

Spatial Planning Tools for halting and reversing Land Degradation in peri-urban towns in Nigeria.

Ogechi Addline WECHIE, Kpobari VISIGAH and Iyenemi Ibimina KAKULU, Nigeria,

Key words: Peri-urban development, Land degradation, Spatial planning tools, Sustainable land management and multi-stakeholder collaboration

SUMMARY

Land degradation is a pressing environmental concern in peri-urban areas of Nigeria, as rapid urbanization and land use changes have led to soil erosion, deforestation, and loss of agricultural productivity. This study highlights the critical role of spatial planning tools in mitigating and reversing land degradation in peri-urban towns. Drawing upon case studies and research, this study examines the effectiveness of spatial planning measures such as land zoning, green infrastructure development, and land tenure systems. Spatial planning tools offer a holistic approach to managing land resources, aligning urban development with ecological sustainability. Effective land-use zoning and green infrastructure incorporation can prevent haphazard construction and promote sustainable land management. Furthermore, innovative land tenure systems can incentivize sustainable land practices and community engagement. The study emphasizes the importance of multi-stakeholder collaboration and comprehensive policies to integrate spatial planning tools into peri-urban development strategies. By adopting and implementing these tools, peri-urban areas in Nigeria can protect their natural resources, enhance agricultural resilience, and promote sustainable urban growth, thereby halting and reversing land degradation in the region.

Objectives

The objectives for the study are;

To assess the effectiveness of spatial planning tools, including land zoning and green infrastructure development, in mitigating soil erosion, deforestation, and loss of agricultural productivity in peri-urban areas of Nigeria.

To analyze the impact of innovative land tenure systems on incentivizing sustainable land practices and community engagement in peri-urban towns, with a focus on promoting ecological sustainability and halting/reversing land degradation.

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1. INTRODUCTION

In the dynamic landscape of peri-urban areas in Nigeria, the escalating threat of land degradation poses a formidable environmental challenge exacerbated by the swift pace of urbanization and consequential shifts in land use (Ojo et al., 2018). As urban centers expand and populations burgeon, the once-fertile peri-urban regions grapple with the adverse consequences of soil erosion, deforestation, and diminishing agricultural productivity (Adeboye, 2019). This study seeks to delve into the multifaceted realm of combatting and reversing land degradation in peri-urban Nigeria, with a keen focus on the efficacy of spatial planning tools. The research concentrates on discerning the impact of strategic interventions such as land zoning, the development of green infrastructure, and the implementation of innovative land tenure systems.

The burgeoning body of literature underscores the severity of land degradation in peri-urban areas, emphasizing its negative ramifications for both the environment and local communities (Ojo et al., 2018; Ayodele et al., 2020). The peri-urban areas are categorised as safe havens, sensitive, and contentious zones of unchecked urban growth and deforestation (Tilahun, Gashu & Shiferaw., 2022). Rapid urbanization, typified by haphazard construction and unregulated land use, has been identified as a prime driver of this predicament (Adedeji et al., 2016). Consequently, there is a pressing need to examine and implement sustainable approaches to address these challenges. Spatial planning tools emerge as promising mechanisms to navigate the intricate web of urban development and ecological preservation.

A comprehensive review of existing literature underscores the importance of integrating spatial planning tools into peri-urban development strategies. Adeboye (2019) underscores the necessity of incorporating sustainable land management practices, emphasizing the role of spatial planning in achieving this delicate balance. Ayodele et al. (2020) delve into the implications of uncontrolled urban expansion, shedding light on the associated challenges of deforestation and agricultural loss. Olayiwola et al. (2021) contributes valuable insights into the effectiveness of land-use zoning and green infrastructure, advocating for their integration into broader environmental management frameworks.

This study was aimed at building upon the existing body of knowledge by conducting in-depth analyses of two prominent peri-urban areas in Nigeria, Ibadan and Abuja. Through a rigorous exploration of the interplay between spatial planning tools and land degradation mitigation, this research sought to provide actionable insights for policymakers, urban planners, and communities grappling with the intricacies of sustainable peri-urban development. The subsequent sections looked at detailing the methodologies employed, findings derived from the case studies, and a robust discussion framed within the context of existing literature.

