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SPECIAL ISSUE: CELEBRATING 20 YEARS OF GEOGRAPHY IN KADUNA STATE UNIVERSITY - ADVANCES AND FRONTIERS IN GEOGRAPHY

Tourist Perceptions of Environmental and Infrastructural Barriers to Urban Leisure in Kaduna Metropolis Hotels

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ABSTRACT

The sustainability and growth of tourism development in Kaduna metropolis are hindered by continued environmental degradation, inadequate infrastructure, and climate-related constraints. This study assessed the major environmental and infrastructural determinants influencing sustainable tourism development in the Kaduna metropolis, with an emphasis on identifying key factors that shape tourists' satisfaction and destination resilience. A structured questionnaire was utilized to collect primary data from 385 respondents at seven purposively selected tourism destinations, including Bafra Hotel, Hotel Seventeen, Zee Cool Hotel, Jay Hilton Hotel, Green Apple Hotel, Top Galaxy Hotel, and Fifth Chukker Polo. A total of 366 valid questionnaires were recovered and used for data analysis. The data were analysed via descriptive statistics, principal component analysis, and logistic regression with SPSS version 26 to examine the effects of the environmental and infrastructural variables on tourism sustainability. The results from the ordinal logistic regression analysis indicated a significant association between flooding, deforestation, waste disposal problems, and poor maintenance of the tourism site, with higher chances of disruption of tourism services ($p < 0.05$). Three main components were extracted via principal component analysis (PCA): environmental quality, infrastructural adequacy, and safety accessibility, which explained 76% of the total variance. The study revealed that without environmental integrity, especially alongside infrastructural development in the Kaduna metropolis, there is no sustainable tourism development in the area. This suggests improved cooperation between government agencies, private investors, and local communities to support green practices, reinforce infrastructure, and enable policy implementation for sustainable tourism growth.

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1 Introduction

Tourism has emerged as one of the fastest-growing sectors in the global economy, strongly contributing to an increase in income, the establishment of employment, a reduction in poverty, and the integration of culture (Mohammed, 2022). The United Nations World Tourism Organization (UNWTO) estimates that international tourist arrivals have exceeded one billion annually, generating trillions of dollars in revenue and providing over 10% of the world's employment (Mustapha, 2025). In addition to its economic significance, tourism plays an important role in promoting cross-cultural understanding, conserving heritage sites, and raising environmental awareness through sustainable practices (Mshelia et al., 2022). Therefore, the industry is seen as an important foundation of the United Nations Sustainable Development Goals (SDGs), particularly Goal 8 (Decent Work and Economic Growth), Goal 12 (Responsible Consumption and Production), and Goal 13 (Climate Action).

The fast pace and increasing scale of the tourism business are putting severe pressure on ecology. Around the world, environmental challenges such as climate change, biodiversity loss, deforestation, flooding, and pollution are worsening annually (Abu-hanifa et al., 2025). Abnormal temperature increases and unseasonal patterns of bad weather in various regions have been widely reported, with recent evidence of more extreme climates in Nigeria (Isa et al., 2023). These shifts in climate have resulted in ecosystem destruction, coastal retreat, and landscape modification, which threaten tourism. Similarly, in most places, the rapid expansion of cities, poor waste management, and excessive utilization of resources are causing widespread environmental degradation (Simon et al., 2021).

These changes lead to a decrease in ecosystem integrity and could also detract from a location's appeal as a tourist destination. The development of tourism destinations can be explained via Butler's Tourism Area Life Cycle (TALC). According to this theory, destinations undergo a series of changes from exploration to eventual decline. Uncontrolled environmental and infrastructural pressures accelerate their decline or simple stasis (Szromek, 2019). Policymakers in Europe have had to reassess the relationships among environmental conservation, infrastructure development, and sustainable tourism management.

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The Doxey Irridex system provides a way to understand the responses of stakeholders and residents, who have to put up with either social pressure or environmental degradation that may generate irritation and resistance. The tourist will be influenced by this situation, as well as by whether his pleasant experience lasts long enough to establish sustainable tourism (Butler, 2009). In this context, the UNWTO (2005) defines sustainable tourism as 'tourism that takes full account of its current and future economic, social, and environmental impacts, addressing the needs of visitors, the industry, the environment, and host communities.' This means that a new model for social development must ensure long-term ecological sustainability if these benefits are to be sustained. Some even suggest that sustainable tourism constitutes a form of 'investment': everybody who benefits from one trip will pay back several times over through a longer and better quality holiday (Wang & Cheablam, 2025). Sustainable tourism can also be conceptually defined by applying the triple bottom line (TBL) approach, which involves integrating economic, social, cultural, and environmental considerations to make long-term destinations resilient (Aransyah et al., 2025).

