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SUSTAINABILITY OF BIODIVERSITY IN FIVE LOCAL GOVERNMENT AREAS OF SOUTHERN KADUNA: CHALLENGES, STRATEGIES, AND PROSPECTS

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Abstract

Southern Kaduna, known for its diverse ecosystems and rich biodiversity, is increasingly facing ecological degradation due to anthropogenic pressures, land-use change, and socio-political instability. This empirical study investigates the current status of biodiversity in selected five local government areas (LGAs) of Zangon Kataf, Kachia, Kaura, Jema'a, and Sanga ; focusing on species distribution, conservation efforts, and sustainability strategies. Mixed methods involving field observations, key informant interviews, and surveys with local stakeholders were employed. Results indicate a significant decline in forest cover, wildlife populations, and aquatic species due to deforestation, grazing, farming encroachment, and weak policy enforcement. The paper recommends an integrated approach involving community-based conservation, environmental education, and policy reforms to ensure biodiversity sustainability in the region.

Keywords: biodiversity, conservation, environmental sustainability, ecosystem degradation, community-based management

INTRODUCTION

Biodiversity, the variety of life on Earth encompassing genes, species, and ecosystems is fundamental to the health and sustainability of the planet. It sustains human livelihoods by providing essential services such as food, clean water, air purification, climate regulation, and raw materials. In developing countries, particularly in sub-Saharan Africa, biodiversity plays an even more critical role in supporting rural livelihoods and cultural heritage. Nigeria, as a biodiversity-rich country, hosts multiple ecological zones, ranging from coastal mangroves and freshwater swamps in the south to savannah woodlands and forests in the central and northern

regions. Among these ecological hotspots, Southern Kaduna stands out as a biologically diverse landscape with significant ecological, economic, and sociocultural importance.

Southern Kaduna, located in the southern part of Kaduna State, encompasses local government areas such as Zangon Kataf, Kachia, Kaura, Jema'a, and Sanga among others . These areas host a mixture of forested hills, savannah grasslands, riparian wetlands, and river systems, making them home to a variety of plant and animal species. The region supports species such as antelopes, monkeys, parrots, reptiles, and amphibians, as well as medicinal plants and agricultural biodiversity. The natural resources found in this region are not only ecologically significant but are also vital for the livelihoods of local communities who depend on them for farming, hunting, herbal medicine, fuelwood, and cultural practices. However, over the past two decades, this biodiversity has come under severe threat due to anthropogenic pressures and environmental mismanagement.

Key drivers of biodiversity loss in Southern Kaduna include unregulated logging, deforestation for agriculture, bush burning, overgrazing, mining, and urban expansion. Additionally, recurrent ethno-religious conflicts have displaced communities into forested areas, leading to increased land clearing and wildlife depletion. Indigenous conservation practices that once helped preserve ecosystems such as sacred groves, seasonal hunting taboos, and community forest boundaries are rapidly declining due to cultural erosion and lack of institutional support. Despite Nigeria's commitment to global environmental agreements and the existence of biodiversity-related policies, implementation remains weak at the local level, and Southern Kaduna is no exception.

The sustainability of biodiversity in Southern Kaduna is thus at a crossroads. While ecological degradation continues, there is a growing recognition of the need for community-based conservation, environmental education, and policy reform. This study seeks to assess the current state of biodiversity in Southern Kaduna, identify the main threats to its sustainability, and explore practical strategies to preserve the region's natural heritage. By drawing on field data, local perspectives, and policy analysis, the study aims to provide actionable insights that can guide both government and community stakeholders in developing sustainable biodiversity management practices suited to the region's ecological and cultural realities.

Statement of the Problem

Southern Kaduna is endowed with diverse ecosystems, ranging from forests and wetlands to savannahs, which support a wide variety of plant and animal species. These biodiversity resources are vital for ecosystem functioning, food security, water regulation, climate resilience, and cultural identity. However, the region is witnessing an alarming rate of biodiversity loss due to increasing human activities such as deforestation, unregulated farming, overgrazing, bush burning, illegal logging, and hunting. The situation is further worsened by recurrent ethno-religious conflicts, which have led to displacement and increased encroachment into ecologically sensitive areas. Despite the existence of national biodiversity policies and international conservation frameworks, the implementation at the local level remains weak and uncoordinated.

