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Rethinking Ecosystems, Climate Change and Insecurity Through Indigenous Knowledge Systems

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Abstract

Climate change has aggravated environmental degradation, resource competition and human insecurity across Nigeria, threatening livelihoods and weakening ecosystem resilience. Although contemporary responses have largely relied on scientific and technological interventions, comparatively little attention has been given to Indigenous Knowledge Systems (IKS), which historically informed environmental conservation and community adaptation. This paper rethinks the relationship between ecosystem governance, climate change and insecurity by examining the significance of indigenous ecological knowledge to contemporary environmental and security challenges. It argues that indigenous practices such as sacred forest conservation, traditional weather forecasting, customary land-use regulation and community-based natural resource management provided sustainable mechanisms for ecological preservation, climate adaptation and conflict mitigation. The study adopts a qualitative historical methodology, drawing on historical literature, ethnographic studies, policy documents and documented case studies from Nigeria. Guided by Indigenous Knowledge Systems and Political Ecology perspectives, it analyses how indigenous environmental practices have shaped ecosystem governance and community resilience across time. The findings reveal that despite the erosion of many indigenous institutions through colonialism, urbanisation and changing socio-economic conditions, indigenous ecological knowledge remains a valuable resource for strengthening climate adaptation, environmental sustainability and local security. The study further contends that the marginalisation of indigenous knowledge in environmental governance has limited community participation and reduced the effectiveness of climate response initiatives. The paper concludes that sustainable responses to climate-induced insecurity require the integration of Indigenous Knowledge Systems with contemporary environmental policies and scientific innovations. It recommends the documentation and preservation of indigenous ecological practices, their incorporation into climate adaptation and environmental governance frameworks, and stronger collaboration among local communities, researchers and policymakers. Such an integrated approach offers a more possible pathway to ecosystem sustainability, climate resilience and community security in Nigeria.

1. Introduction

The accelerating pace of climate change has emerged as one of the defining challenges of the twenty-first century. Beyond rising temperatures and shifting rainfall regimes, it has become a principal driver of ecosystem degradation, food insecurity, biodiversity loss and displacement, particularly in economies that depend heavily on natural resources (Intergovernmental Panel on Climate Change 6). Across Africa, environmental change has increasingly transformed what were once purely ecological concerns into complex socio-economic and security challenges with direct implications for sustainable development.

Nigeria exemplifies this connection. Desertification in the north, recurrent flooding in the Niger-Benue Basin, coastal erosion in the Niger Delta and declining agricultural productivity have intensified competition over land, water and forest resources, contributing to farmer-herder conflict, communal disputes, forced migration and livelihood insecurity (United Nations Environment Programme 14).

Climate change rarely produces violent conflict on its own; rather, it functions as a threat multiplier that aggravates pre-existing social, economic and political vulnerabilities (Intergovernmental Panel on Climate Change. Climate Change (IPCC) 2709).

Contemporary responses to these pressures have been dominated by scientific research, technological monitoring and state-led environmental regulation. Satellite observation, climate modelling and early-warning systems are now central to adaptation planning, yet they frequently overlook the ecological knowledge embedded in Indigenous Knowledge Systems (IKS). For generations, indigenous communities across Nigeria developed locally calibrated practices such as sacred groves, indigenous weather forecasting, rotational farming, customary grazing arrangements and community-based conservation institutions, that regulated resource use and strengthened resilience against environmental shocks (Berkes 8).

Many of these institutions were weakened by colonial administrative restructuring, urbanisation and the ascendancy of Western scientific paradigms, detaching environmental governance from local knowledge and community participation. Recent literature nonetheless argues that effective climate adaptation depends on integrating scientific knowledge with indigenous ecological practice, since each offers distinct but complementary perception (Nyong, et al. 790). This article re-examines the relationship between ecosystems, climate change and insecurity through the lens of IKS, treating indigenous ecological knowledge not as a cultural relic but as a dynamic and empirically documented resource for contemporary environmental governance.

2. Conceptual and Theoretical Perspectives

2.1 Indigenous Knowledge Systems: Conceptualising Environmental Stewardship

Indigenous Knowledge Systems constitute the cumulative body of knowledge, beliefs, values and practices that indigenous communities develop through prolonged interaction with their natural environment. Unlike formal scientific knowledge, which typically depends on controlled experimentation and institutional validation, indigenous knowledge evolves through lived experience, close observation and intergenerational transmission. Berkes defines it as a dynamic system encompassing ecological knowledge, resource-management practice, social institutions and cultural belief that together sustain human-environment relationships (Berkes 7).

Across Nigeria, indigenous environmental institutions remain empirically observable despite decades of social transformation. Among the Yoruba, sacred groves such as the Osun-Osogbo Sacred Grove functioned as protected ecological reserves in which exploitation of flora and fauna was strictly regulated by customary law; the grove's inscription on the UNESCO World Heritage List in 2005 formally recognises its continuing biodiversity value (UNESCO). Comparable conservation traditions existed among the Igbo through ohia nso (sacred forests), while pastoral communities in the north employed

indigenous grazing calendars and seasonal migration routes to minimize pressure on fragile rangelands (Anayo. et al.). These cases, summarised comparatively in Table 1, provides evidence that environmental sustainability was embedded in indigenous social organisation long before the emergence of formal environmental policy.

Table 1
Selected Indigenous Ecosystem Governance Institutions in Nigeria

Community/Region	Institution	Ecological Function	Documented Outcome	Source
Yoruba (Osun State)	Osun-Osogbo Sacred Grove	Restricted logging, hunting and farming within a spiritually protected forest reserve	Designated a UNESCO World Heritage Site in 2005; remains one of the last primary high-forest groves along the Osun River	UNESCO
Igbo (southeastern Nigeria)	Ohia nso (sacred forests)	Customary prohibition of timber extraction and wildlife exploitation in shrine forests	Preserved relict forest patches functioning as informal biodiversity refugia in otherwise farmed landscapes	Anayo
Old and New Ekuri, Cross River State	Ekuri Initiative (community forest management)	Elder-led decision in 1992 to forgo a logging road and self-manage 33,600 hectares of rainforest	Winner of the UNDP Equator Prize (2004); pilot site for UN-REDD; forest remains contiguous with Cross River National Park	United Nations Development Programme
Fulani pastoral communities (northern Nigeria)	Transhumance and grazing-calendar institutions	Seasonal migration routes negotiated with farming communities to match rainfall and pasture cycles	Historically reduced land-use competition prior to demographic and climatic pressures of the past four decades	Blench and Dendo

Source

compiled by the authors from UNESCO; Anayo Ossai; United Nations Development Programme; and Blench and Dendo.

Colonial rule and postcolonial centralisation nonetheless altered these institutions fundamentally. Colonial forest ordinances transferred control of natural resources from communities to the state,

weakening customary management systems, while subsequent urbanisation, commercial agriculture and population growth accelerated the decline of indigenous ecological practice (Rim-Rukeh et al. 76). Extant literature, however, increasingly treats IKS and scientific knowledge as complementary rather than competing frameworks capable of jointly informing climate adaptation and resource governance (Nyong et al. 789).

2.2 Ecosystem, Climate Change and Environmental Insecurity

An ecosystem denotes the dynamic interaction between living organisms and their physical environment, sustaining human existence through services such as food production, water regulation, forest products, flood control, natural resources and biodiversity conservation, and the options to restore, conserve or enhance the sustainable use of ecosystems. (Millennium Ecosystem Assessment 39). Climate change has significantly disrupted these functions: rising temperatures, irregular rainfall, prolonged drought and extreme weather have reduced agricultural productivity and accelerated degradation worldwide, disproportionately affecting rural populations whose livelihoods depend directly on natural resources (Intergovernmental Panel on Climate Change. Climate Change (IPCC) 1248).

Nigeria illustrates this vulnerability empirically. Desertification continues to advance across the Sudano-Sahelian zone; Nwafor's frequently cited estimate places national landmass loss to desert encroachment at roughly 351,000 hectares, advancing southward at approximately 600 metres per year, while the country's official Land Degradation Neutrality report submitted to the United Nations Convention to Combat Desertification records the loss of 463,360 hectares of forest land between 2000 and 2010 alone, more than a quarter of which was converted directly to cropland (United Nations Convention to Combat Desertification 6). Recurrent flooding across the Niger and Benue basins, coastal erosion in the Niger Delta, and uncontrolled deforestation compound this picture, collectively expanding the scope of insecurity beyond conventional military threats to include ecological instability and forced migration (United Nations Environment Programme (UNEP) 68).

