NATIONAL CONSORTIUM FOR REMOTE SENSING EDUCATION, RESEARCH, AND APPLICATIONS

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A Long-Term Reconstruction of Urban Expansion in Indianapolis, 1984-2011

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Objective: Understanding and predicting the impact of the human-induced land cover and land use (LULC) changes on surface processes require long-term historical reconstructions as well as the projections into the future of land cover changes at local, regional, and global scales. Remotely sensed satellites provide the potential for being a relatively straightforward and convenient means to monitor the urban development and to develop strategic plans for urban management. Landsat images represent hitherto the only fine resolution images suitable for consistently revealing the evolvement of urban expansion over decadal years. However, the characterization of the urban expansion over years by utilizing the time series images is still in its infancy. This project strives for implementing a time series segmentation algorithm to effectively perform the land use and land cover (LULC) classification and change detection and to practically use the irregularly spaced remotely sensed images from Landsat satellites for monitoring urban expansions in the metropolitan area of Indianapolis. The project was performed in the following procedures. First, all Landsat images (level 1T) available for the Indianapolis area from 1984 to 2011 were collected through the USGS website (http://earthexplorer.usgs.gov/). Then, a time series segmentation (change detection) algorithm was applied at a pixel-by-pixel basis to derive the land cover maps. Finally, the classification of different land covers was accomplished with the help of the field ("ground truth") and historical reference data.

Significance: This project demonstrates the advantages of Earth observation technologies for delivering useful land cover information. These datasets can help the state and local officials understand the potential risks caused by the human-induced land cover changes. The regional weather and climate models (e.g., Weather Research Forecast model) can directly incorporate the derived land cover maps to predict the impact of urbanization induced land cover changes on regional climate and environment. The urban expansion maps derived from the time series remote sensing data for the metropolitan area of Indianapolis have direct applications to urban management and planning. Potential urban growth drivers, such as economic, demographic, and geographic factors, can be related to the urban growth patterns for understanding the future urban growth. A class module will be developed based on this project to enhance post-secondary education.

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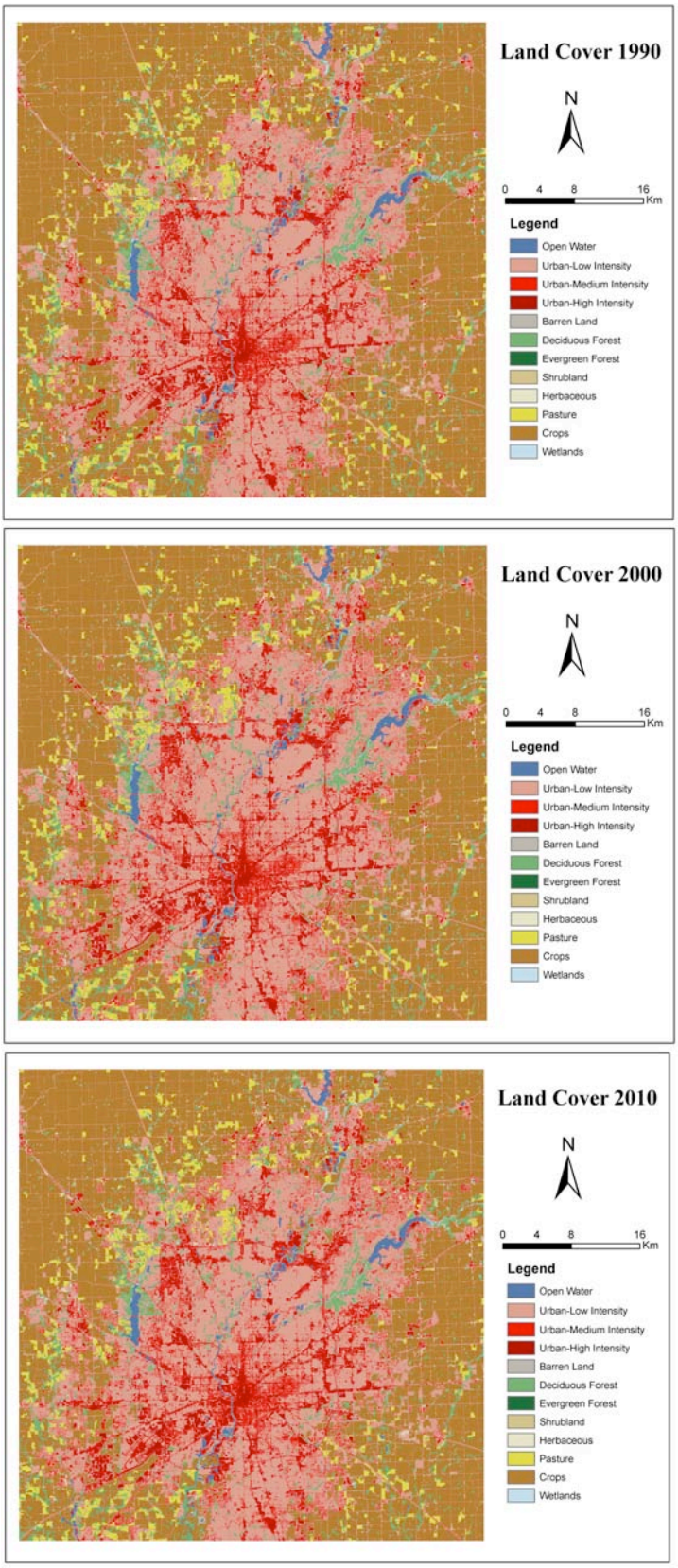

Figure 1 Land cover maps in the year 1990, 2000, and 2010. The identified land covers include water, urban-low intensity, urban-medium intensity, urban-high intensity, barren, deciduous forest, evergreen forest, shrubland, herbaceous, pasture, crops and wetlands.