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## High resolution Sentinel-2 data-based ecological and biophysical variables analysis in Indian part of Sundarban Mangrove Forest

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Mangrove forests are important in Indian Sundarban Biosphere Research (SBR) for coastal hazards and vulnerability reduction. Recent extreme natural disasters like flood inundation, cyclonic effects, shoreline change, and river bank erosion are the main threatening phenomena for coastal livelihood and forest cover change. Mangrove forest is not only a shelter for human life but also important for animals and gradually forest degradation triggers their life in serious issues. Technologies can assist in reducing those serious issues through space-based analysis, and adaptation policies and give them a sustainable life. Current space-based technologies can be applied for forest cover change analysis in the SBR area. This analysis investigates the forest cover in different years (2018 and 2022) through Sentinel-2 data. Various biophysical and ecological variables are measured because of recent cyclonic effects that have gradually affected this region. Some recent cyclones like Titli (2018), Fani (2019), Bulbul (2019), Amphan (2020), and Yass (2021) gradually triggered coastal geomorphology change, shoreline shifting, river bank erosion, and mangrove forest losses. Sentinel 2 data is applied in ArcGIS v10.8 and SNAP v9.0 for calculating those outcomes. The highest NDVI values are observed at 0.72 (2018) and 0.53 (2022), while the highest TNDVI values are also remarkable observations like 1.11 (2018) and 1.02 (2022) respectively. During cyclonic effects, those regions are affected by flood inundation, increased soil salinity, bank erosion, and huge economic losses observed. Similarly, high SAVI values are 1.08 (2018) and 0.81 (2022). The forest areas mainly decrease in G-plot, L block, some parts of Kultali block, and Jambu Dweep areas, while Blacky Island, HaLF-FiSH Island, and near Kakdwip block have increased mangrove forest areas. The high NDSI values observed were 0.42 (2018) and 0.49 (2022) because of saltwater intrusion which is triggering the crop dynamics and production losses in those regions. The S2REP and IRECI, both chlorophyll estimation indices indicate that the forest cover areas are lost during the study periods. The forest degradation index (FDI) values and threshold-based forest health index are also warned for adopting those regions, otherwise, the

mangrove environment is gradually destroyed by natural extreme events and some man-made activities. Mangrove forest protection is essential for the planners, policy-makers, and stakeholders for safe forest life as well as coastal environment and coastal livelihood. Some adaptation strategies like cyclone shelters, mangrove plantations, early warning systems, river bank erosion reduction, and awareness can help to reduce the risk of extreme natural hazard events.