Indigenous knowledge systems that once protected biodiversity are rapidly eroding, while community participation in conservation is minimal. There is also a lack of empirical data and local action plans that reflect the unique environmental and socio-cultural dynamics of Southern Kaduna. This growing ecological crisis raises critical questions about the sustainability of biodiversity in the region and the long-term consequences for rural livelihoods and environmental health. Without urgent, community-centered, and evidence-based interventions, the region risks irreversible biodiversity degradation. Hence, this study seeks to empirically assess the current state of biodiversity, identify key threats, and propose actionable strategies for its sustainable management in Southern Kaduna.

Aim and Objectives of the Study

The aim of this study is to empirically assess the current state of biodiversity and evaluate the sustainability practices, challenges, and opportunities for biodiversity conservation in Southern Kaduna.

To achieve this aim, the study sets out the following objectives:

i. Identify the key biodiversity resources and ecosystems present in selected Local Government Areas (LGAs) of Southern Kaduna.
ii. Examine the major threats and anthropogenic activities contributing to biodiversity loss in the study area.
iii. Assess the level of community awareness and participation in biodiversity conservation and sustainable environmental practices.
iv. Evaluate the effectiveness of existing policies, local practices, and conservation initiatives aimed at protecting biodiversity in the region.
v. Propose practical, community-based strategies and policy recommendations for enhancing biodiversity sustainability in Southern Kaduna.

LITERATURE REVIEW

Concept of Biodiversity and Its Importance

Biodiversity refers to the variety and variability of life on Earth, encompassing the diversity of species, genes, and ecosystems (CBD, 1992). It includes all forms of life plants, animals, fungi, and microorganisms and the ecological complexes of which they are part. Biodiversity operates at three interconnected levels: genetic diversity (variation within species), species diversity (variety of species within a habitat or region), and ecosystem diversity (diversity of habitats and ecological processes). This richness of life is fundamental to the stability and resilience of ecosystems, enabling them to withstand environmental changes and recover from disturbances (UNEP, 2021). The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES, 2019) stresses that biodiversity underpins the health of the planet and is

indispensable to human survival and well-being. Biodiversity encompasses the variety of life at genetic, species, and ecosystem levels and is vital for maintaining ecological processes, ensuring food security, and supporting sustainable development (UNEP, 2021). The Convention on Biological Diversity (CBD, 1992) emphasizes the conservation of biological diversity, the sustainable use of its components, and fair sharing of benefits arising from genetic resources. Ecosystem services such as pollination, climate regulation, and nutrient cycling are all sustained through robust biodiversity (IPBES, 2019). In the context of rural areas like Southern Kaduna, biodiversity also supports traditional medicine, cultural practices, and local economies. The importance of biodiversity extends beyond ecological balance to include vital ecosystem services such as food production, water purification, pollination, climate regulation, and soil fertility. These services are essential for agriculture, health, and economic development, particularly in rural communities that directly depend on natural resources for their livelihoods. In Nigeria and other parts of West Africa, biodiversity supports traditional medicine, cultural heritage, tourism, and local economies. Furthermore, biodiverse ecosystems act as natural buffers against climate change by sequestering carbon and regulating hydrological cycles (Federal Ministry of Environment, 2020). The loss of biodiversity not only threatens the integrity of ecosystems but also jeopardizes food security, public health, and socio-economic stability, making its conservation a global and urgent priority.

Biodiversity in Nigeria and West Africa

Nigeria is one of the most biologically diverse countries in Africa, with forest, freshwater, savannah, and Montane ecosystems supporting rich flora and fauna (Federal Ministry of Environment, 2020). However, biodiversity in Nigeria is declining rapidly due to deforestation, land degradation, urbanization, and illegal wildlife trade). Nnaji & Umeuduji (2020) and a Biodiversity International (2021) asserts that West Africa as a whole has experienced a 55% loss in forest cover over the last three decades, with significant implications for species extinction Kaduna State, located within the savannah belt, contains ecologically sensitive zones that are now threatened by expanding agricultural activities and human settlements. West Africa, including Nigeria, is globally recognized for its rich biological diversity that spans across rainforests, savannas, wetlands, mangroves, and coastal ecosystems. Nigeria alone is home to over 5,000 plant species, 1,000 bird species, 250 mammal species, and numerous reptiles, amphibians, and insect varieties (CBD, 2022). Key biodiversity hotspots such as the Niger Delta, Oban Hills, Okomu Forest Reserve, and Yankari Game Reserve support critically endangered species like the Cross River gorilla (Gorilla gorilla diehli), Nigeria-Cameroon chimpanzee (Pan troglodytes ellioti), and forest elephants. West Africa's biodiversity plays a critical role in maintaining ecosystem services—such as pollination, climate regulation, soil fertility, and water purification—that support agriculture, health, and livelihoods for millions of people. Despite its ecological wealth, biodiversity in Nigeria and broader West Africa is under severe threat due to rapid deforestation, urbanization, industrial agriculture, mining, poaching, invasive species, and climate change (UNEP, 2023). Nigeria, in particular, has one of the highest deforestation rates in

