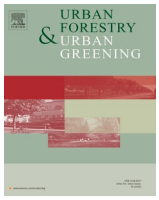
Urban Forestry & Urban Greening 57 (2021) 126931

Contents lists available at ScienceDirect

Urban Forestry & Urban Greening

journal homepage: www.elsevier.com/locate/ufug



Determinants of residents' preferences for Urban Green infrastructure in Nigeria: Evidence from Lagos Metropolis

Adedotun Ayodele Dipeolu [a,*], Eziyi Offia Ibem [b], Joseph Akinlabi Fadamiro [c]

[a] Department of Architecture, College of Engineering and Environmental Studies, Olabisi Onabanjo University, Ogun State, Nigeria
[b] Department of Architecture, Faculty of Environmental Studies, University of Nigeria, Enugu Campus, Enugu State, Nigeria
[c] Department of Architecture, School of Environmental Technology, Federal University of Technology Akure, Ondo State, Nigeria

ARTICLE INFO

Handling Editor: N Nicholas Williams

Keywords:
Determinants
Lagos metropolis
Residents' preferences
Residential neighbourhoods
Urban green infrastructure

ABSTRACT

Understanding preferences for urban green infrastructure (UGI) and the factors responsible for these are very important for adequate provision and effective management of these vital components of the urban environment. There are however very few studies that provide insight into residents' preferences for UGI in sub-Saharan Africa. The aim of this study was to examine residents' preferences for the different forms of UGI with green, tree, water and other features and the factors that influence these in Lagos Metropolis, Nigeria. The data were obtained via a questionnaire survey of 1560 participants in the study area and analysed using descriptive statistics, Mann-Whitney U and Kruskal Wallis tests and multiple regression analysis. The results indicate that the participants generally showed more preferences for UGI with green features including green corridors, lawns, sports fields, parks and gardens than others. Variation in the participants' preferences for UGI was mainly due to differences in their local government area of residence. Nevertheless, the four top determinants of participants' preferences for the different forms of UGI were the environmental and health benefits and quality of UGI as well as the respondents' involvement in pro-green infrastructure activities in their neighbourhoods. The study conclude that urban planners should focus on strategies that maximise the environmental and health benefits and quality of green infrastructure and foster citizens' participation in the development and management of UGI in cities in Nigeria and others countries in sub-Saharan Africa.

1. Introduction

With the increasing rates of urbanization and associated climate change challenges, the urban population in Lagos Metropolis, Nigeria, is gradually losing touch with the greening, cooling, and the recreational benefits of the natural environment (Dipeolu and Ibem, 2020; Oluwafeyikemi and Julie, 2015; Olagunju, 2015; Oduwaye, 2009). Rapid urbanization has led to a significant loss of natural habitats and biodiversity, reduction in green spaces and ecosystem deterioration in many cities in the Global South (UN-HBITAT, 2014; Salisu, 2015; Olagunju, 2015). In the face of growing concerns over these challenges, the installation or provision of green infrastructure (GI) is rapidly gaining recognition in urban planning and environmental management literature as a potent strategy for restoring the lost green spaces and providing diverse social, economic and environmental benefits to the built environment (Conedera et al., 2015; Pakzada and Osmonda, 2016; Jiang et al., 2018; Adegun, 2018, 2019; Dipeolu et al., 2020).

Urban Green Infrastructure (UGI) generally refers to a collection of different multi-functional green space and facilities of diverse characteristics that support sustainable development (Wolch et al., 2014; Adegun, 2017; Jiang et al., 2018; Mexia et al., 2018; YU *et al.*, 2019). It includes natural or semi-natural spaces integrated or combined with man-made systems to create vital environmental services such as floodplains, green roofs, gardens and parks (Basu et al., 2013). Green infrastructure occur in urban areas in four different forms: 1) green features (e.g. green roofs, parks and gardens, lawns and sports fields, green corridors) 2) tree features (e.g. community forest, urban woodlands, street trees) 3) water features (e.g. floodplains/wetland, stream, rivers, ponds, lakes and fountains) and 4) others (e.g. open spaces, non-green parks, wildlife habitats, school play fields, cemeteries) (Roy et al., 2012; Wolch et al., 2014; Adegun, 2018; Dipeolu and Ibem, 2020).

Several authors have noted that studies on peoples' preferences for the different forms of UGI (e.g. those with tree, water and green features) and the factors influencing these can help inform policy makers

* Corresponding author.
E-mail addresses: dipeolu.adedotun@oouagoiwoye.edu.ng (A.A. Dipeolu), eziyi.ibem@unn.edu.ng (E.O. Ibem), jafadamiro@futa.edu.ng (J.A. Fadamiro).

https://doi.org/10.1016/j.ufug.2020.126931
Received 13 July 2020; Received in revised form 30 November 2020; Accepted 9 December 2020
Available online 17 December 2020

and city planners on how to effectively provide and manage green spaces in towns and cities (Wan and Shen, 2015; Lindholst et al., 2016; Madureira et al., 2018). Specifically, previous research in countries such as China (Shan, 2014), Argentina (Craik et al., 2015), Switzerland (Conedera et al., 2015) have revealed that residents showed preferences for different forms of UGI, while other studies in Malaysia (Kasim et al., 2016), the USA (Suppakittpaisarn et al., 2018), Hong Kong (Lo and Jim, 2012) and Portugal (Madureira et al., 2015) reported the aspects that influenced residents' evaluation of the economic, environmental and social benefits of UGI. In addition, the existing studies have also identified the factors that influenced preference for UGI to include residents' socio-economic characteristics such as gender (male or female), age, marital status, education, occupation and proximity to UGI (Conedera et al., 2015). Others are the number, size, arrangement/orderliness (design) and safety of GI sites, the noise level and access to UGI sites by people with disabilities (Karanikola et al., 2016), tree density and understory vegetation density (Suppakittpaisarn et al., 2018), plant colour, leaf size and type (Samimi and Shahhosseini, 2020).

In sub-Saharan Africa, previous studies have examined some aspects of UGI in the different countries. For examples, in South Africa, Shackleton et al. (2014) examined the importance of GI in small and medium-sized towns, while Adegun (2017 and 2018) investigated residents' willingness to pay for GI in informal settlements and their relationship with GI in Johannesburg, respectively. In Tanzania, Roy et al. (2018) highlighted the nexus between the increasing rates of climate change challenges and declining levels of green infrastructure in informal settlements of Dares Salaam, while in Ghana, Mensah (2014) uncovered the nature and challenges associated with the provision of urban green spaces. The studies in Nigeria examined the impact of green wall on thermal comfort in low-income houses in Lagos (Oluwafeyikemi and Julie, 2015), the role of green infrastructure quality in environmental sustainability of residential neighbourhoods in Lagos (Dipeolu and Ibem, 2020) and the relationship between residents' socio-demographic characteristics and with visit to green infrastructure facilities in Lagos metropolis (Dipeolu et al., 2020). Apart from a study in Ethiopia by Gashu et al. (2019) that identified frequency and duration of visits to UGI sites as significant predictors of preference for UGI, no other study known to the authors has examined the preferences of urban population for the different forms of UGI and the factors influencing these among urban population in countries in sub-Saharan Africa. In fact, when compared with other regions of the world, the review by du Toit et al. (2018) indicates that empirical studies on green infrastructure from sub-Saharan Africa are underrepresented in the literature. As a result, there is a lack of understanding of several issues relating to GI and urban population in this region. This situation invariably creates a gap in knowledge for managers and institutions responsible for the provision and management of UGI in countries in this region, including Nigeria.

