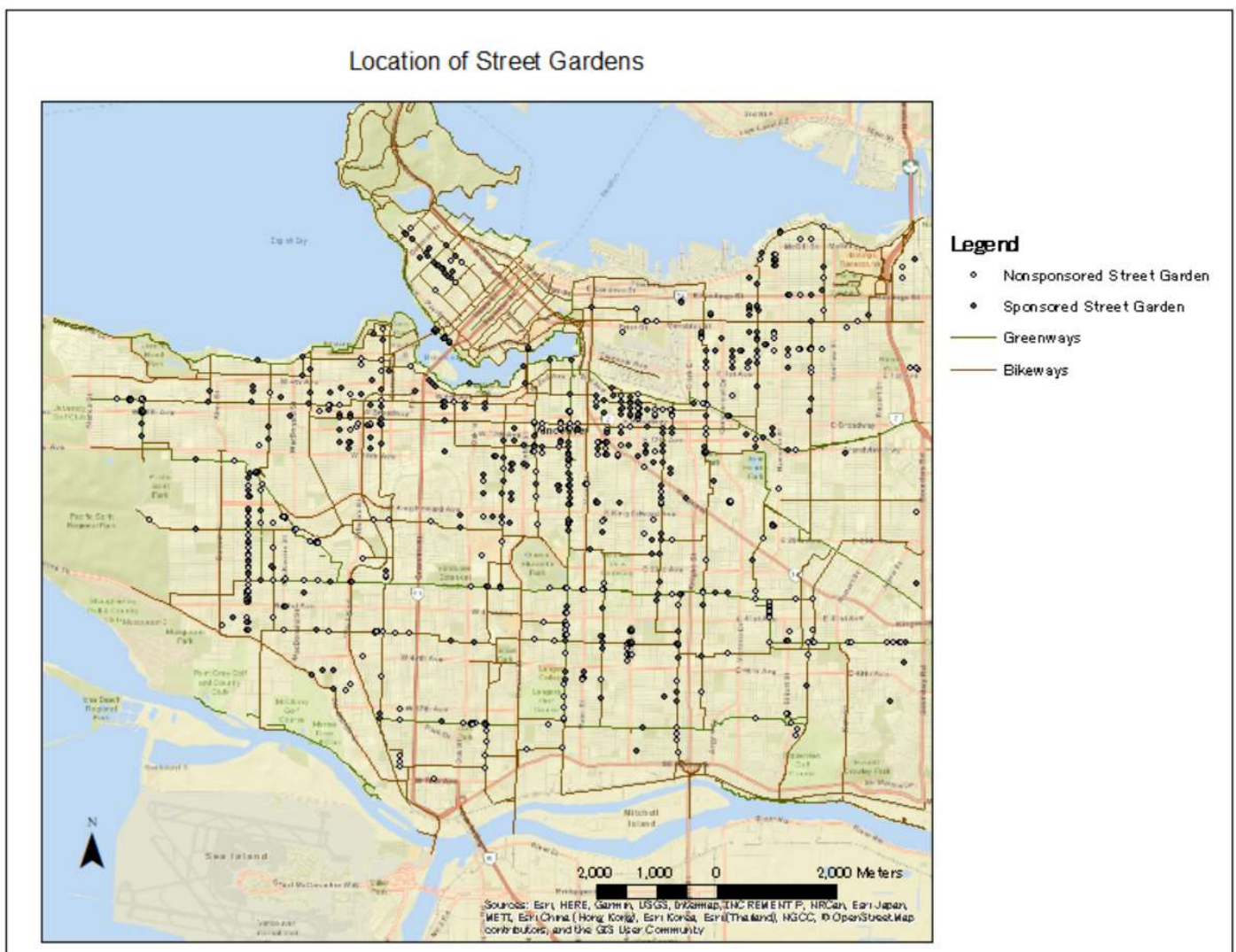


Figure 4. Street Garden Map

6. Analysis of Current Status of the Green Streets Program

6.1 Garden Type

There are 9 types of gardens: bulge, bio retention bulge, planters, traffic circle, island, traffic diverter, boulevard², Neighbourhood Greenway³, riparian. The majority of gardens are the bulge type (56%), followed by traffic circle (28%), boulevard (5%), bio retention bulge (4%), and traffic divider (4%). (Figure 5)

Garden types that are placed in traffic calming infrastructure are bulge, bio retention bulge, planter, traffic circle, island, traffic diverter, which account for 93 % (937 gardens) in number and 68% in area (9,694 m²). They are located at 502 intersections and 12 midblocks.