Even though the tourism sector in developing regions such as Africa has great natural and cultural wealth at hand, it is currently underused owing in part to environmental neglect and poor policy frameworks (Baloch et al., 2023). The need for African countries to strengthen their environmental governance and develop more durable infrastructure to support sustainable tourism lies at the heart of the African Union (AU) and UNWTO's policy prescription for African countries (Richard, 2024). Nigeria, in particular, has many different kinds of tourism assets, ranging from natural parks, cultural festivals, and wildlife reserves to historic and religious sites (Mustapha, 2025). Despite these endowments, the tourism industry in Nigeria has not fully developed as it could have done because of persistent problems such as poor environmental management and infrastructure, insecurity, and insufficient capacity for institutions (Dele, 2021).

The sustainability of tourism locations is increasingly affected by the environment and infrastructure. Many tourism facilities and natural attractions have suffered from poor drainage systems, deforestation, waste mismanagement, frequent flooding, lack of maintenance, and care; as a result, they have deteriorated in condition (Echendu, 2000). These problems are worsened by poor enforcement of regulations, a lack of government funding for tourism infrastructure development, and an absence of community involvement in environmental protection. Without specific management strategies or policy interventions, the tourism potential of the Kaduna metropolis may continue to shrink. Sustainable tourism means balancing environmental protection, infrastructure development, and socioeconomic growth (Manggaprouw et al., 2025; Mustapha & Adewuyi, 2024). This involves environmental regulations, eco-friendly practices, and community involvement being enforced to ensure long-term viability—not only for today's generation but also for future generations.

Therefore, this study aims to ascertain which environmental headaches prevent the overall long-term development of the tourism sector in the Kaduna metropolis. Specifically, it examines the impact of environmental and infrastructural determinants on tourism activity, assesses the extent to which policies and management support sustainability, and gains insights into tourists' and stakeholders' views on environmental practices at, or close to, tourist destinations. By combining quantitative and inferential analyses, this study offers empirical proof of the way in which environmental factors and sustainability in tourism interactions occur. The results will help guide policymakers, urban planners, and tourism operators, who are designing effective ways of protecting natural resource environments from tourism, continuing to diversify their economies by providing more favourable experiences for guests, and bringing about the realization of sustainable development goals in Kaduna State. The findings provide valuable material for decision-makers concerned with environmental concerns, the management of green urban areas, and tourism sector development.

2 Materials and Methods

2.1 Study Area

The Kaduna metropolis covers approximately 3 156 km² and includes the local government areas of Kaduna North, Kaduna South, and parts of Chikun and Igabi. Geographically, Kaduna is located between latitudes 10°23 ′-10°39 ″N and longitudes 7°20 ′-7°35 ″E (Figure 1). It has a tropical savanna climate with clear wetness (April–October, 1400 mm annual rainfall described by harmattan dust haze). The peak temperatures exceed 35°C from March-May, with relative humidities ranging from 25-90% (Baba et al., 2022). The landscape consists of 600–800 m high plains interspersed with stony hills and inselbergs, and is drained mainly by the Kaduna and Gurara Rivers. The soils are mainly ferruginous tropical types with varying fertility, and the vegetation within the northern Guinea savannah zone is characterized by a savannah with tall grasses, scattered trees, and reduced fringe forests under pressure from urban development (Isa et al., 2023).

Kaduna is one of the cities within the Nigerian urban transition, undergoing rapid urbanization and with a projected population of more than 3.3 million in 2024 (Kaduna State Government, 2024), housing several

industrial zones as well as agricultural, educational, and service activities. In the northern geopolitical zone of Nigeria, Kaduna town houses various sporting facilities, natural scenery, and some cultural heritage sites, especially the Kaduna National Museum and Ahmadu Bello Stadium, where the town is significant to the nation as a socioeconomic and tourism center (Saleh, 2015).