With this in mind, the current study sought to investigate residents' preferences for the different forms of UGI and the factors that influence these in Lagos, southwest Nigeria. The specific objectives are to: examine residents' preferences for the different forms of urban green infrastructure in selected residential neighbourhoods in Lagos Metropolis, Nigeria; investigate whether there are differences in preferences for UGI across the different categories of residents; and to identify the factors that influence residents' preferences for the different forms of UGI in the study area. Lagos metropolis was chosen for this research because previous studies (Dipeolu, 2017; Dipeolu and Ibem, 2020) have revealed that since 2011, there have been concerted efforts aimed at increasing the stock of GI in Lagos and its environs. Hence, there is a need to investigate and understand the preferences of the residents for these GI provided in this city.

The study makes a contribution to scientific knowledge by revealing the different forms of UGI the residents show preference for and the aspects that need more attention to ensure that the provision of GI in rapidly and densely populated cities meet the needs of a majority of the population. This is vital in formulating appropriate policies and developing programmes that can promote sustainable, inclusive, habitable and safer cities in the Global South.

2. Users' preferences for UGI

Research on different aspects of UGI is on the increase globally. Madureira et al. (2018) have classified the existing studies on the preferences of urban population for the different forms/categories of UGI into three main groups. The first group include studies on the reasons why people prefer one form of UGI to another. Studies in this category have shown that people preferred grasses and lawns in places such as Guangzhou, China, for the purposes of enjoying fresh air, beautiful scenery and relaxation (Shan, 2014). Also, in Buenos-Aires Argentina, people were reported to had preferred parks for the purposes of relaxation and recreational activities (Craik et al., 2015), while in Swiss mountainous region of the Southern Alps, the population preferred green slopes of the mountains because of visual contact (Conedera et al., 2015).

The second group of studies consists of those that examined the aspects or components of UGI that influenced residents' evaluation of its benefits. For examples, Kasim et al. (2016) reported that residents in Johor-Bahru Malaysia, preferred green space component to water body because green spaces were perceived to have contributed more to their well-being than water bodies, while in the USA, Suppakittpaisarn et al. (2018) reported that people perceived green spaces as having the potential to enhance their well-being and knowledge base on UGI. A similar study by Lo and Jim (2010) also revealed that residents perceived environmental protection and conservation benefits influenced their willingness to pay for services provided in urban green sites in Hong Kong.

The third group of studies include those on the preferred features and characteristics of UGI. In this group is the study by Madureira et al. (2018) which reported cleanliness and maintenance as the most preferred characteristics of UGI by residents in three Portuguese cities. Similarly, the study by Samimi and Shahhosseini (2020) showed that high greenery quantity and flowering plants were the most preferred, while tall foliage plants with wide leaves were the least preferred by residents in Tabriz, Iran.

Furthermore, the findings of studies on the key determinants of preferences for UGI among urban population also indicate that these determinants vary across different countries and include socio-economic and demographics of the population such as gender, age, marital status, education, occupation (Conedera et al., 2015), number, size, design suitability, safety, variety and care of plants, level of noise pollution, provision of facilities for people with disabilities in UGI sites, duration and frequency of visits to green areas (Karanikola et al., 2016). Others determinants include proximity of available urban green spaces to the residents (Conedera et al., 2015), tree density and understory vegetation density (Suppakittpaisarn et al., 2018) and characteristics or attributes of green infrastructure such as the variety of plants (Conedera et al., 2015; Samimi and Shahhosseini, 2020).

Generally, findings of the existing studies reveal that there are variations in preferences for GI among urban population in the different countries. Whereas, some people tended to prefer green spaces and trees with flowers, others showed preference for green parks. Similarly, while some persons showed preferences for certain UGI due to their aesthetic qualities and for providing spaces for relaxation, others preferred certain UGI due to the belief that it contributes more to their well-being than others (Shan, 2014; Conedera et al., 2015; Madureira et al., 2018; Samimi and Shahhosseini, 2020).

Two sets of studies relating to the determinants of preferences for UGI were identified from the review of research literature. The first set of studies identified socio-economic characteristics of the population, while the second set identified the characteristics and location of UGI as the main factors that can influence people's preference for UGI in the different countries. Notably, most of the existing studies identified in the

literature were done in countries in Europe, America and Asia and did not capture the situations in urban areas in sub-Saharan Africa; and thus their findings can be considered inconclusive. In view of the differences in cultural values and belief systems between countries in Europe, America and Asia and their counterparts in sub-Saharan Africa, it is assumed that differences may exist in the preferences for UGI between residents in urban areas in sub-Saharan Africa and their counterpart in other countries, and by extension the factors that influence these. In addition, none of the studies reviewed here examined the combined effects of the socio-economic characteristics of urban population, the UGI quality, health and environmental benefits of UGI on preferences for UGI. This is part of the research gap the current study attempted to fill from the perspective of a developing country in sub-Saharan Africa.

3. Methods

3.1. Study area and research population

Although Lagos State, south-west Nigeria has 20 Local Government Areas (LGAs), just 16 of these LGAs constitute Lagos Metropolis, the study area. Lagos Metropolis with a land mass of 3,475.1/km^2 (1,341.7/m^2) and population density of 2,593.7/km^2 (6,717.8/m^2) had an estimated population of over 13 million people as of 2013. According to the Lagos State Bureau of Statistics (2015), the Lagos Metropolis accounts for over 40 % of all manufacturing, building and construction, wholesale and retail trade activities and provides home for about 77 % of all financial institutions in Nigeria. A study by Dipeolu (2017) revealed that the Government of Lagos State has embarked on extensive provision of GI within Lagos Metropolis through the Lagos State Parks and Gardens Agency (LASPARK). Therefore, the research population comprised residents of residential neighbourhoods in four randomly selected Local Government Areas (LGAs) in Lagos Metropolis. These four LGAs: Ikeja, Kosefe, Lagos Island, and Surulere constitute 25 % of the 16 LGAs in Lagos Metropolis (see Fig. 1 for the map of Lagos Metropolis and the selected LGAs for the study).

