Social Perception of Living Walls in Quito: A Study of Four Vertical Gardens

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Abstract. As part of a transdisciplinary study on the benefits of vertical gardens in Quito (Ecuador), social research was carried out to determine people’s perceptions and level of understanding of living walls. The four gardens studied were on the campus of the Pontifical Catholic University of Ecuador (semi-public), in the San Blas Plaza (public), in the Governmental Financial Platform (semi-public), and in the private offices of an architecture firm (private). The research was organized into two primary phases; the first involved carrying out observations of each of the four vertical gardens. The observations led to the characterization of the immediate surroundings of the gardens, an understanding of accessibility (particularly for people with disabilities and security-related limitations), as well as of the number of people who passed through the space and the type of interactions they had with the garden. During the second phase, a total of 57 interviews were carried out with people in the areas surrounding each of the vertical gardens. The interviews identified basic demographic information about the respondents, how they define vertical gardens, the type, and frequency of their interactions with the specific garden of study, and their perceptions of the benefits and drawbacks of vertical gardens. The information from the interviews was processed to identify key trends related to each garden, as well as identify trends across the four gardens. The results revealed varying levels of understanding of vertical gardens, the influence of esthetics on people’s perceptions, and finally ideas around the benefits and drawbacks of vertical gardens. The conclusions demonstrated a gap between social perceptions of vertical gardens, particularly in public spaces, and the gardens’ potential ecological and air quality contributions to the city.

1. Introduction

Global trends of accelerated urban population growth require effective strategies to both adapt to and mitigate anthropic contributions to environmental degradation and resulting health implications for human populations [1]. Latin America and the Caribbean experienced a 240 percent increase in the population living in urban areas between 1970 and 2000; currently approximately 80 percent of the region’s population is concentrated in cities [2]. Increasing levels of air pollution and rising temperatures related to the heat island effect [3] are among the future challenges identified for these growing urban areas [4].

Burgeoning concerns regarding increased urbanization and its implications for climate change; air quality; water availability and quality; land use; and waste management [5] have spurred local, national, and international strategies oriented towards sustainable urban development (i.e. New Urban Agenda -
NUA and Sustainable Development Goals - SDGs). The New Urban Agenda, product of the international convention HABITAT III held in Quito, Ecuador in 2016, articulated the priority of creating more “safe, accessible, inclusive, green public spaces” [6].

Beyond the political realm, researchers over many decades have been working to determine the potential correlation between green urban infrastructure (green roofs, vertical gardens, etc.) and environmental, psychological, and other health benefits [7-9]. Studies on their environmental contributions have yielded results related to improved air quality [10-11] and counteraction of the heat island effect [12-13], and demonstrate positive effects related to sound absorption and noise reduction [11]. A study carried out in Bogotá, Colombia also demonstrated potential contributions to agricultural production and food sovereignty [14].

Moreover, a significant number of researchers have detected a correlation between exposure to urban greenspace and improved psychological and mental wellbeing [15-18]. Although there is a significant body of research supporting this correlation, based on their findings, Saw et al. question its applicability in the context of “tropical cities” [19]. Valesan and Sattler [20] also documented varying results with regards to participants’ perceptions of urban greening, vertical gardens, and green roofs, identifying aesthetics and perceived drawbacks as factors influencing respondents’ opinions of green infrastructure.

Other studies carried out in urban settings detected correlations between increased exposure to greenspace and decreased crime rates and perceptions of neighborhood safety [16, 21]. However, Fuller et al. emphasize the importance of considering the quality of the green urban infrastructure and its biodiversity as key factors to ensuring increased psychological well-being [17].

This study seeks to understand societal perceptions of vertical gardens in Quito, Ecuador, in relation to the quality of the surroundings, well-being, noise reduction, and safety. This research forms part of a broader transdisciplinary study that seeks to understand the potential contributions of vertical gardens with regards to urban ecology, air quality, and historical relevance in Quito. The complementary study [10] determined that “the ‘active vertical garden’ presents air quality improvements over passive gardens. The phenomenon of absorption of pollutants marks a proposal for improving air quality in critical areas of contamination in the historic center of Quito” [10]. In light of the positive contributions of vertical gardens to air quality, it will be important to understand and take into account social perceptions of them and their benefits for any related public policy proposals around green infrastructure.

