Integrating Cellular Automata and Markov Chain Models for Sustainable Urban Growth Management in Bosso, Niger State, Nigeria

Ekundayo Adesina (Nigeria), Oluibukun Ajayi, Joseph Odumosu (Namibia) and Joshua Ezeanya (Nigeria)

Key words: Access to land; Geoinformation/GI; Land distribution; Land management; Remote sensing; Spatial planning; Cellular automata; geospatial analysis; land use land cover change; Markov-CA model; remote sensing; urban expansion

SUMMARY

Rapid urbanization presents significant challenges to sustainable development, particularly in the context of climate change impacts. This study examines land use and land cover (LULC) changes in Bosso Local Government Area (LGA), Niger State, Nigeria, from 2000 to 2020. Using Landsat 7 and 8 satellite imagery, the LULC dynamics were mapped while employing a Markov-CA model trained on four land cover classes: vegetation, water bodies, built-up areas, and bare land. The model's accuracy was evaluated with a kappa coefficient of 0.973 and an overall accuracy of 95.37%, demonstrating its reliability in predicting future LULC trends. Projections indicate a substantial increase in built-up areas, particularly in central Bosso LGA, alongside a decrease in vegetation and bare land by 2030. These findings highlight the urgent need for effective urban planning, infrastructure development, and sustainable land use policies to accommodate future growth and mitigate potential environmental impacts.