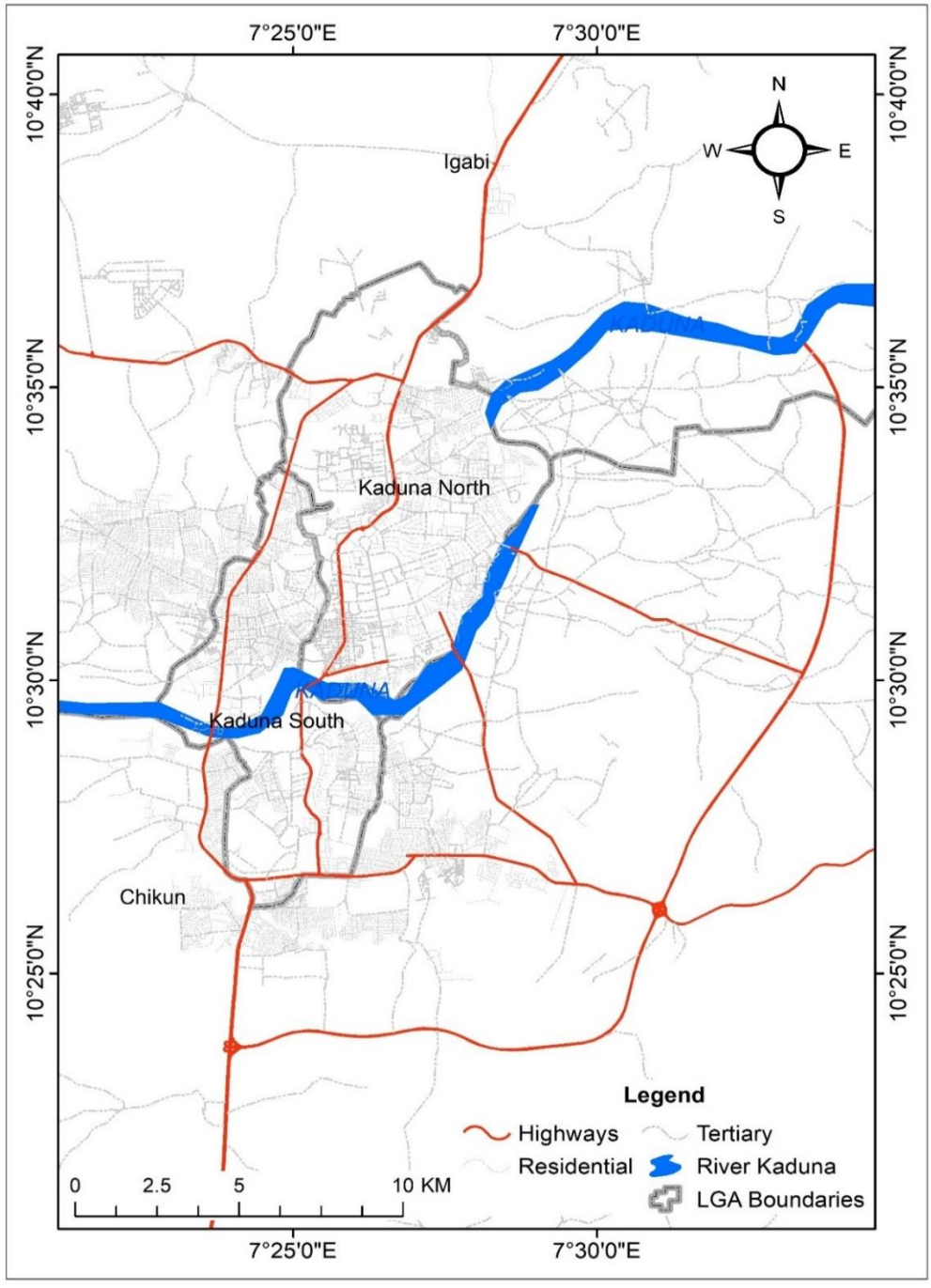

Figure 1: Study area
Source: Modified from GRID3 - Nigeria, 2021

2.2 Methodology

A descriptive cross-sectional survey design was adopted for the study to identify the key environmental and infrastructural determinants that impact sustainable tourism development in the Kaduna metropolis. This design was appropriate since it enabled the systematic collection and analysis of data from a large population of tourists at a single point in time, thus providing an accurate picture of the perceptions and experiences of tourists. It also facilitates the combination of both quantitative and inferential analyses, such as descriptive statistics and logistic regression, to explore the effects of environmental and climatic factors on tourism activity.

The study population included tourists and visitors

who patronized selected tourism and recreational sites in the Kaduna metropolis during the period of study. Although the state is endowed with both natural and man-made attractions, the selection of hotels as units of sampling was because hotels act as major convergence points for various categories of tourists, with minimal filters from state visitors, business travellers, event participants, and others using the recreational facilities of the hotels. Many of the operational recreational parks are limited, and attractions are often spread out over larger areas, making hotels a more convenient and stable environment to meet active tourist populations. The sample size was calculated as follows: Cochran's (1977) formula for an open-access population, which yields 385 respondents at the 95% confidence level and a 5% margin of error.