This relationship between degradation and insecurity has generated sustained scholarly attention within the field of environmental security. Homer-Dixon argues that environmental scarcity rarely causes conflict independently; rather, it interacts with existing political, economic and social inequalities to raise the likelihood of violent competition over scarce resources (Homer-Dixon 177), a proposition borne out by the empirical patterns examined in Section 4.

2.3 Theoretical Framework

This study is anchored on Political Ecology Theory and the Indigenous Knowledge Systems Framework. Political Ecology, developed by Blaikie and Brookfield during the 1980s, holds that environmental degradation cannot be explained by natural processes alone but must be situated within political, economic and historical context; ecological crises frequently result from unequal access to resources, inappropriate development policy and shifting power relations (Blaikie and Brookfield 17). Applied to

Nigeria, the theory clarifies how climate change interacts with poverty, demographic pressure, weak governance and unequal resource distribution to generate insecurity: farmer-herder conflict, land disputes and environmental displacement are shaped as much by historical patterns of resource access and institutional weakness as by changing climatic conditions.

Complementing this is the Indigenous Knowledge Systems Framework advanced by Berkes, which treats indigenous environmental knowledge as a dynamic system integrating ecological understanding, customary institutions, cultural values and adaptive resource-management practice (Berkes 15). Rather than opposing scientific knowledge, the framework advocates their integration for more effective governance. Together, the two perspectives allow the study to explain both the structural drivers of ecosystem degradation and the adaptive capacity embedded within indigenous institutions.

3. Indigenous Knowledge Systems and Ecosystem Governance in Nigeria: A Historical Perspective

Long before the introduction of formal environmental legislation in Nigeria, indigenous communities developed sophisticated systems for regulating human interaction with the natural environment. These systems evolved through centuries of observation and adaptation, forming an integral part of social organisation, cultural identity and economic survival; ecological governance was embedded in customary law, religious belief and communal norms regulating access to land, forests, rivers and other resources (Berkes 14).

The diversity of Nigeria's ecological zones produced equally diverse indigenous practice. In the rainforest belt, sacred forests and groves represented one of the most enduring institutions of ecosystem conservation. The Osun-Osogbo Sacred Grove in present-day Osun State remains among the most celebrated examples: beyond its spiritual significance, the grove has for centuries functioned as a refuge for biodiversity, preserving indigenous plant and animal species that have disappeared from surrounding landscapes because of urbanisation and agricultural expansion, a value formally recognised through its 2005 UNESCO World Heritage inscription (UNESCO).

A particularly instructive empirical case is the Ekuri Initiative in Akamkpa Local Government Area, Cross River State. In 1992, when a logging company proposed constructing an access road through the community's forest in exchange for limited local infrastructure, the elders of Old and New Ekuri instead resolved to manage the forest themselves. The resulting Ekuri Initiative brought approximately 33,600 hectares of contiguous rainforest, an area bordering the Cross River National Park and home to the critically endangered Cross River gorilla under community stewardship (United Nations Development Programme 3). The initiative subsequently won the UNDP Equator Prize in 2004 and became a pilot site for the United Nations REDD+ programme, and its 6,200 Nkokoli residents continue to derive livelihoods from regulated non-timber forest products such as bush mango, kola nut and afang leaf while maintaining an intact forest boundary. Table 3 (Section 5) presents the case in fuller empirical detail; it is introduced here to indicate that customary institutions, where they retained authority, produced

ecological outcomes that have since been independently verified by international agencies rather than merely asserted by local tradition.

Among the Igbo of southeastern Nigeria, similar conservation traditions existed through sacred forests known locally as Ohia Nso, which functioned as centres of worship, dispute settlement and environmental preservation; customary restriction of timber and wildlife exploitation within these forests reinforced environmental ethics by linking resource conservation to communal identity (Anayo et al).

