

A Cellular Automata Approach to Land Use Change Modeling in Northeastern Thailand: Scenarios of Policy Intervention in the Cultivation of Upland Field Crops and Patterns of Land Use/Land Cover Change using Spatial Simulation Models

The cultivation of upland field crops, primarily cassava and sugar cane, in Nang Rong district, northeast Thailand, beginning in the mid- to late-1960s, has helped transform a once forest-dominated landscape to one dominated by agriculture. Today, paddy rice is cultivated throughout the lowlands, field crops and a fragmented forest matrix comprise the uplands, and fruit trees, rubber plantations, and vegetable gardens are among the crops dispersed around nuclear villages. Distributed along a topographic terrace system, upland and lowland crops are cultivated relative to environmental and economic opportunities and geographic access, although crops grown in marginal settings may not be sustainable. Relying upon a remote sensing image time-series, a longitudinal social survey, and GIS coverages, a cellular automata (CA) model is described that is used to characterize land use/cover (LULC) change patterns through specified initial conditions, neighborhood associations, and transition or growth rules. Results of four scenarios or experiments are described that perturb the base LULC change model of cassava, forest, and rice by imposing production quotas in the cultivation of cassava. Derived for the period 1972-2001, CA model results for the scenarios are compared to a time-series of Landsat satellite classifications of LULC using images of simulation runs and plots that describe trends in the composition and spatial organization of cassava, forest, and rice for each scenario. Results are interpreted within a population-environment context in which people, place, and environment are integrated in complex ways. The demise of forest at the expense of expanded lowland paddy rice and upland field crops is a central story of the region. Quotas on the production of cassava alter the trajectories of forest change and result in more consolidated stands over the period of the simulations. Cassava consolidation and in-filling in the extensive uplands of the southwest portion of Nang Rong district is a persistent outcome of the simulations for the various scenarios tested.