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Spatiotemporal analysis of the housing bubble's contribution to the proliferation of illegal landfills – The case of Gran Canaria

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The management of disposed waste in illegal landfills (ILs) is a significant problem in contemporary societies due to respective hazards for the environment and human health. This study investigates the spatiotemporal distribution of IL occurrence for 2000, 2006 and 2012 in two representative areas of Gran Canaria island: northwest (Zone A) and east (Zone B). The interannual growth rate of surfaces affected by ILs for the period between 2000 and 2006 was 4.5% and 9.5% and between 2006 and 2012 it was 6.6% and 6.7%, for Zone A and Zone B respectively. The growth of ILs between 2000 and 2006 was higher in urban areas, spaces under construction, and industrial zones, and may be closely related to the process of urban expansion linked to the real estate boom. The latter would have a deep impact on the landscape due to the proliferation of illegal construction and demolition waste. The growth rate of ILs in urban environments fell during the later period of urban expansion. Besides, this work shows the application of cellular automata (CA) in the analysis of IL occurrence, with ILs considered to be a dynamic and complex system. This may supply added value to policies for environmental repair and protection as well as territorial planning (land use and management), by delimiting possible future areas of IL occurrence. In this regard, IL occurrence was simulated over a long timescale (18 years), to estimate and spatially locate the surface growth of ILs based on CA-Markov and Multiobjective Land Allocation models. The modelling of IL proliferation was divided into three phases: calibration, validation and simulation of the future 2018 scenario. Synchronic data series were used, along with Markov chains and transition rules, in all phases. In the calibration phase the suitability analysis was done and the transition rules and transition potential maps were obtained. The use of dynamic characteristics such as those associated to land uses and static characteristics such as elevation and slope helped model the ILs' growth. Models' accuracy was assessed using Kappa index and landscape metrics. Simulation outputs were not highly accurate when reproducing the exact location of ILs, however, they did correctly reproduce the distribution patterns for IL proliferation. Obtaining the best validation results, the CA_Markov model was used to simulating IL proliferation in 2018, predicting that increases of 52.3 ha and 81.5 ha affected by ILs in Zone A and Zone B respectively.