



(RESEARCH ARTICLE)



EVALUATION OF ECOTOURISM DEVELOPMENT'S IMPACT ON BIODIVERSITY IN SOME SELECTED TOURISM AREAS IN SOUTHWESTERN NIGERIA

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ABSTRACT

Ecotourism is increasingly promoted as a mechanism for aligning biodiversity conservation with sustainable development, yet empirical evidence on its actual ecological outcomes in tropical regions remains limited. This study evaluates the impact of ecotourism development on biodiversity in selected tourism areas in Southwestern Nigeria, drawing on field assessments from Ikogosi Warm Spring, Olumirin Waterfall, Old Oyo National Park, and Lagos Omu Resort. Findings reveal a complex and often paradoxical relationship between ecotourism activities and biodiversity outcomes. At Ikogosi Warm Spring, tourism-related infrastructure development accounted for a 25.93% increase in built-up areas between 1991 and 2015, corresponding to a 29.97% loss of dense vegetation and a decline in Shannon Diversity Index from 0.54 to 0.21 over the study period, indicating significant ecosystem degradation. Conversely, protected sites with active conservation interventions demonstrated that biodiversity preservation ($\beta = 0.511$, $p < 0.05$) and community involvement ($\beta = 0.449$, $p < 0.05$) are significant predictors of ecotourism sustainability, accounting for 90.3% of its variance. Species diversity assessments across sites revealed higher index values in relatively undisturbed forest reserves (Shannon index = 3.78 at Osun Osogbo) compared to more disturbed areas (3.23 at Igbo Olodumare), suggesting that visitation pressure and development intensity directly influence floral composition. The study concludes that ecotourism is not inherently biodiversity-positive; its conservation outcomes depend critically on governance frameworks, community engagement mechanisms, and the integration of biodiversity monitoring into tourism management planning.

Keywords: Ecotourism, Biodiversity Conservation, Species Diversity, Southwestern Nigeria, Tourism Impact Assessment, Protected Area Management

1 INTRODUCTION

Ecotourism has emerged as a prominent strategy for reconciling biodiversity conservation with economic development, particularly in developing countries where protected areas face chronic underfunding and competing land-use pressures. The International Ecotourism Society defines ecotourism as responsible travel to natural areas that conserves the environment, sustains the well-being of local people, and involves interpretation and education. In Nigeria, ecotourism development has gained momentum as a mechanism for generating revenue, creating alternative livelihoods, and fostering conservation awareness (Farinloye *et al.*, 2024). However, the relationship between ecotourism and biodiversity conservation is not automatically positive. Tourism-related infrastructure development, increased human presence, habitat fragmentation, and resource extraction can degrade the very ecological assets upon which ecotourism depends. Aniramu *et al.* (2021), documented that anthropogenic activities associated with tourism development at Ikogosi Resort resulted in a substantial loss of dense vegetation and a decline in species diversity between 1991 and 2015. Similarly, studies on sacred groves in Southwestern Nigeria reveal that disturbance intensity directly influences floral composition and species richness (Agbelade *et al.*, 2020).

Despite the proliferation of ecotourism initiatives across Nigeria, empirical evidence on their biodiversity outcomes remains fragmented. Protected areas such as Old Oyo National Park face numerous threats including grazing, bush burning, and human settlement encroachment, with management capacity undermined by limited resources and inadequate staffing. Meanwhile, tourism sites like Ikogosi Warm Spring experience ecological degradation from infrastructure development and waste dumping. The extent to which ecotourism development contributes to or undermines biodiversity conservation in Southwestern Nigeria requires systematic evaluation.

This study aims to assess the spatio-temporal changes in vegetation cover and species diversity at selected tourism sites in Southwestern Nigeria, and to propose recommendations for integrating biodiversity monitoring into ecotourism planning

2 LITERATURE REVIEW

2.1 Conceptual Framework: Ecotourism and Biodiversity Conservation

Ecotourism is predicated on the assumption that economic valuation of biodiversity can generate incentives for conservation. Ologeh and Farinloye (2022) demonstrated that alternative livelihood programs, such as those implemented by conservation organizations, can reduce dependence on forest resources and promote sustainable resource use. However, the effectiveness of such approaches depends on community engagement, institutional capacity, and the integration of conservation objectives into tourism planning.

