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Biodiversity Loss and Environmental Change in Nigeria: Drivers, Impacts and Conservation Measures

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Abstract

Biodiversity sustains ecosystems, providing essential services to people, but Nigeria's environment faces multiple human-induced pressures that threaten critical habitats, species and their livelihoods. This paper presents an integrative review of the key drivers of biodiversity loss in Nigeria, as well as five conservation responses that would enhance the country's policy framework. Relevant literature was searched on 18-23 October 2026, using combinations of keywords related to biodiversity, habitat, forest, aquatic ecosystem, pollution, invasive species, and conservation. A total of 23 sources were considered, including 16 peer-reviewed articles and 7 reports or policies from official institutions. The main findings include the interactive pressures of forest conversion and fragmentation, petroleum pollution and alien Nypa palms on Nigeria's mangroves and aquatic ecosystems. Notably, the study's regional comparisons of forest connectivity contrast sharply with findings specific to Nigeria, and the gas-flaring estimates only represent emissions and economic costs to the country. The paper recommends connected landscapes, ecological restoration, sustainable agricultural practices, stronger regulation and control, and effective monitoring and reporting with clear benchmarks. Nigeria has a National Biodiversity Strategy and Action Plan 2025-2030 that contains general strategies for conserving the country's natural resources, but its successful implementation requires coordinated action, including disclosing relevant environmental information to the public and engaging communities in conservation efforts.

Keywords

Biodiversity Loss, Nigeria, Aquatic Ecosystems, Invasive Species, Conservation

1. Introduction

Nigeria comprises diverse terrestrial, freshwater, coastal and marine ecosystems that provide food production, water regulation, carbon storage, cultural values and livelihoods. These ecosystems are exposed to agricultural expansion, urban growth, infrastructure development, logging, hunting, mining, petroleum activities, pollution and climatic variability. The current challenge is therefore not environmental degradation alone, but the interaction of multiple pressures that can reduce the integrity of the ecosystems and the capacity of communities to depend sustainably on natural resources [1] [2].

The international policy context has been significantly changed: the Kunming-Montreal Global Biodiversity Framework (KMGBF) sets out four long-term goals and 23 action-oriented targets for 2030, including biodiversity-inclusive spatial planning, ecosystem restoration, effective conservation, species recovery and inclusive participation [3]. United Nations Environment Programme and the International Resource Panel [2] also frame biodiversity loss, climate change and pollution as interconnected dimensions of the triple planetary crisis. The frameworks change the focus from isolated environmental issues to integrated management of landscapes, resources and human activities. The KMGBF specifically calls for participatory, integrated and biodiversity-inclusive spatial planning in target 1, and effective restoration and conservation in targets 2 and 3.

Nigeria's revised National Biodiversity Strategy and Action Plan (NBSAP) 2025-2030 addresses this agenda at the national level. The revised NBSAP [4] includes 23 national biodiversity targets and uses a whole-of-government and whole-of-society approach. The official record of the Convention on Biological Diversity confirms that Nigeria has adopted the revised NBSAP as whole-of-government policy and that its 23 national targets match the global biodiversity targets. The policy context therefore presents an opportunity to move from a general environmental concern to a measurable conservation and restoration effort.

However, the evidence base in Nigeria is fragmented: studies often address individual pressures such as forest loss, wildlife exploitation, protected-area management, pollution or gas flaring. Rarely are they synthesized into a single framework, showing how pressures interact and which conservation responses align most directly with Nigeria's current policy architecture. This review addresses this gap by integrating recent empirical evidence and international and national policy frameworks, offering the contribution of a concise, Nigeria-focused synthesis, linking ecological pressures to implementable conservation measures and indicators.

The objective of this paper is to synthesize the major drivers of biodiversity loss and environmental change in Nigeria and identify five practical, policy-relevant measures for improving biodiversity conservation and ecosystem resilience.

2. Conceptual Framework

The conceptual framework adopted for this review is formed by the drivers and pressures of biodiversity loss and environmental change, the resulting ecological

and socioeconomic impacts, and conservation measures that cut across Nigeria's country context, considering the IPBES evaluation, the KMGBF, the triple planetary crisis outlined by the UNEP, the FAO's forest management strategy, and Nigeria's revised NBSAP [1]-[5].