In northern Nigeria, where aridity and rainfall variability define agrarian life, Hausa farming communities relied on indigenous knowledge of soil characteristics and seasonal indicators from the flowering of particular trees, bird behaviour and wind direction, to determine planting periods, complementing practical farming experience and minimizing climatic risk (Ajibade and Shokemi 54). Fulani pastoral communities developed comparably elaborate systems of seasonal migration and grazing management, with transhumance routes organised around rainfall and pasture availability and local agreements negotiated between herders and farmers (Blench and Dendo).

Indigenous water-resource governance followed a similar logic: rivers, streams and wetlands were treated as communal resources protected through customary rules enforced by traditional authorities, with fishing seasons regulated and certain water bodies periodically closed to allow fish populations to regenerate (Ostrom 88). Agricultural practice reflected comparable ecological sophistication like mixed cropping, crop rotation, shifting cultivation and agroforestry-maintained soil fertility and reduced vulnerability to crop failure, practices that contemporary agroecological research increasingly recognises as legitimate forms of climate adaptation rather than primitive technique (Altieri and Nicholls 480).

This ecological balance was disrupted profoundly during the colonial period. Colonial forest policy introduced statutory control over forests and wildlife, replacing customary governance with centralised administrative institutions and frequently excluding indigenous communities from lands they had historically conserved (Ribot 55). The postcolonial period compounded this disruption through rapid population growth, urban expansion and the spread of formal education systems that displaced oral transmission of ecological knowledge. Nevertheless, as the Ekuri case illustrates, IKS did not disappear; where customary authority survived contestation, it continued to generate measurable conservation outcomes.

4. Climate Change, Environmental Insecurity and Community Resilience in Contemporary Nigeria

Climate change has increasingly transformed environmental challenges into complex security concerns across Nigeria. The frequency and intensity of climate-related events over the past three decades have significantly amplified vulnerability in rural and urban communities alike, so that climate change is no longer viewed solely as an environmental issue but as a multidimensional phenomenon bearing directly on economic development, food security and political stability (Intergovernmental Panel on Climate

Change 15). Table 2 summarizes four of the most robustly documented indicators of this transformation.

Table 2
Empirical Indicators of Climate-Linked Environmental Insecurity in Nigeria and the Lake Chad Basin

Indicator	Documented Figure	Source
Lake Chad surface-area contraction, 1963-present	From approximately 25,000 km² to under 1,500 km² (a decline of roughly 90 percent), affecting close to 40 million basin residents	United Nations Environment Programme
Forest-land loss to degradation and desertification, 2000–2010	463,360 hectares of forest land lost nationally, of which 344,710 hectares converted to shrub/grassland and 118,570 hectares to cropland	United Nations Convention to Combat Desertification
2022 flood disaster	More than 3 million people affected across 34 states; 603 confirmed deaths; over 1.4 million displaced; approximately 569,251 hectares of farmland damaged	United Nations Office for the Coordination of Humanitarian Affairs
Farmer-herder conflict fatalities	At least 2,991 herders killed nationally in 2013; more than 1,300 deaths recorded between January and June 2018 alone across the north-central states	International Crisis Group

Source

compiled by the authors from United Nations Environment Programme; United Nations Convention to Combat Desertification; United Nations Office for the Coordination of Humanitarian Affairs; and International Crisis Group.

Lake Chad offers the starkest regional illustration. Once among Africa's largest freshwater bodies, the lake's surface area has contracted by approximately 90 percent since 1963, from roughly 25,000 square kilometres to under 1,500 square kilometres, a decline driven jointly by reduced rainfall, upstream irrigation demand and unsustainable water abstraction across the four riparian states of Chad, Cameroon, Niger and Nigeria (United Nations Environment Programme). The contraction has curtailed fishing and farming livelihoods for a basin population once estimated at nearly 40 million, intensifying competition for the residual water and grazing resources that remain a dynamic widely cited in security analyses of Boko Haram recruitment in the surrounding north-eastern states.

