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Public Perception of Urban Green Infrastructure Quality in Towns from Southeast Nigeria

Ifeanyi N. CHUKWU[1], **Osita E. UZONNAH**[1], **Eziyi O. IBEM***[2], **Francis O. UZUEGBUNAM**[2]

** Corresponding author*

[1] *Alex Ekwueme Federal University, Department of Architecture, Ndufu-Alike, Ikwo, Ebonyi State, NIGERIA*

[2] *University of Nigeria, Department of Architecture, Enugu Campus, Enugu State, NIGERIA*

chukwu.ifeanyi@funai.edu.ng https://orcid.org/0000-0002-7103-0464

uzonnah.ernest@funai.edu.ng https://orcid.org/0000-0001-7619-3409

eziyi.ibem@unn.edu.ng https://orcid.org/0000-0002-7214-6338

francis.uzuegbunam@unn.edu.ng https://orcid.org/0000-0002-8732-1418

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ABSTRACT

The extent to which green infrastructure contributes to the sustainability of the urban ecosystem is determined by several factors, including its availability in quantity and quality. However, in many urban areas in Nigeria, very little research has been done to deepen understanding of the quality of green infrastructure and its determinants. This research investigated the public perception of urban green infrastructure (UGI) quality and the factors that influenced this in four major towns in Ebonyi State, Southeast Nigeria. A survey of 513 participants was conducted with the data analysed using descriptive and categorical regression analyses, Mann-Whitney U, and Kruskal-Wallis H Tests. The results revealed that many of the participants have regular contact with UGI mainly for enjoying nature and fresh air, and preferred trees and water features. It was also observed that 66% of the respondents felt that the quality of green infrastructure in their locations was generally good but relatively higher where they work or do business than where they live. Differences in perception of UGI quality were due to their level of education, town of location, and type of neighbourhood environment. The regression analysis revealed that the respondents' level of education, age, and marital status had the most significant influence on their perception of UGI quality. This study implies that for a better understanding of the public perception of UGI quality and effective planning and provision of UGI the factors identified in this research should be given adequate consideration by urban planners and managers.

1. INTRODUCTION

As the rate of urbanization and its concomitant effects accelerate globally, architects and urban planners are turning to the planning and management of green infrastructure as a strategy for promoting sustainable urban development. Green infrastructure (GI) refers to any vegetative element or system or interconnected network of green spaces and water bodies strategically planned, provided, and managed to deliver multiple ecosystem services and socio-economic values and benefits in human settlements (World Green Infrastructure Network, 2021). In towns and cities, GI manifests as urban green infrastructure (UGI) and includes all kinds of natural, semi-natural, and man-made green spaces and facilities integrated into the planning of layouts, services, and buildings and their surroundings towards achieving a cleaner and healthier built environment and well-being of people (Tzoulas et al., 2007; Jiang et al., 2018; Dipeolu and Ibem, 2020)

and improving the resilience of the urban ecosystem to adverse effects of climate change (Idiata, 2016; Cole et al., 2017). A survey of the literature revealed that green infrastructure can be categorised into four main groups. These are 1) grasses and shrubs found in lawns (Jiang et al., 2018; Adegun, 2019; Forest Research, 2010), green roofs, green walls or green facades (Oluwafeyikemi and Julie, 2015; Hewitt et al., 2020), retaining walls (United State Environmental Protection Agency (USEPA), 2017), gardens cultivated with ornamental plants and planter boxes (Potchter et al., 2006); 2) trees in urban forests (Obi et al., 2021) and farms (Shukur et al., 2016; USEPA, 2017) on the streets and woodlands (Forest Research, 2010; Wood and Esaian, 2020); 3) water bodies (i.e. blue infrastructure) found in natural wetlands, swamps, lakes, canals, floodplains/riparian corridors, rivers, streams/brooks, and human-made water features such as fountains, pools, and rainwater harvesters (USEPA, 2017; Adegun, 2019); and 4) others, such as sports fields (Herman and Drozda, 2021), schoolyards, wildlife parks (Hunold, 2019), cemeteries (Rae, 2021) and allotments (Adegun et al., 2021; Dymek et al., 2021).

Previous studies have shown that GI is a vital component of the urban environment (Amati and Taylor, 2010; Jiang et al., 2018; Adegun, 2019) due to its multifunctional benefits (USEPA, 2017; Shakya and Ahiablames, 2021; Adegun et al., 2021). These benefits include the improvement of urban image (Wicki et al., 2021), protection or restoration of wildlife habitats (Shukur et al., 2016; Kumar et al., 2019), provision of recreation and relaxation facilities (Zhang et al., 2013) beautification of the environment (Shackleton et al., 2017; Adegun, 2021; Nordh and Olafsson, 2021), improvement of the community (Alaimo et al., 2016; Chiabai et al., 2018) and ecosystem health (Madureira et al., 2018) and people's quality of life (Myers and Hansen, 2020), the reduction in energy consumption in buildings (Oluwafeyikemi and Julie, 2015) and stormwater runoffs (Jiang et al., 2018; Adegun, 2019). In addition, UGI contributes to food security (Obi et al., 2021) and helps reducing urban heat islands (Potchter et al., 2006; Idiata, 2016) and air (Hewitt et al., 2020) and water pollution (Van Seters et al., 2009). However, the extent to which GI plays these vital roles in the urban ecosystem depends on several factors among which the availability in the right quantity (Henderson-Wilson et al., 2017; Lapointe et al., 2020) and quality (Kambites and Owen, 2006; Dipeolu and Ibem, 2020) as well as the frequency and duration of human contact with it (Hartig et al., 2003).

Regarding the quality of GI, Jerome et al. (2019) have argued that understanding the quality of green infrastructure is quite vital in ensuring that it contributes to the well-being of humans and the urban ecosystem. A review of the literature revealed that generally, GI quality is a function of its characteristics (Jerome et al., 2019) or physical attributes (Dennis et al., 2018) and its conditions in any location (Dennis et al., 2020). Hence, the evaluation of GI quality must take cognisance of the characteristics of its constituent elements and public perception of these characteristics (Brkanić, 2019; Dipeolu and Ibem, 2020). Research has shown that several parameters can be used to assess the quality of GI. These include ease of access and closeness of UGI to people's homes, and the opportunity it provides for people to experience nature (O'Neil and Gallagher, 2014), the social (Shakya and Ahiablames, 2021) and economic benefits of UGI (Jerome et al., 2019) and the various ecosystem services UGI offers such as the purification of air, urban temperature regulation (Potchter et al., 2006; Idiata, 2016), stormwater management (USEPA, 2017; Jiang et al., 2018) and environmental beautification (Adegun et al., 2021). It has also been argued that since people's preference for products and services is a function of due to quality of such products and services (Zia and Sohail, 2016), some preference-related parameters such as the reasons why people have contact with or use UGI (Jackson, 2002; Dennis et al., 2020), design and level of equipment and facilities provided in green spaces (Dipeolu and Ibem, 2020), the attractiveness of GI elements (USEPA, 2017; Dipeolu and Ibem, 2020) and accessibility to green areas by the public (Dennis et al., 2020), level of cleanliness (Madureira et al., 2018) and maintenance of GI sites (Dipeolu and Ibem, 2020), vegetation health or tree density (Suppakittpaisarn et al., 2018), the type of flowers and foliage, and size of plant leaves (Samimi and Shahhosseini, 2020), size and adequacy of green space, and presence of gardens or parks for social interactions, leisure and recreational activities (Dipeolu and Ibem, 2020), can also be used to evaluate the quality of UGI.

