

Review of Forest Plantation and Conservation Issues in Akwa Ibom State, Nigeria from 1987- 2026

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Abstract

Forest plantations and conservation initiatives play critical roles in maintaining ecological stability, supporting biodiversity conservation, mitigating climate change, and providing sustainable forest resources. This study reviewed the historical development of forest plantations and the associated conservation challenges in Akwa Ibom State, Nigeria, from 1987 to 2026, while also examining the antecedent forestry activities that existed before the creation of the state. The study adopted a qualitative review approach based on the analysis of peer-reviewed journal articles, government reports, policy documents, technical reports, books, and publications from international organizations. Relevant literature was synthesized thematically to evaluate trends in plantation establishment, forest reserve management, conservation policies, ecosystem degradation, and restoration efforts. The findings revealed that plantation forestry in Akwa Ibom State evolved from colonial forest reservation schemes and large-scale afforestation programmes associated with the Taungya system and the Nigerian Newsprint Manufacturing Company (NNMC) at Oku Iboku. During the 1960s to the late 1980s, extensive plantations of *Gmelina arborea* and *Tectona grandis* were established to support industrial wood production. However, the collapse of the NNMC led to a significant decline in plantation management, resulting in widespread illegal logging, agricultural encroachment, forest fragmentation, and degradation of plantation estates. The review further identified urbanization, fuelwood exploitation, weak institutional capacity, inadequate funding, and poor policy implementation as major factors contributing to forest loss across the state. In coastal areas, mangrove ecosystems have experienced severe degradation due to oil exploration activities, recurrent oil spills, overharvesting, and shoreline disturbances. Despite these challenges, recent years have witnessed renewed interest in forest restoration and conservation driven by climate change concerns, biodiversity protection, and international environmental commitments. Various tree-planting campaigns and mangrove restoration projects have been initiated, although their effectiveness has often been constrained by inadequate monitoring and limited community participation. Comparative evidence from countries such as China, Brazil, Vietnam, and South Africa demonstrates that sustainable forestry development depends on strong institutional frameworks, continuous investment, industrial integration, and stakeholder involvement. The study concludes that the long-term sustainability of forest resources in Akwa Ibom State requires revitalization of plantation forestry, strengthened conservation institutions,

community-based forest management, and improved policy implementation. Integrating ecological restoration with sustainable economic utilization of forest resources is essential for enhancing environmental resilience and supporting sustainable development in the state.

Keywords: Forest plantation, forest conservation, sustainable forest management, deforestation, mangrove restoration, biodiversity conservation, forestry policy, climate change adaptation, Akwa Ibom State, Nigeria.

1. Introduction

Forests constitute one of the most important natural resources globally, providing ecological, economic, and social benefits that support sustainable development. They serve as carbon sinks, regulate local and regional climates, conserve biodiversity, protect watersheds, prevent soil erosion, and supply timber and non-timber forest products that sustain millions of livelihoods worldwide (Food and Agriculture Organization [FAO], 2020). Forest plantations, in particular, have become an integral component of modern forest management because they reduce pressure on natural forests while supplying industrial wood, fuelwood, pulp, and other forest products. Globally, plantation forests occupy approximately 294 million hectares, accounting for about 7 percent of the world's forest cover, yet they contribute more than one-third of industrial roundwood production (FAO, 2020; Imoh et al, 2025; Abraham et al 2025). Countries such as China, Brazil, India, Indonesia, and Vietnam have demonstrated how well-managed plantation forestry can contribute significantly to economic growth, employment generation, environmental restoration, and climate change mitigation (Payn et al., 2015; Jimmy et al, 2025; Ebong et al, 2025).

The importance of forest plantations has increased in recent decades due to concerns over deforestation, biodiversity loss, climate change, and ecosystem degradation. The global forest area declined by approximately 178 million hectares between 1990 and 2020 despite extensive afforestation efforts in several countries (FAO, 2020). Tropical regions, particularly in Africa and South America, continue to experience significant forest loss driven by agricultural expansion, urbanization, infrastructure development, mining activities, and unsustainable logging practices (Curtis et al., 2018). Consequently, international frameworks such as the United Nations Sustainable Development Goals (SDGs), the Paris Climate Agreement, the Bonn Challenge, and the United Nations Decade on Ecosystem Restoration (2021–2030) emphasize forest conservation and restoration as critical pathways toward environmental sustainability (United Nations Environment Programme [UNEP], 2021).

In Africa, forests play a vital role in supporting rural livelihoods and ecosystem services. However, the continent records some of the highest rates of forest degradation globally. According to FAO (2020), Africa experienced the highest net forest loss of any region between 2010 and 2020, averaging approximately 3.9 million hectares annually. Countries such as Ghana, Côte d'Ivoire, Nigeria, Cameroon, and the Democratic Republic of Congo have witnessed extensive depletion of forest resources due to agricultural expansion, fuelwood extraction, illegal logging, and weak governance structures (Acheampong et al., 2019; Ordway et al., 2019). Despite numerous conservation policies, forest reserves across many African countries remain vulnerable to encroachment, poor funding, and inadequate enforcement of environmental regulations.

