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A GIS-based spatiotemporal analysis of wildfire dynamics: The Mediterranean region in Turkey

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Abstract: *Türkiye's Mediterranean Region is among the areas most frequently affected by wildfires due to high temperatures, pronounced precipitation seasonality, prolonged summer drought, and intense human activity. This study aims to identify the spatiotemporal patterns of concentration, persistence, and change in wildfire occurrences across the region using a Geographic Information Systems–based approach. Wildfire records for the 2020–2025 period were modelled using a Space–Time Cube constructed with 10 km spatial cells and three-month temporal intervals. Incremental Spatial Autocorrelation analysis was conducted to determine the spatial dependence of wildfire occurrences and identify an appropriate analysis distance, followed by Emerging Hot Spot Analysis based on the Getis–Ord Gi* statistic. The results were evaluated according to the new, consecutive, persistent, intensifying, sporadic, and diminishing hot spot categories. WorldClim bioclimatic variables were used to investigate the relationships between the identified hot spot categories and long-term climatic conditions. Multicollinearity among the variables was assessed using correlation analysis and variance inflation factors. Differences among the hot spot categories with respect to the selected bioclimatic variables were evaluated using nonparametric statistical tests and effect-size measures. The findings showed that wildfire occurrences were concentrated along the coastal zone and within wildland–urban interface areas. While hot spots exhibited persistent patterns in some subregions, new or intermittent clusters emerged in others. The study examines not only where wildfires are concentrated but also the bioclimatic conditions associated with these spatial concentrations. Compared with conventional density maps, this integrated approach is expected to provide a more comprehensive understanding of the persistence, trajectories, and climatic context of wildfire dynamics. The findings are intended to contribute to the spatial prioritisation of wildfire prevention measures, the development of early warning systems, and the formulation of regional wildfire management plans.*

Keywords: *GIS, space–time cube, forest fire, wildland–urban interface.*