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Remote Sensing Approach to Predict the Impacts of Land Use/Land Cover Change on Urban Thermal Comfort Using Machine Learning Algorithms

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Abstract : Urbanization is an incessant process that involves the transformation of land use/land cover (LULC), resulting in a reduction of cool land covers and thermal comfort zones (TCZs). This study explores the directional shrinkage of TCZs in Kuwait using Landsat satellite data from 1991 – 2021 to predict the future LULC and TCZ distribution for 2026 and 2031 using cellular automata (CA) and artificial neural network (ANN) algorithms. Analysis revealed a rapid urban expansion (40 %) in SE, NE, and NW directions and TCZ shrinkage in N – NW and SW directions with 25 % of the very uncomfortable area. The predicted result showed an urban area increase from 44 % in 2021 to 47 % and 52 % in 2026 and 2031, respectively, where uncomfortable zones were found to be concentrated around urban areas and bare lands in N – NE and N – NW directions. This study proposes an effective and sustainable framework to control TCZ shrinkage, including zero soil policies, planned landscape design, manmade water bodies, and rooftop gardens. This study will help urban planners and policymakers to make Kuwait an eco–friendly, functional, and sustainable country.

Keywords : land cover change, thermal environment, green cover loss, machine learning, remote sensing
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