Further, research has also shown that in the case of subjective assessment of the quality of the physical environment, the socio-demographics of the assessors such as gender, age, education, marital status, and others are very important and can influence the outcome of the evaluation process (Gashu et al., 2019; Brkanić, 2019). Hence, these socio-demographic variables are also considered as some of the factors that can influence how the public perceives UGI quality in the current research. The foregoing implies that the quality of UGI can be assessed by direct physical observations or measurements of its attributes (i.e. objective assessment) and by the public perception on these attributes (i.e. subjective assessment) (Gashu et al., 2019). However, several authors have underscored the benefits of using human perception in GI research (Nastran et al., 2022) as they help capturing human experience and interactions with GI (Dipeolu and Ibem, 2020) and how they feel about the physical characteristics of the different forms of GI (Gashu et al., 2019), and their attitudes towards it (Haq et al., 2021).

The review by Parker and de Baro (2019) shows that green infrastructure research was still

evolving in most parts of the world with very few studies coming from countries in Asia, South America, and Africa. This seems to resonate with the assertion by du Toit et al. (2018), that empirical research on UGI from the African continent is grossly under-represented in the international literature. However, in Sub-Saharan Africa, GI research has thus far focused on issues such as the barriers to its provision (Mensah, 2014), its aesthetic value (Shackleton et al., 2017), perception and use (Gashu et al., 2019), and the peoples' willingness to pay for it (Adegun, 2018).

In Nigeria, previous authors have examined the role of UGI in promoting thermal comfort in residential buildings (Oluwafeyikemi and Julie, 2015), UGI quality in residential neighbourhoods (Dipeolu and Ibem, 2020), residents' preferred forms of UGI in Lagos (Dipeolu et al., 2021b), its integration strategies and values in domestic gardens, green walls and roofs, public parks, urban trees (Adegun et al., 2021) and forests (Obi et al., 2021). Notably, apart from the study by Dipeolu and Ibem (2020), much is not known about how the public perceives the quality of UGI and the factors that influenced this in towns and cities in Southeast Nigeria due to the lack of adequate research. This might have contributed to the poor conception, planning, and implementation of urban infrastructure programmes in Nigeria, as reported by Oladipo et al. (2020).

Against this background, this study aimed at investigating how the public perceives the quality of green infrastructure and the factors that influenced this in four major towns in Southeast Nigeria using Ebonyi State as a case study. The study sought to achieve three basic research objectives, which are:

a) to understand how the public perceives the quality of green infrastructure in four towns of Abakiliki, Afikpo, Ikwo, and Uburu in Ebonyi State, Southeast Nigeria;

b) to investigate whether there are variations in the perception of quality of urban green infrastructure among the different groups of survey participants in the study area;

3) to determine the specific factors with the most significant influence on how the survey participants perceived the quality of urban green infrastructure in the four towns selected for this study.

A study of this nature is important for a deeper insight into how to enhance the quality of UGI. Hence, this research is considered valuable in providing fresh insight into how the public perceives the quality of green infrastructure and the factors that influenced this in small and medium-sized towns in Southeast Nigeria. The findings are expected to inform stakeholders in urban planning, management, and policy formulation on aspects that require more attention for effective planning and provision of quality green infrastructure and maximisation of the benefits of UGI in the study area and beyond.

2. METHODOLOGY

2.1. Study area and research design

Ebonyi is one of the five States in Southeast Nigeria covering an area of 5,530 km², with an estimated human population of 4,339,136 individuals, and a population density of 444.0 people/km². It is one of Nigeria's major producers of rice and root crops such as yam and cassava (Ebonyi State Ministry of Agriculture and Natural Resources, 2021). The four major towns of the state purposively selected for this research are Abakiliki, Afikpo, Ikwo, and Uburu (Fig. 1).

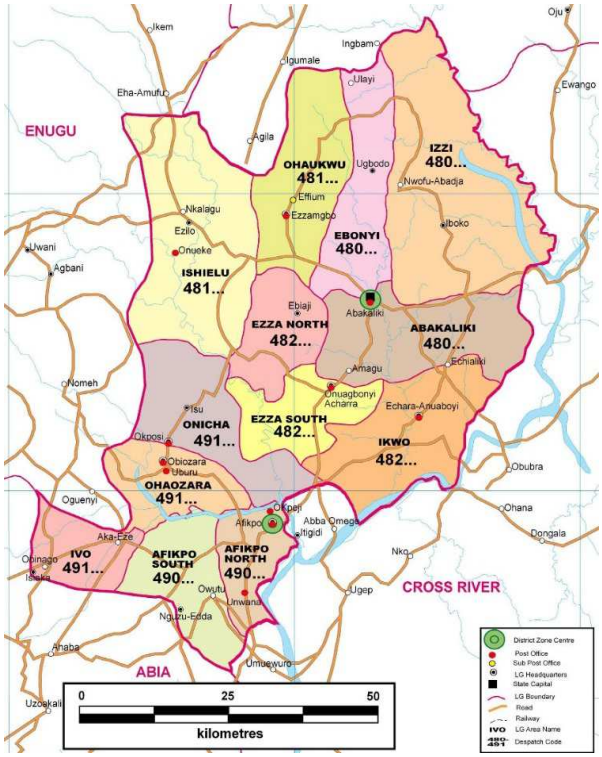

Fig. 1. Map of Ebonyi State showing the towns of Abakiliki (480), Ikwo (482), Afikpo (490) and Uburu (491).

Although current accurate population figures for each of these towns are not available, the 2006 national population census in Nigeria revealed that Abakaliki, which is the administrative headquarters of the State, with a land area of 439.6 km², had a population of 149,683 inhabitants, but currently it is estimated to have a population of 632,000 persons (United Nations, 2022). Afikpo, which is part of the Afikpo North Local Government area, with a land area of 164 km², had a population of 156,649 inhabitants, Ikwo with a land area of 577.6 km² had 214,969 inhabitants, while the population number for Uburu - the largest town in Ohaozara local government area, with an area of 312 km² - was part of the 148,317 persons recorded for this local government area (The Federal Republic of Nigeria, 2009). In Nigeria, the basic classifications of GI are green areas (grasses, shrubs, flowers), trees, water elements, and others (see Dipeolu and Ibem, 2020; Adegun et al., 2021) and the Town

Planning Laws of 1992 provide the legal framework for the planning and management of GI in public and private spaces in this country (Alabi, 2009).