3.2. Research design

The research design adopted for this study was a cross-sectional survey. This is because of the nature of the research objectives and the advantages it offered in the collection of quantitative data from the participants in the four LGAs within the shortest period of time. Moreover, previous studies on this subject identified were also based on cross-sectional surveys (see for example Shan, 2014; Craik et al., 2015; Madureira et al., 2018; Dipeolu and Ibem, 2020). The sample size for the survey was determined by using the formula for infinite population presented by Turner (2003) as shown in Eq. 1.

$$n = \frac{(Z_\alpha)^2 r(1-r)fk}{phe^2} \quad (1)$$

Where n, represents the sample size, Z_α, which is the critical value of the normal distribution as presented in the Table of Standard Normal Distribution at 95 % confidence level taken as 1.96, r represents an estimate of the proportion of the respondents in the survey, which in this research is taken as 50 %, f is the design effect, which is = 4, while k represents non-response rate, which is taken as 20 % in this research, $p = 0.03 \times 18 = 0.54$, representing the proportion of the total population accounted for by the target population and upon which the parameter, r, is based. As recommended by Turner (2003), 0.03 represents each year of age represented by the target population and h is the average household size

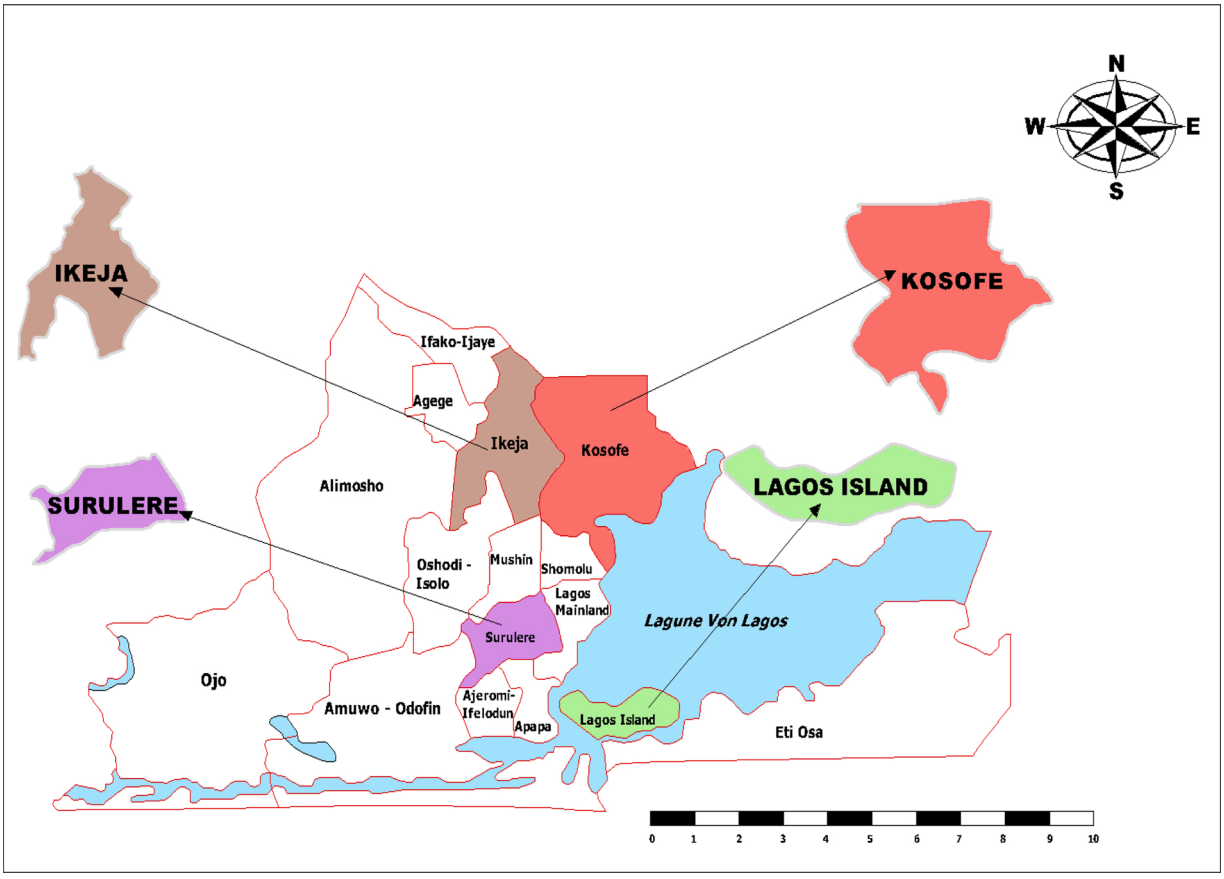


Fig. 1. Map of Lagos Metropolis showing the four sampled LGAs.
Source: Lagos State Ministry of Environment

(in persons), which is often assumed to be six (6 persons) for surveys in most developing countries and *e* is the margin of error (i.e. 0.05) or level of precision set at 5% of *r*. Using the aforementioned parameters and substituting them in the formula in Eq. 1 as shown in Eq. 2,

$$n = \frac{(1.96^2 \times 0.5 \times 0.5 \times 4 \times 0.2)}{[0.54 \times 6 \times (0.05 \times 0.5)^2]} = 379.4 \approx 380 \quad (2)$$

a minimum of 380 participants was obtained for each of the four LGAs selected for the survey. This means that a minimum of 1520 participants in all the four LGAs were required for the survey. The choice of Turner's (2003) formula in the estimation of the sample size was informed by the need to have a sample size that is representative of the characteristics of the research population for specific levels of precision, confidence, and variability. These are essential for accurate statistical estimations.

The data were obtained from the participants with the help of pre-tested structured questionnaire designed by the researchers. The review of literature was helpful in the identification of variables investigated. The questionnaire was structured into different sections based on the specific issues investigated. Specifically, the first section was used in extracting data on the following variables 1) the participants' socio-economic and demographic characteristics 2) the UGI sites they patronised or visited in their neighbourhoods 3) the reasons why they visit the different forms of UGI and 4) their involvement in pro-green infrastructure activities/or programmes in their respective neighbourhoods.

The second section contained questions on the participants' perceived quality and benefits of UGI within their neighbourhoods. The data on residents' perceived quality of UGI were based on the parameters developed by previous authors (Bonaiuto et al., 2006). The questions were framed on the quality, quantity, level of equipment/facilities on UGI sites, availability and accessibility to UGI in the neighbourhoods. Similarly, the data on environmental sustainability benefits of UGI were based on variables related to issues such as air pollution, greenhouse gas emission, collection and disposal of waste, share of energy from renewable sources, water quality, use of pesticides and chemicals for farming, energy use intensity, deforestation, passenger transport mode and government development assistance. In collecting the data on UGI quality and environmental benefits of UGI, the participants were asked to rate their levels of agreement or disagreement with statements related to these aspects based on 5-point Likert type scale ranging from '1' for *Strongly disagree* to '5' for *Strongly agree*.

3.3. Data collection

Part of the data collection process involved visits by the first author to the Lagos State office of the National Population Commission (NPC) to obtain the lists and maps of Enumeration Areas (EAs) in the study area. These documents helped in the identification of 17 EAs consisting of 3 EAs in Ikeja, 5 EAs each in Kosofe and Surulere and 4 EAs in Lagos Island. Prior to the main survey the questionnaire was pre-tested in an unselected Local Government Area in Lagos Metropolis. The feedback helped in adjusting some of the questions in the final version of the questionnaire used in the survey.

The main survey lasted for 20 weeks (i.e. from March to July 2017) and it comprised the administration and retrieval of copies of the questionnaire from the residents in the selected neighbourhoods. The selection of the participants in the survey was based on the sampling intervals (k) determined by dividing the number of houses in each of the 17 enumeration areas (EAs) identified by the sample size, which were 400 persons for each of the EAs. A total of 6283 households comprising 1591 households in the three EAs selected in Ikeja LGA, 1852 households in the five EAs selected in Kosofe LGA, 1402 households in the four EAs in Lagos Island LGA and 1438 households in the five EAs selected in Surulere LGAs was involved. The household heads were systematically sampled from the list of numbered houses in each EA until the required 400 household heads allocated to each of the EAs was achieved. The first (1 st) house at the nodal point within each EA was chosen, subsequent selections were systematically done based on the predetermined sampling interval (k) for each of the four LGAs sampled. One copy of the questionnaire was administered by hand to every consenting household head or adult representative found in the housing units when the survey was carried out. Out of the 1600 copies of the questionnaire administered by the researchers and trained research assistants, 1560 of them were retrieved giving a response rate of 97.5 %. All the questionnaires retrieved were correctly completed by the participants in the survey.