It focuses on the fact that biodiversity loss in Nigeria is triggered by multiple interactions rather than singular events. Activities such as land-use changes, agricultural practices, and overexploitation, together with extractive industries, mining, pollution, gas flaring, and climate change, constitute the primary pressures that trigger ecological disruptions and threaten habitats, species, and the general environment. In addition, the lack of effective governance and environmental oversight exacerbates the situation by creating institutional and policy challenges that hinder the response mechanisms and interventions against biodiversity loss.

Consequently, Nigeria experiences ecological effects such as habitat loss and fragmentation, biodiversity loss, degradation of vital resources such as water and soil, and a reduction in ecosystem services, which affect social aspects such as livelihood security and general well-being. Therefore, conservation strategies such as the protection and restoration of habitats and ecosystems, sustainable agricultural practices, and curbing illegal mining and pollution alongside enhancing governance and community participation in conservation efforts should be considered. Overall, the conceptual framework is premised on the fact that biodiversity loss is better addressed when both immediate and underlying drivers are considered. This foundation guides the following discussion on drivers, impacts, and interventions addressed in this paper (see **Figure 1**).

Drivers → Ecosystem pressures → Ecological and socioeconomic impacts → Conservation measures → Improved biodiversity, ecosystem resilience and sustainable development

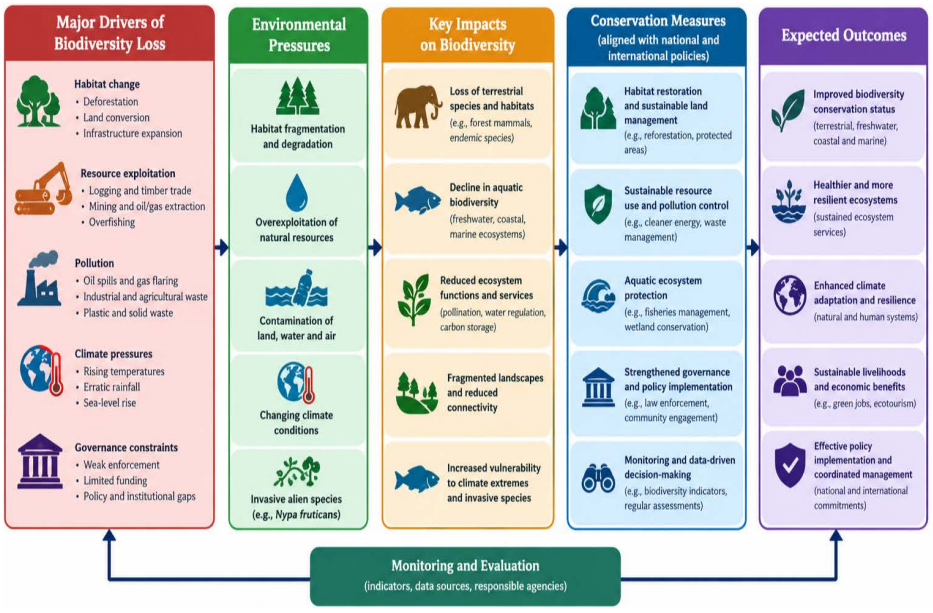


Figure 1. Conceptual framework linking drivers, ecological pressures, impacts and conservation responses in Nigeria. Source: Authors' synthesis based on [1]-[5].

2.1. Literature Review (Drivers of Biodiversity Loss and Environmental Change in Nigeria)

Biodiversity loss and environmental change in Nigeria encompass the cumulative effects of interacting land-use, economic, climatic and institutional pressures. This section critically examines the principal drivers, including habitat transformation, agricultural expansion, resource exploitation, pollution, climate variability and governance deficiencies.

Synthesizing these dimensions provides an evidence-based foundation for assessing ecological vulnerability and strengthening integrated biodiversity conservation and environmental management in Nigeria.

2.1.1. Land-Use Change, Deforestation and Habitat Fragmentation

Land-use change is a fundamental pathway through which biodiversity is lost because conversion or degradation of natural habitat reduces ecosystem area, quality and connectivity. Studies demonstrate that this pressure remains substantial in Nigeria. Okoduwa *et al.* [6] reported substantial forest loss in Okomu Forest Reserve between 2000 and 2024, with forest loss exceeding forest gain and regrowth occurring in fragmented locations.