In terms of the rate of GSP gardens which are currently sponsored (“sponsorship rate”), there is not a large difference between garden types. Most garden types show around between 50% and 60 %, as the total average is 54.1%. (Figure 6)

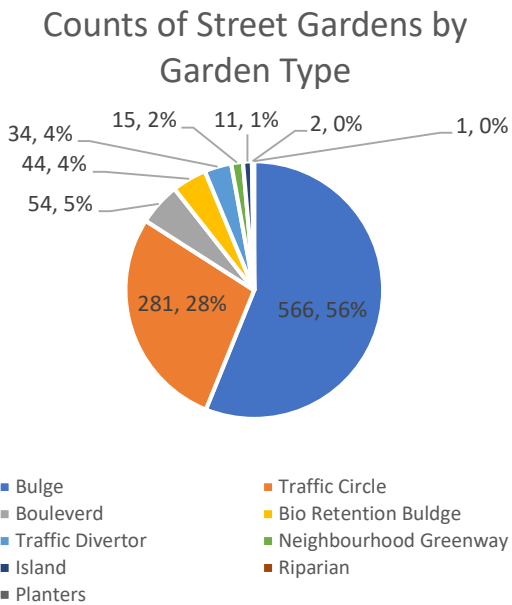


Figure 5. Counts of Street Gardens by Garden Type

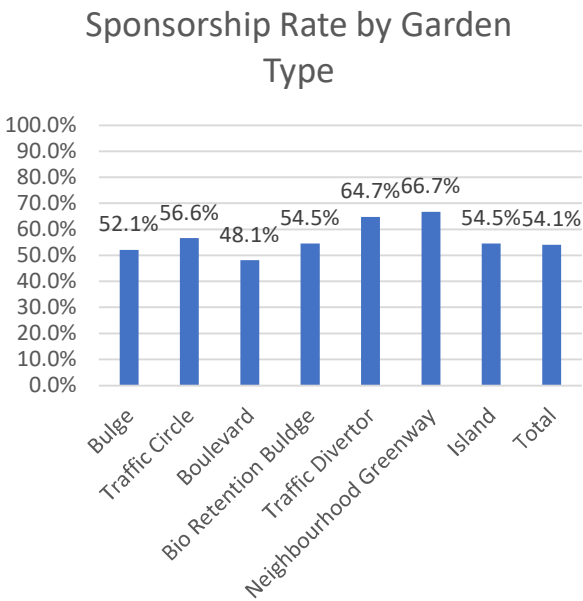


Figure 6. Sponsorship Rate of Street Gardens by Garden Type

² The area between the street curb and the sidewalk that is typically planted with grass.

³ Small-scale, local connections for pedestrians and cyclists initiated and maintained by local communities, which are seen as partnerships between the City and communities. (City of Vancouver. 2013)

6. Analysis of Current Status of the Green Streets Program

6.2 Garden Size

In terms of the garden size, the average size of all the street gardens is 24.7m²; the mode is 12 m², and the median is 16 m². Sponsored gardens have similar characteristics; the average size is 26.1 m², and the mode and median are the same as the total gardens. The size statistics for total street gardens and solely sponsored gardens show similar distributions.

Table 3. Summary of Statistics of Street Gardens

	Total Street Gardens (m ²)	Sponsored Street Gardens(m ²)
Mean	24.68	26.14
Median	16	16
Mode	12	12
Standard Deviation	55.15	47.63
Variance	3042.00	2268.65
Range	1269	463
Minimum	1	1
Maximum	1270	464