3.4. Data analysis

Based on the three research objectives stated, the data collected were subjected to three basic types of analyses. The first analysis was simple descriptive statistics such as frequencies and percentages and were used to analyse the socio-economic characteristics of the participants and their preferences for the four categories of UGI investigated. Furthermore, mean scores (MSs) were calculated for the quality, health and environmental sustainability benefits of UGI as rated by all the 1560 respondents put together and these were later used in the regression analysis. The second analysis conducted was test of variance using Mann-Whitney U and Kruskal-Wallis H Tests. These tests were used to investigate whether the differences in preferences for UGI across the various groups of participants were statistically significant. In carrying out these tests, the UGI visited was the dependent variable, while socio-economic variables such as gender, age, education, marital status, income, ethnic origin, religious affiliation, household size and Local Government Area of residence of the participants were the independent variables.

The last type of analysis conducted was Categorical Regression (CATREG) analysis, which was used to investigate the determinants of the participants' preference for the different categories of UGI. In carrying out this analysis, the criterion variable was the type of UGI sites visited, while the mean scores (MSs) for each of quality, health and environmental sustainability benefits of UGI, reasons for visiting UGI sites, involvement in pro-green infrastructure activities/programmes as well as the socio-economic characteristics of the participants were the independent variables. The CATREG analysis was used instead of the traditional linear regression model because the dataset consists of a mixture of nominal, interval and ratio data. As Shrestha (2009) rightly explained, the optimal scaling feature of CATREG analysis gives it advantage over the traditional linear regression analysis in dealing with datasets of this nature.

4. Results

4.1. Residents' preferences for the different categories of urban green infrastructure

The data presented in Table 1 include the frequency and percentage distributions of the socio-economic characteristics of the participants in the survey. Results of the descriptive statistics reveal that more male than female residents participated in the survey and that around 60.3 % of the participants were over 29 years old, 57.4 % were in marriage relationship, and around 88.8 % had household size of two persons and above. In addition, the participants were 64.4 % Christians, 70.6 % of Yoruba ethnic origin, 62.1 % had a minimum of tertiary level of education and 73.2 % of them were employed either in the private and public sectors of the Nigerian economy (see first and second columns of Table 1).

Participants' preferences for the four categories of UGI in the study area were investigated by asking them to indicate which forms of UGI sites they had visited within the past weeks. Many (42.1 %) of the respondents reported that they had visited GI with green features, followed by around 23.5 % who visited other categories of GI, while the

Table 1
Respondents' socio-economic characteristics and preferences for UGI.

Variables	Frequency (%) n = 1560	Forms of UGI Visited				
		No response	Green Spaces	Tree features	Water features	Others
Gender						
Male	914(58.6)	160 (17.5)	373 (40.8)	103 (11.3)	59 (6.5)	219 (24.0)
Female	646(41.4)	116 (18.0)	282 (43.7)	55 (8.5)	46 (7.1)	147 (22.8)
Age						
Less than 30 years	587(37.6)	94 (16.0)	256 (43.6)	65 (11.0)	36 (6.1)	138 (23.5)
30–49 years	752(48.2)	142 (18.9)	307 (40.8)	70 (9.3)	56 (7.5)	177 (23.5)
50+ years	189(12.1)	35 (18.5)	78 (41.3)	21 (11.1)	10 (5.3)	45 (23.8)
No Response	32(2.0)	–	–	–	–	–
Marital status						
Never married	592(37.9)	105 (17.7)	245 (41.4)	53 (9.0)	41 (6.9)	148 (25)
Married	896(57.4)	161 (18.0)	382 (42.6)	94 (10.5)	60 (6.7)	199 (22.2)
No longer married	62(4.0)	9 (14.5)	20 (32.3)	7 (11.3)	9 (14.5)	17 (27.4)
No response	10(0.7)	–	–	–	–	–
Religious affiliations						
Christianity	1004(64.4)	186 (18.5)	428 (42.6)	93 (9.3)	71 (7.1)	229 (22.8)
Islam	471(30.2)	81 (17.2)	189 (40.1)	53 (11.3)	29 (6.2)	119 (25.3)
Traditional Religion	51(3.3)	4 (7.8)	23 (45.0)	8 (15.7)	4 (7.8)	12 (23.5)
Others	34(2.2)	5 (14.7)	14 (41.2)	4 (11.8)	2 (5.9)	9 (26.5)
Household size						
1 person	166(10.6)	27 (16.3)	71 (42.8)	17 (10.2)	1 7 (10.2)	34 (20.5)
2–4 persons	731(46.9)	127 (17.4)	314 (43.0)	83 (11.4)	39 (5.3)	168 (23.0)
4+ persons	654(41.9)	120 (18.3)	267 (40.8)	58 (8.9)	48 (7.3)	161 (24.6)
No Response	9(0.6)	–	–	–	–	–
Ethnic origin						
Yoruba	1102(70.6)	200 (18.1)	298 (27.0)	163 (14.8)	155 (14.1)	286 (26.0)
Hausa/Fulani	112(7.2)	17 (15.2)	51 (45.5)	14 (12.5)	8 (7.1)	22 (19.6)
Ibo	286(18.3)	47 (16.4)	121 (42.3)	30 (10.5)	21 (7.3)	67 (23.4)
Others	60(29.4)	12 (20.0)	22 (36.7)	9 (15.0)	5 (8.3)	12 (20.0)
Highest level of educational						
No Formal Education	84(5.4)	17 (20.2)	29 (34.5)	9 (10.7)	6 (7.1)	23 (27.3)
Primary school level	108(6.9)	22 (20.4)	40 (37.0)	10 (9.3)	7 (6.5)	29 (26.9)
Secondary school	395(25.3)	71 (18.0)	152 (38.5)	42 (10.6)	28 (7.0)	12 (25.48)
Tertiary education	968(62.1)	166 (17.1)	430 (44.4)	96 (9.9)	64 (6.6)	212 (21.9)
No Response	5(0.3)	–	–	–	–	–
Employment status						
Unemployed	173(11.1)	24 (13.9)	77 (44.5)	19 (11.0)	4 (2.3)	49 (28.3)
Self employed	704(45.1)	83 (11.8)	269 (38.2)	88 (12.5)	63 (8.9)	201 (28.6)
Private/public sector employees	439(28.1)	43 (9.8)	211 (48.1)	58 (13.2)	42 (9.6)	85 (19.3)
Students and others	244(15.6)	51 (20.9)	98 (40.2)	23 (9.4)	16 (6.6)	56 (23.0)
LGA of residence						
Ikeja	390(25.0)	35 (9.0)	176 (45.1)	47 (12.1)	33 (8.5)	99 (25.4)
Kosofe	390(25.0)	83 (21.3)	166 (42.6)	41 (10.5)	23 (5.9)	77 (19.7)
Lagos Island	390(25.0)	83 (21.3)	159 (40.7)	31 (8.0)	24 (6.2)	94 (24.1)
Surulere	390(25.0)	75 (19.2)	154 (39.5)	39 (10.0)	25 (6.4)	97 (24.9)

Numbers outside the bracket represent frequencies (n), while numbers in the brackets represent percentages (%).