At a broader regional scale, Wingate *et al.* [7] estimated an almost 17% decline in structurally intact forest between 2000 and 2024 across Togo, Benin, Nigeria and Cameroon, alongside a roughly one-third reduction in protected areas connected by intact forest corridors. This is a four-country West African result, not a Nigeria-only estimate. It nevertheless illustrates the regional importance of maintaining corridors that connect protected areas. For Nigeria, the policy implication is to map and safeguard corridors, buffer zones and stepping-stone habitats while monitoring local changes with national and state-level data.

Comparative evidence from southwestern Nigeria also indicates that relatively less disturbed forest can retain stronger species diversity and structural characteristics than more disturbed protected forest [8].

2.1.2. Agriculture and Land Degradation

Agricultural expansion supports livelihoods and food security, but poorly planned expansion can replace natural habitats, reduce vegetation diversity, intensify soil disturbance and affect water systems. Evidence from Western Africa indicates that agriculture, logging and fire are among the pressures associated with perceived and measured forest degradation, while local perceptions do not always correspond closely with measurable ecological change [9].

FAO similarly emphasizes innovation in technology, institutions, policy and finance as important to sustainable forest management [5]. In Nigeria, agricultural land-use decisions should therefore be integrated with forest conservation, watershed protection and restoration planning, with greater emphasis on productivity within existing agricultural landscapes and biodiversity-compatible practices such as agroforestry.

2.1.3. Unsustainable Exploitation, Mining and Petroleum Activities

Illegal logging, hunting, mining and petroleum activities can remove biological resources directly while also altering habitats and local livelihood systems. Evidence from Cross River State demonstrates that conservation education, alternative livelihood support and anti-poaching patrols can contribute to biodiversity conservation in protected areas [10].

Human-wildlife coexistence research in Okomu and Cross River also shows the importance of community benefits and compensation mechanisms in reducing tensions around protected areas [11]. Evidence on threatened raptors in Nigeria further indicates that socio-cultural factors and human-wildlife conflict should be considered in species conservation planning [12]. Governance arrangements matter as well: research in Enugu and Cross River States found that forest policies and enforcement conditions shape local access and conservation outcomes [13].

These findings indicate that effective control of resource exploitation requires both credible enforcement and locally legitimate livelihood strategies.

2.1.4. Pollution and Gas Flaring

Pollution affects biodiversity through contamination of air, soil and water and through changes in ecological conditions. Industrial noise is an additional but often overlooked pressure; research in Okomu found that industrial activities can alter wildlife behaviour and contribute to wildlife displacement [14].

Gas flaring is especially important in petroleum-producing areas because it combines greenhouse-gas emissions with local environmental and socioeconomic risks. Okwilagwe and Olubusoye [15] estimated that 11.06 trillion cubic feet of associated gas were flared in Nigeria between 2002 and 2024, generating approximately 714.62 million tonnes of CO_2-equivalent emissions and direct revenue losses of about US$56.75 billion. These estimates quantify emissions and economic costs; they do not directly measure changes in species abundance, population viability or biodiversity. The biodiversity pathway is plausible where flaring co-occurs with habitat disturbance, air pollution, noise and associated oil-and-gas infrastructure, but it requires direct ecological monitoring to establish the magnitude of effects, generating approximately 714.62 million tonnes of CO_2-equivalent emissions and direct revenue losses of about US$56.75 billion.

These findings strengthen the case for credible monitoring, transparent reporting, effective penalties and improved gas utilization.

2.1.5. Freshwater, Coastal and Marine Biodiversity

Nigeria's aquatic biodiversity is exposed to pressures that differ by ecosystem but often originate from connected catchment and coastal processes. In freshwater systems, untreated municipal and industrial effluent, agricultural runoff, sedimentation, dams, wetland conversion, overfishing and destructive fishing practices can degrade spawning and nursery habitats and alter water quality. In estuaries and coastal waters, oil spills, produced water, plastics, shoreline development and mangrove removal affect fish, invertebrates, birds and the habitats on which

