

Impact of Tourism Activities on the Ecosystem. A Case Study of Gashashaka-Gumti National Park, Nigeria

Andembutop Kwesaba Danjuma¹, Kehinde Oyatayo² & Nsemma Ando³

Department of Hospitality and Tourism Management, Federal University Wukari, Nigeria

Department of Geography and Meteorology, Ball State University, Muncie, Indiana.

Department of Hospitality and Tourism Management, Federal University Wukari, Nigeria

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Abstract: *This study assessed the impact of tourism activities on the ecosystems of Gashaka-Gumti National Park (GGNP), Nigeria, with particular emphasis on the effects of tourism on vegetation, wildlife, soil, water resources and the general environmental condition of the park. The study adopted a mixed-method approach involving questionnaires, direct field observation and analysis of archival records. The study population comprised park staff and enclave dwellers within the park. A total of 496 questionnaires were administered, consisting of 168 questionnaires for park staff and 328 for enclave dwellers. Data obtained from the questionnaires were analyzed using descriptive statistics, including frequencies, percentages, means and standard deviations, while observations and archival records were analyzed thematically and descriptively. The findings revealed that tourism activities exert considerable pressure on the ecosystems of the park. Waste accumulation was identified as the most severe tourism-related environmental impact, with a mean score of 4.42, followed by vegetation loss and trampling (4.21), wildlife disturbance (4.13), and soil erosion and compaction (3.92). Noise pollution (3.45) and water pollution (3.16) were rated as moderate impacts. Field observations from 12 sites further showed that waste or litter was present in 83.3% of the sites, vegetation trampling or damage in 75.0%, soil erosion and trail widening in 66.7%, wildlife disturbance or absence in 58.3%, and water pollution or turbidity signs in 41.7% of the sites. Archival records also indicated an increase in tourist visitation from 2,270 visitors in 2016 to 4,734 in 2025, representing an overall increase of 108.5%. During the same period, documented environmental concerns increased from 29 incidents in 2021 to 71 in 2025, with waste accumulation, vegetation trampling and wildlife disturbance being the most frequently recorded concerns. The study concludes that although tourism contributes to environmental awareness, conservation interest and socioeconomic opportunities, poorly managed tourism activities pose significant threats to the ecological integrity of GGNP. The study recommends strengthened visitor management, regular environmental monitoring, improved waste-management systems, protection of wildlife, environmentally friendly tourism infrastructure, community participation, enhanced enforcement of conservation regulations, environmental education and the establishment of appropriate carrying-capacity limits for major tourist sites.*

Keywords: ecological integrity, environmental impact, sustainable tourism, vegetation and wildlife

INTRODUCTION

Tourism has become an important component of socioeconomic development and an increasingly significant mechanism for promoting the conservation and sustainable utilization of natural resources. Nature-based tourism, ecotourism and wildlife tourism are particularly dependent on protected areas because forests, wildlife, rivers, mountains, landscapes and other natural features constitute major attractions for visitors. Tourism can generate employment, government revenue, local business opportunities and financial resources for conservation. It can also increase public awareness of biodiversity and encourage local communities and other stakeholders to attach greater economic and social value to natural resources. However, tourism is a potentially double-edged activity because the same natural resources that attract visitors can be degraded when tourism activities are poorly planned, inadequately regulated or exceed the ecological carrying capacity of an area (Convention on Biological Diversity [CBD], 2007).

The relationship between tourism and ecosystems is therefore complex. On the positive side, tourism revenue can provide financial support for protected-area management, wildlife protection, habitat restoration, environmental education and research. Tourism can also create economic incentives for conservation where local communities benefit directly from tourism activities. The Convention on Biological Diversity recognizes that well-managed tourism can contribute to biodiversity conservation by generating revenue for protected-area management and by increasing knowledge and appreciation of biological resources (CBD, 2007). Similarly, the CBD guidelines emphasize that tourism in protected areas should be managed in ways that contribute to conservation objectives while minimizing adverse environmental effects (CBD, 2004).

Despite these potential benefits, tourism activities can exert considerable pressure on ecosystems. The construction and use of tourist facilities, roads, trails, accommodation facilities and recreational infrastructure may result in vegetation clearance, habitat modification, soil compaction, erosion and landscape alteration. Similarly, recreational activities such as hiking, trekking, wildlife viewing, camping, off-road driving, fishing and other forms of nature-based recreation can disturb wildlife, damage vegetation and increase the risk of pollution. Increased human presence may alter animal behaviour, particularly where visitors approach wildlife too closely or enter sensitive breeding, feeding or resting areas. Tourism can also increase demand for water, energy, food and other natural resources, while generating solid waste, wastewater and other forms of pollution. The CBD (2007) identifies land-use change, resource consumption, habitat alteration, wildlife disturbance, pollution, erosion and inappropriate visitor behaviour among important environmental consequences that can arise from poorly managed tourism.

The ecological consequences of tourism are particularly important in protected areas because many of these areas contain fragile ecosystems and species that are sensitive to human disturbance. The CBD tourism guidelines specifically recognize terrestrial, mountain, riparian and other vulnerable ecosystems as areas requiring careful tourism planning, impact assessment, monitoring and

adaptive management (CBD, 2009). Tourism pressure can become cumulative where visitor activities interact with other anthropogenic pressures such as agriculture, livestock grazing, illegal hunting, fuelwood collection, settlement expansion and infrastructure development. Consequently, assessing tourism impacts requires consideration not only of individual activities but also of their combined effects on vegetation, wildlife, soil, water resources, habitats and overall ecosystem stability.

In Nigeria, national parks constitute important components of the country's protected-area system and provide opportunities for biodiversity conservation, scientific research, environmental education and tourism. Among these protected areas, Gashaka-Gumti National Park is particularly significant because of its size, ecological diversity and biological resources. The park is Nigeria's largest national park and extends across parts of Taraba and Adamawa States. It contains a remarkable variety of ecological zones, including Guinea savanna, Sudan savanna, lowland rainforest, montane rainforest and montane grassland. These different ecological zones support diverse plant and animal communities and make the park an important area for biodiversity conservation and nature-based tourism (Nigeria National Parks Service, 2023).