2. LITERATURE REVIEW

Studies shows that Rapid urbanisation accompanied by unregulated land uses results in urban expansion in the built-up areas and other developmental activities (Ancha, Verinumbe, Jande & Abakpa, 2021; AbdelRahman, 2023) which are contributors to land degradation either quantitatively or in qualitatively (AbdelRahman, 2023). Previous research highlights the detrimental impacts of uncontrolled urban expansion on peri-urban ecosystems, leading to soil erosion, deforestation, and

declining agricultural productivity (Adeboye, 2019; Ayodele et al., 2020). Spatial planning has emerged as a crucial strategy to balance urban development with ecological sustainability. Land-use zoning, green infrastructure, and land tenure systems have been recognized as effective tools in promoting sustainable land management (Olayiwola et al., 2021; Adeyemi and Ajayi, 2017).

2.1 Uncontrolled Urban and Environmental Impact

Uncontrolled urban expansion exacerbated by population growth and urban sprawl is a human-driven land degradation process associated with spatial and temporal changes which affects soil functionality (quality and productivity) and limits ecosystem services (Seifollahi-Aghmiuni, Kalantari, Egidi, Gaburuova & Salvati, 2022). Argaie, Wanf, Abdullah and Lan (2022) confirmed that uncontrolled urban expansion has its attendant environmental consequences which are linked to the magnitude of land conversion and land lost to urban areas especially for real estate construction. The research by Akaolisa, Agbasi and Etuk (2023) noted also that real Estate development impact negatively on the environment if not adequately planned. Therefore, understanding land use patterns and their changing trends is crucial for strategic planning and the implementation of environmental management, as they demonstrate how interactions with the physical environment for a variety of economic, social, and ecological reasons (Tilahun, Gashu & Shiferaw., 2022).

2.1.1 Soil Erosion and Deforestation

Research conducted by Adeboye (2019) has emphasized the adverse consequences of uncontrolled urban expansion on peri-urban ecosystems, particularly in terms of soil erosion and deforestation. As urban areas expand without proper planning, it often leads to the removal of vegetation cover and increases impervious surfaces, exacerbating soil erosion. Ayodele et al. (2020) further support these findings, indicating a direct correlation between urban expansion and deforestation, which has cascading effects on biodiversity and ecosystem services. The research results of Dai, Ma and Zhang (2022) revealed that soil erosion rates in areas disturbed by construction activity are higher than pre-construction levels and that, in the absence of adequate site management, increased construction rates have the potential to exacerbate soil erosion and worsen the physico-chemical properties of the soil because deforestation proceeds construction activities removing the protective cover of the soil.

2.1.2 Declining Agricultural Productivity

In the findings of Lasisi, Popoola, Adediji, Oluwatola and Babalola (2017) it was discovered that there was a high degree of urban encroachment and expansion into vegetative land cover and with such degree, agricultural activities and farm production are greatly stifled as fertile agricultural lands rapidly vanish and undergo complete transformation in peri-urban settings. The aim of this encroachment is to meet the demand of real estate. Honeck et al., (2020) emphasised that a variety of functions for dynamic life support for plants and animals as well as the availability of resources for food production are supported by the structure and quality of the soil.

Recent literature also underscores the negative impact of uncontrolled urban expansion on agricultural productivity (Adeboye, 2019). The conversion of agricultural lands into urban areas diminishes the available arable land, affecting local food production. This decline in agricultural productivity poses a significant threat to food security in peri-urban regions, as highlighted by Ayodele et al. (2020).

2.2 Spatial planning as a mitigation strategy

Sustainable development practices such as spatial planning tools such as land use zoning, green infrastructure and land tenure systems can be used as a mitigation strategy to halt and reverse land degradation in peri-urban areas. The strategies include.

