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Analyzing the Impact of Demographics on Resident Use and Understanding of Urban Green Spaces

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by

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INTRODUCTION

The goal of the study was to determine if demographics affect the use of urban green spaces via a survey that was distributed to residents of Santa Monica, Culver City, and Inglewood, California. These three cities were chosen because they are close geographically, but represent different reported demographics. Additionally, all three of these cities are independent of Los Angeles County, but are still representative of the greater Los Angeles area and population. In person surveys were distributed to residents to determine how they use and understand urban green areas in their neighborhoods. Multiple linear regression was performed to analyze the survey results. Based upon these statistics, neither demographics nor survey location had a significant impact on the resident survey responses.

BACKGROUND

Urban ecology refers to how humans interact with the environment around them, generally focusing on developed areas (Pickett et al., 2008). An urban environment, as defined by the field, has high population density, abundant built structures, vast impervious surfaces, altered climatic and hydrological conditions, air pollution, and modified ecosystem functions (Wu, 2014). In recent studies, urban ecology aims to look at how humans interconnect with cities, emphasizing that both systems need to be studied at the same time. Cities are the preferred area to study this relationship because they are centers for major environmental problems (Urban Ecology History). As of 2014, 54% of the total global population lived in urban areas; this is predicted to rise in coming years (World Health Organization, n.d.). This is exacerbating climate change issues, particularly in the form of greenhouse gas emissions; research suggests that 75% of global anthropogenic emissions come from cities (Bulkeley, 2010).

However, cities are also the centers of innovation for combating climate change, as they have the resources to address climate-change problems (Rosenzweig et al., 2010). City leaders also tend to be more willing to act than leaders at other levels of government, as they can often link ecological programs to other issues. The Cities and Climate Protection Program (CCP) is an international institution that encourages cities to act against climate change through restructuring and innovative solutions (Anguelovski and Carmin, 2011).

One way of doing this is through urban greening projects, which uses natural spaces to cool temperatures in urban areas (Bowler et al., 2010). Another example of this is green infrastructure, which is the use of green spaces to promote urban health alongside natural well-being (Tzoulas et al., 2007). This method works on providing ecological functions through green areas to developed areas (Ahern, 2007). Green infrastructure can offset greenhouse-gas (GHG) emissions, remove air and water pollutants, cool local climate, and improve public health (Pataki et al, 2011).

Urban green spaces also have direct benefits to society by empowering individuals, organizations, and communities through passive and active engagement (Westphal, 2003). Green spaces can increase community involvement and decrease tensions among varying societal groups (Peters et al., 2009) and attract individuals or groups and promote social behavior (Sullivan et al., 2004).

Demographics influence the use and application of green spaces, as there are inequalities in urban environments (Heynan et al., 2006). For example, household income and the distribution of residential tree canopy is closely linked in urban areas. Therefore, lower-income groups, which also tend to be minorities, have less access to green spaces in their neighborhoods. Women and people with children were more likely to appreciate a fully natural green space, versus one that also has ornamental elements (Caula et al., 2009). Additionally, people in higher professions and those with higher incomes are more

likely to financially contribute to greening projects. Based upon this data, it can be concluded that those in lower-income situations will, again, not get the benefits of urban green spaces.

Therefore, looking at how demographics affect the use of green spaces in Los Angeles, California is beneficial to better understand how social inequities intersect with ecology. This has implications for future city planning if residents are not getting benefits from the spaces constructed in their neighborhood. To narrow the scope of the study, three cities within Los Angeles county were chosen: Culver City, Santa Monica, and Inglewood.

RESEARCH QUESTIONS AND HYPOTHESIS

The goal of the project was to see if demographics affect how residents view and use urban green spaces. The first hypothesis was that residents in lower income brackets would feel less connected to green spaces due to the lack of city resources. The second hypothesis was that residents who live farther from green spaces would feel less connected to the spaces they use. Finally, the third hypothesis was that all residents would find green spaces beneficial to cities.

Therefore, by combining these questions, it could be determined if the three cities selected are creating green spaces that are beneficial to residents, or if more needs to be done to meet the needs of certain populations.

METHODS

Study Area

Los Angeles is an ideal city in which to study urban green projects because it is a highly populated urban area. There is also a growing environmental movement in Los Angeles' city planning, partially due to Mayor Eric Garcetti's Sustainable City pLAn, which was released in April, 2015 (City pLAn, n.d.). The three cities selected were chosen because they are geographically close together (see Figure 1), but have differing demographics across a variety of factors (see census information in Table 1).