fisheries depend. A recent assessment combining remote sensing and field evidence estimated that Nigeria lost 4.5% of its mangrove area between 1990 and 2023; oil-spill pollution was identified as the direct cause of at least 37% of mangrove ecosystem loss, while the invasive Nypa fruticans palm dominated nearly 10% of mapped mangroves by 2023 [16]. Research on Niger Delta contamination has also reported elevated petroleum hydrocarbons in sediments and water, with exceedances of relevant quality criteria indicating likely risks to aquatic and sediment-dwelling organisms [17]. These findings are Nigeria-specific, although they do not represent every freshwater or marine ecosystem in the country. They support routine water-quality and biological monitoring alongside spill prevention, wetland protection, sustainable fisheries management and restoration of native mangrove communities.

2.1.6. Invasive Alien Species

Invasive alien species can compete with native species, alter habitat structure and disrupt ecosystem processes; IPBES identifies them among the major direct drivers of global biodiversity loss [1]. They warrant inclusion in a Nigeria-focused review because their effects can extend from changes in vegetation composition to altered habitat availability and ecosystem functioning.

A particularly well-documented Nigerian example is the introduced mangrove palm Nypa fruticans in the Niger Delta. Using field surveys and multiple remote-sensing datasets, Fatoyinbo *et al.* estimated that Nigeria lost 4.5% of its mangrove area between 1990 and 2023; by 2023, Nypa dominated approximately 93,178 ha, close to 10% of the mapped mangrove area, after expanding by about 70,000 ha over 15 years [16]. The same study attributed at least 37% of mangrove ecosystem loss to oil-spill pollution [16]. These results show that invasive-species spread and petroleum pollution can act together, although the reported area estimates should not be interpreted as direct measurements of all associated species-level effects. Priority actions include mapping invasion fronts, monitoring native mangrove recovery, testing site-appropriate control methods and preventing further spread. Comparable, consistent national data for other invasive species and freshwater systems remain a monitoring need.

2.1.7. Climate Change and Environmental Variability

Climate change interacts with existing ecological pressures by altering temperature, rainfall patterns, drought risk, fire regimes and species' suitable habitats. IPBES identifies land- and sea-use change, direct exploitation, climate change, pollution and invasive alien species among the major direct drivers of biodiversity loss [1].

Yahaya *et al.* [18] explained the value of combining remote sensing and species-distribution modelling to identify vegetation condition and habitat suitability under environmental variability.

This evidence supports an integrated approach in which climate adaptation is considered alongside habitat protection, restoration and resource governance ra-

ther than treated as a separate environmental agenda.

2.1.8. Governance and Environmental Monitoring Constraints

Governance determines whether environmental policies are translated into consistent action. Nigeria's revised NBSAP provides a stronger national policy platform, but implementation requires coordination among federal and state institutions, local governments, communities, researchers, civil society and the private sector [4].

Evidently, monitoring technologies can improve the spatial identification of forest disturbance and recovery. UAV LiDAR and multispectral data, for example, have been successfully integrated to map disturbance severity in a West African forest patch [19], while newer remote-sensing research emphasizes multi-sensor approaches for evaluating forest recovery [20].

The governance requirement is therefore not simply more data, but institutional arrangements that connect data to planning, enforcement, budgeting and conservation decisions.

Table 1 shows the synthesis of evidence for this study.

Table 1. Evidence synthesis.

S/N	Drivers/pressure	Recent evidence	Principal implication	Priority response
1.	Land-use change and fragmentation	Okomu forest loss; decline in intact forest corridors across West Africa [6] [7].	Habitat area and connectivity are both being reduced.	Landscape-scale spatial planning, corridors and protected-area integration.
2.	Agriculture and forest degradation	Agriculture, logging and fire are associated with forest degradation [9].	Production pressures can progressively erode ecosystem integrity.	Agroforestry, sustainable intensification and protection of high-value habitats.
3.	Resource exploitation and wildlife pressure	Conservation education, livelihood support and patrols show positive conservation associations in Cross River [10].	Enforcement alone is insufficient where livelihoods depend on natural resources.	Enforcement plus community participation and alternative livelihoods.
4.	Pollution and gas flaring	Industrial noise affects wildlife behaviour; gas flaring remains environmentally and economically costly [14] [15].	Pollution and energy practices can create cumulative ecological pressure.	Monitoring, sanctions, pollution control and gas-utilisation measures.
5.	Climate and monitoring	Remote sensing and modelling improve assessment of vegetation and habitat conditions [18] [20].	Evidence can be spatially targeted but requires institutional uptake	Integrated monitoring linked to planning, budgeting and enforcement

Source: Authors' synthesis of the reviewed evidence.

