



# ASSESSING THE IMPACT OF LAND COVER AND LAND USE CHANGE ON URBAN INFRASTRUCTURE RESILIENCE IN ABUJA, NIGERIA: A CASE STUDY FROM 2017 TO 2022

## OCENA WPŁYWU ZMIAN POKRYCIA I UŻYTKOWANIA GRUNTÓW NA ODPORNOŚĆ INFRASTRUKTURY MIEJSKIEJ W STOLICY NIGERII, ABUDŻY: STUDIUM PRZYPADKU Z LAT 2017-2022

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### Abstract

*The remarkable feature of rapid urbanisation, which has fundamentally altered the distribution of land cover and land use (LULC), is what sets the contemporary era apart. The impact of these modifications on the resilience of Abuja's metropolitan infrastructure from 2017 to 2022 is examined in this study. Our study examined the dynamic changes in LULC using information from remote sensing, geospatial analysis software, and land cover categorization techniques. The findings indicate major changes in Abuja's topography, including a decrease in the number of water bodies, a decrease in the number of trees, the expansion of urban areas, changes in agricultural land use, and fluctuations in the amount of grazing land. The previously mentioned changes have significant consequences for urban infrastructure resilience, affecting various sectors such as water supply, transportation, housing, utilities, and food distribution systems. The infrastructure supporting water supply and sanitation may be severely stretched as the number of water bodies decreases, affecting the quantity and quality of accessible water supplies. As metropolitan areas expand, greater strain is placed on transportation infrastructure, exacerbating traffic congestion and complicating road maintenance difficulties. Changes in agricultural land use can have an impact on food production and distribution, hence affecting food security. Deforestation can cause ecological deterioration, affecting a variety of aspects such as temperature regulation, biological diversity, and atmospheric purity. Adaptive approaches, green infrastructure, and adopting sustainable urban design can all strengthen the resilience of urban infrastructure, according to this study. The significance of renewable energy adoption, community participation, green building laws, the establishment of public-private partnerships, integrated water resource management, and data-driven decision-making is emphasised. Improving legal frameworks that prioritise resilience and sustainability is critical. It is critical to have a complete grasp of the complicated links between changes in LULC, and the resilience of urban infrastructure in order to enable educated urban design and decision-making processes. Policymakers and urban planners may address and minimise the negative consequences of climate change while improving the overall quality of life in cities by using sustainable development practises. The findings of this study have the potential to dramatically improve Abuja's people's well-being and sustainability, especially given the variety of urban difficulties they encounter.*

**Keywords:** geospatial analysis, infrastructure resilience, remote sensing, sustainability, urbanization

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## Streszczenie

Współczesną erę wyróżnia niezwykle szybka urbanizacja, która zasadniczo zmieniła rozkład pokrycia terenu i użytkowania gruntów (LULC). W niniejszym badaniu przeanalizowano wpływ tych zmian na odporność infrastruktury metropolitalnej Abudży w latach 2017-2022. Dynamiczne zmiany LULC zbadano przy użyciu informacji z teledetekcji, oprogramowania do analizy geoprzestrzennej oraz technik kategoryzacji pokrycia terenu. Wyniki wskazują na poważne zmiany w topografii Abudży, w tym spadek liczby zbiorników wodnych, spadek liczby drzew, ekspansję obszarów miejskich, zmiany w użytkowaniu gruntów rolnych i wahania w ilości pastwisk. Zmiany te mają znaczące konsekwencje dla odporności infrastruktury miejskiej, wpływając na różne sektory, takie jak zaopatrzenie w wodę, transport, mieszkalnictwo, usługi komunalne i systemy dystrybucji żywności. Infrastruktura wspierająca zaopatrzenie w wodę i urzędnictwo sanitarne może być poważnie obciążona, ponieważ malejąca liczba zbiorników wodnych odbija się na ilości i jakości dostępnych zasobów wody. Wraz z rozwojem obszarów metropolitalnych rośnie obciążenie infrastruktury transportowej, co zwiększa natężenie ruchu i komplikuje utrzymanie dróg. Zmiany w użytkowaniu gruntów rolnych wpływają na produkcję i dystrybucję żywności, a tym samym na bezpieczeństwo żywnościowe. Wylesianie może powodować pogorszenie stanu środowiska, wpływając na regulację temperatury, różnorodność biologiczną i czystość atmosfery. Według naszych badań podejście adaptacyjne, zielona infrastruktura i przyjęcie zrównoważonego projektowania urbanistycznego mogą wzmocnić odporność infrastruktury miejskiej. Podkreśla się znaczenie energii odnawialnej, udziału społeczności, przepisów dotyczących zielonego budownictwa, ustanowienia partnerstw publiczno-prywatnych, zintegrowanego zarządzania zasobami wodnymi i podejmowania decyzji w oparciu o dane. Kluczowe znaczenie ma poprawa ram prawnych, które powinny priorytetowo traktować kwestie odporności miejskiej oraz zrównoważonego rozwoju. Świadome projektowanie urbanistyczne i procesy decyzyjne możliwe są jedynie przy zrozumieniu skomplikowanych powiązań między zmianami w LULC a odpornością infrastruktury miejskiej. Zastosowanie praktyk zrównoważonego rozwoju umożliwi decydentom i urbanistom zminimalizowanie negatywnych konsekwencji zmian klimatycznych oraz podniesienie ogólnej jakości życia w miastach. Wyniki tego badania mogą potencjalnie znacznie poprawić dobrobyt i zrównoważony rozwój mieszkańców Abudży, zwłaszcza biorąc pod uwagę różnorodność napotykanych przez nich trudności miejskich.

**Słowa kluczowe:** analiza geoprzestrzenna, odporność infrastruktury, teledetekcja, zrównoważony rozwój, urbanizacja

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