The respondents were evenly distributed across the seven hotels that were purposefully selected based on visitation frequency and environmental significance (Bafra Hotel, Hotel Seventeen, Zee Cool Hotel, Jay Hilton Hotel, Green Apple Hotel, Top Galaxy Hotel, and Fifth Chukker Polo). Thus, each site had approximately 55 respondents (385 ÷ 7 = 55). Among the 385 responses distributed, 366 were retrieved and validated to be analysable, leading to a 95% response quota. Owing to the temporary nature of tourists, a convenience sampling technique was utilized to recruit individuals willing to participate. Although initially hotel-based sampling allows easier access and quicker response, it is well established that this sampling framework may not completely encompass tourists who visit only outdoor attractions.

A structured questionnaire was employed for the field study to gather in-depth information from the respondents. Sociodemographic characteristics, including sex, age, marital status, education, occupation, income, and nationality, were collected via the instrument. It additionally considered perceptions regarding the environmental and infrastructural facets of destination selection and the role of climate and natural disasters in tourism-related patterns of activity and environmental obstacles, such as deforestation, floods, waste management, infrastructure disrepair, biodiversity, and climate change disruptions to tourism. Additionally, inputs on environmental sustainability management and policies supporting tourism development were collected. The questionnaire mixed nominal, ordinal, and Likert-scale items (5-point scale) to gather both objective and subjective information.

The questionnaire was evaluated by experts from the fields of environmental management, tourism studies, and statistics for validation and reliability. They provided feedback that led to slight wording adjustments, which improved clarity and structure. To ensure understanding and reliability, a pilot test was performed with 30 respondents from outside the study area. The instrument had high internal reliability fit for social science purposes because it reported a Cronbach's alpha of 0.86. This data collection took four weeks and was carried out through the implementation of questionnaires at the chosen tourism sites. Research assistants, trained to achieve ethical standards of voluntary participation, confidentiality, and informed consent, assisted the respondents in completing the questionnaires.

All the data were coded and analysed via the Statistical Package for the Social Sciences (SPSS, version 26) and Microsoft Excel. The sociodemographic characteristics of the respondents were summarized via descriptive statistics (frequencies and percentages). The mean scores and PCA were used to determine the top environmental and infrastructure factors for destination choice. Variables with high correlations were collapsed by PCA into key components that reflect (i) environmental factors, (ii) safety factors, and (iii) natural factors. Frequency distributions reflecting the intensity of respondents' opinions were used to assess how tourism was influenced by climate and natural hazards.

In addition, researchers have conducted ordinal logistic regression analysis to evaluate the associations between environmental challenges and the number of instances of tourism disruption, which is the dependent variable. The independent variables were also some of the major environmental hurdles, such as flooding, deforestation, inadequate infrastructure capacity, and environmental pollution. Odds ratios (ORs) and p values were obtained to express the results of the models and to analyse the likelihood and significance of each predictor in the model (Wald test). Model fit statistics (likelihood ratio test, pseudo R^2 [Nagelkerke], and test of parallel lines) were investigated to sustain the robustness of the analysis. Finally, crosstabulation and percentages were used to analyse the respondents' perceptions regarding sustainable environmental management and policy support for tourism development. All analyses were performed at the 95% confidence level ($p < 0.05$).

3 Results

The socioeconomic characteristics of the respondents are summarized in Table 1. There were more females (54.9%) than males (45.1%) in the sample. Most of the respondents were young adults, and 63.7% were aged less than 35 years. A large proportion of the respondents (45.6%) were married, and singles accounted for another 38.8%. With respect to education level, most (54.9%) held tertiary degrees, a potentially more environmentally and tourism-literate cohort.

Table 1: Sociodemographic characteristics of the respondents

Variable	Category	Frequency	Percent
Gender	Male	165	45.1
	Female	201	54.9
Age Group	18–24	109	29.8
	25–34	124	33.9
	35–44	68	18.6
	45–54	48	13.1
	55+	17	4.6
Marital Status	Single	142	38.8
	Married	167	45.6
	Divorced	35	9.6
	Widowed	22	6
Education	Primary	45	12.3
	Secondary	85	23.2
	Tertiary	201	54.9
	Other	35	9.6
Occupation	Civil Servant	122	33.3
	Self-Employed	192	52.5
	Student	45	12.3
	Unemployed	7	1.9
Monthly Income (₦)	< 50,000	15	4.1
	50,000–100,000	76	20.8
	100,001–200,000	151	41.3
	200,001–300,000	45	12.3
	> 300,000	79	21.6
Nationality	Nigerian	282	76.8
	Chinese	25	6.8
	British	21	5.7
	Indian	14	3.8
	South African	12	3.3
	German	8	2.2
	American	5	1.4