Nigeria possesses one of the richest forest ecosystems in West Africa, ranging from mangrove forests and freshwater swamp forests in the south to Guinea and Sudan savannah woodlands in the north. Historically, forests covered nearly 30 percent of the country's land area, but rapid deforestation has significantly reduced this coverage over the last century (Ojonigu et al., 202; Osogi et al, 2025; Jimmy et al, 2025). Nigeria currently records one of the highest deforestation rates in the world, losing substantial portions of its forest cover annually due to agricultural expansion, urban growth, fuelwood extraction, infrastructural development, and illegal timber harvesting (FAO, 2020). The country's tropical rainforest belt, which includes Akwa Ibom State, has been particularly affected because of high population densities, increasing demand for land, and extensive exploitation of forest resources.

The history of forest plantation development in Akwa Ibom State is closely linked to colonial forestry policies and post-independence industrialization initiatives (Osogi et al, 2025; Uno et al, 2026). Prior to the creation of Akwa Ibom State in 1987, the area formed part of the former Cross River State and benefited from plantation forestry programmes established to supply industrial timber and pulpwood. During the colonial period, forest reserves such as Stubbs Creek Forest Reserve, Obotme Forest Reserve, and Mbioso Forest Reserve were established primarily to secure timber resources and regulate forest exploitation (Cross River State Forestry Department, 1984). The adoption of the Taungya system in the 1960s and 1970s facilitated the establishment of extensive plantations of *Gmelina arborea* and *Tectona grandis* across the Itu, Ibiono Ibom, and Ini forest zones. This system integrated food crop cultivation with tree planting and was widely regarded as an effective strategy for afforestation and community participation in forest management (Nair, 1993).

The establishment of the Nigerian Newsprint Manufacturing Company (NNMC) at Oku Iboku further accelerated plantation forestry development within the region. Large-scale plantations were established to provide a sustainable supply of pulpwood for newsprint production, thereby creating employment opportunities and stimulating rural economic development. Similar plantation-based industrial forestry models were successfully implemented in countries such as Brazil, Chile, South Africa, and Indonesia, where strong linkages between forest industries and plantation management contributed significantly to national economies (Payn et al., 2015). However, unlike these countries, the collapse of the NNMC in the 1990s created a major setback for plantation forestry in Akwa Ibom State. The disappearance of the primary industrial consumer of plantation timber resulted in reduced investment, poor maintenance of plantation estates, and widespread encroachment into forest reserves.

Since the creation of Akwa Ibom State in 1987, forest conservation has faced increasing challenges associated with rapid urbanization, population growth, agricultural expansion, infrastructural development, and dependence on petroleum resources. As oil revenues became the dominant source of state income, forestry gradually lost its strategic importance in economic planning and resource allocation. Consequently, many plantation estates suffered neglect, while illegal logging, fuelwood harvesting, and conversion of forest lands to agricultural and residential uses intensified. Similar trends have been documented in several resource-dependent economies where extractive industries displaced investments in sustainable land-use management and environmental conservation (Sunderlin et al., 2005).

Another major conservation challenge in Akwa Ibom State relates to the degradation of mangrove ecosystems along the Atlantic coastline. The state hosts extensive mangrove forests, particularly within Ibeno, Eastern Obolo, and Eket Local Government Areas. These ecosystems provide critical ecological services, including shoreline stabilization, carbon sequestration, fisheries support, and biodiversity conservation (Alongi, 2014). However, oil exploration activities, recurrent oil spills, dredging operations, urban expansion, and overexploitation of mangrove wood have contributed significantly to ecosystem degradation. Similar environmental problems have been reported in the Niger Delta region and other oil-producing coastal zones worldwide, including Ecuador, Indonesia, and parts of the Gulf of Mexico (Duke et al., 2007).

Recent years have witnessed renewed interest in forest restoration and conservation due to growing concerns about climate change, biodiversity loss, flooding, and erosion hazards. Government agencies, non-governmental organizations, and community groups have initiated various tree-planting campaigns aimed at restoring degraded landscapes and enhancing environmental sustainability. These initiatives align with global restoration programmes such as the Bonn Challenge and the African Forest Landscape Restoration Initiative (AFR100), which seek to restore millions of hectares of degraded forest landscapes across Africa (WRI, 2022). Nevertheless, evidence from many developing countries suggests that tree-planting campaigns often emphasize numerical targets rather than long-term sustainability, monitoring, and ecosystem integrity (Brancalion & Holl, 2020).

Although several studies have examined deforestation, biodiversity conservation, mangrove degradation, and forest reserve management in southern Nigeria (Akindele et al., 2013; Ebong et al., 2026; Ogar et al., 2020; Ojonigu et al., 2021), there remains a significant gap in the literature regarding the historical evolution of forest plantation development and conservation challenges in Akwa Ibom State since its creation in 1987. Existing studies are generally fragmented, focusing on specific forest reserves, biodiversity assessments, or environmental impacts of oil exploration. Few studies provide a comprehensive longitudinal review that integrates plantation establishment, industrial forestry development, policy shifts, conservation interventions, and emerging environmental challenges over nearly four decades.