2. Methodology

This study focused on four vertical gardens in Quito, paying particular attention to perceived benefits and drawbacks of the green infrastructure. The sites were selected based on their typology (public, semi-public or private) with the goal of identifying if or how perceptions differ based on the characteristics of the surrounding space. Table 1 below provides basic information about each site.

| Code | Site Name | Type      | Location                                                                 |
|------|-----------|-----------|--------------------------------------------------------------------------|
| S1   | Faculty of Architecture, Design, and Arts (FADA-PUCE) | Semi-public | Inside the department’s building on the campus of the Pontifical Catholic University of Ecuador (PUCE). |
| S2   | San Blas Plaza | Public     | Adjacent to one of the main entry points to the Historic Center of Quito (HCQ). |
| S3   | Northern Government Financial Management Platform (GFMP) | Semi-public | On the eighth floor of this governmental building complex in the North-Center of Quito. |
| S4   | ENNE Architecture Firm | Private    | Inside the private offices of the architectural firm in the North-Center of Quito. |
All four sites are located in what is considered the Center and North-Center of Quito; the location of each vertical garden can be visualized in figure 1.

**Figure 1.** Vertical Gardens Studied in Quito-Ecuador

Source: María José Burbano.
The vertical garden in San Blas was chosen for its location at a highly transited public location; it is also one of the first, and largest, vertical gardens in the Metropolitan District of Quito. The vertical garden at the Faculty of Architecture, Design, and Arts (FADA) was included to ensure continuity to previous studies carried out by the Pontifical Catholic University of Ecuador (PUCE). The third site, the semi-public gardens of the Northern Government Financial Management Platform (GFMP), was chosen for its scale and to determine the level of employee interaction. The fourth site, ENNE Architecture Firm, served as an example of a private vertical garden with limited access.

To implement this study, two research tools were developed and applied: in-situ observations and interviews. The observations were used to understand the dynamics of the four sites and gathered information about the following aspects:

- Characteristics of the surroundings
- The location (in relation to the urban setting, if applicable)
- Accessibility of the space and the garden
- Safety-related conditions of the surroundings
- Frequency and duration of people’s visits to the space
- Types of interactions with the vertical garden

Based on the information collected through the first observations, a structured interview protocol with a series of open-ended questions was developed to gather the following information:

- Demographics: age, gender, occupation
- General knowledge about vertical gardens: definition of a vertical garden and the ability to identify other gardens in Quito
- Information about their relationship with the garden being studied: number, duration, and type of interaction
- Perceptions of the garden being studied: benefits and drawbacks; relationship with stress; safety of the surroundings; role of the garden in the city

Two observations and eighteen interviews were carried out in the FADA gardens; four observations and nineteen interviews in San Blas; two observations and nineteen interviews in the GFMP; and one observation and an interview in ENNE Architecture Firm. The information gathered was first tabulated at the site-level; the results were later compared across the four sites in order to identify trends and differences with regards to respondents’ perceptions.

3. Results and Discussion
The results revealed varying levels of understanding of vertical gardens, different types of interactions across the four cases, the influence of aesthetics on people’s perceptions, and finally, ideas regarding the benefits and drawbacks of vertical gardens. Table 2 illustrates key information gathered during the observations.

| Vertical Garden (Site) | Dates and times of visits (Number of people observed passing by the garden) | Characteristics of the space | Location | Surroundings | Accessibility | Safety |
|------------------------|--------------------------------------------------------------------------------|-----------------------------|----------|--------------|--------------|--------|
| FADA-PUCE Interior Garden (S1) | October 12, 2018 2-3:30 pm 30 people<br>October 15, 2018 9:15 - 10.45 am 7 people | Built on the facade of a classroom in the interior patio of the FADA building on the south end of the PUCE campus. | Open, but infrequently visited area | Limited space to take shelter from sun or inclement weather | Difficult to access for people with disabilities | To enter the campus, one must sign in with university security |
Of the 57 interviews conducted, thirty-four respondents identified as male (60%), twenty-two as female (38%), and one (2%) did not associate with either gender. Table 3 shows the number of respondents according to their age range at each of the four sites. Noteworthy, yet unsurprising because
of the university location, all interviewees at the FADA-PUCE Interior Garden were between the ages of 18 and 25.

