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Identification of Relationship between Urban Heat Islands & Vegetation Cover through Landsat 8: A Case Study of Colombo & Gampaha Districts in Sri Lanka

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Abstract

Global Warming is a major environmental problem that all kind of organisms has been affected at present. Urban Heat Island (UHI) is one of primary impacts of Global Warming. UHI is a phenomenon that the temperature of urban area is higher than surrounding rural areas or suburban areas. This increasing trend of temperature in urban areas affects many environmental entities such as air quality, water resources, habitats behaviors, climate changes. The most remarkable incident that relate with UHI, is the difference of thermal properties of the surfaces. Many countries experience the consequences of Urban Heat Islands in many aspects such as economic, health, social and environmental affects. Thus to mitigate such impacts of UHI, it is very important to identify the main reasons behind this. In this paper UHIs in Colombo, Gampaha Districts and the relationship between UHI and vegetation cover were analyzed based on Landsat 8, 30 m resolution data. Land Surface Temperature was derived from Landsat thermal Infrared band through several equations of United State Geological Surfay (USGS) guidelines using Arc GIS 10. Conversion of Digital Number (DN) values to Top of Atmosphere (TOA) Radiance, Conversion of TOA Radiance to Satellite Brightness temperature and final calculation of Land Surface Temperature considering land surface emissivity are the steps that had been done for the analysis. Vegetation cover was derived by using vegetation index with the Red and Near Infra Red bands.

The result shows that the land high surface temperature directly relates with the urbanized regions where vegetation cover is very less. High temperature difference could be identified that cause to arise the urban heat island effects in Colombo & Gampaha districts. There is a strong linearly negative correlation with correlation coefficient value of -0.742 between land surface temperature and vegetation cover. 78.8 km^2 (including water) of total area had been identified as NDVI value less than 0.1. And extent of high temperature area was 74.12 km^2 where temperature more than 27˚C at 10.22 am. The area in temperature range of 25-27 was 464.95 km^2 and area in NDVI value range 0.1-0.2 was 333.04 km^2. 1471.1 km^2 was identified as NDVI value between 0.3-0.4 and the area at low temperature was 1529 km^2 where temperature less than 25˚C. According to this results, high temperature at non-vegetated areas and low temperature at vegetated areas could be noted very clearly. This is probably due to the ecological function of vegetation that lay down the surface temperature from high evapotranspiration. Vegetated areas are mostly sensed with surface temperature. Thus research output can be useful for policy-makers and planners of development projects such as Western province Megapolis project as well as for general public to understand the urban heat island effects and importance of vegetation cover to mitigate such impacts.

***Keywords*:** Urban heat island, Vegetation, NDVI, Arc GIS, Landsat, Sri Lanka