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Spatiotemporal simulation of changes in rice cropping systems in the Mekong Delta, Vietnam

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With the dramatic development of agro-economics, population growth, and climate change, the rice cropping systems in the Vietnamese Mekong Delta (VMD) have been undergoing a major change. Information on rice cropping practices and changes in cropping systems is critical for policymakers to devise successful strategies to ensure food security and rice grain exports for the country. The primary objective of this research is to map rice cropping systems and predict future dynamics of rice cropping systems using MODIS time-series data from 2002 to 2012. A phenology-based classification approach was applied for the classification and assessment of rice cropping systems. Then, the Cellular Automata-Markov (CA-Markov) model was used to simulate future changes in rice-cropping activities. To obtain precise prediction, a calibration of CA-Markov were implemented by using a series of rice crop maps. The comparisons between the classification maps and the ground reference data indicated satisfactory results with overall accuracies above 81%, and Kappa coefficients above 0.75, respectively. The simulated maps of rice cropping systems for 2010–2012 were extrapolated by CA-Markov model based on the trend of rice cropping systems during 2002–2009. The comparison between the predicted scenarios and the classification maps for 2010–2012 presents a reasonably close agreement. In summary, the CA-Markov model with a long-term calibration confirmed the validity of the approach for dynamic modeling of changes in rice cropping systems in the study region. The results obtained from this study demonstrate that the approach produced satisfactory results in terms of accuracy, quantitative forecast, and spatial pattern changes. Thus, projections of future changes would provide useful information for the agricultural policymakers in respect to formulating effective management strategies of rice cropping practices in VMD.