

Change analysis and modeling future urban scenarios in Nairobi City

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- (1) **Introduction:** Urban population in cities in Africa is increasing at a very fast rate leading to sprawl and associated undesirable environmental and social consequences.
- (2) **Objective:** The main objective of this study is to analyze the dynamics of land use and land cover changes using satellite data and produce an urban growth model for the city of Nairobi.
- (3) **Data:** Multi-temporal Landsat images covering Nairobi city for the years 1976, 1988, 1995 and 2000 were used in a post classification analysis with GIS to map land use/cover changes for the city. For modeling urban expansion, urban extents for the various years were extracted from the various land use/cover maps. Additional data used for modeling included: transportation network data, slope data, layer of excluded areas and population data.
- (4) **Approach:** A Cellular Automata (CA) model was used for modeling urban growth for Nairobi city. This is a probabilistic model that uses Monte Carlo iterations for calibration to generate multiple simulations for growth. During calibration, each simulation was compared with the control years within the time series and averaged fit statistics were produced to measure the performance of a set of coefficients values in reproducing the observed urban

development patterns. For successful initialization of the CA model for Nairobi city, five input layers were used: urban extents, transportation, areas excluded from urbanization, slope and hillshade. In addition, two transportation network layers of different years were used. The calibration process using historical data for Nairobi helped obtain coefficients that controlled the behavior of urban growth. These coefficient values were used to predict growth of Nairobi city till 2030.

- (5) **Results:** The results are shown in Figures 1 and 2. Substantial land use/cover changes were noted while simulation results show dramatic growth of urban areas, with the urban land occupying much of the total land within Nairobi city and its immediate surroundings.
- (6) **Conclusions:** This study has analyzed the dynamics of land use/cover changes for Nairobi city and produced an urban growth model for predicting the future growth using CA spatial modeling. The CA model was found to be very useful for foreseeing the spatial consequences of planning policies and providing useful information for urban planning.

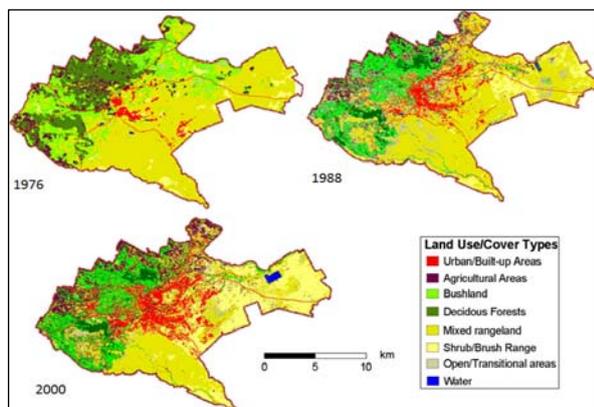


Fig. 1: Land use/cover changes in Nairobi city between 1976 and 2000.

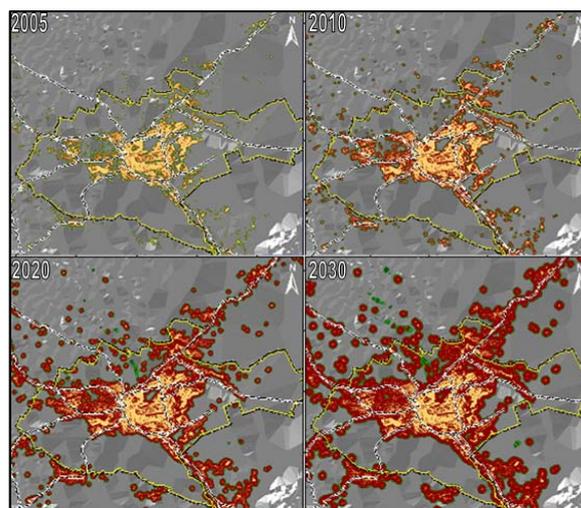


Fig. 2: Simulated urbanized areas for Nairobi city up to 2030