Shoreline Dynamics and Land Use Shifts in Sandwip Island, Bangladesh: A **Comprehensive Analysis Using Digital Shoreline Analysis System and Satellite Imagery**



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Introduction

Bangladesh as a lowland deltaic country is associated with the convergence of two large rivers, the Ganges and the Brahmaputra, both of which originate from the Himalayan massif. Shoreline modification due to coastal erosion is one of the greatest problems in a vast array of coastal regions worldwide world. Coastal erosion occurs when natural processes or human activities lead to the erosion of sediments from the coast, resulting in a gradual withdrawal of the sea-land boundary. Land Use and Land Cover (LULC) estimation is quantifying the types and dynamics in land wears off and surface cover transforms over time. The LULC has also have been affected, with changes of bare land, mudflats, homestead cover, grassland, cropland, green cover, and mangrove cover.

91°28'20"E 91°30'0"E 91°31'40"E LULC map of Sandwip (2023) Bv usind Sentinal 2 Data IN Google Earth Engine Sandyarea Barrenlan Cropland Vegetatior Waterbod



Objective

Analysis of the shoreline of Sandwip

- Analysis of the Land Use and Land Cover (LULC)
- Accuracy Assessment using Kappa method

Methodology















Result



analysis: Linear Regression Rate (LRR) signified the areas of heavy erosion with a rate of as low as -110.8 m/year, while accreting areas indicated as much as +17.2 m/year growth. Net Shoreline Movement (NSM) recorded the highest retret of – 1,556.5 meters and as much as +1,489.8 meters increase, which are the positional changes in the long term. The End Point Rate (EPR) supported these results, with erosion values of –

LULC:

The built-up area expanded from 23% in 2020 to 31% in 2023. Sandy areas decreased from 30% in 2020 to 22% in 2023. Barren land increasing from 5% in 2020 to 10% in 2023. Cropland areas decreased from 25% in 2020 to 14% in 2023. Vegetation coverage, starting at 15% in 2020, increases 19% in 2023.water body increase from 2% in 2020 to 4% in 2023.

Key Findings

- Expansion of water body and restoration of vegetation suggest sound environmental action.
- Expansion of built-up area and loss of sandy area are issues of sustainability.
- Sandwip shoreline is suffering from long-term erosion and accretion by human interference through the construction of bridges.
- High classification accuracy (85%–95%) using the Kappa method confirms methodological reliability.

Conclusion

In this study, Digital Shoreline Analysis System (DSAS) metrics (LRR, NSM, EPR) effectively quantify coastal changes and highlight erosion or accretion zones. Significant shoreline accretion detected near bridge construction, emphasizing localized human influence. LULC analysis revealed major changes in urbanization, cropland distribution, and vegetation between 2020 and 2023. The shifting pattern emphasizing the need of implement policies to protect water resources, regulate urban growth and promote sustainable land use practice.

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