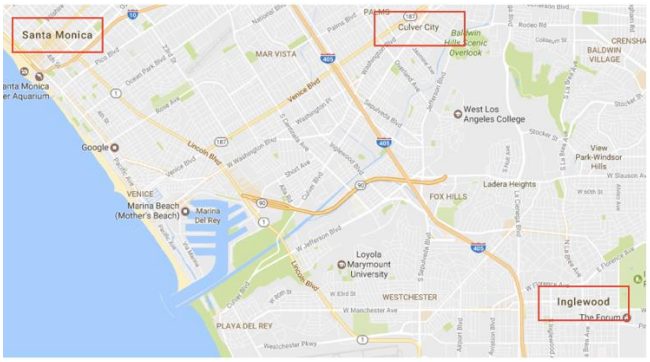


Figure 1: map showing distances between cities. Map taken from Google Maps.

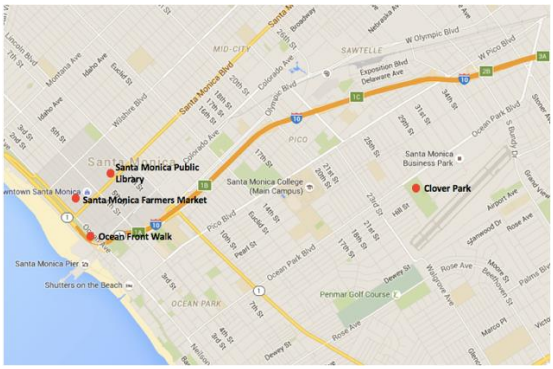
Table 1: city demographic information as of 2014 (City Data, 2014)

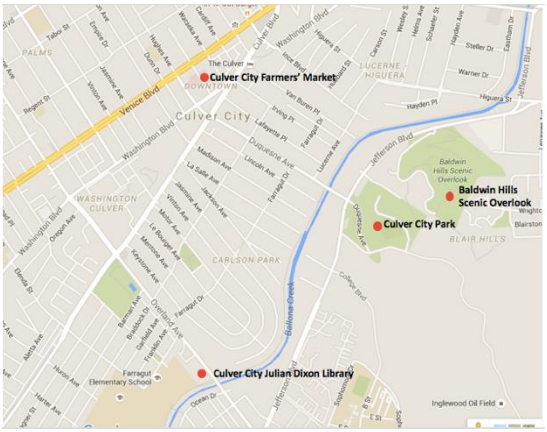
Race (% of total population)	Culver City	Santa Monica	Inglewood
White alone	48	67.8	3.5
Hispanic alone	23.7	14.1	54.2
Asian alone	15	9.3	0.6
Black alone	8.9	4.2	40

Two or more races	3.3	3.8	1.3
Other race alone	0.4	0.06	0.3
Amerian Indian alone	0.3	N/A	0.02
Native Hawaiian or Pacific Islander alone	0.1	0.1	N/A

Residents were surveyed at local parks, libraries, and farmers' markets. The three sites for each city were chosen because they are public areas frequented by people who live within that region. Additionally, it is believed that these three sites offer a variety of residents, thereby getting a wider sample of the population. While there was some variation with attendance at these sites between the three cities, it is similar enough to allow for comparisons.

In Santa Monica, surveyors visited the Santa Monica Public Library, the Santa Monica Farmers' Market, the Ocean Front Walk, and Clover Park (Figure 2A). In Culver City, surveyors went to the Culver City Julian Dixon Library, the Culver City Farmers' Market, Culver City Park, and the Baldwin Hills Scenic Overlook (Figure 2B). Finally, surveyors went to the following sites in Inglewood: Inglewood Public Library, Inglewood Farmers' Market, Edward Vincent Junior Park, and Darby Park (Figure 2C).

A) 

B) 

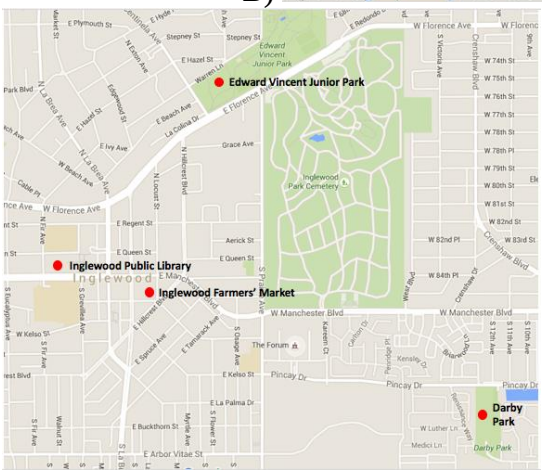
C) 

Figure 2: A) survey locations for Santa Monica B) survey locations for Culver City C) survey locations for Inglewood. All images taken from Google Maps.

