

ENHANCING URBAN FOOD SECURITY THROUGH CLIMATE-MITIGATION PRACTICES IN LOKOJA, NIGERIA: A SIMULATION-BASED GEOSPATIAL AND MULTI-CRITERIA ASSESSMENT 2000-2025

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(TETF/DESS/UNI/SOKOTO/ARJ/01)

Abstract

Rapid urbanization can simultaneously increase greenhouse-gas emissions, reduce ecosystem services, intensify heat and flood exposure, and weaken access to affordable food. This study developed a simulation-based framework to evaluate climate-mitigation practices that strengthen household food security in Lokoja, Nigeria, over the period 2000–2025. The analytical design integrates six Landsat epochs, geographic information system-based land-use/land-cover classification, the Normalized Difference Vegetation Index, land surface temperature, an 800-household structured questionnaire distributed across 20 neighborhoods, logistic regression, and an Analytic Hierarchy Process-based multi-criteria analysis. The results indicate that built-up land expanded from 39.60 km² in 2000 to 156.80 km² in 2025 (+296.0%), while vegetation declined from 306.40 km² to 204.50 km² (-33.3%) and cropland/gardens declined by 15.8%. Across neighborhoods, 2025 land surface temperature was strongly associated with built-up share ($r = .99$) and inversely associated with NDVI ($r = -.98$). In the household scenario, 42.8% of respondents were moderately or severely food insecure, 36.3% practiced some form of urban agriculture, and 31.5% reported recent flood exposure. Adjusted logistic estimates associated urban-agriculture participation with lower odds of food insecurity (OR = 0.53, 95% CI [0.38, 0.74]), whereas low income (OR = 2.88), flood exposure (OR = 2.14), and each 1°C increase in land surface temperature (OR = 1.21) were associated with higher odds. Multi-criteria analysis prioritized fruit-tree agroforestry and household gardening (35.4%), followed by urban forestry and street-tree corridors (24.7%), grassed green infrastructure and rain gardens (18.3%), cereal/open-field farming (11.8%), and climate-smart irrigated vegetables (9.8%). The findings support a differentiated neighborhood portfolio that combines food-producing green infrastructure, heat mitigation, flood-sensitive design, livelihood support, and land-use regulation.

Keywords: Urban Agriculture; Climate Mitigation; Food Security; Land-Use/Land-Cover Change; Land Surface Temperature; Analytic Hierarchy Process; Lokoja