Within Nigeria itself, advancing desertification in the far north has reduced grazing land and water availability, pushing pastoral communities southward into closer contact with sedentary farming communities whose own land is simultaneously under pressure from population growth and declining soil fertility. Although farmer-herder conflict has multiple historical, political and socio-economic causes, environmental stress functions as an important aggravating factor (Moran et al.). The scale of resulting violence is empirically substantial: International Crisis Group research recorded at least 2,991 herders killed nationally in 2013 alongside more than 64,750 stolen cattle, and documented more than 1,300

additional deaths between January and June 2018 in the north-central states of Benue, Plateau, Nasarawa and Taraba (International Crisis Group, Herders 4; International Crisis Group, Stopping 1). The same research estimates that herder-farmer violence cost federal and state governments an average of 47 percent of internally generated revenue across the four worst-affected Middle Belt states (International Crisis Group, Herders 9), underscoring that environmental insecurity in Nigeria carries measurable fiscal as well as humanitarian cost.

Southern Nigeria presents a distinct but equally significant dimension of climate-related insecurity. The floods of 2022 which is the most severe since 2012, affected more than three million people across thirty-four states, killed 603 people, injured more than 2,400, displaced upward of 1.4 million and damaged an estimated 569,251 hectares of farmland, according to figures compiled jointly by NEMA and the United Nations Office for the Coordination of Humanitarian Affairs (United Nations Office for the Coordination of Humanitarian Affairs). Bayelsa State alone recorded roughly 700,000 people displaced or affected, while flooding in Borno, Adamawa and Yobe simultaneously triggered a cholera outbreak that produced more than 7,700 reported cases (ACAPS and Nigeria 2–3). Beyond their immediate humanitarian toll, such disasters generate durable socio-economic disruption, including increased poverty, food shortages and internal migration (National Emergency Management Agency 42).

Despite these pressures, local communities continue to suggest adaptive capacity through IKS. Indigenous farmers increasingly combine traditional agricultural knowledge with contemporary technique like crop diversification, mixed farming, agroforestry, indigenous seed preservation and flexible planting calendars, to reduce climate-related risk (Altieri and Nicholls 37). Traditional weather forecasting, based on bird migration, flowering patterns, insect behaviour, cloud formation and wind direction, continues to provide useful local information, particularly when combined with modern meteorological services (Ajibade and Shokemi 61). Community-based natural resource management similarly persists: traditional institutions in many communities continue to regulate access to forests, fishing grounds and grazing areas through customary law enforced by village councils and traditional rulers, and such institutions frequently secure higher compliance than externally imposed regulation precisely because they are rooted in community participation and trust (Ostrom 90).

The capacity of IKS to respond to contemporary climate pressure is nonetheless constrained. Urbanisation, population growth and changing socio-economic aspirations have weakened many customary institutions, while formal environmental policy has frequently privileged scientific expertise over local knowledge and participation, a disconnect that has limited the effectiveness of numerous adaptation programmes because policy interventions often fail to reflect local ecological realities (Berkes 285). The erosion of intergenerational knowledge transmission compounds this challenge: as oral traditions, apprenticeship and everyday participation in farming and resource management give way to formal schooling and migration, valuable environmental practice risks disappearing precisely as climate change demands more diverse, locally grounded adaptation strategies (UNESCO, Local 17).

5. Integrating Indigenous Knowledge Systems into Contemporary Environmental Governance

The increasing complexity of climate change and environmental insecurity has exposed the limitations of relying exclusively on scientific and technological approaches to ecosystem management. Advances in climate science, remote sensing, geographic information systems and environmental modelling have significantly improved the capacity to monitor environmental change, yet these innovations often fail to capture the socio-cultural dimensions of ecosystem governance at community level; adaptation strategies designed without meaningful engagement with local knowledge frequently encounter weak implementation, limited ownership and poor long-term sustainability (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 26).

International policy frameworks increasingly acknowledge indigenous ecological knowledge as a substantive resource rather than mere cultural heritage. The Convention on Biological Diversity, adopted in 1992, explicitly recognises the importance of traditional knowledge in biodiversity conservation and sustainable resource management, while UNESCO continues to advocate the integration of indigenous knowledge into climate adaptation and disaster-risk-reduction programming (Convention on Biological Diversity, art. 8(j); UNESCO, Local 9). In Nigeria, however, environmental governance remains predominantly centralised: policies are formulated primarily through federal and state institutions, and although community participation is frequently emphasised in policy documents, indigenous ecological knowledge rarely occupies a central position in environmental planning (Federal Ministry of Environment 41).

