## Abstract

Metropolitan areas will grow to triple by 2030, equal to 68 per cent of the population in the world, including anthropogenic landscape changes in impervious surfaces of the urban areas and placed as a significant driving force to local climate variation.

Frequently, urban growth, which includes Land Use and Land Cover Changes (LULCC), modifies land surface thermal characteristics. Land surface temperature (LST) and elevation have significant socio-economic and environmental implications on the rapid urban growth and global warming structure. Accordingly, the main objects of the study were (i) to map urban growth, (ii) to link urban growth with urban heat island growth, (iii) to estimate the implications of thermal trends on land characteristics (NDVI, NDBI, NDWI and UI) as well as test the viability of satellite data with ground measurements of land surface temperature at the different land cover in Delhi to study on UHI during the summer season on 2015-16. Proper temporal monitoring of urban development and following environmental issues is crucial for securing our cities and approaching sustainability. According to objectives, we used broadband multi-spectral Landsat 5, 7 and 8, in-situ LULC observations, air temperature (Ta) and land surface temperature data were integrated. LULC maps were obtained from multi-spectral remote sensing. To improve remote sensing-based urban growth mapping, we tested combining multi-spectral reflective data with thermal data and vegetation indices. Vegetation cover indexes were also combined with NDBI data to map the spatial distribution of heat vulnerability in Delhi. Human thermal discomfort changes in the environment in response to seasonal LULC, where we evaluated UHI levels from LST that were regained from Landsat 5,7 and 8 data(1993-2020), and also we analysed the responses of LST, NDVI, NDBI, NDWI and UI to the long term urban growth from 1996 to 2017. This research could investigate the diurnal thermal behaviour of several urban surfaces and landscape components, including pavements, vegetation, and barren land under the sun and shadow.The field experiment was conducted on 17 areas characterised by urban futures. Under the hot summer conditions, we measured the barren land, grass, trees, and air temperature for 2015-16 (April, May and June). The results showed that the asphalt under the sun and open area without vegetation cover and pavements(sidewalks) elevated the air temperature above them throughout the day. There is a significant measurement gap between satellite land surface temperature and thermometer in the field. In contrast, the trees and the vegetation under shadow lowered the air temperature near the ground, which cannot be measured by satellite due to resolution differences. The impact of vegetation cover on land surface temperature and, specifically, tree cover are influenced by the configurations of greenery. Compared to the open lawn, the grass shaded by trees was more effective in cooling during the UHI formation in the city. Knowing the thermal behaviour of various urban surfaces and landscape components is essential for planners and designers and also a new method was developed and applied to adjust field data to the time of the satellite overpass. The adjusted field data were then verified using corrected ST and LST retrieved from Landsat 8. The effect of various urban LULC surfaces on the urban thermal environment was then examined.In addition, land surface temperature correlated with LULC landscape patterns, and landscape composition and spatial configuration affected UHI effects to varying degrees. This study demonstrates a possible way to study and examine the association between LULC and the urban thermal environment and suggests some essential measures to improve urban planning to reduce UHI effects on sustainable development.