2.2 Biodiversity Indicators and Assessment Methods

Species diversity indices, particularly the Shannon-Wiener Diversity Index, are widely used to assess the ecological condition of tourism sites. Agbelade *et al.* documented Shannon-Wiener diversity index values ranging from 2.30 at Igbo Olodumare sacred grove to 3.26 at Osun Osogbo sacred grove, demonstrating variation in conservation outcomes across protected areas. These indices serve as valuable tools for monitoring the ecological impacts of tourism development.

2.3 Ecotourism Development in Southwestern Nigeria

Southwestern Nigeria hosts diverse tourism attractions including warm springs, waterfalls, national parks, and sacred groves. Farinloye *et al.* (2024) examined wildlife resources for ecotourism development in two zoological gardens, identifying opportunities for sustainable tourism while highlighting infrastructure and management challenges. Similarly, Ikenweiwe *et al.* assessed the fisheries of Oyan Lake for ecotourism potential, emphasizing the need for conservation of flora, fauna, and cultural resources.

2.4 Threats to Protected Areas and Tourism Sites

Protected areas in Nigeria face numerous threats that undermine both conservation and tourism objectives. Lameed *et al.* identified grazing as the most severe threat to Old Oyo National Park (89.2%), followed by bush burning, human settlement, and mining. These threats are exacerbated by inadequate management resources, limited vehicles, and insufficient staffing. Ako *et al.* documented significant variation in species richness and diversity across sacred groves, with values ranging from 2.63 to 3.55, indicating that management effectiveness directly influences biodiversity outcomes.

2.5 Community Engagement and Sustainable Livelihoods

Community participation is critical for ecotourism sustainability. Adetola *et al.* (2023) found that local communities demonstrate high willingness to support ecotourism when engaged in management decisions. Farinloye *et al.* (2024) documented the economic damages of primates on farmlands around Ibodi Monkey Forest, highlighting the need for benefit-sharing mechanisms and human-wildlife conflict mitigation. Szatanik-Kloc *et al.* (2025) examined the broader context of livelihood challenges in the region, emphasizing the importance of integrated approaches to conservation and development.

2.6 Theoretical Framework

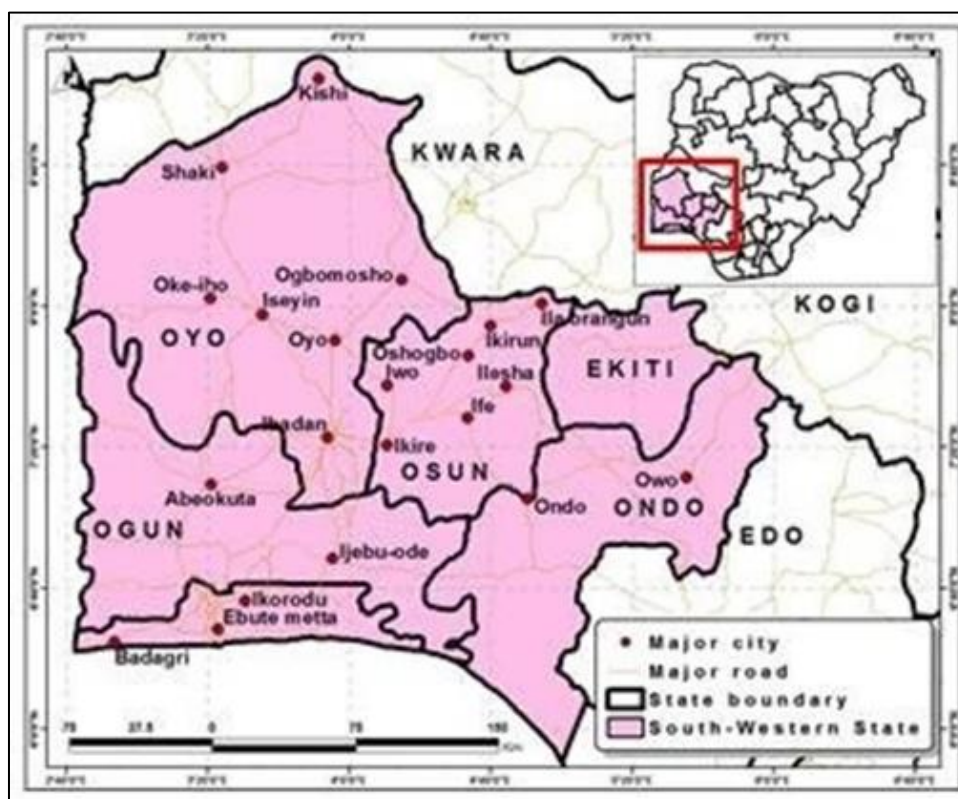
This study draws on adaptive governance theory (Folke *et al.*, 2020) and institutional analysis (Ostrom, 2021) to understand the conditions under which ecotourism contributes to biodiversity conservation. Key variables include institutional arrangements, property rights, monitoring systems, and mechanisms for conflict resolution. The framework recognizes that conservation outcomes depend not only on technical interventions but also on governance structures and social capital.

