AGRICULTURAL AUTOMATION, CLIMATE CHANGE-ACTION AND FOOD SECURITY: GLOBAL ISSUES & LOCAL PERSPECTIVES

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AGRICULTURAL AUTOMATION, CLIMATE CHANGE-ACTION AND FOOD SECURITY (GLOBAL ISSUES & LOCAL PERSPECTIVES)

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TABLE OF CONTENTS

Preface

Editorial Note

Table of Contents

Acknowledgement

Dedication

Part one: AGRICULTURAL AUTOMATION Chapter One

Chapter One

Organic and Mineral Soil Amendments as Enablers of Climate-Smart Agricultural Automation: Implications for Soil Water Management and Food Security

*Paul Omaye Joseph[1,4], Enya Anari Akpa[2,4], King Ndeari Dedan[3,4],

Chapter Two

Climate Change–Driven Shifts in Plant Pathogen Epidemiology

IVOKE, Michael Anaelechi

Chapter Three

Bridging the Post-Harvest Loss Gap: Modernizing Middle-Mile Logistics to Eliminate Food Loss

Uzoma Uloma Onyewuchi (Ph.D)

SAEREM BOOK CHAPTERS First Published 2026 ISBN 978-978-60709-7-6

Chapter Four

Transforming Agriculture with Smart Technologies: Benefits,Challenges and Implementation Pathways

[1]Igbojionu, Donatus Okwudiri,[2]Igbojionu, Juliet Nnennaya and [3]Anyika, Felicia

Part two: THE CONCEPT OF CLIMATE CHANGE-ACTION

Chapter Five

Impact of Climate Change on Growth in Nigeria.

Tanimu Joseph[1] & Rebecca Yusuf Auta[2]

Chapter Six

Assessment of Conveyance Efficiency and Its Effect on Agricultural Activities in the Falalia Sector of Middle Rima Valley Irrigation Scheme, Goronyo, Nigeria.

***Sadiq Salihu Kumu[1]; Ibrahim Bala[1]; Umar Ibrahim Chonoko[2]; Fiddausi Salihu Kumu[3]**

Chapter Seven

Digital Veterinary Extension and Statistical Modelling for Climate-Resilient Livestock Disease Surveillance in Nigeria

[1]Chidinma Theresa Nwosu[1], Aren Fatandi Peter[2,] Silas Yibarga Gani[3] & Baridanu Hope Mbube[4]

Chapter Eight

Review of Environmental Degradations in Nigeria From 1960 To 2026: Threats, Policy Frameworks, and Strategic Responses

[1,3]Salami, K. D. [2]Iroko, O.A., [4]Pius, Emmanuel Ekomki and [3]Soba, T. M.

SAEREM BOOK CHAPTERS First Published 2026 ISBN 978-978-60709-7-6

Part three: THE CONCEPT OF FOOD SECURITY

Chapter Nine

Musa Paradisiaca (Plantain) Production In A Climate Change Agriculture

Omu, Paul B.

Chapter Ten

Building Climate Resilience in Nigeria's Food Systems: Integrating Adaptation Strategies for Sustainable Food Security:

Dr. Ijeoma Rose Ezebuike

Chapter Eleven

Snake Gourd as a Neglected and Underutilized Crop for Food Security and Climate Resilience in Southeast Nigeria
Dr. Ogechukwu Anulika Umeh

Chapter Twelve

Climate-Smart Livestock Production: Adaptation, Mitigation and Sustainable Strategies for Resilient Livestock systems

Amaechi, C.I. and Adeyemi, E.A

SAEREM BOOK CHAPTERS First Published 2026 ISBN 978-978-60709-7-6

Preface

This book adopts an exegetical approach as well as a pedagogic model, making it attractive agriculture and environmental economics teachers, professional practitioners and scholars. It is eschews pedantry and lays bars the issues in such clarity that conduces to learning. The book elaborates on contemporaneous Agricultural Automation, Climate Change-Action and Food Security issues of global significance and at the same time, is mindful of local or national perspectives making it appealing both to international and national interests. The book explores the ways in which Agricultural Automation, Climate Change-Action and Food Security issues are and should be presented to increase the public's stock of knowledge, increase awareness about burning issues and empower the scholars and public to engage in the participatory dialogue Agricultural Automation, Climate Change-Action and Food Security necessary in policy making process that will stimulate increase in food production and environmental sustainability. Agricultural Automation, Climate Change-Action and Food Security**:** *Global Issues & Local Perspectives* is organized in three parts. Part One deals with The Concept of Agricultural Automation, Part Two is concerned with The Concept of Climate Change-Action and Part Three deals with the Concept of Food Security

Eteyen Nyong; October 2026

SAEREM BOOK CHAPTERS First Published 2026 ISBN 978-978-60709-7-6

Chapter Eight

Review of Environmental Degradations in Nigeria From 1960 To 2026: Threats, Policy Frameworks, and Strategic Responses

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TABLE OF CONTENTS

1.0 **INTRODUCTION**

1.1 Background to the Study

1.2 Objectives of the Study

1.3 Significance of the Study

2.1 Interconnected Drivers and Impacts of Environmental Degradation in Nigeria

2.2 Conceptual Review

2.2.1 Concept of the Environment

2.2.2 Environmental Threats and Degradation

2.2.3 Environmental Governance

2.3 Major Environmental Threats in Nigeria 1960-2026

2.4 Consequences and Impact of Some Environmental Issues in Nigeria

2.5 Possible Strategies to Address Environmental Threats

2.6 Nigeria's Environmental Policies and Laws

2.7 Approved Environmental Policies, Laws and Institutional Frameworks in Nigeria

SAEREM BOOK CHAPTERS First Published 2026 ISBN 978-978-60709-7-6

2.7.1 National Policy on the Environment
2.7.2 Environmental Impact Assessment Act
2.7.3 NESREA and Environmental Regulations
2.7.4 NOSDRA and Petroleum Pollution Governance
2.7.5 Climate Change Act and NDC Framework
2.8. Challenges and Weakness to Environmental Management

3.0 METHODOLOGY

3.1 Research Design
3.2 Inclusion and Exclusion Criteria
3.3 Data Extraction and Thematic Analysis
3.4 Assessment of Implemented Strategies and Their Efficacy
3.5 Policy Recommendations for Improved Environmental Management