3. Review Methodology

This paper employs an integrative review rather than a systematic review or meta-analysis. Searches were undertaken on 23 October 2026, using PubMed/Europe PMC, scholarly search results, publisher journal pages, DOI records, and official institutional sources, including the Convention on Biological Diversity (CBD), the

Food and Agriculture Organization of the United Nations (FAO), and Nigerian government portals. Searches were undertaken for literature published predominantly from 2022 to 2026, retaining foundational sources where necessary to elucidate internationally recognised drivers of biodiversity and policy frameworks. The search strings combined geographical terms alongside ecological pressures and conservation responses. Examples included: (Nigeria OR "Niger Delta" OR "West Africa") AND ("biodiversity loss" OR "forest degradation" OR "habitat fragmentation"); (Nigeria OR "Niger Delta") AND ("freshwater biodiversity" OR "marine biodiversity" OR mangrove OR "oil spill"); and (Nigeria OR "West Africa") AND ("invasive alien species" OR "gas flaring" OR conservation OR "forest connectivity"). Policy searches included "Nigeria National Biodiversity Strategy and Action Plan 2025-2030" and "Nigeria National Forest Monitoring System".

Sources were eligible for inclusion if they addressed at least one review theme, had identifiable publication or institutional provenance, and provided evidence relevant to Nigeria or a clearly transferable West African context. Priority was given to articles reporting Nigerian empirical studies, studies reporting spatial analyses, environmental measurements, peer-reviewed reviews, or official policy or monitoring documents. Sources were excluded if their provenance could not be established, they did not address biodiversity or a relevant ecological pressure, or their geographical and ecological context had little relevance to the review objective. Older foundational sources were retained where they established global drivers or policy commitments.

The final synthesis comprised 23 sources: 16 peer-reviewed journal articles and seven institutional assessments, policy documents or official monitoring resources. Each retained source was reviewed for its geographical scope, method or evidential basis, principal ecological pressure, reported consequence and relevance to conservation action. Evidence was grouped thematically and compared with the Kunming-Montreal Global Biodiversity Framework and Nigeria's revised National Biodiversity Strategy and Action Plan 2025-2030. Thematic evidence synthesis is presented in Table 1, and implementation-oriented monitoring framework is presented in Table 2. The count refers to sources retained for the final synthesis, not to the number of initial search results.

This review does not claim exhaustive retrieval, duplicate-independent screening, PRISMA compliance or pooled effect estimates. A contemporaneous log of total records retrieved and excluded was not available; accordingly, no initial search-result or exclusion counts are reported. The review is presented as a transparent, policy-oriented integrative synthesis rather than a systematic review. For full replication, a future update should archive each database query, retrieval date, screening decision and full-text exclusion reason.

4. Measures for Improving Biodiversity in Nigeria

This section provides practical, institutionally viable measures for restoring bio-

diversity and improving the environmental resilience of Nigeria. The proposed interventions cover ecosystem protection and restoration, sustainable land management, regulatory enforcement, monitoring and community participation.

These measures offer a coordinated opportunity to translate commitments on biodiversity into conservation outcomes and development gains.

4.1. Strengthen Protected Areas and Ecological Connectivity

Nigeria needs to shift from the current emphasis on protecting discrete areas towards ensuring ecological connectivity between diverse habitats. Federal and state environmental authorities should identify critical corridors, buffers, biodiversity hotspots and other priority areas using GIS and remote sensing, and incorporate them into spatial plans and development-containment decisions.

Protected area management should be supported by patrolling and community supervision and clear accountability structures. This directly addresses KMGBF Targets 1 and 3 on biodiversity-inclusive spatial planning and effectively conserved, well-connected areas [3].

Priority actors: Federal and State Ministries responsible for environment and forestry, protected-area agencies, planning agencies, research institutes and host communities.

Indicator: Area of priority habitats and ecological corridors mapped, acknowledged and under active management.