Furthermore, while global experiences from countries such as China, Brazil, Vietnam, and South Africa demonstrate the importance of sustainable plantation management, institutional support, community participation, and industrial integration in achieving successful forestry outcomes (Payn et al., 2015; FAO, 2020), there is limited understanding of how these lessons can inform forest conservation and plantation management in Akwa Ibom State. The absence of comprehensive historical evaluations limits evidence-based policymaking and constrains efforts to develop effective strategies for sustainable forest management in the state.

It is against this backdrop that this study reviews the development of forest plantations and conservation issues in Akwa Ibom State from 1987 to 2026. The study examines the historical trajectory of plantation forestry, assesses major conservation challenges, evaluates policy and institutional responses, and identifies pathways for strengthening sustainable forest management. By situating the experience of Akwa Ibom State within broader national and global forestry discourses, the study contributes to understanding the opportunities and constraints of forest conservation in rapidly changing socio-economic and environmental contexts.

2. Review of Related Literature

2.1 Concept of Forest Plantation and Conservation

Forest plantations are deliberately established forest stands composed of planted or seeded tree species managed for economic, ecological, or social objectives (FAO, 2020). Historically, plantation forestry emerged as a response to increasing demand for timber and the depletion of natural forests during the industrial revolution. Over time, plantations evolved from purely production-oriented systems to multifunctional landscapes designed to provide ecosystem services such as carbon sequestration, biodiversity enhancement, watershed protection, and climate regulation (Payn et al., 2015).

Globally, forest conservation encompasses policies, practices, and institutional arrangements aimed at protecting forest ecosystems from degradation while ensuring sustainable utilization of forest resources. The concept gained international prominence following growing concerns about tropical deforestation and biodiversity loss during the latter half of the twentieth century. Conservation strategies now integrate sustainable forest management, community participation, ecosystem restoration, protected area establishment, and climate mitigation measures (Lindenmayer et al., 2012).

The relationship between plantation forestry and conservation remains a subject of considerable academic debate. While plantation forests can reduce harvesting pressure on natural forests and contribute to reforestation efforts, critics argue that large-scale monoculture plantations may reduce biodiversity, alter ecosystem processes, and increase vulnerability to pests and diseases (Bremer & Farley, 2010). Consequently, contemporary forestry policy increasingly emphasizes mixed-species plantations, landscape restoration approaches, and community-based forest management systems that balance production objectives with conservation goals.

2.2 Global Trends in Forest Plantation Development

Forest plantation development has expanded significantly over the last five decades. According to FAO (2020), planted forests occupy approximately 294 million hectares worldwide and account for a substantial proportion of global industrial wood production. China represents one of the most successful examples of large-scale afforestation, having established over 80 million hectares of planted forests through programmes such as the Three-North Shelterbelt Project and the Grain for Green Programme (Liu et al., 2008). These initiatives have contributed significantly to reducing soil erosion, combating desertification, and increasing national forest cover.

Similarly, Brazil has emerged as a global leader in commercial plantation forestry through extensive cultivation of eucalyptus and pine species. Research by Ibáñez et al. (2014) indicates that plantation forestry contributes substantially to Brazil's export earnings while reducing pressure on natural forests in the Amazon region. Chile and Uruguay have adopted comparable plantation-based forestry models, demonstrating the potential of strategic government policies and private-sector investments in achieving sustainable forest resource development.

In Southeast Asia, countries such as Indonesia, Vietnam, and Malaysia have expanded plantation forestry to meet rising demand for timber, pulp, and biomass energy. Vietnam's forestry reforms, particularly since the 1990s, have transformed the country from a net importer of forest products into a major exporter while simultaneously increasing national forest cover from approximately

28% in 1990 to over 42% in recent years (Meyfroidt & Lambin, 2008). However, concerns remain regarding biodiversity loss and ecosystem simplification associated with plantation monocultures.

Studies from Europe and North America demonstrate the importance of integrating ecological principles into plantation management. In Finland, Sweden, and Germany, plantation forestry increasingly incorporates biodiversity conservation measures, habitat connectivity, and ecosystem-based management approaches (Brockerhoff et al., 2008). These experiences suggest that economic productivity and ecological sustainability need not be mutually exclusive when supported by sound governance structures and scientific management.

2.3 Forest Conservation and Biodiversity Protection: Global Perspectives

Global concern about forest conservation has intensified due to accelerating biodiversity loss and climate change. Forest ecosystems contain approximately 80% of terrestrial biodiversity and play a critical role in global carbon cycling (IPCC, 2022). The conversion of forests to agricultural land remains the primary driver of forest loss worldwide, particularly in tropical regions (Curtis et al., 2018).

Several international initiatives have emerged to address these challenges. The Bonn Challenge, launched in 2011, seeks to restore 350 million hectares of degraded land by 2030. Similarly, the United Nations Decade on Ecosystem Restoration (2021–2030) promotes global efforts to reverse ecosystem degradation and enhance environmental resilience (UNEP, 2021).