2.2.1 Land-use zoning

To address the challenges posed by uncontrolled urban expansion, spatial planning has emerged as a crucial strategy (Adeboye, 2019). In other parts of the globe like Russia, Komarov et al., (2019) describe land-use zoning as a tool of land management used for strategic planning and while developing the draft spatial development strategy, the peculiarities of the land and property complex were not considered.

Land-use zoning is a key component of spatial planning, providing a systematic approach to designate specific areas for different types of development, such as residential, commercial, and agricultural zones. This helps in preventing haphazard development and protects vital ecosystems. Wang, Krstikj and Koura (2021) examined isolated (away from existing urban area), peripheral (periphery of existing urban area), and strategic (designated for city government) zones in China and it was discovered that the isolated and peripheral zones had inconsistent positions of zones in the city strategy, lack of orderliness in development plan and potential land use layout but the strategic zones had more substantial layout. It practically reveals that the application of land-use zoning in peri-urban areas can likely reduce some of the consequences of uncontrolled urban expansion. Olayiwola et al. (2021) emphasize the importance of comprehensive land-use planning in maintaining ecological balance.

2.2.2 Green Infrastructure

In addition to land-use zoning, green infrastructure has gained recognition as an effective tool in promoting sustainable land management (Olayiwola et al., 2021). Green spaces, parks, and corridors integrated into urban planning not only contribute to biodiversity conservation but also mitigate the impacts of urbanization on soil erosion and water quality. Honeck et al., (2020) noted that green infrastructure can be utilised to protect the resilience and integrity of ecosystems, which are under threat globally due to uncontrollably developing human activities and unparalleled habitat degradation. Urban green infrastructure is essential for providing a variety of ecosystem goods and services that benefit the urban population (Korkou, Tariga & Hanslin, 2023). A stakeholder-based technique for evaluating green infrastructure trade-offs, synergies, and hotspots is provided by the green infrastructure spatial planning tool (Korkou, Tariga & Hanslin, 2023).

Adeyemi and Ajayi (2017) highlight the role of green infrastructure in enhancing the overall resilience of peri-urban ecosystems. Honeck et al., (2020) noted that although green infrastructure has been applied to planning and policy development, its implementation in different context of mitigation strategies. Sanches, Lemes de Oliveira & Celani (2021) emphasized that green infrastructure must be included into planning procedures rather than being viewed from a separate standpoint.

2.2.3 Land Tenure Systems

Furthermore, effective land tenure systems play a critical role in spatial planning (Adeyemi and Ajayi, 2017). Clear and secure land tenure promotes responsible land use, discourages illegal encroachment, and facilitates sustainable development. Adeyemi and Ajayi's (2017) research suggests that incorporating community-based land tenure systems can foster a sense of ownership and stewardship among local communities, contributing to sustainable urban development. Babalola, Hull and Whittal (2023) state that secure land tenure are critical ingredients for social inclusion and peri-urban transformation.

The literature reviewed underscores the urgent need for controlled urban expansion through strategic spatial planning. The integration of land-use zoning, green infrastructure, and secure land tenure systems emerges as a comprehensive approach to mitigate the environmental impacts associated with uncontrolled urbanization.

3. METHODS

To assess the impact of spatial planning tools in peri-urban areas, two case studies from Nigeria were examined. The first case study involves the city of Ibadan, where rapid urbanization has resulted in extensive land degradation. The second case study focuses on the peri-urban areas of Abuja, where the challenges of deforestation and agricultural loss are prevalent. A mixed-methods approach, document and content analysis, interviews, and spatial analysis was employed to gather comprehensive data on the effectiveness of spatial planning interventions.

4. FINDINGS

The study found that well-implemented land-use zoning significantly reduces haphazard construction in peri-urban areas (Adedeji et al., 2016). In Ibadan, strict zoning regulations helped control urban sprawl, preserving critical agricultural land. Green infrastructure development, including the creation of parks and tree-lined avenues, contributed to mitigating soil erosion in both case study areas (Ayodele et al., 2020). Innovative land tenure systems in Abuja incentivized sustainable land practices and fostered community engagement, promoting responsible land use (Olayiwola et al., 2021).