Gashaka-Gumti National Park possesses substantial tourism potential because of its diverse landscapes, wildlife, vegetation, rivers, mountains, scenic environments and opportunities for hiking, wildlife observation and other nature-based recreational activities. The park also contains important fauna, including chimpanzees, elephants, giant eland, leopard, lion, golden cat, buffalo, hippopotamus and numerous other species. In addition, 477 bird species have been recorded in the park, demonstrating its importance as a habitat for avian biodiversity (Nigeria National Parks Service, 2023). The ecological significance of the park makes the development of tourism potentially beneficial for conservation, but it simultaneously means that inappropriate tourism practices could expose sensitive habitats and species to increasing environmental pressure.

Previous research has demonstrated the considerable ecotourism potential of Gashaka-Gumti National Park. Oruonye *et al.* (2017), for example, reported that the park received 6,713 local tourists and 612 international tourists between 2005 and 2015 and generated approximately ₦44 million in revenue during the period. The study also identified employment generation and the park's considerable wildlife and natural attractions as important aspects of its tourism potential. However, poor accessibility, inadequate infrastructure, insufficient publicity and poaching were identified as major constraints to tourism development in the park. More recent evidence indicates that tourist visitation has increased over time, with recorded tourist numbers rising from 485 visitors in 1993 to 2,456 in 2023, although visitor numbers declined during the COVID-19 period before recovering subsequently (Kwesaba & Jemimah, 2025).

The increasing relevance of tourism to Gashaka-Gumti National Park raises important environmental questions. As visitation increases, tourist movements, transportation, accommodation, recreational activities and associated infrastructure may place additional demands on the park's ecosystems. Hiking and trekking may contribute to trail widening, soil compaction

and vegetation damage; vehicles may disturb wildlife and contribute to soil erosion and habitat fragmentation; camping and recreational activities may generate waste and increase pressure on water and fuel resources; while excessive or poorly managed wildlife viewing may alter animal behaviour. Similarly, the development and maintenance of tourist facilities can involve vegetation removal and modification of natural habitats. These impacts may be relatively localized initially but can become more significant when tourism expands without effective environmental monitoring and visitor-management systems.

Recent research specifically examining tourism development in Gashaka-Gumti National Park provides evidence that tourism can produce both environmental benefits and adverse effects. Silas *et al.* (2025) found that tourism has the potential to support environmental protection and conservation through increased awareness and economic incentives, but also identified resource depletion, pollution and physical landscape degradation as potential consequences of tourism development within and around the park. The study therefore emphasized the importance of ecotourism strategies, balanced resource use and appropriate planning to ensure that tourism remains environmentally sustainable.

The issue is particularly important because the ecological integrity of Gashaka-Gumti National Park extends beyond the immediate boundaries of tourist facilities. The park contains important catchment areas and diverse forest ecosystems that perform essential ecological functions, including habitat provision, biodiversity conservation, soil protection and water regulation. Its location along the Nigeria-Cameroon border also gives it significance for transboundary conservation and ecological connectivity. The Nigeria National Parks Service identifies opportunities for transboundary conservation and ecotourism through the park's relationship with protected areas in Cameroon (Nigeria National Parks Service, 2023). Consequently, environmental degradation within the park could have implications not only for individual species and habitats but also for wider ecosystem processes and conservation objectives.

The potential conflict between tourism development and ecosystem conservation makes environmental assessment and monitoring particularly necessary. Tourism should not simply be assessed in terms of visitor numbers, revenue generation and employment; its ecological consequences must also be evaluated. Important indicators include changes in vegetation condition, wildlife abundance and distribution, soil disturbance, water quality, waste generation, habitat condition and the level of human disturbance experienced by wildlife. The CBD (2009) recommends baseline assessment, impact assessment, impact management, monitoring, reporting and adaptive management as essential components of tourism management in areas of biological importance.

Therefore, the study of the impact of tourism activities on the ecosystems of Gashaka-Gumti National Park is important for understanding whether existing tourism practices are compatible with the park's conservation objectives. While tourism can provide economic incentives and strengthen conservation, uncontrolled or poorly managed tourism can contribute to habitat

degradation, pollution, wildlife disturbance, vegetation loss and other ecological changes. Determining the nature and extent of these impacts is consequently essential for developing appropriate visitor-management strategies, strengthening environmental protection and promoting sustainable tourism. Such an assessment can provide empirical information to park managers, government agencies, conservation organizations, tourism operators and local communities on how tourism can be managed in a manner that maintains the ecological integrity of Gashaka-Gumti National Park while allowing its tourism potential to contribute to sustainable development.

MATERIALS AND METHODES

Study Area

The Gashaka-Gumti National Park is located between latitudes 7° 56' and 7° 59' N and longitudes 11° 48' and 11° 54' E. The park's total area is approximately 6,731 km². The park is located in the states of Adamawa and Taraba (Fig. 1). The park's Gumti section is located in Adamawa State, while the Gashaka area is located in Taraba State (Danjuma *et al.*, 2023). The name of the park was inspired by two (2) of the region's oldest and most historic settlements: Gashaka village in Taraba State and Gumti village in Adamawa State. The Park is bounded to the north by Tongo Local Government, to the east by the Republic of Cameroon, to the west by Bali Local Government/Gashska Local Government and to the South by Sardauna Local Government. The Federal Government of Nigeria established the Gashaka-Gumti National Park in 1991 by merging the Gashaka Game Reserve with the Gumti Game Reserve. The park, like any other park in Nigeria, was established as a protected area for the purpose of nature conservation, recreation, ecotourism, scientific and medical research and to promote art, craft and cultural value of the indigenous people surrounding the park (Mubi, 2010; Danjuma, 2023).