Among the respondents, the largest percentage (52.5%) were self-employed, followed by civil servants (33.3%) and students (12.3%), and only 1.9% were unemployed. Most (41.3%) had a salary range of ₦100,001– ₦200,000, followed by 21.6% above ₦300,000, which shows that tourists have a higher disposable income. The sample was predominantly Nigerian (76.8%), but a significant minority were foreigners (23.2%), especially Chinese (6.8%) and British (5.7%), indicating Kaduna's capacity for a local international tourism hub.

Table 2: Tourists' Perceived Environmental and Infrastructural Determinants of Destination Choice

Variable	SD	S	N	A	SA	Mean	PC1	PC2	PC3
Natural scenery influences decisions	25	36	62	151	92	3.83	-0.11	-0.96	0.24
Clean, well-maintained environment	9	11	31	123	192	4.34	-0.38	0.21	-0.87
Waste discourages visitation	14	14	22	141	175	4.23	-0.46	0.09	0.88
Pollution affects interest	3	10	32	119	202	4.38	-0.46	0.11	0.88
Security & safety influence choices	0	0	3	102	261	4.7	-0.53	-0.12	-0.17
Climate conditions affect decisions	8	28	20	122	188	3.87	-0.46	0.02	-0.17
Biodiversity attracts visits	22	29	48	155	112	4.2	-0.12	-0.97	0.14
Accessibility & infrastructure	14	10	19	141	182	2.99	-0.46	0.07	-0.2

Component	Eigenvalue	% Variance Explained	Cumulative %
PC1	3.12	34.70%	34.70%
PC2	2.47	27.50%	62.20%
PC3	1.25	13.80%	76.00%

Table 2 presents the determinants of destination choice as perceived environmental and infrastructure determinants. The principal component analysis (PCA) identified three factors that drive tourists' perceptions of environmental and infrastructural conditions in the Kaduna metropolis. The first principal component (PC1) explained 34.7% of the total variance and was highly correlated with environmental cleanliness and waste management, pollution, and climate variables. The negative loadings for clean + well-maintained (-0.38), waste-discouraging visitation (-0.46), pollution-affecting interest (0.46), and climate limitations (0.46) reflect a common latent dimension of environmental quality, suggesting that tourists view managed and clean surroundings as crucial elements of their positive visitation experience. This coincides with the average ratings of cleanliness (4.34), waste disposal (4.23), and pollution control (4.38), which received the highest scores, indicating their role in determining the destination's attractiveness.

The second principal component (PC2), explaining 27.5% of the variance, gives stronger weights to variables representing natural scenery (-0.96) and biodiversity (-0.97) than to the other variables, suggesting that PC2 reflects the impacts of ecological endowments on tourism. This suggests that tourists see natural scenery and biodiversity as important destination attributes, indicating that ecological capital is a key driver of tourism demand in cities. Biodiversity (mean = 4.2) and natural scenery (mean = 3.83) have high mean scores, which again reinforce the importance of these attributes for attracting visitors even in the presence of other environmental or infrastructure deficiencies.

The third factor (PC3) explained 13.8% of the variance and correlated positively with waste management (0.88) and pollution (0.88), and negatively with a clean environment (-0.87), suggesting a secondary environmental management concept involving sanitation practices. Although this third factor (PC3) accounts for less variance than the first two factors (PC1 and PC2), it confirms that waste disposal and pollution are still perceived separately by tourists, even though they might lead to satisfaction and an intention to revisit individually. Accessibility & Infrastructural elements, while very important for tourism functionality, have low mean scores (2.99) and moderate loadings across all components (0.68 to 0.73), indicating that while tourists feel less favourable to Kaduna Metropolis in terms of these elements, the deficiency in infrastructure is recognized by tourists as a hindrance to full tourism satisfaction. On the other hand, security and safety, which are the highest-rated variables (mean = 4.7) and load strongly on PC1 (-0.53), underscore that tourists value safe and secure environments more than other environmental or infrastructural attributes.

Together, the three components account for 76% of the total variance explained, providing empirical evidence that environmental quality, ecological endowments, and sanitation-related management practices are important latent dimensions that influence tourists' perceptions. The results imply that cleanliness, waste disposal, biodiversity maintenance, and the security of the area are the most crucial attributes that contribute to tourist fulfilment and must be targeted as interventions to facilitate visible improvement in satisfaction, whereas infrastructure expansion is complementary and distant in the list of needs of tourism at such times, leading to destination sustainability.