Questionnaire design

A survey was created that asked residents a series of questions about how frequently they use green spaces, the importance of green spaces, their experiences with green spaces, re-planting efforts, and the biological role of green spaces. Additionally, residents were asked for demographic information (see Figure A1 for full survey). The survey was voluntary and anonymous; it was cleared by the Institutional Review Board at Loyola Marymount University in May 2016.

The survey was done in person because this was believed to be more effective to achieve a high response rate (Cook et al., 2000). The University affiliation was also highlighted, as this has been found to increase participants' willingness to respond (Fox et al., 1988). Having a monetary incentive, in this case a $100 gift card, was also used to rise interest. The survey was kept at four pages, which has been found to also increase response rate due to the shorter length (Yammarino et al., 1991).

Sampling and Survey Method

Residents were selected based upon their willingness to complete the survey. Some residents did opt to not complete the survey, or certain sections if they did agree to participate. There was also some difficulty with a language barrier; a future study should include a Spanish version of the instrument. The survey was distributed during the work week, generally in the afternoon. Therefore, it may be possible that certain segments of the population, such as people with full-time jobs, were not included in the sample. However, attempts were made to go to sites at a variety of times throughout the week to get a more representative population. There is also the possibility that some of the collected surveys are from individuals who do not live in the selected cities, as some forms did not contain zip code information. While the samples from each city are large enough to determine significance, a subsequent study should allow for more time for survey distribution to get a more representative sample.

Data Analysis

First, all demographic information was compared to that in Table 1 to see if the study represented the area well. While there were some differences, the collected data is fairly representative of the neighborhood based on census information and given data (see Table A1 for experimental demographic breakdown). Therefore, the results can be considered credible for the area in which they were collected and can be analyzed.

To answer the research questions, the responses for question four were summed, as these all ask residents about the importance of green spaces (first set of questions in table form). All the responses for question five were also summed, as these revolve around green space connectivity (second set of questions in table form). Question 8C was also used, as this question access about resident access to green spaces (fourth set of questions in table form).

The results were then analyzed using multiple regression analysis. First, the questions were analyzed in regard to demographic information and then for location. The questions were finally analyzed in terms of their averages to discuss general trends.

RESULTS

Demographic Information

All of the neighborhoods were first analyzed for the sum of question four in regards to their age, gender, race/ethnicity, and income (Table 2). Based upon the low R-squared value and p values greater than 0.05, these results are not significant.

Table 2: linear regression results for the summed question four responses for all neighborhoods

Linear Regression

Regression Statistics

R	0.13660
R-square	0.01866
Adjusted R-square	-0.03742
S	5.19055
N	75

SUM Q4 = 19.18342 - 0.00974 * Age - 0.46986 * Gender - 0.36137 * Race/Ethnicity - 0.02254 * Income

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	4	35.85785	8.96446	0.33273	0.85505
Residual	70	1,885.92882	26.94184		
Total	74	1,921.78667			

	Coefficient	*Standard Error*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%)*
Intercept	19.18342	2.87461	13.45018	24.91666	6.67339	4.89381E-9	*rejected*
Age	-0.00974	0.04143	-0.09238	0.07289	-0.23514	0.81478	*accepted*
Gender	-0.46986	1.21424	-2.89157	1.95186	-0.38696	0.69996	*accepted*
Race/Ethnicity	-0.36137	0.33111	-1.02176	0.29901	-1.09139	0.27885	*accepted*
Income	-0.02254	0.23133	-0.48391	0.43882	-0.09744	0.92265	*accepted*
T (5%)	1.99444						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

All of the neighborhoods were then analyzed for their summed question five responses in regard to age, gender, race/ethnicity, and income (Table 3). Based upon the low R-squared value and p values greater than 0.05, these results are not significant.

