

Urban growth monitoring and prediction with remote sensing and GIS in Wuhan Region, China

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(1) Purpose: This study investigates land use/cover changes and urban growth in Wuhan region by employing remote sensing and GIS techniques. The final goal of this study is to predict the urban growth in Wuhan region (2014-2030) by employing Multi-layer Perceptron neural network and Markov.

(2) Data:

(A). Landsat images in 2000, 2009 and 2014, with a spatial resolution of 30m, are obtained from the United States Geological Survey.

(B). Driving factors used for LUCC modeling include: (i) City center; (ii) Roads; (iii) Elevation: Digital Elevation Model (DEM); (iv) Slope: Extracted from DEM; and (v) Euclidean distance from land categories.

(3) Methods: The satellite images are classified to produce accurate land use/cover maps by using the maximum likelihood tool in ArcGIS. Multi-layer Perceptron neural network (MLP NN) is used for transition potential mapping, and Markov module in TerrSet-Land Change Modeler is used for simulation and prediction. The actual change simulation is done by Land Change Modeler, which uses an internal module to allocate the Quantity of change (predicted by using 2000 and 2009 maps and Markov) based on

the transition potential maps (modeled by using 2000 and 2009 maps, the driving factors, and MLP NN) (Fig. 2). Concerning the urban land and water, some rules are taken into account as follows: (I) transformation from urban land into another category is unlikely to happen; and (II) water is also considered stable and unlikely to change into another category. The two corresponding transitions are excluded from all transitions.

(4) Results: In Wuhan region, urban land has expanded from 27.3 thousand ha in 2000 to 71.06 thousand ha in 2014 (Fig. 1). The degree of urbanization has increased along the two sides of Yangtze River. In each side, the urban growth increased spatially from the city proper to the outskirts. The future urban growth in Wuhan region is predicted by the MLP neural network and Markov. The simulation result shows that the newly urbanized areas are predicted to extend to the northwestern and southwestern parts in Wuhan region in 2030. The predicted map in 2030 shows 41.27% increase in urban land from 2014, indicating that urban growth is expected to continue in the future (Fig. 3). These areas are considered to be distributed in the surrounding of the urban core because of low altitudes.

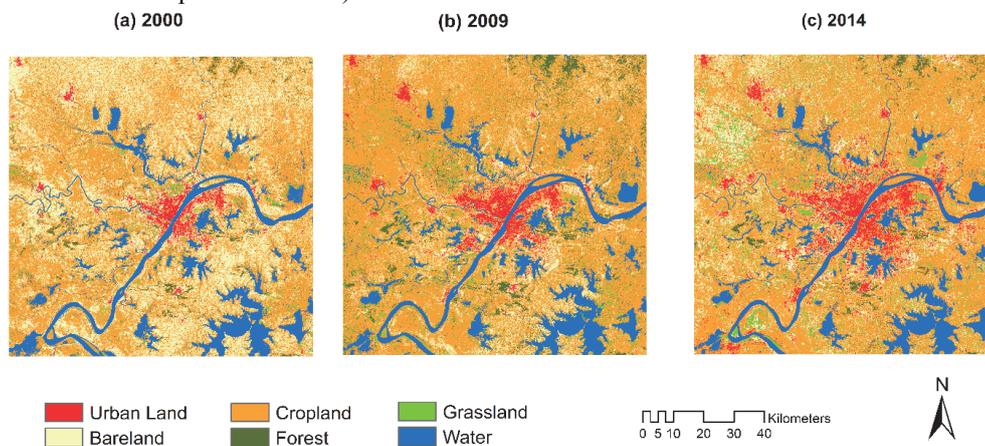


Figure 1: LUCC maps in Wuhan region in 2000, 2009, 2014

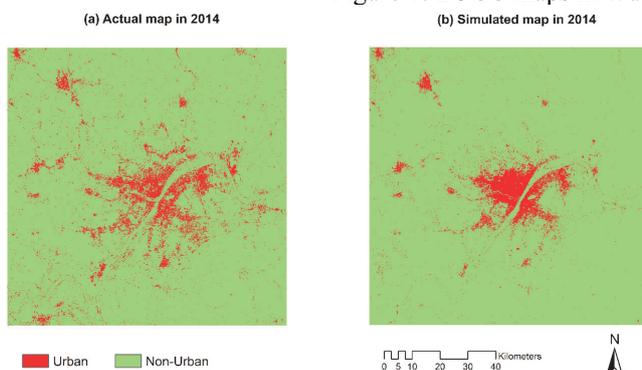


Figure 2: The urban/non-urban land map in Wuhan region in 2014

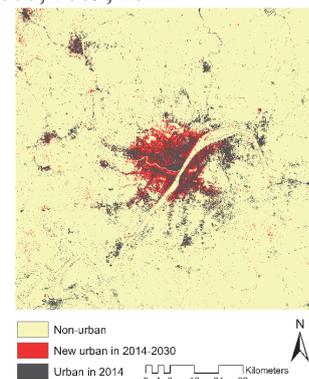


Figure 3: Predicted urban land in 2030 with the actual urban land in 2014