4.0 CONCLUSION

5.0 REFERENCES

1.0 INTRODUCTION

1.1 Background to the Study

Nigeria's environment is a major component of national wealth (Akadiri, Olasehinde-Williams and Haouas, 2026). The country contains a broad range of ecological zones, from coastal and mangrove systems through tropical rainforest and derived savanna to the drier Sudan and Sahelian environments. These systems provide ecosystem services such as food, freshwater regulation, carbon storage, soil formation, pollination, flood attenuation, timber and non-timber forest products, fisheries, wildlife habitat and cultural values (Rai, 2026). The National Policy on the Environment identifies environmental protection and natural-resource conservation as foundations of sustainable development and emphasizes the links among environmental quality, health, livelihoods and economic development Selvakumar, Seenivasan, Deshmukh, Ponnapalli, and Das (2025). Since independence in 1960, the scale and character of environmental pressure in Nigeria have changed substantially. Early environmental regulation was largely sectoral, addressing forestry, wildlife, public health, water resources, agriculture and petroleum activities. The rapid expansion of petroleum production, urban centres, roads and industries increased the need for a coordinated national environmental governance system. The 1988 toxic-waste incident at Koko, Delta State, was a major turning point and contributed to the development of the Harmful Waste Decree and the Federal Environmental Protection Agency framework (Areola, 1998). Petroleum development has been particularly important to Nigeria's environmental history. Oil exploration and production have generated government revenue and

SAEREM BOOK CHAPTERS First Published 2026 ISBN 978-978-60709-7-6

employment, but spills, produced water, pipeline failures, gas flaring, dredging and other activities have degraded ecosystems in parts of the Niger Delta Chijioke Ebong and Ufomba (2018). UNEP's assessment of Ogoniland documented extensive contamination after decades of petroleum operations and concluded that restoration would require long-term, scientifically managed intervention (Nwozor, 2020). The significance of this evidence is broader than Ogoniland because it demonstrates how environmental contamination can affect drinking water, agricultural land, fisheries, mangroves and community wellbeing simultaneously. Forests and other terrestrial ecosystems have also experienced severe pressure. Agricultural expansion, fuelwood and charcoal demand, settlement growth, timber extraction, infrastructure development, fires and other land-use changes reduce forest extent and quality. FAO's Global Forest Resources Assessment provides the principal international framework for measuring forest extent and change and shows that Africa experienced the world's largest regional net forest loss during 2010–2020 Galiatsatos, Donoghue, Watt, Bholanath, Pickerin, Hansen, and Mahmood (2020). Nigeria therefore needs to treat forests not merely as sources of timber but as infrastructure for soil protection, biodiversity, watershed regulation, climate mitigation and rural livelihoods.

Environmental degradation is not uniform across Nigeria. Northern dry lands experience drought, desertification, land degradation, water stress and vegetation loss; the humid southeast is particularly affected by severe gully erosion; the Niger Delta faces oil pollution, mangrove degradation and coastal hazards; while major urban areas experience air pollution, flooding, inadequate drainage, solid-waste accumulation, sewage problems and rapid land-use change. Climate change interacts with these existing pressures. The IPCC identifies increasing climate risks from extreme heat, heavy precipitation, drought and other hazards, while the World Bank's recent Nigeria Country Climate and Development Report stress the need to align development, climate resilience, infrastructure and low-emission pathways

Nigeria's response has evolved from fragmented sectoral measures to a broader environmental governance system. Important institutions and instruments include the Federal Ministry of Environment, NESREA, NOSDRA, the National Agency for the Great Green Wall, the National Council on Climate Change and state-level environmental institutions. NESREA currently lists regulations covering wetlands, waste, mining, erosion and flood control, desertification and drought, forest fire, endangered species, plastics, air quality, water quality, chemicals, electronic waste, batteries and other sectors (Fayemi, 2022). The legal architecture is therefore extensive.

The period 1960 to 2026 is consequently important for a historical review. It allows environmental threats to be examined alongside the expansion of agriculture, petroleum, mining, urbanisation and infrastructure,

while also tracing the development of environmental laws, institutions and policy instruments (Obiakor and Ezeonyejiaku, 2026). Long-term review can distinguish persistent problems from emerging ones and can identify where policy responses have been repeated without sufficient implementation. It can also help connect forestry and wildlife management with broader issues of climate resilience, watershed protection, land restoration and sustainable livelihoods (Owusu, Frimpong, Boadi, Peprah, Aduhene-Chinbuah, Opoku and Asante, 2026). However, the existence of policies, laws and institutions alone does not guarantee environmental sustainability. Effective implementation requires adequate funding, enforcement, monitoring, reliable environmental information, institutional coordination, community participation, political commitment and accountability. Therefore, the major environmental challenge facing Nigeria from 1960 to 2026 is not only the development of appropriate policies but also the effective translation of these policies into measurable improvements in environmental quality and human well-being.

1.2 Objectives of the Study

The broad objective of this paper is to examine the environmental threats, possible strategies, and approved policies in Nigeria from 1960 to 2026. Specifically, the study seeks to identify and document the major environmental threats facing Nigeria within this period, and to analyze the key drivers and impacts of environmental degradation. It will also evaluate the content, implementation, and effectiveness of approved environmental policies and legal frameworks, as well as assess the effectiveness of existing strategies for environmental protection, forest restoration, pollution control, and climate adaptation. Based on these findings, the study will propose integrated strategies and policy recommendations for sustainable environmental governance in Nigeria from 2026 onwards.

1.3 Significance of the Study

This study matters to government, institutions, communities, academia, and development partners because it links Nigeria's environmental history from 1960 to 2026 with present challenges and future pathways. For government and policymakers, the 66-year review provides evidence to strengthen laws and strategies such as the National Conservation Act of 1989, the National Climate Change Policy, and the new "Securing Nigeria's Forest Future 2026 to 2036," while exposing implementation gaps. For agencies like NESREA, NOSDRA, NiMET, and State Ministries of Environment, it identifies priority threats and policy failures to guide targeted action on deforestation, oil spills, waste, and climate adaptation. For communities and civil society, it shows how degradation affects health, livelihoods, and food security in

the Niger Delta, North, and urban areas, and supports advocacy for community forestry and climate justice. For academia, it offers a long-term governance framework for research and modeling. For partners like UNDP, UNEP, GEF, and the World Bank, it aligns with Nigeria's 2026 $1 billion forest restoration plan and informs investments in climate-smart agriculture, renewable energy, and pollution control under SDG 13 and SDG 15.

2.1 Interconnected Drivers and Impacts of Environmental Degradation in Nigeria

Environmental degradation in Nigeria is not a single problem with a single cause. It is a collection of interconnected processes that affect land, forests, wildlife, freshwater, coastal ecosystems, the atmosphere and human settlements. The environmental history of the country since independence has been shaped by agricultural expansion, population growth, urbanisation, petroleum development, industrialisation, infrastructure expansion, mining, changing consumption patterns and climatic variability. The resulting pressures are distributed unevenly across ecological zones. Dryland degradation is particularly important in northern Nigeria; forest conversion and habitat fragmentation affect the humid and transitional zones; erosion is severe in parts of the southeast; petroleum pollution is concentrated in the Niger Delta; and flooding, air pollution and solid waste are especially visible in rapidly growing urban centres.