Table 3: linear regression results for the summed question five responses for all neighborhoods

Linear Regression

Regression Statistics

R	0.19877
R-square	0.03951
Adjusted R-square	-0.01538
S	4.45362
N	75

SUM Q5 = 11.85222 + 0.0379 * Age + 0.91054 * Gender + 0.06826 * Race/Ethnicity + 0.20467 * Income

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	4	57.11255	14.27814	0.71985	0.58124
Residual	70	1,388.43412	19.83477		
Total	74	1,445.54667			

	Coefficient	*Standard Error*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%)*
Intercept	11.85222	2.51728	6.83167	16.87277	4.70835	0.00001	*rejected*
Age	0.03790	0.03637	-0.03464	0.11044	1.04200	0.30100	*accepted*
Gender	0.91054	1.03758	-1.15886	2.97994	0.87756	0.38319	*accepted*
Race/Ethnicity	0.06826	0.28413	-0.49843	0.63494	0.24022	0.81086	*accepted*
Income	0.20467	0.28760	-0.36894	0.77828	0.71164	0.47905	*accepted*
T (5%)	1.99444						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

All of the neighborhoods were finally analyzed for question 8C in regard to their age, gender, race/ethnicity, and income (Table 4). Based upon the low R-squared value and p values greater than 0.05, these results are not significant.

Table 4: linear regression analysis for question 8C from all neighborhoods

Linear Regression

Regression Statistics	
R	0.17803
R-square	0.03169
Adjusted R-square	-0.02364
S	1.54249
N	75

Q8C = 3.53149 + 0.00482 * Age + 0.15445 * Gender + 0.09322 * Race/Ethnicity - 0.11388 * Income

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	4	5.45126	1.36282	0.57279	0.68326
Residual	70	166.54874	2.37927		
Total	74	172			

	Coefficient	*Standard Error*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%)*
Intercept	3.53149	0.87184	1.79265	5.27032	4.05059	0.00013	*rejected*
Age	0.00482	0.01260	-0.02031	0.02994	0.38234	0.70337	*accepted*
Gender	0.15445	0.35936	-0.56228	0.87117	0.42978	0.66867	*accepted*
Race/Ethnicity	0.09322	0.09841	-0.10305	0.28949	0.94728	0.34675	*accepted*
Income	-0.11388	0.09961	-0.31254	0.08479	-1.14323	0.25684	*accepted*
T (5%)	1.99444						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Location Dependent

The neighborhoods and locations were then analyzed independently to determine if this influenced survey response. The first question analyzed was the summed question four responses (Table 5). Based upon the low R-squared value and p values greater than 0.05, these results are not significant.

Table 5: location dependent analysis for the summed question four responses

Linear Regression

Regression Statistics	
R	0.19649
R-square	0.03861
Adjusted R-square	0.01815
S	5.43534
N	97

SUM Q4 = 20.12773 - 1.20461 * ID - 0.57988 * Location

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	2	111.52520	55.76260	1.88751	0.15714
Residual	94	2,777.03150	29.54289		
Total	96	2,888.55670			

	Coefficient	*Standard Error*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%)*
Intercept	20.12773	1.88634	16.38235	23.87310	10.67024	0.00000	*rejected*
ID	-1.20461	0.71412	-2.62251	0.21330	-1.68684	0.09495	*accepted*
Location	-0.57988	0.67806	-1.92619	0.76644	-0.85519	0.39462	*accepted*
T (5%)	1.98552						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

The neighborhoods were analyzed for the summed question five responses (Table 6). Based upon the low R-squared value and p values greater than 0.05, these results are not significant.

Table 6: location dependent analysis for the summed question five responses

Linear Regression

Regression Statistics	
R	0.04032
R-square	0.00163
Adjusted R-square	-0.01962
S	5.02888
N	97

SUM Q5 = 15.89102 - 0.07268 * ID - 0.23068 * Location

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	2	3.87063	1.93532	0.07653	0.92639
Residual	94	2,377.22215	25.28960		
Total	96	2,381.09278			

	Coefficient	*Standard Error*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%)*
Intercept	15.89102	1.74528	12.42572	19.35631	9.10514	0.00000	*rejected*
ID	-0.07268	0.66072	-1.38455	1.23920	-0.10999	0.91265	*accepted*
Location	-0.23068	0.62736	-1.47631	1.01495	-0.36770	0.71392	*accepted*
T (5%)	1.98552						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Finally, the neighborhoods were analyzed for question 8C (Table 7). Based upon the low R-squared value and p values greater than 0.05, these results are not significant.

