

IMPACTS OF LOSS OF VEGETATION COVER ON URBAN HEAT ISLAND; A CASE STUDY OF LAHORE, PAKISTAN

Arfa Rizwan, Candidate, Master of Science in Urban & Regional Planning, University of Alberta

EXECUTIVE SUMMARY

The rate of urbanization in the world is significantly faster than ever. More than 54 percent of the world's population already lives in cities, with a predicted 66 percent living in cities by 2025 (United Nations, 2014). Compared to the rest of the globe, Asia has 46 percent of its population living in cities. Pakistan is not far behind in urbanization, with cities and towns accounting for 35% of the population. Pakistan has the biggest population living in the cities among the South Asian Association for Regional Cooperation (SAARC) countries. When cities urbanize the surrounding vegetation is converted into built up area to adjust population growth, resulting in environmental deterioration such as noise and carbon pollution, soil erosion, and habitat and species loss (Zipperer, Sisinni, Pouyat, & Foresman, 1997; Vesely 2007; Young 2010). This has resulted in a slew of ecological and environmental issues, as well as a decline in the ecological quality of many cities around the world (Gregg, Jones, & Dawson, 2003; Alberti & Marzluff, 2004; Kim & Baik, 2005; Zhao et al. 2006; Matteucci & Morello, 2009). As a result, the amount, quality, and distribution of urban vegetation/trees in cities worldwide show the history of urbanization and associated ecological changes over time (Jim, 2004; Jim & Zhang, 2013).

The rapid change in land use made cities vulnerable to urban climate change and the Urban Heat Island (UHI) effect. The "Urban Heat Island" represents a characteristic of the whole or part of the city, which is comparatively warmer than its nearby rural area. UHI varies from season to season and day to day. The urban areas' temperature can be 2–6 °C higher in hot seasons (Alam & Rabbani, 2007) and can be 13 °C higher in winter than in the surrounding countryside.

Once the city of gardens (Shirazi, 2012), Lahore is now experiencing shrinkage of green space. Significant changes in LULC have been observed in Lahore within a single decade. The built area had

increased from 911.14 km² in 1992 to 1268.85 km² in 2009. (Overall increase is 71.61 %). As a result, the area of vegetation and open land has decreased. This development regarding urban land use is alarming because it will lead to various associated problems (Shirazi, 2009). The metropolitan area of Lahore experiencing rapid urbanization aided in the loss of vegetation that has resulted in remarkable urban and environmental problems.

In this research, Landsat imagery from 2000, 2010, and 2020 is used to assess the temperature variations in Lahore, by searching the relationship between the Land Surface Temperature (LST) and the Normalized Difference Vegetation Index (NDVI). For land-use change detection, multi-source & multi-temporal satellite images and GIS & Remote Sensing (RS) techniques are significant aspects in analyzing urban expansion and loss of vegetation cover worldwide. During the research, it was found that the average surface temperature in Lahore in 2000 maximum temperature was 33.738 °C for built-up areas and 32.74 °C for vegetation, and in 2020, the maximum LST was observed as 38.917 °C in built-up areas, 37.525 °C for vegetation respectively. This had led to an intensified Urban Heat Island effect in the urban areas. Research analysis indicates that there is an in direct relationship between LST and NDVI, and a direct relation between LST and NDBI in a particular season. This research will help the city government and urban planners to devise policies to develop urban forests (to mitigate Lahore's rising temperature) and sustainable land use planning and development in Lahore.

KEYWORDS: Vegetation cover, Urban Heat Island (UHI), Lahore, Land Surface Temperature (LST), Land use/Land cover technique (LULC), Remote Sensing