

# **Land Use / Land Cover Interpretation and Analysis for Three National Monuments**

**Sunil Narumalani, Ph.D.**

**Deepak Mishra**

**Robert Rothwell**

**CALMIT**

**University of Nebraska-Lincoln**

**May 2004**

## **EXECUTIVE SUMMARY**

This project integrates remote sensing and landscape metrics to quantify land use/land cover change at three National Park Service units. These include (a) Effigy Mounds National Monument (EFMO), Iowa; (b) Pipestone National Monument (PIPE), Minnesota; and (c) Wilson's Creek National Battlefield, Missouri. Aerial Photography spanning a period of six decades, IKONOS pan-sharpened (1x1 m) data, and input from the Park Service were used to develop land cover classification maps for the 1940s, 19660s, and 1990s. A post-classification algorithm was applied to derive land cover changes, and landscape metrics were used to analyze specific habitat classes.

At EFMO, overall changes in natural vegetation between 1940s-1990s showed interchangeable shifts whereby the canopies of some areas of deciduous forests and bottomland woodlands thinned out, whereas others transited from croplands in the 1940s to full growth forest in the 1990s. Similar patterns were observed for cropland and pasture, where the total area of cropland declined while that of pasture increased, albeit with a decline in the number of patches. Land cover changes around EFMO reflect the impacts of management decisions made in response to shifts in agricultural and economic policy while, within EFMO the areas of "natural" vegetation are well maintained and devoid of any significant human activity.

The majority of land use at the PIPE study area is dominated by agriculture. Pasture and cropland make up most of the areas used for production and an exchange between the two classes can occur as a result of several factors. Soil conservation goals, changes in economic subsidies for grain crops, changes in profit margins for land owners that can be realized in other categories of commodities are things farmers must consider when deciding how to get the most return from the land assets they control. From an overall perspective 1940s-1990s, there was an increase in urbanization through infrastructure development, commercial, and residential. A general decline in pasture areas was accompanied by increases in cropland indicating changes in agricultural practices in the region.

A WICR landscape patterns revealed that “natural” land cover classes (e.g., oak/hickory forest) have been affected by human influences through the regularization of their boundaries. Major landscape changes around WICR have been due to the exponential urban development and residential growth in cities near the park (NPS, 2002). Recent growth in the Springfield metropolitan area has changed the character of land use patterns in the suburban areas of Springfield, Battlefield, and Republic. Large agricultural tracts increasingly are being subdivided into 10-acre residential home sites; as a result, the land area being subdivided into 10-acre residential home sites; as a result, the land area of Springfield has grown significantly. In 1961, WICR was approximately 10 miles from Springfield city limits. Now, however, metropolitan Springfield is as close as five miles from the park, and this changing land use pattern is visible and audible from within the park boundaries. For example, transportation improvements to serve this growing suburban population are bringing higher traffic volumes and associated noise to

county road ZZ and highway 182, which respectively border the western and northern boundaries of the park.

Unlike typical change detection procedures, the project focused on integrating the change detection results with landscape metrics. By incorporating input from PC LTEM personnel and local residents, a detailed and thorough land cover classification scheme was produced. The post classification change detection method provided information on the “from-to” conversion between land covers, while the landscape metrics explained the impact of human influence in and around the study area.

## **PUBLICATIONS**

Narumalani, S., Mishra, D., and Rothwell, R. 2004. Analyzing Landscape structural change using image interpretation and spatial pattern metrics. *GIScience and Remote Sensing*, 41, No. 1, pp. 25-44.

Narumalani, S., Mishra, D., and Rothwell, R. . 2004. Change detection and landscape metrics for inferring anthropogenic processes in the greater EFMO area. *Remote Sensing of Environment*, proof.