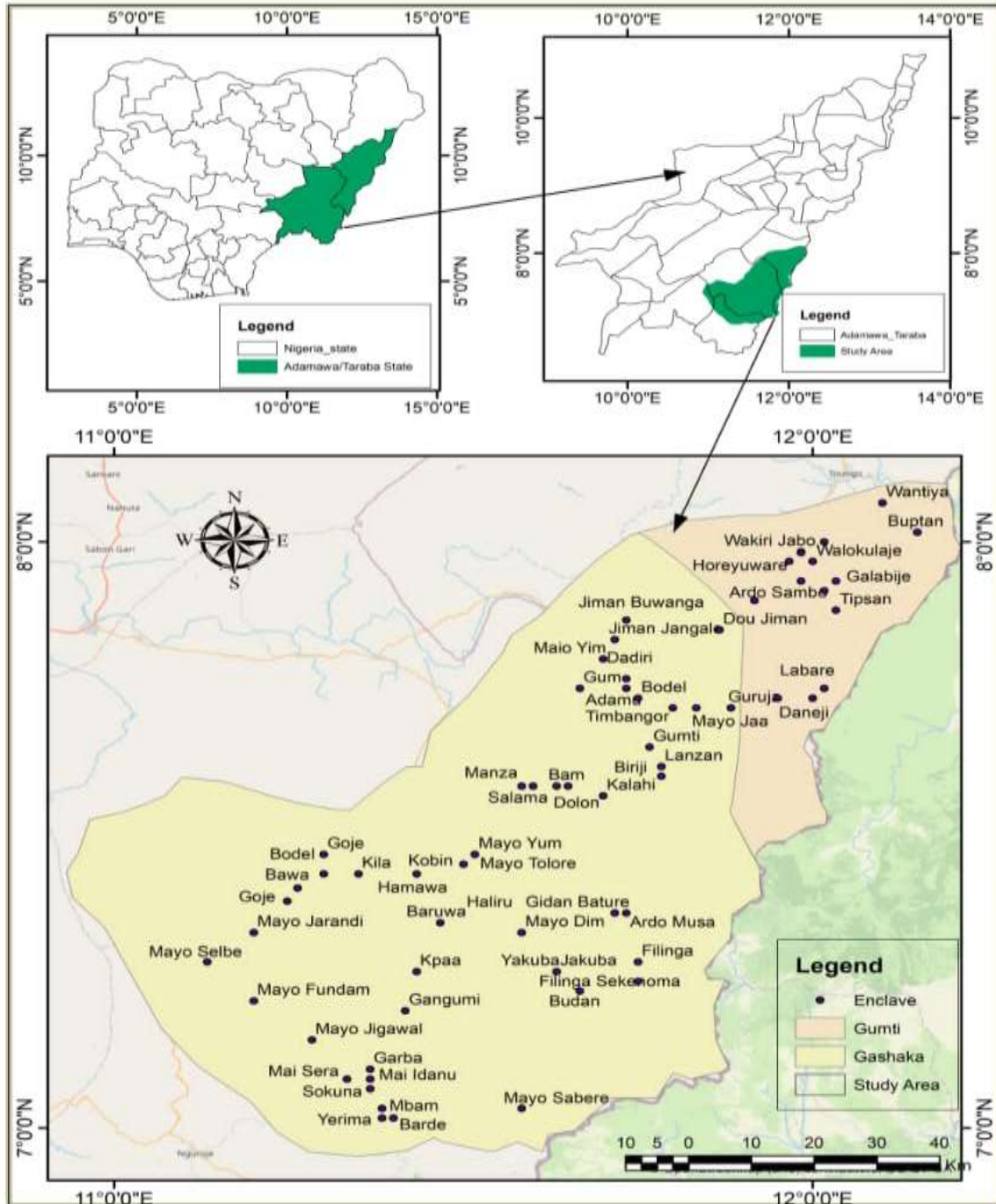


Figure 1.1: Gashaka Gumti National Park, the Study Area

Source: Taraba State Geographic Information System (TAGIS) (2023)

The climate of Gashaka-Gumti National Park is marked by rainy and dry seasons. The rainy season usually starts in March/April and lasts till October/November, while the dry season begins in October/November to March/April of every year. The park has temperature range of 18°C (64°F) to 36°C (96°F) and an annual rainfall of about 1,500mm with a single rainfall maxima in September (Danjuma *et al.*, 2023). The dry season experienced in the study area begins in November and lasts till March. It is characterized by northeasterly or the harmattan wind from Sahara Desert. The average temperature of GGNP is 29°C while the humidity level of the area is at an average of 38 percent (Mubi, 2010; Danjuma *et al.*, 2023).

The Northern, Gumti sector of the Park is relatively flat, whilst the Southern, Gashaka sector is more mountainous. This rugged terrain is characterised by steep, thickly forested slopes, deep plunging valleys, precipitous escarpments and swiftly flowing rivers. Altitude ranges from 450 metres above sea level in the plains of the Northern sector, to the peaks and pinnacles of Mount Gangirwal (Mounting of death) in the Southern Park sector, which at a staggering 2,400 metres above sea level, represents Nigeria's highest mountain (Dunn, 2001; Mubi, 2010; Danjuma *et al.*, 2023).

There is a good drainage system in Gashaka-Gumti National Park as seen in Oruonye *et al.* (2017). The park is transversed by rivers such as Mayo Kam, Mayo Yim, Mayo Kpa, Mayo Gamgam, Mayo Beriji and Mayo Burtali which serve as a home to some aquatic animals and a good source of water to the surrounding settlements (Oruonye *et al.* 2017; Danjuma, 2023).

According to Mubi (2010), Gashaka-Gumti is composed of sedimentary rock. The sedimentary rocks in the region are known to be mineralized with lead (pb) and zinc (zn). The pre-Cambrian Basin also is considered the "oldest, crystalline, solid foundation in the country" and contains the igneous and metamorphic rock. The sedimentary rock is found in the basins that separate the basement complex landmass. The sedimentary rock, which is the main rock type in the area, leads to erosion and weathering of landforms within the park. The mountainous region of Gashaka-Gumti National Park provides an optimal landform for the local watershed.

The Gumti sector has very fertile soil which supports various agricultural activities of the enclave settlements within and around the park. Humic ferrisol and lithosols are mostly found in the higher altitudes, and ferruginous tropical soils at the lower elevations, with alluvial soils in river valleys (Danjuma *et al.*, 2023).

Gashaka-Gumti National Park is comprised of different vegetation zones and each of them with different characteristics of plants found.

