LCLUC Abstract

Simulating Land Use Dynamics in Southeast Asia: A Cellular Automaton Approach

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This project, using recently developed cellular automaton modeling procedures and a temporally, substantively rich case study, develops spatially-explicit model-based simulations of future LCLUC scenarios for Nang Rong, Thailand and the broader Southeast Asian region, including Vietnam, Cambodia, and China. The research draws heavily on recent work in remote sensing, demography, sociology, complexity theory, and related social and biophysical disciplines. The scenarios are based on empirically observed relationships in the following areas: a) history and spatial pattern of village settlement; b) road development, expansion of available vehicles, and changing geographic accessibility; c) migration and household formation; d) land titling and linkages to investment in various land uses; e) climate and monsoon history; f) global economic factors, including world cassava prices and the 1997 economic crisis; and g) electrification, and the accompanying rise in TV viewership and consumerism. Results of the simulations will be used to examine the spatial distribution and composition of LCLUC.

The project exploits a rich collection of interlinked data sets for Nang Rong, some of which were developed under previous NASA funding. There is a collection of previously analyzed Landsat images (TM and MSS) dating back to 1973. Other remotely sensed data available includes AVHRR, SPOT, and SAR, as well as aerial photos dating back to the1950s. Community and household level surveys are available for 1984, 1994, and 2000. Out-migrants have been followed, and in-migrants added to the data set. Digital coverages showing roads, rivers, elevation, soil types and other spatial-thematic data are available within our GIS. Daily precipitation and temperature data are available since 1965. Human dimensions and Landsat derived land use data can be linked at the village level for 1984, 1994, and 2000, and at the household level for approximately 9,000 households in 2000.

After developing, calibrating, and validating the cellular automaton modeling scenarios for Nang Rong through the use of a deep satellite time series, spatially explicit LCLUC patterns will be derived for the period 1950- 2020. We will increase the extent of our geographic reach into the surrounding region, including Cambodia, China, and Vietnam, by relating LCLUC patterns in these countries and their drivers to our scenarios for Nang Rong. These are countries with significant extant forest coverage, some of which has likely been preserved due to their difficult political and social histories in the past 50 years. While prediction is difficult, it seems that at least a sub-set of these countries is poised for substantial social and economic change, with resulting implications for LCLUC and the carbon cycle.