4.2. Restore Degraded Forests and Ecosystems

Restoration efforts need to focus on ecological function and not merely on tree planting. Restoration should set out species lists, degraded riparian zones, forest reserves, mangroves and other priority ecosystems and include maintenance and survival monitoring in project budgets.

Nigeria can use forest-inventory information and geospatial monitoring to set baselines and assess restoration. This reflects KMGBF Target 2, which calls for effective restoration of degraded terrestrial, inland-water, coastal and marine ecosystems [3]. Recent remote-sensing research supports the use of multiple sensors to separate out structural recovery from simple increases in canopy greenness [20].

Priority actors: Forestry agencies, states, communities, NGOs and development partners.

Indicator: Hectares under verified ecological restoration and percentage of restoration sites meeting survival or ecosystem-function targets.

4.3. Promote Sustainable Agriculture and Land Management

Agricultural policy needs to discourage the conversion of high-biodiversity ecosystems while seeking to intensify production from already-cultivated land. Agroforestry, soil conservation, integrated watershed management and climate-smart practices can reduce pressure on natural habitats.

Biodiversity considerations should be part of agricultural extension, land-use planning and infrastructure appraisal. This is consistent with the NBSAP's mainstreaming approach and supported by evidence that agricultural pressure is closely linked to forest degradation in Western Africa [4] [9].

Priority actors: Federal and State Ministries responsible for agriculture and the environment, extension services, local government and farmer organisations.

Indicator: Proportion of priority agricultural landscapes under biodiversity-friendly land-management practices.

4.4. Control Illegal Resource Exploitation, Pollution and Gas Flaring

Environmental enforcement should target those activities with the highest ecological and social costs. This requires improved field supervision and clearer licensing and traceability for timber and minerals, improved prosecution for major wildlife offences, pollution monitoring and credible deterrents for non-compliance.

In petroleum-producing areas, independent verification of gas-flaring volumes should be made and reported and investments in gas gathering and utilization should be undertaken with an eye to environmental protection. Studies highlight the scale of Nigeria's cumulative flaring emissions and economic losses and identify weaknesses in infrastructure and regulation that constrain progress [15].

Priority actors: Environmental regulators, petroleum regulators, security agencies, state governments and operators.

Indicator: Verified reduction in illegal extraction incidents, pollution exceedances and routine gas-flaring volumes.

4.5. Strengthen Governance, Environmental Monitoring and Community Participation

Nigeria needs to strengthen biodiversity and environmental monitoring systems that are interoperable, making use of satellite, field, community and administrative data and accessible to researchers and to planning agencies.

These indicators should routinely be used for budgeting, enforcement and policy appraisal. Community participation should go beyond consultation and include conservation education, livelihood incentives and meaningful roles in monitoring.

Experience in Cross River demonstrates positive contributions from conservation education, alternative livelihoods and anti-poaching patrols, while research on sacred groves demonstrates that working with customary institutions and formal governance systems can be key to long-term biodiversity protection [10] [21].

Priority actors: Federal and State Governments, research institutes, universities, communities, NGOs and development partners.

Indicator: Frequency of biodiversity-monitoring updates, proportion of priority ecosystems with current spatial data and number of communities participating in conservation monitoring. **Table 2** shows the proposed monitoring framework for this study.

Table 2. Proposed biodiversity monitoring framework for Nigeria.