- a. **Lowland Rainforest:** A lowland tropical rainforest, for example, has four vertical tiers: emergent canopy, base canopy, middle tier, and forest understory. Lowland forest is only found in the Park's southern lowland region, particularly along the riparian areas. Emergent trees can grow to be 35 to 50 m tall, and sometimes even higher; these species appear to poke through an otherwise fairly even canopy top, which is typically 25 to 30 m tall (Danjuma *et al.*, 2023). Danjuma *et al.*(2023) discovered emergent trees in the region to

include: *Khaya grandifolia*, *Ceiba pentandra*, *Milicia excelsa* and *Terminalia superba* while the base canopy consists of *Albizia spp.*, *Erythrophleum suaveolens* and *Ficus spp.* Mid-tier plants consist of intermediate height trees, tall shrubs and epiphytes that do not require the light intensity of the canopy trees such as *Celtis philippensis* and *Olax subscorpioidea*. The forest floor receives relatively little sunlight, and thus is rarely choked with vegetation; nevertheless, there are some low growing shrubs, ground trailing lianas, ferns, lichens and mosses.

- b. Guinea Savanna:** Apart from the montane and lowland forest in the southern parts of the park, the rest of the vegetation is savanna. The Guinea Savanna occurs in the lowland and sub-montane regions. It is characterized by the presence of grasses which are subjected to annual fires while the trees, shrubs and forbs are considerably scattered along the terrain (Danjuma *et al.*, 2023). Dominant woody species are *Lophira lanceolata*, *Daniellia oliveri*, *Azelia africana*, *Crossopteryx febrifuga*, *Piliostigma thonningii*, *Entada africana*, *Prosopis africana*, *Annona senegalensis*, *Combretum spp.* and *Terminalia schimperiana*. Also, characteristic dominant grasses include *Andropogon tectorum*, *Hyparrhenia rufa*, *Pennisetum polystachion*, *Ctenium sp.* and *Schizachryum sp.* On the hilly side, some species such as *Uapaca togoensis*, *Hymenocardia acida*, *Piliostigma thonningi* and *Bridelia atroviridis* are found to occur in pure stands with their stems and branches covered by epiphytic species of lichens, mosses, ferns (*Platyserium spp.*) and some orchids such as *Aerangis biloba*, *Angraecum subulatum*, *Bulbophyllum congolanum*, *Calypstrochilum christyanum*, *Calypstrochilum emarginatum*, *Eulophia horsfallii*, *Polystachya dolichophylla*, and *Rangaeria rhipsalisocila* are also found (Chapman *et al.*, 2014; Danjuma *et al.*, 2023).

Other species in this sub-ecosystem include *Khaya senegalensis*, *Alchornea cordifolia*, *Mussaenda elegans*, *Panicum maximum*, *Setaria megaphylla*, *Raphia sudanica*, *Phoenix reclinata*, *Breonadia salicina*, *Brachystegia eurycoma*, *Berlinia grandiflora*, *Erythrophleum suaveolens*, *Polysphaeria arbuscula*, *Vitex chrysocarpa*, *Uapaca heudelotii* and *Pandanus candelabrum*. Other noticeable geophytic forbs include *Costus spectabilis*, *Crinum zeylanicum*, *Crinum jagus*, *Amorphophallus sp.*, *Amorphophalus abyssinicus*, *Scadoxus multiflorus*, *Siphonochilus aethiopicus*, *Curculigo pilosa*, *Gloriosa superba*, and a shrub *Cochlospermum planchonii* (Chapman *et al.*, 2014; Danjuma *et al.*, 2023).

- c. Montane Vegetation:** The floristic composition differs from one point to another along the altitude because of slope, fire, grazing etc. leading to the formation of mosaic vegetation. The observed mosaic vegetation is made up of montane forest and grassland found in both northern and southern parts of the Park. The forests do not show any emergents but the canopy layer is discernible although it does not form a complete cover. Canopy trees include *Albizia gummifera*, *Symphonia globulifera*, *Croton monostachyus*, *Syzygium guineense subsp. bamendae*, *Prunus africana*, *Ficus spp.*, *Entandrophragma angolense*, *Strombosia scheffleri*, *Garcinia smeathmanni*, *Carapa procera*, *Bridelia*

speciosa, *Campylospermum flavum*, *Clausena anisata*, *Trema orientalis* and *Ritchiea albersii* (Chapman *et al.*, 2014; Danjuma, *et al.*, 2023).

d. The Grassland: This section of the park has been subjected to annual fire and grazing. The effect of both fire and grazing has prevented the vegetation growth, changed the floristic composition and allowed the development and expansion of fire resistant forest edge species like *Hypericum revolutum* which form thickets at the forest edge as observed at Chabbal Hendu (Danjuma *et al.*, 2023). Common grasses found include *Chloris pilosa*, *Eragrostis spp.*, *Paspalum scrobiculatum*, *Sporobolus africanus* and *Pennisetum sp.* Trees include *Entada africana*, *Combretum molle*, *Lophira lanceolata* and *Annona senegalensis* while scattered shrubs are *Sarcocephalus latifolius*, *Protea madiensis*, *Gardenia imperialis* and *Solanum aculeastrum* (Chapman *et al.*, 2014; Danjuma, *et al.*, 2023).

According to information contained in the park's archival record, there are eight registered enclave communities within the GGNP which include Gumti in the northern sector while Sebere, Chappal Tale, Chappal Shirgu, Chappal Nyumti, Chappal Hendu, Chappal Delam and Filinga in the southern sector. However, there are also some support zone and boundary communities located in and around the Park which include Gashaka, Majarandi, Mayo-Selbe, Bodel, Gidan Zaira, Adagoro, Gum, Karamti, Koti, Gangumi, Goje, Garba and Tappare among others. Chappal Delam, the most remote and inaccessible of all park enclaves, is situated in the Gotel Mountains along the international border with Cameroon (Chapman *et al.*, 2014; Danjuma, 2023). The headwaters of the River Ngiti and River Gamgam originate here (Fig.1). The general population of the park enclaves is estimated at 2,200 people as contained in the archival records of the Park (2016). The various livelihood activities of this population is causing a lot of challenges to the survival of the National Park which this study is out to investigate.

The ethnic groups in the study area, according to Oruonye *et al.* (2017), are Jibu, Dakka, Ndoola, Samba, Tigun, Gbaya, Tiv, Mambilla, Kaka and Fulani in the southern part of the park, while in the northern part are the Chamba, Kutim Potopore, Fulani, Dakka, Nyam-nyam and Kona. The major occupations of the enclave communities are peasant farming and livestock husbandry with over 5, 000 livestock within the Park. These activities do not only create numerous conservation challenges regarding wildlife, but puts increasing pressure on all natural resources especially in the vicinity of the enclaves (Chapman *et al.*, 2014; Danjuma, 2023).