Table 3: Influence of climate and hazards on tourism

Factor	Not at all	Slightly	Moderately	Strongly	Very Strongly
Seasonal climate (rainy/dry season)	22	38	60	141	105
Presence of natural hazards	2	0	28	81	255

Table 3 shows how climate conditions and natural hazards influence tourism activities. Regarding the seasonal climate, the majority of respondents agreed that variations in weather conditions affect tourism. A total of 141 respondents said that the influence was strong, and 105 said that it was very strong. This implies that, as evidenced by the form of the response distribution and the relationship between the timing of the rainy and dry seasons, the timing of the rainy and dry seasons is also a meaningful determinant of tourism activity. For example, outdoor activities and access to some tourist sites may be limited during the rainy season due to flooding or poor road conditions. However, the dry season might result in an influx of tourists due to pleasant weather, comfort, and security. This was particularly true for the 22 respondents who were in the 'seasonal climate does not influence tourism' category, demonstrating the ongoing impact of seasonal weather on tourist decisions.

Responses to natural hazards are even more unanimous. Though 255 respondents said it was very strong, and 81 said it was strong. Two respondents indicated that natural hazards had no influence on tourism, and no one chose them as slightly influential. This clearly demonstrates that tourism activities are considerably deterred by natural hazards, including floods, droughts, erosion, or landslides. When there is such danger, tourists tend to worry about their safety, and places that are vulnerable to such threats will see a low rate of visits and a low level of traveler mileage.

Table 4: Relationship between Environmental Challenges and the Frequency of Tourism Disruptions

Predictor Variable	OR	95% CI	p value	Significance
Deforestation	1.45	1.08 – 1.94	0.014	*
Flooding/Drainage	2.12	1.50 – 2.98	<0.001	**
Waste Management	1.56	1.11 – 2.20	0.011	*
Biodiversity Loss	1.63	1.10 – 2.41	0.015	*
Poor Maintenance	2.4	1.68 – 3.44	<0.001	***
Climate Change	1.88	1.22 – 2.90	0.004	**

Note: OR = odds ratio; CI = confidence interval; *p < 0.05; **p < 0.01; ***p < 0.001

The associations between environmental challenges and the number of tourism disruptions are shown in Table 4. The results show that environmental issues significantly affect the frequency of tourism disruptions in the Kaduna metropolis, highlighting how ecological, infrastructural, and climatic conditions are intricately related to the sustainability of urban tourism. Among all the variables, inadequate maintenance of tourism infrastructure was one of the strongest predictors (odds ratio 2.40, $p < 0.001$) of significantly more frequent tourism disruptions (i.e., a greater likelihood that tourism infrastructure becomes unusable due to insufficient maintenance of facilities, amenities, and pathways). This finding further underscores the importance of reliable infrastructure to ensure the continuity of tourism and connects with earlier findings that emphasized the need for working functional facilities to improve visitor satisfaction and destination resilience. The impact of flooding and drainage problems was also significant (OR = 2.12, $p < 0.001$), as tourism sites are sensitive to heavy rainfall and poor drainage systems that restrict accessibility, lower visitor safety, and degrade destination attractiveness.

Factors related to environmental degradation, namely deforestation (OR = 1.45, $p = 0.014$) and biodiversity loss (OR = 1.63, $p = 0.015$), were positively correlated with disruption frequency, indicating that habitat and vegetation loss reduce the ecological and scenic value of the area. The other significant waste management challenge was improper handling of solid and liquid waste (OR = 1.56, $p = 0.011$), indicating that improper handling of solid and liquid waste not only degrades the environment but can also affect human health and determine tourists' perceptions, visitation, and repeat visits. Climate change effects (OR = 1.88, $p = 0.004$), whereas weather, such as erratic weather patterns, temperature fluctuations, and extreme events, led to greater potential for tourism disruptions, also pointed to the general sensitivity of urban tourism systems to the external stressors of global human–environment relationships.

Overall, these findings point to infrastructural shortcomings, ecological collapse, and climate vulnerability as drivers of tourism disturbance in the Kaduna Metropolis. This finding reinforces that infrastructure-related factors are antecedent to extreme climate events and can therefore respond quickly to

targeted interventions, such as improved maintenance, better drainage systems, and effective waste management, to reduce short-term tourism disruptions. Simultaneously, long-term approaches focused on environmental restoration, biodiversity, and climate adaptation must be prioritized to bolster urban tourism's resilience and sustainability. These results offer empirical insights for policymakers, site managers, and urban planners, suggesting that integrated management of infrastructure, environmental quality, and climate-related risks is appropriate for supporting sustainable urban tourism planning.