The revised National Policy on the Environment presents environmental management as a development issue involving natural-resource conservation, pollution control, public health, sustainable livelihoods and intergenerational responsibility (Izah, Ogwu and Salimon, 2025).

International assessments reinforce this integrated approach. The IPCC concludes that climate risks increase with additional warming and that adaptation and mitigation are more effective when integrated into development planning (Ye, Yigitcanlar, Xu, Head, Hang, Sanchez and Niyogi, 2025). The World Bank's 2026 Nigeria country climate and development report similarly treats climate change as an issue affecting growth, infrastructure, poverty, natural resources and public policy rather than as an isolated environmental concern (Igbini, Ikenga, and Oharisi, 2026).

2.2 Conceptual Review

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2.2.1 Concept of the Environment

The environment refers to the totality of biophysical and socio-economic conditions within which organisms and human societies exist (Pauliuk and Hertwich, 2015). In practical environmental management, this includes air, water, soil, vegetation, forests, wildlife, microorganisms, climate, minerals, built environments and the interactions among them. The environment is therefore both a source of resources and a system that performs ecological functions. Forests provide timber and non-timber products, but they also regulate water, store carbon, protect soils and provide habitat. Wetlands support fisheries and biodiversity while also storing water and reducing flood peaks (Speed, Gippel, Vollmer and Tickner, 2026). This functional perspective is important for Nigeria because environmental degradation can create losses that are not captured by conventional economic statistics. When a wetland is converted to an uncontrolled settlement, for example, the immediate benefit may be additional housing land, but society may lose flood-storage capacity, water filtration, biodiversity and recreational or cultural values. Similarly, clearing a forest may create short-term agricultural land while reducing soil protection, carbon storage, wildlife habitat and future availability of forest products. Environmental management consequently requires consideration of both direct resource values and ecosystem services. This is especially relevant to forestry and wildlife management because forest ecosystems are often managed for timber while their wider contributions to watershed regulation, biodiversity and climate resilience receive less attention.

2.2.2 Environmental Threats and Degradation

Nigeria has faced a complex and intensifying array of environmental threats since 1960, driven largely by anthropogenic pressures. Early threats such as deforestation and desertification have persisted and worsened, with Nigeria losing an estimated 350,000 to 400,000 hectares of forest annually between 2010 and 2025, representing one of the highest deforestation rates globally at 3.5% (FAO, 2024; Maero and Bassey, 2026). Desertification affects 11 frontline northern states, advancing southward at about 0.6km per year and threatening over 40 million livelihoods Ahmed, 2022). As urbanization accelerated to over 52% of the population living in cities by 2024 (World Bank, 2024), new threats emerged, including air pollution, solid waste, and housing deficits, with unsustainable building practices contributing significantly to CO_2 emissions in fragile zones like the South-South (Akpa, Nworie, Obasi, Omoruyi and Ugbor, 2026; Ajayi, Ayodele, Okula, 2026). Pollution has become pervasive, with Eghomwanre and Ogbebor (2026) documenting high indoor particulate exposure in urban healthcare facilities, while Ogunbode (2026) and Oyelami *et al.* (2026) noted that over 60 million Nigerians still lack access to clean water, worsening waterborne diseases. In the Niger Delta, petroleum pipeline vandalism and crude oil theft cause over

200,000 barrels lost daily and severe ecosystem damage, with more than 13,000 oil spills recorded from 1960 to 2023 (NOSDRA, 2024; Okumagba, 2021). Climate change acts as a threat multiplier, with NIHSA (2024) reporting that the 2022 floods displaced 1.4 million people and caused $6.7 billion in losses, while increasing droughts reduce agricultural productivity in the north. These interconnected biological, chemical, physical, and climatic threats are amplified by weak institutions, inadequate funding, and limited community participation (Isei *et al.,* 2026).

2.2.3 Environmental Governance

Environmental governance refers to the laws, institutions, policies, decision-making processes, monitoring systems, enforcement arrangements and stakeholder relationships through which environmental resources and risks are managed (Sekasi, Harrod and Andrade, 2026). Governance is broader than government because communities, traditional institutions, businesses, researchers, civil society and international organisations also influence environmental outcomes. The Nigerian experience demonstrates why governance matters. The country has developed numerous laws and regulations, including environmental impact assessment requirements, pollution-control regulations, oil-spill response mechanisms, climate legislation and regulations covering waste, water, air, mining, plastics and biodiversity. NESREA's current regulatory inventory includes instruments covering dams and reservoirs, energy, healthcare waste, chemicals and pesticides, batteries and plastic waste, among others (Suleiman, Raimi, and Sawyerr, 2019). The existence of regulations, however, does not necessarily mean that environmental conditions improve. Implementation depends on institutional capacity, financing, technical expertise, monitoring, transparency, sanctions, political commitment and public participation. Environmental governance should therefore be evaluated using both process indicators and environmental outcomes.

2.3 Major Environmental Threats in Nigeria 1960-2026

2.3.1 Deforestation and Land Degradation:

Between 1960 and 2026, deforestation and land degradation have become some of Nigeria's most pressing environmental problems. Nigeria has faced a complex and evolving array of environmental threats since its independence in 1960, with these challenges intensifying and diversifying over time (Maero and Bassey, 2026). Nigeria has lost over 60% of its original forest cover **(**Akanwa, Iloduba, Mind'je, Onwuzuligbo and De Dieu, 2026) with the country currently having less than 10% forest cover remaining against the 25% recommended by the FAO. Each year, an estimated 350,000 to 400,000 hectares of forest

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are cleared for farming, logging, fuelwood, and urban expansion. This loss of trees has exposed soils to erosion, reduced soil fertility, and made many areas in the north more vulnerable to desertification. In the south, especially in the Niger Delta and Middle Belt regions including Lafia, clearing of vegetation for agriculture and settlement has destroyed habitats for many medicinal plants and wildlife (Manoj, Rashmi, Niveditha., Veeresh, and Salami, 2025). The result is lower crop yields, increased flooding, loss of biodiversity, and growing pressure on the remaining forest reserves. Without urgent restoration efforts, continued deforestation threatens both food security and the survival of plant species that communities depend on for medicine and livelihoods. The Nigerian Conservation Foundation (NCF) reported that Nigeria lost nearly 90% of its forest cover in the last 30 years, leaving less than 10% of the original forest landscape intact. Key drivers include demand for fuelwood and charcoal by 60% of the population, illegal logging, agricultural expansion, and urbanization. Deforestation has led to soil erosion, loss of nutrients, extinction of species, and aggravated climate change impacts. In the Southwest, proximate drivers include lumbering, polewood extraction, and crop cultivation, with population increase and poverty as underlying drivers.

