Review

A Snapshot of Nigeria's Biodiversity Loss: Architectural Implications

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A Snapshot of Nigeria's Biodiversity Loss: Architectural Implications

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Abstract: Biodiversity loss poses a significant threat to ecosystems and human well-being globally, with Nigeria no exception. This article delves into the architectural implications of biodiversity loss in Nigeria, exploring the multifaceted factors contributing to this phenomenon and its ramifications for architectural practice. The discussion encompasses the adverse impacts of deforestation, pollution, and climate change on Nigeria's rich biodiversity and the challenges and opportunities they present for architects. Through examining case studies and examples, the article highlights innovative architectural projects that address biodiversity loss while promoting sustainable design principles. Moreover, it elucidates the importance of interdisciplinary collaboration between architects, biologists, and policymakers in developing effective mitigation and adaptation strategies. Ultimately, this article underscores the urgent need for architects to integrate biodiversity conservation into their practices and advocates for policy interventions that prioritise the preservation of Nigeria's natural heritage.

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1. Introduction

Biodiversity, also called biological diversity, is the variety of life found in a place on Earth or, often, the total variety of life on Earth. A standard measure of this variety, species richness, is the count of species in an area. Biodiversity also encompasses the genetic variety within each species and the variety of ecosystems species create (Heydari et al., 2020; Hoban et al., 2020). Biodiversity is vital to the maintenance of the world. It is a common human heritage, so losing each organism limits our future options. Biodiversity is fundamental to the health and functioning of ecosystems, contributing to ecosystem services such as pollination, nutrient cycling, and climate regulation. Moreover, biodiversity supports livelihoods and cultural identities, particularly in indigenous communities reliant on natural resources for their sustenance and well-being (Elwell et al., 2020).

Biodiversity loss is a decrease in biodiversity within a species, an ecosystem, a geographic area, or Earth. It describes the decline in the number, genetic variability, and variety of species and biological communities in each area. This loss in the variety of life can lead to a breakdown in the functioning of the ecosystem where the decline has happened. Human interventions could trigger Biodiversity loss or occur naturally (Sage, 2020; Wassie, 2020; Wilson et al., 2020). Biodiversity loss is occurring at an alarming rate worldwide due to various human activities such as deforestation, habitat destruction, pollution, and climate change. This loss threatens ecosystems' stability and resilience, jeopardising their services and exacerbating environmental degradation (Okorondu et al., 2022; Prakash & Verma, 2022). Biodiversity loss is a pressing global issue with profound implications for ecosystems and human societies. The intricate web of life on Earth, comprising millions of species, provides essential services such as clean air, water, and food, making biodiversity conservation critical for sustainable development. This phenomenon is seldom more apparent than in Nigeria, a nation rich in biodiversity but with substantial obstacles in maintaining its natural legacy. (Akindele et al., 2021). Nigeria, situated in the biodiversity-rich region of West Africa, harbours diverse ecosystems ranging from rainforests to savannas, supporting a wealth of plant and animal species (Lata & Rashid, 2021). However, rapid population growth, urbanisation, and industrialisation have

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exerted immense pressure on its ecosystems, leading to habitat loss, species decline, and environmental degradation (Raimi et al., 2021).

Disregarding the consequences of biodiversity loss overlooks its impact on architecture despite its primarily ecological perspective. Architects significantly shape the constructed environment, influencing resource use, land use patterns, and environmental impact. Therefore, understanding how biodiversity loss intersects with architectural practice is essential for developing sustainable solutions that mitigate its adverse effects (Sun et al., 2022).

Aim

The study examined biodiversity loss in Nigeria with a view to evaluating the architectural implications.

Objectives of the Review

The objectives of this review are to:

- To evaluate architectural implications of biodiversity loss;
- To analyse the strategies for mitigation and adaptation;
- To examine factors contributing to biodiversity loss.

2. Literature Review

2.1. Understanding Biodiversity Loss in Nigeria

2.1.1. Factors Contributing to Biodiversity Loss

i. Deforestation and Land-use Change

Nigeria has experienced extensive deforestation over the past few decades, primarily driven by agricultural expansion, logging, and urbanisation. The conversion of forested areas into agricultural land, infrastructure development, and industrial activities has led to the fragmentation and loss of vital habitats for numerous plant and animal species. Furthermore, unsustainable logging practices exacerbate the problem, causing irreparable damage to forest ecosystems and diminishing biodiversity (Ogidi & Akpan, 2022; Wajim, 2020).