Intervention/indicator	Baseline or data source	Suggested baseline year	Responsible agency/partners	Reporting frequency
Protected areas and connectivity: hectares of priority habitat/corridors mapped, legally protected and effectively managed; connectivity change.	National parks/ protected-area boundaries; state forestry inventories; satellite land-cover and forest-connectivity analysis; NBSAP reporting.	Establish a harmonised geospatial baseline in 2026-2027; retain available historical imagery for trend analysis.	Federal Ministry of Environment; National Park Service; state forestry and environment agencies; state physical-planning authorities; research institutions and host communities.	Annual administrative update; remote-sensing assessment every 2 - 3 years.
Restoration: hectares restored; native vegetation survival; change in mangrove/forest cover and selected ecological indicators.	Restoration project registers; National Forest Monitoring System (NFMS), National Forest Inventory and satellite imagery; field plots and mangrove surveys.	Use the first verified site inventory as the project baseline; record 2026-2027 condition where no defensible baseline exists.	Federal and state forestry departments; Federal Ministry of Environment; relevant state wetlands/coastal agencies; research institutions and community groups.	Annual site checks; ecological outcome assessment every 2 - 3 years.
Sustainable agriculture: share of priority landscapes under agroforestry, soil conservation and biodiversity-compatible practices; natural-habitat conversion rate.	Agricultural extension records; state land-use/ land-cover maps; farm and watershed surveys; satellite change detection.	Set landscape-specific baseline using the latest available map and farm survey, preferably 2026-2027.	Federal Ministry of Agriculture and Food Security; state agriculture ministries and extension services; state environment/planning agencies; farmer organisations.	Annual programme reporting; land-cover review every 2 - 3 years.
Pollution, extraction and flaring: verified spill events and affected area; water-quality exceedances; illegal logging/mining cases; routine flare volumes.	NOSDRA oil-spill monitor and incident records; HYPREP remediation/ monitoring data; NESREA compliance data; NUPRC gas-flaring data; state forestry and mining enforcement records.	Use the latest verified agency records as the initial baseline and publish methods and geographic coverage; avoid treating emissions as a direct biodiversity metric.	NOSDRA; NESREA; NUPRC; HYPREP in its mandate area; Federal Ministry of Environment; state regulators and law-enforcement partners.	Quarterly incident and compliance reporting; annual consolidated assessment.
Governance and community participation: frequency and spatial coverage of biodiversity updates; communities involved; response time to reported threats; budget execution.	NBSAP monitoring and reporting; agency workplans and budgets; community-monitoring registers; university and NGO field datasets; national biodiversity clearing-house records where available.	Conduct an institutional and data inventory in 2026-2027, document gaps and agree on common definitions.	Federal Ministry of Environment/NBSAP coordination mechanism; National Biodiversity Steering Committee or designated successor; state environment agencies; universities, NGOs and community institutions.	Annual public progress report; mid-term review aligned with NBSAP milestones.

Source: Authors' proposed framework. Agencies listed are proposed lead or data-holding institutions; responsibilities should be confirmed against current statutory mandates and state-level arrangements. Where no consistent national ecological baseline is available, the first verified survey should be documented as the baseline rather than presenting an unverified value.

4.6. Discussion

The evidence indicates that Nigeria's biodiversity problem is a landscape-governance issue. Forest loss, wildlife exploitation, agricultural expansion, pollution and

petroleum activities do not act independently or additively but can interact to produce cumulative impacts when biodiversity is fragmented in a context of weak environmental governance and limited community livelihood options. The Okomu evidence indicates the value of landscape-scale monitoring, and the West African connectivity study indicates that conservation gains can be compromised if protected areas are increasingly isolated [6] [7].

A second implication is that conservation measures should be designed as complementary packages. Protected areas without connectivity may leave species isolated; restoration without protection may be followed by renewed degradation; enforcement without livelihood alternatives may generate resistance; and monitoring without institutional response may create information without conservation impact. The five measures proposed in this review are therefore interlocking rather than individual recommendations.

The policy environment is more conducive than that reflected in the original manuscript. Nigeria's NBSAP 2025-2030 sets out 23 national biodiversity targets aligned to the KMGBF and adopts a whole-of-government and whole-of-society approach [4]. The implementation challenge is to translate those national commitments into state and local spatial plans, sectoral programmes, annual budgets, development-control decisions and measurable indicators.

Further implication concerns evidence and monitoring. Nigeria has some elements of a National Forest Monitoring System, including satellite land monitoring and forest-inventory components, although the FAO country resource indicates that national forest monitoring is an evolving institutional process [22]. FAO also reported in 2026 on Nigeria's efforts to enhance transparency in forest monitoring and climate reporting [23]. Evidently, the value of satellite and multi-sensor approaches for measuring forest loss, disturbance and recovery [18] [19]. Future conservation policy should therefore establish common baselines and repeat monitoring rather than rely solely on periodic narrative assessments.

Therefore, biodiversity conservation should be framed as a development issue rather than only an environmental-sector responsibility. Forests, wetlands, mangroves and other ecosystems provide services that underpin food systems, water security, climate regulation and livelihoods. The central policy question is therefore how Nigeria can meet development needs while maintaining high-value ecosystems functional. This requires cross-sectoral planning, credible enforcement, ecological restoration, community participation and sustained financing.