Research from Costa Rica has demonstrated how payment-for-ecosystem-services schemes can successfully incentivize forest conservation while improving rural livelihoods (Pagiola, 2008). In Nepal, community forestry programmes have significantly reduced deforestation and enhanced local participation in forest governance (Oldekop et al., 2019). Comparable successes have been documented in Mexico and Tanzania, where decentralized forest management has improved conservation outcomes through community ownership and benefit-sharing arrangements.

Despite these achievements, many developing countries continue to struggle with weak institutional capacity, inadequate funding, corruption, and conflicting land-use priorities. Consequently, forest conservation outcomes often vary considerably across regions and governance systems.

2.4 Forest Plantation and Conservation in Africa

Africa hosts approximately 624 million hectares of forests, representing about 16% of global forest cover (FAO, 2020). However, the continent experiences the highest rate of net forest loss globally. Between 2010 and 2020, Africa lost nearly 3.9 million hectares of forest annually, primarily due to agricultural expansion, fuelwood harvesting, infrastructure development, and population growth (FAO, 2020).

Several African countries have implemented plantation forestry programmes to address forest depletion. South Africa remains the continent's most developed plantation forestry economy, with extensive pine and eucalyptus plantations supporting a robust timber industry (Meyer, 2018). The country demonstrates how strong institutional frameworks, research support, and industrial integration can sustain plantation forestry over extended periods.

Conversely, experiences in Ghana, Cameroon, and the Democratic Republic of Congo reveal persistent challenges associated with illegal logging, land tenure conflicts, and weak enforcement of conservation policies (Acheampong et al., 2019). Studies by Ordway et al. (2019) indicate that

agricultural commodity expansion continues to drive substantial forest loss across sub-Saharan Africa despite numerous conservation initiatives.

The African Forest Landscape Restoration Initiative (AFR100) seeks to restore 100 million hectares of degraded land across the continent by 2030. While promising, the initiative faces challenges related to financing, governance, and long-term sustainability. Scholars argue that successful restoration requires stronger integration of local communities into conservation planning and implementation processes (Chazdon et al., 2021).

2.5 Historical Development of Forest Plantations in Nigeria

The development of forest plantations in Nigeria can be traced to colonial forestry policies implemented during the early twentieth century. The colonial administration established forest reserves primarily to secure timber supplies and regulate exploitation. By the 1930s, numerous forest reserves had been gazetted across southern Nigeria, including areas presently located within Akwa Ibom State (FORMECU, 1998).

Following independence, plantation forestry expanded significantly through government-led afforestation programmes. Species such as *Gmelina arborea*, *Tectona grandis*, *Pinus caribaea*, and *Eucalyptus camaldulensis* became widely planted because of their rapid growth and commercial value (Akindele et al., 2013). The introduction of the Taungya system further facilitated plantation establishment by integrating food production with forestry development.

Despite these efforts, Nigeria's forestry sector has experienced significant decline since the 1980s. Studies indicate that poor funding, weak institutional capacity, policy inconsistency, illegal logging, and increasing land-use pressures have undermined sustainable forest management (Ojonigu et al., 2021). Furthermore, the discovery and exploitation of petroleum resources shifted national economic priorities away from agriculture and forestry, contributing to declining investments in plantation development.

Recent studies suggest that Nigeria loses approximately 350,000–400,000 hectares of forest annually, making it one of the countries with the highest deforestation rates globally (FAO, 2020). This trend has raised concerns regarding biodiversity conservation, climate resilience, and rural livelihoods.

2.6 Forest Plantation Development and Conservation Issues in Akwa Ibom State

Akwa Ibom State lies within Nigeria's tropical rainforest and mangrove ecological zones, making it one of the country's most biologically diverse regions. Historically, forest reserves such as Stubbs Creek, Obotme, and Mbioso played important roles in timber production, biodiversity conservation, and watershed protection.

The establishment of the Nigerian Newsprint Manufacturing Company (NNMC) at Oku Iboku represented a major turning point in the state's forestry history. Large-scale plantations of *Gmelina arborea* were established to provide raw materials for newsprint production. Similar industrial forestry models have been successfully sustained in Brazil, Chile, and South Africa through continuous industrial demand and policy support (Payn et al., 2015).

However, the collapse of NNMC during the 1990s significantly altered the trajectory of plantation forestry in Akwa Ibom State. Without a viable industrial market for plantation timber, many plantation estates experienced neglect and abandonment. Field-based studies conducted in southern

Nigeria have consistently identified illegal logging, agricultural encroachment, fuelwood extraction, and poor institutional monitoring as major threats to forest reserves (Akindele et al., 2013; Ogar et al., 2020).

Mangrove ecosystems within Ibeno, Eastern Obolo, and Eket Local Government Areas have also suffered extensive degradation. Oil exploration, recurrent oil spills, dredging operations, coastal erosion, and overharvesting of mangrove wood have contributed to ecosystem decline (Duke et al., 2007). Similar patterns have been documented in other oil-producing coastal regions such as Indonesia and Ecuador, where hydrocarbon development has generated substantial ecological impacts.