The Ekuri Initiative, introduced in Section 3, provides the most empirically documented Nigerian counter-example and merits closer examination as an integration model. Table 3 summarizes its key attributes.

Table 3
The Ekuri Initiative: Case Study Snapshot

Attribute	Detail
Location	Akamkpa Local Government Area, Cross River State, Nigeria
Population	Approximately 6,200 indigenous Nkokoli (Lokorli-speaking) residents of Old and New Ekuri
Governance mechanism	Elder-led communal decision to reject a proposed logging road in 1992 and manage the forest instead through the community-owned Ekuri Initiative
Area under community management	33,600 hectares of contiguous rainforest bordering the Cross River National Park
International recognition	UNDP Equator Prize (2004); pilot community for UN-REDD; registered as an Indigenous and Community Conserved Area
Contemporary pressure	Unauthorised commercial logging incursions since 2023 have prompted joint appeals by civil-society organisations to federal authorities and UN human-rights mechanisms

Source

compiled by the authors from United Nations Development Programme and the ICCA Registry.

What distinguishes Ekuri from a purely nostalgic account of custom is its documented interaction with formal governance and international institutions: the initiative was independently verified and internationally recognised through the UNDP Equator Prize, formally registered as an Indigenous and Community Conserved Area with UNEP's World Conservation Monitoring Centre, and incorporated as a pilot site within Nigeria's UN-REDD programme (United Nations Development Programme 4–6). At the same time, the case illustrates the fragility of unsupported customary authority: since 2023, unauthorised commercial logging incursions by an external timber company have prompted joint appeals from civil-society organisations to Nigeria's Ministry of Environment and the UN Special Rapporteur on the situation of human-rights defenders, precisely because customary institutions lack statutory backing sufficient to withstand externally financed extraction (Tribune Online Nigeria). The Ekuri experience therefore illustrates both the empirical viability of community-based ecosystem governance and the structural vulnerability it faces without formal legal recognition, a vulnerability that integration with statutory frameworks could substantially reduce.

Traditional institutions more broadly, councils of elders, village assemblies, age-grade associations and customary authorities, have historically regulated access to forests, grazing lands, fisheries and water resources through locally accepted rules and sanctions. Because such institutions derive legitimacy from community participation rather than external enforcement, they often secure higher levels of compliance than centrally imposed regulation; Ostrom argues that sustainable management of

common-pool resources depends largely on locally developed institutions capable of balancing collective interests with environmental sustainability (Ostrom 88).

IKS also offer concrete opportunities for enhancing climate-adaptation strategy. Rural communities continue to employ indigenous weather forecasting, drought-resistant crop varieties, mixed cropping and traditional soil-conservation technique evolved through generations of environmental observation. Rather than dismissing these practices as unscientific, policymakers should treat them as complementary sources of locally specific environmental knowledge: scientific climate models provide valuable regional forecasts, while indigenous forecasting often captures micro-environmental variation that shapes local agricultural decisions, and combining both forms of knowledge can improve the accuracy, accessibility and social acceptance of climate information services (Nyong, et al. 792).

Environmental conflict prevention represents a further area of relevance. Competition over land, water and forest resources frequently escalates because formal legal institutions are slow, inaccessible or perceived as lacking legitimacy by local communities. Historically, indigenous dispute-resolution mechanisms emphasised dialogue, consensus-building and restorative reconciliation rather than adversarial litigation, with traditional rulers, lineage heads and councils of elders mediating disputes before they escalated into violence. While such institutions cannot resolve contemporary environmental conflict on their own, their integration with formal governance structures could strengthen conflict prevention and improve trust between communities and government agencies (Boege 18).