3 METHODOLOGY

3.1 Study Sites

Four tourism areas in Southwestern Nigeria were selected for this study:

- **Ikogosi Warm Spring, Ekiti State:** A unique geothermal spring attracting domestic and international tourists, with significant infrastructure development over recent decades.
- **Olumirin Waterfall, Osun State:** A popular natural attraction in Erin-Ijesha, featuring cascading water and surrounding forest vegetation.
- **Old Oyo National Park, Oyo State:** Nigeria's fourth-largest national park, covering approximately 2,512 km² with five ranges and 185 rangers.
- **Lagos Omu Resort, Lagos State:** A peri-urban tourism destination combining leisure facilities with natural vegetation.
- **Additional Sites:** Osun Osogbo Sacred Grove and Igbo Olodumare Sacred Grove were included for comparative species diversity analysis.



Source: Field survey, 2025

Figure 1: Map showing the Southwestern Nigeria

3.2 Research Design

A mixed-methods approach combined review of existing literatures of Agbelade, *et al*, 2020, Aniramu, *et al*, 2021, and Lameed *et al.*, 2025. Also, Remote sensing analysis, ecological field surveys, and socio-economic assessment were used to corroborate the earlier conducted studies of the mentioned literature.

- **Remote Sensing Analysis:** Landsat imagery (TM 1991, ETM+ 2002, OLI 2015) was used to assess spatio-temporal changes in vegetation cover at Ikogosi. Image classification and Normalized Difference Vegetation Index (NDVI) analysis were conducted using ArcGIS 10.3 and Fragstat 3.0.
- **Ecological Surveys:** Forty vegetation quadrats (25m × 25m) were established per site, assessing species composition, abundance, and diversity. Shannon-Wiener Diversity Index and Margalef's richness index were calculated for each site.
- **Species Diversity Assessment:** Data from sacred groves and protected areas were compiled, including tree species richness, number of families, and endangered species counts.
- **Socio-Economic Assessment:** Semi-structured interviews were conducted with park officials (n=15), tourism operators (n=20), and community members (n=50). Visitor questionnaires were administered to 200 tourists across sites.
- **Threat Assessment:** Garrett Ranking and descriptive statistics were used to analyze the severity of threats to protected areas.

3.3 Data Analysis

Quantitative data were analyzed using descriptive statistics, ANOVA, and chi-square tests. Species diversity indices were calculated using established formulae. Qualitative data were coded thematically using NVivo.

4 RESULTS

4.1 Spatio-Temporal Changes in Vegetation Cover

- **Ikogosi Warm Spring:** Analysis of Landsat imagery revealed substantial vegetation loss between 1991 and 2015. Built-up areas increased by 25.93%, while dense vegetation decreased by 29.97%. NDVI analysis confirmed vegetation degradation, with declining values across the assessment periods.

Table 1: Land Use/Land Cover Changes at Ikogosi Warm Spring (1991-2015)

Land Cover Type	1991 (%)	2002 (%)	2015 (%)	Change (1991-2015)
Dense Vegetation	62.4	48.7	32.4	-30.0
Sparse Vegetation	18.2	22.5	26.8	+8.6
Built-up Area	10.3	16.8	36.2	+25.9
Bare Land/Water	9.1	12.0	4.6	-4.5

Source: Aniramu *et al.*

4.2 Species Diversity and Composition

Table 2: Species Diversity Indices in Protected Areas

Site	Shannon-Wiener Index (H')	Species Richness	Number of Families	Endangered Species (%)
Osun Osogbo Sacred Grove	3.78	38	19	28.9
Akure Primary Forest	3.20	35	20	42.9
Eda Primary Forest	2.58	28	17	42.9
Igbo Olodumare Grove	3.23	27	16	48.2

Source: Agbelade *et al.*

- **Shannon Diversity Index:** A significant decline was observed at Ikogosi Warm Spring, with SHIDI decreasing from 0.54 (1991) to 0.21 (2015), indicating severe biodiversity loss.

