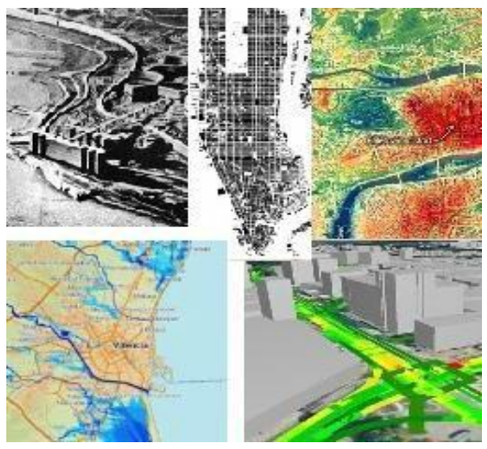

3rd Conference on Future Challenges in Sustainable Urban Planning & Territorial Management

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Assessing the Impact of Land Use Land Cover Patterns on Land Surface Temperature in Dhaka Metropolitan Area A Geospatial Approach

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INTRODUCTION

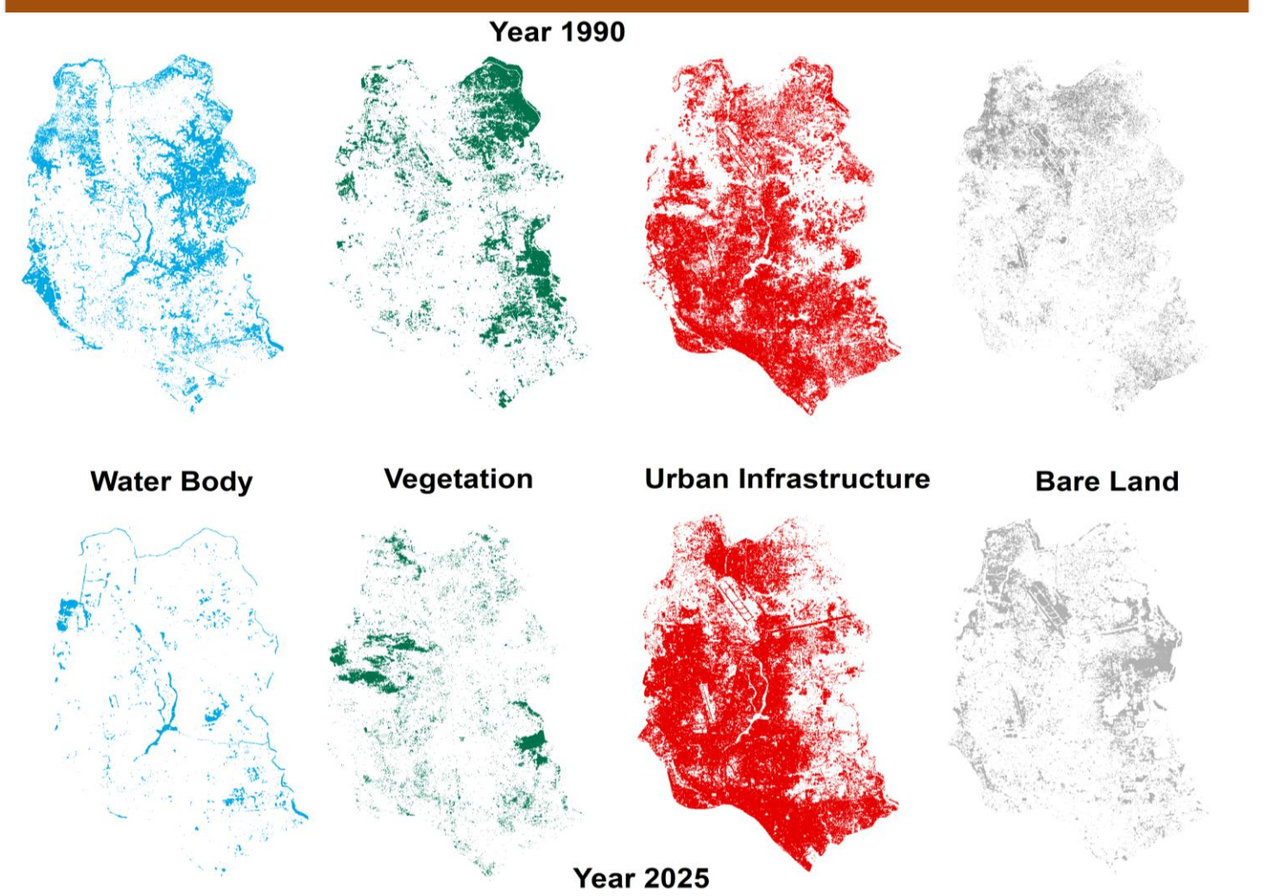
Rapid urbanization has emerged as a major driver of land use land cover (LULC) transformation and urban thermal alteration in megacities of the Global South. Dhaka, one of the most densely populated cities in the world, has experienced extensive and largely unplanned urban expansion over recent decades, resulting in significant modification of surface characteristics. These changes have directly influenced land surface temperature (LST) patterns and intensified the Urban Heat Island (UHI) effect, making long-term spatiotemporal assessment essential for understanding urban climate dynamics and supporting sustainable urban planning.

