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Assessment of coastal land area changes at Calido beach, Kalutara, using remote sensing and GIS techniques

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Calido beach in Kalutara is situated on the western coast of Sri Lanka. It has been severely affected by coastal erosion aggravated by the removal of the sand bar in May 2017. This study aims to assess changes in coastal land area from 2015 to 2021 at two-year intervals utilizing remote sensing and GIS techniques. It focuses on quantifying variations due to sand bar removal and comparing these changes using Landsat 8 OLI images from June in 2015, 2018 and 2021, with 2015 serving as the baseline year. The Normalized Difference Water Index (NDWI), applied to satellite images using ArcGIS software, played a key role in differentiating water and non-water surfaces. NDWI values were reclassified, converted from raster to polygon format, and then smoothened. Subsequently, the non-water surface area for each year was calculated using the geometry tool in ArcGIS software, providing insights into the impact of sand bar removal on coastal morphology. The analysis revealed a minor reduction in the non-water surface area from 4.867 km² in 2015 to 4.865 km² in 2018, which corresponds to a reduction of about 0.04%. By 2021, the non-water surface area increased substantially to 4.966 km², indicating a growth of about 2.08% from 2018 and 2.04% from 2015. The study highlighted the dynamic nature of the coastal land area at Calido Beach, where a slight erosion was noted by 2018, but a substantial increase in non-water surface area was observed by 2021 due to sand deposition after the removal of the sand bar. These findings emphasize the dynamic impact of human interventions on coastal morphology. Recommendations include conducting environmental assessments and developing an integrated coastal management plan to ensure sustainable coastal development and effective management. Additionally, it is crucial to validate these preliminary findings with ground-based measurements to ensure their accuracy and reliability.

Keywords: Calido beach, Coastal land area, GIS, NDWI, Sand bar