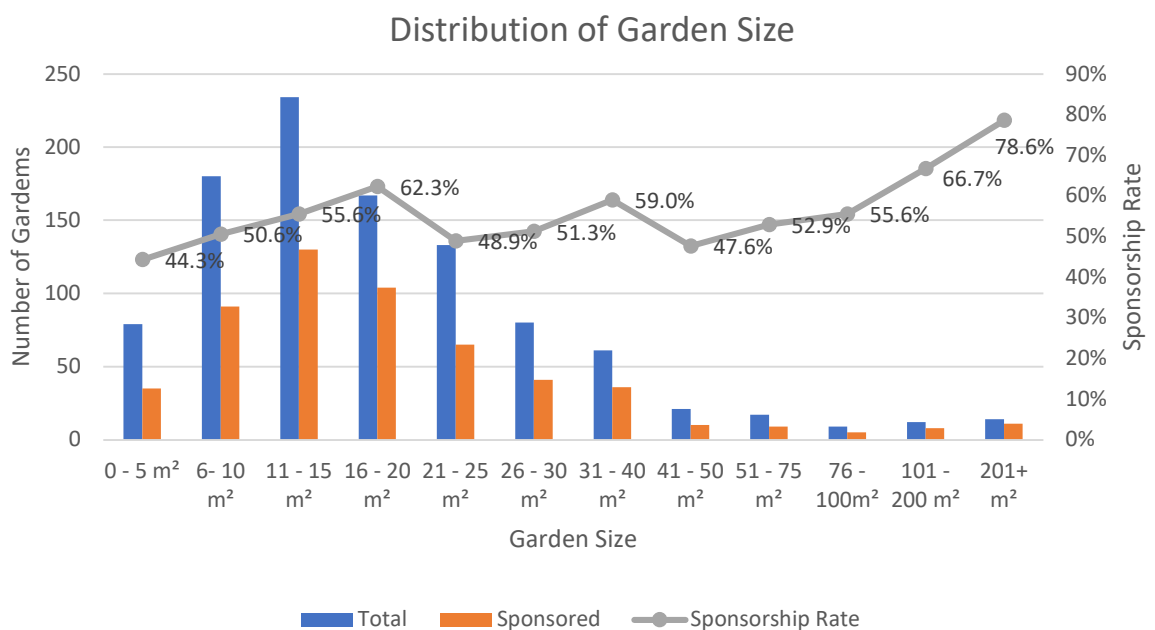


Figure 7. Distribution of Streets Garden Size

6. Analysis of Current Status of the Green Streets Program

As for the garden size by garden type, bulges and traffic circles, which make up over 80% of all the street gardens, have lower average sizes than the total average, while islands, boulevards, neighbourhood greenways, and riparian have larger garden sizes.

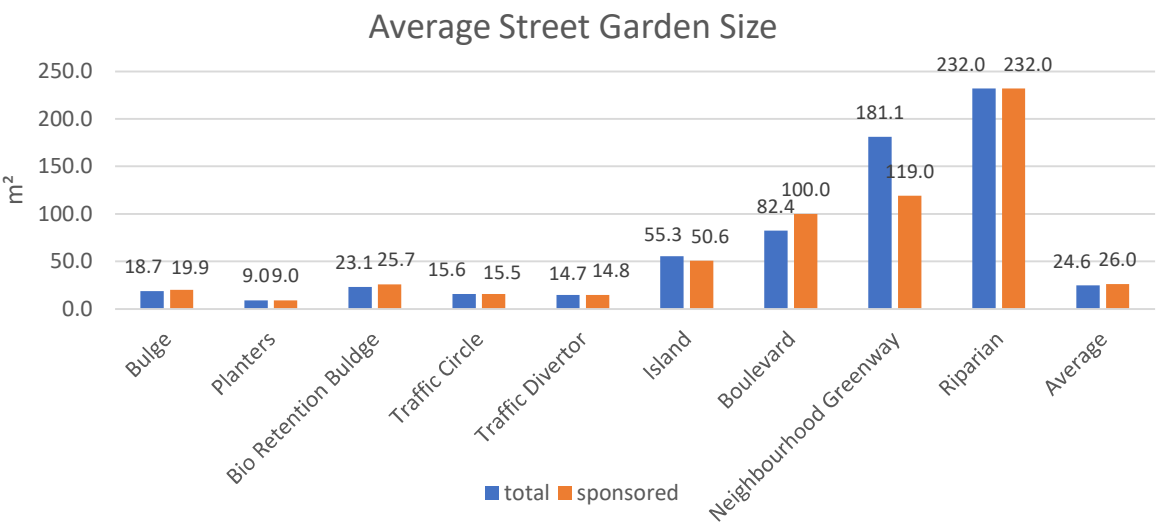


Figure 8. Average Streets Garden Size

6.3 Relation of Sponsorship with Land Use

Street gardens are installed along local streets, and the majority of street gardens are in areas with lower population density such as single-family residential districts. Figure 9 shows the distribution of street gardens by zoning district. More than half of all the street gardens (56%) are located in one-family dwelling districts, followed by multi-family (19%), and two-family dwelling (16%). Comprehensive development and commercial districts make up just 5% and 6% respectively.

Counts of Street Gardens by Zoning District

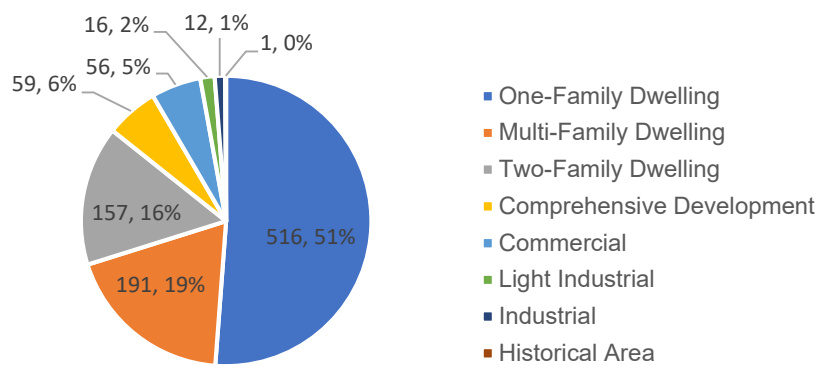


Figure 9. Counts of Street Gardens by Zoning District

6. Analysis of Current Status of the Green Streets Program

On the other hand, the sponsorship rate is higher than 50% in commercial, comprehensive development, multi-family dwelling and two-family dwelling districts, compared to one-family dwelling districts where the rate is lower than 43%. It seems that the higher population density the area has, the higher sponsorship rate it has.