Dhaka (Figure 1), the capital city of Bangladesh, is located on the lower Ganges Delta and forms the core of the Dhaka Metropolition, which covers approximately 1,530 km² with the central city around 360 km². The urban landscape is densely populated and has undergone rapid expansion over recent decades, making it a key focus of land use and environmental research. Geographically, Dhaka lies between approximately 23°36′–23°55′ N latitude and 90°08′–90°34′ E longitude.

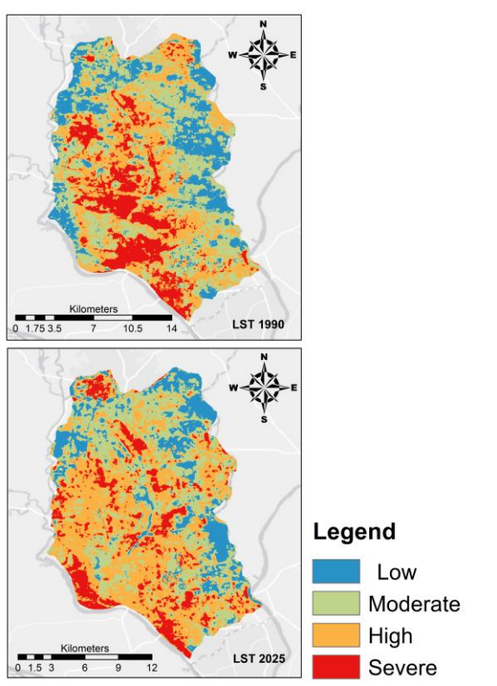
Methodology

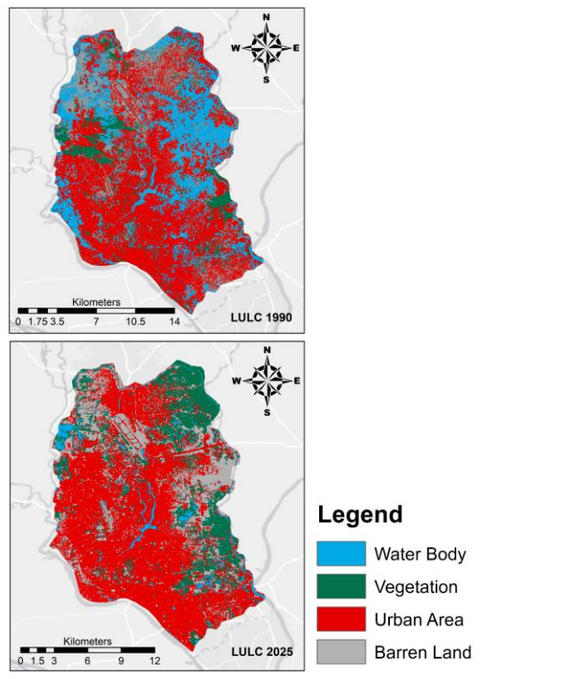
This study used a geospatial approach to analyze the spatiotemporal relationship between LULC and LST in the Dhaka Metropolitan Area from 1990 to 2025 using multi-temporal Landsat imagery. Twenty-three cloud-free images for 1990 and forty-two for 2025 were processed through geometric, radiometric, and atmospheric corrections and co-registered to a common reference system. LULC maps were produced using supervised classification and post-classification comparison was applied to quantify land cover transitions. LST was derived from thermal infrared bands, and mean LST values for each LULC class were extracted using GIS overlay techniques. A fishnet grid with 10,000 sampling points was generated, and the extracted LST–LULC data were statistically analyzed using Python, with all spatial analyses conducted in ArcGIS Pro.

Results



closely associated with a sustained rise in LST intensifying urban thermal stress. Published studies indicate that Dhaka's LST has increased by several degrees since the early 1990s, consistent with rapid expansion of built-up areas and loss of natural cooling.





Pearson correlation analysis shows that water bodies (r = −0.44) and vegetation (r = −0.51) are negatively correlated with LST, confirming their cooling influence. In contrast, urban areas (r = +0.45) and barren land (r = +0.18) exhibit positive correlations with LST.

CONCLUSIONS

The observed LST–LULC relationships confirm that land cover transitions play a critical role in shaping Dhaka's thermal environment. Urban planning policies in Dhaka should prioritize the protection and restoration of water bodies, expansion of urban green spaces, and climate-sensitive land-use planning to mitigate surface warming and enhance long-term urban climate resilience.

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