The study adopted a cross-sectional survey research design due to the nature of the three objectives and the advantage of collecting data from geographically dispersed populations within a relatively short period. The research population comprised all adult residents, workers, students, and business people in the aforementioned four towns purposively selected for the study. Given that the exact adult population number in Ebonyi State and the four selected towns is not available, the sample size for this survey was estimated using Cochran's (1963) formula shown in equation 1.

Minimum sample size,

$$n_o = \frac{z^2 pq}{e^2} \quad (1)$$

where:

- n_o is the lowest or acceptable sample size;
- '*z*' presents the value (i.e.1.96) for a confidence level of 95%;
- p is equal to 0.5;
- q is 1-p while, and e represents the level of precision in the statistical estimation. Substituting these parameters in equation 1, the least acceptable sample size was of 385 adult respondents.

2.2. Data collection instrument

The data-gathering instrument used was a structured questionnaire designed by the researchers based on variables identified from the literature review. The questionnaire used in the larger research was divided into seven sections A to G (see Appendix). However, in line with the stated objectives of this paper, only the data gathered using Sections A, C, and G of the questionnaire are presented in this article.

Section 'A' consisted of questions on the socio-demographics of the respondents, their preferred forms of UGI, frequency of contact with GI, and the purposes of using UGI space in the towns. Both nominal and interval scales of measurement were used in framing the questions.

Section 'C' included questions on the respondents' quality ratings of urban green infrastructure and key ecosystem services it provides in their neighbourhoods using an ordinal scale.

In total, 14 variables were used to investigate the quality of UGI with the respondents asked to rate each of these based on a 5-point Likert type scale of 1, 2, 3, 4, and 5 for Very Poor, Poor, Fair, Good, and Very Good, respectively, while Section 'G' featured questions on the important roles of GI in the provision of four vital ecosystem services namely, environmental beautification, reduction of stormwater runoff, purification of air and urban temperature regulation. They were investigated using the 5-point Likert type scale ranging from 1 ('Not Important') to 5 ('Very Important'). Before the main survey, the questionnaire was pre-tested in Abakiliki and Ikwo. This availed the researchers of the opportunity to investigate the reliability of the instrument. The data from pre-testing of the questionnaire were subjected to Cronbach's Alpha test and the result produced a Cronbach's Alpha value of 0.92 for the 14 items used to investigate UGI quality in this research.

2.3. Data collection and analysis

The survey was conducted between May and October 2021 in the study area. Samples were taken from different neighbourhoods in the four selected towns with 560 copies of the questionnaire administered to adult participants only. A simple random sampling technique was used in selecting the participants with a copy of the questionnaire given to each person by hand. However, only 520 copies of the distributed copies of the questionnaire were retrieved from the participants, representing a 92.9% response rate. Of the 520 copies of the questionnaire retrieved, seven were not correctly filled out and were considered invalid.

The IBM Statistical Package for Social Sciences (SPSS) was used for data processing and analysis. For the research objective 1, data were analysed using descriptive analysis involving the use of frequencies, percentages, mean item score, and standard deviation to describe and categorise the data obtained. The data for objective 2 were analysed using the Mann-Whitney U and Kruskal-Wallis H Tests of variance. In these tests, the dependent variable was the overall UGI quality rating, and the independent variables were the respondents' socio-demographic variables (including gender age, highest educational qualification, marital and employment status), the type of urban environments in which the respondents were found during the survey, the number of years the respondents had lived/ worked/carried out business activities at the location, and the town of location. The choice of descriptive analysis and Mann-Whitney U and Kruskal-Wallis H Tests of variance for the analysis of the data for objectives 1 and 2 was informed by the non-parametric nature of the data as recommended by Pallant (2011), and evidence in the literature showing that previous similar studies have also used them (see Dipeolu et al., 2021a; Dipeolu et al., 2021b).

Similarly, given that the data for the last research objective are both nominal and ordinal, categorical regression (CATREG) analysis was used in analysing them. Again, the choice of this particular analysis over the traditional linear regression analysis was because of the optimal scaling option in the former, which enables it to effectively transform and standardize non-numerical data such as nominal and

ordinal data into numerical data before the estimation, to produce only standardized coefficient estimates, as explained by Shrestha (2009). Moreover, similar previous research has also adopted this (see Dipeolu et al., 2021a; Dipeolu et al., 2021b). In this analysis 'the participants' rating of the overall quantity of GI was the criterion (dependent) variable, while their town of location, gender, age, marital and employment status, level of educational attainment, length of stay in the neighbourhood, type of neighbourhood environment in the towns, frequency of contact with GI, the purpose for using UGI spaces, their preferred forms of GI, rating of the importance of UGI in beautifying the environment, purifying the air, regulating urban temperature and reducing storm water runoffs were the independent variables. The results are presented using tables, text, and charts.

3. RESULTS

3.1. Survey participants' preferred UGI, frequency of contact with UGI, and rating of ecosystem services UGI provides

A summary of the personal profiles of the survey participants shows that most of them are males between the ages of 21 years and 30 years and were not yet married but highly educated, employed, found in the school environment, and have stayed, within the location for at least one year (Table 1).

Table 1. Survey participants' social demographics and preferred forms of UGI.

