Aesthetic preference for different green boundary wall designs in Colombo, Sri Lanka

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Abstract

In many urban settings, unconventional greening solutions like greening boundary wall facades are gaining popularity. Recent studies have shown that having green walls is mostly motivated by their aesthetic appeal. However, no research work has focused on identifying what kind of configurations, and species are aesthetically preferred. This study investigated the aesthetic preferences for 56 different green boundary wall designs that were made for 11 different green wall configurations that were suitably planted with 15 different plant species. 516 participants in a photo-simulated psychological experiment assessed the photo-stimulated designs for their overall aesthetic preference as well as five other independent characteristics that could affect their choice of these designs. The most favoured living walls included Ficus pumila, or creeping fig, according to the results. The desire for living walls was higher than that for green facades. All other designs were thought to be better choices for boundary walls, except the greening options of ground coverings with the species Roheo or Ferns. Adding Thambergia, Passion Fruit, Cat's Claw, Galepemia, and Ixora to boundary walls can increase preferences. Green wall configurations having less vegetation coverage and more exposed boundary wall surface areas received the least preference. Further attractiveness and suitability of the plant species were identified as factors influential on the preference. Given their functional, environmental, aesthetic, and financial advantages, living walls planted with Creeping Fig species can be suggested as the most practical choice for boundary wall greening among the design alternatives examined. The design alternatives proposed can be used to improve the aesthetic appearance of urban roadside landscapes as well as to bring restorative benefits to gardens of hospitals and elderly homes.

Keywords: Wall façade configurations, Green Wall Design alternatives, Green Facades, Green boundary walls, Living walls, Species

Introduction

Research Background

Many past research works, provide evidence of various benefits to humans by viewing greenery [1, 2, 3]. Green walls in urban areas can bring about multiple benefits related to thermal comfort [4], purification of air [5], noise attenuation and deposition of particulate matter [6]. The tendency to enhance green infrastructure through the introduction of green walls is common in urban spaces where space is cost. Green walls refer to all forms of vegetated vertical surfaces [7]. Hanging Gardens of Babylon is a traditional method of green wall while the new technological advances have resulted in a variety of designs that can be incorporated into new or existing infrastructure [8]. Much research work has been conducted for green walls constructed as external or internal building walls. However, research work focusing on the potential benefits of greening the roadside boundary walls remains less researched. While they may bring about benefits similar to green walls in buildings, they may also contribute to the improvement of the aesthetics of the roadside and the image of the city.

People spend a lot of time on the streets. Artificial walls, such as those made from cement blocks can be made aesthetically pleasing by making them green walls. A previous study by the research team observed that the aesthetic value of green boundary walls is considered a key motivator to install greenery [9]. There is a common consensus regarding preference towards vegetation and its aesthetic, affective, and restorative qualities. However, these preference tendencies show very complex patterns across different types of vegetation. It is unlikely for people to have a similar reaction to greenery since greenery consists of many types of vegetation that are kept in different styles [10]. This calls for proper research work aimed at distinctively identifying the green boundary wall configurations and respective species that are aesthetically preferred through proper research work. In that context, this research aims to identify green boundary wall designs that are aesthetically preferred.

Literature Review

Benefits of urban greenery and preferred qualities of vegetation. Greening systems such as green roofs

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and green walls are often used to improve the appearance of buildings [8]. The sight of green can relax and calm people [11]. The psychological and aesthetic benefits that urban greenery brings have been extensively studied. Natural and vegetated areas are perceived as positive and aesthetically pleasing compared to areas without vegetation. Landscapes that are more natural lead to more preference [10]. Residents of new urban areas placed greater value on being close to nature. Their choice of place to live was influenced by the opportunity to view nature from home [12]. Green roofs can improve the aesthetic appearance in urban areas [13]. Buildings covered with certain types of vegetation appeared to be more aesthetically pleasing and relaxing than buildings without vegetation [10]. Benefits related to aesthetic characteristics are one of the main reasons for building green infrastructure for the people of Athens in Greece [14]. From the research discussed above, it can be concluded that the presence of green spaces in urban spaces leads to better aesthetics compared to spaces without green spaces. In addition, such spaces can calm people and evoke positive feelings, resulting in a restorative effect. Such an appreciation of greenery could also influence their choice of place to live.