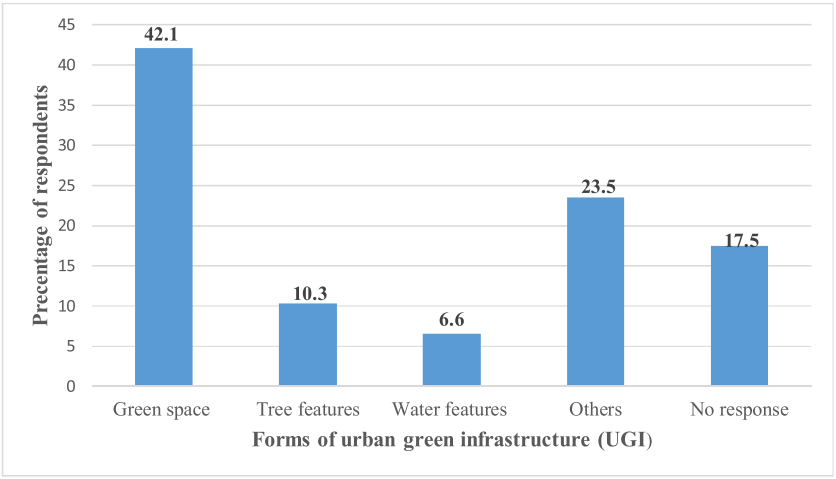


Fig. 2. Categories of UGI Visited by the Participants.

least proportion (6.7 %) visited GI with water features (Fig. 2).

In addition, around 50.2 % of the participants indicated that the reason for visiting UGI sites was for social interactions, 25.2 % said it was for spiritual exercise, 23.9 % claimed that it was for relaxation/recreational purposes, while very small proportion (0.7 %) indicated that they visited UGI sites for other purposes. From these results, it is clear that a greater proportion of the residents sampled showed preference for UGI with green features and the main reason for visiting UGI sites in the study was for social interactions.

4.2. Differences in residents' preferences for the different forms of UGI

The study also investigated differences in the participants' preferences for the different forms of UGI across each group. The results reveal differences in the proportion of the participants that showed preferences for the four categories of UGI investigated in this study (Table 1). Although the pattern in the distribution of the participants according to their preferences for each category of UGI appears to follow the number of participants in each socio-economic group, an exception can be found in the residents' local government areas of residence where the highest proportions of participants in Ikeja LGA showed preference for each of the four categories of UGI investigated. However, more participants in Kosofe LGA showed preference for UGI with green features than their counterparts in Lagos Island and Surulere but had the least number of participants showing preference for UGI with water features and other categories of UGI. Furthermore, the least number of participants showing preference for UGI with green features and with tree features were in Surulere and Lagos Island LGAs, respectively.

In order to ascertain whether the observed differences in the participants' preferences for the four categories of UGI across the difference groups are statistically significant, Mann-Whitney U and Kruskal-Wallis H Tests were conducted (Table 2).

From the Mann-Whitney U for the differences in preference for UGI across between male and female respondents in the survey, U = 288015.000, W = 496996.000, Z= -0.864 and $p = 0.388$. The difference in preference for the different categories of UGI by gender is not statistically significant. Apart from participants' local government area of residence with X^2, df = 2 and $p = 0.001$, all the other seven variables investigated emerged with $p > 0.05$ (Table 2). This result means that differences in preference for the four categories of UGI among the sampled population are not statically significant across residents' gender, marital status, religion, household size, level of education, ethnic origin and employment status, rather they are statically significant across the respondents' local government areas of residence.

4.3. Determinants of residents' preferences for the different categories of UGI

From the categorical regression analysis, a combination of both socio-economic characteristics and UGI related variables predicted preference for UGI among the participants in the survey. The regression model produced F (844, 715) = 1.29 at significance value ($p < 0.000$).

Table 2
Kruskal-Wallis H Test Statistics for Preference for UGI.

Variables	Kruskal Wallis Test		
	X^2	*Df*	*p*
Age	0.28	2	0.869
Marital status	2.56	3	0.464
Religious affiliations	3.29	3	0.350
Household size	0.46	2	0.793
Ethnic origin	0.31	3	0.958
Highest level of educational	1.87	3	0.601
Employment status	1.11	4	0.892
LGAs of residence	17.71	2	0.001*

*Statistically significant ($p \leq 0.05$).

With the R^2 value of 0.603, the regression model explains around 60.3 % of the variance in the preference for UGI among the population sampled. The *p*-values indicate that nine of the 14 variables investigated emerged as the significant predictors of preference for UGI in the survey. Out of these, four of the predictors, namely, marital status, religious affiliations, ethnic group, and employment status are socio-economic characteristics of the participants. Others are participants' involvement in urban greening activities or programmes, reasons for visiting to green infrastructure sites, quality of UGI, health benefits of UGI, and environmental benefits of UGI (Table 3)

The beta (β) coefficients also reveal that environmental benefits of UGI with the highest β coefficient of 0.772 contributed most to explaining participants' preference for UGI in the survey. This is followed by the health benefits of UGI (β = 0.273), quality of UGI (β = 0.232), involvement in pro-UGI activities (β = 0.156), and reasons for visits to green infrastructure sites (β = 0.136), respectively (see Table 3). These mean that a combination of socio-economic characteristics and UGI-related factors are the determinants of preferences for the different forms of UGI by participants in residential neighbourhoods in the selected four LGAs of Lagos Metropolis, Nigeria. For the top five predictors of preferences for UGI, the results mean that there will be a change in preferences by 0.772, 0.273, 0.232, 0.159 and 0.136 times per unit increase in standard deviation in the environmental benefits of UGI, health benefits of UGI, the quality of UGI, participants' involvement in pro-UGI activities and reasons for visiting UGI sites, respectively. These are therefore, the top five factors with positive influence on residents' preferences for the different forms of UGI in the study area.

5. Discussion

This study investigated residents' preferences for the different forms of urban green infrastructure and the factors that influenced these in Lagos Metropolis, Nigeria. Emanating from the results are issues considered important for further discussion. First, this study revealed that a greater proportion of the population sampled preferred UGI with green features (e.g. parks, gardens, sport fields, green roof, city farms

Table 3
Coefficients of regression for determinants of preferences for UGI.

Independent Variables/ Predictors	Standardized Coefficients		Df	f	p
	Beta	Estimate of Standard Error			
Gender	0.020	0.028	1	0.479	0.489
Age	0.025	0.034	2	0.540	0.583
Marital status	0.093	0.046	2	4.034	0.018 *
Household size	0.062	0.055	1	1.283	0.258
Religious affiliations	0.072	0.038	3	3.672	0.012 *
Ethnic group	0.079	0.044	3	3.293	0.020 *
Highest education attained	0.056	0.043	3	1.731	0.159
Employment status	0.063	0.039	3	2.681	0.046 *
Local Government Area of residence	0.040	0.050	3	0.649	0.584
Involvement in pro-UGI activities	0.159	0.063	2	6.334	0.002 *
Reasons for visits to UGI sites	0.136	0.048	3	7.967	0.000 *
Quality of UGI	0.232	0.054	36	18.633	0.000 *
Health benefits of UGI	0.273	0.058	34	21.863	0.000 *
Environmental benefits of UGI	0.772	0.033	748	551.720	0.000 *
Dependent Variable: Which of the green Infrastructure do you visit?					