Recent conservation efforts in Akwa Ibom State have increasingly focused on reforestation, climate change adaptation, erosion control, and mangrove restoration. Nevertheless, available evidence suggests that many interventions remain fragmented, underfunded, and inadequately monitored. Unlike successful restoration programmes in Costa Rica, China, and Vietnam, forest conservation initiatives in Akwa Ibom State often lack long-term institutional commitment and community ownership mechanisms.

The reviewed literature demonstrates that successful forest plantation development and conservation depend on strong institutional frameworks, sustainable financing mechanisms, community participation, industrial integration, and effective governance structures. Experiences from China, Brazil, Vietnam, Finland, and South Africa illustrate how plantation forestry can simultaneously contribute to economic development, biodiversity conservation, and climate mitigation when supported by coherent policies and long-term planning.

In contrast, much of the literature on Nigeria focuses primarily on deforestation trends, biodiversity loss, and forest reserve degradation. Studies specifically examining Akwa Ibom State remain limited and fragmented. Existing research tends to address isolated issues such as mangrove degradation, illegal logging, or biodiversity conservation without providing a comprehensive historical assessment of forest plantation development and conservation dynamics since state creation in 1987.

3. Materials and Methods

3.1 Materials

The review focused on Akwa Ibom State, located in the south-south geopolitical zone of Nigeria. The state lies approximately between latitudes 4°30'N and 5°33'N and longitudes 7°25'E and 8°25'E. It covers an estimated land area of about 7,245 km² and is characterized by tropical rainforest, freshwater swamp forest, mangrove ecosystems, and coastal environments. Annual rainfall ranges from 2,000 mm to over 4,000 mm, making the state one of the wettest regions in Nigeria.

Akwa Ibom State possesses several important forest reserves and plantation estates, including Stubbs Creek Forest Reserve, Obotme Forest Reserve, Mbioso Forest Reserve, and plantation forests located in Itu, Ibiono Ibom, Ini, Ikono, and other parts of the state. The state's ecological significance is further enhanced by extensive mangrove forests located within Ibeno, Eket, and Eastern Obolo Local Government Areas. These ecosystems support biodiversity conservation, carbon sequestration, fisheries production, shoreline protection, and livelihood activities.

3.2 Methods

This study adopted a qualitative review research design involving a comprehensive synthesis of published and unpublished literature on forest plantation development and conservation issues in Akwa Ibom State between 1987 and 2026. The review approach was considered appropriate because the study sought to examine historical trends, policy developments, conservation challenges, institutional responses, and emerging sustainability concerns within the forestry sector over a period of nearly four decades. The review also incorporated comparative analyses of global and regional forestry experiences to contextualize local developments within broader international forest conservation discourses. Review studies provide opportunities for integrating findings from diverse sources to establish patterns, identify knowledge gaps, and generate evidence-based recommendations for policy and practice.

The study relied exclusively on secondary data obtained from multiple sources. Information was collected from peer-reviewed journal articles, conference proceedings, academic theses and dissertations, government reports, forestry department records, policy documents, environmental impact assessment reports, books, technical reports, and publications from international organizations.

Major sources consulted included publications from the Food and Agriculture Organization (FAO), United Nations Environment Programme (UNEP), United Nations Development Programme (UNDP), World Resources Institute (WRI), Intergovernmental Panel on Climate Change (IPCC), Nigerian Federal Ministry of Environment, Nigerian Conservation Foundation (NCF), Forestry Research Institute of Nigeria (FRIN), National Bureau of Statistics (NBS), and Akwa Ibom State Ministry of Environment.

Additional information was obtained from internationally recognized academic databases, including Scopus, Web of Science, ScienceDirect, SpringerLink, JSTOR, Taylor & Francis Online, Wiley Online Library, Google Scholar, and African Journals Online (AJOL).

A structured literature search was conducted to identify relevant studies published between 1987 and 2026. The search process utilized combinations of keywords and Boolean operators to maximize coverage of relevant literature. Key search terms included:

- Forest plantation in Akwa Ibom State
- Forest conservation in Nigeria
- Forest reserve management
- Deforestation in southern Nigeria
- Mangrove restoration in the Niger Delta
- Biodiversity conservation
- Sustainable forest management
- Reforestation programmes
- Community forestry
- Forestry policy in Nigeria
- Plantation forestry development
- Climate change and forest conservation

Boolean operators such as AND, OR, and NOT were applied to refine search outputs and eliminate irrelevant studies. Reference lists of selected articles were further examined to identify additional relevant publications.

Furthermore, no known study has systematically reviewed nearly four decades (1987–2026) of plantation forestry development, institutional transformations, industrial influences, conservation interventions, and emerging environmental challenges within Akwa Ibom State. This creates a significant empirical and policy gap. The present study addresses this deficiency by providing a holistic review of forest plantation development and conservation issues in Akwa Ibom State while situating local experiences within broader national and international forestry discourses.