Table 5: Sustainable Environmental Management and Policy Support for Tourism

Question	Category	Frequency	Percentage (%)
Would improved environmental management encourage more visits?	Yes	239	65.3
	No	127	34.7
Most effective practices for sustainability	Waste disposal	172	47
	Afforestation & reforestation	76	20.8
	Biodiversity protection	51	13.9
	Environmental awareness campaigns	45	12.3
	Climate adaptation measures	22	6
Government policies can improve tourism sustainability	Strongly Disagree	15	4.1
	Disagree	42	11.5
	Neutral	82	22.4
	Agree	91	24.9
	Strongly Agree	136	37.2
Most effective policy strategies	Infrastructure improvement	–	38.5
	Tourism promotion & awareness	–	21.3
	Enforcement of environmental regulations	–	16.9
	Incentives for eco-friendly operations	–	12.3
	Community engagement	–	10.9

Table 5 presents the respondents' perceptions of sustainable environmental management and tourism development with policy support. These findings shed light on improved environmental practices and government interventions that enhance the potential for sustainable tourism and tourism inflows. More than two-thirds of respondents (65.3%) indicated that better environmental management would lead to greater willingness to visit tourist destinations. On the other hand, only 34.7 percent disagreed with the assessment. The results show that most respondents believe that a clean, organized, and eco-friendly environment enhances the attractiveness of innovative tourism. Sustainable environmental stewardship is considered an important driver of tourism because tourists historically choose destinations with higher environmental quality, safety, and scenic beauty.

In terms of best practices for sustainability, waste disposal management ranked first among the options (47 percent). This implies that the cleanliness and attractiveness of tourist spaces, as well as respondents' perceptions of appropriate waste disposal and sanitation, are important. Inadequate solid waste management often leads to pollution, bad odors, and the degradation of scenic beauty, ultimately repelling tourists. Afforestation and reforestation (20.8%) followed, and most importantly, ecosystem restoration and maintenance of vegetation for a good climate, good ecosystem function, and beauty. Protecting biodiversity (13.9%) and environmental awareness campaigns (12.3%) were also identified as relevant sustainability strategies, highlighting the importance of education and conservation as integral parts of the tourism ecosystem. In contrast, climate adaptation measures (6%) received the least support, as many respondents may not have connected proactive climate strategies, such as flood control or heat mitigation, directly with tourism resilience.

Regarding policy support, these replies show enthusiasm for government objectives. In total, 62.1% (37.2% strongly agree and 24.9% agree) feel that

sustainability in tourism can be markedly improved by government policies. Only a small minority (15.6%) disagreed; 22.4% were neutral. This suggests that the respondents have confidence that, in addition to sound environmental regulation, funding, and politically acceptable and practical) Strategic planning is a critical input for sustainable tourism development. This level of consensus also suggests public expectations that governments do more to ensure that the environmental protection embodied in the model code is accompanied by sustainable tourism practices.

While infrastructure improvement (38.5%) was the most impactful policy, this suggests that by increasing access to roads, water supplies, waste systems, and electricity at tourism sites, tourism efficiency and tourist satisfaction significantly improved. This is followed closely by tourism promotion and awareness (21.3%), indicating the need for an ongoing education and marketing campaign that informs consumers about the benefits of sustainable tourism for both tourists and local communities. The enforcement of environmental regulations (16.9%) was also highlighted as a key aspect of policy, reflecting the strict implementation of environmental standards to prevent environmental degradation. In addition, information regarding incentives for green operations (12.3%) and community engagement (10.9%) was perceived as supportive strategies, thereby acknowledging that local communities and actors in the private sector play important roles in sustainable tourism governance.

4 Discussion

The outcomes of this study highlight the critical significance of environmental quality in shaping tourism sustainability in the Kaduna metropolis. According to global evidence (Perkumienė et al., 2023; Shimizu et al., 2023), security and safety are the most important factors influencing tourist visits. The near-unanimous prioritization of safety (99.2%) underscores its unquestionable relevance in destination selection, mirroring broader security concerns that continue to hamper Nigeria's tourist economy. Cleanliness, waste management, and the absence of pollution are important factors in determining site attractiveness. These findings are consistent with those of Koliotasi et al. (2023), who reported that poor waste management negatively affects destination image and visitor satisfaction. The heavy emphasis on environmental cleanliness shows that even simple actions, such as rubbish collection and pollution control, could significantly boost the competitiveness of Kaduna's tourism sector.