Variables	The preferred form of green infrastructure											
	Grass and shrubs		Tree features		Blue infrastruc-ture		Others		None		Total	
	no	%	no	%	no	%	no	%	no	%	no	%
Location												
Ikwo	41	13.0	48	9.4	53	10.3	18	3.5	25	4.9	185	36.1
Afikpo	38	7.4	60	11.7	39	7.6	8	1.6	36	7.0	181	35.3
Abakaliki	38	7.4	50	9.7	33	6.4	10	1.9	0	0.0	131	25.3
Uburu	3	0.6	5	1.0	8	1.6	0	0.0	0	0.0	16	3.1
Gender												
Male	75	14.6	107	22.8	91	17.7	30	5.8	23	4.5	326	63.5
Female	40	7.8	65	12.7	47	9.2	14	2.7	21	4.1	187	36.5
Marital status												
Never married before	95	18.5	120	23.4	103	22.0	25	4.9	28	5.5	371	72.3
In marriage relationship	19	3.7	46	9.0	25	4.9	13	2.5	11	2.1	114	22.2
Lost spouse through death	1	0.2	2	0.4	6	1.2	3	0.6	4	0.8	16	3.1
Separated from spouse	3	0.6	1	0.2	2	0.4	1	0.2	0	0.0	7	1.4
No response	1	0.2	3	0.6	2	0.4	2	0.4	1	0.2	5	1.0
Age groupings												
21-30years	93	18.1	120	23.4	108	21.0	30	5.8	28	5.5	379	73.9
31-40years	19	3.7	42	8.2	16	3.1	7	1.4	6	1.2	90	17.5
41-50years	1	0.2	7	1.4	6	1.2	1	0.2	6	1.2	21	4.1
51-60years	1	0.2	1	0.2	3	0.6	2	0.4	3	0.6	10	1.9
61years+	0	0.0	0	0.0	3	0.6	2	0.4	0	0.0	5	1.0
No response	1	0.2	2	0.4	2	0.4	2	0.4	1	0.2	8	1.6
Highest level of educational attainment												
Never went to school	4	0.8	4	0.8	7	1.4	5	1.0	2	0.4	22	4.3
Primary education	4	0.8	1	0.2	1	0.2	0	0.0	0	0.0	6	1.2
Post-primary education	45	8.8	75	14.6	59	11.5	14	2.7	20	3.9	213	41.5
Post-secondary education	62	12.1	91	17.7	67	13.1	25	4.9	21	4.1	266	51.9
No response	0	0.0	1	0.2	4	0.8	0	0.0	1	0.2	6	1.2
Employment status												
Not employed	47	9.2	55	10.7	52	10.1	13	2.5	19	3.7	186	36.3
Work for myself	45	8.8	82	16.0	63	12.3	16	3.1	17	3.3	223	43.5
Employed by a private organization	13	2.5	19	3.7	11	2.1	8	1.6	5	1.0	56	10.9
Employed by a government agency	6	1.2	15	2.9	11	2.1	6	1.2	3	0.6	41	8.0
No response	4	0.8	1	0.2	1	0.2	1	0.2	0	0.0	7	1.4
Type of neighbourhood environment												
School	56	10.9	71	13.8	68	13.3	18	3.5	13	2.5	226	43.8
Work/business	21	4.1	46	9.0	37	7.2	11	2.2	9	1.8	124	24.0
Residential	38	7.4	53	10.3	33	6.4	13	2.5	22	4.3	159	31.0
No response	0	0.0	2	0.4	0	0.0	2	0.4	0	0.0	4	0.8
Years of working/living/doing business in the location												
Not up to 1 year	42	8.2	33	6.4	33	6.4	6	1.2	12	2.3	126	24.6
Between 1 year and 5 years	43	8.4	67	13.1	57	11.1	21	4.1	11	2.1	199	38.8
Between 6 years and10 years	10	1.9	43	8.4	22	4.3	11	2.1	7	1.4	93	18.1
Between11years and15 years	2	0.4	4	0.8	6	1.2	0	0.0	3	0.6	15	2.9
More than 15 years	6	1.2	10	1.9	11	2.1	4	0.8	7	1.4	38	7.4
No response	12	2.3	15	2.9	9	1.8	2	0.4	4	0.8	42	8.2

The results also show that around 33.5% of the survey participants preferred UGI with tree features, 26.9% preferred blue infrastructure, and 22.4% preferred grass and shrubs, while 8.6% preferred other

forms of UGI and 8.6% claimed that they preferred none of the UGI. This means that the highest share of the participants preferred tree features.

Furthermore, the results also revealed that most of the survey participants (73.7%, 68.6%, 64.0%, and 62.5%) indicated that UGI is important for environmental beautification, reduction of stormwater runoff, urban air purification, and reduction of air temperature, respectively (Table 2).

Table 2. Survey participants' rating of the importance of UGI in ecosystem services provision.

Rating of some vital ecosystem services provided by UGI	Not important		Slightly important		Moderately		Important		Very important		Total	
	no	%	no	%	no	%	no	%	no	%	no	%
Beautification of the environment	32	6.2	42	8.2	61	11.9	100	19.5	278	54.2	513	100
Reduction of stormwater runoff	9	1.8	45	8.8	107	20.9	180	35.1	172	33.5	513	100
Purification of air	13	2.5	41	8.0	87	17.0	143	17.9	229	44.6	513	100
Regulation of urban temperature	28	5.5	40	7.8	117	22.8	183	35.7	145	28.3	513	100

Regarding their frequency of contact with UGI, the results revealed that the highest share of respondents (42.3%) indicated that they sometimes have contact with UGI, followed by 23.6% who said they rarely have contact, 15.8% often have contact, 12.3% always have contact, while 6% of them declared they never had contact with green infrastructure in the locations.

Similarly, the highest proportion of individuals (37.4%) said they use GI spaces to enjoy nature and fresh air, 20.7% of them use these spaces for relaxation and walking and 17.5% for recreation/ sporting activities, while others use GI spaces for various other activities (Fig. 2).

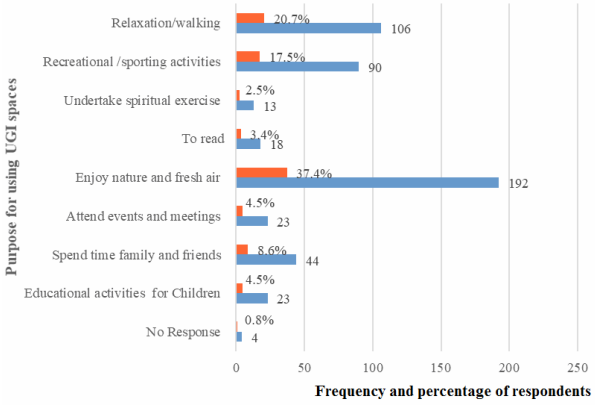

Fig 2. The purpose of using urban infrastructure spaces.

These results show that many of the participants preferred tree features, have contact with GI infrastructure, and used GI spaces in their respective locations mainly to enjoy nature, fresh air, relaxation, and walking.

3.2. Respondents' perception of UGI quality

Results of the descriptive analysis of the participant's perception of the UGI quality in their neighbourhoods show that 28.3% perceived the UGI quality to be good, followed by 27.1% who rated it to be fair and 22.2% who indicated that the quality was poor (Fig. 3).

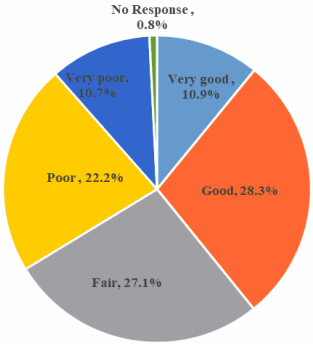

Fig. 3. Respondents' rating of the overall quality of UGI in the study area.

This result suggests that around 39% of the respondents rated the UGI quality to be more than fair, while 32% said the quality was not good at all. It can be inferred that most of the respondents perceived the quality of GI in the four towns to be good and acceptable. The highest percentage (42.7%, 41.8%, 41.6%) of the participants also rated the *safety of green infrastructure location; flowers of shrubs and trees*; *water features in all seasons of the year*, respectively to be good (Table 3). However, the lowest share of respondents (31.2%) rated the quality of *green parks where children can play freely* to be more than fair.

Table 3. Descriptive analysis of the quality of green infrastructure.