Effective integration nonetheless requires addressing structural constraints. First, indigenous ecological knowledge remains inadequately documented; because much of it continues to be transmitted orally, it is vulnerable to erosion through generational change, migration and urbanisation, making systematic documentation involving historians, anthropologists, environmental scientists and knowledge holders essential (Berkes 311). Second, environmental education should recognise indigenous knowledge alongside scientific knowledge rather than presenting sustainability exclusively from a Western scientific perspective. Third, public policy should move beyond consultation toward genuine co-production, involving indigenous knowledge holders in environmental planning, implementation and evaluation rather than treating them as beneficiaries of externally designed programmes (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) 34). Finally, technological innovation should be viewed as complementary to, rather than a substitute for, IKS: remote sensing and climate modelling provide invaluable monitoring tools, while indigenous ecological knowledge contributes contextual understanding that technological observation alone cannot capture.

6. Conclusion

The study has examined the relationship between ecosystems, climate change, insecurity, and Indigenous Knowledge Systems within the Nigerian context. The analysis indicates that indigenous communities have historically developed locally grounded institutions, environmental practices, and social mechanisms for managing natural resources, responding to ecological stress, and maintaining

communal resilience. These practices provide important insights into the relationship between environmental governance and human security.

The study further suggests that climate change and ecosystem degradation can intensify existing social and economic vulnerabilities, particularly where livelihoods depend heavily on land, forests, water, and pastoral resources. However, the relationship between environmental change and insecurity is neither automatic nor uniform. It is shaped by wider political, economic, institutional, and historical conditions, including weak governance, resource competition, exclusion, and inadequate conflict-resolution mechanisms.

The findings do not suggest that Indigenous Knowledge Systems should replace scientific knowledge or formal state institutions. Rather, they support a complementary approach in which indigenous knowledge is recognised as a valuable source of environmental understanding and community-based adaptation. Such integration should be participatory, context-sensitive, and respectful of community ownership and intellectual rights.

Consequently, effective responses to climate-related insecurity in Nigeria require more than technological or security-based interventions. They also require inclusive environmental governance, stronger local institutions, improved documentation of indigenous practices, community participation, and sustained collaboration between indigenous knowledge holders, researchers, government agencies, and development organisations. Further empirical research is necessary to evaluate how such approaches can be adapted across Nigeria's diverse ecological and socio-political settings.

Limitations of the Study

This study has several limitations. First, its qualitative historical and documentary design relies on existing scholarly publications, institutional reports, policy documents, and documented case studies rather than original fieldwork or primary empirical data. Consequently, the analysis is dependent on the scope, accuracy, and availability of the existing documentary record.

Second, the selected cases, particularly the Ekuri Initiative and other indigenous environmental institutions, illustrate specific historical and ecological contexts and cannot be assumed to represent all indigenous communities or ecological zones in Nigeria. The experiences of communities in the forest, savannah, Sahelian, coastal, and semi-arid environments may differ considerably.

Third, the study does not employ statistical modelling, longitudinal field measurements, or experimental techniques to establish causal relationships between Indigenous Knowledge Systems, ecosystem conservation, climate adaptation, and insecurity. Its conclusions should therefore be understood as historically grounded analytical interpretations rather than universally generalizable or experimentally verified findings.

Finally, the study does not claim that Indigenous Knowledge Systems can independently resolve the complex environmental and security challenges confronting Nigeria. Rather, it argues that indigenous knowledge may contribute meaningfully when recognised, documented, protected, and integrated carefully with scientific knowledge, institutional support, and appropriate public policy. Further research involving community-based fieldwork, comparative case studies, and systematic evaluation of contemporary adaptation initiatives would help assess the practical effectiveness and limitations of integrating indigenous and scientific knowledge systems.

Declarations

Author Contribution

F. J. Ogaleye, A. O. Ojo, and S. F. Olatoyinbo reviewed the manuscript

Data Availability

This study is based on qualitative historical and documentary analysis. The evidence underlying the analysis and Tables 1–3 was compiled from publicly available institutional reports, policy documents, documented case studies, and scholarly publications cited in the manuscript. The principal sources and their relationship to the evidence presented in the study are further documented in the accompanying supplementary material. No primary survey dataset, statistical code, or computational scripts were generated because the study did not involve statistical or computational analysis.

Ethical Approval

This article does not contain any studies with human participants performed by any of the authors.

Informed Consent

This article does not contain any studies with human participants performed by any of the authors.

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Supplementary Files

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