The findings also emphasize the importance of ecological endowments, with the natural landscape and biodiversity functioning as strong motivators for tourism. This finding is congruent with that of Tangban et al. (2025), who identify wildlife and landscapes as core natural capital for sustainable tourism. However, the significance of this result lies in the fact that environmental endowments alone do not translate into tourism benefits unless they are supported by stable governance, routine maintenance, and functional accessibility. This matters because it challenges the resource-centric assumption that natural attractions are self-sustaining drivers of tourism demand. Instead, the results underscore that tourism competitiveness depends on integrating ecological assets with infrastructural reliability and institutional capacity. Where instability, neglect, or poor access persists, natural resources risk becoming economically underutilized or environmentally degraded, thereby weakening their potential contribution to sustainable tourism and local development.

The strong influence of seasonal climatic conditions and natural hazards on visitation patterns underscores the Kaduna metropolis's vulnerability to environmental variability. The tendency of many respondents to avoid destinations affected by flooding, poor drainage, or extreme weather is significant because it demonstrates how climate-related disruptions translate directly into behavioral responses that reduce tourism demand. This matters for destination planning, as it shows that environmental hazards do not merely pose episodic risks but systematically undermine accessibility, visitor confidence, and revenue stability. The identification of poor site maintenance as the most powerful deterrent to visitation further reveals that tourism vulnerability is not driven solely by climatic forces but is amplified by governance and institutional capacity. This finding is important because it indicates that many climate-related impacts on tourism are preventable through routine maintenance, effective drainage management, and proactive oversight of infrastructure. Consequently, strengthening institutional responsiveness and maintenance regimes may offer more immediate and cost-effective gains for tourism sustainability than climate mitigation efforts alone.

Importantly, the survey revealed widespread acceptance of the need for sustainable environmental management. The majority of respondents viewed waste management, afforestation, and biodiversity conservation as vital to tourism development. However, perceptions of effectiveness were mixed, with roughly one-quarter of respondents rating existing measures as inadequate. This indicates a perceived implementation gap, where respondents felt that existing environmental management efforts have not translated into consistent improvements at tourism sites. Despite these insights, the study has several limitations that should be acknowledged. Data collection was concentrated largely within hotel-based

tourism facilities, which may introduce sectoral bias and limit the generalizability of the findings to other forms of tourism, such as cultural, heritage, or nature-based attractions outside formal hotel environments. The study also adopted a cross-sectional design and relied solely on tourists' perceptions at a single point in time. As a result, the findings capture perceived conditions rather than objectively measured environmental or infrastructural changes over time, and causal inferences should therefore be made with caution. Future studies could address these limitations by incorporating longitudinal data, objective environmental indicators, and a broader range of tourism destinations and stakeholder groups.

The study shows that sustainable tourism in Kaduna requires a two-pronged approach: addressing immediate issues such as insecurity, garbage, and flooding while also investing in long-term solutions such as afforestation, biodiversity protection, and infrastructure improvements. Strengthened government policy, private-sector investment, and community participation are needed to close current gaps and ensure that environmental management effectively contributes to tourism promotion and economic development.

5 Conclusion

Research has revealed that environmental factors are essential to the sustainability of tourism development in the Kaduna metropolis. Protection and safety, sanitation, garbage collection, pollution control, accessibility, scenic beauty, and faunal diversity have been identified as essential components for attracting tourists. Shifts in seasonal climate unpredictability and environmental hazards, such as flooding and poor drainage, have been found to have a massive impact on visitation patterns, with 55% of tourists avoiding specific locations altogether due to insecurity and a lack of maintenance. Regression analysis revealed that the causes with the greatest impact on tourism sustainability were poor site care and flooding, whereas the causes that were even more damaging to site attractiveness were deforestation, waste mismanagement, biodiversity loss, and climate variability.

The data also reflect popular support for environmental management actions such as waste disposal, tree planting, and biodiversity conservation. However, perceptions of differential effectiveness indicate a disconnect between policy goals and outcomes. Finally, the results of this study imply that effective environmental management, support for infrastructure, and increased administrative capacity are vital for safeguarding and sustaining the Kaduna metropolis.

Studies have shown that improving policing, surveillance, and local-level security measures at tourism sites can increase traveler confidence and safeguard tourism investments. More serviceable waste management practices and sanitation practices, such as more frequent waste collection and recycling initiatives as well as stronger enforcement of environmental regulations, could help keep destinations attractive.

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