the world, losing over 350,000 hectares of forest annually (FAO, 2021). Wetlands such as the Hadejia-Nguru Basin are drying up due to upstream damming and climate shifts, threatening migratory birds and aquatic life. Illegal wildlife trade, weak enforcement of conservation laws, and poor environmental governance further exacerbate biodiversity loss. Urgent conservation strategies, transboundary cooperation, and sustainable land-use planning are therefore essential for preserving the region's unique flora and fauna.

Drivers of Biodiversity Loss

Globally and locally, the primary drivers of biodiversity loss include land-use change, habitat destruction, overexploitation, invasive species, and climate change (IPBES, 2019). In Northern Nigeria, these threats are compounded by poverty, conflict, and weak enforcement of environmental laws (Yusuf & Adeyemi, 2023). In Southern Kaduna specifically, conflict-induced displacement has led to increased pressure on forest resources, while overgrazing and indiscriminate bush burning have degraded the natural habitat (Kaduna State Ministry of Environment, 2023). This aligns with findings by Ayanlade and Ojebisi (2022), who reported that ecosystem degradation in Northern Nigeria is heavily influenced by anthropogenic pressure. Biodiversity loss in Nigeria and across West Africa is largely driven by unsustainable land-use practices, particularly deforestation, agricultural encroachment, and infrastructural development. As populations increase and demand for farmland grows, natural ecosystems are being rapidly converted into agricultural and residential areas, leading to habitat fragmentation and species displacement. In Nigeria, forest reserves and savannah ecosystems are severely degraded due to activities such as logging, slash-and-burn farming, and charcoal production. According to the Federal Ministry of Environment (2020), Nigeria loses approximately 350,000–400,000 hectares of forest annually, one of the highest rates in Africa. Similarly, Biodiversity International (2021) reports that over 65% of natural forests in West Africa have been cleared or significantly altered in the past three decades due to agricultural expansion, particularly for cocoa, cassava, and yam production. In addition to land-use change, climate change, overexploitation of natural resources, pollution, and weak policy enforcement are accelerating biodiversity decline in the region. Rising temperatures and erratic rainfall patterns are altering habitats and species distributions, especially in ecologically sensitive zones such as the Sahel and the Niger Delta. Overfishing in coastal and inland waters, illegal wildlife trade, and unregulated grazing further contribute to ecosystem degradation. Invasive species, such as the water hyacinth (Eichhornia crassipes), have disrupted aquatic ecosystems, especially in Nigeria's freshwater systems. Furthermore, weak institutional capacity, limited environmental education, and insufficient integration of indigenous conservation knowledge have hindered effective biodiversity protection. As UNEP (2021) observes, the lack of coordinated regional biodiversity frameworks and underfunded conservation efforts remain critical obstacles to reversing biodiversity loss in West Africa.