Green infrastructure	Very poor		Poor		Fair		Good		Excellent		No response		Mean item score	Std. dev.
	no	%	no	%	no	%	no	%	no	%	no	%		
Safety of where green infrastructure	48	9.4	108	21.1	131	25.5	134	26.1	85	16.6	7	1.4	3.20	1.22
The greenness of the leaves of plants, shrubs and tree	61	11.9	83	16.2	144	28.1	146	28.5	68	13.3	11	2.1	3.15	1.21
Types of flowers of shrubs and trees	66	12.9	94	18.3	129	25.1	144	28.1	69	13.5	11	2.1	3.11	1.24

The healthiness of urban street trees	63	12.3	112	21.8	145	28.3	127	24.8	65	12.7	1	0.2	3.04	1.23
The attractiveness of water features in all seasons of the year	60	11.7	118	23.0	138	26.9	113	22.0	73	14.2	11	2.1	3.04	1.21
Quality of water features	69	13.5	113	22.0	111	21.6	136	26.5	66	12.9	18	3.5	3.03	1.26
The greenness of ported plants in my house/office/business premises	79	15.4	103	20.1	127	24.8	132	25.7	70	13.6	2	0.4	3.02	1.28
State of green areas in all seasons of the year	53	10.3	130	25.3	158	30.8	116	22.6	52	10.1	4	0.8	2.98	1.15
Accessibility of green infrastructure to most people	65	12.7	132	25.7	118	23.0	136	26.5	55	10.7	7	1.4	2.97	1.22
Cleanliness of green spaces	82	16.0	108	21.1	140	27.3	130	25.3	51	9.9	2	0.4	2.92	1.23
Level of equipment of green spaces and parks	72	14.0	126	24.6	145	28.3	116	22.6	47	9.2	7	1.4	2.88	1.19
Maintenance of green infrastructure	90	17.5	134	26.1	94	18.3	131	25.5	59	11.5	5	1.0	2.87	1.30
Green parks for relaxation, recreation, and social interactions	92	17.9	138	26.9	117	22.8	9 2	17.9	71	13.8	3	0.6	2.83	1.31
Green parks where children can play freely	109	21.2	126	24.6	111	21.6	92	17.9	68	13.3	7	1.4	2.77	1.34

Furthermore, the results also show that, based on the mean item score of the 14 items used in the UGI quality assessment, items with mean scores ranging from 3.02 to 3.20 and the first seven items, representing 50% of items investigated, were rated to be of good quality, while the remaining seven (50%) with mean item scores of between 2.77 and 2.97 were rated as having poor quality (Table 3). This means that the *safety of green infrastructure locations* with a mean score of 3.20 was ranked the best quality of UGI in these urban areas, followed by *foliage (leaves) of plants, shrubs, and trees* with a mean score of 3.15, *flowers of shrubs and trees* (3.11) and *water features in all seasons of the year* (3.04), respectively. The aspect with the least quality was *green parks where children can play freely* with a mean score of 2.77 (Table 3).

3.3. Factors responsible for the differences in perception of UGI quality

The results of the Mann-Whitney U test for the differences in GI quality assessment among males and females in the survey showed U = 29438.00, W = 46829.00, Z = -0.33, and p = 0.74; meaning that the differences in UGI quality assessment between males and females respondents are not statistically significant. The Kruskal-Wallis H Tests however revealed that the respondents' highest level of educational qualification (X^2 = 11.793 df = 4 and p = 0.019), location of the respondents (X^2 = 10.862 df = 4 and p = 0.028), and type of environment/neighbourhood (X^2 = 14.076 df =4 and p = 0.007) are all significant and all the other four variables included in the analysis came up with p>0.05, meaning that they are not statistically significant (Table 4).

Table 4. Kruskal-Wallis H Test of significance in variations of UGI quality ratings.

Variables	Kruskal Wallis Test		
	X^2	*df*	*p*
Age groupings	4.356	4	0.360
Marital status	7.130	4	0.129
Level of education	11.793	4	0.019*
Employment status	8.954	4	0.062
Location (town)	10.862	4	0.028*
Length of living/working/doing business in the location	3.354	4	0.500
Type of environment of the respondents	14.076	4	0.007*

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

These results show that differences in the participants' perception of GI quality are due to their level of education, the location (town), and the type of urban environment rather than their gender, marital status, employment status, and how long they have stayed in the locations. Further, it was also observed that the highest proportion (47.03%) of the participants who indicated that the quality of UGI in their area was

good were in Ikwo, 38.12% in Afikpo, and 30.53% in Abakiliki, and the lowest in Uburu. Similarly, the highest share of those who perceived the quality of UG to be good had post-secondary education (38.35%), about 37.10% had post-primary and the least had primary education as their highest level of educational attainment. Therefore, comparatively, the respondents felt that Ikwo and the work environment had the highest quality of the UGI, while Uburu and residential environments had the lowest UGI quality and that the higher the educational attainment of the participants, the higher quality rating.

3.4. Factors that influenced respondents' perception of UGI quality

Results of the regression analysis produced F (136.084, 376.916) = 2.826, $p < 0.000$, and R^2 of 0.665, suggesting that the regression model explained around 67% of the variance in the participants' perception of UGI quality in the survey. Regression coefficients of the predictors of UGI quality also revealed that out of the 15 variables investigated 13 items with a p-value less than 0.05 ($p<0.05$) are the significant predictors of UGI quality in the survey. These include respondents' age (p = 0.001); marital status (p = 0.001), level of education (p = 0.000), employment status (p = 0.014), length of stay in the locations (p = 0.008), frequency of contact with UGI (p = 0.000), purpose for using GI spaces (p = 0.000), the type of neighbourhood environment (p = 0.000); the preferred forms of GI (p = 0.029) and the location (town) (p = 0.000). Others are the extent of agreement on the role of GI in environmental beautification (p = 0.036), reduction of stormwater runoff, and regulation of urban temperature (p = 0.000) (Table 5).

Table 5. Regression coefficients of the predictors of UGI quality.

Predictors of UGI quality	Coefficients				
	Standardized coefficients				
	Beta	Bootstrap (1000) Estimate of Std. Error	df	F	Sig.
Gender	0.015	0.034	1	0.193	0.661
Age groupings	0.182	0.081	4	5.066	0.001*
Marital status	0.177	0.083	4	4.606	0.001*
Level of education	0.270	0.091	3	8.858	0.000*
Employment status	0.090	0.048	3	3.594	0.014*
Length of stay in the location	0.071	0.038	4	3.514	0.008*
Frequency of contact with GI	0.154	0.066	4	5.472	0.000*
Purpose of using GI spaces	0.153	0.047	8	10.595	0.000*
Location (town)	0.132	0.053	3	6.321	0.000*
Type of neighbourhood environment	0.180	0.060	4	8.816	0.000*
Preferred form of green infrastructure	0.073	0.044	4	2.717	0.029*
Beautification of the urban environment	0.083	0.052	4	2.601	0.036*
Reduction of stormwater runoff	0.173	0.056	4	9.621	0.000*
Purification of air	0.073	0.053	4	1.884	0.112
Regulation of urban temperature	0.124	0.047	4	7.012	0.000*
Dependent variable: quality of green infrastructure at your location					

**Statistically significant ($p < 0.05$).*

The beta (β) coefficients also show that, in the order of ranking, participants' level of education having the highest value of β-coefficient of 0.270 has the highest influence on their UGI quality assessment, followed by their age (β = 0.182), type of neighbourhood environment (β = 0.180), marital status (β = 0.177), the role of GI in the reduction of stormwater runoffs (β = 0.173), participant' frequency of contact with GI (β = 0.154) and purpose for using GI spaces (β =0.153) (Table 5). However, the participants' preferred forms of green infrastructure (β = 0.073) and length of stay in the location (β = 0.071) had the least influence on how they perceived UGI quality in the four towns sampled (Table 5).

