

Channel Migration and Floodplain Land Use/Land Cover Transformation in the Gaurang River Basin, Assam, India: A Multi-Temporal Remote Sensing and GIS Assessment

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Abstract

In the foreland of the Himalayas, some of the most important geomorphic processes that affect riverine landscapes are channel migration and floodplain modification. This study uses multi-temporal Remote Sensing (RS) and Geographic Information System (GIS) techniques to investigate the spatio-temporal dynamics of channel migration and associated land use/land cover (LULC) changes in the Gaurang River Basin. Survey of India topographic maps (1971–1977), Landsat imagery (2001 and 2021), and the Shuttle Radar Topography Mission (SRTM) Digital Elevation Model (DEM) were utilised to analyse channel migration, sinuosity, radius of curvature, erosion–deposition processes, and LULC changes.

The results reveal significant geomorphic instability throughout the basin, particularly in the middle and lower reaches. The channel migration was highest at Reach 4 (5.83 km²) from 1973 to 2001 and bank erosion was the greatest at Reach 2 (11.90 km²) from 1973 to 2021. Channel sinuosity was greater in the lower reaches (2.25–2.44) than in the upper reaches (1.17–1.30), indicating increased meandering and lateral channel instability. LULC analysis revealed significant landscape transformation, with the settlement area increasing from 23.66 km² to 253.91 km², while agricultural land and vegetation cover declined. The overall accuracy of supervised classification was 90–92.5% and Kappa coefficients exceeded 0.88.

The findings reveal that channel migration has played a major role in floodplain instability and LULC transformation in the Gaurang River Basin, highlighting the need for integrated land-use planning, riverbank stabilisation, and sustainable floodplain management to minimise flood hazards and erosion.

Keywords

Channel migration, Floodplain dynamics, Land use/land cover, Riverbank erosion, Remote Sensing, GIS, Gaurang River.