Classification of Green Wall Configurations and Green Boundary Wall Configurations. Installing green walls in cities is considered one option to encourage people to engage with Nature [15]. In need of more urban green spaces, the focus on nontraditional greenspaces, such as rooftop gardens, green facades and other non-traditional greening options is increasing. Traditionally more attention has been drawn towards greening buildings. Further, several researchers have presented classifications for green walls constructed in buildings. However, those options for roadside greening have not been well-researched [16]. Therefore, a clear classification of urban roadside vegetation systems cannot be found in existing literature.

According to much literature dealing with the vertical greening of buildings, green walls can take the form of living walls or green facades. With living walls, plants grow on the wall in a green growing medium placed in either containers/modular panels or geotextiles. The green facades refer to the arrangements where plants either develop directly or develop along designed support structures. Their roots lie in the ground and can also grow into a wall or supporting structure. [17]. In this arrangement, plants cover the facade as they climb the wall or hang down from the top of the wall [5]. Three of the main vertical greening systems applicable to Sri Lanka have been identified as wall planting, green walls and terraces [15]. The authors of the literature review on vertical green systems [18] presented several classifications of green walls based on construction methods. Based on their comprehensive review, the authors proposed classifying vertical greening systems in buildings into four green facades and nine living walls.

Based on their classification of green facades and residential walls, the roadside green walls adjacent to boundary walls can also be classified into different configurations. When such green boundary wall configurations are planted with different species, it creates a range of boundary wall green options for residents to choose from. Drawing on the above classification [18] and a series of on-site observations, previous work has reported 12 different boundary wall greening configurations adopted by residents of the Western Province of Sri Lanka [19]. Therefore, these 12 configurations consisting of four living walls and eight green facades can be considered as an appropriate classification to reflect the different boundary wall configurations for urban areas of Sri Lanka.

Design alternatives for boundary walls to create a higher aesthetic appearance. According to Sabbison (2018) [20], non-material benefits like the aesthetic advantages of viewing urban ecosystems are provided by urban ecosystem services. For building owners and the general public, green technologies like green walls and roofs can have several positive effects in the social, environmental, and economic spheres [21]. These advantages include energy conservation, noise reduction, air purification, habitat creation, particulate matter filtration, urban agriculture space creation, and positive human impact.

Vertical garden systems can reduce the unwanted aesthetic impacts of the city such as corroded building surfaces, grey facades, and soulless structures [17]. As stated by Misgav Ayala (2000) [22], vegetation has the potential to enhance the urban environment's aesthetic appeal. It was discovered that some species combinations were more preferred than individual species [23]. According to a different study [24], roadside vegetation that combines grass and flowering plants is the most desired. Preference for green walls is also influenced by wall design [25].

Greenery in a building's vertical skin has the potential to obtain a new architectural identity [26]. Vertical greening is often preferred and given priority because of its ability to combat the above issues. Further, it gives aesthetic value to buildings [27]. Urban landscapes that indicate care, control, and tidiness and that are managed accordingly are preferred by the general public [16]. Plant layers can enhance good design or disguise bad design [28]. When plants are added to plain walls or roofs visual interest can be created [29]. Aesthetical and functional aspects of a green façade are affected by the plant species used [26].

In summary, the improvement of aesthetic appeal as well as mitigating the negative appearance is one of the key benefits of urban vegetation. Previous findings regarding the beneficial impact of introducing plant layers and species variation recommend that variation of vegetation design can identify optimum design alternatives with the highest preference. A thorough review of vertical greenery systems by Radić et al. (2019) [18] has indicated the need for future work focusing on how people would perceive variations in their design elements, such as the type of plant, height, and position on the wall. The aesthetic preference for various designs of green walls can vary depending on the wall configuration and plant species, so it's critical to determine which design alternatives are most preferred.

Research Aim and Objectives

This research aims to find out human preference towards green boundary wall design alternatives for green boundary wall configurations would be preferred and the underlying reasons for those. Specifically, it attempts to investigate the following objectives.