2.3.2. Pollution: Air, Water and Soil

Pollution remains a serious challenge. Industrial emissions, improper waste management, and urbanization cause air, water, and soil pollution. Major cities like Lagos and Port Harcourt suffer poor air quality. In the Niger Delta, oil pollution threatens marine ecosystems and livelihoods of fishing and farming communities. NOSDRA data show over 754,000 barrels of crude oil were spilled between 2006 and 2022, with pipelines 565 times more likely to leak than in the EU. Only 4% of 6,300 spills between 2010-2015 were remediated. Other pollution sources include industrial pollution, municipal waste, and gas flaring (zenodo.orgthisdaylive.comnials-nigeria.org).

2.3.3 Climate Change and Extreme Weather

Climate change exacerbates Nigeria's challenges through rising temperatures, changing rainfall patterns, and increased extreme weather. Coastal areas are vulnerable to sea-level rise and erosion. Northern Nigeria faces desertification progressing at 0.6km per year, with 35% of land once cultivable in 1950 now desert or severely degraded. This has displaced over 400,000 Nigerians in 5 years. Climate impacts also include flooding, gully erosion in the Southeast, and drought in the North (Amin, Keshta, Ragab, Chakrabortty and Elaksher, 2026)

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2.3.4. Biodiversity Loss and Other Threats

Habitat destruction, overuse of resources, and invasive species drive biodiversity loss (Prakash and Verma, 2022). Iconic species like the Cross River gorilla and Nigerian chimpanzee are endangered due to illegal wildlife trade and habitat loss (Dunn, Bergl, Byler, Eben-Ebai, Etiendem, Fotso, and Williamson, 2014). Other threats listed in Vision 2010 include soil crust formation, destruction of watersheds, mining pits, and urban decay (Akpa, Nworie, Obasi, Omoruyi and Ugbor, 2026). From 1960 to 2026, Nigeria has experienced a steady decline in its plant and animal diversity due to deforestation, habitat destruction, pollution, and over-exploitation. The country is one of Africa's biodiversity hotspots, yet more than 200 species of plants and animals are now considered threatened, including many medicinal plants that rural communities depend on (Negi, Rawat and Bhatt, 2026). In places like Lafia and across the Middle Belt, clearing of land for farming, fuelwood harvesting, and urban growth has wiped out forest patches and wetlands that once supported a wide range of species. Wildlife poaching, bush burning, and the unsustainable harvesting of Non-Timber Forest Products have also reduced populations of trees, birds, and animals. Beyond biodiversity loss, other threats such as invasive species, oil spills, and climate variability are making ecosystems less resilient. The loss of biodiversity is not just an ecological issue, it directly affects food security, traditional medicine, and the livelihoods of millions of Nigerians who rely on nature for survival (Adewoye, 2026).

2.3.5 Climate Change

Climate change has become one of Nigeria's most urgent environmental challenges (Salami, Akinyele, Muhammad. and Lukman, 2025). Across the country, the signs are already clear and affecting daily life. The average temperature has been rising steadily, making heatwaves longer and more intense, especially in the northern states (Baba, Babati, and Isa, 2026). Rainfall patterns have become increasingly irregular, with shorter rainy seasons and unexpected dry spells that disrupt farming. At the same time, flooding has grown worse, from the annual overflow of the River Niger and Benue that displaces millions, to flash floods in cities like Lagos and Onitsha. In the far north, prolonged drought and desertification are shrinking farmland and water sources, forcing migration southward. Meanwhile, coastal communities in the Niger Delta and Lagos face sea-level rise and coastal erosion that wash away homes, farmland, and roads. Together, these changes threaten food security, livelihoods, and public health, making climate adaptation a national priority.

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2.3.6 Mining-Related Environmental Degradation

Illegal and unregulated mining has become a major source of environmental damage in Nigeria. Across states like Zamfara, Niger, and Nasarawa, artisanal miners dig without permits or safety measures, leaving behind deep pits and gullies that cause severe land degradation (Hwyere-Yashim, 2025).

The chemicals used, especially mercury and cyanide in gold processing, often run into nearby rivers and streams. This leads to water pollution and heavy metal contamination that makes drinking water unsafe for communities. Forests and vegetation are also cleared to create mining sites and access roads, resulting in deforestation and loss of habitat for plants and wildlife. The use of mercury is particularly dangerous because it persists in soil and water, poisoning crops, fish, and people who depend on them. In the long run, these activities not only destroy farmland and ecosystems but also create serious health risks for rural communities living near mining areas (Yadav,Talreja, Chauhan, Khan and Ashfaq, 2027).

2.3.7 Major Floods in Nigeria Since 1960

Flooding has been one of Nigeria's most recurring and destructive environmental disasters since 1960, and its frequency and severity have increased due to urbanization, poor drainage, deforestation, dam management, and climate change.

Early floods: 1960s to 1990s

In the first decades after independence, floods were mostly localized. The 1963 and 1980 flood in Ibadan and parts of the southwest displaced thousands and damaged farmlands after unusually heavy rainfall (Bernard, 2026). The 1988 flood affected riverine communities along the Benue and Niger rivers, especially in Lokoja and Makurdi, destroying homes and crops. During this period, poor urban planning in cities like Lagos and Port Harcourt already made drainage systems inadequate, but impacts were limited compared to later years.

2000s: Urban and coastal flooding intensifies

The 2010 flood was a warning sign. Heavy rains and the release of water from Lagdo Dam in Cameroon caused flooding in 13 states, with Adamawa, Benue, and Kogi badly hit (Buba and Leonard, 2026).

Farmlands were washed away and over 200,000 people were displaced. 2011 saw severe urban flooding in Lagos, Ibadan, and Abuja, where blocked drains and building on floodplains turned rainfall into flash floods that killed people and destroyed property.

2012: The worst flood in recent history

The 2012 flood is regarded as Nigeria's most devastating flood since 1960. Exceptional rainfall combined with the opening of Lagdo Dam led to the overflowing of the Niger and Benue rivers. 30 of 36 states were affected. Over 2 million people were displaced, 363 people died, and more than 1.3 million hectares of farmland were destroyed. The economic loss was estimated at over ₦2.6 trillion. Communities in Kogi, Bayelsa, Delta, and Anambra were submerged for weeks. This disaster exposed weak early warning systems and poor disaster preparedness.

2018 and 2020: Repeated riverine and urban floods

In 2018, flooding again affected 12 states, with over 200 deaths and 500,000 people displaced (Abegaz, Wang and Xu, 2024). The Niger and Benue basins were hit hardest, and the government blamed both heavy rain and dam releases. 2020 floods, worsened by COVID-19, affected 28 states. More than 100 people died and over 300,000 people were displaced. Lagos, Kebbi, and Jigawa recorded severe urban and rural flooding (Adesina, Uduma-Olugu and Tang, 2025).