* Statistically significant ($p \leq 0.05$).

and grasses) than all the other forms of UGI in the study area. This result seems to be in line with evidence in Guangzhou, China indicating peoples' preferences for green spaces (Shan, 2014), Switzerland where Conedera et al. (2015) reported preference for green slopes of the mountains and in Buenos-Aires Argentina, where Craik et al. (2015) observed that most of those sampled in that research preferred green parks. Furthermore, the findings of this research also provide support to that by Kasim et al. (2016) revealing residents' high preference for green spaces in Johor-Bahru, Malaysia, and that in Samimi and Shahhosseini (2020) showing that most people in Tabriz, Iran, preferred GI with green features and flowering plants more than other forms of UGI.

The possible explanation for the observed preference for UGI with green features among the population in the sampled neighbourhoods is that the current efforts in providing green infrastructure in Lagos Metropolis are skewed toward the provision of UGI with green features than the other forms of UGI. However, the finding showing that about one-half of the participants indicated that the reason for visiting UGI sites in the study area was for social interactions seems to contradict the findings by Shan (2014) suggesting that the main reasons why people visited GI sites in Guangzhou-China, were for enjoying fresh air, beautiful scenery and relaxation. It is also inconsistent with evidence (Craik et al., 2015) indicating that in Buenos-Aires, Argentina, the main reasons why people visited UGI was mainly for relaxation and recreational activities. The differences in the results of these studies may be attributed to variations in the socio-economic characteristics and cultural values of the urban population in China, Argentina and Nigeria.

Second, from the results of the Mann-Whitney U and Kruskal-Wallis H tests, differences in preference for the four categories of UGI among the population sampled are statistically significant across the respondents' local government areas of residence (Table 2). This appears to be consistent with the finding by Conedera et al. (2015) indicating that proximity of available urban green spaces to residents was a key factor that influenced preference for urban green spaces among the residents. It however, appears to be contrary to the findings of the same study which reported differences in preferences for Swiss mountainous region of the Southern Alps varied across some socio-economic variables such as gender, age, marital status, education, occupation of the population. Results of the current study showed that the highest number of participants living in Ikeja LGA preferred each of the four categories of UGI investigated, which is in contrast to what was observed in the remaining three LGAs sampled. This result seems to suggest that more UGI is available in Ikeja LGA, especially those with green features. Arguably, this might be linked to the fact that Ikeja is the administrative capital of Lagos State; and thus it was receiving more attention from urban managers than other parts of the metropolis when it comes to the provision and maintenance of UGI. This is again, in line with evidence (Byrne et al., 2009; Wolch et al., 2014) suggesting that within cities, green spaces are not always equitably distributed and that access to UGI is often highly stratified based on several factors including income, race, age and gender of the residents.

Lastly, nine of the 14 variables investigated emerged as the significant predictor of preference for the different types of UGI among those sampled. Specifically, the current study shows that marital status, religious affiliations, ethnic group, and employment status were significant predictors of preferences of UGI. This seems to provide support to an earlier study by Conedera et al. (2015), which reported that marital status, religious affiliations, ethnic origin and employment status were the determinants of preference and use of urban and peri-urban green spaces in a Swiss mountainous region of the Southern Alps. However, gender and age of the participants appeared not to have significant influence on preferences for UGI in the study area. This is also in line with the findings by Conedera et al. (2015) indicating that gender and age were not among the socio-economic variables that influenced residents' preference for green areas in the Swiss mountainous region of the Southern Alps. This specific finding might be linked to the results of the Mann-Whitney U and Kruskal-Wallis H Tests both of which showed that the differences in preference for UGI between male and female respondents and across the different age groupings are not statistically significant (Table 2). In addition, the results also show that almost equal proportions of the male and female and participants across the three age groupings indicated preferences for the four categories of UGI investigated (Table 1). What these results mean is that the participants' preferences for the different forms of UGI may not be as a result of differences in their role in the society as male or female as well as their age groups. Consequently, gender and age of residents may not really be critical factors considered in understanding the preference for GI among urban population in the study area.

Also worthy of note is the identification of the participants' involvement in pro-UGI activities as one of the determinants of preferences for UGI. This finding also appears to resonate with the evidence (Moskell and Allred, 2013; Young and McPherson, 2013) indicating that involvement in pro-green infrastructure activities can help to explain why people may show preference for and ready to protect the different forms of UGI within their immediate environments. Again, the emergence of reasons for visiting UGI sites as one of the determinants of preference for UGI among the population sampled did not come as a surprise. This is because previous authors (Home et al., 2012; Shan, 2014; YU et al., 2019; Zuniga-Teran et al., 2020) have noted that the various reasons why people visit or use UGI are among the key factors that can influence their choice and use of the different GI.

Further analysis of the results also reveals that the environmental and health benefits as well as quality of UGI were among the five top determinants of preferences for UGI by the population sampled. Specifically, the identification of the health benefits as a predictor of preferences for UGI can be linked to evidence showing that contacts with GI such as urban parks, gardens and other green spaces can lead to a reduction in psychological distress and feelings of aggression (Home et al., 2012), improvement in the quality of life and mental health (Mexia et al., 2018), promotion of physical and recreational activities (Craik et al., 2015), leisure and social interactions (Shan, 2014),which in turn engender sound health, well-being and sense of place (Alaimo et al., 2016). Similarly, the emergence of environmental benefits of green infrastructure as a significant predictor of residents' preferences for UGI can also be linked to the diverse environment benefits of UGI such as reconnection of fragmented natural environment, restoration and protection of the natural ecosystems (Tavakol-Davani et al., 2015; Saleh and Weinstein, 2016), improvement of biodiversity (Pugh et al., 2012; Liu et al., 2015), regulation of urban temperature (Oluwafeyikemi and Julie, 2015), reduction of air pollution (Shan, 2014; Mexia, 2018), improvement of storm water management(Shackleton et al., 2017; Pennino et al., 2016) and minimization of the effects of greenhouse gases in the atmosphere (Roy et al., 2018; Dipeolu and Ibem, 2020).

The study also revealed the quality of UGI was also a significant predictor of preference for the different forms of GI in the study area. This findings also appear to be consistent with evidence showing that key characteristics such as cleanliness and maintenance (Madureira et al., 2018), high greenery quantity (Samimi and Shahhosseini, 2020), variety and care of plants(Conedera et al., 2015), provision of facilities for people with disabilities in UGI sites (Karanikola et al., 2016), tree density and understory vegetation density (Suppakittpaisarn et al., 2018) all of which contribute to the quality of UGI are vital aspects that can influence individual preferences for UGI. In sum, the current study has shown that there are similarities and differences in the findings on this subject in Lagos Metropolis, Nigeria, and previous studies in other contexts as originally assumed in this research.

6. Conclusion and study implications

This study investigated residents' preferences for the different forms of UGI and the factors that influenced these in Lagos Metropolis, Nigeria. From the findings, the following conclusions and implications were arrived at. First, the study indicates that a greater proportion of the

population sampled in the four local government areas of Lagos Metropolis preferred UGI with green features than the other three forms of green infrastructure investigated. This means that the residents considered this form of GI as making more contributions in enhancing their well-being than the other forms investigated. In view of this, it is imperative for those officials and agencies responsible for formulating policies and developing programmes aimed at providing and managing GI to give more attention to improving the quantity and quality of this category of GI in the study area and other cities in sub-Saharan Africa. This will ensure that a majority of the population have unhindered access to the preferred form of UGI in their respective neighbourhoods and benefit maximally from it.