Table 7: location dependent responses for question 8C

Linear Regression

Regression Statistics	
R	0.16221
R-square	0.02631
Adjusted R-square	0.00514
S	1.49306
N	95

Q8C = 3.83853 - 0.22217 * ID + 0.22658 * Location

ANOVA

	d.f.	*SS*	*MS*	*F*	*p-level*
Regression	2	5.54193	2.77096	1.24301	0.29331
Residual	92	205.08965	2.22924		
Total	94	210.63158			

	Coefficient	*Standard Error*	*LCL*	*UCL*	*t Stat*	*p-level*	*H0 (5%)*
Intercept	3.83853	0.51936	2.80704	4.87002	7.39092	6.52195E-11	*rejected*
ID	-0.22217	0.19848	-0.61637	0.17202	-1.11938	0.26589	*accepted*
Location	0.22658	0.18948	-0.14975	0.60291	1.19579	0.23485	*accepted*
T (5%)	1.98609						

LCL - Lower value of a reliable interval (LCL)

UCL - Upper value of a reliable interval (UCL)

Finally, the averages for the three analyzed questions were calculated (Table 8). Santa Monica and residents at parks had the highest averages for the Sum of Q4, while Inglewood and library residents had the lowest averages. Culver City and park residents had the highest average for the sum of question five, while Inglewood and library residents again had the lowest. Finally, Santa Monica and library residents had the highest average for question 8C, while Inglewood and park residents had the lowest.

Table 8: average response value for the three neighborhoods and the three survey locations

Location	SUM Q4	SUM Q5	Q8C
SM	4.741666667	4	4.117647059

CC	4.271692745	4.032894737	3.648648649
IN	3.898333333	3.65	3.615384615
Parks	4.549075391	3.993589744	3.578947368
Library	4.030858361	3.830645161	4.064516129
Farmers Market	4.312307692	3.903846154	3.961538462

DISCUSSION

Based upon the results of the multiple linear regression analysis, none of the results are statistically significant. This indicates that there are not differences due to demographics between the neighborhoods or survey locations. Therefore, two of the hypotheses were not supported, as individuals in lower incomes did not significantly feel less connected to green spaces, residents further from green spaces did not have significantly less connectivity. It can be said that the third hypothesis was supported, as all residents felt that green spaces were important to their communities. Therefore, all of the cities are meeting the needs of their residents at similar levels.

However, looking at the average survey responses for the three questions analyzed does have some indication for the direction of future work. Inglewood residents responded lower, on average, for the three measures, perhaps indicating that residents may feel less connection to green spaces and have less access. A future study could expand this project to survey more residents to try to achieve statistically significant results. Residents surveyed in parks responded higher in terms of green space importance and connectivity but lowest in terms of accessibility; a future project could assess if individuals are more appreciative of green spaces if they must travel further for them. They may be due to a lack of access in their own neighborhoods. Additionally, residents have previously been known to not perceive health benefits for green spaces within 1-3km of their homes (Maas et al., 2006).

Future work should also consider the other questions in the survey. For the sake of resources and time of this study, only three questions were considered. To gain a more comprehensive understanding of these neighborhoods, all questions should be used.

There are several sources of error in this experiment. First, there was a relatively small sample size; future work should have a longer survey period to collect data from more residents. Surveys should also be done at various times of day and on the weekends to get a more representative sample. A Spanish version of the survey should also be available, as several individuals asked to participate were not able to complete the survey in English. It could also be that the questions in the survey were leading, unclear, or difficult to answer. The survey should go through a series of revisions to ensure all questions are appropriate. Finally, GIS software could be used to overlay demographic information with urban green areas to determine their connectedness in these neighborhoods.

ACKNOWLEDGEMENTS

I would like to thank the Center for Urban Resilience at Loyola Marymount University for their support throughout this project, especially Dr. Michele Romolini for her guidance, advice, and mentorship. Thanks to Loyola Marymount University, as well, for their funding during the summer of 2016. Finally, thank-you to the residents of Santa Monica, Culver City, and Inglewood for their participation in this project.

APPENDIX
Figure A1: research survey

You are Invited to Participate in a Research Survey About Your Neighborhood!

Complete this form to enter for the chance to win a $100 gift card!

Project Description

Welcome to the Loyola Marymount University Study of city residents and their local green spaces. This study is being conducted by an LMU undergraduate student who would like to learn more about how residents use and experience local green spaces. This is a brief survey that should take no longer than 10 minutes to complete. The survey will ask about your thoughts and activities related to your local green spaces, with the goal of influencing future city planning.

Consent

This survey is completely anonymous and voluntary, and you may end it at any time. You will never be identified by name and your contact information will not be stored.

Please ask the survey distributer if you would like to view the Human Subject's Bill of Rights.