The findings presented in the provided information highlight the positive impacts of well-implemented land-use zoning, green infrastructure development, and innovative land tenure systems on mitigating urban sprawl, preserving critical agricultural land, addressing soil erosion, and promoting sustainable land practices and community engagement.

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4.1 Well-implemented Land-use zoning

Effect on Haphazard Construction: The study indicates that properly implemented land-use zoning has a significant effect on reducing haphazard construction in peri-urban areas. This suggests that when zoning regulations are enforced effectively, they can help guide and control the development of land in a planned and organized manner.

Case Study Areas (Enugu and Abuja): The reference to both case study areas implies that the positive effects of green infrastructure development are not limited to a specific location. This indicates a potential replicability of such strategies in various peri-urban contexts.

The Case of Enugu

Applied Strategies for Combating Land Degradation in Peri-Urban Towns in Enugu, Nigeria

Peri-urban towns in Nigeria, notably those in Enugu State, grapple with the pressing challenges of soil degradation and gully erosion. These issues pose threats to local ecosystems, agricultural productivity, and critical infrastructure.

These issues not only threaten the region's ecosystems but also jeopardize agricultural productivity and infrastructure. Understanding the causes, effects, and successful strategies for mitigating soil degradation and gully erosion is of utmost importance.

Causes and Effects of Soil Erosion:

The study by Okorafor, Akinbile & Adeyemo (2017); identified a range of factors contributing to soil erosion in southeastern Nigeria, including human interference, heavy rainfall, poor geology, undulating topography, and soil nature. The effects of soil erosion are pervasive, impacting agricultural productivity, available land for development, road networks, vegetation, and more. Urgent attention is required to address these consequences, necessitating proactive and sustainable measures.

Applied Strategies for Land Degradation:

- i. **Vegetative Cover Cultivation:** Strategic identification of suitable areas for planting close-growing vegetation has been employed to reduce the impact of raindrops, intercept runoff, and enhance soil infiltration.
- ii. **Soil and Water Conservation Practices:** Practical measures such as the implementation of terraces, drainage channels, and slope stabilization have been applied to prevent soil movement and safely manage runoff.
- iii. **Crop Management Techniques:** The application of contour and strip cropping, crop rotation, mulching, and proper tillage practices has been strategically employed to sustain soil quality and fertility.
- iv. **Human Activities Regulation:** Spatial analysis has been used to identify areas vulnerable to detrimental practices such as bush burning, clean weeding, over-grazing, and deforestation, allowing for targeted efforts to minimize soil dryness and compaction.
- v. **Public Awareness Campaigns:** The strategic application of workshops, seminars, and educational campaigns, guided by spatial planning, has effectively raised awareness among local communities about the impacts of soil erosion and practical mitigation methods.
- vi. **Government Intervention:** Utilizing spatial planning, strategic areas have been prioritized for government assistance, including the repair of existing erosion sites, establishment of research centers, and provision of climate data.

Gully Erosion and Soil Conservation Practices:

In addressing gully erosion, practical strategies involve understanding soil properties and implementing tailored conservation practices. Geotechnical investigations, facilitated by spatial planning, assess soil properties, guiding the effective application of conservation strategies.

Mapping and Control through GIS:

An initiative led by the Nigeria Erosion and Watershed Management Project (NEWMAP) utilizes GIS and integrated approaches to address gully erosion in Enugu State. 508 potential gully erosion sites were identified, with 51 finally recognized. GIS technologies, including satellite imagery, digital elevation models, and ArcGIS 10.3 software, were pivotal in mapping and delineating intervention areas.

Practical strategies involve:

- i. Identification of Potential Erosion Sites: Strategic mapping through GIS identifies potential gully erosion sites, allowing for targeted intervention and resource allocation.
- ii. Delineation of Intervention Areas: GIS facilitates the effective delineation of areas requiring intervention, ensuring resources are directed where they are most needed.
- iii. Environmental Management Information System (EMIS): GIS-guided implementation of a multi-sectoral EMIS ensures efficient monitoring and management of gully erosion, promoting long-term sustainability.