2022: The most recent national-scale disaster

The 2022 flood surpassed 2012 in scale. From June to October, prolonged rainfall and dam releases led to floods in 34 states. According to NEMA, over 1.4 million people were displaced, 662 people died, and 2,407 people were injured. Over 200,000 houses and 332,000 hectares of farmland were destroyed. Bayelsa, Anambra, Kogi, and Jigawa were among the worst hit. Food prices spiked nationwide because major rice and maize farms were lost just before harvest.

2.3.8 Gas flaring and Landslide

Since 1960, gas flaring and landslides have been major environmental problems in Nigeria. Evidence shows that the Niger Delta has experienced continuous gas flaring by oil companies, releasing methane, CO_2, and soot that cause acid rain, crop failure, and respiratory illnesses in communities like Bonny, Warri, and Port Harcourt. Despite government policies to end flaring by 1984, then 2010, and now 2030, Nigeria

still flares over 200 billion cubic feet yearly. For landslides, evidence includes the 2011 Jos Plateau landslide that killed several people, and recurrent slope failures in Enugu, Abakaliki, and parts of Ibadan linked to deforestation, heavy rainfall, and poor construction on hillsides, increasing displacement and damage.

2.3.9 Soil Erosion

Soil erosion is one of the most severe and visible forms of environmental degradation in Nigeria, with distinct regional patterns and alarming rates of land loss. Findings from across the country show that erosion is particularly devastating in southeastern Nigeria, especially in Anambra, Imo, Abia, Enugu, and Ebonyi States, where gully erosion has reached crisis proportions. According to Egbuna and Alom (2024) Anambra State alone has over 1,000 active gully erosion sites, some measuring over 100 meters deep and several kilometers long, displacing communities and destroying infrastructure. The Nigeria Erosion and Watershed Management Project (NEWMAP) reported that gully erosion in the southeast accounts for over 60% of total land degradation in the zone, with annual soil loss estimated at 10-25 tons per hectare. In northern Nigeria, sheet and wind erosion dominate due to deforestation, overgrazing, and prolonged dry seasons, contributing to desertification which affects 11 frontline states with a desertification rate of 0.6km per year (Federal Government of Nigeria, 2023). Studies by Oparaku and Ibe (2026) identified key drivers as deforestation for fuelwood, unsustainable farming practices, road construction without drainage, sand mining, and heavy rainfall intensity linked to climate change, with rainfall in the south exceeding 2000mm annually. The impacts are multidimensional, including loss of arable land estimated at over 400,000 hectares annually nationwide (FAO, 2024), siltation of rivers, destruction of homes and roads, and increased poverty, as over 70% of rural households depend on agriculture. Although interventions such as NEWMAP and community-based watershed management have reclaimed some sites, effectiveness remains limited due to weak enforcement, inadequate funding, and poor maintenance, leaving erosion as a persistent threat to food security and sustainable development from 1960 to 2026.

2.4 Consequences and Impact of Some Environmental Issues in Nigeria

Nigeria's environment has faced serious pressure since 1960 due to population growth, industrialization, oil exploration, and poor planning. The consequences are visible in daily life, health, food, and the economy.

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a) Deforestation has led to the loss of over 3.6 million hectares of forest between 1990 and 2010 according to FAO data. This has reduced timber supply, destroyed habitats for wildlife, and increased carbon emissions. Rural communities that depend on fuelwood and non-timber forest products now travel farther, while medicinal plants are disappearing.

b) Desertification is most severe in the 11 northern states. The Sahara is advancing southward at about 0.6km per year. Farmlands are turning to sand, groundwater is dropping, and herders and farmers now clash over shrinking grazing land and water. Food insecurity and migration to southern cities have increased as a result.

c) Oil Pollution in the Niger Delta has contaminated land, rivers, and creeks for decades. Spills from pipelines, sabotage, and gas flaring have destroyed fishing and farming, which are the main livelihoods. Health studies link exposure to respiratory problems, skin diseases, and reduced life expectancy in host communities. Cleanup has been slow and costly.

d) Climate Change is intensifying rainfall patterns and heat across Nigeria. The north is getting hotter and drier, while the south experiences heavier rains. This has disrupted planting seasons, reduced crop yields for maize, sorghum, and yam, and increased the spread of pests and diseases. Coastal areas also face sea level rise that threatens homes and infrastructure.

e) Flooding occurs almost yearly, especially between July and October. Major floods in 2012, 2018, and 2022 displaced over 1.4 million people and destroyed farmlands, roads, and schools. Poor drainage, blocked waterways by solid waste, and building on floodplains worsen the impact. The floods also contaminate drinking water and trigger cholera outbreaks.

f) Gully Erosion has devastated parts of southeastern Nigeria, including Anambra and Imo states. Deep gullies have swallowed homes, roads, and farmland, cutting off communities. The loss of topsoil reduces agricultural productivity and increases sediment in rivers, which affects water quality and dams.

g) Air Pollution comes from vehicle emissions, generator use, industrial smoke, and gas flaring. Lagos, Port Harcourt, and Onitsha record some of the highest PM2.5 levels in Africa. This contributes to asthma, pneumonia, and other respiratory illnesses, especially among children and the elderly. Indoor air pollution from firewood and charcoal also affects millions of households.

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i) Water Pollution results from untreated industrial waste, sewage, oil, and agricultural runoff. Most urban rivers are unsafe for drinking or fishing. This has led to waterborne diseases like diarrhea and typhoid, and has killed aquatic life. Communities without pipe-borne water are forced to use contaminated sources.

g) Solid Waste Management is overwhelmed in major cities. Only about 30-40% of waste is formally collected. The rest blocks drains, creating flooding and breeding mosquitoes and rodents. Open dumpsites emit methane and leachate that pollute soil and groundwater, while scavengers face health risks.

k) Biodiversity Loss is occurring as forests, wetlands, and grasslands disappear. Species like the Cross River gorilla and some medicinal plants are now endangered. This loss weakens ecosystems that provide pollination, flood control, and natural medicines, and reduces potential for eco-tourism and research.

l) Mining-Related Environmental Degradation from unregulated artisanal mining of gold, coal, and limestone has left open pits, acid mine drainage, and dust pollution. In Zamfara, lead poisoning from gold mining killed hundreds of children between 2010 and 2012. Farmlands are degraded and water sources contaminated, hurting both health and agriculture.

m) The causes and pattern of flooding in Nigeria have shifted over time. Before the 2000s, floods were mainly triggered by heavy rainfall. Since then, climate variability, poor urban drainage, indiscriminate dumping of solid waste in waterways, construction on floodplains, deforestation, and uncoordinated dam water releases from Nigeria and Cameroon have worsened the problem. The impacts are severe and recurring: loss of lives, mass displacement, destruction of roads, schools and homes, outbreaks of waterborne diseases like cholera, and food insecurity from washed-away farmlands. Floods also deepen poverty in rural communities that depend on farming and fishing, setting back development gains each year.

