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# Green Infrastructure Study: An Assessment of the awareness of residential plot owners with different socioeducational status, Lagos, Nigeria

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## Abstract

Approaches and strategies to develop the urban environment sustainably has in recent times been on the increase, with green strategies being the major focus. The research aims at assessing the influence of educational level of residents on awareness of green infrastructure within their residential plots with a view of proposing strategies for green infrastructure enhancement within the urban development. The research focused on residential plots in Amuwo-Odofin, Lagos, Nigeria. Questionnaires were distributed strategically to elicit information on resident's socio-educational status and residential site status. Analysis at two levels, which involved descriptive statistics and multiple regression analysis, using Statistical Package for Social Science (SPSS) Version 21 was carried out. The study reveals a strong positive relationship between the educational level of respondents and their awareness of the green infrastructure provision through open natural spaces within their residential plots, with these perceptions also varying with other demographic factors. The study concluded that continuous education in the form of public and private enlightenment of residents and prospective developers by government environmental agencies and built environment professionals is an essential educational strategy. Employing this educational strategy of enlightenment at various levels will improve the chances of enhancing environmental and nature sustenance within residential plots through green infrastructure planning.

**Keywords:** Green Infrastructure, Educational Status, Residential Plot, Nature, Urban Environment

## INTRODUCTION

Climate change, human population growth and land use change are among the most significant threats to nature and ecosystem (Borrensen, Ulinboka, Nyahongo, Ranke, Skjaervo & Roskaft, 2022). Urban planners have always been faced with the challenge of multiple objectives in development plans, a

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challenge intensified by pressures for urbanization, sustainability and climate resilience (Xu *et al,* 2020). Furthermore, Boulton, Dedekorkut, Holden & Burne (2020), presented this issue of increased soil sealing as leading to decreased infiltration of rainwater and increased surface water runoff, resulting in flooding as well as ecological and social consequences on natural spaces and habitat loss.

Education levels as presented by the United Nations Educational Scientific and Cultural Organization (2026) refers to the various stages of formal learning that individuals attain throughout their academic journeys, typically involving primary, secondary and tertiary education with each representing a distinct phase in educational development. As argued by Kovacic et al (2024), education level significantly shapes perception, with higher education levels typically leading to more critical, refined and analytical evaluations of beauty and designs. With issues of global climate change impacts such as biodiversity loss, extreme heat waves and public health threats, green infrastructure serves as a potential resilience strategy to address these issues (Dodman et al, 2023), hence enhancing climate change adaptation prospects of communities. Drawing attention to Green infrastructure (GI) for urban developments is important because its benefits and potentials are not usually given the deserved priority in planning and development in cities within sub-Sahara Africa (Di Toit et al, 2018).

Environmental sustenance is of critical essence when focusing on cities and environments, especially fast developing urban areas in developing countries, in which Nigeria is included, with green infrastructure being a strategic tool to achieve this (Adegun et al, 2023). The problem of climate change adaptation in Nigeria prompts a situation where GI progresses from remaining essentially a concept into a strategically purposeful action that is informed by information on state of the art nationally (Ekong 2017). Study by Oliveira et al (2024) emphasizes the crucial role of higher education institutions in advancing biodiversity conservation, habitat protection and broader ecological priorities to support the development of resilient and sustainable urban environments.

## LITERATURE REVIEW

The essence of green infrastructure utilization as a climate change adaptation strategy is increasingly given prominence amongst practitioners of spatial planning, with this strategic approach necessitating the creation of a holistic and integrated city management system (Monika & Robert, 2023). With the implementation of green spaces as a focus in the urban planning process, the goals of contributing to the provision of ecosystem services can be met, which is beneficial to local communities while improving environmental quality and adapting cities to climate change through green infrastructure inclusion (Nakamura, 2022). Green infrastructure refers to green spaces and other environmental features that deliver goods and services associated with the sustenance of human beings (Natural England, 2009). Monika & Robert (2023) perceived GI as a strategically planned network of natural and semi natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services. GI according to Zin-Hong et al (2025) though a spatial tool for urban planning and a strategy for climate change adaptation, can potentially contribute directly or indirectly to all sustainable development goals.

Among the set of practices utilizing nature and natural practices in urban planning, green infrastructure planning presents promising solutions to reduce the negative effects of urban related climate change issues and increase ecosystem services (Daniele & Viviana, 2020). These green methods of urban design were designed to reduce impervious areas through different ecological means (Cano & Barkdol, 2016) at small and large scales, ultimately improving the environment and generally propelling environmental sustainability in the urban sector. Furthermore, the system involves an integrated network of engineered vegetated areas and open spaces used to protect natural ecosystem principles and functions and to offer a wide variety of benefits to people and wildlife (Tang et al 2021). SUDS are known for providing multiple

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environmental benefits including climate change impacts reduction (Coutts and Haihn 2015, Ghods et al, 2020; Roseboro et al, 2021), along with ecological and social benefits and other potential monetizable benefits in the long term (Hamann et al 2020).