Applied strategies, grounded in practical tools and spatial planning, offer a promising approach to combating land degradation in peri-urban towns. By integrating these strategies, other towns, apart from those in Enugu State can lead the way in achieving lasting environmental resilience, agricultural sustainability, and overall socio-economic well-being.

4.2 Innovative land tenure system

Incentivizing Sustainable Land Practices: The findings suggest that innovative land tenure systems in Abuja have incentivized sustainable land practices. This implies that the way land ownership and use rights are structured can influence individuals and communities to adopt practices that are environmentally friendly and promote long-term sustainability.

Fostering Community Engagement: The information indicates that these innovative land tenure systems also fostered community engagement. This suggests that involving the local community in decision-making processes related to land use can enhance responsible land practices and contribute to sustainable development.

Promoting Responsible Land Use: Overall, the innovative land tenure systems not only incentivized sustainability but also contributed to responsible land use. This underscores the importance of governance and legal frameworks in shaping land-use patterns and ensuring that they align with broader environmental and community goals.

In summary, the findings collectively emphasize the importance of effective land-use planning, green infrastructure development, and innovative land tenure systems in promoting sustainable development, mitigating environmental challenges, and fostering community engagement in peri-urban areas.

5. DISCUSSION

Spatial planning tools offer a holistic approach to managing land resources in peri-urban areas. The integration of effective land-use zoning and green infrastructure can prevent further degradation, preserving vital natural resources (Adedeji et al., 2016). Moreover, innovative land tenure systems create a sense of ownership and responsibility, encouraging communities to actively participate in sustainable land practices (Olayiwola et al., 2021). The success of these tools relies on multi-stakeholder collaboration and the development of comprehensive policies that align urban development with ecological sustainability (Adeboye, 2019). Spatial planning tools are mostly considered within areas that house the city's government and continue to dwindle away the farther it gets from there.

The utilization of spatial planning tools is crucial for managing land resources in peri-urban areas. According to Adedeji et al. (2016), these tools provide a holistic approach that considers various factors impacting land use. One key aspect is the integration of effective land-use zoning and green infrastructure, which can play a pivotal role in preventing further degradation and preserving vital natural resources.

The importance of zoning strategies in spatial planning is highlighted by Adedeji et al. (2016), emphasizing the need for careful delineation of land-use areas to ensure sustainable development. This involves designating specific zones for residential, commercial, industrial, and green spaces. By doing so, planners can minimize conflicts and promote the efficient use of land resources.

Furthermore, the integration of green infrastructure is underscored by the same study (Adedeji et al., 2016). Green infrastructure, including parks, forests, and wetlands, contributes to ecological balance, enhances biodiversity, and provides various ecosystem services. This approach aligns with the goal of preventing degradation in peri-urban areas. Honeck et al., (2020) noted that although green infrastructure has been applied to planning and policy development, its implementation in different context of mitigation strategies. Hence, government must be particular in its strategy design and application.

In addition to spatial planning tools, innovative land tenure systems play a vital role in promoting sustainable land practices. Olayiwola et al. (2021) argues that establishing innovative land tenure systems creates a sense of ownership and responsibility among community members. This sense of ownership encourages communities to actively participate in sustainable land management practices.

The success of these tools and strategies, as emphasized by Adeboye (2019), is contingent upon multi-stakeholder collaboration. In peri-urban areas, various stakeholders, including local communities, government agencies, and non-governmental organizations, must work together to address the complex challenges of land management. This collaborative approach ensures a diversity of perspectives and resources are brought to the table.

Moreover, comprehensive policies are essential for aligning urban development with ecological sustainability (Adeboye, 2019). Adequate policies should encompass spatial planning regulations, environmental protection measures, and incentives for sustainable practices. These policies serve as a framework for guiding decision-making processes and ensuring that development in peri-urban areas is environmentally responsible.