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Plate 1: Ibadan Flood on 26 August 2011 Plate 2: Minning site in Taraba state

Source: World bank, 2026





Plate 3: Deforestation site **Plate 4:** Impact of fire on Biodiversity





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Plate 5: Landslide

Plate 6: Gas flaring

Source: Naturenews for Africa





Plate 7: Climate change is fueling Extreme Weather

Plate 8: Climate change is fueling Extreme Weather

Source: Earth Justice, 2025

2.5 Possible Strategies to Address Environmental Threats

a) Forest Restoration and Sustainable Forest Management

In 2026 Nigeria launched the "Securing Nigeria's Forest Future (SNFF)" initiative a $1 billion, 10-year strategy (2026–2036) to restore degraded landscapes, strengthen governance, and unlock financing. It targets mobilizing blended finance from public, private, and carbon market sources. The 2026 International Day of Forests theme "Forests and Economies" also emphasized restoration and sustainable livelihoods (thisdaylive.comhealthwise.punchng.com). Measures include: Afforestation, Reforestation, Community forestry, Forest reserves, Forest certification and Plantation development (Salami, Muhammad, Adeniyi and Nasir, 2026)

b) Climate Adaptation and Renewable Energy:

Strategies include energy efficiency programs, such as distribution of 1 million compact fluorescent lamps and partnership with UNEP and GEF in 2011. The Clean Technology Fund Investment Plan envisaged USD 1.3bn for low-carbon growth. The President set a 30 GW renewable energy target for the next decade. The proposed "Port Harcourt Framework for Environmental Education and Ecological Governance"

advocates a National Environmental Education Policy 2026–2035, community-based learning, and university research on mangrove restoration and flood management. Experts argue environmental literacy must be integrated into formal education and leadership development. Addressing oil spills requires improved enforcement, as 90% of spills 2010-2015 lacked post-cleanup assessment. Strategies also include waste management reforms in urban areas and control of industrial emissions (Tang *et al.,* 2026)

c) Pollution Control

Pollution control in Nigeria has become critical given decades of industrial growth, oil exploration, and rapid urbanization since 1960. Key actions include regular environmental monitoring by agencies like NESREA to track air, water, and soil quality. Government has set industrial emission standards to limit smoke, chemicals, and toxic discharges from factories. In the Niger Delta, improved oil spill response mechanisms are used to contain leaks and clean affected areas. There is also growing investment in wastewater treatment plants to reduce contamination of rivers. Additionally, cleaner production technologies are being promoted to help industries use less energy, recycle waste, and produce with fewer pollutants, protecting both human health and ecosystems

d) Environmental Education

Since the 1980s, the Nigerian government has recognized environmental education as key to solving the country's ecological problems. To do this, it runs public awareness campaigns through radio, TV, and social media to inform citizens about issues like deforestation, flooding, and waste management. Environmental clubs have been established in secondary schools and universities to train young people as environmental stewards. The subject has also been integrated into the school curriculum from primary to tertiary levels, teaching students about conservation, climate change, and sustainability. Community participation is encouraged through town hall meetings and NGO programs, helping local people take ownership of protecting forests, water bodies, and medicinal plant resources in their areas.

e) Waste Management

Waste management in Nigeria has become a major priority due to rapid urban growth and rising plastic and organic waste since 1960 (Ganancias and Rubenial, 2026). Key strategies now include recycling

programs in cities like Lagos and Onitsha to recover plastics, metals, and paper from dumpsites. Waste segregation at household and market levels is being promoted to separate biodegradable waste from non-biodegradables. Composting is encouraged in rural and peri-urban areas to turn food and farm waste into manure. Government and private sector are also pushing circular economy initiatives that turn waste into resources, and Extended Producer Responsibility, EPR, which requires manufacturers to manage waste from their products, reducing pollution and landfill pressure.

f) Renewable Energy

To reduce dependence on fossil fuels and address climate change, the Nigerian government has been promoting renewable energy since the 2000s. Solar energy is the fastest growing option, with solar home systems and mini-grids now powering rural communities, schools, and health centers across the country. Wind energy projects are being explored in northern states with high wind speeds, while small and large hydropower dams on rivers like Niger and Benue continue to supply electricity. Biomass energy from agricultural waste is also used for power and fuel. In addition, clean cooking technologies such as improved cookstoves and LPG are encouraged to cut deforestation and indoor air pollution.

g) Integrated Water Resources Management

Water stress has increased in Nigeria due to population growth, climate change, and pollution since 1960. To manage this, government and stakeholders use Integrated Water Resources Management, IWRM. Strategies include watershed protection to prevent erosion and siltation of rivers, and river basin management through the 12 River Basin Development Authorities that coordinate dams, irrigation, and flood control. Rainwater harvesting is promoted in schools and homes to supplement supply during dry seasons. Efficient irrigation techniques like drip and sprinkler systems are also encouraged, especially in northern Nigeria, to grow more food with less water and reduce pressure on groundwater.

h) Ecosystem Restoration

Ecosystem restoration has become urgent in Nigeria to reverse decades of deforestation and land degradation. Key programs include mangrove restoration in the Niger Delta to protect coastlines and fish breeding grounds damaged by oil and erosion. Wetland conservation efforts focus on areas like the Hadejia-Nguru and Fadama wetlands that support biodiversity and livelihoods. In the north, Nigeria is part

of the Great Green Wall initiative to plant trees across 11 states to stop desertification. Landscape restoration projects also target degraded farmlands and forest reserves by planting trees and grasses, improving soil fertility, water retention, and habitats for plants and wildlife.

2.6 Nigeria's Environmental Policies and Laws

Findings on Nigeria's environmental policies and laws reveal a progressive but enforcement-constrained framework from 1960 to 2026. Since independence, Nigeria moved from fragmented sectoral control to a centralized system starting with the Federal Environmental Protection Agency (FEPA) Act of 1988, created after the 1988 Koko toxic waste dumping incident where over 3,500 tons of hazardous waste were illegally dumped in Delta State. This triggered the 1989 National Policy on the Environment, the first comprehensive policy addressing air, water, and biodiversity. The 1992 Environmental Impact Assessment (EIA) Act made environmental assessment mandatory for major projects, yet NESREA (2024) reports indicate that less than 40% of projects in the oil and construction sectors fully comply. Section 20 of the 1999 Constitution places environmental protection as a state duty, though it remains non-justiciable. The 2004 National Forestry Policy responded to alarming deforestation, as Nigeria had lost over 60% of its primary forest cover between 1960 and 2005 according to FAO data. In 2007, FEPA was replaced by NESREA, which now enforces 33 sectoral regulations introduced under the 2009 National Environmental Regulations covering pollution and waste. Climate governance advanced with the 2012 National Climate Change Policy Response Strategy and culminated in the landmark 2021 Climate Change Act, which established the National Council on Climate Change and legally commits Nigeria to a net-zero target by 2060. Nigeria also submitted its updated Nationally Determined Contributions (NDCs) in 2021, pledging 20% unconditional and 47% conditional emission reduction by 2030. Despite having a fairly complete legal framework aligned with SDGs, findings show persistent gaps in funding, overlapping mandates between NESREA and oil sector regulators, and weak grassroots implementation, limiting effectiveness.