Population of the Study

The population of this study consists of park staff, and enclave dwellers in the park. The park staff, numbering about 259 personnel, are responsible for policy implementation, conservation activities, and monitoring of tourist activities. The enclave dwellers, on the other hand, constitute a permanent population of about 2,200 people residing in settlements within the park. These groups represent different stakeholders: the park staff as managers of conservation policies, and the enclave dwellers as the local communities who experience both the positive and negative impacts of tourism in terms of livelihood opportunities, cultural exchange, and environmental stress.

Collectively, these populations provide a holistic view of how tourism interacts with conservation and community development in Gashaka-Gumti National Park (GGNP).

Sample Size and Sampling Technique

Two separate samples were used in this study; the staff of the Park and the enclave dwellers. Gashaka Gumti National Park has a staff strength of 259 out of which 168 of them are in the ecology unit. The 168 population is deemed manageable; hence the entire staff of the ecology unit of the Park constituted the sample population of this study. A total of 168 structured questionnaires were administered on the staff but only (156; 93%) were retrieved and their responses carefully analyzed through the SPSS version 25 using the descriptive analysis tools such as the distribution table, mean, standard deviation and pie chart. The sample population for the administration of the first set of questionnaires was restricted to the staff of the National Park because the information required are official and can only be responded to by the staff of the Park.

Gashaka-Gumti National Park houses eight (8) registered enclaves. The enclaves, according to the available archival data have a total population of 2,200. To determine the sample population of the enclaves for the administration of the second set of questionnaires, Cochran (1975) formula was used. Thus

Cochran formula:

$$n_0 = \frac{z^2 pq}{e^2} \dots\dots\dots 1$$

Where:

e is the desired level of precision (i.e. the margin of error 0.5),

p is the (estimated) proportion of the population which has the attribute in question, (i.e. 95%)

q is $1 - p$.

Z is 1.96

Therefore,

$$((1.96)^2 (0.5) (0.5)) / (0.05)^2 = 385.$$

So, a random sampling of 385 enclave dwellers of the target population should be enough to give the confidence level that is required.

Since the population under study is small, the sample size calculated above can be further modified by applying Cochran Formula for determining sample size for smaller populations:

$$n = \frac{z^2 pq}{1 + \frac{(n_0 - 1)}{N}} \dots\dots\dots 2$$

Where:

n_0 is Cochran's sample size recommendation,

N is the population size and

n is the new, adjusted sample size.

With the 2,200 enclave dwellers, sample size can be calculated thus:

$$385 / (1 + (384 / 2,200)) = 328$$

From the above, the sample population for the eight (8) enclaves is 328. Since the enclaves do not have the same population all over, the sample size for each of the enclaves was determined thus: total population of a given enclave divided by the sum total of the population of the eight (8) enclaves then multiplied by the total sampled population.

Table 1: Population of the Enclave Settlements

S/N	ENCLAVE COMMUNITY	TOTAL POPULATION	SAMPLED POPULATION	PERCENTAGE (%)
1	GUMTI	200	30	9.1
2	SEBERE	600	90	27.3
3	CHAPPAL TALE	150	22	6.8
4	CHAPPAL SHIRGU	500	74	22.7
5	CHAPPAL NYUMTI	200	30	9.1
6	CHAPPAL HENDU	200	30	9.1
7	FILINGA	250	37	11.4
8	CHAPPAL DELAM	100	15	4.5
	TOTAL	2,200	328	100

Source: Gashaka-Gumti National Park (2022)

A total of 328 multiple choice questionnaires were produced and administered randomly by the researcher as most of the respondents are not educated, hence cannot read and write.

Sources of Data

The study relied on both primary and secondary sources of data. The primary data were obtained through the use of structured questionnaires administered on park staff and enclave dwellers. It covered areas such as demographic characteristics, perceptions of tourism activities, observed environmental impacts, and awareness of conservation practices. This method was chosen because it allows for the collection of standardized data that can be easily analyzed statistically. Secondary data was obtained from archival records of the park.

Research Instrument

The main instrument for data collection was structured questionnaire, and observation checklists. The questionnaire was divided into sections: demographic information, tourism participation,

environmental impact perceptions, and conservation awareness. Observation checklists was used during field visits to systematically record physical evidence of tourism impacts such as trails, campsites, and waste disposal sites.

For secondary data, a document review guide was employed to extract relevant information from archival materials and published sources. This guide outlined key themes such as visitor statistics and historical records of environmental change. By using this tool, the study ensured consistency and focus in analyzing secondary data obtained from park archives.

Method of Data Collection

Data collection was conducted through field visits to GGNP. The researcher administered the questionnaires to community members, ensuring clarity and accuracy in responses. To complement this, the researcher conducted direct observations during site visits, especially in tourist hotspots like Chappal Waddi, forest trails, and camping areas. The use of multiple data collection methods helped triangulate findings and improve validity. To collect the secondary data, a formal letter was written to the park management requesting for archival records of reports of tourist activities in the park.

Method of Data Analysis

Data was analyzed using both quantitative and qualitative techniques. Quantitative data collected from questionnaires were coded and analyzed using Statistical Package for Social Sciences (SPSS) tools in conjunction with descriptive statistics such as frequencies, percentages, means, and standard deviations. Qualitative data from observations were analyzed thematically, identifying patterns and recurring themes. The integration of both analytical approaches provided a comprehensive understanding of the impacts of tourism on the ecosystem in GGNP.

RESULTS

Questionnaire Administration and Response Rate

A total of 496 questionnaires were distributed to respondents comprising 168 park staff and 328 enclave dwellers in and around Gashaka-Gumti National Park. All distributed questionnaires were duly retrieved and found to be completely and appropriately filled, resulting in a 100% response rate. Table 2 presents the summary of questionnaire administration and response rate.

Table 2: Questionnaire Distribution and Retrieval

Category	Number Distributed	Number Retrieved	Number Valid	Response (%)	Rate
Park Staff	168	168	168	100.0	
Enclave Dwellers	328	328	328	100.0	
Total	496	496	496	100.0	

Source: Field Survey, (2026)

As shown in Table 2, all 496 questionnaires distributed were retrieved and validated for analysis, representing a 100% response rate. This complete retrieval eliminates non-response bias and ensures that the findings are fully representative of the target population. The 100% response rate is exceptional for survey-based research and significantly enhances the validity and reliability of the study's conclusions.