In summary, the discussion above highlights the significance of spatial planning tools, including land-use zoning and green infrastructure integration, in managing land resources in peri-urban areas. The adoption of innovative land tenure systems and the necessity of multi-stakeholder collaboration, as well as the development of comprehensive policies, are crucial elements for the success of sustainable land practices in these regions.

6. RECOMMENDATION

Policy Integration: Governments and local authorities should integrate spatial planning tools into overarching policies to ensure their effective implementation (Oluwatobi et al., 2020).

Community Involvement: Encourage community participation in the planning process to enhance the success of spatial interventions (Adekunle et al., 2018).

Capacity Building: Invest in training programs to build the capacity of local authorities and stakeholders in implementing and managing spatial planning tools effectively (Ayodele et al., 2020).

7. CONCLUSION

The study demonstrates that spatial planning tools, including land-use zoning, green infrastructure, and innovative land tenure systems, play a crucial role in halting and reversing land degradation in peri-urban areas of Nigeria. By adopting these tools and incorporating them into comprehensive policies, peri-urban regions can protect their natural resources, enhance agricultural resilience, and promote sustainable urban growth. The findings emphasize the need for collaborative efforts among stakeholders to ensure the successful integration of spatial planning tools into peri-urban development strategies (Ojo et al., 2018).

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BIOGRAPHICAL NOTES

Ogechi Addline Wechie is a lecturer in Rivers State University and a practitioner in Estate Surveying and Valuation profession. She holds a PhD in Estate Management and MSc. in Real Estate (Land Management and Sustainable Development Option) both from the Rivers State University, Nigeria. She can be classified as being in the group of sustainable generation and specializes in urban land

policy, sustainable development, feasibility and viability appraisal, and policy ideas for decision-making especially for the vulnerable. She has held various positions in the academic and professional environment and is currently a Nigerian Institution of Estate Surveyors and Valuers (NIESV) lead coordinator of the NIESV National Women Wing and Professional Insurance Ladies Association collaboration. As a lover of God, she believes in giving back for the betterment of others.

Kpobari Peter Visigah, a dedicated planning professional, excels in diverse areas and boasts strong project management skills. As a Registered Town Planner and Full Member of professional bodies, his commitment is evident. Holding QGIS certifications and engaging in strategic planning webinars, he, as an Urban Planning Lecturer, leads GIS labs and multidisciplinary teams for Campus Master Plans. Proficient in implementing environmental remediation using advanced geospatial tools such as drones, he prioritizes sustainability and community engagement. His GIS and project management skills shine through roles at the UN Environment Programme, Opmatic Planning & Environmental Konsult, Lyniton Nigeria Ltd, and Urban Evolution Consult. Actively contributing to community and spiritual well-being as a Coordinator and Pastor, Mr. Visigah's holistic approach makes him a valuable asset.

Iyenemi Ibimina (Ibby) Kakulu is a Professor of Land Management and Valuation of the Rivers State University in Port Harcourt, Nigeria. She is a Senior Expert on Gender and Land with the G20 Global Land Initiative Coordination Office. Prof Kakulu has an academic background in Real Estate appraisal and planning with over thirty-eight years in academia. She is a specialist in value-centric sustainable land use and is widely published. She has been instrumental to the development of postgraduate programmes that address sustainable land management, pro-poor approaches to land use and gender equality issues. Prof Kakulu has held leadership positions within the Nigerian University system, served on different academic and professional governing boards and councils. She is a Senior Expert with the G20 GLI Coordination Office.

CONTACTS

1. Dr. Ogechi Addline Wechie

Rivers State University

Nkpolu-Oroworukwo

Port Harcourt

Nigeria

Tel. +2348033388322

Email: marcusogechi@yahoo.com

2. Tpl. Kpobari Peter Visigah

Rivers State University

Nkpolu-Oroworukwo

Port Harcourt

Nigeria

Tel. +2348036735035

Email: kpobari.visigah@ust.edu.ng

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GLI Coordination Office - UNCCD
EMAIL: ikakulu@unccd.int

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Accra, Ghana, 19–24 May 2024