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Geospatial and Temporal Changes in Urban Green Space; Case Study in Kandy Four Gravets and Gangawata Korale Divisional Secretariat Division (1988-2024)

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Abstract

Urban green spaces in Kandy City are experiencing a significant decline due to rapid urbanization and expansion of built-up areas. This reduction threatens the ecological balance, environmental quality, and residents' well-being, calling for an urgent need to assess and understand the extent and rate of these changes. Accordingly, this study aims to analyze the geospatial and temporal changes in urban green spaces in Kandy Four Gravets and Gangawata Korale Divisional Secretariat Division. To achieve this, population density maps for the years 2000, 2003, 2007, 2016, and 2020 were obtained from the "WorldPop" database to assess population density trends. Additional population data were collected from the Department of Census and Statistics. Landsat images for the years 1988, 1994, 2003, 2007, 2016, and 2024 were downloaded from the United States Geological Survey (USGS) to analyze the Normalized Difference Vegetation Index (NDVI) based on ArcGIS 10.8 and Erdas-2014. After that, the NDVI maps for each year were classified into three categories: water bodies, built-up areas, and green spaces, using the threshold values. Accordingly, the threshold values for green spaces were 0.3020, 0.3561, 0.3532, 0.3515, 0.3090, and 0.3045 for 1988, 1994, 2003, 2007, 2016, and 2024 respectively. The classification results were validated through accuracy assessments, utilizing 100 random sample points for each map, cross-referenced with Google Earth Pro. The findings suggest that population density is a major factor driving urbanization, with a consistent growth in population from 1988 to 2024. Urban green spaces measured approximately 53.61 km² in 1988, 53.31 km² in 1994, 51.88 km² in 2003, 42.58 km² in 2007, 37.76 km² in 2016, and 35.95 km² in 2024. This demonstrates a continuous decline in urban green spaces over the observed period. A significant decrease in green spaces was observed after 2007, aligning with the country's economic growth, expansion of infrastructure, and the conversion of vacant and forested lands into urban settlements, administrative buildings, and industrial parks in and around Kandy City. This study underscores the alarming reduction of green spaces in Kandy City, driven primarily by urbanization and population growth. If this trend continues, it could have severe environmental and social consequences, including loss of biodiversity, reduced climate resilience, and diminished quality of life for residents. Therefore, it is critical to adopt sustainable urban planning strategies that prioritize the preservation of green spaces to mitigate the adverse effects of rapid urbanization and protect the ecological integrity of Kandy.

Keywords: *Normalized difference vegetation Index (NDVI), Remote sensing, Urban green space, Urbanization.*