These results show individual, location, and GI ecosystem services factors significantly influenced participants' perception of the quality of UGI in the study area.

4. DISCUSSION

This research investigated how the public perceived the quality of UGI and the factors that influenced this in small and medium-sized towns in Southeast Nigeria using four major urban areas of Ebonyi State as the case study. From the results, three key issues have been identified for discussion. Before delving into these key issues, it is important to offer some explanations on the observed variations in the socio-demographics of the survey participants. Although the 2006 population census figures indicated that the proportion of males to females in the four towns was 328,098 to 341,523 (Federal Republic of Nigeria, 2009), it was observed that the ratio of males to females who took part in the survey was 1.74: 1. This means that the number of males who took part in the survey is twice that of the females. This could be

attributed to the fact that the male gender is more available than the female group to participate in a survey of this nature. It was also observed that the highest proportion of the survey participants was never married before and was highly educated. This can be linked to the presence of university campuses in Abakiliki, Ikwo, and Uburu and a polytechnic in Afikpo, which can contribute to the influx of young people and highly educated persons into urban areas. The foregoing and the willingness of the younger than older persons to participate in surveys in the study area might also help to explain why most of the participants in this survey are between 21 years and 30 years (74%). Although in a similar research in Lagos Metropolis, Nigeria, Dipeolu and Ibem (2020) reported less participation of younger persons younger than 30 years old when compared with older persons, in line with the observations in the current research, most of the participants in that survey were males and highly educated persons. This may suggest that the male gender and highly educated persons are more willing and available to take part in questionnaire surveys in urban areas in Nigeria.

Regarding the first key issue emerging from the research, it was found that a majority of the participants preferred trees and water (blue infrastructure), and used UGI spaces mainly for enjoying nature and fresh air, recreation, and walking. These findings are contrary to those by previous studies indicating that people in the Swiss mountainous region of the Southern Alps, the population preferred green slopes of the mountains because of visual contact (Conedera et al., 2015) and cleanliness and maintenance of UGI sites (Madureira et al., 2018). These findings are also inconsistent with that by Dipeolu et al. (2021b) indicating that a majority of people in residential neighbourhoods in the Lagos metropolis preferred green corridors, lawns, sports fields, parks, and gardens and that one-half of the participants visited UGI sites mainly for social interactions. It was also observed that about 66% of our survey participants felt that the general quality of the different forms of UGI in the study area was generally good. This means that most of the participants view the attributes of the different forms of UGI as good in delivering basic ecosystem service and contributing to public health and the quality of life of the people. The finding on UGI quality appears to be contrary to the finding by Dipeolu and Ibem (2020) indicating that around 62.5% of the respondents perceived the quality of green infrastructure in residential neighbourhoods of the Lagos metropolis to be poor. Arguably, the variation in these findings might be due to differences in the sources of data, socio-demographics, and the number of participants in the two surveys. There are also findings indicating *the safety of GI locations; the greenness of leaves of plants, shrubs, and trees* and *the types of flowers of shrubs and trees* were rated higher in quality than other components. These seem to be consistent with the results achieved by previous authors (Jackson, 2002; Samimi and Shahhosseini, 2020) that the foliage of plants, shrubs and trees, and flowers of shrubs and trees were among the attributes of GI that contribute to its quality. This result can be linked to what Dennis et al. (2018) concluded on the importance of the greenness of leaves of plants, shrubs, and trees and the types of flowers of shrubs and trees in determining the quality of GI. In addition, these three features contribute to the effectiveness of UGI in the provision of recreation and relaxation spaces (Zhang et al., 2013) beautification of the environment (Adegun, 2021; Nordh and Olafsson, 2021), improvement of the community (Alaimo et al., 2016; Chiabai et al., 2018) and ecosystem health (Madureira, et al., 2018) and reduction of urban heat islands (Potchter et al., 2006; Idiata, 2016) and air pollution (Hewitt et al., 2020) and others.

The second issue is that there are differences in how the different categories of respondents perceived the quality of UGI in the survey due to their levels of education, the town of location, and the type of neighbourhood environment they were found in the four towns sampled. This means that the quality attributed to UGI by the public is a function of these three variables. Specifically, as relating to differences in UGI quality evaluation, it was also observed that the highest number of participants (47.03%) who indicated that the quality of UGI in their area was good were in Ikwo, about 38.12% were in Afikpo, and 30.53% in Abakiliki, whilst the least in Uburu. Similarly, about 38.35% of those who perceived the quality of UG to be good had post-secondary education, 37.10% had post-primary and the least had primary education as their highest level of educational attainment. Further, many of those who perceived the quality of UGI as good were in the places where they work or do business (43.55%), about 39.0% were in their places of residence, and 37.17% were in schools. It can be inferred from these results that, comparatively, the respondents felt that Ikwo and the neighbourhoods where they work or do business had the highest quality of the UGI, while Uburu and the neighbourhoods where they lived had the lowest UGI quality.

Notably, the finding on the role of the size of the town (location) in the differences in perception of UGI quality seems to provide support to the findings of Dipeolu and Ibem (2020) indicating that location was a major factor that influenced the residents' perception of green infrastructure quality in residential neighbourhoods in Lagos, Nigeria. Although the number of participants that rated the quality of UGI as good is consistent with the number of participants in each town and their highest level of educational attainment, a variation was observed in the type of neighbourhood environment the participants were found in during the survey. The results specifically revealed the highest number of those who rated the UGI

quality to be good were in the neighbourhoods where they work or do business instead of in the schools where the highest number of the survey participants was found (43.8%). This result suggests that there is uneven and inequitable distribution of quality green infrastructure in places where schools, places of work/business, and residences are located in the four towns sampled.

