Goldschmidt 2026 Abstract
https://doi.org/10.46427/gold2026.37208

Hydrogeochemical Impacts of Cyclonic Inundation and the Transition to Circular Livelihoods in the Indian Sundarbans

MR. RATUL GHOSH, MSC[1], RANJANA RAY CHAUDHURI[1] AND SWAPAN K SAHOO[2]

[1]TERI School of Advanced Studies
[2]Shaligram Research Institute

The Indian Sundarbans, a UNESCO World Heritage site and a global climate hotspot, exists in a precarious hydro-ecological paradox, despite being a water-abundant delta, the region faces acute freshwater scarcity driven by accelerating climate change. Rising sea levels and the increasing frequency of high-intensity cyclones like Amphan and Yaas in the last few years, have led to repeated tidal inundation causing irreversible salinization of agricultural lands. This study integrates high-resolution hydrogeochemical baselines with community-led adaptation strategies to address the collapse of agrarian livelihoods in the vulnerable islands of Satjelia and Gosaba.

Hydrogeochemical analysis of 48 groundwater and 36 surface water stations (sampled Jan–April 2025) reveals a critical degradation of the freshwater interface. Simpson's Ratio (Cl^- / HCO_3^-) analysis confirms severe seawater mixing in shallow aquifers, with ratios frequently exceeding 6.6. Wilcox diagram analysis indicates that water in cyclone-affected zones has a Soluble Sodium Percentage (%Na) exceeding 80%, resulting in a high Sodium Adsorption Ratio (SAR). This geochemical shift has triggered widespread soil deflocculation, rendering traditional paddy cultivation chemically unviable and locking marginal farmers particularly women into a cycle of poverty and climate-induced migration.

To dismantle this barrier, we leveraged these geochemical baselines to justify and implement the "Selai Sundori" initiative, a circular economy model. