Land Use Land Cover Change Analysis in the Southern Part of Khulna Division, Bangladesh

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Abstract:

Over the last few decades, Land Use and land Cover (LULC) has been considerably transformed in the southern part of Khulna division, Bangladesh. This area is characterized by diverse LULC patterns such as agricultural area, urban zone, industrial & port area, mangrove forest Sundarbans, fresh and saline water bodies (Banglapedia, 2023). Rapid urbanization, agricultural expansion, industrial development, shrimp aquaculture, land encroachment, deforestation and associated LULC have led to significant challenges on livelihood and ecosystem services in this region (Hossain & Hasan, 2017; Moniruzzam et al., 2018; Morshed et al., 2022; Sowgat, 2012). Understanding the LULC scenario for this area is very important for sustainable land management and economic development. This study aims to assess the spatiotemporal changes of LULC from 2013 to 2023 using remote sensing and ArcGIS Pro, identify their driving forces, and the socio environmental impact of these changes. To assess the patterns of LULC changes, datasets were obtained from Landsat 8 Collection 2 Level 2 for the years of 2013 and 2023 as TIFF format (raster images) and subsequently processed in ArcGIS Pro. These raster images were extracted within the study area and Support Vector Machine (SVM) algorithm based on the supervised classification technique was used for LULC classification and then maps for 2013 and 2023 were generated using map elements. The tools calculate field and calculate geometry were applied to obtain accurate area (km²) and the percentage of each class. Besides, this study also involved collecting information from secondary data sources and existing literature for identifying the driving factors of LULC changes and its impact assessment. The findings reveal that vegetation or forest cover and water bodies have reduced, and agricultural land and developed or build up areas increased significantly over the period (Figure 2). In 2013 total forest covered was 3705.30 km² (44.79%) which declined to 3241.20 km² (39.18%) in 2023. Total forest loss was 464.10 km² (5.61%). Water bodies reduced 2.13% (175.66 km²). In 2013, water bodies were 1776.71 km² (21.48%) and 2023 it is reduced to 1601.05 km² (19.35%). Cultivated or agricultural land raised 2188.73 km² (26.46%) to 2434.70 km² (29.43%) and total agricultural land increased 245.97 km² which is approximately 2.97%. Besides, developed areas increased sharply from 600.82 km² (7.26%) to 994.63 km² (12.02%). Overall, 4.76% (393.81 km²) of developed area increased which indicating the trends of rapid urbanization.
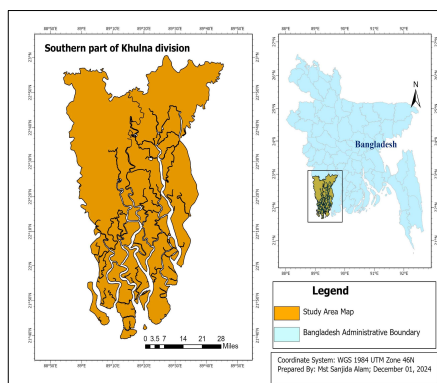
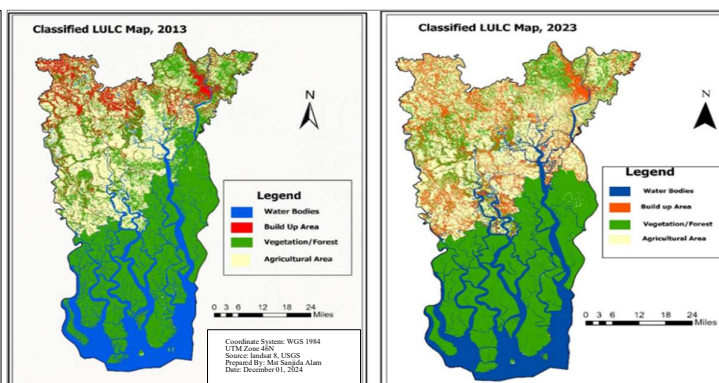Figure 1: Map of Study Area   Figure 2: Classified LULC Map-2013 and 2023

According to secondary literature, population growth, enhanced farming activities to produce enough food for the increasing population, urban growth, infrastructure development, various economic activities and climatic factors were found as key drivers of these changes (Sultana & Miah, 2022; Abdi et al., 2024; Ferdous et al., 2023). In addition, poverty was also influencing the LULC change in this area, as extremely poor people were extracting timber, wood and honey for their livelihood which led to the destruction of forest (Abdullah et al, 2016). Changes in LULC are creating varied socio-economic and environmental disruption in this area. The most common environmental consequences are biodiversity loss and ecological imbalance, increasing soil salinity and decreasing soil fertility, increasing environmental pollution, amplifying the climate change processes and effects such as longer summer, very short winter, and low rainfall,

and increasing the risk of disasters such as tidal flood and cyclone (Miah et al, 2020; Bari et al., 2024; Hossain & Rahman, 2021; Kafy et al., 2021). The LULC changes have significant socio-economic impacts including migration of local people from disasters prone coastal areas to urban areas, shifting livelihood and occupation and reducing income and economic growth (Rahman et al., 2017; Miah et al, 2020). These results highlight the reality of delicate interplay between development and conservation of the environment. Findings of the current study are crucial for policy makers and planners to develop balanced and sustainable land use concepts and strategies focusing on green infrastructure and resources conservation.

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