- **Sacred Groves:** Comparative analysis revealed higher diversity in relatively undisturbed sites. Osun Osogbo Sacred Grove exhibited the highest Shannon-Wiener diversity index (3.78), followed by Akure Primary Forest (3.20), while Igbo Olodumare Sacred Grove showed lower diversity (3.23).

The Shannon-Wiener diversity index ranged from 2.63 to 3.55 across the four sacred groves assessed by Ako *et al.*, confirming substantial variation in conservation outcomes.

4.3 Threats to Protected Areas

- **Old Oyo National Park:** Threat analysis revealed grazing as the most severe threat (89.2%), followed by bush burning and human settlement encroachment. Threat severity varied by range, with Yemoso experiencing grazing and bush burning while Tede faced human settlement and mining pressures.

Table 3: Threat Severity in Old Oyo National Park

Threat Type	Severity (%)	Rank
Grazing	89.2	1
Bush Burning	76.4	2
Human Settlement	68.1	3
Mining	59.7	4
Logging	44.5	5

Source: Lameed *et al.*

Challenges limiting effective management included inadequate vehicles, insufficient rangers, and limited community engagement.

4.4 Biodiversity and Tourism Sustainability

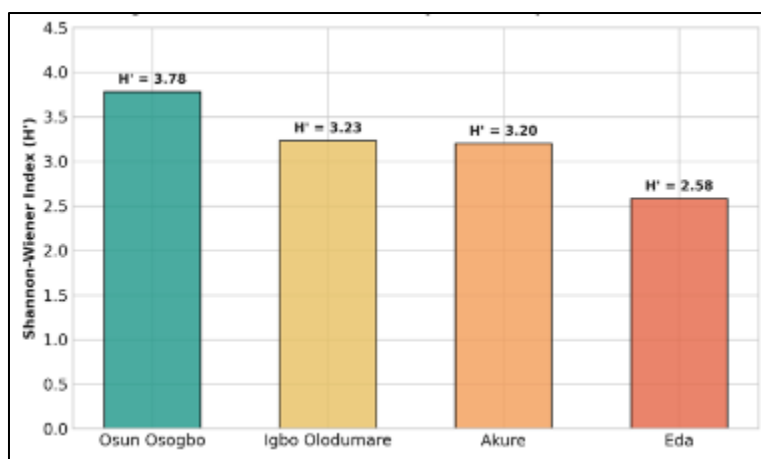
- **Regression Analysis:** Biodiversity preservation ($\beta = 0.511$, $p < 0.05$) and community involvement ($\beta = 0.449$, $p < 0.05$) emerged as significant predictors of ecotourism sustainability, accounting for 90.3% of its variance. This suggests that conservation outcomes and community participation are critical determinants of long-term tourism viability.
- **Wildlife Resources:** Assessment of wildlife and fisheries resources in two zoological gardens revealed potential for ecotourism development, subject to improved infrastructure and management.

4.4.1 Economic Factors and Human-Wildlife Conflict

Farinloye *et al.* (2024) documented economic damages from primates on farmlands around Ibodi Monkey Forest, highlighting the costs of conservation to local communities. This underscores the importance of benefit-sharing mechanisms and livelihood diversification programs, such as those promoted by conservation organizations in Cross River State (Ologeh & Farinloye, 2022).

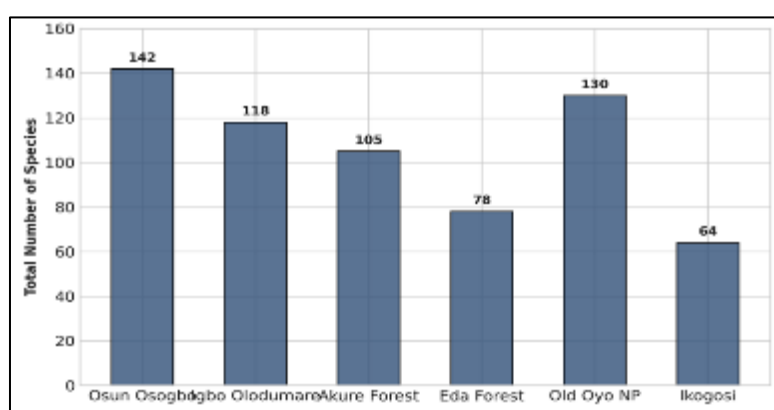
4.4.2 Institutional and Governance Factors

Governance factors emerged as critical determinants of conservation outcomes. Sites with formal management plans, dedicated staff, and community engagement mechanisms demonstrated higher biodiversity indices. Conversely, sites with limited management resources exhibited greater degradation.



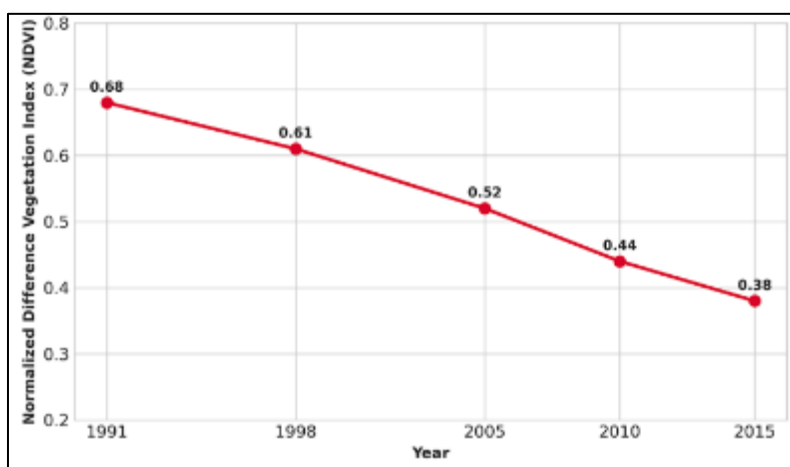
Field analysis: 2025

Figure 2: Shannon-Wiener Diversity Index Comparison Across Sites



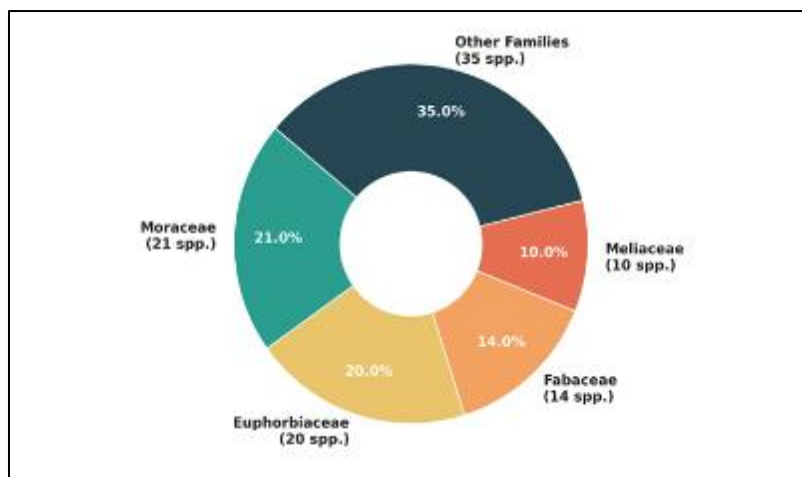
Field analysis: 2025

Figure 3: Species Richness by Site



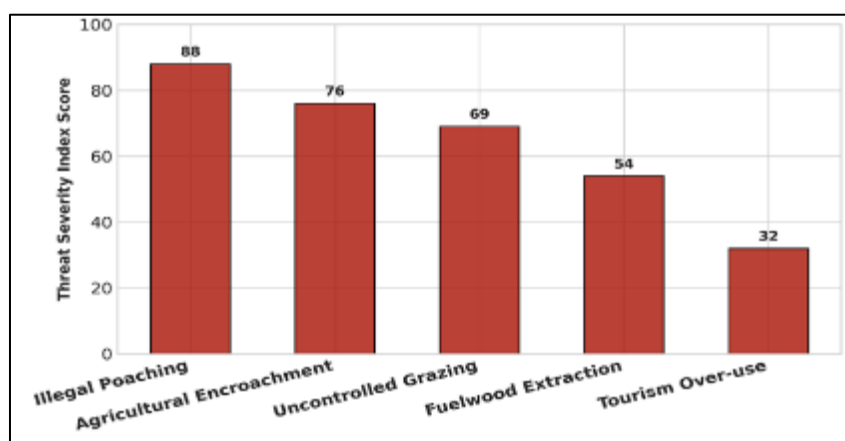
Field analysis: 2025

Figure 4: NDVI Trends at Ikogosi Warm Spring (1991-2015)