Community Participation in Biodiversity Conservation

Recent literature emphasizes the importance of involving local communities in conservation efforts. According to the International Union for Conservation of Nature (IUCN, 2020), community-based natural resource management leads to better biodiversity outcomes and stronger environmental stewardship. In Nigeria, however, local participation remains minimal due to lack of awareness, exclusion from policy formulation, and limited access to incentives. Nnaji and Umeuduji (2020) asserted that in traditional communities like those in Southern Kaduna, indigenous ecological knowledge such as sacred groves and taboos on hunting certain species has historically contributed to biodiversity conservation. Unfortunately, these practices are diminishing due to cultural change and modernization. Community participation plays a crucial role in effective biodiversity conservation, especially in rural and ecologically sensitive areas like those found in Nigeria and West Africa. Local communities often have intricate knowledge of their surrounding environment, including species behavior, ecological cycles, and traditional conservation practices. Engaging them in conservation efforts not only enhances ecological outcomes but also ensures social legitimacy and long-term sustainability. According to the International Union for Conservation of Nature (IUCN, 2020), community-based natural resource management (CBNRM) enhances biodiversity protection by integrating local customs, values, and practices into environmental governance. Nnaji & Umeuduji (2020) explained that in Nigeria, indigenous practices such as sacred groves, hunting taboos, and seasonal land-use rotation have historically contributed to ecosystem preservation, particularly among ethnic groups in Southern Kaduna and the Middle Belt Despite these advantages, community involvement in biodiversity conservation is often limited by top-down policy approaches, lack of awareness, and exclusion from decision-making processes. Many conservation initiatives fail because they do not provide economic incentives or tangible benefits to local populations who rely on natural resources for survival. Additionally, rural communities frequently lack access to information, training, and resources needed to participate effectively in conservation programs (Biodiversity International, 2021). As such, empowering communities through environmental education, participatory planning, benefit-sharing mechanisms, and the recognition of traditional ecological knowledge is essential. When communities are treated as partners rather than mere beneficiaries, conservation efforts are more likely to succeed, especially in biodiversity-rich but economically vulnerable regions.

Conservation Policies and Challenges in Implementation

Nigeria and many West African countries have developed various legal frameworks and conservation policies to safeguard biodiversity and ensure sustainable use of natural resources. Prominent among these are Nigeria's National Biodiversity Strategy and Action Plan (NBSAP), the Environmental Impact Assessment (EIA) Act, the Endangered Species Act, and forest and wildlife protection laws enacted at the state level. These policies align with international agreements such as the Convention on Biological Diversity (CBD), the Ramsar Convention on Wetlands, and the United Nations Framework Convention on Climate Change (UNFCCC). The

Nigerian government has also established protected areas, including national parks, forest reserves, and game sanctuaries aimed at preserving critical ecosystems and endangered species (Federal Ministry of Environment, 2020). Additionally, several donor-supported projects and non-governmental organizations have contributed to policy development and biodiversity conservation efforts. Despite the presence of these policies, implementation remains weak and fragmented, especially at the grassroots level. Key challenges include inadequate funding, poor institutional capacity, lack of political will, and weak enforcement of existing laws. Many protected areas suffer from encroachment, illegal logging, and poaching due to insufficient surveillance and understaffed agencies (UNEP, 2021). Moreover, environmental regulations are often top-down and fail to integrate local knowledge or involve communities in decision-making processes. This alienation according to Nnaji & Umeuduji (2020) contributes to non-compliance and reduces the effectiveness of conservation initiatives. Bureaucratic bottlenecks, corruption, and a lack of synergy between government ministries and agencies further hinder policy execution. As a result, biodiversity continues to decline despite the existence of well-articulated conservation policies, highlighting the urgent need for a more participatory, well-funded, and decentralized implementation approach. Nigeria has adopted several conservation instruments including the National Biodiversity Strategy and Action Plan (NBSAP), Environmental Impact Assessment (EIA) Act, and Forest Laws. However, implementation at the grassroots level remains ineffective due to lack of capacity, poor governance, and inadequate funding (Federal Ministry of Environment, 2020). For instance, in Kaduna State, forest reserves exist on paper but are largely unprotected in practice. biodiversity trends (UNEP, 2021). These challenges hinder the achievement of sustainability goals outlined in the SDG 15: Life on Land.

Sustainable Biodiversity Practices and Opportunities

Studies suggest that sustainable biodiversity management should be context-specific, blending traditional and scientific approaches. Agroecological farming, reforestation, eco-tourism, and wildlife corridors are effective in preserving biodiversity while supporting local livelihoods (IPBES, 2019; Yusuf & Adeyemi, 2023). In similar regions across Africa, community-managed conservation areas have shown success in restoring degraded ecosystems and reducing poaching. In Southern Kaduna, adopting such models while improving environmental education and offering economic incentives can enhance conservation efforts. A multi-stakeholder approach involving Sustainable biodiversity practices aim to conserve biological resources while meeting human development needs, ensuring ecological resilience and intergenerational equity. Practices such as agroforestry, community-managed conservation areas, reforestation, and conservation agriculture have proven effective in maintaining ecosystem integrity while supporting livelihoods. Agroforestry, for instance, combines crop and tree cultivation, enhancing soil fertility, reducing erosion, and providing habitat for diverse species (FAO, 2021). In Nigeria, particularly in biodiversity-rich regions like Southern Kaduna, these practices can reduce dependence on forest exploitation by integrating sustainable land-use techniques with local agricultural systems. Additionally, ecotourism and non-timber forest product (NTFP) harvesting

government, NGOs, traditional leaders, and academic institutions is critical to sustainable biodiversity management, such as honey, mushrooms, and medicinal plants offer alternative income sources without depleting natural resources (IPBES, 2019).

