

ABSTRACT

Land Surface Temperature (LST) and Land Use Land Cover (LULC) are vital for understanding global climate change, as even minor changes can significantly impact regional and global environments. Rapid urbanization is altering LULC worldwide, leading to increased LST, which relates directly to several Sustainable Development Goals (SDGs), particularly SDG 11 (Sustainable Cities and Communities), SDG 13 (Climate Action), and SDG 15 (Life on Land). This study focuses on estimating LST and LULC changes over 15 years in Delhi NCR, a region that has seen substantial population growth over the past two decades, drastically affecting its land cover. Using Google Earth Engine, we estimated Land Surface Temperature (LST), Urban Heat Island (UHI) effects, Normalized Difference Vegetation Index (NDVI), and Normalized Difference Built-up Index (NDBI). Landsat imagery from 2005, 2010, and 2020 was analysed for LULC changes. A Random Forest Classifier, a machine learning algorithm, was employed to predict UHI for 2025. Additionally, we calculated the Urban Thermal Field Variance Index (UTFVI) and Surface Urban Heat Island (SUHI) to identify UHI hotspots. The findings reveal a rapid increase in built-up areas and a decline in vegetation and agricultural land. LST was highest in densely built-up and barren areas, lower in agricultural and vegetated areas, and lowest over water bodies. Numerous UHI hotspots were identified, mainly in densely populated and industrial sections of the city. These insights underscore the need for sustainable urban planning to mitigate climate impacts and support the SDGs.

Keywords: LST, LULC, UHI, ML, SUHI, UTFVI, NDVI, NDBI, Google Earth Engine, Landsat