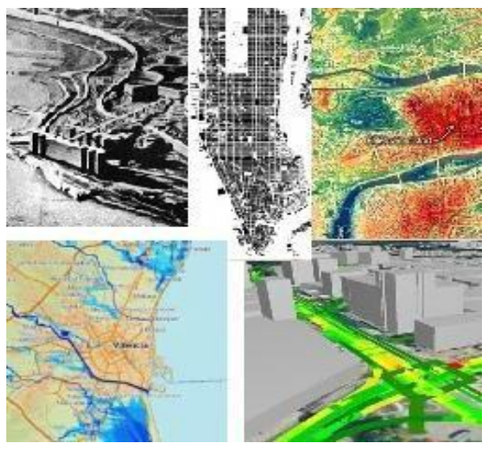

3rd Conference on Future Challenges in Sustainable Urban Planning & Territorial Management

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Analysis of Urban Heat Island Intensity in Dhaka and Its Relationship with Land Use Land Cover Types

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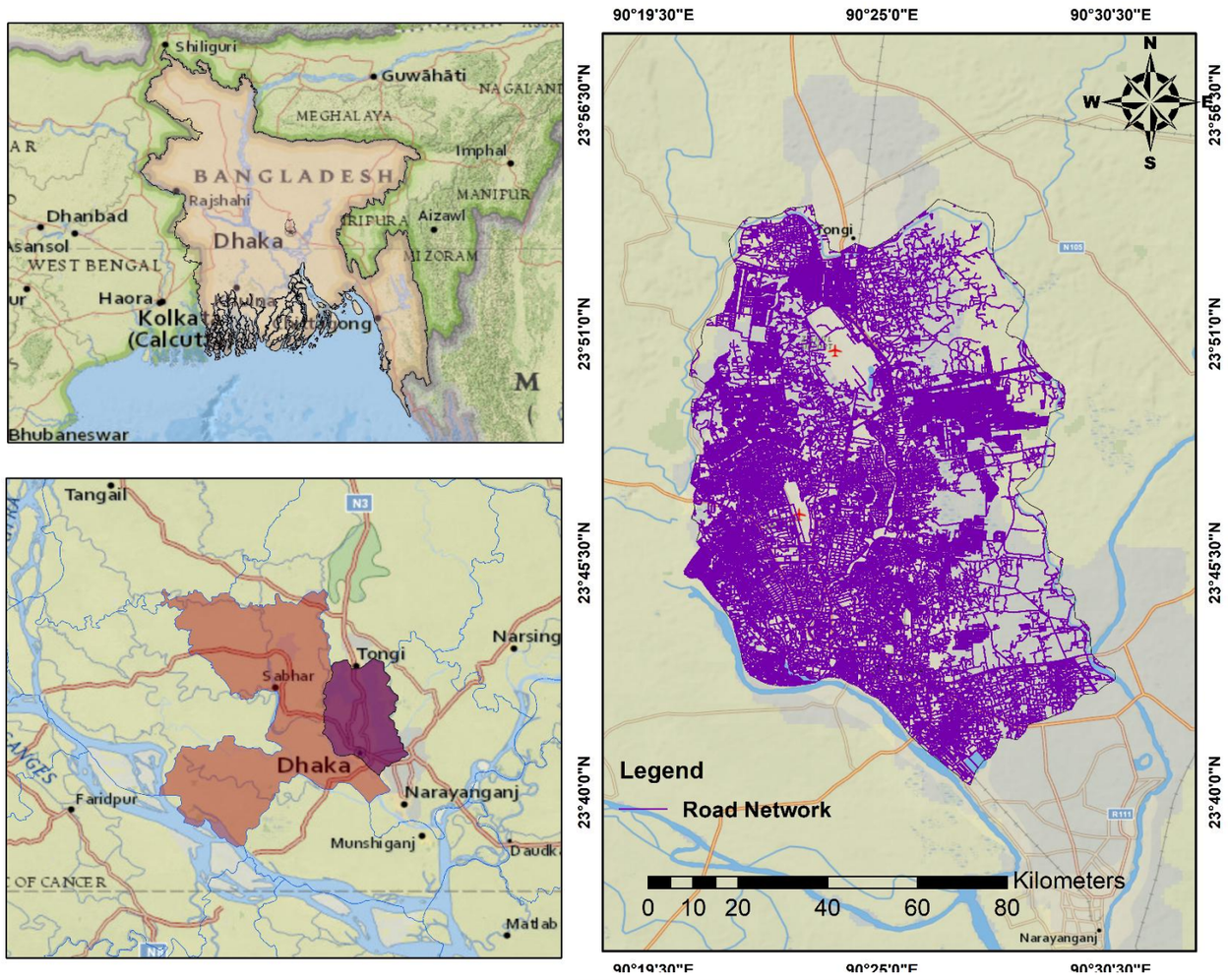
INTRODUCTION