ii. Pollution and Habitat Degradation

Pollution from industrial activities, urban runoff, and agricultural practices poses significant threats to Nigeria's biodiversity. Contamination of water bodies with chemical pollutants and improper waste disposal degrade aquatic habitats, jeopardising the survival of aquatic species. Similarly, air pollution from industrial emissions and vehicular exhaust contributes to habitat degradation. It poses health risks to humans and wildlife (Fasona et al., 2022).

iii. Climate Change Impacts

Climate change exacerbates biodiversity loss in Nigeria by altering temperature and precipitation patterns, disrupting ecosystems, and exacerbating existing environmental stressors. Rising temperatures, changing rainfall patterns, and extreme weather events pose significant challenges for biodiversity conservation efforts, affecting species distributions, migration patterns, and reproductive cycles. Furthermore, climate change-induced sea-level rise threatens coastal ecosystems and the livelihoods of coastal communities, exacerbating the vulnerability of already endangered species (Roy et al., 2023).

2.1.2. Current State of Biodiversity in Nigeria

i. Threatened Species and Ecosystems

Nigeria is home to a diverse array of species, including iconic mammals such as elephants, lions, and chimpanzees, as well as numerous endemic plant and bird species. However, many species face significant threats due to habitat loss, poaching, and human-wildlife conflicts. Additionally, Nigeria's unique ecosystems, such as the Niger Delta mangroves and the Cross River rainforest, are under

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immense pressure from human activities, with many facing the risk of irreversible degradation and loss (Onyena & Sam, 2020).

ii. Conservation Efforts and Their Effectiveness

Despite the challenges, Nigeria has tried to conserve its biodiversity by establishing protected areas, wildlife reserves, and conservation initiatives. Government agencies, non-governmental organisations, and local communities actively participate in biodiversity conservation projects to protect endangered species, restore degraded habitats, and promote sustainable land management practices. However, the effectiveness of these efforts varies, with limited resources, inadequate enforcement of environmental regulations, and socio-economic pressures undermining conservation outcomes (Adeyanju et al., 2022).

These factors contributing to biodiversity loss in Nigeria are multifaceted and interconnected, requiring comprehensive strategies that address the underlying drivers of environmental degradation (Hussain & Reza, 2023). Practical biodiversity conservation efforts must prioritise habitat protection, sustainable land management, and community engagement while addressing the broader socio-economic and political challenges that hinder conservation efforts (Hoffmann, 2022).

2.2. Architectural Implications of Biodiversity Loss

2.2.1. Loss of Natural Habitats and Green Spaces

i. Impacts on Urban Planning Design

The loss of natural habitats and green spaces in Nigeria due to deforestation and urbanisation poses significant challenges for urban planning and design. As cities expand and infrastructure development encroaches upon natural areas, urban planners must contend with the loss of ecosystem services provided by green spaces, such as flood mitigation, air purification, and biodiversity conservation. Moreover, the degradation of natural habitats diminishes the aesthetic and recreational value of urban environments, impacting the quality of life for city residents (Li et al., 2022; Uchida et al., 2021).

ii. Challenges for Sustainable Architecture

The depletion of natural habitats and green spaces presents challenges for architects seeking to design sustainable built environments in Nigeria. Sustainable architecture aims to minimise environmental impact, conserve resources, and promote human well-being through energy-efficient design, eco-friendly materials, and integration of green technologies. However, the loss of natural habitats limits opportunities for incorporating biophilic design elements and green infrastructure into architectural projects, making it more difficult to achieve sustainability goals (Agboola et al., 2024; Ignatieva et al., 2020).

2.2.2. Increased Vulnerability to Climate Change

i. Need for Resilient Architectural Designs

Nigeria's vulnerability to climate change, exacerbated by biodiversity loss and environmental degradation, underscores the need for resilient architectural designs to withstand extreme weather events, temperature fluctuations, and other climate-related impacts. Resilient architecture incorporates principles of adaptation and mitigation to minimise vulnerability and enhance the capacity of buildings and infrastructure to cope with changing environmental conditions. Resilient designs may include designing buildings with robust structural systems, using climate-responsive materials, and implementing passive design strategies to reduce energy consumption and enhance thermal comfort (Elshafei et al., 2021; Salimi & Al-Ghamdi, 2020).

ii. Incorporating Natural Elements for Climate Adaptations

Architecture can be crucial in climate adaptation by incorporating natural elements and green infrastructure into building designs. Green roofs, living walls, and permeable pavements enhance biodiversity, mitigate urban heat island effects, and help manage stormwater runoff and improve air quality. Additionally, passive cooling techniques such as natural ventilation and shading devices can

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reduce reliance on mechanical systems and contribute to energy savings, reducing carbon emissions and mitigating climate change (Monteiro et al., 2020; Ramyar et al., 2021).