Driven by the challenge of adapting cities to climate change, storm water management is high on the agenda of landscape architectural practice, with studies (Suyeon & Kyungin, 2017; Antje & Ole, 2013) indicating that GI acting as visible storm water management systems enhances the experience of local terrains. The amenity concept of SUDS as defined by Woods et al (2015) is a useful or pleasant facility or service, constituting urban design or space quality, liveability or quality of life for habitats and aesthetic appreciation amongst others, commonly associated with habitat/biodiversity. GI planning have gained growing public interest in recent years as a result of its positive effects and recreational amenities perceived in the urban landscape (Qiangian, 2014).

Vermont (2016) emphasizes that through an extensive assessment of the natural landscapes of a site, the planner/ designer is able to place structures and site elements to minimize potential impacts, balancing human benefits with environmental functions, thus improving site aesthetics. According to the United States Environmental Protection Agency (2012), SUDS emphasizes the use of natural vegetation to control storm water, add value and improve aesthetics of public and private spaces. As an alternative site design strategy, GI has a direct correlation to enhance liveability and community aesthetics (Guillette, 2010). Smart growth according to (USEPA, 2024) are practices that cover a range of development strategies in which GI and conservation are inclusive strategies that help protect the natural environment and at the same time make communities more attractive, economically stronger and more liveable.

**METHOD**

In a study to explore natural amenity perceptions of sustainable urban drainage systems, a green infrastructure water management strategy, Suyeon et al (2017) selected three (3) case study sites to actualize the study. Employing the approach of this successful socio-ecological study, the research population to gather quantitative data for this study is all the residential plots in the selected estate categories in satellite town. Satellite town has three (3) categories of estates.

Category one comprises estates in which land areas (plots) were allocated by the Federal Ministry of Lands and Housing with buildings designed and developed by the owners. There are ten (10) estates in this type and site E comprising 133 residential plots was selected as type one study population because it has the highest number of residential plots compared to the other sites (estates) in this type. Category two comprises estates in which buildings were designed and developed by the Federal Ministry of Lands and Housing before the plot's allocation process. There are seventy-seven (77) closes, grouped into 3 sectors.

Sector 2 comprising 496 residential plots was selected as type two study population because it has the highest number of residential plots compared to the other sectors. Category three comprises land areas under the jurisdiction of the Federal Ministry Lands and Housing but in the custody of the traditional royal families (Agbojo-Alagbo Chieftaincy Family), with the allocation of plots done by the family representatives. New-site residential estate was randomly selected in this category and comprises 714 residential plots. Hence, the research population to gather quantitative data is the combination of residential plots from the selected categories, which is a total of 1,343 residential plots as presented in table 1, whose house heads were respondents for the questionnaires.

The research sample size was calculated using a sample size calculator according to Creative Research System (2012) at a confidence level of 95% and confidence interval of 5. The total sample size after adding the individual sample sizes generated by the sample size calculator for administered questionnaires

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is 567. Data collected from the field was sorted and then analyzed, using the statistical package for social sciences (SPSS) version 21. The data analysis was done at two levels. The univariate analysis which described the population characteristics using frequency distribution tables, percentages and bar charts. The second level analysis was done using multiple regression analysis.

**Table 1: Research Population for Residential Plots**

| | ESTATE | Research Population | Research Sample |
|---|---|---|---|
| 1 | CATEGORY 1 **(Site E)** | 133 | 99 |
| 2 | CATEGORY 2 **(Close 17-Close 55)** | 496 | 217 |
| 3 | CATEGORY 3 **(New site Estate)** | 714 | 251 |
| | **Total** | **1343** | **567** |

## RESULTS AND DISCUSSIONS

As presented in table 3, from the regression results, education level significantly predicts environmental perception. Higher educational attainment is associated with stronger awareness, preservation behavior and introduction of natural landscape elements. The regression results indicate that educational level significantly predicts residents' environmental perception. Education showed a positive relationship with all dependent variables, suggesting that higher educational attainment increases environmental awareness and sustainable practices.

For awareness of the importance of nature, education produced a positive effect ($\beta = 0.31$, $p < 0.001$) with an explanatory power of $R^2 = 0.14$, indicating that education accounts for approximately 14% of the variation in respondents' awareness levels.Similarly, education significantly influenced nature preservation behaviour ($\beta = 0.28$, $p = 0.002$, $R^2 = 0.11$), showing that respondents with higher education levels were more likely to preserve natural landscape features.For nature introduction, education recorded the strongest effect ($\beta = 0.35$, $p < 0.001$, $R^2 = 0.17$), indicating that education plays an important role in encouraging residents to incorporate natural elements into residential sites.Education is a critical determinant of environmental understanding because increased knowledge enhances appreciation and adoption of sustainable landscape practices.