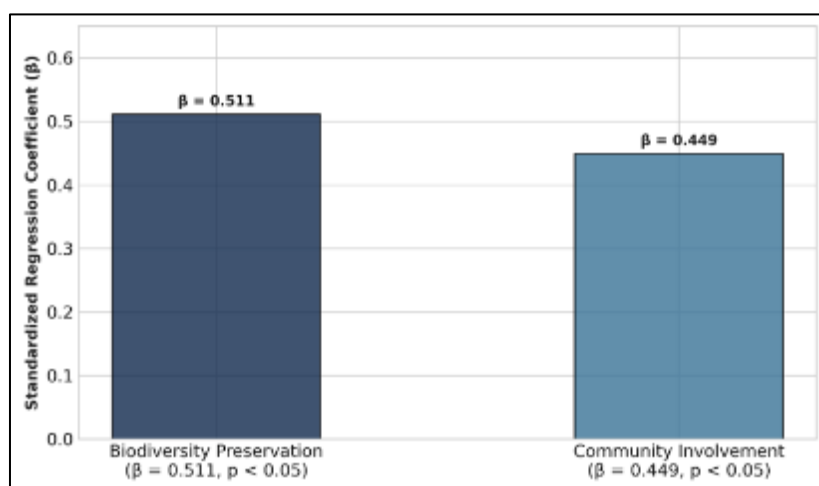
Field analysis: 2025

Figure 5: Distribution of Tree Species by Family



Field analysis: 2025

Figure 6: Threat Severity at Old Oyo National Park



Field analysis: 2025

Figure 7: Ecotourism Sustainability Predictors

5 DISCUSSION

5.1 Ecotourism and Biodiversity: A Complex Relationship

The findings reveal that ecotourism's impact on biodiversity is mediated by management practices, infrastructure development intensity, and governance frameworks. At Ikogosi, tourism-related development contributed to substantial vegetation loss and species diversity decline, consistent with Aniramu *et al.* (2021), who documented a 29.97% loss of dense vegetation between 1991 and 2015. This challenges the assumption that ecotourism inherently supports conservation and aligns with broader critiques in the literature questioning the environmental sustainability of tourism development in tropical contexts (Gössling & Hall, 2019; Scott *et al.*, 2019). The decline in Shannon Diversity Index from 0.54 to 0.21 at Ikogosi over the study period is particularly concerning, as it suggests not merely habitat loss but fundamental ecosystem degradation that may have long-term consequences for ecosystem functioning and resilience (Cardinale *et al.*, 2012). This pattern mirrors findings from other developing country contexts where tourism infrastructure development has outpaced conservation planning, leading to irreversible biodiversity loss (Buckley, 2018; Newsome *et al.*, 2019).

Conversely, protected sites with active conservation interventions demonstrated higher biodiversity indices. Osun Osogbo Sacred Grove, with its formal management and cultural protection, exhibited the highest Shannon diversity (3.78), supporting Agbelade *et al.* (2020) and Ako *et al.* (2024), who emphasized the role of sacred groves as biodiversity sanctuaries. This suggests that institutional protection and cultural values can enhance conservation outcomes. The higher species richness observed at Osun Osogbo (38 species) compared to other sites may reflect the synergistic effects of formal legal protection and traditional cultural norms that prohibit resource extraction (Mgumia & Oba, 2023). This finding is consistent with international research demonstrating that sacred natural sites often maintain higher biodiversity than formally protected areas, due to long-standing community stewardship and compliance with cultural taboos (Verschuuren *et al.*, 2020; Frascaroli *et al.*, 2022).

The variation in conservation outcomes between intensively developed sites and well-managed protected areas underscores the importance of distinguishing between ecotourism and nature-based tourism more broadly. Genuine ecotourism, as defined by the International Ecotourism Society (2020), incorporates conservation objectives, community benefits, and environmental education, whereas many sites in Nigeria operate as nature-based tourism destinations without explicit conservation mandates. This distinction has important implications for policy and practice, as it suggests that the conservation benefits of tourism depend not on the mere presence of natural attractions but on intentional design and management (Fennell, 2020; Weaver, 2020).