Rapid urbanization has significantly altered land use/land cover (LULC) and intensified urban heat island (UHI) effects in many South Asian megacities. Among them, the Dhaka Metropolitan Area has experienced extensive, largely unplanned expansion, marked by the conversion of vegetated and water surfaces into dense built-up land, leading to rising land surface temperatures. Previous studies have established strong links between built-up growth and increased thermal intensity, as well as the cooling role of vegetation and water bodies. However, long-term, spatially explicit assessments of how different UHI intensity levels evolve in response to LULC change remain limited. This study addresses this gap by analyzing the spatio-temporal dynamics of UHI intensity in Dhaka from 1990 to 2025 and examining its relationship with LULC using multi-temporal satellite-derived land surface temperature data.

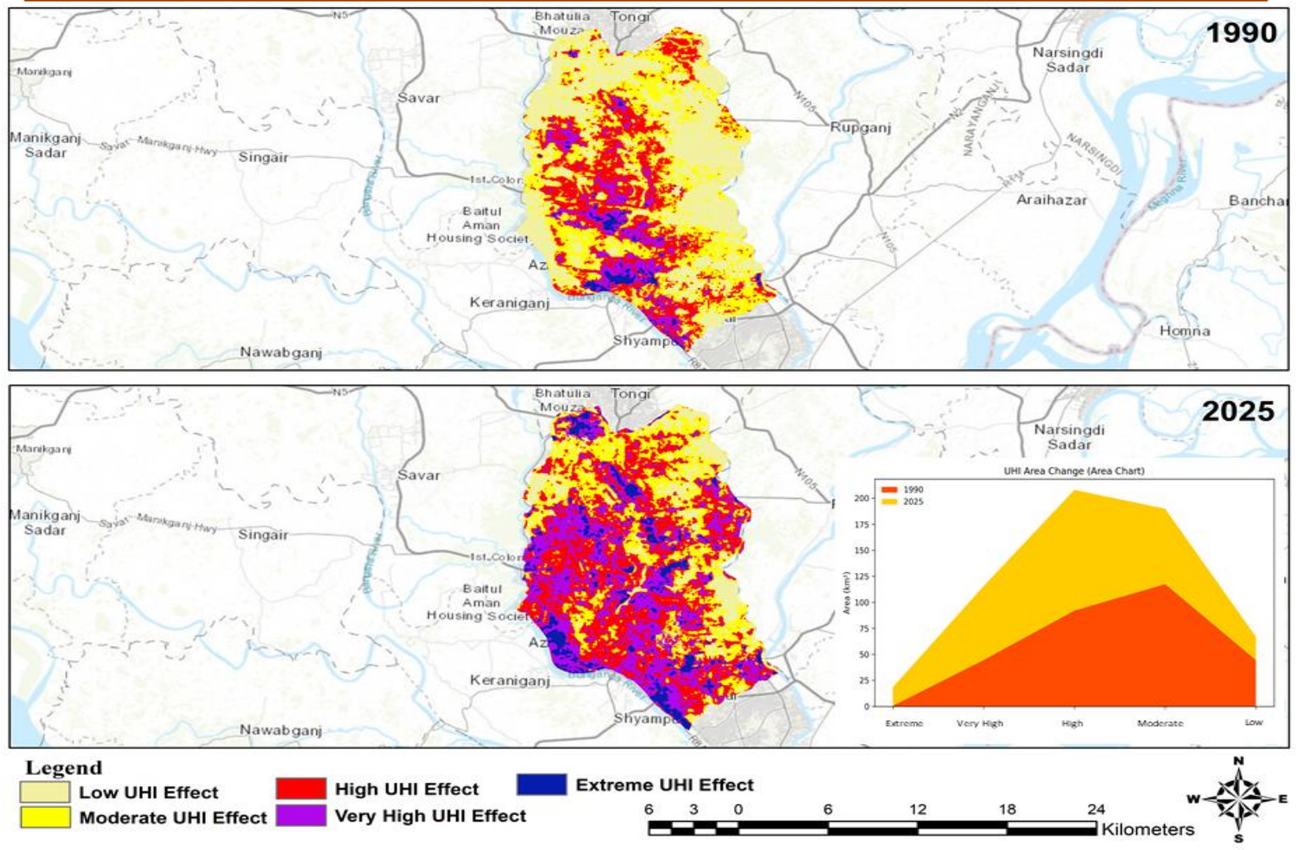
Study Area



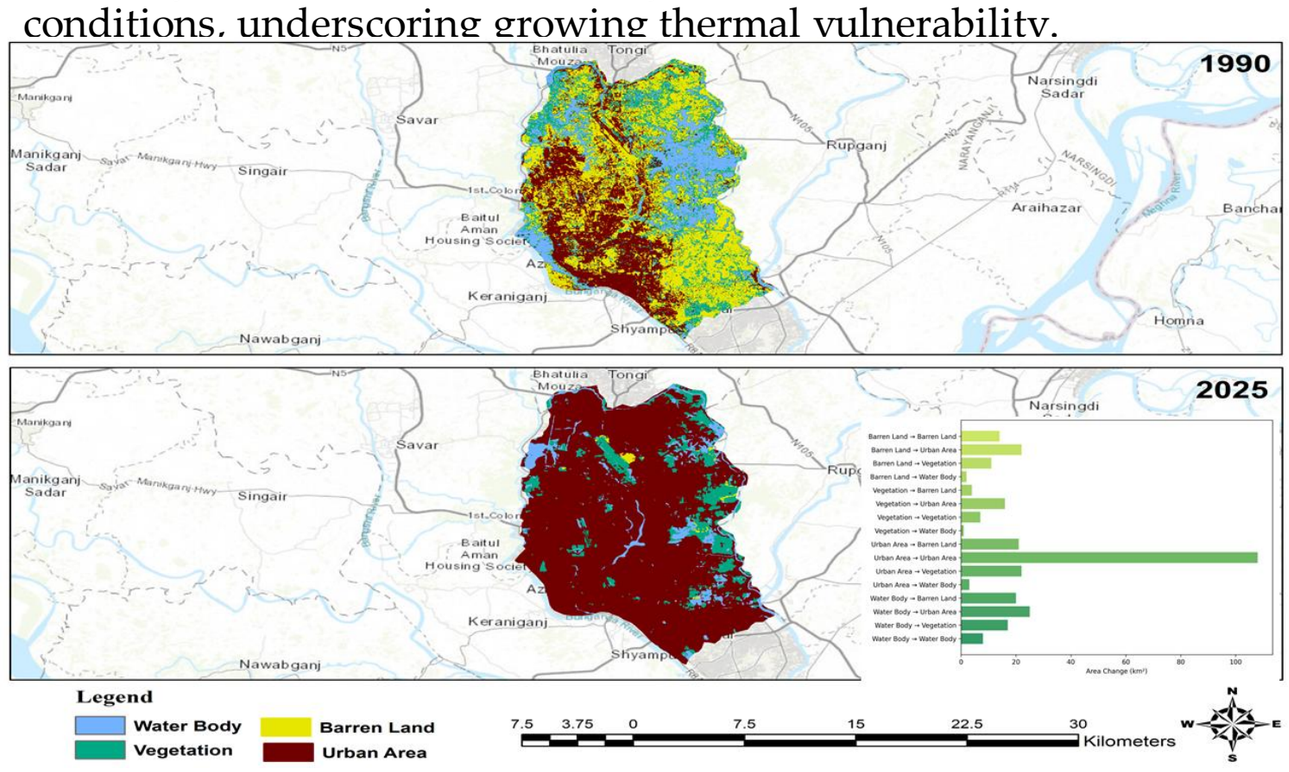
Materials & Method

UHI intensity was calculated using LST derived from satellite thermal data, with all processing performed in ArcGIS Pro. Thermal bands were radiometrically calibrated, atmospherically and emissivity corrected, and reprojected to a uniform coordinate system before LST retrieval. Mean LST values were extracted for urban and surrounding non-urban areas, and UHI intensity was derived from spatial LST variation. UHI intensity was classified using the Natural Breaks (Jenks) method to capture spatial heterogeneity in urban thermal conditions. LULC classification was conducted using supervised classification of multispectral imagery in ArcGIS Pro. Representative training samples were selected for major LULC classes, including built-up areas, vegetation, water bodies, agricultural land, and bare land. The resulting LULC maps were used to examine the relationship between LULC patterns and LST-based UHI distribution.

Results and Discussion



The analysis reveals a pronounced shift toward higher UHI intensity over time. The Extreme UHI category increased by nearly 3000%, indicating the rapid development of severe thermal hotspots. Similarly, Very High and High UHI areas expanded by about 59.5% and 26.0%, respectively, reflecting escalating urban thermal stress. In contrast, Moderate and Low UHI zones declined sharply by 38.4% and 49.6%, suggesting a loss of relatively cooler urban surfaces, systematic intensification of UHI conditions, underscoring growing thermal vulnerability.



CONCLUSIONS

This study demonstrates that rapid and largely unplanned urbanization in Dhaka has significantly intensified the urban heat island effect through sustained land use/land cover transformation. The expansion of built-up areas and the loss of vegetation and water bodies have driven a clear spatial redistribution toward higher UHI intensity zones.

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