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Calculation of vegetation changes in western, southern and eastern coasts of Sri Lanka by using GIS and remote sensing techniques

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Abstract

Coastal vegetation provides protection against various water-related events and serves as a cost-effective alternative for both tsunami and general coastal protection in developing countries. The coastal zone is a highly dynamic area that experiences sudden changes due to natural and anthropogenic activities, and the coastal vegetation is also subject to rapid changes in response to these dynamics. To monitor these changes effectively, the use of GIS and remote sensing techniques is the most efficient method. Therefore, this study was conducted to analyze vegetation changes up to 2 km landward area from baseline in Western, Southern and Eastern coasts in Sri Lanka using geo-referenced Sentinel-2 (10 m resolution with less than 10% cloud cover) images. Sentinel-2 launched in 2015 and more clear images available from 2017. To conduct this study, data from the years 2017, 2018, and 2020 were utilized. The changes in vegetation were estimated by calculating the Normalized Difference Vegetation Index (NDVI) using ArcGIS 10.8 software. The findings indicate that the total vegetation cover on each coast underwent changes. Specifically, on the West coast, the vegetation cover was estimated to be 367.49 km², 376.01 km², and 371.90 km² in 2017, 2018, and 2020, respectively. From 2017 to 2018, the vegetation cover increased by 8.52 km², but decreased by 4.11 km² in 2020. On the Southern coast, the vegetation cover was calculated as 441.63 km², 446.84 km², and 436.25 km² in 2017, 2018, and 2020, respectively. Vegetation cover increased by 5.21 km² from 2017 to 2018 and then decreased by 5.38 km² in 2020. On the East coast, calculated as 433.43 km² in 2017, 386.62 km² in 2018, and 460.88 km² in 2020. Coastal vegetation decreased by 46.81 km² in the first two years and increased by 74.26 km² in 2020. Calculated Kappa coefficient is 88.6% for Accuracy testing. The changes observed in coastal vegetation could be attributed to various factors such as human activities, coastal development, or natural phenomena. Monitoring and analyzing coastal vegetation changes are crucial for maintaining coastal protection against both natural and anthropogenic activities, as well as for the planning of future development projects.

Keywords: Coastal vegetation, GIS, NDVI, Sentinel

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