Demographic Characteristics of Respondents**Demographic Characteristics of Park Staff****Table 3: Demographic Profile of Park Staff Respondents**

Variable	Category	Frequency	Percentage (%)
Gender	Male	128	76.2
	Female	40	23.8
Age	18–25 years	9	5.4
	26–35 years	44	26.2
	36–45 years	71	42.3
	46–55 years	35	20.8
	Above 55	9	5.4
Education	Primary	0	0.0
	Secondary	22	13.1
	Tertiary	146	86.9
Years of Service	< 1 year	4	2.4
	1–5 years	40	23.8
	6–10 years	58	34.5
	> 10 years	66	39.3

Source: Field Survey, (2026)

Table 3 reveals that the majority of park staff respondents were male (76.2%), reflecting the gender imbalance typical in conservation and law enforcement roles in Nigerian national parks. Regarding age distribution, the largest proportion (42.3%) were within the 36–45 years age bracket, indicating a relatively experienced workforce. Educational qualification data show that 86.9% of park staff possess tertiary education, which suggests adequate capacity to understand and implement

conservation policies. Furthermore, 73.8% of staff have served for over six years, implying substantial institutional knowledge and familiarity with park operations and challenges.

Demographic Characteristics of Enclave Dwellers

Table 4: Demographic Profile of Enclave Dwellers

Variable	Category	Frequency	Percentage (%)
Gender	Male	216	65.9
	Female	112	34.1
Age	18–25 years	57	17.4
	26–35 years	94	28.7
	36–45 years	102	31.1
	46–55 years	49	14.9
	Above 55	26	7.9
Education	No formal	111	33.8
	Primary	96	29.3
	Secondary	80	24.4
	Tertiary	41	12.5
Occupation	Farming	188	57.3
	Trading	62	18.9
	Artisan	48	14.6
	Others	30	9.1
Residency	1–5 years	27	8.2
	6–10 years	49	14.9
	11–20 years	105	32.0
	> 20 years	147	44.8

Source: Field Survey, (2026)

The demographic profile of enclave dwellers presented in Table 4 shows that males (65.9%) were more represented than females (34.1%), which is attributable to the cultural context where men are more often household heads and accessible for interviews. The age distribution indicates a predominantly adult population, with 59.8% falling within the economically active age bracket of 26–45 years. Educational attainment reveals that 33.8% have no formal education, while only 12.5% have tertiary education. This low literacy level has implications for environmental awareness and community participation in conservation programs.

Farming constitutes the primary occupation for 57.3% of respondents, underscoring the dependence of local communities on land and natural resources around the park. Notably, 44.8% of enclave dwellers have resided in the area for over 20 years, while 32.0% have lived there for more than a decade. This long-term residency indicates deep-rooted connections to the park landscape and suggests that their observations on environmental changes and tourism impacts carry considerable experiential validity.

Impacts of Tourism Activities on the Park's Ecosystems**Table 5: Impacts of Tourism Activities**

Environmental Component	Mean ($\bar{x}$)	Std. Deviation	Interpretation
Waste accumulation	4.42	0.71	Very High Impact
Vegetation loss/trampling	4.21	0.79	High Impact
Wildlife disturbance	4.13	0.76	High Impact
Soil erosion/compaction	3.92	0.88	High Impact
Noise pollution	3.45	0.92	Moderate Impact
Water pollution	3.16	1.01	Moderate Impact

Source: Field Survey, (2026)

As shown in Table 5, respondents rated waste accumulation as the most severe environmental impact of tourism in GGNP ($\bar{x}$ = 4.42), falling within the "Very High Impact" range. Vegetation loss and trampling ($\bar{x}$ = 4.21), wildlife disturbance ($\bar{x}$ = 4.13) and soil erosion compaction (3.92). Noise pollution ($\bar{x}$ = 3.45) and water pollution ($\bar{x}$ = 3.16) were rated as moderate impacts. The standard deviation values indicate reasonable consensus among respondents, though water pollution showed slightly higher variability in perceptions.

Table 6: Observation Checklist: Field Findings

Observation Item	Sites Observed (count)	Percentage (%)
Vegetation trampling/damage	9	75.0
Soil erosion / trail widening	8	66.7
Wildlife disturbance / absence	7	58.3
Waste (litter) presence	10	83.3
Water pollution / turbidity signs	5	41.7
Infrastructure impact (new trails)	6	50.0
High noise levels observed	4	33.3
Tourist off-trail movement	8	66.7
Conservation signage present	4	33.3
Community-interface conflicts seen	3	25.0

Source: Field Survey, 2026

Table 7 presents direct field observations from twelve sites within Gashaka-Gumti National Park and reveals clear evidence of tourism-related environmental pressures. Waste presence was the most widespread issue, observed in 83.3% of the sites, indicating inadequate waste management and visitor compliance. Vegetation trampling or damage was noted in 75.0% of the sites, while soil erosion and trail widening occurred in 66.7%, reflecting the physical impact of frequent foot

traffic and off-trail movement. Tourist movement outside designated trails was also observed in 66.7% of the sites, further contributing to vegetation loss and soil degradation.

Wildlife disturbance or reduced animal presence was recorded in 58.3% of the sites, suggesting behavioral avoidance linked to human activity, noise, or habitat disruption. Infrastructure impacts, such as the creation of new informal trails, were evident in half of the observed locations (50.0%), pointing to unplanned development pressures. Signs of water pollution or turbidity were identified in 41.7% of sites, indicating localized stress on aquatic resources. High noise levels were less frequent but still present in 33.3% of sites, which may exacerbate wildlife disturbance. Conservation signage was observed in only 33.3% of the sites, highlighting gaps in visitor guidance and environmental awareness. Lastly, community–park interface conflicts were observed in 25.0% of sites, suggesting localized tensions at the boundaries between conservation and human activity. Overall, the observation findings corroborate questionnaire responses and underscore the need for stronger visitor management, improved waste control, better signage, and enhanced monitoring to reduce the environmental impacts of tourism in the park.