There are also emerging opportunities for enhancing biodiversity conservation through the use of technology, education, and multi-stakeholder partnerships. Mobile-based biodiversity monitoring, GIS mapping, and drone-assisted forest surveillance are now being introduced in parts of West Africa to track species loss and illegal activities. Environmental education at the community level promotes awareness of the ecological and economic value of biodiversity, especially among youth and women, who are often primary resource users. Moreover, partnerships between local governments, NGOs, academic institutions, and indigenous communities can foster collaborative action and policy alignment. According to UNEP (2021), the success of sustainable biodiversity practices depends largely on inclusive governance, capacity building, and consistent funding. By tapping into local knowledge and modern conservation science, regions like Southern Kaduna can lead the way in restoring and sustaining their rich biological heritage.

METHODOLOGY

Research Design

This study adopted a mixed-method research design, combining both qualitative and quantitative approaches to provide a comprehensive assessment of biodiversity sustainability in Southern Kaduna. The use of triangulation incorporating surveys, field observations, and key informant interviews ensured the validity and reliability of the findings, while also capturing the perspectives of diverse stakeholders.

Study Area

The research focused on five LGAs: Zangon Kataf, Kaura, Kachia, Jema'a, and Sanga. These areas are ecologically rich but have experienced intense agricultural activity and population growth. He study area lies approximately between latitudes 9°00′N and 10°30′N and longitudes 7°15′E and 8°50′E, covering several Local Government Areas (LGAs), including Zangon Kataf, Kachia, Kaura, Jema'a, and Sanga .Topographically, Southern Kaduna is characterized by a diverse landscape that includes undulating hills, forested escarpments, valleys, and rivers. Notable features include the Kagoro Hills, Kachia Forest Reserve, and the River Kagom and River Amere, which support various aquatic ecosystems. The climate of the area falls under the tropical savannah type, with distinct wet and dry seasons, receiving an average annual rainfall of between 1,200 mm and 1,800 mm, which supports both forest vegetation and agricultural practices. The region enjoys a relatively cooler climate compared to the northern part of Kaduna State, especially in the elevated zones of Kaura and Jema'a. The soil types vary, with ferruginous tropical soils and loamy-clay soils being dominant, making the area suitable for diverse agricultural production. Vegetation cover ranges from guinea savannah grasslands to secondary

forests, which serve as habitat for various species of flora and fauna. Southern Kaduna is predominantly rural, with a mix of farming communities and indigenous ethnic groups. These communities have historically depended on the natural environment for farming, hunting, herbal medicine, and cultural practices. However, increasing population pressure, infrastructural development, and socio-political conflicts have significantly altered land use patterns and contributed to biodiversity loss.