**Table 2: Socio educational Status**

| | Variable | Frequency /Percentage | | |
|---|---|---|---|---|
| | | **Category 1** | **Category 2** | **Category 3** |
| ii | **Sex** | | | |
| | Male | 89 (89.9%) | 131 (60.4%) | 226 (90.0%) |
| | Female | 10 (10.1%) | 86 (39.6%) | 25 (10.0%) |
| iii | **Age** | | | |

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| | | | | |
|---|---|---|---|---|
| | 25-34 | 16 (16.2%) | 54 (24.9%) | 16 (6.4%) |
| | 35-44 | 42 (42.4%) | 85 (39.2%) | 124 (49.4%) |
| | 45-54 | 32 (32.3%) | 52 (24.0%) | 87 (34.7%) |
| | 55-Above | 9 (9.1%) | 26 (11.9%) | 24 (9.5%) |
| iv | **Highest Level of Education completed** | | | |
| | Secondary | 26 (26.3%) | 13 (6.0%) | 62 (24.7%) |
| | Tertiary | 49 (49.5%) | 172 (79.3%) | 118 (47.0%) |
| | Masters | 24 (24.2%) | 32 (14.7%) | 69 (27.5%) |
| | Doctorate | - | - | 2 (0.8%) |
| | **Total** | **99** | **217** | **251** |

**Chart 1. Educational level of Respondent**

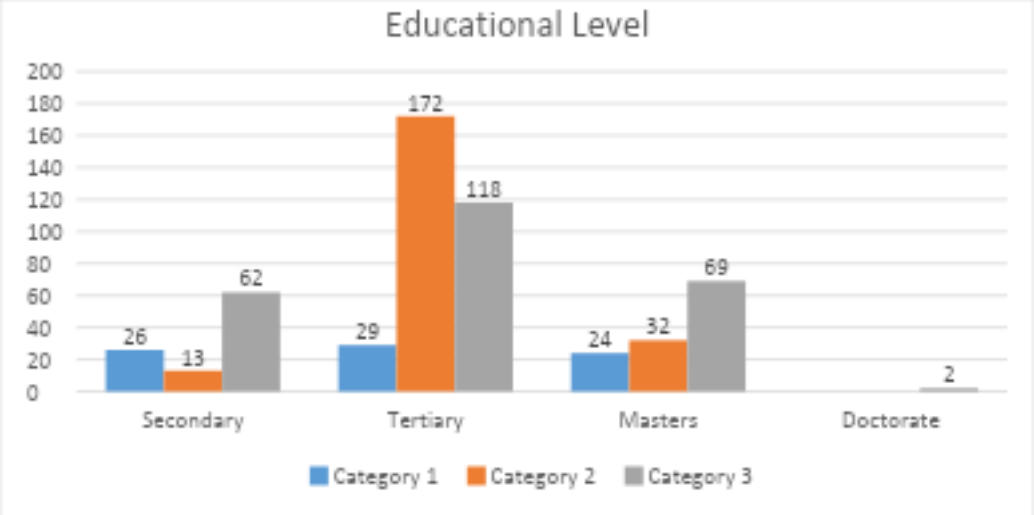


**Table 3: Education Level Predicting Environmental Perception**

| Dependent Variable | B | SE | Beta | t | Sig. | $R^2$ |
|---|---|---|---|---|---|---|
| Nature Awareness | 0.31 | 0.08 | 0.31 | 3.88 | <0.001 | 0.14 |
| Nature Preservation | 0.28 | 0.09 | 0.28 | 3.11 | 0.002 | 0.11 |
| Nature Introduction | 0.35 | 0.07 | 0.35 | 4.62 | <0.001 | 0.17 |

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Dependent Variables: Awareness of importance of nature, Nature preservation, Nature introduction

Regression Results:

Nature awareness: $\beta=0.31$, SE=0.08, $t=3.88$, $p<0.001$, $R^2=0.14$

Nature preservation: $\beta=0.28$, SE=0.09, $t=3.11$, $p=0.002$, $R^2=0.11$

Nature introduction: $\beta=0.35$, SE=0.07, $t=4.62$, $p<0.001$, $R^2=0.17$

## RECOMMENDATIONS

The following are the recommendations evolving from results of the study

- Continuous education in the form of public and private enlightenment of residents and prospective developers by government environmental agencies and built environment professionals is an essential educational strategy for GI Awareness.
- The government through its various housing authorities should periodically organize sustainable development programs to enlighten stakeholders in building development on the strategies and essence of developing ecologically.
- As part of Government's implementation strategy, a certain percentage of the residential plot area must be unpaved to serve as environmental sustaining area of residential plots during plot development, which must be shown and presented as part of the details of the site analysis on the site plan drawing for Building Approval

## CONCLUSION

The study through its research methodology and analysis has presented results to show that socio-educational factors of residents can affect GI awareness within residential plots. The study showed that an increase in the educational level of residents will increase their awareness of GI in developing areas within open spaces, hence creating more opportunities for environmental sustenance. Therefore, the need for intensified enlightenment from building control agencies to enhance setback appreciation and compliance during plot development. Furthermore, with GI awareness likely increasing with educational level, it implies that individual and community enlightenment through different means of the essential benefits of GI is important for adoption and implementation.

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