Table 1: Approved Environmental Laws, Policies and Programs and Legal Frameworks from 1960 to 2026

Year	Law, Policy or Institution	Main purpose
1960s	Forestry, public-health, wildlife and town-planning laws	Regulated forests, sanitation, settlements and wildlife
1968	Oil in Navigable Waters Act	Controlled oil pollution in Nigerian waters
1969	Petroleum Act	Regulated petroleum operations
1978	Land Use Act	Established a national system of land administration

1988	Harmful Waste legislation	Prohibited illegal importation and dumping of hazardous waste
1988	Federal Environmental Protection Agency Act	Established Nigeria's first national environmental regulatory agency. (UNEP Law Platform)
1989	National Policy on the Environment	First comprehensive environmental policy. (un.org)
1991	Pollution-control regulations	Addressed effluent, industrial pollution and waste
1992	Environmental Impact Assessment Act	Made EIAs mandatory for major development projects. (un.org)
1999	Revised National Policy on the Environment	Updated environmental objectives and strategies
1999	Federal Ministry of Environment	Centralised federal environmental policy and coordination
1999	Section 20 of the Constitution	Directed the state to protect land, water, air, forests and wildlife. Mandates protection and improvement of the environment. (ResearchGate
1988, 2000, 2026	National Forest Policy Revised National Forest Policy Securing Nigeria's Forest Future (SNFF)	i. Promoted sustainable forest management and conservation ii. Climate change, REDD+, community participation iii. $1B restoration, halt deforestation, green economy
2006	NOSDRA Act	Established an agency for oil-spill detection and response
2007	NESREA Act	Established national environmental enforcement arrangements. Replaced FEPA and strengthened environmental regulation. (Disciplines In Nigeria)
2007	National Policy on Drought and Desertification	Addressed drought, desertification and dryland degradation
2009	National Environmental Regulations	Regulated air, water, waste, chemicals, industries and ecosystems. (nesrea.gov.ng)
2011	National Adaptation Strategy and Plan of Action	Identified national climate-adaptation priorities
2011	Desertification-control regulations	Introduced enforceable measures for dryland protection
2012	National Climate Change Policy and Response Strategy	Provided an early national climate-policy framework
2012	Great Green Wall Strategic Action Plan	Guided restoration and livelihood interventions in drylands
2013	National Agricultural Resilience Framework	Integrated resilience into agriculture
2015	First Nationally Determined Contribution	Presented Nigeria's initial Paris Agreement climate commitment
2015	National Biodiversity Strategy and Action Plan	Biodiversity conservation.
2016	Revised National Policy on the Environment	Updated environmental policy incorporating sustainable development principles. (UNEP Law Platform)

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2018	NESREA amendment	Strengthened enforcement provisions
2021	Climate Change Act	Established a statutory national climate-governance framework
2021	National Climate Change Policy 2021–2030	Guided mitigation, adaptation and climate-resilient development
2021	Updated Nationally Determined Contribution	Revised Nigeria's climate commitments
2021	Nationally Determined Contributions (NDCs) and Energy Transition initiatives, Petroleum Industry Act	Reformed petroleum governance and environmental responsibilities
2022	National Council on Climate Change	Became the apex coordinating institution for climate matters
2022	Energy Transition Plan	Presented a pathway for energy access and net-zero development
2024	Long-Term Low-Emission Development Strategy	Outlined Nigeria's low-emission pathway towards 2060
2024	First Biennial Transparency Report	Reported climate actions and emissions under the Paris Agreement
2025	Nigeria NDC 3.0	Updated national climate mitigation and adaptation commitments
2025–2026	Updated environmental guidelines and regulations	Strengthened environmental audits, compliance and enforcement

Nigeria's NDC 3.0 was submitted to the UNFCCC on 22 September 2025, while its first Biennial Transparency Report was submitted in December 2024.

2.7 Approved Environmental Policies, Laws and Institutional Frameworks in Nigeria

Nigeria's environmental policy history has evolved through a series of legal and institutional milestones. The most important point is that environmental governance is cumulative: later institutions and policies build upon earlier laws, while some responsibilities remain divided among agencies.

2.7.1 National Policy on the Environment

The National Policy on the Environment provides a broad framework for environmental management. It recognizes the need to integrate environmental considerations into development planning and to protect natural resources while supporting human wellbeing. Its significance lies in providing an umbrella policy against which sector-specific programmes can be aligned (Pröbstl, Paulsch, Zedda, Nöske, Santos, and Zinngrebe, 2023). However, policy effectiveness depends on mainstreaming. Agriculture, transport, energy, mining, housing and petroleum decisions can create environmental effects even when the responsible ministry is not an environmental institution. Environmental governance therefore requires cross-sector coordination.

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2.7.2 Environmental Impact Assessment Act

Environmental Impact Assessment is a preventive instrument. Its purpose is to identify likely environmental and social impacts before projects are implemented and to consider alternatives and mitigation measures. For Nigeria, EIA is important because infrastructure and extractive projects can have large footprints. Its effectiveness depends on technical quality, transparency, meaningful participation, enforcement of conditions and post-project monitoring. An EIA that is completed only as an administrative requirement without effective follow-up will have limited environmental value.

2.7.3 NESREA and Environmental Regulations

NESREA is central to environmental standard-setting and enforcement across numerous sectors. Its current regulatory inventory demonstrates the breadth of the environmental framework, including regulations addressing waste, chemicals, batteries, plastics, water, air, mining, erosion, wetlands, endangered species and energy (Elombah, 2026).

The breadth of regulations is a strength, but it also creates a substantial implementation burden. Effective enforcement requires laboratories, inspectors, monitoring equipment, legal support, data systems and coordination with states and sector agencies.

2.7.4 NOSDRA and Petroleum Pollution Governance

NOSDRA provides a specialized institutional mechanism for oil-spill detection and response. The need for such an agency reflects the distinctive environmental risks associated with petroleum production and transportation. Research suggests that response and remediation remain constrained by institutional capacity, resources, overlapping responsibilities and technical limitations (Ewim *et al.,* 2023). Strengthening the entire spill-management chain from prevention to long-term remediation is therefore more important than focusing solely on emergency response.

