Land Cover Change Modeling in Kathmandu, Nepal

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(1) Introduction: As the result of population growth and migration from rural to urban areas, urbanization has been recognized as a critical process in metropolitan areas of Nepal. The Kathmandu metropolitan region, capital and major tourist gateway, has been facing rapid urbanization over the last three decades. Recently, it has an estimated population of 2.18 million with an annual growth rate of 5.2%.

(2) Objective: Main objective of this research is to model land cover dynamics in the Kathmandu metropolitan region using weight of evidence and cellular automata techniques.

(3) Data and methodology: In this paper, two land cover maps of the region at 30 meters spatial resolution for the years 1991 and 2000 are acquired from Thapa and Murayama (2010), which are created using remote sensing techniques. Elevation, slope, population growth, and proximity to urban centers, roads, rivers, and industries are investigated as major drivers of land change in the valley. A land change model is calibrated using the weight of evidence in cellular automata framework (Thapa and Murayama, 2010). The model is designed in DYNAMICA software environment. Overall accuracy of the model is achieved at 91% with Kappa coefficient of 86%.

(4) Results: The Fig. 1 shows the land cover maps of 1991 and 2000 derived from the remote sensing and GIS techniques, and simulated land cover maps of 2000, 2010, and 2020 derived from the modeling. Using the same configuration of the 1991-2000 simulation model and input map of 2000 and road network of 2000, we performed a simulation aiming to extrapolate the spatial patterns of urban growth in the valley for the year 2010 and 2020. The simulated landscape for 2010 and 2020 shows the urban growth consistently expanding eastwards agglomerating the sub-urban villages. The built-up surface of villages in the southeastern part also starts agglomeration by 2010. By 2020, all the urban centers will be aggregated into a greater metropolitan region in the valley. The observed spatial patterns suggest that most vulnerable land cover seems to be shrubs land which may change likely to agricultural area. The changing spatial patterns over the study period show that the agricultural area will be converted mostly to the urban built-up area.

(5) Conclusion: The simulation estimates, however, are based on extrapolation from historic processes which are not guaranteed to continue in the future but it mirrors spatial patterns of land cover in the valley if the historic process continues. In this case, the model has generated maps to show where and how the land cover change in Kathmandu is heading in the next two decades from 2000, which may be a critical reference to make decisions for guiding future urban development and sustainable land management in the valley.

(6) Reference:

Thapa, R. B. and Murayama, Y. (2010) Urban growth modeling of Kathmandu metropolitan region, Nepal. *Computers, Environment and Urban Systems (in press)*.

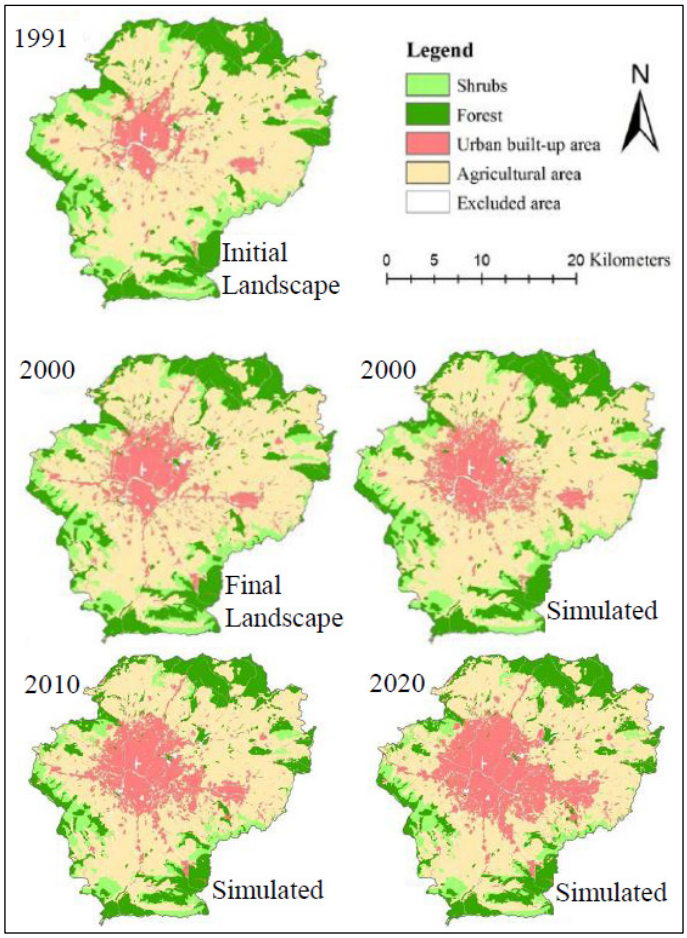

Fig. 1: Real and simulated land cover maps (1991-2020)