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The Agent-based Model for Simulation of Land Exploitation in Taiwan

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Taiwan is one of the most densely populated countries in the world, covering approximately 36,197 km^2 with a population density of about 650 inhabitants per km^2. The efficient use of limited land resources is important to support the livelihood of the majority of rural people, while safeguarding the environment and natural ecosystems. Due to the increasing numbers of violations to land use legislation, it is critical to identify behavioral patterns of illegal land exploitation and reexamine national land management policies based on negative impacts caused by humans. This study aims at developing an agent-based model to simulate decision-making between violators and governments in land use in order to understand interactions between illegal land use changes and land policies coupled with socio-economic and environmental factors. The model was designed using empirical data collected from field investigations and spatial socioeconomic datasets relating to supposedly illegal land use change areas extracted from temporal satellite data for the period 2003 to 2016. The decision logics of behavioral patterns in land development were obtained from a decision tree algorithm. Upon evaluation of classification performance for the decision tree, the accuracy is around 80%, while Cohen's Kappa index is moderate and AUC is good. The findings achieved from this study demonstrate the potential application of multidimensional datasets using data mining techniques to investigate interactions between agents and between the agents' activities and their environment. The results could provide policymakers with spatial quantitative information on illegal land use changes that are useful for devising successful strategies to mitigate the number of illegal land exploitation.

Keywords: Land management, Agent based modeling, Decision tree, Land use change