

A comparative study of land surface temperature in African cities based on Landsat Data

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The unprecedented rapid uncontrolled and unplanned urbanization that has been experienced in African cities in recent decades, makes them interesting case studies for understanding the Urban Heat Island (UHI) phenomenon. However, studies exploring the surface UHI effect in the context of Africa are uncommon. Therefore, this study sort to comprehend the effect of UHI in four African cities; Lagos (Nigeria), Nairobi (Kenya), Addis Ababa (Ethiopia) and Lusaka (Zambia), by examining the relationship of Land Surface Temperature (LST) with impervious surfaces and green spaces in each city.

Landsat-8 OLI/TIRS data were used to estimate LST, impervious surfaces and green spaces in each city. For the purpose of comparison, we used a 40 km ×40 km subset with a 20km radius from the city center of each city as a common unit of analysis. Geospatial analysis including techniques such as urban- rural gradient, UHI intensity, spatial metrics and statistical analysis were employed to relate the spatial distribution of LST to the density impervious surfaces and green spaces across the landscape of each study area.

The results indicated that the variation in mean LST distribution in all the study areas has been influenced by the urban landscape conditions. The correlation of impervious surface and green space density with mean LST across the urban-rural gradient were positive and negative, respectively. The results revealed a distinct variation in the relationship of mean LST with the density of impervious surfaces and green spaces between within and beyond the urban foot print, especially in the cities with relatively small urban foot prints (i.e. Nairobi and Lusaka). The UHI intensity also increased across the urban-rural gradient in all cities. Significant relationships between the mean LST and spatial metrics (patch density, size, shape, complexity and aggregation) was also observed indicating influence on the surface UHI by the urban landscape configuration. The study reveals useful information that can help control the effects of the uncontrolled and unplanned urbanization in Africa to provide better urban environmental conditions for the urban dwellers and further encourage sustainable urban development in African cities.

Keywords: Urban Heat Island, Land Surface Temperature, Impervious Surface, Green Space, African cities