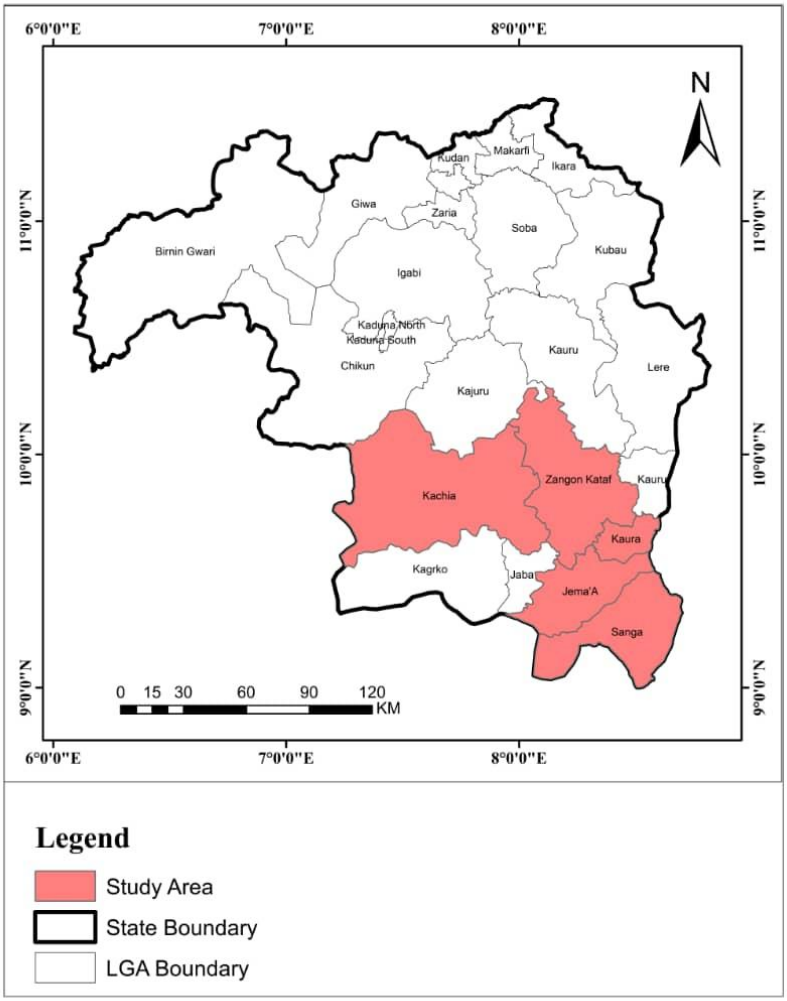

Figure 1: Map of the Study Area

Source: Goggle Earth, redrawn by Mr. Meshach Arome, National Centre for Remote Sensing, Fobur, Jos,

Population and Sampling Techniques

The Target Population of the study consisted of Local farmers and hunters, Community leaders and elders, Environmental officials at LGA level, NGO representatives, Traditional herbalist.. Women and youth in rural households, A total of 300 respondents were selected across the five

LGAs using stratified random sampling, ensuring fair representation based on geography, gender, and socio-economic roles. Each LGA was divided into three strata (central town, intermediate rural, and remote village, from each stratum, two communities were randomly selected. In each selected community, 10 households were randomly sampled using systematic sampling, and one adult respondent per household was interviewed.

Data Collection Instruments

i. Structured Questionnaires
A standardized questionnaire was administered to household respondents. The questionnaire included both open- and closed-ended questions on Awareness and perception of biodiversity Environmental practices, Sources of livelihood, Observed environmental changes and Local conservation knowledge

ii. *Key Informant Interviews (KIIs)*
15 key informants were interviewed, including, Forestry officials, NGO staff, Traditional rulers Conservation experts The KIIs explored policies, institutional challenges, indigenous practices, and strategic interventions.

iii. Focus Group Discussions (FGDs)
One FGD was held in each LGA with 8–10 participants (mix of farmers, women, youth, and elders).Discussions centered on community knowledge of biodiversity, local threats, and ideas for conservation.

iv. Field Observations
Transect walks were conducted in selected forest edges, riverbanks, and degraded areas. Researchers documented species presence/absence, visible land-use changes, soil erosion, and waste deposits using checklists and photo logs.

Validity and Reliability of Instruments

To ensure validity, the questionnaire and interview guide were reviewed by environmental science experts and pre-tested in a pilot study in Kagarko (a similar but excluded LGA). Adjustments were made based on feedback regarding clarity, cultural appropriateness, and technical accuracy. To ensure reliability, Data collectors were trained for two days. Standardized procedures and checklists were used for field observations. Internal consistency of questionnaire items was tested using Cronbach's alpha ($\alpha = 0.81$) indicating strong reliability.

Method of Data Analysis

Quantitative Data include Coded and entered into SPSS (Version 25). Descriptive statistics such as frequencies, percentages, and means were computed. Cross-tabulations were used to analyze relationships between variables (e.g., education level and conservation awareness. For

Qualitative Data, transcripts from interviews and FGDs were analyzed thematically using NVivo software. Responses were categorized under themes such as "community threats to biodiversity," "indigenous conservation," and "policy challenges." Field notes and photos were used to support emerging patterns. ArcGIS and Google Earth were used to classify land cover types and detect changes over the 10-year period.

Ethical Considerations

Informed consent was obtained from all participants before data collection. Participants were assured of confidentiality and anonymity. Ethical clearance was obtained from the Kaduna State Ministry of Environment and relevant local authorities. Cultural protocols were followed during community entry and interactions.