- Investigate whether boundary walls with vegetation have greater preference levels than boundary walls without any vegetation.
- Evaluate different green wall designs to select highly preferred green wall designs
- Evaluate different green wall designs to select species for highly preferred green wall designs
- Analyze the factors affecting the preference for different green boundary wall designs

MATERIALS AND METHODS

The green boundary wall configurations used in this study were based on the 12 configurations identified in a previous study [19]. Due to their similar appearance, two of the twelve configurations the fence-supported climber wall and the mesh-supported climber wall were combined into a single category. This resulted in 11 configurations consisting of four living walls and seven green facades used in this study. Table **??** gives the details of 11 configurations used for the study. For each configuration, suitable plant species were identified based on field observations. Existing plant species in green boundary walls were identified during an observational study in the western province of Sri Lanka. Counted the occurrence of each species by travelling about 50 Km along roads within the western province of Sri Lanka covering all the 3 districts and their frequency distribution was made from a total of 1000 plants. Species that were found to have the highest frequency which is appropriate to particular green wall configurations were selected in this method. Thereby 28 alternative designs were obtained to introduce greenery to boundary walls. These design alternatives can be applied to the roadside of the boundary wall or the garden side of the boundary wall. This results in 56 design alternatives. To find out whether these design alternatives are preferred or not, a psychological study was conducted using photo-simulated stimuli. Stimuli photographs of different wall configurations were created by retouching two base photographs (one garden side and one roadside) with different green wall configurations and species. The base photographs, species photographs and photographs of the 11 boundary wall configurations were captured at eye level, at the same light levels and direction, while maintaining a fixed distance between the camera and the boundary wall. These were taken from the roads within the Colombo district. The photographs were taken on a sunny day between 10:00 to 15:00 hours.

A Likert scale-based questionnaire was prepared to evaluate aesthetic preference for the 56 alternatives. Respondents were asked to evaluate each configuration for overall preference and five other criteria that would influence the decision for overall preference. These five decision criteria are Naturalness, Attractiveness, Suitability to limited space, and Suitability of the plant species to the configuration. Participants rated overall preference and five decision criteria using a 1 to 5 Likert scale (1- Lowest, 2 - Somewhat low, 3 – Average, 4 – High, 5 - Highest). The survey was conducted using google forms and the link was published on social media. Additional questions were included to select only people who frequently use roads in Colombo and to collect demographic data of the respondents. Colombo residents and people who frequently visit Colombo were taken into one category and responses of the other people who hardly visit Colombo city were excluded.

The minimum survey sample size required to represent the population of Colombo district to have a confidence level of 95% and a 5% margin of error was 385 as per the Morgan tables [30]. As done in many psychological research works, the participants were recruited through a call for voluntary participation. 516 people who responded to a request made publicly on several social media platforms have participated in the survey conducted via Google Forms.

Descriptive statistics were used to determine the most preferred design alternatives, species, and configurations. The overall preference levels for each

Table 1: *Socio-Demographic Characteristics of the Participants*

Parameter	Percentage
Gender	
Male	62
Female	38
Age (years)	
(18 - 30)	77
(31 - 40)	15
(41 - 50)	6
(51 - 60)	1
(> 60)	1
Average Monthly income range in Rupees	
Less than 23,000	30
(23,000 - 39,999)	13
(40,000 - 69,999)	21
(70,000 - 99,999)	10
(100,000 - 129,999)	8
(130,000 - 160,000)	10
More than 160,000	9
Level of highest education	
O/L	0
A/L	12
Diploma	6
Graduate	63
Postgraduate	18

design alternative/ species /configuration were calculated by calculating the mean value of the overall preference ratings of 516 respondents using Equation 1. These overall preference values were used to understand the preference trends of design alternatives, species, and configurations. The mean values of each of the five decision criteria were calculated similarly. Further regression analysis was conducted to understand the influential factors for overall aesthetic preference. For this overall preference was considered as the independent variable while the five decision criteria were the independent variables. The regression model with the highest R2 selected was used for this purpose.

$$P_m = \frac{\sum_{i=0}^{n} p_{mi}}{n} \tag{1}$$

P_m– Average Overall Preference level of configuration number m

p_{mi} - Overall Preference rating of i th respondent for configuration m

n – Total number of respondents rated image m

RESULTS AND DISCUSSION

The sociodemographic characteristics of the sample are given in Table 1. Accordingly, 514 people have completed the questionnaire. This is higher than the 384 minimum sample size for 95% confidence level and 5% margin of error.

