

Analysis of the Relationship between Urban Heat Islands and Land Use by Remote Sensing Techniques (A case study of Colombo District)

K.P.S. Uthpala (1), S. Sivanantharajah (2), C.H. Edussuriya (3)

¹Institute of Human Resource Advancement, University of Colombo

²Sri Lanka Survey Department, No 150, Kirula Road, Narahenpita, Colombo 05

³Central Environmental Authority, No 104, Denzil Kobbekaduwa Mawatha, Battaramulla

Email: sulakshiss@gmail.com; siva271.survey@gmail.com;
chedus1969@gmail.com

Abstract

Urban Heat Islands (UHI) can be described as areas that experience high temperature conditions when compare to the surrounding rural areas. Rise in average temperature due to Global Warming process is experienced by all countries especially in tropical areas at present. Urban Heat Island is one of primary impacts of Global Warming and there is a high probability of creating UHIs in urban areas. Colombo district represents the 77.6% (1,802,904) of total urban population while it has been developed as the major commercial city.

The main objective of the study was to determine the relationship between urban heat islands and land use types in study area and specific objectives were to estimate the pattern of Land Surface Temperature (LST) using Land sat 5/8 images, to identify the UHIs in the study area, to identify the different land use types and their thermal properties and to analyze the relationship between temperature and different LU/LC types.

LST was derived using Landsat images of 1997, 2007 and 2017 which were downloaded through USGS website. The software ArcGIS 10.3 version was used to calculate LST and Google Earth Pro software was used for ground verification. Both Normalized Difference Vegetation Index (NDVI) and Normalized Difference Built Index (NDBI) indices were used for this study to analyze the relationship between UHI and LU/LC types.

According to the results totally 42.84 sqkm (6.26% from total land area) in Colombo District have been converted into UHI areas. Colombo MC has highest extent of UHI areas as 21 sqkm (49%). The lower extent of UHIs identified in Preadeshiya Sabhas, among them UHI extent of Seethawakapura PS was 0.7 sqkm. The maximum temperature recorded as 31.550C from an industrial zone (Thelawala North GND) located in Moratuwa MC. The minimum temperature was 21.610C and it was reported from a Rubber land which is in Seethawaka PS. Properties of LU/LC in urban areas decides the albedo of the surface that directly relates with urban temperature. The darker objects usually having a lower albedo value than light colored objects while it is stored more energy inside the object and cause to increase temperature. Seethawakapura Export Processing Zone, Port City, Colombo Harbor, Ratmalana airport and Sri Lanka Parliament represented high temperature values while Labugama tank and forest reserve, Bolgoda Lake, Diyawanna Oya represented low temperature values. There was a direct relationship between UHIs and LU/LC. The lands which are densely covered with vegetation represent low temperature values while built-up areas represent high temperature values.

The output of this study can be utilized effectively for sustainable development of urban areas and proper urban planning in future. The public can aware regarding effects of UHIs to minimize impacts and encourage maintaining of green environment. Further it is recommended to do studies on the impacts of UHIs on human health.

Key words: Urban Heat Island, Colombo, Land Surface Temperature, Land Use/Land Cover, NDVI, NDBI