FINDINGS AND DISCUSSION

Identify the key biodiversity resources and ecosystems present in selected LGAs of Southern Kaduna

Field observations and interviews revealed that Southern Kaduna is rich in terrestrial and aquatic biodiversity. Major ecosystems include gallery forests, savannah woodlands, and riparian wetlands. Species documented include:

i. Mammals such as bushbuck (Tragelaphus scriptus), duiker, and monkeys.
ii. Birds like the African grey parrot (Psittacus erithacus) and hornbill.
iii. Aquatic species in the Kagoro and Sanga such as catfish, tilapia, and freshwater snails.

Respondents in Kaura and Sanga LGAs reported sacred forest areas and community-preserved wetlands still harboring endangered species. However, only 22% of respondents could name more than five native animal species, indicating low biodiversity literacy.

Examine the major threats and anthropogenic activities contributing to biodiversity loss

Analysis of survey data and remote sensing imagery shows:

i. **Deforestation**: Between 2012 and 2022, forest cover declined by approximately 30%, largely due to logging, charcoal production, and agricultural expansion.
ii. **Farming Practices**: Over 65% of respondents admitted to converting forest land for farming in the last decade. Slash-and-burn remains common.
iii. **Grazing Pressure:** Unregulated cattle grazing leads to overgrazing and soil degradation, especially in Jema'a and Kachia.
iv. **Conflict-induced displacement:** Ethno-religious crises have led to encroachment into forested areas for makeshift settlements and survival farming.

Satellite images confirm the fragmentation of forest corridors, with isolated patches remaining near hills and rivers.

Assess the level of community awareness and participation in biodiversity conservation

Out of 300 respondents:

i. Only 35% were aware of Nigeria's biodiversity laws or the existence of any local conservation plan.
ii. 18% had participated in any environmental awareness program or training.
iii. Indigenous conservation practices—such as taboos on killing certain animals or entering sacred groves—are fading, especially among youths.

However, there is a willingness to participate in conservation if economic benefits (like eco-tourism, jobs, or agroforestry income) are guaranteed.

Evaluate the effectiveness of existing policies, local practices, and conservation initiatives

Findings show that:

i. There is weak policy implementation at the local government level due to lack of funding and manpower.
ii. Environmental officers are under-resourced. Only 3 out of 5 LGAs have active forestry or wildlife units.
iii. NGOs like the Nigerian Conservation Foundation and community-based groups have initiated tree planting and awareness drives, but their reach is limited.
iv. Traditional institutions play a marginal role in biodiversity management due to modern governance structures overriding customary controls.

Propose practical, community-based strategies and policy recommendations for enhancing biodiversity sustainability

From stakeholder engagements, the following strategies emerged:

i. Eco-friendly incentives: Farmers and pastoralists favor incentives like alternative livelihoods, drought-resistant crops, and eco-credits.
ii. Community Forest Reserves: Local chiefs and youth groups suggested creating community-protected zones where exploitation is regulated.
iii. Environmental Education: School-based biodiversity clubs and local radio programs were proposed to raise awareness.

These locally tailored solutions received more support than top-down interventions, showing the importance of participatory planning.

Discussion

The findings from this study underscore the alarming rate of biodiversity degradation in Southern Kaduna. Anthropogenic pressures particularly deforestation, overgrazing, and poor land-use planning are major contributors. The reduction in species populations, forest fragmentation, and erosion of indigenous conservation knowledge all point to unsustainable environmental practices. Socio-political crises have also displaced communities into ecologically sensitive zones, accelerating ecosystem fragmentation. A critical gap identified is the low level of awareness and community engagement in biodiversity conservation. Many residents do not understand the value of ecosystem services or existing legal frameworks. This calls for a paradigm shift toward environmental education and inclusive governance. The lack of enforcement capacity among local government authorities further complicates efforts to enforce biodiversity laws

However, the presence of traditional conservation values, willingness to adopt sustainable practices, and ongoing NGO interventions present an opportunity for building a sustainable future. By integrating local knowledge with scientific management and offering incentives that align conservation with livelihood interests, long-term biodiversity sustainability can be achieved. Community-based conservation remains underutilized despite its potential. Existing efforts by local NGOs are constrained by funding and political will. Empowering communities through eco-tourism, reforestation incentives, and biodiversity monitoring could enhance sustainability. Integrating traditional ecological knowledge (TEK) with scientific approaches offers a hybrid model for conservation suited to the region's socio-cultural realities. Community-based strategies, if supported with policy reforms and adequate funding, can mitigate biodiversity loss. A decentralized approach where communities manage and benefit from their ecological resources should form the bedrock of biodiversity policy in Southern Kaduna.