Preference for different green wall design alternatives

The average preference values for each of the design alternatives constructed with specific species are given in Figure 1. In comparison to the bare wall (2.48), the preference levels of all green design alternatives (overall average 3.57) were high and were above the average preference value of 3.0. Previous research work focusing on houses has found that those with vegetation are preferred more in comparison to those without vegetation [31, 32]. Preference for that landscape can be improved by introducing natural landscapes [33]. According to another research [10], natural and vegetated areas are preferred more than built areas and are perceived as more aesthetically beautiful. Further, these can evoke more positive emotions and have restorative effects. Areas having vegetation and nature are perceived more positively than those areas that do not have vegetation A study conducted among residents of the UK found similar results where buildings integrated with green facades had significantly higher preference levels, than those without [10]. Improvement of aesthetic properties and improvement of the quality of life of tenants are the most important benefits of constructing green infrastructures for people in Athens Greece [14].

According to the data for all designs, the preference values were quite similar for the garden side and roadside. The highest preference among all designs was for type F Living wall attached climbers Ficus Pumila for the roadside (4.30) and garden side (4.28). In this configuration, the Ficus Pumila plants grow attached to the wall and cover the wall surface fully. This growth pattern hides the artificial wall surface and creates a uniform surface texture against the non-uniform appearance that is available in trees or bushes. Previous research work on boundary walls planted with Ficus Pumila had a temperature reduction of about 20 °C within a 3 m range from the wall and a reduction in particle matter concentration by 0.1 mg/m^3. Further, the observations of existing boundary walls planted with Ficus Pumila for more than a decade revealed that the roots have not caused significant wall deterioration [27]. Since the plants grow attached to the wall, living walls made of Ficus Pumila require minimal cost and effort for installation and maintenance [19]. Considering the aesthetic, environmental and economic benefits associated, living walls planted with Ficus Pumila species can be recommended for boundary wall greening.

Also, the Plant wall of Ixora, the Living wall with

Figure 1: *Average preference values for different design alternatives for greening the boundary walls*