Table 4. Sponsorship rate of Street Gardens by Zoning District

Zoning District	Counts of Sponsored Street Gardens	Counts of Total Street Gardens	Sponsorship rate
Commercial	40	56	71.4%
Comprehensive Development	40	59	67.8%
Multi-Family Dwelling	128	191	67.0%
Two-Family Dwelling	105	157	66.9%
One-Family Dwelling	222	516	43.0%
Industrial	4	12	33.3%
Light Industrial	5	16	31.3%

6.4 Relation of Sponsorship with Population Density

As the project looked at the sponsorship of street gardens in each neighbourhood, highly developed neighbourhoods in or next to Downtown Vancouver have a high sponsorship rate of over 80%, such as Downtown (100%), Fairview (91.7%), and West End (82.4%). On the contrary, neighbourhoods distant from Downtown Vancouver are likely to have a low sponsorship rate, and tend to be residential districts (Figure10, Appendix B).

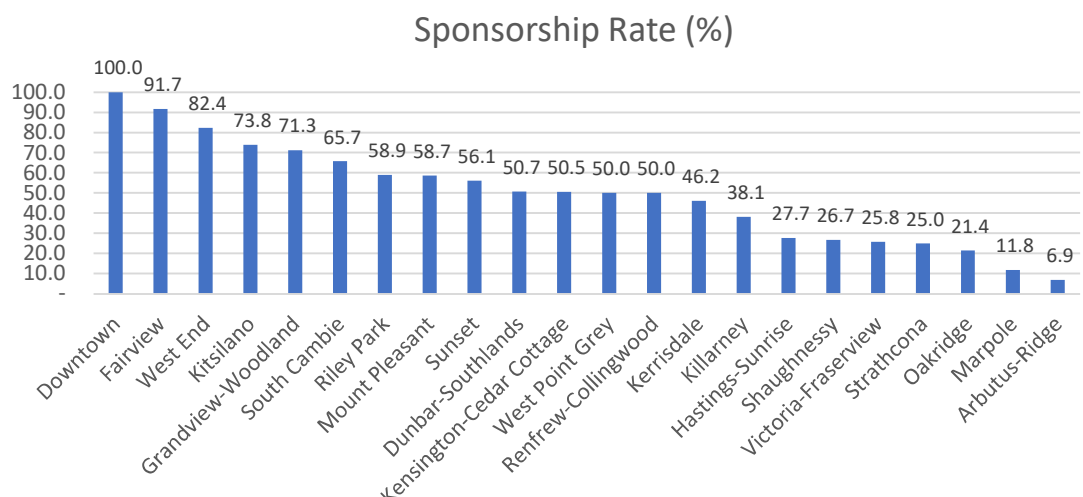


Figure 10. Sponsorship Rate of Street Gardens by Neighbourhood

6. Analysis of Current Status of the Green Streets Program

From another demographic aspect, there seems to be a negative correlation between population density and the average age in the city. In other words, neighbourhoods with higher population densities have a lower age average, as shown in Figure 11. Young populations might be more likely to prefer to live where there is easier to access city centres, work places and commercial areas.

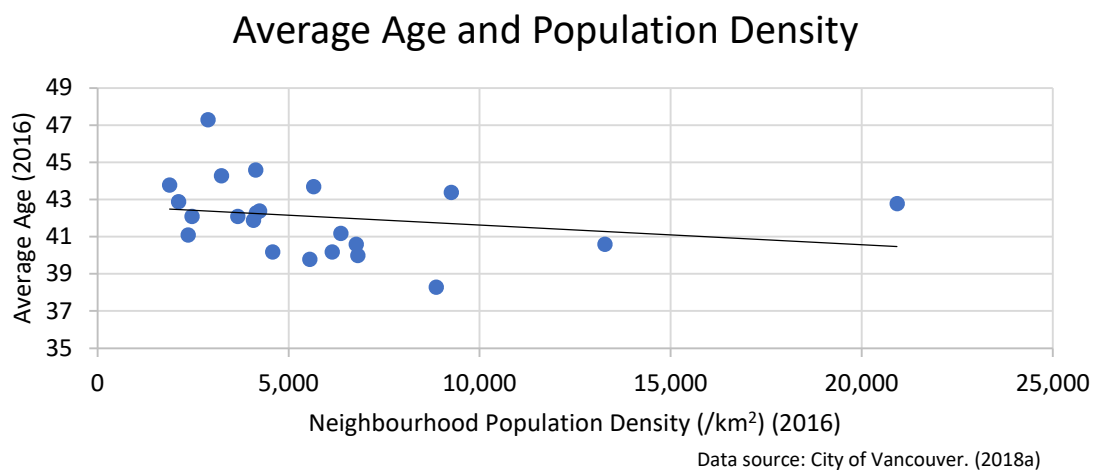


Figure 11. Average Age and Population Density

6.5 Regression Analysis

The project will examine the findings in the previous section that demographic factors (population density) can have a positive effect on residents' sponsorship of green streets. As shown in the scatter plots in Figure 12, there seems to be a positive correlation between the sponsorship rate of street gardens and neighbourhood population density.