5. Conclusions

This review establishes that biodiversity loss and environmental change in Nigeria are complex and interacting processes, driven by the combined effects of land-use pressures, resource exploitation, climatic variability, socioeconomic demands and institutional weaknesses.

Land-use change, deforestation and habitat fragmentation continue to threaten ecological integrity, and agricultural expansion and land degradation intensify

pressure on natural ecosystems. Unsustainable exploitation through illegal logging, hunting, mining and petroleum activities further depletes biological resources and degrades habitats. Pollution and gas flaring impose additional ecological and economic costs, and climate variability adds to environmental vulnerabilities. Weak institutional coordination, enforcement and environmental monitoring can further constrain effective responses.

Accordingly, five sustainable conservation measures are prioritised to translate biodiversity commitments into practical, measurable and context-responsive actions in Nigeria.

1) Strengthening protected areas and ecological connectivity requires moving beyond isolated conservation sites to interconnected landscapes that are capable of maintaining habitat continuity and species movement. Protected areas should be supported by ecological corridors, buffer zones and biodiversity-sensitive spatial planning, with GIS and remote sensing to identify priority habitats and monitor changes. Effective management should also include regular surveillance, clear institutional responsibilities and community participation.

2) Restoring degraded forests and ecosystems should focus on recovering ecological functions rather than simply increasing the number of trees planted. Restoration efforts should prioritise degraded forest reserves, riparian ecosystems, mangroves and other ecologically important areas using appropriate native species. Long-term maintenance, survival assessment and geospatial monitoring should be incorporated into restoration programmes to determine whether interventions are generating meaningful ecological recovery.

3) Promoting sustainable agriculture and land management is essential to reduce the conversion of biodiversity-rich ecosystems while maintaining agricultural productivity and rural livelihoods. Greater emphasis should be placed on agroforestry, soil conservation, watershed management and climate-smart agricultural practices. Incorporating biodiversity considerations into agricultural extension, land-use planning and infrastructure development can help reconcile food production with ecosystem conservation.

4) Controlling illegal resource exploitation, pollution and gas flaring requires stronger environmental regulation, surveillance and enforcement. Illegal logging, wildlife exploitation and unregulated mining should be addressed through improved licensing, traceability, field monitoring and prosecution of serious offences. Similarly, pollution control and independent monitoring of gas flaring should be strengthened, along with increased investment in gas capture and utilisation to reduce both environmental damage and economic losses.

5) Strengthening governance, environmental monitoring and community participation is critical to sustain the preceding interventions. Nigeria requires integrated monitoring systems that combine satellite observations, field inventories, administrative records and community-generated information to support timely decision-making. Communities should be recognised as active conservation partners through environmental education, livelihood incentives and participation in

monitoring and resource management. Enhanced coordination among Government Institutions, Research Organisations, Civil Society and Local Communities will improve accountability and implementation.

Nigeria's revised NBSAP 2025-2030 provides an appropriate policy platform for advancing these measures; however, its effectiveness will depend on translating national commitments into spatially explicit plans, adequately financed programmes, credible enforcement mechanisms and measurable indicators. Ultimately, the required policy shift is from broad environmental protection commitments to coordinated, evidence-based, locally responsive and monitorable biodiversity conservation action capable of delivering both ecological resilience and sustainable development outcomes.

Declaration of Generative AI and AI-Assisted Technologies in Manuscript Preparation

During manuscript preparation, the authors used Claude (Anthropics) solely for limited language editing of selected sentences in order to revise in order to improve clarity. No AI tool was used to generate research content, analyze data, interpret results, or prepare references, the ideas, argument, and intellectual contribution of the paper are entirely original. All AI-assisted suggestions were reviewed, revised where necessary, and approved by the authors, who take full responsibility for the final manuscript.

Author Contributions

David Olugbenga Taiwo: conceptualization, formal analysis, and writing—original draft preparation. Fayokemi Sarah Abe: methodology, investigation, and writing—review and editing. Joseph Aderemi Akinola: supervision, validation, and writing—review and editing. All authors have read and agreed to the published version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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