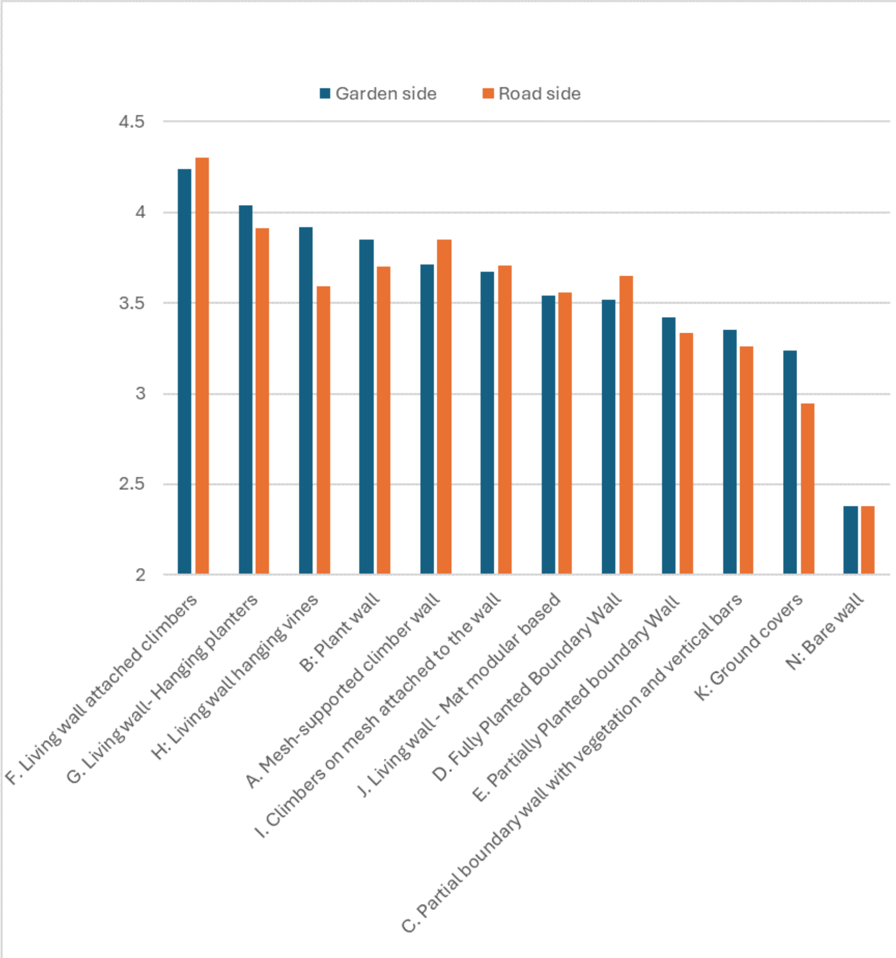

Figure 2: *Preference for different green boundary wall designs*

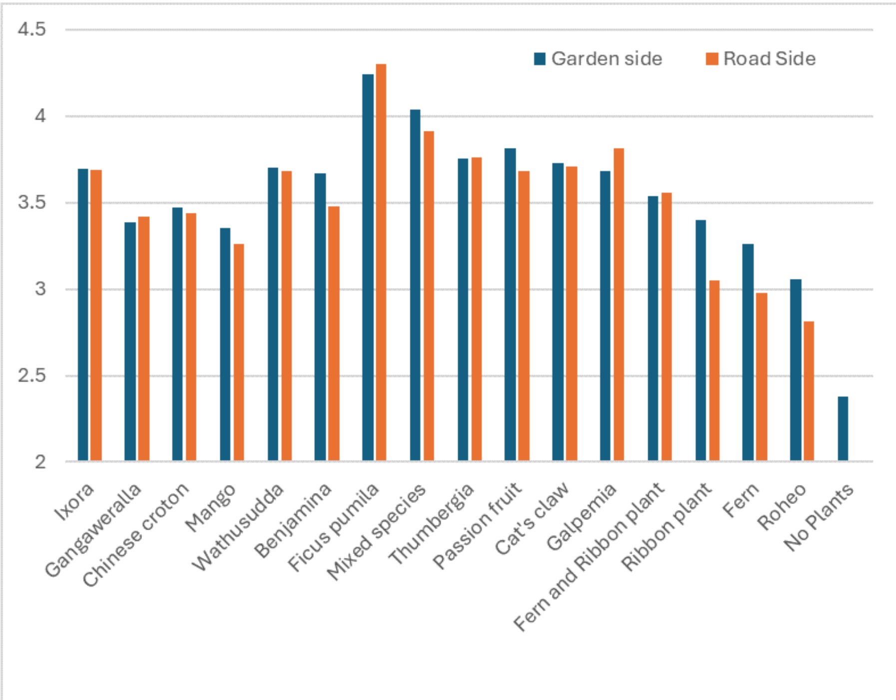

Figure 3: *Average preference levels for different species used for green boundary walls*

hanging planters planted with Mixed species and Living wall-hanging vines Thumbergia had also preference values above 4. The lowest preference values were for Ground cover Roheo (2.86) on the roadside and Ground cover Fern (2.98) on the roadside which was lower than the Likert Scale 3 – Average preference. All other designs were aesthetically appreciated since they had their preference values above 3.0.

Preference for different wall configurations

The average preference levels for the 11 green boundary wall configurations are given in Figure 2. Accordingly, for both garden and roadside views the highest preference was for Living walls. Climbers growing on a structure, climbers on mesh, and fully planted walls also received higher preference levels. The Ground covers received the lowest preference levels, falling below the average value level of 3.0. Fully planted boundary walls (3.51) have received a somewhat higher preference in comparison to partially planted boundary walls (3.35). In comparison to seven green facades, the preference for the living walls was higher for both garden and roadside views. Previous research work has also suggested that living walls can offer more creative and aesthetic potential [26].

