

Spatiotemporal Variation of Land Surface Temperature and Urbanization Indicators in the Bandarawela Divisional Secretariat Division, Sri Lanka

¹K. Nishanthi, ²PPG. Jayathilake, ³SMNS. Senanayaka

^{1,2,3}University of Kelaniya

Correspondence: knishanthi@kln.ac.lk

Abstract

Anthropogenic activities contribute prominently to the natural environment, particularly to vegetation cover and land surface temperature (LST). The present study examines the spatiotemporal variation in LST and its associated urbanization indicators, such as Normalized Difference Vegetation Index (NDVI), Normalized Difference Built-up Index (NDBI), Urban Heat Index (UHI), and urban hotspot distribution of the Bandarawela Divisional Secretariat Division, Sri Lanka. The remote sensing data gained from Landsat 5 for 2005 and Landsat 8 images for 2015 and 2025, and geospatial analysis by ArcGIS, were conducted to examine temporal changes. The results demonstrate as, the Land Surface Temperature (LST) values decreased from 16.83–31.69°C in 2015 to 16.72–30.41°C in 2025 but the 2005 was ranged from 8.31 – 31.43°C, and there is a significant increase in the Normalized Difference Built-up Index (NDBI), from 0.133 in 2015 to 0.235 in 2025, indicating substantial urban expansion during the study period. Conversely, the Normalized Difference Vegetation Index (NDVI) shows as 0.657 in 2005, but there is a slight decrease, from 0.598 in 2015 to 0.592 in 2025, reflecting minimal vegetation loss. Likewise, the urban heat island (UHI) effect exhibited a notable reduction, with values dropping from 11.68 in 2015 to 0.81 in 2025. However, the findings show an increasing trend in annual maximum and minimum temperature distribution in the area. These findings suggest an improvement in microclimatic conditions despite ongoing urban growth. The spatial distribution of urban hotspots also shifted, highlighting dynamic changes in land use patterns, particularly within the urban core of the study area. These findings indicate the complex interplay between environmental forces and urbanization that focuses on integrating ecological issues into sustainable urban planning. The research area is a developed tourist resort by virtue of having benign climatic conditions all year round. Nevertheless, recurring changes in land use and urban sprawl can pose threats to the tourism industry. Therefore, the enforcement of comprehensive urban planning regulations is essential to ensure a sustainable and resilient future.

Keywords: Urbanization, LST, NDVI, NDBI, UHI, Urban hotspot distribution