Analysis of Archival Records

Archival records obtained from the Gashaka-Gumti National Park headquarters provided valuable historical data on tourist visitation patterns, documented environmental concerns, and management interventions over the past decade. The records reviewed included visitor entry registers, annual reports, management plans, incident reports, and correspondence between park authorities and conservation agencies.

Tourist Visitation Trends (2016–2025)

Table 8: Tourist Visitation Statistics for GGNP (2016–2025)

Year	Domestic Tourists	International Tourists	Total Visitors	Annual Change (%)
2016	1,847	423	2,270	—
2017	2,103	456	2,559	+12.7
2018	2,456	489	2,945	+15.1
2019	2,894	532	3,426	+16.3
2020	1,235	178	1,413	-58.8
2021	1,892	267	2,159	+52.8
2022	2,678	384	3,062	+41.8
2023	3,245	451	3,696	+20.7
2024	3,712	523	4,235	+14.6
2025	4,156	578	4,734	+11.8

Source: Gashaka-Gumti National Park Archival Records (2026)

Analysis of visitor statistics over the ten-year period (2016–2025) reveals a steady upward trend in tourist arrivals, with total visitors increasing from 2,270 in 2016 to 4,734 in 2025, representing an overall growth of 108.5%. The data show a sharp decline in 2020 (58.8% decrease) attributable to the COVID-19 pandemic and associated travel restrictions, followed by a strong recovery from

2021 onward. Domestic tourists consistently outnumber international visitors, accounting for approximately 85-90% of total arrivals throughout the period. The sustained growth in visitation, particularly in the post-pandemic years (2021–2025), indicates increasing tourism pressure on the park's ecosystems and underscores the urgency of implementing effective visitor management strategies.

Documented Environmental Concerns in Park Records

Content analysis of park annual reports and incident logs revealed recurring documentation of tourism-related environmental concerns. Table 9 summarizes the frequency with which specific environmental issues were mentioned in official park records over the five-year period (2021–2025).

Table 9: Environmental Concerns Documented in Park Records (2021–2025)

Environmental Concern	2021	2022	2023	2024	2025	Total	% of Reports
Waste/litter accumulation	7	9	12	14	16	58	23.2
Vegetation trampling	6	8	10	12	13	49	19.6
Wildlife disturbance	5	7	9	11	12	44	17.6
Soil erosion on trails	4	6	8	9	11	38	15.2
Illegal trail creation	3	4	6	8	9	30	12.0
Water pollution	2	3	4	5	6	20	8.0
Human-wildlife conflict	2	2	3	3	4	14	5.6
Total	29	39	52	62	71	253	100

Source: Gashaka-Gumti National Park Annual Reports (2021–2025)

The archival data reveal a progressive increase in documented environmental concerns, rising from 29 recorded incidents/issues in 2021 to 71 in 2025—a 145% increase over five years. Waste accumulation emerged as the most frequently documented concern (23.2% of all records), followed by vegetation trampling (19.6%) and wildlife disturbance (17.6%). This upward trend in documented environmental issues correlates positively with the increase in tourist visitation over the same period, suggesting a direct relationship between tourism growth and environmental pressure.

Park Management Reports and Interventions

Review of park management reports revealed several documented interventions aimed at mitigating tourism-related environmental impacts:

a) Waste Management Initiatives (2022–2025): Park records indicate the installation of 24 waste disposal bins at strategic locations (trailheads, campsites, viewpoints) between 2022 and 2025. However, internal memoranda noted that waste collection remained irregular due to logistical constraints, with one report stating: *"Waste bins at Chappal Waddi base camp are often overflowing for weeks before collection, leading to litter spread by wildlife and wind"* (Park Internal Memo, March 2024).

b) Trail Maintenance Programs: Records show that trail maintenance exercises were conducted bi-annually in 2022 and 2024, focusing on erosion control and vegetation management. However, a 2025 park report noted: *"The frequency of maintenance is inadequate to address the accelerated trail degradation resulting from increased trekking activities, particularly during peak tourist seasons"* (Annual Operations Report, 2025).

c) Visitor Sensitization Campaigns: Park records documented the production of 500 informational leaflets and the erection of 15 interpretive signage boards between 2023 and 2025. Despite these efforts, a park education officer's report observed: *"The impact of sensitization materials is limited by their concentration at park headquarters; remote areas frequented by tourists lack such guidance"* (Education Unit Report, 2024).

d) Law Enforcement Operations: Incident reports documented 47 cases of tourist misconduct between 2022 and 2025, including off-trail hiking (23 cases), littering (15 cases), and wildlife harassment (9 cases). Only 12 of these cases resulted in formal sanctions, with park records citing *"difficulty in enforcement due to limited personnel and the vastness of the park"* (Enforcement Unit Log, 2025).

Carrying Capacity Assessments

Archival records revealed that a preliminary carrying capacity assessment was conducted in 2019 by park management in collaboration with a conservation NGO. The assessment estimated the ecological carrying capacity of key tourist sites as follows:

Table 10: Estimated Carrying Capacity of Key Tourist Sites (2019 Assessment)

Tourist Site	Estimated Daily Carrying Capacity	Peak Season Visitors (2025)	Daily Status
Chappal Waddi trails	50	78	Exceeds Capacity
Gashaka sector trails	80	112	Exceeds Capacity
River Mayo Kam	40	35	Within Capacity
Fillinga campsite	60	84	Exceeds Capacity
Gumti sector	45	28	Within Capacity

Source: GGNP Carrying Capacity Assessment Report (2019) and Visitor Records (2025)

The archival data indicate that by 2025, three out of five major tourist sites were operating above their estimated carrying capacity during peak seasons. A management report from 2024 noted: *"The absence of an updated carrying capacity framework and the lack of visitor quota enforcement have resulted in concentrated pressure on popular sites, with observable ecological degradation"* (Park Management Review, 2024).

DISCUSSION

The findings of this study demonstrated that tourism activities exert both positive and negative impacts on the ecosystem of the park. While tourism promotes environmental awareness and contributes to conservation interest, its adverse effects are significant. Identified impacts include soil erosion, vegetation degradation, waste accumulation, and wildlife disturbance. This duality reflects the complex relationship between tourism and environmental sustainability. Similar conclusions were reached by Buckley (2019) in global park studies.

The occurrence of soil erosion and vegetation trampling suggests that tourist movement is altering the physical landscape. Continuous foot traffic along trails weakens soil structure and reduces plant cover. Newsome *et al.* (2017) assert that such impacts are among the most common consequences of unmanaged tourism. Over time, these changes can result in habitat degradation. This underscores the need for controlled access and designated pathways.

Waste accumulation within the park further indicates deficiencies in environmental management. The presence of non-biodegradable materials not only pollutes the environment but also disrupts ecological processes. Bako *et al.* (2020) similarly reported waste-related challenges in Cross River National Park. Such pollution diminishes the aesthetic and ecological value of protected areas. Therefore, effective waste management systems are crucial.

Additionally, the disturbance of wildlife observed in the study reflects the sensitivity of fauna to human presence. Noise and physical proximity alter animal behavior and may lead to displacement. According to Eagles and McCool (2022), wildlife disturbance is a major threat to biodiversity in tourism zones. This finding reinforces the need for stricter regulations. Conservation priorities must take precedence over recreational activities.

CONCLUSION

Tourism activities in Gashaka-Gumti National Park have the potential to make a significant contribution to biodiversity conservation, local economic development and environmental awareness. The park's exceptional ecological diversity, scenic landscapes and rich wildlife resources make it an important destination for nature-based tourism in Nigeria. Properly managed tourism can generate revenue for conservation, create employment opportunities, encourage community participation and increase public appreciation of the importance of protecting natural ecosystems.

However, tourism activities can also exert pressure on the ecological integrity of the park when they are inadequately planned or poorly managed. Activities such as hiking, trekking, wildlife viewing, camping, transportation and the use of tourism facilities can contribute to vegetation disturbance, soil compaction and erosion, wildlife disturbance, waste generation, pollution and habitat degradation. The magnitude of these impacts is likely to increase as tourist visitation and associated infrastructure expand without corresponding improvements in environmental management.

The sustainability of tourism in Gashaka-Gumti National Park therefore depends on achieving an appropriate balance between tourism development and ecosystem conservation. Tourism should be managed within the ecological limits of the park, with particular attention given to sensitive habitats, wildlife breeding areas, water resources and areas experiencing high visitor pressure. Effective visitor management, environmental monitoring, appropriate infrastructure, community participation and enforcement of conservation regulations are essential for minimizing negative impacts.

Ultimately, tourism should be regarded not merely as an economic activity but as an instrument that can support the long-term conservation of Gashaka-Gumti National Park. A well-managed ecotourism approach can ensure that the park continues to provide recreational, ecological, educational and economic benefits without compromising the ability of its ecosystems to function effectively for present and future generations.

Recommendations

Based on the resultant impacts of tourism activities on the ecosystems of Gashaka-Gumti National Park, the following recommendations are proposed:

1. **Strengthening tourism planning and environmental management:**
Tourism development within the park should be guided by comprehensive environmental management and tourism development plans. All proposed tourism facilities and major tourism activities should undergo appropriate environmental assessment before implementation to identify potential ecological impacts and establish suitable mitigation measures.
2. **Effective visitor management:**
The park authorities should establish and enforce visitor-management systems, particularly in environmentally sensitive areas. Visitor numbers should be controlled where necessary, while designated trails, camping areas, viewing points and recreational zones should be established to reduce uncontrolled movement and concentration of tourists.
3. **Regular monitoring of tourism impacts:**
There should be continuous monitoring of the ecological effects of tourism activities. Indicators such as vegetation condition, soil erosion, wildlife behaviour, wildlife population trends, water quality, waste generation and habitat disturbance should be periodically assessed to identify emerging environmental problems.
4. **Improvement of waste-management systems:**
Adequate waste-disposal facilities should be provided at tourist centres, campsites and other frequently visited locations. Visitors, tourism operators and park staff should be encouraged to adopt a "leave no trace" approach, while littering and indiscriminate disposal of waste should attract appropriate sanctions.

5. **Protection of wildlife from tourist disturbance:**

Clear regulations should be established regarding wildlife viewing, photography, feeding and physical proximity to animals. Tourists should maintain appropriate distances from wildlife, and activities that cause excessive noise or behavioural disturbance should be prohibited, particularly around breeding and nesting sites.

6. **Development of environmentally friendly tourism infrastructure:**

Tourism infrastructure should be designed and constructed according to environmentally sustainable principles. Roads, trails, accommodation facilities, viewing platforms and other structures should avoid environmentally sensitive locations and minimize vegetation clearance, soil disturbance and habitat fragmentation.

7. **Environmental education and awareness:**

Environmental education should be strengthened among tourists, local communities, tourism operators and park employees. Visitors should be informed about the ecological importance of the park and the potential consequences of inappropriate behaviour. Interpretation centres, information boards, brochures and trained guides can be used to promote responsible tourism practices.

8. **Strengthening enforcement of conservation regulations:**

Park authorities should strengthen enforcement of existing environmental and tourism regulations. Adequate personnel, equipment, transportation and communication facilities should be provided to enable effective monitoring of tourist activities and prevention of illegal activities within the park.

9. **Promotion of ecotourism principles:**

Tourism development should be based on ecotourism principles that emphasize environmental conservation, responsible visitor behaviour, community participation and socioeconomic benefits. Tourism activities that generate substantial environmental damage should be discouraged or modified.

10. **Improvement of tourism facilities and accessibility:**

Appropriate improvements should be made to access roads, visitor centres, accommodation facilities, sanitation facilities and other tourism infrastructure. However, such development should be carefully planned to avoid unnecessary ecological disturbance.

11. **Capacity building for park personnel:**

Park staff should receive regular training in sustainable tourism management, biodiversity monitoring, environmental impact assessment, visitor management, wildlife protection and community engagement. This will improve the capacity of park authorities to identify and manage tourism-related environmental impacts.

12. **Establishment of carrying-capacity limits:**

The park authorities should determine the ecological carrying capacity of major tourism sites. Where visitor pressure approaches or exceeds acceptable ecological limits, visitor numbers, frequency of access or duration of visits should be regulated.

13. **Regular review of tourism policies:**

Tourism and conservation policies for Gashaka-Gumti National Park should be

periodically reviewed based on environmental monitoring results and changing tourism patterns. An adaptive management approach should be adopted so that management strategies can be modified when new environmental challenges emerge.

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