The least preferred three configurations were a Partially planted boundary wall, a Partial boundary wall with metal vertical bars and vegetation, and Ground covers. In these, the boundary wall surface was partially visible as the vegetation cover was not full. Previous research work has identified perceived naturalness as a predictor of preference. Further, perceived naturalness is determined by the natural appearance and amount of vegetation; as well as the presence or absence of built/human elements [10]. Ulrich (1983) [33] has also found that for Americans those senses would appear natural when they contain more vegetation and few manmade elements. The lower preference for the aforementioned three categories and higher preference for the walls fully covered with vegetation shows that having more vegetation and less exposed boundary wall surface would lead to a higher preference in green boundary walls. This holds important information for landscape architects, urban planners and residents since they can expect to create aesthetically pleasing roadside landscapes by introducing more greenery in roadside facades.

Preference for species

The species tested in this study are the most frequently observed in boundary walls of the Colombo district. The results confirmed that except for Ferns and Rheo, the species tested in this study are preferred. This confirms the preference for selected species and for the design alternative. According to Figure 3, the highest preference was for Ficus pumila (4.2). It was followed by Thambergia (4.0); Passion Fruit (3.9); Cats claw (3.7), Galepemia (4), Ixora (3.8). This result is in agreement with observations of previous studies on species in existing boundary walls. As suggested in previous research work [26] different species have different levels of preference. These outcomes will thus help urban planners and architects in identifying species of higher preference.

Determinants of overall preference for options of green boundary walls

A regression analysis was conducted to study how overall preference can be predicted based on the underlying bases behind preference investigated through five independent variables (attractiveness, naturalness, suitability of the plant species to the wall configuration, and suitability to limited space).

Table 2 gives the outcomes of the regression analysis which has generated two models to predict the overall preference based on five independent variables. Among these, Model A had an R2 value of 0.988. According to Model A overall preference for green boundary walls is determined by only attractiveness. Model B had the highest R2 value of 0.995, among the two models generated. According to Model B, the overall preference for green boundary walls is determined by the attractiveness of the wall and the suitability of the species to the wall configuration. This reflects that preference decision is influenced by the aesthetic appearance and concerns about the suitability of the species to the wall.

The potential of greening boundary walls to create restorative spaces

In addition to the aesthetic benefits, greenery may evoke more positive emotional responses in comparison to negative responses such as anger which may result due to less preferred urban senses [10]. Also, long-term exposure to such vegetation may lead to more restorative benefits A restorative environment can aid recovery from directed attention fatigue [34, 35] and stress [32]. Natural scenes can be more restorative than built ones [31] Green and natural areas can be effective in restoring attention [36]. In reviewing the social benefits of vertical greenery systems [18], proposed that improvement to aesthetic value can improve human health and mental wellbeing, and enhance public spaces. According to the work reviewed by authors visual and physical contact with plants can generate restorative effects lead-

Table 2: *Results of regression Analysis*

Gender Model Summary c										
Model	**R**	R^2	**Adjusted R Square**	**Estimate SE**	**Change Statistics**					**Durbin-Watson**
					R Square Change	**F Change**	**df1**	**df2**	**Sig. F Change**	
A	.988a	0.976	0.975	0.06	0.976	2488.255	1	62	0	NaN
B	.995b	0.99	0.99	0.037	0.015	97.668	1	61	0	2.086

a. Predictors: (Constant), Attractiveness
b. Predictors: (Constant), Attractiveness, Suitability of the plant species to the wall configuration
c. Dependent Variable: Overall preference

ing to decreased stress, improve the patient recovery rate and develop higher resistance to illness. These research-based concepts are widely used by landscape architects in designing restorative living spaces such as hospitals and elderly homes in the developed world. The outcomes of this study which verified the preference for urban vegetation in the Sri Lankan context can be applied to the design of hospitals and elderly homes which have less attractive boundary walls installed for security purposes. Through the installation of preferred green boundary wall design alternatives especially to the garden side of the wall of hospitals and elderly homes, landscape architects can create aesthetically preferred environments with restorative benefits instead of bare boundary walls.