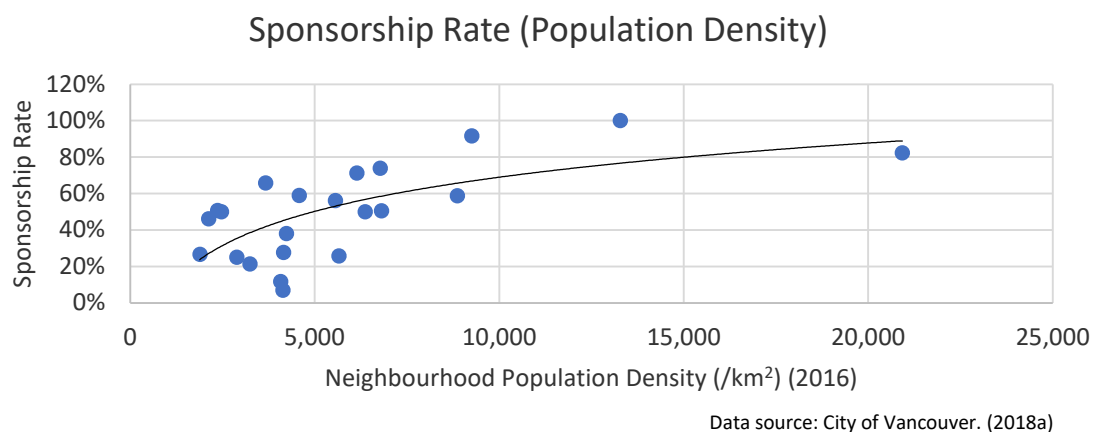


Figure 12. Sponsored Rate of Street Gardens and Population Density

6. Analysis of Current Status of the Green Streets Program

Next, the project will conduct a regression analysis to examine how much population density can have a positive impact on the sponsorship of street gardens. To see if there is correlation of sponsorship of green gardens with general gardening culture and residents' gardening preference factor, the project will add a parameter of number of off-street community gardens in the neighbourhood. As the project look at the sponsorship rate, it will use Logit Model shown below:

$$\ln\left(\frac{\text{sponsorship_rate}}{1 - \text{sponsorship_rate}}\right) = \beta_0 + \beta_1 \cdot (\text{population_density}) + \beta_2 \cdot (\text{num_community_gardens})$$

As a result of the regression analysis, both population density and the number of community gardens showed positive significance at 95% of level of confidence as demonstrated in Table 5. This may indicate that both the two factors can have a positive influence on the sponsorship of street gardens.

Table 5. Summary of Regression Analysis

SUMMARY OUTPUT

Regression Statistics		
Multiple R	0.670809	
R Square	0.449985	significant at 95% level of confidence
Adjusted R Square	0.392089	
Standard Error	2.133056	
Observations	22	

ANOVA					
	df	SS	MS	F	Significance F
Regression	2	70.72652474	35.36326237	7.77226787	0.0034163
Residual	19	86.44863975	4.549928408		
Total	21	157.1751645			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%
Intercept	-2.58339	0.878635525	-2.940228338	0.008400973	-4.4223944	-0.7443838
population density	0.000304	0.000110181	2.755560389	0.012582321	7.3E-05	0.0005342
# community gardens	0.30877	0.14161666	2.180319451	0.042012786	0.0123625	0.6051766

Data source: City of Vancouver. (2018a)

6.6 Summary of Analysis

The sponsorship of street gardens is also influenced by land use rather than just street garden type and size. Sponsorship rates were generally higher in commercial, comprehensive development and multi-family dwelling districts than in two-family dwelling, one-family dwelling, and industrial districts. Population density and the number of community gardens have significantly positive impact on sponsorship rates.

7. discussion

The data analysis in the previous chapter has led to three main findings regarding GSP sponsorship.

First, there do not seem to be major differences in street garden size and type between sponsored and non-sponsored gardens. The GSP is easy for residents to initiate because the City provides a new GSP volunteer with initial planting and a resident can apply to sponsor any size of street gardens, which allows them to work on gardening at their own pace and within their own capacity. Furthermore, street gardens are located on local streets with low traffic volumes and speeds, which can help GSP volunteers enjoy gardening on the street without a big concern for safety. For safety reasons, only street gardens located in residential areas and on calm streets are available for the GSP (Harper. 2012.). However, there are a few safety concerns indicated by GSP volunteers. For example, to access a traffic circle, you must cross the vehicle lane. Nevertheless, there is not a clear difference of the sponsorship rate between bulges (52.1%) and traffic circles (56.6%).

Secondly, street gardens in locations which are more urbanized are more likely to be sponsored. Commercial and comprehensive development districts show a high sponsorship rate and street gardens in locations with higher population density are also more likely to be sponsored. In addition, there are some comments that indicate that the GSP allows residents without their own gardens to access gardening. The GSP may encourage residents' feelings of fulfillment and enhance access to green space in urbanized areas with high population densities.

