URBAN GROWTH MODELING AND TREND ANALYSIS USING MULTI-TEMPORAL SATELLITE DATA

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Abstract: Trending urbanization in developing countries are major issues for sustainable development and planning. Unplanned urbanization leads to large scale land cover changes affecting the ecological diversity with the degradation of the environment, enormous consumption of resources, creation of urban heat islands, changes in local climate, and groundwater regime. Remote sensing and Geographical Information System (GIS) data have been used widely to analyze and study the patterns of urban expansions. Development of effective models to analyze land use land cover changes (LULC) and study their spatiotemporal dynamics is a crucial aspect for sustainable development and planning. The study aims at LULC change detection and prediction for a future urban extension to analyze and monitor urban growth at a city-level. Lucknow, the capital city of Uttar Pradesh state in India has been selected as a study area. It is the largest city in Uttar Pradesh state. Lucknow city is spread across 110 wards and contains a population of 36.8 lakhs in 2011 (census of India). Land change modeler is utilized for past change detection and future prediction of LULC. The study is carried out with supervised classification of satellite images obtained from LANDSAT thematic mapper for the years 1990, 1999, 2009 and 2016. It was observed that built-up area was 76.76 sq. km. in the year 1999, which further increased to 208.73 sq. km.in the year 2016. We determined the trend of urbanization, and based on that we predicted the scenario of urban growth using Markov chain analysis. The LULC maps of 1999 and 2009 are employed for predicting LULC in the year 2016. The predicted results are compared with the actual built-up of 2016 for validation. Finally, based on simulation results, the future scenario of LULC has been predicted for the years 2025 and 2030. A high validation accuracy of 82.28% is obtained. The urban area of 2025 is predicted as 236.21 sq. km which reaches up to 249.6 sq. km. in 2030.

Keywords: Markov Chain Analysis (MCA), Land Use Land Cover (LULC), Urbanization, Prediction