The last issue is that 13 of the 15 variables investigated, including four socio-demographics: education, marital and employment status, and age, and nine other variables: the respondents' length of stay in the locations, frequency of contact with UGI, the purpose for using GI spaces, the type of neighbourhood environment, the preferred form of green infrastructure, location (town), the importance of GI in environmental beautification, stormwater management and regulation of urban temperature significantly influenced the participants' perception of UGI quality in the survey. The emergence of the respondents' marital and employment status, and age, which also came up as factors that significantly influenced public perception of UGI quality, is a further confirmation of the evidence in the literature (Gashu et al., 2019; Brkanić, 2019) indicating that socio-demographic variables of individuals influence how they perceive the quality of the physical environment. The next factor that significantly influenced the participants' UGI quality assessment is the type of neighbourhood environment. The result revealed that the respondents perceived the higher quality of UGI in the places where they work or do business than in schools and places where they live. This disparity in the quality of GI in the different neighbourhoods seems to provide support to Wolch et al.'s (2014) conclusion that within urban areas, the quality of UGI is not always the same across different neighbourhoods due to the socio-demographics of the population and other planning and management issues. It was also found that respondents' identification of the importance of GI in the reduction of urban stormwater runoffs and regulation of air temperature also influenced their UGI quality rating. This finding did not come as a surprise because previous studies (Potchter et al., 2006; Idiata, 2016; Jiang et al., 2018) have shown that these are among the key ecosystem services UGI provides that can be used to access its quality (Kambites and Owen, 2006; Jerome et al., 2019). However, contrary to the expectations that participants' identification of the role of GI in the purification of air, it did not significantly influence their evaluation of UGI quality in this research.

The other factors that also considerably influenced our survey participants' evaluation of UGI quality are their frequency of contact with GI, the purpose for which they used GI spaces, and their preferred forms of GI in the four towns. Specifically, the result on the influence of frequency of contact with UGI seems to provide support to evidence in the literature (Hartig et al., 2003) indicating that the frequency of human contact with GI contributes to the extent its benefits can be maximised and, by extension, how its quality can be assessed. In addition, the influence of the purpose for using GI spaces on the perception of UGI quality can be explained by the results showing that many of the respondents in the survey used GI spaces mainly to enjoy nature and fresh air. This also appears to be in line with the submission by O'Neil and Gallagher (2014) that the ease of access to different forms of UGI and the opportunity this provides for people to experience nature are among the key parameters for assessing the quality of UGI. Furthermore, the direct association between preference and quality of products and services as established by Zia and Sohail (2016), and the evidence of the influence of the reasons for visiting UGI sites (Dipeolu et al., 2021) might also help to explain the findings on the influence of the preferred forms of GI on the participants' UGI quality assessment in this research. Given the foregoing, the current study can be considered to have achieved its goal of deepening the understanding of the quality of green infrastructure and its predictors in the study area.

5. CONCLUSIONS

This study investigated how the public perceives the quality of urban green infrastructure and the factors that influenced this in Southeast Nigeria having four major towns in Ebonyi State as the case study. The findings informed the following conclusions and implications. First, most of the survey participants perceived the quality of UGI in the towns to be generally good, yet, some of them feeling that the quality of green parks where children can play, the level of cleanliness, maintenance, and equipment in green spaces and parks for relaxation, recreation, and social interactions, and others was not good enough. This implies that more attention is required to improve these aspects in the planning and management of green infrastructure in the urban areas sampled.

Second, the differences in public perception of UGI quality in this research are determined by the participants' level of education, town of location, and types of neighbourhood environments. This implies that people with different levels of educational attainment in different towns and neighbourhood environments tend to perceive the quality of green infrastructure differently and this can influence their preference for UGI. Subsequently, researchers should take cognisance of these when exploring the quality of green infrastructure from the lens of the urban population in a developing country like Nigeria.

Third, although 13 factors are found to influence public perception on the quality of UGI in this survey, the five with the most significant influence are the respondents' level of education and age, type of

neighbourhood environment, marital status, and participants' understanding of the importance of green infrastructure in reducing stormwater runoffs in the study area. This implies that for an adequate understanding of how the public perceives the quality of green infrastructure, urban infrastructure researchers, policymakers, and programme managers in the study area and beyond need to pay specific attention to these factors for positive results in their endeavours.

Despite the insight gained from this research, it has some noteworthy limitations. First, by focusing on four towns and adopting a cross-sectional survey research design and questionnaire as the data-gathering instrument, the findings capture the situation at the time the survey neglecting what the situation was before and will be after the survey. The data collection method used also exposed the results to the influence of respondents' bias. Therefore, further studies should consider investigating more towns in the study area and adopting longitudinal surveys and mixed-methods of inquiry for robust findings. Second, the regression model for the present study accounted for around 67% of the determinants of UGI quality, meaning that the remaining 23% of the predictors were not explained in the current study. Given this, further research is suggested to uncover the factors that influence public perception of UGI quality in the study area. Third, the survey did not include data on the percentage of green spaces and the main types in the four towns sampled. These, among other aspects, are considered potential areas for future research that can appeal to a broader audience.

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APPENDIX 1

QUESTIONNAIRE ON GREEN INFRASTRUCTURE IN URBAN AREAS IN SOUTHEAST NIGERIA

Dear Participants,
This questionnaire is designed to collect information from residents and workers in urban areas in Southeast Nigeria on several issues related to green infrastructure (e.g. grasses, plants, trees, water bodies, open spaces, green parks/gardens, etc.). It is essentially an instrument for gathering data for academic work. Responding to the questions on this questionnaire implies informed consent to participate in this research. Participation in this research possesses no health and economic risks to you, but it will take about 15 minutes of your valuable time. All information provided will be treated with a high degree of confidentially and anonymity.

Thanks in anticipation of your participation in this research.

A. Socio-demographic Data
Please tick (√) as appropriate
1. Name of your town and location: ----------
2. Which of these is your gender? Male [ ] Female [ ]
3. What is your age range? 21-30yrs [ ]31-40yrs [ ] 41-50yrs [ ] 51-60yrs [ ] 61yrs+ [ ]
4. Marital status: Single [ ] Married [ ] Divorced [ ] Widowed [ ] Separated [ ]
5. What is the last level of education you completed? No formal Education [ ] Primary school [ ] Secondary School [ ] College of Education/ Polytechnic/University [ ]
6. Your current employment status can best be described as Unemployed [ ] Self-Employed [ ] Employee of a Private Organization [ ] Public sector/Government Employee [ ]
7. Number of years you have been working/living/doing business in this place: Less than 1 year [ ]
1-5years [ ] 6-10years [ ] 11-15years [ ] 16years+ [ ]
8. Which of this best describes your location? School [ ] Work [ ] Residential [ ] Business/commercial environment [ ] Industrial/Commercial environment [ ]