Finally, GSP sponsorship seems more active in pro-gardening communities. Neighbourhoods with more community gardens are more likely to have a higher sponsorship rate in the GSP. The difference between a GSP garden and a community garden is whether it is on-street or off-street. Communities with active gardening cultures are also willing to take care of on-street gardens (green infrastructure).

One big challenge in promoting the GSP is the uneven distribution of street gardens in terms of land use. Around 70% of the street gardens are supplied in districts with a lower sponsorship rate, such as one-family and two-family dwelling districts. This is because these districts areas take up a larger geographic area in the city than other land uses. Therefore, increasing sponsorship in these districts is key to achieving higher GSP sponsorship rates in the city as a whole.

8. Recommendations

Based on the discussion above, the project gives the following recommendations for promoting sponsorship in the GSP.

Strategic Promotion of Green Infrastructure Sponsorship in High-Density Neighbourhoods

The City should engage residents who live in populous and highly developed districts in the maintenance of green space. Strategically promoting the GSP in these high-density neighbourhoods makes sense because residents are less likely to have their own gardens and further greening these areas aligns with the City's sustainability goals. Residents are potentially powerful supporters in the maintenance of green space, and considering residential areas will continue to densify in the future, it is important that residents are on board with greening initiatives.

Widespread Advertising

The City should advertise and promote the GSP positively for residents through community groups and educational organizations, in addition to the GSP signs in the street gardens. The GSP is currently promoted mainly through sponsored signs or available signs posted in street gardens. The majority of the GSP volunteers heard about the program from the signs or from friends, neighbours or relatives. Moreover, because sponsorship is not as active in low density areas, it may be effective to advertise the GSP not only to passersby but also to various community groups and educational organizations, which could make people more aware of the program. Promoting the GSP through cultural initiatives is another way to promote the GSP; for example, adding an outdoor arts activity combined with street landscaping to the list of projects eligible for the Cultural Grants Program.

Cultivation of Gardening Culture

The City should enhance people's awareness of the importance of green public space and promote gardening culture. The regression analysis for street garden sponsorship indicates positive relations between the GSP sponsorship and the number of community gardens, which implies that the GSP is more likely to be active in pro-gardening communities. It may be effective to promote local gardening culture through multiple types of channels such as horticulture and environmental education in school. At the same time, many current sponsors show their appreciation for supports from the City. The City should therefore keep supporting GSP volunteers, and constantly listening to their needs.

9. Conclusion

To achieve a higher degree of urban sustainability in Vancouver, the use of green traffic calming infrastructure on local streets has increased, as well as the expansion of bike networks and care for urban ecosystems. The GSP has involved volunteer residents in the maintenance of green infrastructure (street gardens). GSP volunteers enjoy gardening on streets because they appreciate its positive impacts on the community and on themselves. The analysis of the current status of street gardens gives a suggestion that the GSP gives residents without their own yards opportunities to garden and adds green space to neighbourhoods with high population density. In order to further improve the GSP, it is necessary to engage the public in street garden maintenance through various advertisement channels and the promotion gardening culture overall.