These implications of biodiversity loss for architecture in Nigeria are far-reaching, encompassing challenges related to urban planning, sustainability, climate resilience, and human well-being. Addressing these implications requires a holistic approach integrating principles of biodiversity conservation, sustainable design, and community engagement into architectural practice, creating more resilient, healthy, and livable built environments.

3. Case Studies and Examples

3.1. Showcase of Architectural Projects Addressing Biodiversity Loss

i. Incorporation of Green Roofs and Vertical Gardens

Case Study A: The Nigerian Conservation Foundation Headquarters, Lagos.

The Nigerian Conservation Foundation (NCF) Headquarters in Lagos is a prime example of incorporating green infrastructure to mitigate biodiversity loss in urban environments. The NCF is pursuing sustainable building features such as extensive green roofs planted with native vegetation, providing habitat for birds and insects while reducing stormwater runoff and heat island effects. Vertical gardens adorn the building's facades, further enhancing biodiversity and improving air quality within the surrounding area (Nebo & Oko, 2023).

Case Study B: The Lekki Conservation Centre, Lagos.

The Lekki Conservation Centre exemplifies the adaptive reuse of urban spaces to preserve biodiversity and promote environmental education. Originally established as a nature reserve within the rapidly urbanising city of Lagos, the centre now serves as a sanctuary for diverse plant and animal species, including monkeys, crocodiles, and various bird species. Architectural interventions such as elevated walkways and observation towers allow visitors to experience the natural environment firsthand while minimising disturbance to sensitive habitats (Adedeji, 2023b, 2023a).

3.2. Success Stories in Sustainable Architecture in Nigeria

i. Community-Led Conservation Initiatives

Case Study C: The Makoko Floating School, Lagos

The Makoko Floating School demonstrates the power of community-led conservation initiatives and innovative architectural solutions to address environmental challenges. Located in the informal settlement of Makoko, built on stilts over the Lagos Lagoon, the floating school provides educational facilities for local children while raising awareness about climate change and the importance of preserving wetland ecosystems. Designed to withstand flooding and sea-level rise, the school is a beacon of resilience and sustainability in environmental uncertainty (Nyandega, 2023).

ii. Government Policies Promoting Eco-Friendly Architecture

Case Study C: The Green Building Council of Nigeria (GBCN)

The Green Building Council of Nigeria (GBCN) promotes eco-friendly architecture and sustainable development practices nationwide. Through initiatives such as the Green Building Rating System (GBRS) and the certification of green buildings, the GBCN incentivises adopting environmentally responsible design and construction practices. By integrating energy efficiency, water conservation, and biodiversity preservation principles into building codes and regulations, the GBCN fosters a culture of sustainability within the Nigerian construction industry, driving positive change towards a more resilient and environmentally conscious built environment (Ebekozien et al., 2022).

These case studies illustrate the diverse approaches and strategies architects, communities, and government agencies employ to address biodiversity loss and promote sustainable architecture in Nigeria. By showcasing successful projects and initiatives, we can inspire future collaborations and innovations contributing to biodiversity conservation while creating healthier, more resilient, and livable built environments.

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4. Conclusions

Blessed with rich biodiversity, Nigeria faces significant challenges due to biodiversity loss driven by deforestation, pollution, and climate change. Threatened species and ecosystems underscore the urgency of addressing this issue, as biodiversity loss jeopardises ecological integrity and undermines human well-being and sustainable development efforts.

Architecture is crucial in addressing biodiversity loss by integrating sustainability, resilience, and biophilic design principles into built environments. Architectural interventions such as green roofs, vertical gardens, and adaptive reuse of urban spaces provide opportunities to preserve biodiversity, enhance ecosystem services, and promote human-nature connection. Moreover, sustainable architecture can catalyse positive change, inspiring communities, industries, and policymakers to prioritise biodiversity conservation in their practices and policies.

Architects and policymakers must prioritise biodiversity conservation in their practices and policies in light of the urgent need to address biodiversity loss in Nigeria. Architects are called upon to embrace sustainable design principles, collaborate with biologists and policymakers, and advocate for environmentally responsible development practices. Conversely, policymakers must enact and enforce regulations that safeguard natural habitats, promote sustainable land use, and incentivise green building practices. Together, architects and policymakers can drive positive change and contribute to preserving Nigeria's rich biodiversity for present and future generations.

In conclusion, addressing biodiversity loss in Nigeria requires collective action, commitment, and collaboration across sectors. We may design constructed settings that support human existence and nurture and safeguard the variety of species we coexist on this planet by incorporating biodiversity conservation into architectural practices and policy. Let us create a future where ecosystems flourish, biodiversity increases, and everyone can experience sustainable development.