If you have any further questions about the research, please contact Dr. Michele Romolini, Director of Research at LMU's Center for Urban Resilience at michele.romolini@lmu.edu or 310-338-7443. You may also ask for her business card.

If you have any further questions, comments, or concerns about the study or the informed consent process, you may contact David Hardy, Ph.D. Chair, Institutional Review Board, 1 LMU Drive, Suite 3000, Loyola Marymount University, Los Angeles CA 90045-2659, (310) 258-5465, david.hardy@lmu.edu.

Before you begin, can you confirm that you understand the purpose of this study and that you wish to participate?

☐*Yes* ☐*No*

Thank you very much for your participation!

Please continue to next page

Survey Questions

Responding to all survey questions is voluntary. No information linking responses to participants will be used or revealed, except to contact the raffle winner.

How frequently do you use green spaces in your neighborhood? A green space is, for example, a park, community garden, a block with street trees, or a forest.

Every day | Every other day | Once a week | Twice a month | Once a month | Less than once a month

If applicable, which parks or green spaces do you use: _____
_____

How frequently do you think your neighbors use green spaces in your neighborhood?

Every day | Every other day | Once a week | Twice a month | Once a month | Less than once a month

How frequently do you use green spaces outside of your neighborhood?

Every day | Every other day | Once a week | Twice a month | Once a month | Less than once a month

If applicable, which parks or green spaces do you use: _____
_____

Please indicate how you feel about the following statements.

1=strongly disagree 2=disagree 3=neither agree nor disagree 4=agree 5=strongly agree

	1	2	3	4	5
Green spaces are important to a neighborhood					
I am interested in seeing more green spaces in my neighborhood					
Green spaces are important to a city					
Green spaces are a beneficial allocation of city resources					

Please indicate how well the following statements apply to how you feel after using a green space

1=not at all 2=a little 3=somewhat 4=quite a bit 5=a great deal

	1	2	3	4	5
I feel more peaceful after using a green space					
I feel connected to green spaces in my neighborhood					
Green spaces are one of my favorite things about my neighborhood					
I feel more connected to my neighborhood after using a green space					

Please continue to next page

How would you rank the amount of green spaces in your neighborhood?

More than sufficient | *Sufficient* | *Insufficient* | *Very lacking* | *Unsure*

Please respond to the following questions (note: re-planting in this instance refers to removing initial plantings and replacing them with more resilient or native species)

	Yes	Somewhat	No	Unsure
Are you aware of any re-planting efforts in your neighborhood?				
If responded "Yes" to the question above, do you believe this re-planting was effective?				
Do you support re-planting?				
Do you think re-planting is an effective way to control water runoff? Runoff is when water is not collected into the ground due to concrete or other man-made measures				

Please indicate your response to the following statements

1=strongly disagree 2=disagree 3=neither agree nor disagree 4=agree 5=strongly agree

	1	2	3	4	5
Green spaces have a significant impact on water control					
The green spaces in my neighborhood are an important reason why I chose to live there in the first place					
I am within walking distance to the nearest green space (10-15 minutes)					
Understanding biological impacts of green spaces is important to me					
There is enough educational material around my neighborhood green spaces to understand their impact					
I would like to see more educational materials around my local green spaces					
I am aware of the biological roles of green spaces in a neighborhood setting					

Please continue to next page

Demographic Information

All demographic information is confidential and will not be released in conjunction with other recorded data. All responses are voluntary.

Age: _____

Gender: □ *Male* □ *Female* □ *Transgender* □ *Other*

Race/Ethnicity (check all that apply): □ *White* □ *Black or African American* □ *American Indian or Alaska Native* □ *Native Hawaiian or Pacific Islander* □ *Other*

Zip Code: _____

Income Leve (please circle): *< $10K | $10K-$20K | $20K-$50K | $50K-$80K | $80K-$100K | $100K-$150K | $150K-200K | >$200K*

Highest Education Reached: *Some high school | High school diploma or GED | Some college | College | Some graduate or professional school | Graduate or professional school*

Preferred email to be contacted via if raffle prize winner (optional):

_____

Table A1: experimental demographic information as a percent of the total survey population

Race/Ethnicity	Culver City (% of population)	Santa Monica (% of population)	Inglewood (% of population)
Black/African American	11.8	6.5	52
Other	11.8	16.1	32
White	61.8	71	4
White/American Indian		3.2	
White/Other		3.2	
American Indian	2.9		
Japanese	5.9		
Native Hawaiian	2.9		8
White and Black	2.9		
Latino/Mexican			4

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