| Age Range | S1 | S2 | S3 | S4 | TOTAL |
|-----------|----|----|----|----|-------|
| 18-25     | 18 | 4  | 3  | 0  | 25    |
| 26-39     | 0  | 4  | 8  | 1  | 13    |
| 40-64     | 0  | 9  | 8  | 0  | 17    |
| 65+       | 0  | 2  | 0  | 0  | 2     |
| TOTAL     | 18 | 19 | 19 | 1  | 57    |

Before asking respondents about their perception of benefits or drawbacks of vertical gardens, they were asked to define a vertical garden and mention any others that they know in Quito. These two questions helped to better comprehend respondents’ understanding of vertical gardens as well as their awareness of other gardens in the city. All but one respondent of the FADA-PUCE (S1) interior garden interviewees were able to identify other vertical gardens in Quito, while only nine of nineteen respondents in the San Blas Plaza (S2), thirteen of nineteen interviewees at the Northern Government Financial Management Platform Building Complex (S3), and the lone interviewee at ENNE Architecture Firm did know of other vertical gardens. In order to discern whether there was a statistically significant difference in the ability to name other vertical gardens in Quito based on the site where people were interviewed, a Pearson’s chi-squared ($\chi^2$) test was carried out using the information from table 4.

| Vertical Garden | Knows other vertical gardens in Quito | Does not know other vertical gardens in Quito | Total |
|-----------------|--------------------------------------|----------------------------------------------|-------|
| S1              | 17                                   | 1                                            | 18    |
| S2              | 9                                    | 10                                           | 19    |
| S3              | 13                                   | 6                                            | 19    |
| S4              | 1                                    | 0                                            | 1     |
| TOTAL           | 40                                   | 17                                           | 57    |

Considering an $\alpha = .05$, the result of the $\chi^2$ test yields a p value of 0.01662907 indicating that indeed the location of the interview has a statistically significant effect on the interviewees possibility of naming another vertical garden. This allows us to understand that there is a relevant difference in level of knowledge related to vertical gardens that could be related to the type of garden, considering that San Blas Plaza (S2) is the only site that is considered fully “public” and also represents the location where respondents had the lowest rates of knowledge of other vertical gardens in Quito. However, when asked to define a “vertical garden”, the vast majority of respondents from all four sites responded with definitions ranging from “plants on a wall”; “a garden perpendicular to the ground”; “plants attached to new buildings”; “beautiful things that help decorate”; and others as “climbing plants”.

Across the four sites studied, only 5% of respondents (n=57) indicated that they did not perceive any positive aspects of living walls. The perceived benefits of vertical gardens amongst the vast majority (95%) of interviewees (n=57) fell into the following categories: esthetic value; air purification and environmental decontamination; space optimization; and stress alleviation. The esthetic value was described as its visual appeal and the pleasantness of looking at something natural and alive, others highlighted the “decorative” nature of these living walls, and some others even said how it made the space look “cozier and more inviting.” The category of air purification and environmental decontamination was mentioned by many, some simply used those words, while others spoke about the role of the plants in CO$_2$ absorption. Space optimization was named by fewer people, but was still a
recurring benefit that was highlighted by respondents who explained that vertical gardens allow plants to be present even in locations that do not necessarily allow for gardens on the ground due to limited space. A smaller group of respondents mentioned stress alleviation, due to the “peace”, and “tranquility” that the gardens provide just by looking at them.

Interviewees were posed the following question related to this last category: “To what extent do you believe that in moments of stress, seeing or interacting with a vertical garden can help?” Although this question was open ended, responses were categorized into “very helpful”, “somewhat/potentially helpful”, and “not at all helpful.” Seventy-five percent of respondents (43) indicated that they thought the vertical gardens were “very helpful” in moments of stress; nine percent (5) that they were “somewhat/potentially helpful”, and sixteen percent (9) that they were “not at all helpful.” To determine whether or not these results supported any significant relationship between these perceptions and gender (table 5) or age range (table 6), $\chi^2$ tests were run considering an $\alpha = .05$.

| Gender | Very helpful in moments of stress | Somewhat / potentially helpful in moments of stress | Not at all helpful in moments of stress | Total |
|--------|----------------------------------|--------------------------------------------------|----------------------------------------|-------|
| Feminine | 16 | 2 | 4 | 22 |
| Masculine | 26 | 3 | 5 | 34 |
| Other | 1 | 0 | 0 | 1 |
| **Total** | **43** | **5** | **9** | **57** |

| Age range | Very helpful in moments of stress | Somewhat / potentially helpful in moments of stress | Not at all helpful in moments of stress | Total |
|-----------|----------------------------------|--------------------------------------------------|----------------------------------------|-------|
| 18-25     | 22 | 1 | 2 | 25 |
| 26-39     | 9 | 1 | 3 | 13 |
| 40-64     | 10 | 3 | 4 | 17 |
| 65+       | 2 | 0 | 0 | 2 |
| **Total** | **43** | **5** | **9** | **57** |

The resulting $p$ values for these tests, indicate both the variables gender ($p=0.977321689$) and age range ($p=0.412269301$) are independent of the perceived helpfulness of vertical gardens in moments of stress.

The majority of respondents at the site of the vertical garden in San Blas Plaza indicated an inability to identify negative aspects of vertical gardens due to the regular upkeep and maintenance of this particular garden. Meanwhile, various respondents from the Northern Government Financial Management Platform Building Complex spoke from personal experience, mentioning flooding issues, dying plants, maintenance challenges, as well as problems related to poor installation that directly affect the esthetic value and the potential for falling plants. Outside of drawbacks related to maintenance, respondents also highlighted such potential issues as “humidity” and “wall damage”, “installation costs”, propensity to insect infestations.

4. Conclusions and Recommendations
The overall objective of this study was to determine social perceptions of the potential benefits of vertical gardens by analyzing the four sites in Quito, Ecuador that have varying levels of public access. The number of interviewees could be seen as a general limitation of this study, however the research yielded preliminarily results that support a broadly perceived benefit of the vertical gardens. Due to the length of the interviews, this study might be considered a departure point for more in-depth research or comparative studies on social perceptions that may lead to more conclusive results regarding the
connection between vertical gardens and social phenomenon such as crime rates [16, 21], reduced levels of stress [15-18], etc.

Similar to the results of Wong et al., this research revealed varying levels of knowledge related to vertical greenery systems [22] among the general population. The findings demonstrate a gap between social perceptions of vertical gardens, particularly in public spaces, and the gardens’ potential ecological benefits and demonstrated contributions to air quality contributions to the city [10].

The aesthetic value of vertical gardens was a factor emphasized by many—similar to the findings of Fernandez-Cañero [23]—with significant weight given to the importance of their regular maintenance and having an “orderly” or “tidy” appearance. This was of particular relevance in S3 where respondents had firsthand experience of the issues related to vertical gardens, such as flooding and dying plants. These results evidence the importance of ensuring regular maintenance to the irrigation and drainage systems, as well as to the plants. It also highlights a potential challenge related to the inclusion of native plants in the vertical gardens, particularly those that might have a more “natural” or “unkempt” aspect.

The results suggest that in order to propose the development of public policies oriented towards the incorporation of new vertical gardens or ecological corridors in Quito, it will be necessary to raise awareness in the population. This process could be supported by data and facts that evidence the benefits the gardens for the city [10]. This coincides with conclusions and recommendations from other similar research on urban greening in different urban settings [22].