Second, the study also revealed that differences in preferences for the four categories of UGI among the residents who participated in the survey were as a result of their local government areas of residence. This result suggests that there are differences in access, quality and distribution of the different forms of UGI infrastructure in the four local government areas investigated, and that the population in each LGA has peculiar need as regards UGI. It also indicates the existence of different user groups within the population with differences in perceptions and contrasting needs with respect to UGI. The implication of this is that urban planners and managers need to tailor policies and programmes related to the provision and management of GI to the specific choices of the population in the different localities to avoid the waste of scarce resources in the provision of UGI that would not be patronised by a majority of the target population. This will among other benefits promote frequent and longer visits or use of GI sites leading to improved well-being of the urban population in a developing country like Nigeria.

Third, a combination of socio-economic characteristics of the population and attributes of UGI emerged as the determinants of preferences for the different forms of UGI in the study area. This implies that for effective provision and management of GI for the ultimate benefits of urban population in sub-Saharan Africa, policy makers and city planners need to consider the specific needs of the different socio-economic groups within the population, their motivations for visiting GI sites and tendencies to participate voluntarily in activities that promote the development and management of UGI. In addition, this also implies that city planners and managers should give adequate attention to the provision of high quality and well-equipped UGI sites with great potentials to maximise the environmental and health benefits associated with GI within urban environments. Apart from improving the level of patronage of UGI with possible increase in revenue for city authorities, these will further enhance cities' resilience to climate change challenges and their liveability ratings.

Lastly, the current study is not without limitations. For examples, the data used were sourced mainly via the administration of copies of structured questionnaires in four Local Government Areas of Lagos Metropolis, Nigeria. Consequently, the findings are limited to the biases of the participants in the survey, and to the four LGAs sampled. This implies that future study is required, and such study should consider adopting different research design and extending the geographic coverage to other neighbourhoods, LGAs in Lagos and other cities in Nigeria. In addition, the regression model for this study explained around 60.3 % of the variance in preferences for UGI among the population sampled. This means that the remaining 39.7 % of the variance is not accounted for in the current research. Hence, further research is also needed to possibly identify the remaining 39.7 % of the determinants of preference for urban green infrastructure by investigating more variables.

CRediT authorship contribution statement

Adedotun Ayodele Dipeolu: Conceptualization, Data curation, Investigation, Project administration, Writing - original draft, Writing - review & editing. **Eziyi Offia Ibem:** Formal analysis, Methodology, Visualization, Writing - review & editing. **Joseph Akinlabi Fadamiro:** Resources, Supervision, Visualization, Writing - review & editing.

Declaration of Competing Interest

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Acknowledgements

The authors appreciate Lagos State Ministry of Environment for granting the ethical approval (MOE/OES/7250/52) for this study. All participants in the survey are also appreciated for their time and kind contribution to this research.

References

Adegun, B.O., 2017. Developing green infrastructure in a Johannesburg informal settlement: investigating residents' willingness to pay. Procedia Eng. 198, 176–186. https://doi.org/10.1016/j.proeng.2017.07.081.

Adegun, O.B., 2018. Residents' relationship with green infrastructure in Cosmo City. Johannesburg. Journal of Urbanism 11 (3), 329–346.

Adegun, O.B., 2019. Green infrastructure in informal unplanned settlements: the case of Kya Sands, Johannesburg. Int. J. Urban Sustain. Dev. 11 (1), 1–12.

Alaimo, K., Crawford, C., Snyder, E.H., 2016. Harvesting health in the garden. In Hodges.

Basu, K., Bussolo, M., Dailami, M., Timmer, H., 2013. Capital for the future: saving and investment in an interdependent world. Global Development Horizons (GDH) Series. World Bank, 2013, Washington DC http://documents.worldbank.org/curated/en/2013/05/17723744/ global-development-horizons-capital-future-savinginvestment-interdependent-world.

Bonaiuto, M., Fornara, F., Bonnes, M., 2006. Perceived residential environment quality in middle and law extension Italian cities. Rev. Eur. Psychol. Appliquã©e/european Rev. Appl. Psychol. 56, 23–34.

Byrne, J., Wolch, J., Zhang, J., 2009. Planning for environmental justice in an urban national park? J. Environ. Plan. Manag. 52 (3), 365–392.

Conedera, M., Del Biaggio, A., Seeland, K., Morettia, M., Home, R., 2015. Residents' preferences and use of urban and peri-urban green spaces in a Swiss mountainous region of the Southern Alps. Journal of Urban Forestry & Urban Greening 14, 139–147.

Craik, J., Faggi, A., Miguel, S., Vorraber, L., 2015. Why Do People Use Parks and Plazas in Buenos Aires? Retrieved from https://www.thenatureofcities.com/2015/03/09/why-do-people-use-parks-and-plazas-in-buenos-aires/ on April 6, 2020.

Dipeolu, A.A., 2017. Impact of Green Infrastructure on Environmental Sustainability in Selected Neighbourhoods of Lagos Metropolis, Nigeria. PhD Thesis. Department of Architecture, Federal University of Technology, Akure, Nigeria.

Dipeolu, A.A., Ibem, E.O., 2020. Green infrastructure quality and environmental sustainability in residential neighbourhoods in Lagos, Nigeria. Int. J. Urban Sustain. Dev. https://doi.org/10.1080/19463138.2020.1719500.

Dipeolu, A.A., Aluko, O.R., Omoniyi, S.S., Oyinloye, M.A., 2020. Assessment of residents' socio-demographic factors associated with visit to green infrastructure facilities in Lagos Metropolis. Nigeria. International Journal of Built Environment and Sustainability 7 (2), 45–55.

du Toit, M.J., Cilliersa, S.S., Dallimer, M., Goddard, M., Guenat, S., Corneliusa, S.F., 2018. Urban green infrastructure and ecosystem services in sub-saharan Africa. Journal of Landscape and Urban Planning 180, 249–261. https://doi.org/10.1016/j.landurbplan.2018.06.001.

Gashu, K., Gebre-Egziabher, T., Wubneh, M., 2019. Local communities' perceptions and use of urban green infrastructure in two Ethiopian cities: bahir Dar and Hawassa. J. Environ. Plan. Manag. https://doi.org/10.1080/09640568.2019.1578643.

Home, R., Hunziker, M., Bauer, N., 2012. Psychosocial outcomes as motivations for visiting nearby urban green spaces. Leis. Sci. 34 (4), 350–365.

Jiang, Y., Zevenbergen, C., Ma, Y., 2018. Urban Pluvial Flooding and Stormwater management: a contemporary review of China's challenges and "sponge cities" strategy. Environ. Sci. Policy 80, 132–143.

Karanikola, P., Panagopoulos, T., Tampakis, S., Karipidou-Kanari, A., 2016. A perceptual study of users' expectations of urban green infrastructure in Kalamaria, municipality of Greece. Manag. Environ. Qual. Int. J. 27 (5), 568–584. https://doi.org/10.1108/MEQ-12-2014-0176.