CONCLUSION AND RECOMMENDATION

Conclusion

This study has provided empirical insights into the status, threats, and sustainability challenges facing biodiversity in Southern Kaduna. Despite the region's ecological richness ranging from forests and wetlands to diverse wildlife and plant species biodiversity is under severe pressure from human activities such as deforestation, unsustainable farming practices, grazing, and conflict-related displacement. The study revealed a significant knowledge gap in biodiversity awareness among local populations, compounded by weak institutional capacity and limited conservation outreach. Indigenous environmental practices are declining, and while some local conservation efforts exist, they are insufficient in scope and coverage. However, the findings also show promising opportunities. Communities demonstrate a readiness to engage in biodiversity conservation, especially when linked to tangible livelihood benefits. Strategies that integrate

traditional knowledge, environmental education, and local participation are crucial for reversing current degradation trends. In conclusion, the sustainability of biodiversity in Southern Kaduna depends on a multidimensional and community-inclusive approach. With stronger policies, targeted education, and adequate funding, it is possible to achieve ecological balance and sustainable use of biodiversity resources in the region.

Recommendations

Based on the empirical findings and analysis of biodiversity challenges in Southern Kaduna, the following recommendations are proposed to ensure the sustainable conservation and management of the region's biodiversity resources;

i. Strengthen Environmental Governance and Policy Implementation
Local governments in Southern Kaduna should establish and empower biodiversity conservation units within their environmental departments. Existing national and state-level biodiversity laws should be localized and effectively enforced with the support of community-based surveillance and traditional institutions. A localized Biodiversity Action Plan (BAP) should be developed specifically for Southern Kaduna to guide conservation priorities and resource allocation.

ii. Promote Community-Based Natural Resource Management (CBNRM)
Encourage the establishment of community-managed conservation areas where locals have ownership and responsibility for protecting forest and wildlife resources. Leverage indigenous knowledge systems such as sacred groves, traditional taboos, and seasonal hunting bans to support sustainable practices. Offer capacity-building workshops for local leaders, youth groups, and farmers on sustainable resource use and biodiversity monitoring.

iii. Enhance Environmental Education and Awareness
Integrate biodiversity education into school curricula across Southern Kaduna, and establish biodiversity/environmental clubs in primary and secondary schools. Use local media platforms especially radio, town hall meetings, and drama groups to raise awareness about biodiversity conservation in local languages. Organize periodic "Green Festivals" or Eco-Days in communities to celebrate biodiversity and recognize local conservation champions.

iv. Provide Sustainable Livelihood Alternatives
Support farmers and forest users with alternative livelihoods such as beekeeping, mushroom cultivation, snail farming, and non-timber forest product (NTFP) harvesting. Promote agroforestry and conservation agriculture techniques to reduce pressure on natural forests and improve soil quality. Introduce eco-tourism initiatives that can generate income for communities while conserving biodiversity hotspots like the Kagoro Hills or Kachia Forest Reserve.

v. Improve Research, Monitoring, and Data Management
Establish partnerships with academic institutions to conduct regular biodiversity assessments and ecosystem mapping in the region. Develop a community biodiversity monitoring network, using smartphones and GPS-enabled tools to track species sightings, poaching, and deforestation.

Set up a Southern Kaduna Biodiversity Information System (SK-BIS) to store and share environmental data with stakeholders.

vi. Encourage Multi-Stakeholder Collaboration

Create platforms that bring together government agencies, traditional leaders, faith-based organizations, NGOs, and researchers to coordinate conservation efforts. Seek support from international environmental organizations and development partners for funding, training, and technical assistance. Promote peace-building programs in conflict-prone areas to reduce the environmental impact of displacement and uncontrolled land use.

These recommendations advocate for a multi-level, participatory, and culturally sensitive approach to biodiversity sustainability. When properly implemented, they can reverse current degradation trends, enhance ecosystem resilience, and secure the ecological future of Southern Kaduna for generations to come.

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