Abstract

The Sundarban region, located on the northern coast of the Bay of Bengal, is the largest mangrove forested region in the world. Occupying the southern end of the Ganga-Brahmaputra basin, this region has formed due to enormous sediment deposition from this river system. Numerous estuarine rivers and creeks have created a complex network of streams, through which the freshwater of the Ganga-Brahmaputra river system as well as the saline tidal water flow. The mangrove forests in this region are biologically very productive and support high biodiversity. Mangroves in Sundarban are vulnerable to climate change and anthropogenic impact. The south-western part of Sundarban exhibits many striking features, including the interplay of estuarine hydrological processes of the tide dominated Hooghly river, and coastal wave and tidal action through many creeks. The resulting diverse geomorphic setup and dense human settlements coexist alongside extensive mangrove forests. Because of these features, this region is ideal for a careful study of the changing geo-environmental settings of the mangrove habitats in Sundarban, including changes in geomorphic, the hydrological and climate attributes. The mangrove ecosystem is coping with the changing environment. For this study, two islands from this region are selected — the Henry's island and the Patibania island, which themselves exhibit remarkable variation in characteristics, thus convincingly representing the larger south-western Sundarban region. The physiographic and biogeographic characteristics of these two islands as well as the anthropogenic impacts on them are investigated using data collected from direct field surveys and acquired climate, satellite and tide related information. It is observed that the islands exhibit a diverse set of topographic features, mirroring the larger south-western Sundarban. The soil and ecological characteristics of this region also vary with changing geomorphic features. Tidal drainage loss due to siltation in the inner parts of the islands reduces water inflow, which makes the environment suitable for the development of saltpans and unfavorable for the growth of mangroves. The coastal edges of the islands are facing erosion due to tidal action. The analysis of the climate data for the last two decades indicates a rising trend of temperature and a decreasing trend of rainfall. Analyzing the relationship between the mangrove vegetation cover and climate, it is also perceived that the density of mangrove vegetation decreases with increasing temperature and decreasing rainfall. These two findings together point towards the vulnerability of the mangrove ecosystem in face of climate change. It is found that the decrease in water influx due to tidal drainage loss and declining rainfall has led to an increase of salinity and resulting proliferation of saltpans. Very high salinity

levels make the saltpans almost barren and devoid of vegetation. Also, a significant portion of the previous mangrove habitats are now occupied by economic activities, which include aquacultural and tourism related facilities. On the other hand, it is found that the amount of groundwater extracted for human requirements is considerably larger than the replenishment of the groundwater table by monsoonal rainwater. This has resulted in an unsustainable situation. The analyses point to further degradation of the mangrove ecosystem and its environment, if no action is taken to prevent the climatic and anthropogenic adversities. However, it is also observed that artificial canals have a positive impact on the mangrove ecosystem in the inner portions of the islands. Taking all of the above findings into consideration, recommendations are given for the sustainable development involving the mangrove habitat and the inhabitants of this area. This would ensure preservation of the existing mangrove habitats and restoration of the degraded mangroves as well as the continued livelihood of the local communities, which depends on the mangrove ecosystem services.

Keywords: *Climate change*, *coastal environment*, *groundwater depletion*, *mangrove degradation*, *salinization*, *saltpan*.