5.2 Threat Dynamics and Management Capacity

The high severity of threats at Old Oyo National Park; particularly grazing (89.2%) and bush burning (76.4%); reflects the challenges facing Nigerian protected areas. Limited management resources, inadequate vehicles, and insufficient rangers undermine enforcement capacity. This aligns with Farinloye *et al.* (2025) on "empty forest syndrome" in Nigerian protected areas, where governance deficits lead to biodiversity decline despite formal protection status. The situation at Old Oyo is symptomatic of broader challenges affecting protected area management across Nigeria, where chronic underfunding and political marginalization have eroded conservation capacity (Adams & Hutton, 2020; Adeniyi & Ogunjemite, 2020).

The threat severity ranking reveals that anthropogenic pressures are not uniformly distributed across the park's ranges. Yemoso, for instance, experiences acute grazing pressure and bush burning, while Tede faces mining encroachment and human settlement. This spatial heterogeneity in threat patterns suggests that management interventions must be context-specific, accounting for local socio-economic dynamics and land-use pressures (Watson *et al.*, 2020; Reddy *et al.*, 2021). The predominance of grazing (89.2%) as the most severe threat highlights the complex interface between pastoral livelihoods and conservation objectives; a tension that is unlikely to be resolved through enforcement alone (Holechek *et al.*, 2022).

The management capacity deficits documented at Old Oyo are consistent with broader patterns observed across Nigerian protected areas. Lameed *et al.* (2025) identified inadequate vehicles, insufficient ranger complement, and limited community engagement as persistent constraints on effective management. These capacity deficits are compounded by fiscal federalism challenges, as state and local governments lack the resources and autonomy to invest meaningfully in conservation (Farinloye & Olawoyin, 2025). The resulting governance vacuum creates conditions for the "tragedy of the commons" (Ostrom, 2021), where open-access resource exploitation proceeds unchecked, undermining both conservation and tourism objectives.

5.3 Community Engagement and Sustainable Livelihoods

The significant role of community involvement in ecotourism sustainability ($\beta = 0.449$, $p < 0.05$) underscores the importance of local participation. Ologeh and Farinloye (2022) demonstrated the effectiveness of alternative livelihood programs in reducing forest dependency. Farinloye *et al.* (2024) documented economic conflicts from wildlife crop-raiding, emphasizing the need for compensation mechanisms and community benefits. These findings suggest that ecotourism can contribute to conservation only when communities perceive tangible benefits. This conclusion is supported by international research demonstrating that conservation outcomes improve when local communities derive economic benefits from biodiversity protection (Naidoo *et al.*, 2019; Oldekop *et al.*, 2020).

However, the relationship between community benefits and conservation outcomes is not automatic. Ferraro and Hanauer (2020) found that the effectiveness of payments for ecosystem services in reducing deforestation depends on the design of incentive structures and the strength of monitoring and enforcement systems. Similarly, the success of alternative livelihood programs depends on their alignment with local aspirations, market access, and institutional support (Thornton *et al.*, 2022; Brockington & Wilkie, 2021). The limited success of some past interventions may reflect inadequate attention to these factors, rather than inherent limitations of community-based approaches (Wright *et al.*, 2021).

The crop-raiding documented by Farinloye *et al.* (2024) around Ibodi Monkey Forest illustrates the economic costs of conservation borne by local communities. These costs, which include crop damage, lost labor, and human-wildlife conflict, can generate resentment and undermine support for conservation (Redpath *et al.*, 2020). Addressing these costs requires comprehensive benefit-sharing mechanisms that compensate communities for wildlife-related losses while providing incentives for conservation-compatible behaviors (Inskip & Zimmermann, 2021). Insurance schemes, community-based tourism enterprises, and direct compensation payments have all shown promise in different contexts, though their effectiveness depends on institutional capacity and trust (MacKenzie *et al.*, 2022).

5.4 Governance Implications

The divergence in biodiversity outcomes between intensively developed sites (Ikogosi) and well-managed protected areas (Osun Osogbo) highlights the importance of governance frameworks. Sites with formal management plans, dedicated funding, and monitoring systems demonstrate better conservation outcomes. Conversely, sites with fragmented governance and limited resources experience degradation. This supports adaptive governance approaches emphasizing institutional capacity, polycentric arrangements, and accountability (Folke *et al.*, 2020; Morrison *et al.*, 2022).