Greenery preference from an evolutionary perspective

The present study confirmed that installing vegetation in green boundary walls can lead to higher levels of preference for such walls. The reasons behind such preference can be explained using the two most frequently used theories in landscape perception. Appleton (1975) [37] proposed the theory of Prospect and Refuge which is the most frequently theory to understand the reasons for landscape preference. It explains that people prefer landscapes that show signs of prospect or refuge. Vegetation is a sign of prospect and thus landscapes with vegetation are highly preferred. Kaplan (1987) [38] has proposed a framework to explain environmental preference based on an evolutionary perspective. Accordingly, people prefer environments that possess indicators that support human life such as water or vegetation. Such preference is intuitive and carried through human evolution so that humans do not waste time processing information. The outcomes of this study clarifying the preference towards boundary walls with green is in line with the aforementioned two famous theories of landscape perception namely Kaplan's evolutionary perspective and Appleton's prospect and refuge theory. This opens up a huge opportunity for urban planners and landscape architects to install preferable landscapes by utilizing the less space-consuming vertical greenery systems adjacent to artificial boundary walls.

Recommendations for installing greenery create appealing boundary walls.

Greenery is an increasingly used tool by local authorities, architects, and urban planners for the regeneration of cities. White and Gatersleben (2011) [10]. Research knowledge on how to use greenery for this purpose would make such work more effective. Based on the outcomes of the study following recommendations can be made to urban planners, landscape architects and residents to support landscape management on roadsides.

- Living walls planted with Ficus Pimula can be recommended as a design option that would lead to higher aesthetic appreciation, contribute to air purification and creation of thermal comfort as well as the minimal effort for installation and maintenance.
- Living walls receive higher aesthetic appreciation. These options can further be extended by adding more colourful species, and diversification of plants [18]
- Climbers growing on a structure, climbers on mesh, and fully planted walls also received higher preference levels and can thus be recommended as design alternatives
- Greening boundary walls with Thambergia; Passion Fruit, Cats claw, Galepemia and Ixora can lead to higher preferences

Sampling and methodological issues

The questionnaire used in the present study was distributed as a Google form via the Internet and might have excluded those who did not use the Internet which may have reduced the sample representativeness [**<empty citation>**](Sturgis 2006). The present study focused on the landscapes of the Colombo district using residents and frequent users of Colombo which is the most urbanized district in Sri Lanka. The findings may be affected by the above factors limiting the generalizability of the to the given circumstances. However future work can verify the applicability of results to other contexts using similar methodologies.

Evaluation of scenic beauty based on photographs has been used in many studies [39]. Photographs may not give real experience as actual site observation but a convenient way since the construction of such green walls and conducting multiple real site observations for the survey is challenging. A meta-analysis done using 11 papers calculated a strong relationship with a correlation of 0.86 between preferences obtained from actual site observation and preferences obtained through colour photographs [40]. A previous research work has revealed that the use of virtual environments and imagery is suitable for stated choice research in the built environment [25].

CONCLUSION AND RECOMMENDATIONS

This research investigated the potential aesthetic benefits of the introduction of vegetation to boundary walls and attempted to identify the designs (configurations and species) that can lead to higher aesthetic appreciation. According to the results, except for two ground cover alternatives, all other proposed design alternatives with greenery were preferred over bare walls. Living walls made with Ficus pimula which is a very frequently adopted alternative in Colombo streets received the highest preferred. Living walls, climbers growing on a structure, climbers on mesh and fully planted walls were the highest preferred configurations. Configurations with ground covers were not preferred. Fully planted boundary walls received a higher preference than partially planted boundary walls. In terms of species, Ficus pimula was the highest preferred species while Thambergia; Passion Fruit, Cats claw, Galepemia and Ixora were also highly preferred. The outcomes of this study were in agreement with the two famous landscape theories, namely the Prospect and Refuge theory by Appleton and Kaplan's Evolutionary perspectives of landscape preference. This suggests Sri Lankan people have similar patterns of landscape preference within the scope of perception of greening the boundary walls.

The above outcomes on most preferred design alternatives could be used by the planners in encouraging landowners to plant boundary walls in both road facades and garden sides. The landowners who would like to make a green wall that's appreciated by others can use the above information in deciding the green wall configurations. Further, the findings can be extended to designing gardens to create restorative benefits in hospitals and elderly homes.