3.2.1 Inclusion and Exclusion Criteria

To ensure scientific rigor and relevance, literature included in the review met the following criteria:

Inclusion Criteria

1. Studies published between 1987 and 2026.
2. Research focusing on forest plantations, forest conservation, biodiversity protection, mangrove ecosystems, forestry governance, and environmental sustainability.
3. Studies conducted in Akwa Ibom State, the Niger Delta region, Nigeria, and comparable international contexts.
4. Peer-reviewed journal articles, official reports, policy documents, books, and academic theses.
5. Publications written in English.

Exclusion Criteria

1. Publications lacking clear methodological descriptions.
2. Studies unrelated to forestry, conservation, or environmental management.
3. Duplicate publications.
4. Opinion articles without empirical or documentary evidence.
5. Sources with unverifiable authorship or publication credentials.

3.2.2 Data Extraction and Organization

Relevant information from selected publications was extracted and organized into thematic categories. Extracted variables included publication year, study location, research objectives, methodological approach, key findings, identified conservation challenges, policy recommendations, and implications for sustainable forest management.

The reviewed literature was subsequently grouped into the following thematic areas:

- i. Historical evolution of forest plantation development.
- ii. Global experiences in plantation forestry.
- iii. Forest conservation and biodiversity management.
- iv. Deforestation and forest degradation.
- v. Mangrove ecosystem conservation.

- vi. Community participation in forestry management.
- vii. Forestry policy and institutional frameworks.
- viii. Climate change and forest restoration initiatives.
- ix. Emerging conservation challenges in Akwa Ibom State.

This thematic categorization facilitated systematic comparison of findings across different geographical contexts and time periods.

3.2.3 Data Analysis

Data were analyzed using qualitative content analysis and thematic synthesis techniques. The approach involved identifying recurring concepts, trends, relationships, and contradictions within the reviewed literature. Findings from studies conducted in Akwa Ibom State were critically compared with evidence from other parts of Nigeria, Africa, Asia, Europe, North America, and Latin America.

The analysis emphasized similarities and differences in plantation development trajectories, conservation outcomes, institutional arrangements, and policy effectiveness. Particular attention was given to lessons that could inform sustainable forest management practices in Akwa Ibom State.

A critical interpretive approach was adopted to evaluate the strengths and weaknesses of existing forestry policies, conservation interventions, and plantation management strategies. This enabled the identification of research gaps and emerging priorities for future forestry development within the state.

4. Results and Findings

4.1 Historical Evolution of Forest Plantation Development in Akwa Ibom State

The review revealed that forest plantation development in Akwa Ibom State has undergone four major phases: the colonial conservation era (pre-1960), plantation expansion and industrial forestry era (1960–1987), post-state creation and industrial decline era (1987–2000), and the contemporary conservation and restoration era (2000–2026). Each phase was characterized by distinct policy priorities, management approaches, and conservation challenges.

Evidence from historical forestry records indicates that forest plantation initiatives in the area now known as Akwa Ibom State originated during the colonial period when forest reserves were established primarily to secure timber resources and regulate exploitation. During this period, the creation of Stubbs Creek Forest Reserve and other protected forest areas represented the earliest formal conservation efforts in the region.

The period between 1960 and 1987 witnessed the most significant expansion of plantation forestry. Government-supported Taungya programmes facilitated the establishment of extensive *Gmelina arborea* and *Tectona grandis* plantations, particularly within Itu, Ibiono Ibom, and Ini areas. These plantations were strategically developed to supply raw materials for the proposed and later operational Nigerian Newsprint Manufacturing Company (NNMC) at Oku Iboku.

Following the creation of Akwa Ibom State in 1987, plantation forestry initially benefited from continued support associated with NNMC operations. However, the eventual collapse of the newsprint industry led to a substantial reduction in plantation management activities. Consequently,

many plantation estates became vulnerable to illegal logging, encroachment, and land-use conversion.

Recent decades have witnessed renewed attention to forest conservation driven by climate change concerns, biodiversity conservation initiatives, coastal ecosystem restoration programmes, and international environmental commitments.

Table 1: Historical Timeline of Forest Plantation Development and Conservation Challenges in Akwa Ibom State

Period	Major Forestry Activities	Dominant Plantation Species	Key Achievements	Major Challenges
Pre-1930	Traditional forest utilization by local communities	Indigenous species	Natural forest conservation through traditional practices	Limited formal management
1930–1960	Colonial forest reservation and protection	Indigenous hardwoods	Establishment of Stubbs Creek and other reserves	Timber-focused management with limited community participation
1960–1975	Expansion of plantation forestry through Taungya system	<i>Gmelina arborea</i> , <i>Tectona grandis</i>	Large-scale plantation establishment	Dependence on monoculture plantations
1975–1987	Industrial forestry development linked to NNMC	Gmelina, Teak	Expansion of pulpwood plantations	Weak biodiversity considerations
1987–1995	Peak plantation management after state creation	Gmelina, Teak	Continued plantation maintenance	Increasing pressure from population growth
1995–2005	Decline following NNMC collapse	Existing Gmelina plantations	Limited plantation retention	Illegal logging, encroachment, poor funding
2005–2015	Conservation awareness and reforestation campaigns	Indigenous and exotic species	Tree planting initiatives	Weak monitoring and maintenance
2015–2026	Climate-focused restoration and mangrove rehabilitation	Mangrove species, indigenous trees	Coastal restoration projects and conservation advocacy	Oil pollution, urbanization, land conversion, inadequate funding

Source: Compiled and synthesized from Food and Agriculture Organization (2020); Cross River State Forestry Department (1984); Forestry Management, Evaluation and Coordinating Unit (1998); Payn, T. et al. (2015); Akindele, S. O. et al. (2013); Ojonigu, A. F. et al. (2021); and other reviewed literature.