B. Availability of Urban Green Infrastructure in your area
Please tick (√) as appropriate the following categories of green infrastructure found in your area or location.
1. Green Spaces: Green roofs [ ] Grasses [ ] Sports Field [ ] Green Parks [ ] Green Gardens [ ] Urban farms [ ] All green Spaces [ ] Green walls [ ] Planter boxes [ ] None [ ]
2. Tree features: Urban Forests [ ] Urban/Street Trees [ ] Woodlands [ ] Allotments [ ] None [ ]
3. Water features: Fountains [ ] Floodplains [ ] Streams [ ] Rivers [ ] Lakes [ ] Ponds [ ] Canals [ ] Rainwater Harvester [ ] None [ ]
4. Others: Opens Spaces [ ] None Green Parks [ ] Schoolyards [ ] Wildlife park [ ] Cemetery [ ] None [ ]
5. Which of these categories of green infrastructure do you prefer staying close to or viewing? Green spaces [ ] Tree features [ ] Water features [ ] Others [ ] None [ ]
6. Indicate the frequency at which you stay close to or view the green infrastructure identified in 5 above: Never [ ] Rarely [ ] Sometimes [ ] Often [ ] Always [ ]
7. You stay close to where green infrastructure is for the following reasons:
Relaxation and walking [ ] Recreation/sporting [ ] Meeting friends [ ] Spiritual exercise [ ] To read [ ] Enjoy nature and get fresh air [ ] Attend events and meetings [ ] Spend time with family [ ] Educational activities for Children [ ]
8. Which of these describes the quantity of green infrastructure in your area: Very Low [ ] Low [ ] Not Sure [ ] High [ ] Very High [ ]
9. Which of these forms of green infrastructure would you recommend to be more installed in your area?
Green spaces [ ] Tree features [ ] Water features [ ] Green parks [ ] Others [ ]

C. Quality of Green Infrastructure in your area
Please rate by ticking **(√)** the quality of the following categories of urban green infrastructure in your area/location

No.	Green Infrastructure	Very poor	Poor	Fair	Good	Very good
1	Green spaces					
2	Urban/street trees					
3	Water features					
4	Green parks for relaxation, recreation, and social interactions					
5	State of green areas in all seasons of the year					
6	Green parks where children can play freely					
7	Foliage (leaves) of plants, shrubs, and tree					
8	Flowers of shrubs and trees					
9	Maintenance of green infrastructure					
10	Water features in all seasons of the year					
11	Level of equipment of green spaces and parks					
12	Accessibility of green infrastructure to most people					
13	Safety of where green infrastructure is					
14	Ported plants /planter boxes in my house/office/business premises					

D. Attitudes toward Urban Green Infrastructure

Please indicate by ticking **(√)** your agreement or disagreement with the following statements describing your attitude toward green infrastructure in your area/location using ***1= Completely disagree 2= Disagree, 3=Not Sure, 4=Agree, 5= Completely Agree***

No.	Statements	1	2	3	4	5
1	I am involved in maintaining green spaces in my area/location					
2	I am happy having the green infrastructure in my area/location					
3	I feel good staying around or viewing green infrastructure in my area					
4	I talk about the green infrastructure in my area/location with other people					
5	I consider the green infrastructure in my area/location an important of my life					
6	I am interested in learning more about green infrastructure					
7	I am willing to pay to stay around or view green infrastructure					
8	The presence of green in my area/location makes me feel more alive.					
9	I am willing to participate in a program to take care of plants, trees, or any other green infrastructure in my area/location					
10	I encourage people to plant flowers, shrubs, and trees around their homes, places of business, and work					
11	I discourage people from walking on lawns and destroying plants and trees					
12	I strongly disagree with those who feel that we do not need plants and trees because they block sunlight and air from entering buildings in my area					
13	I strongly disagree with people who feel that we do not need trees in my area because they prevent them from seeing outside their homes and office from the windows					
14	I feel that green infrastructure is needed in my area for ecosystem preservation and restoration					
15	I feel that the management of urban green infrastructure is too expensive for the people					
16	I feel that the installation and management of urban green infrastructure should be a joint responsibility of the government and the people					
17	I disagree with the notion that plants and trees by shading their leaves contribute to waste generation in my area/location					

E. Social benefits of Urban Green Infrastructure

Please, indicate by ticking **(√)** your level of agreement or disagreement with the following benefits of urban green infrastructure: ***Strongly disagree = 1; Disagree = 2; Undecided = 3 Agree = 4; Strongly Agree = 5***.

No.	Green infrastructure brings the following social benefits	1	2	3	4	5
1	Helps me to know other people in the area/location very well					
2	Makes it possible for social interactions in my area/location					

3	Provides an avenue where people meet and share their life experiences and get advice from other people in my area/location					
4	Helps in social cohesion in my area					
5	Facilitates social networking and social capital formation among people in my area					
6	Enhances quality of life of people					
7	Reduces or checks crime in my area/location					
8	Increases recreational opportunities and interactions with nature in my area					
9	Facilitates seeing and talking with other people in my area/location					
10	It makes people develop a strong sense of community in my area					
11	Provides educational opportunities for children					
12	Reduces stress					
13	Makes me feel happy or satisfied with life					
14	Helps me to enjoy my daily work activities					
15	Helps me to face my challenges daily					
16	Helps me to make sound decisions on family, work, or business issues					
17	Makes me feel refreshed by bringing me closer to nature					
18	Enhances my productivity at work					
19	Reduces anxiety					
20	Gives me mental stability					
21	Facilitates healing and recovery, and my overall health and well-being					
22	Helps me shade weight and prevent chronic diseases associated with obesity					
23	Helps me function effectively and fulfill my purpose in life					

F. Economic benefits of Urban Green Infrastructure

Please indicate by ticking **(√)** your level of agreement or disagreement with the following economic benefits of urban green infrastructure using ***Strongly disagree = 1 Disagree = 2 Undecided = 3 Agree = 4 and Strongly agree = 5.***

No.	Green infrastructure brings the following economic benefits	1	2	3	4	5
1	Increases property values and tax revenue					
2	Reduces the use of energy in buildings for cooling, lighting, and ventilation					
3	Improves food security through urban farming					
4	Increases productivity among office employees					
5	Green job creation					
6	Provides medicinal plants					
7	Promotes tourism					
8	Promotes recreation and leisure					
9	Promotes economic growth and investment					
10	Reduces cost of stormwater management					

G. Importance of Green Infrastructure in Urban Environmental Sustainability

Based on your knowledge and experience, please rate by ticking **(√)** the level of importance of green infrastructure in the urban environmental sustainability of your area using 1= ***Not Important, 2= Slightly Important, 3= Moderately Important, 4= Important 5= Very Important***

No.	Green infrastructure brings the following environmental	1	2	3	4	5
1	Environment beautification					
2	Visual screening of unsightly buildings or infrastructure					
3	Restoration of the damaged part of the urban landscape					
4	Soil erosion control					
5	Flood prevention and control					
6	Slowing down and reducing stormwater runoff					
7	Natural ecosystem conservation					
8	Improvement of air quality by reducing the level of carbon dioxide and trapping airborne particulates in the atmosphere					
9	Biodiversity protection and pollination					
10	Reduction of the ecological footprint of urban areas					
11	Reduction of surface and air temperatures					
12	Reduction of noise pollution					
13	Improvement of housing quality					

14	Natural ecosystem conservation					
15	Elimination of odour within the environment					
16	Reduction of greenhouse gas production					
17	Effective water management through rainwater harvesting					
18	Improvement of water quality					
19	Maintenance of a healthy natural ecological system					
20	Serves as windbreakers that protect buildings from the rainstorm					
21	Serves as way finding purpose in urban areas					
22	Facilitates access to cleaner, safer and greener urban environment					
23	Natural disasters vulnerability reduction					