Limitation

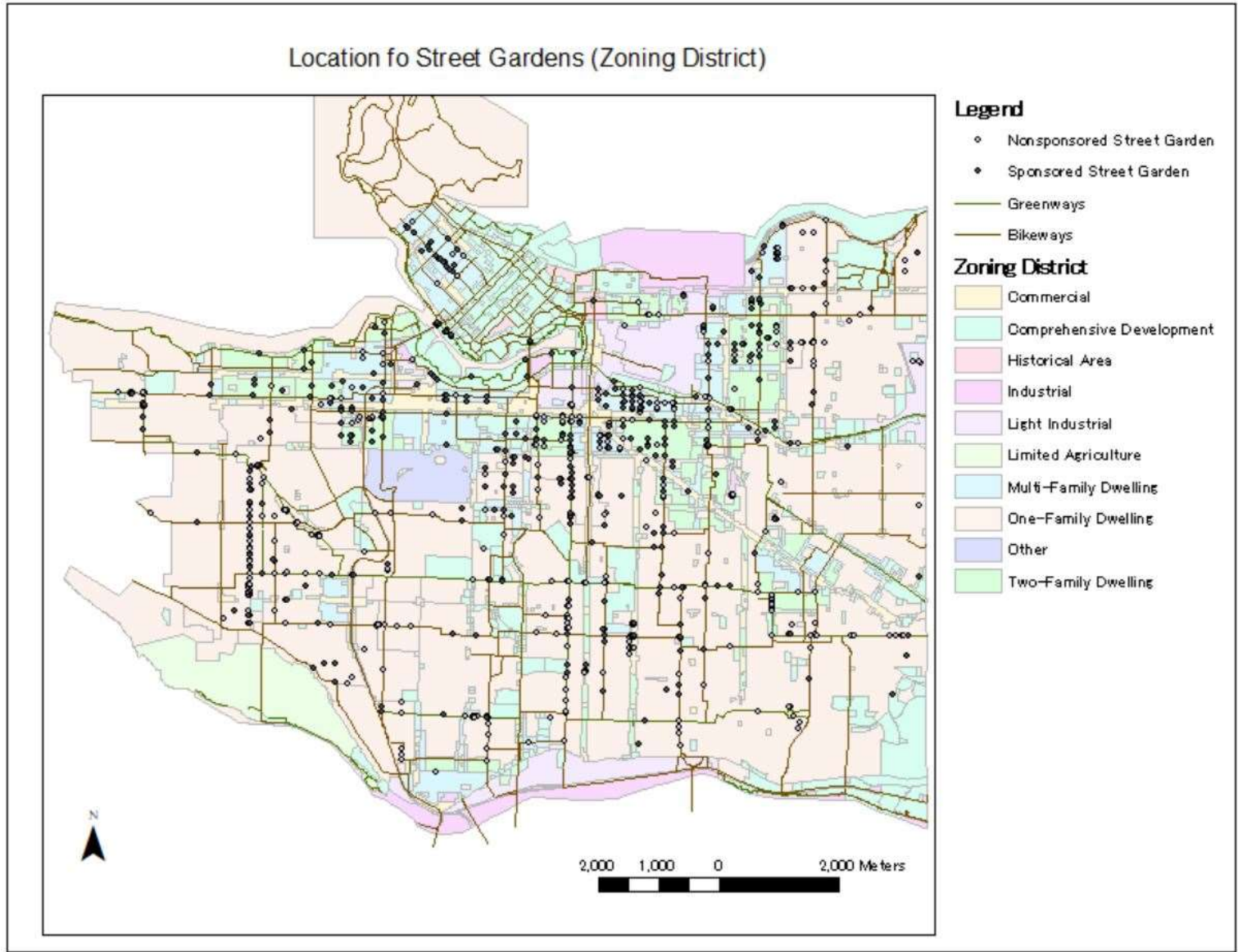
This project was conducted based on a limited amount of data and information. The feedback obtained from GSP volunteers for this study does not necessarily represent the views of all GSP volunteers. Moreover, garden status data used in the analysis is a snapshot of November 28th, 2018, and the number of sponsors of street gardens fluctuates throughout the year and there may be some seasonal tendencies. A chronicle of data for street gardens was not available.

References

- City of Vancouver. (2009). Green Streets Vancouver
- City of Vancouver. (2012a). Greenest City 2020 Action Plan. Retrieved on November 10, 2019, from <https://vancouver.ca/files/cov/Greenest-city-action-plan.pdf>
- City of Vancouver. (2012b). Recommended plant list. Retrieved on January 16, 2019 from <https://vancouver.ca/home-property-development/recommended-plant-list.aspx>
- City of Vancouver. (2012c). Transportation 2040 Plan. Retrieved September 20, 2018, from <https://vancouver.ca/streets-transportation/transportation-2040.aspx>
- City of Vancouver. (2013). Neighbourhood greenways: Improving connections in your community. Retrieved on January 16, 2019, from <https://vancouver.ca/streets-transportation/neighbourhood-greenways.aspx>
- City of Vancouver. (2015). Boulevard Gardening Guidelines. Retrieved on December 12, 2018, from <https://vancouver.ca/home-property-development/gardening-guidelines.aspx>
- City of Vancouver. (2017). Renewable City Action Plan. Retrieved on January 16, 2019, from <https://vancouver.ca/files/cov/renewable-city-action-plan-november-2017.pdf>
- City of Vancouver. (2018a). Open Data catalogue. Retrieved January 19, from <https://vancouver.ca/your-government/open-data-catalogue.aspx>
- City of Vancouver. (2018b). The Green Streets Program: Volunteer gardening on traffic calming spaces. Retrieved on January 20, 2019, from <https://vancouver.ca/home-property-development/green-streets-program.aspx>
- City of Vancouver Landscape Task Force. (1992). Greenways, public ways. Final Report.
- Harper, K. (2012). Reclaiming Loose Space: Implications of Loose Space for Physical Activity. Retrieved on February 17, 2019, from <https://atrium.lib.uoguelph.ca/xmlui/handle/10214/3573>
- Jin, J. (2016). Green Stormwater Infrastructure on City Streets. Greenest City Scholar Project. Retrieved on December 26, 2018, from https://sustain.ubc.ca/sites/sustain.ubc.ca/files/GCS/2016%20Project%20Reports/Green%20Stormwater%20Infrastructure%20on%20City%20Streets_Jin%20_2016.pdf
- Kingsley, J., Townsend, M., & Henderson-Wilson, C. (2009). Cultivating health and wellbeing: Members perceptions of the health benefits of a Port Melbourne community garden. *Leisure Studies*, 28(2), 207-219. doi:10.1080/02614360902769894
- Kristensson, I. (2011). Volunteer motivation in Vancouver's Green Streets Program. Retrieved on October 2, 2018, from https://stud.epsilon.slu.se/3275/1/kristensson_i_111010.pdf
- National Association of City Transportation Officials (NACTO). (2014). Urban Bikeway Design Guide (2nd ed.). Retrieved on March 17, 2019, from <https://nacto.org/publication/urban-bikeway-design-guide/>
- Wakefield, S., Yeudall, F., Taron, C., Reynolds, J., & Skinner, A. (2007). Growing urban health: Community gardening in South-East Toronto. *Health Promotion International*, 22(2), 92-101. doi:10.1093/heapro/dam001