5. Recommendations

5.1. Strategies for Mitigation and Adaptation

5.1.1. Policy Recommendations for Integrating Biodiversity Conservation in Architectural Practices

i. Strengthening Environmental Regulations

Nigeria's environmental regulations are crucial in shaping architectural practices and promoting biodiversity conservation. Addressing biodiversity loss requires policymakers to prioritise enforcing and enhancing existing environmental laws and regulations. Such efforts would include protecting critical habitats, regulating land-use practices, and promoting sustainable development. By enforcing stricter environmental standards and penalties for non-compliance, policymakers can create a regulatory framework that incentivises architects to integrate biodiversity conservation into their designs and construction practices (de Luca et al., 2021).

ii. Incentivising Green Building Practices

Incentivising green building practices is essential for mainstreaming biodiversity conservation in architectural projects. Policymakers can provide financial incentives, tax breaks, and other rewards to developers and building owners who incorporate sustainable design features such as green roofs, passive solar design, and energy-efficient technologies. Additionally, governments can establish green building certification programs and rating systems to recognise and promote environmentally friendly buildings. By creating tangible benefits for sustainable development, policymakers can encourage architects to prioritise biodiversity conservation and sustainability in their projects (Debrah et al., 2022).

5.2. Collaboration Between Architects, Biologists, and Policymakers

i. Interdisciplinary Approaches to Address Biodiversity Loss

Addressing biodiversity loss requires interdisciplinary collaboration among architects, biologists, policymakers, and other stakeholders. By bringing diverse perspectives and expertise, interdisciplinary teams can develop holistic solutions integrating ecological principles with architectural design and planning. Architects can work closely with biologists to identify priority

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conservation areas, design wildlife-friendly habitats, and incorporate green infrastructure into urban environments. Policymakers can facilitate collaboration by fostering partnerships between government agencies, academic institutions, and conservation organisations, leveraging collective knowledge and resources to tackle complex environmental challenges (AlAli et al., 2023; Sigmund et al., 2023).

ii. Advocacy for Sustainable Development

Architects have a unique opportunity to advocate for sustainable development practices prioritising biodiversity conservation and environmental stewardship. By raising awareness about the importance of biodiversity, architects can mobilise support for policies and initiatives that promote sustainable land use, habitat protection, and wildlife conservation. Through outreach efforts, educational programs, and public engagement, architects can empower communities to take action and demand environmentally responsible development practices. By advocating for sustainable development principles at the local, national, and global levels, architects can drive positive change and contribute to preserving biodiversity for future generations (Taljaard et al., 2021).

Addressing biodiversity loss in Nigeria requires a comprehensive approach encompassing policy reform, stakeholder collaboration, and advocacy for sustainable development. By integrating biodiversity conservation into architectural practices and promoting interdisciplinary collaboration, we can create environments that harmonise with nature, enhance biodiversity, and contribute to ecosystems' long-term health and resilience. Architects can be pivotal in shaping a more sustainable and biodiverse future for Nigeria and beyond through strategic policy interventions and collective action (Coombes & Viles, 2021).

6. Areas for Future Studies

i. Integration of Biodiversity Conservation in Urban Planning:

Future research should explore effective strategies for integrating biodiversity conservation into urban planning and design. This includes developing guidelines for the preservation of green spaces, the incorporation of native plant species in urban landscapes, and the creation of wildlife corridors in densely populated areas.

ii. Innovative Green Infrastructure Solutions:

Further investigation into innovative green infrastructure solutions, such as green roofs, vertical gardens, and permeable pavements, is needed to assess their long-term impact on urban biodiversity and ecosystem services. Research should focus on optimizing these technologies for different climatic and ecological conditions across Nigeria.

iii. Resilient Architectural Design in the Context of Climate Change:

As climate change continues to exacerbate environmental challenges, there is a need for research into resilient architectural designs that can adapt to changing conditions. This includes exploring passive design strategies, the use of climate-responsive materials, and the role of architecture in enhancing community resilience to climate impacts.

iv. Interdisciplinary Collaboration Models:

Research should focus on developing and testing models for effective interdisciplinary collaboration between architects, biologists, and policymakers. These models could explore best practices for integrating ecological knowledge into architectural design processes and for fostering partnerships that promote sustainable development.

v. Assessment of Policy Effectiveness in Promoting Sustainable Architecture:

There is a need for ongoing research to assess the effectiveness of existing policies and regulations aimed at promoting sustainable architecture and biodiversity conservation. This includes evaluating the impact of green building certification programs, financial incentives for eco-friendly construction, and the enforcement of environmental regulations on biodiversity outcomes.

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