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# **MAJOR FINDINGS**

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The south-western part of Sundarban is remarkable for its various contrasting features, which include its diverse geomorphology, dense human population, interplay of estuarine and tidal systems, and significant mangrove forest interspersed with reclaimed lands. The diverse geomorphology is the result of the interplay of the Hooghly estuarine system, the complex tidal environment, the monsoonal rainfall, coupled with vast sediment load and resultant siltation in many of the estuarine streams. However, the physiography of this region is undergoing changes due to human pressure and the ongoing climate change.

Two islands in this region are selected for the study of the geomorphology and associated ecological characteristics, the Henry's island and the Patibania island. The two islands are selected for their strikingly different characteristics, which enable the pair to serve as a microcosm of the larger south-western Sundarban region. The reserve forest of the Patibania island reflects the characteristics of the natural growth of mangroves in this region with minimal or nonexistent human interference, while the inhabited Henry's island provides a study area for the effects of human influence on the geomorphology and mangrove ecology. The location of the Patibania island next to the Muriganga river (a distributary of the Hooghly river) provides it with relatively more freshwater inflow, whereas the north-south layout of this island makes it susceptible to longshore tidal currents. On the other hand, the Saptamukhi river flowing next to the Henry's island, has no source of freshwater and is only tidally fed. The shape of the Henry's island makes it sensitive to the cross-shore tidal action, resulting in the formation of wide tidal flats and beaches.

The geomorphic settings of these two coastal islands are investigated. The coastal settings are studied separately along with investigating the potential consequences of sea level rise. The physiography of the islands is studied along with the hydrological characteristics and their effects on the mangroves. Finally, potential for sustainable development and coastal resource management in this region are analyzed. Extensive field investigation data are collected with other sources of data consisting of satellite imagery, digital elevation models and meteorological data are used to arrive at the inferences related to this research work. The major findings are given below in accordance with the chapter sequence.

- The relatively small areas of the two islands contain a disproportionately diverse collection of geomorphic settings. These geomorphic settings are described in Chapter 2. The diversity of the geomorphic settings of the two islands points toward the geomorphic complexity of the south-western Sundarban. It is also found that the natural hydrological

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processes play a paramount role in shaping the present geomorphology of the islands, and the ongoing sea level rise would potentially have a significant impact on the islands due to their relatively low elevation level.

- The coastal processes influence the island geomorphology. In particular, the wave and tidal actions are the principal factors in forming and maintaining the coastal environment. Sea level rise has the potential to profoundly alter the topography of the islands. However, human activity has significantly modified the coastal setup of the studied islands. These findings are presented in Chapter 3.
- Along the varied geomorphic settings, soil texture and chemical properties also differ significantly. In addition, the prevalent mangrove species and their growth characteristics vary remarkably over the geomorphic settings. Tidal inundation and overwash deposits have deep influences on the mangrove ecology. Bioturbation also significantly alters the near-shore environment. These findings are presented in Chapter 4. The possibility of restoring degraded mangroves by ecological engineering has also been discussed.
- From the temporal analysis of the set of climate variables, it is clearly observed that the temperature of the south-western Sundarban region is increasing, while the rainfall is decreasing. Also, it is found that the mangrove forest cover degrades with rise in temperature and decline in rainfall. Further, it is observed that the extraction of groundwater is unsustainable, and even the groundwater recharge from monsoonal rainfall is unable to compensate for the year-round extraction. The above findings have profound implications for the future of the mangrove ecology in the south-western Sundarban. These findings are presented in Chapter 5.
- In view of the unsustainable exploitation of resources like groundwater and mangrove products, possible opportunities of sustainable development and coastal resource management in the study area are examined. It is observed that a combination of regulatory framework to limit human intrusion in the mangrove forests and careful management of human activities outside the forest area would work well for the restoration of mangroves while preserving the existing habitats. Also, the region has ecotourism potential, and with proper planning and execution, the region can be developed into an ecotourism hotspot. These findings are presented in Chapter 6.