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Table 3: *Suitable plant species for each configuration*

Name	Configuration	Type and Description	Preferred species
A. Mesh-supported climber wall		Green Façade: Climbers grown on the ground and supported by a mesh supported on vertical poles and without a boundary wall	Passiflora edulis, Thunbergia grandiflora, Tristellateia australasiae, Ficus pumila, Dolichandra unguis, Asparagus racemosus, Petrea volubilis, Allamanda cathartica, Vitis vinifera, Antigonon leptopus, Momordica charantia, Philodendron imbe, Combretum indicum
B.Plant wall		Green Façade: Bushes are grown as a fence without a boundary wall. regular pruning is done to maintain the shape of a wall.	Ixora coccinea, Durantha erecta, Phyllanthus myrtifolius, Syzygium campanulatum, Excoecaria cochinchinensis, Cupressus sempervirens, Ficus benjamina, Tabernaemontana divaricate, Murraya paniculata
C. Partial boundary wall with vegetation and vertical bars		Green Façade: The lower half of the boundary wall is constructed as a block wall and the upper half is constructed using metal bars like a fence. plants are grown roadside or/and garden side of the wall	Mangifera indica, Durantha erecta, Phyllanthus myrtifolius, Syzygium campanulatum, Ixora coccinea, Excoecaria cochinchinensis, Cupressus sempervirens, Ficus benjamina, Tabernaemontana divaricate, Murraya paniculata
D. Fully Planted Boundary Wall		Green Façade: Bushes are grown along the boundary wall and maintain the height as wall height	Tabernaemontana divaricate, Durantha erecta, Phyllanthus myrtifolius, Syzygium campanulatum, Ixora coccinea, Excoecaria cochinchinensis, Cupressus sempervirens, Ficus benjamina
E. Partially Planted boundary Wall		Green Façade: Bushes are grown along the boundary wall and maintain the height as half of the wall height	Ficus benjamina, Durantha erecta, Phyllanthus myrtifolius, Syzygium campanulatum, Ixora coccinea, Excoecaria cochinchinensis, Cupressus sempervirens, abernaemontana divaricate, Murraya paniculata
F. Living wall attached climbers		Living wall: Climbers are grown along the boundary wall covering the wall. climbers can attach themselves to the wall and do not need extra supportive structure	Ficus pumila, Campusis radicans, Piper betle

Table 3. Suitable plant species for each configuration Continued...

Name	Configuration	Type and Description	Preferred species
G. Living wall- Hanging planters		Living wall: Plants are grown in planters attached to the vertical surface of the boundary wall	Chlorophytum comosum, Sansevieria zeylanica, Evolvulus alsinoides, Plumbago capensis, Tradescantia spathacea, Nephrolepis exaltata
H. Living wall hanging vines from the top		Living wall: Vines are planted in structure on the top of the boundary wall and hanging down along the wall	Thunbergia grandiflora, Tristellateia australasiae,Ficus pumila,Dolichandra unguis, Asparagus racemosus, Petrea volubilis, Allamanda cathartica,Vitis Vinifera, Antigonon leptopus, omordica charantia,Philodendron imbe, Combretum indicum
I. Climbers on mesh attached to the wall		Green Façade: Climbers are grown on ground and grow up along the boundary wall with the support of mesh attached to the wall surface.	Dolichandra unguis, Thunbergia grandiflora, Tristellateia australasiae, Ficus pumila, Asparagus racemosus, Petrea volubilis,Allamanda cathartica,Vitis Vinifera, Antigonon leptopus, omordica charantia
J. Living wall - Mat modular based		Living wall: Use pre-assembled modules with ground and vegetation for rapid installation	Mixed species, Sansevieria zeylanica, Evolvulus alsinoides, Plumbago capensis, Tradescantia spathacea, Nephrolepis exaltata, Chlorophytum comosum
K. Ground covers		Green Façade: Ground covers are grown roadside and /or garden side of the boundary wall	Chlorophytum comosum, Sansevieria zeylanica, Evolvulus alsinoides, Plumbago capensis, Tradescantia spathacea, Nephrolepis exaltata, Chlorophytum comosum

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