

GEOSPATIAL INSIGHTS INTO ECOLOGICAL SHIFTS AND THERMAL LANDSCAPES IN LAHORE

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Abstract

Lahore, Pakistan's second-largest metropolitan city, has experienced rapid urbanization over the past two decades, making it highly susceptible to the Urban Heat Island (UHI) effect. This study investigates the ecological impacts of UHI in Lahore from 2000 to 2020 using multi-temporal Landsat satellite imagery and geospatial analysis. The Radiative Transfer Method (RTM) was applied to deliver Land Surface Temperature (LST), enabling the spatial and temporal mapping of thermal patterns. Findings reveal a significant rise in LST correlating with the expansion of built-up areas and a substantial decline in vegetation cover. Urban zones exhibited degraded ecological conditions and higher surface temperatures compared to surrounding rural areas. These results highlight the growing thermal stress in metropolitan Lahore, emphasizing the urgent need for data-driven urban planning. The study offers valuable insights for policymakers to develop targeted mitigation strategies aimed at reducing UHI effects and promoting sustainable urban development. In addition, spatial metrics and NDVI analyses were employed to quantify landscape changes, revealing fragmentation of green spaces and altered land use patterns. This underscores the necessity of integrating green infrastructure, adaptive land use policies, and climate-responsive planning into Lahore's future urban framework.

Keywords: ecological evaluation, thermal environment, landscapes, geospatial, Lahore