2.7.5 Climate Change Act and NDC Framework

The Climate Change Act 2021 provides a statutory basis for climate governance in Nigeria. It creates a framework for coordinating climate action, supporting low-emission development and building resilience. The NDC process then connects national actions to the Paris Agreement. Nigeria's NDC 3.0 was submitted on 22 September 2025 and is listed as active by the UNFCCC (Brah, 2026). The current phase of climate policy therefore requires a shift from commitment-making toward implementation, monitoring and financing

2.8. **Challenges and Weakness to Environmental Management**

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2.8 1 Weak enforcement

Some industries and individuals continue to violate environmental standards because inspections may be irregular and penalties may not be consistently applied.

*2.8.*2 Inadequate funding

Environmental institutions may lack vehicles, laboratories, monitoring equipment, personnel and funds for field operations.

*2.8.*3 Overlapping responsibilities

The mandates of federal, state and sectoral agencies sometimes overlap, causing conflict, delay or uncertainty.

*2.8.*4 Corruption and political interference

Environmental approvals or enforcement actions may be influenced by political or financial interests.

2.8.5 Low public awareness

Some citizens are not fully aware of environmental laws or the long-term effects of harmful practices.

2.8.6 Poverty

People who depend on forests, charcoal, informal mining or flood-prone urban settlements may have few alternatives.

*2.8.*7 Insecurity

Banditry, insurgency and communal conflict can restrict access to restoration sites, forests, parks and monitoring locations.

*2.8.*8 Weak community participation

Communities may be consulted only after major decisions have already been made. This can reduce trust and project ownership.

*2.8.*9 Poor environmental data

Information on forests, pollution, waste, biodiversity and land degradation may be incomplete or distributed across different institutions.

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3.0 Methodology

This review article systematically synthesizes existing literature to provide a comprehensive analysis of environmental threats, strategic responses, and approved policies in Nigeria from 1960 to 2026. Adopting a rigorous, transparent, and reproducible methodology.

3.1 Research Design

This study adopts a documentary review design combining historical, descriptive, thematic and policy-analysis approaches. The design is appropriate because the study seeks to examine environmental threats and environmental governance over a 66-year period rather than to estimate the characteristics of a single contemporary population.

3.2 Inclusion and Exclusion Criteria

Documents were included where they:

i. Provided a clearly applicable national/regional assessment.
i. Contained evidence relevant to one or more environmental threats
ii. Covered the 1960–2026 historical period
iii. Provided identifiable authorship, institutional responsibility, publication date or source provenance.

Documents were excluded where they:

i. Contained unverifiable claims without an identifiable source.
ii. Duplicated another source without adding evidence.
iii. Used statistics without sufficient explanation of definitions, dates or methods.
iv. Focused entirely on topics outside the environmental scope of the study.

3.3 Data Extraction and Thematic Analysis

Information was extracted under five broad themes: (1) environmental threat, (2) drivers, (3) impacts, (4) policy/institutional response and (5) implementation challenges and strategies. Documents were compared chronologically to identify changes in environmental governance from 1960 to 2026. Thematic synthesis was then used to identify recurring patterns across ecological zones and sectors. Policy analysis focused on five dimensions: policy objective, institutional responsibility, regulatory instrument, implementation mechanism and expected environmental outcome. This framework helps distinguish between the existence of a policy and its likely effectiveness.

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3.4 Assessment of Implemented Strategies and Their Efficacy

The assessment of environmental strategies in Nigeria shows mixed results with limited efficacy across sectors. Studies by Isei *et al.* (2026) and Maero and Bassey (2026) found that weak institutional frameworks, inadequate funding, and poor community participation hinder effective conservation, resulting in persistent deforestation, desertification, and biodiversity loss. Despite policies, Nigeria loses an estimated 350,000 hectares of forest annually, according to (Oyediji and Adenika, 2022; Sambe, 2018). In urban development, Akpan *et al.* (2026) reported critically low adoption of Sustainable Architectural Design Strategies (SADS) among professionals in the South-South zone, while Ajayi *et al.* (2026) noted lack of validated frameworks for climate-smart housing despite rapid urbanization at 4.2% annually. In the oil sector, challenges such as pipeline vandalism cost Nigeria over $2 billion yearly (Afinotan, 2022), though the Petroleum Industry Act 2021 introduced the Host Communities Development Trust to improve local engagement. Similarly, public health and water sectors show gaps, with Ogunbode (2026) revealing that over 60 million Nigerians still lack access to clean water, undermining SDG 6.

3.5 Policy Recommendations for Improved Environmental Management

Policy recommendations for improved environmental management in Nigeria have been a central focus of environmental literature. Effective environmental governance requires the strengthening and enforcement of existing legal frameworks such as the National Environmental Standards and Regulations Enforcement Agency (NESREA) Act and the Environmental Impact Assessment (EIA) Act, which have often suffered from weak implementation. The need for integrated policy approaches that combine forest restoration, pollution control, and climate adaptation strategies, arguing that fragmented policies limit effectiveness. Community participation and indigenous knowledge systems are critical for sustainable forest management and should be incorporated into policy design. The literature also highlights the importance of sustainable financing and technology adoption for environmental protection, as observed by Zotz (2016) who recommended increased budgetary allocation and public-private partnerships. Recent studies from 2022 to 2025 advocate for a shift towards circular economy, renewable energy transition, and climate-smart agriculture as viable strategies for mitigating environmental threats. Scholars agree that for Nigeria to achieve sustainable environmental governance from 2026 onwards, policies must be coherent, participatory, enforceable, and aligned with global sustainability goals such as the Sustainable Development Goals (SDGs) (Chauhan, Dolma, Vardhan and Bhupendra, 2026).

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4.0 Conclusion

This review has meticulously charted the complex trajectory of environmental threats, strategic responses, and policy evolution in Nigeria from 1960 to 2026. Through a systematic synthesis of existing literature, it has highlighted how the nation's environmental landscape has been profoundly shaped by a dynamic interplay of socio-economic development, escalating degradation, and attempts at policy intervention. The analysis underscored the persistent and diverse nature of environmental challenges, ranging from early issues of deforestation and pollution to contemporary concerns of climate change, resource depletion, and the critical need for sustainable urban development. While significant progress has been made in establishing regulatory frameworks and implementing various strategies, the review also illuminated critical gaps. These often stem from challenges in enforcement, inadequate funding, weak institutional capacity, and limited community participation. Despite the introduction of progressive policies, the efficacy of these measures has frequently been hampered by various factors, including governance issues and a lack of integrated approaches. Ultimately, Nigeria's environmental journey reflects a continuous struggle to balance economic growth with ecological preservation, emphasizing the ongoing necessity for robust, adaptable policies and effectively implemented strategies to foster true environmental sustainability.

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