The review identified a gradual shift from production-oriented forestry toward conservation-oriented forest management. During the 1970s and 1980s, plantation programmes were primarily

designed to provide industrial timber and pulpwood. However, contemporary forestry initiatives increasingly emphasize environmental restoration, climate change mitigation, erosion control, biodiversity conservation, and ecosystem resilience.

A notable finding is that plantation management activities have declined considerably since the collapse of the Nigerian Newsprint Manufacturing Company. Unlike countries such as Brazil, China, Vietnam, and South Africa where plantation forestry remains closely integrated with industrial value chains, Akwa Ibom State lacks strong industrial demand capable of sustaining large-scale plantation investments.

Table 2: Major Forest Plantation Species and Their Management Objectives

Species	Origin	Major Purpose	Current Status
<i>Gmelina arborea</i>	Exotic	Pulpwood, timber production	Many plantations degraded or poorly maintained
<i>Tectona grandis</i> (Teak)	Exotic	Construction timber	Present in fragmented plantation blocks
<i>Rhizophora racemosa</i>	Indigenous mangrove	Coastal protection and fisheries habitat	Subject to restoration efforts
<i>Avicennia germinans</i>	Indigenous mangrove	Biodiversity conservation	Threatened by oil pollution
Indigenous rainforest species	Native	Ecological restoration	Increasingly promoted in reforestation programmes

Source: Adapted and synthesized from Food and Agriculture Organization (2020); Payn, T. et al. (2015); Alongi, D. M. (2014); Bremer, L. L. & Farley, K. A. (2010); Akindele, S. O. et al. (2013); and other reviewed literature.

The review revealed that forest conservation in Akwa Ibom State is constrained by multiple interacting environmental, socio-economic, and institutional factors.

Illegal logging emerged as one of the most persistent threats to forest reserves and plantation estates. Several studies reported that inadequate monitoring, insufficient forestry personnel, and weak enforcement mechanisms have facilitated unauthorized timber harvesting across many forest reserves. Plantation forests established during the NNMC era have been particularly vulnerable due to reduced government oversight.

Population growth and increasing demand for agricultural land have intensified encroachment into forest reserves. The review found that portions of plantation estates originally established under the Taungya system have been converted to permanent agricultural land uses, resulting in significant reductions in plantation coverage.

Rapid urban expansion within Uyo and surrounding areas has contributed to forest fragmentation and habitat loss. Road construction, housing development, sand mining, and commercial activities continue to exert pressure on forest ecosystems across the state.

The review identified oil-related environmental degradation as a major conservation challenge in coastal areas. Mangrove ecosystems in Ibeno, Eastern Obolo, and Eket have experienced extensive

degradation due to oil spills, dredging operations, pipeline construction, and associated industrial activities.

Table 3: Major Conservation Challenges and Their Environmental Impacts

Conservation Challenge	Primary Drivers	Environmental Consequences
Illegal logging	Weak enforcement, poverty, timber demand	Forest degradation, biodiversity loss
Agricultural encroachment	Population growth, food demand	Habitat destruction, fragmentation
Urbanization	Infrastructure expansion	Forest conversion and ecosystem disruption
Oil pollution	Petroleum exploration activities	Mangrove degradation and biodiversity decline
Fuelwood harvesting	Household energy dependence	Deforestation and ecosystem stress
Climate change	Rising temperatures and altered rainfall	Increased ecosystem vulnerability
Weak institutional capacity	Inadequate funding and manpower	Poor forest management outcomes

Source: *Synthesized from Food and Agriculture Organization (2020); Curtis, P. G. et al. (2018); Duke, N. C. et al. (2007); Ogar, D. A. et al. (2020); Ojonigu, A. F. et al. (2021); Alongi, D. M. (2014); and other reviewed literature.*

The findings suggest that many forest reserves within Akwa Ibom State have experienced varying levels of degradation over the review period. While some portions remain relatively intact, significant sections have been affected by encroachment, illegal harvesting, and inadequate management.

The review further revealed that plantation forests established between the 1960s and 1980s are aging without adequate replacement programmes. Consequently, the state's plantation resource base has gradually declined over time. This contrasts sharply with experiences in countries such as China and Vietnam, where systematic replanting programmes ensure continuity of plantation resources.