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References

[1] OECD 2017 Healthy People, Healthy Planet – The role of health systems in promoting healthier lifestyles and a greener future
[2] MINURVI, ECLAC and UN-Habitat 2016 América Latina y el Caribe: desafíos, dilemas y compromisos de una agenda urbana común prepared for Habitat III United Nations Conf. on Housing and Sustainable Urban Development October 17-20 Quito Ecuador
[3] U.S. Environmental Protection Agency (EPA) 2008 Urban Heat Island Basics In: Reducing Urban Heat Islands: Compendium of Strategies
[4] UN Environment 2019 Global Environment Outlook – GEO-6: Summary for Policymakers Cambridge: Cambridge University Press
[5] OECD and Bloomberg Philanthropies 2014 Cities and Climate Change: National Governments Enabling Local Action
[6] UN-Habitat III 2017 The New Urban Agenda
[7] Nowak D, Dwyer J F y Childs G 1998 Los beneficios y costos del enverdecimiento urbano ed L Krishnamurthy and J R Nascimento Áreas Verdes Urbanas en Latinoamérica y el Caribe (Proc. Int. Seminar on Urban Greening in Latin America and the Caribbean) Centro de Agroforestería para el Desarrollo Sostenible Universidad A
[8] Parsons R 1991 The potential influences of environmental perception on human health J. Environ. Psychol. 11 pp 1–23
[9] Ulrich R S, Simons R F, Losito B D, Fiorito E, Miles M A and Zelson M 1991 Stress recovery during exposure to natural and urban environments J. Environ. Psychol 11(3) pp 201–30
[10] Ramírez F, Davis M J M, Chiquer S y Vallejo A 2019 Calidad de aire en el centro histórico de Quito Revista Diseño Urbano & Paisaje 35 pp 50–61
[11] Ottelé M 2011 The green building envelope: vertical greening Delft University of Technology PhD Dissertation
[12] Alexandri E and Jones P 2006 Temperature decreases in an urban canyon due to green walls and
green roofs in diverse climates *Build. Env.* **43** pp 480–93

[13] Dimoudi A and Nikolopoulou M 2003 Vegetation in the urban environment: microclimatic analysis and benefits *Energ. Buildings* **35**(1) 69–76

[14] Navas Navarro F H y Peña Torres L M 2012 Los diseños verticales y la agricultura unidos para la producción de alimentos en los Módulos para Huertas Urbanas Verticales *Revista de Investigación Agraria y Ambiental* **3**(2) pp 73–84

[15] Kuo F E 2001 Coping with Poverty *Environ. Behav.* **33**(1) pp 5–34

[16] Groenewegen P P, van den Berg A E, de Vries S and Verheij R A 2006 Vitamin G: Effects of green space on health, well-being, and social safety *BMC Public Health* **6** p 149

[17] Fuller R A, Irvine K N, Devine-Wright P, Warren P H, Gaston K J 2007 Psychological benefits of greenspace increase with biodiversity *Biol. Lett.* **3**(4) 390–4

[18] van den berg A, Hartig T and Staats H 2007 Preference for nature in urbanized societies: stress, restoration, and the pursuit of sustainability *J. Soc. Issues* **63**(1) pp 79–96

[19] Saw L E, Lim F K S, Carrasco L R 2015 The relationship between natural park usage and happiness does not hold in a tropical city-state *PLoS ONE* **10**(7): e0133781

[20] Valesan M and Sattler M A 2008 Green walls and their contribution to environmental comfort: environmental perception in a residential building ed P Kenny, V Brophy and J Lewis *25th Conf. on Passive and Low Energy Architecture* October 22-24 2008 University College Dublin Ireland

[21] Kuo F E and W C Sullivan 2001 Environment and crime in the inner city: does vegetation reduce crime? *Environ. Behav.* **33**(3) pp 343–67

[22] Wong N H, Tan A Y K, Tan P Y, Sia A and Wong N C 2010 Perception studies of vertical greenery systems in Singapore *J. Urban Plan. Dev.* **136** pp 330–8

[23] Fernandez-Cañero R, Emilsson T, Fernandez-Barba C and Herrera Machuca M A 2013 Green roof systems: a study of public attitudes and preferences in southern Spain *J. Environ. Manage.* **128** pp 106–15