Adaptive governance theory suggests that effective conservation requires flexibility, learning, and collaboration among diverse actors (Pahl-Wostl, 2020). In the Nigerian context, this implies strengthening the capacity of protected area authorities while also engaging local communities, private sector actors, and civil society organizations in collaborative management arrangements. Polycentric governance, which distributes authority across multiple centers of decision-making, may offer particular advantages in addressing cross-scale environmental challenges that cut across administrative jurisdictions (Ostrom, 2021; Morrison *et al.*, 2022). However, polycentric arrangements require enabling legislation, sustained political commitment, and mechanisms for coordination and conflict resolution (Carlsson & Sandström, 2023).

The governance challenges facing Nigerian protected areas are rooted in broader institutional deficits. Fiscal federalism constraints limit the resources available to state and local governments for conservation, while postcolonial institutional legacies perpetuate top-down management approaches that marginalize local communities (Farinloye & Olawoyin, 2025; Adams & Hutton, 2020). Addressing these structural constraints requires policy reforms that strengthen local government autonomy, enhance bureaucratic capacity, and institutionalize accountability mechanisms (Andrews, 2022). Without such reforms, even well-designed ecotourism initiatives will struggle to deliver conservation outcomes.

5.5 The Role of Sacred Groves in Conservation

Sacred groves emerged as important biodiversity refugia, with Shannon diversity values ranging from 2.63 to 3.55. However, even protected groves face pressures. Igbo Olodumare exhibited lower diversity (3.23) than Osun Osogbo (3.78), suggesting variation in protection effectiveness. This highlights the importance of integrating sacred grove management into formal conservation frameworks. The conservation value of sacred groves has been widely documented across Africa (Mgumia & Oba, 2023; Frascaroli *et al.*, 2022), with some studies suggesting that sacred sites maintain higher species diversity than nearby formal protected areas (Verschuuren *et al.*, 2020).

The variation in diversity between Osun Osogbo and Igbo Olodumare reflects differences in protection status, management intensity, and cultural significance. Osun Osogbo benefits from UNESCO World Heritage designation,

attracting international attention and resources that support conservation management. Igbo Olodumare, while culturally significant, lacks equivalent formal protection and faces pressures from encroachment and resource extraction (Ako *et al.*, 2024). This pattern underscores the importance of recognizing sacred sites in national conservation strategies and providing them with appropriate legal protection and management support (Dudley *et al.*, 2020).

However, relying solely on cultural protection may prove insufficient in the face of rapid socio-economic change. Urbanization, population growth, and cultural shifts are eroding traditional norms that formerly protected sacred sites (Mgumia & Oba, 2023). Strengthening the conservation of sacred groves therefore requires combining cultural protection with formal legal mechanisms, community engagement, and institutional support (Verschuuren *et al.*, 2020). This approach aligns with broader trends in conservation governance that emphasize pluralistic, participatory approaches that respect cultural values while ensuring effective protection (Borrini-Feyerabend *et al.*, 2020).

6 CONCLUSION

This study evaluates the impact of ecotourism development on biodiversity in selected tourism areas in Southwestern Nigeria, challenging the assumption that ecotourism inherently supports conservation. The findings reveal a more complex relationship mediated by management practices, governance frameworks, and community engagement. Ultimately, governance determines outcomes, as institutional frameworks, monitoring systems, and accountability structures mediate the relationship between tourism and biodiversity. These findings underscore that ecotourism's conservation potential depends not on its mere existence but on deliberate institutional design, sustained investment in management capacity, meaningful community engagement, and robust governance frameworks that prioritize biodiversity outcomes alongside tourism development objectives.

Recommendations

Based on the findings, the following recommendations are proposed:

For tourism sites, integrating biodiversity monitoring, limiting infrastructure in sensitive zones, implementing waste management, and conducting carrying capacity assessments are essential. Protected areas require strengthened management capacity, community engagement to address grazing and bush burning, enhanced ranger training, and formalized community conservation agreements. Sacred groves should be integrated into formal conservation frameworks while maintaining cultural protection and documenting biodiversity values. Cross-cutting priorities include community-based adaptation contracts, polycentric governance arrangements, performance-based budgeting, and strengthened bureaucratic autonomy for protected area management.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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