Table 4: Current Status of Major Forest Ecosystems in Akwa Ibom State

Forest Ecosystem	Conservation Status	Major Threats
Stubbs Creek Forest Reserve	Moderately degraded	Logging, encroachment
Mbioso Forest Reserve	Degraded	Agricultural expansion
Obotme Forest Reserve	Moderately degraded	Illegal harvesting
Plantation forests (Itu/Ibiono/Ini)	Fragmented and aging	Poor maintenance, logging
Coastal mangrove forests	Highly vulnerable	Oil pollution, fuelwood harvesting
Community forests	Variable condition	Weak management systems

Source: *Compiled from Akindele, S. O. et al. (2013); Ogar, D. A. et al. (2020); Duke, N. C. et al. (2007); Food and Agriculture Organization (2020); Forestry Management, Evaluation and Coordinating Unit (1998); and other reviewed literature.*

A positive finding from the review is the increasing recognition of forest conservation as a climate adaptation and environmental sustainability strategy. Government agencies, community organizations, and non-governmental organizations have implemented tree-planting campaigns,

mangrove restoration programmes, environmental awareness projects, and ecosystem rehabilitation initiatives.

However, the review found that many interventions remain project-based rather than institutionalized. Long-term monitoring, maintenance funding, and community ownership structures are often inadequate, reducing the sustainability of conservation outcomes.

The overall evidence indicates that forest plantation development in Akwa Ibom State has transitioned from an era of active plantation expansion and industrial forestry to a period characterized by declining plantation productivity and increasing conservation challenges. While significant forest resources remain within the state, they face mounting pressures from illegal logging, agricultural expansion, urbanization, oil-related environmental degradation, and weak institutional support.

The review further demonstrates that successful forestry experiences from countries such as China, Brazil, Vietnam, Finland, and South Africa were largely driven by strong policy frameworks, sustainable financing mechanisms, industrial integration, and active community participation. In contrast, forestry development in Akwa Ibom State has been constrained by inconsistent policy implementation, declining institutional investment, and inadequate long-term management strategies.

Consequently, the sustainability of forest resources in Akwa Ibom State will depend on the adoption of integrated conservation approaches that combine plantation revitalization, biodiversity protection, community participation, climate adaptation measures, and strengthened forestry governance.

5. Conclusion

This review examined the evolution of forest plantation development and conservation issues in Akwa Ibom State from the pre-state creation era to 2026. The findings reveal that the state once possessed a vibrant plantation forestry system driven by colonial forest reservation policies, the Taungya afforestation programme, and the industrial demand generated by the Nigerian Newsprint Manufacturing Company (NNMC) at Oku Iboku. These initiatives facilitated the establishment of extensive plantations of *Gmelina arborea* and *Tectona grandis*, particularly within the Itu, Ibiono Ibom, and Ini forest zones, making forestry an important component of regional economic development.

However, the collapse of the NNMC marked a turning point in the state's forestry sector, leading to reduced investment, weak plantation management, and widespread encroachment into forest estates. Over the years, illegal logging, agricultural expansion, urbanization, fuelwood exploitation, oil-related environmental degradation, and inadequate institutional support have significantly undermined forest conservation efforts. Coastal mangrove ecosystems, which provide critical ecological services, have been particularly vulnerable to oil spills, overharvesting, and habitat degradation.

Despite these challenges, the review indicates growing awareness of the importance of forests in climate change mitigation, biodiversity conservation, erosion control, and environmental sustainability. Recent reforestation and mangrove restoration initiatives demonstrate renewed commitment to forest conservation, although many programmes remain fragmented and inadequately monitored. Compared with successful forestry models in countries such as China,

Brazil, Vietnam, and South Africa, the forestry sector in Akwa Ibom State continues to face challenges associated with weak policy implementation, limited funding, and insufficient community participation.

The study concludes that the long-term sustainability of forest resources in Akwa Ibom State will depend on revitalizing plantation forestry, strengthening conservation institutions, promoting community-based forest management, and integrating forestry into broader environmental and economic development strategies. Without deliberate interventions, continued forest degradation may compromise biodiversity conservation, ecosystem services, and climate resilience within the state.

5.1 Recommendations

1. The Akwa Ibom State Government should develop and implement a comprehensive forest plantation revitalization programme to rehabilitate aging and degraded plantation estates across the state.
2. Forestry institutions should be strengthened through increased funding, improved staffing, and enhanced monitoring and enforcement mechanisms to reduce illegal logging and forest encroachment.
3. Community-based forest management approaches should be promoted to encourage local participation, ownership, and stewardship of forest resources.
4. Large-scale restoration of degraded mangrove ecosystems should be prioritized in coastal areas affected by oil pollution, fuelwood harvesting, and shoreline degradation.
5. Indigenous tree species should be integrated into future afforestation and reforestation programmes to improve biodiversity conservation and ecosystem resilience.
6. Partnerships among government agencies, private investors, research institutions, and environmental organizations should be strengthened to support sustainable forestry development and conservation initiatives.
7. Continuous forest inventory, remote sensing monitoring, and environmental impact assessments should be conducted to provide reliable data for evidence-based forestry planning and policy formulation.

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Authors' contributions

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