Appendices

Appendix A. Street Gardens and Zoning Districts (6.3 Relation of Sponsorship with Land Use)

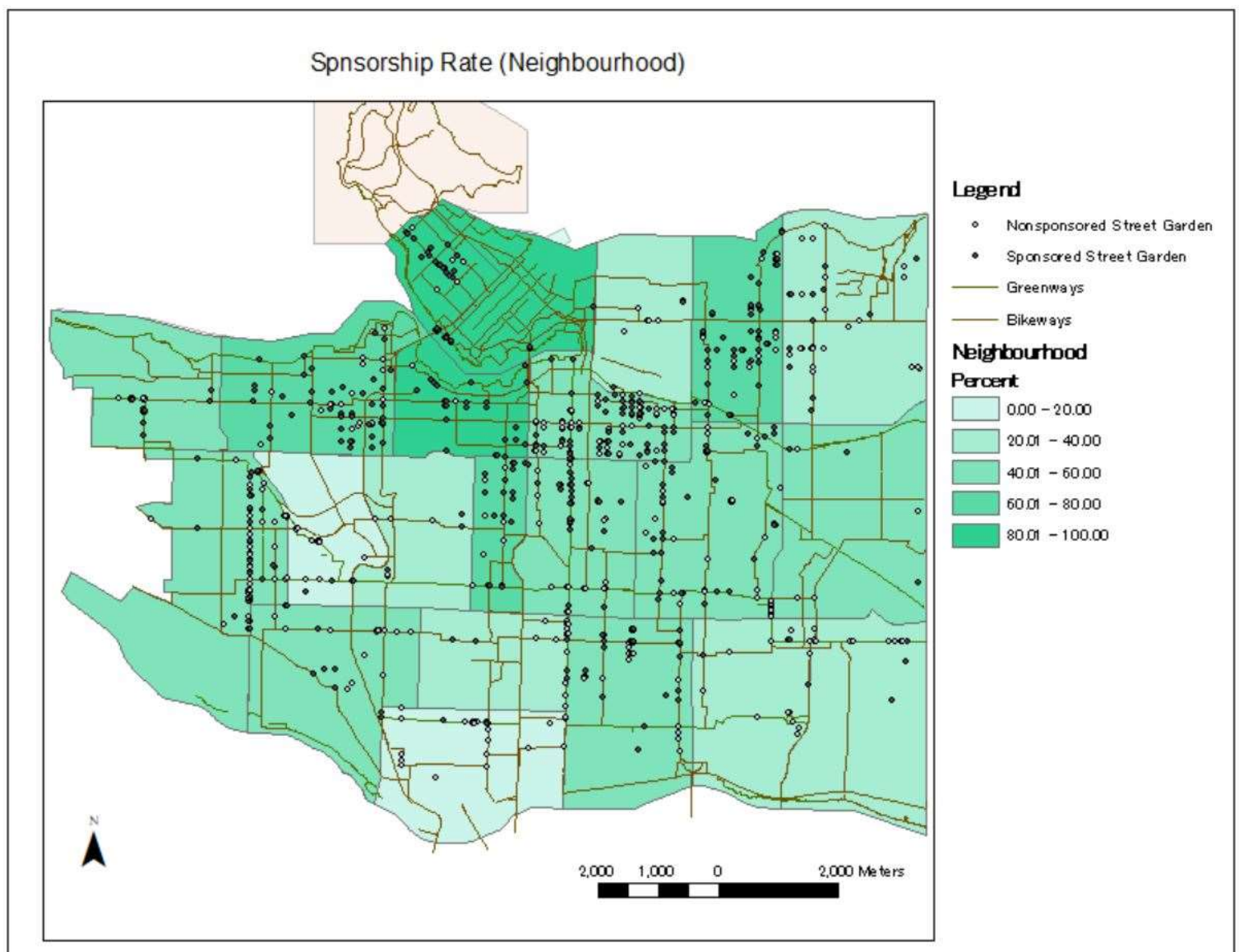


Source: City of Vancouver. (2018a)

The garden status is a snapshot of November 28, 2018, based on information from L. Nowatschin, City of Vancouver, in December 2018.

Appendices

Appendix B. Sponsorship Rate of Green Streets (6.4 Relation of Sponsorship with Population Density)



Source: City of Vancouver. (2018a)

The garden status is a snapshot of November 28, 2018, based on information from L. Nowatschin, City of Vancouver, in December 2018.