Kasim, A.C., Azizan, M.U., Hussin, K., Rahman, M.M., 2016. Urban residents and their preferences of environmental elements. WIT Transactions on Ecology and The Environment 210, 185–194. https://doi.org/10.2495/SDP160161.

Lagos State Bureau of Statistics, 2015. On October 22, 2015. Retrieved from. www.sparc-nigeria.com/RC/files/1.2.5_Lagos_MTSS_Economic_Planning.pdf.

Lindholst, A.C., Konijnendijk van den Bosch, C.C., Kjøller, C.P., Sullivan, S., Kristoffersson, A., Fors, H., Nilsson, K., 2016. Urban green space qualities reframed toward a public value management paradigm: The case of the Nordic Green Space Award. . Urban Forestry and Urban Greening 17, 166–176.

Liu, W., Chen, W., Peng, C., 2015. Influences of setting sizes and combination of green infrastructures on community's storm water runoff reduction. Ecol. Modell. 318, 236–244.

Lo, A.Y.H., Jim, C.Y., 2010. Willingness of residents to pay and motives for conservation of urban green spaces in the compact city of Hong Kong. Urban For. Urban Green. 9, 113–120.

Madureira, H., Nunes, F., Oliveira, J.V., Cormier, L., Madureira, T., 2015. Urban residents' beliefs concerning green space benefits in four cities in France and Portugal. Urban For. Urban Green. 14, 56–64. https://doi.org/10.1016/j.ufug.2014.11.008.

Madureira, H., Nunes, F., Oliveira, J.V., Madureira, T., 2018. Preferences for urban green space characteristics: a comparative study in three portuguese cities. Environments 5, 23–36. https://doi.org/10.3390/environments5020023.

Mensah, C.A., 2014. Urban green spaces in Africa: nature and challenges. Int. J. Ecosyst. 4 (1), 1–11.

Mexia, T., Vieira, J., Príncipe, A., Anjosa, A., Silva, P., Lopes, N., Branquinho, C., 2018. Ecosystem services: urban Parks under a magnifying glass. Journal of Environmental Research 160, 469–478.

Moskell, C., Allred, S.B., 2013. Residents' beliefs about responsibility for the stewardship of park trees and street trees in New York City. Landsc. Urban Plan. 120, 85–95.

Oduwaye, L., 2009. Spatial variations of values of residential land use in Lagos Metropolis. Journal of African Research Review. An International Multi-Disciplinary Journal, Ethiopia 3 (2), 381–403. Retrieved from. http://www.academicjournals.org/JGRP.

Olagunju, T.E., 2015. Impacts of human-induced deforestation, forest degradation and fragmentation on food security. Journal of New York Science 8 (1), 23–34.

Oluwafeyikemi, A., Julie, G., 2015. Evaluating the impact of vertical greening systems on thermal comfort in low income residences in Lagos. Nigeria. Procedia Engineering 118, 420–433.

Pakzada, P., Osmonda, P., 2016. Developing a sustainability indicator set for measuring green infrastructure performance. Procedia - Social and Behavioural Sciences 216 (68), -79.

Pennino, M.J., McDonald, R.I., Jaffe, P.R., 2016. Watershed-scale impacts of stormwater green infrastructure on hydrology, nutrient fluxes, and combined sewer overflows in the Mid-Atlantic Region. Sci. Total Environ. 565, 1044–1053. https://doi.org/10.1016/j.scitotenv.2016.05.101.

Pugh, T.A., MacKenzie, A.R., Whyatt, J.D., Hewitt, C.N., 2012. Effectiveness of Green Infrastructure for improvement of air quality in urban street canyons. Int. J. Environ. Sci. Technol. (Tehran) 46 (14), 7692–7699.

Roy, S., Byrne, J., Pickering, C., 2012. A systematic quantitative review of urban tree benefits, costs, and assessment methods across cities in different climatic zones. Journal of Urban Forestry and Urban Greening 4 (11), 351–363. https://doi.org/10.1016/j.ufug.2012.06.006.

Roy, M.M., Shemdoe, R., Hulme, D., Mwageni, N., Gough, A., 2018. Climate change and declining levels of green structures: life in informal settlements of dares salaam. Tanzania. Landscape and Urban Planning 180, 282–293.

Saleh, F., Weinstein, M.P., 2016. The role of nature-based infrastructure (NBI) in coastal resiliency planning: a literature review. J. Environ. Manage. 183, 1088–1098. https://doi.org/10.1016/j.jenvman.2016.09.077.

Salisu, A., 2015. Perceptions and contributions of households towards sustainable urban green infrastructure in Malaysia. Habitat Int. 47, 285–297.

Samimi, P.M., Shahhosseini, H., 2020. Evaluation of resident's indoor green space preferences in residential complexes based on plants' characteristics. Indoor Built Environ. https://doi.org/10.1177/1420326X20917436.

Shackleton, C.M., Blair, A., De Lacy, P., Kaoma, H., Mugwagwa, N., Walton, M.T.D., 2017. How important is green infrastructure in small and medium-sized towns? Lessons from South Africa. Landsc. Urban Plan. 180, 273–281.

Shan, X.Z., 2014. Socio-demographic variation in motives for visiting urban green spaces in a large chinese city. Habitat Int. 41, 114–120.

Shrestha, S.L., 2009. Categorical regression models with optimal scaling for predicting indoor air pollution concentrations inside kitchens in Nepalese Households. Nepal J. Sci. Technol. 10, 205–211.

Suppakittpaisarn, P., Jiang, B., Slavenas, M., Sullivand, W.C., 2018. Does density of green infrastructure predict preference? Urban For. Urban Green. https://doi.org/10.1016/j.ufug.2018.02.007.

Tavakol-Davani, H., Burian, S.J., Devkota, J., Apul, D., 2015. Performance and cost-based comparison of green and gray infrastructure to control combined sewer overflows. J. Sustain. Water Built Environ. 2 (2), 19–27.

Turner, A.G., 2003. Sampling strategies- Expert Group meeting to review the draft handbook on designing of household sample surveys. Secretariat, Statistics Division. ESA/STAT/AC.93/2.

UN-HABITAT, 2014. The State of African Cities 2014: Re-Imagining Sustainable Urban Transitions. UN-Habitat., Nairobi.

Wan, C., Shen, G.Q., 2015. Salient attributes of urban green spaces in high density cities: the case of Hong Kong. Habitat Int. 49, 92–99.

Wolch, J.R., Byrne, J., Newell, J.P., 2014. Urban green space, public health, and environmental justice: the challenge of making cities 'just green enough.'. Journal Landscape and Urban Planning 125, 234–244. https://doi.org/10.1016/j.landurbplan.2014.01.017.

Young, R.F., McPherson, E.G., 2013. Governing metropolitan green infrastructure in the United States. Landsc. Urban Plan. 109 (1), 67–75.

YU, Y., Xu, H., Wang, X., Wen, J., Du, S., Zhang, M., Ke, Q., 2019. Residents' willingness to participate in green infrastructure: spatial differences and influence factors in Shanghai. China. Sustainability 11, 5396. https://doi.org/10.3390/su11195396.

Zuniga-Teran, A.A., Staddon, C., de Vito, L., Gerlak, A.K., Ward, S., Schoeman, Y., Hart, A., Booth, G., 2020. Challenges of mainstreaming green infrastructure in built environment professions. J. Environ. Plan. Manag. 63 (4), 710–732.