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Sea-Level Rise and Salinity Penetration in Coastal Bangladesh: A Case Study of Pekua's Water and Agricultural Vulnerability

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Abstract

Salinity intrusion in coastal regions is a growing environmental threat exacerbated by climate-induced sea-level rise. Bangladesh, with its extensive coastline and low-lying terrain, is among the most vulnerable nations facing this challenge. This study investigates spatial variations in groundwater and surface water salinity in the coastal belt of Pekua Upazila, Chattogram, and assesses its implications for agricultural sustainability and freshwater availability. Using Brix percentage as a salinity metric, water samples from tube wells and irrigation sources were analyzed along a transect extending inland from the coastline. Results indicate a significant inverse relationship between salinity concentration and distance from the shore, with peak salinity levels recorded at Ujantia and the lowest at Toitong–Shilkhali. Alarmingly, groundwater salinity at Rajakhali, located 10.8 km inland, exceeded the 0.05 Brix % safety threshold prescribed by international standards. These findings reveal a narrowing band of land where groundwater remains suitable for drinking and irrigation. If this salinity-affected zone continues to expand, it may trigger forced displacement and agricultural decline, threatening local livelihoods and food security. The study underscores the urgent need for integrated water resource management, adaptive agricultural practices, and climate-resilient infrastructure to mitigate salinity impacts. By linking these localized effects to the broader objectives of SDG 13, this research highlights the critical role of community-scale adaptation in global climate action.

Keywords

Salinity intrusion, Climate change, Sea-level rise, Groundwater, Irrigation, SDG 13, Coastal agriculture, Bangladesh.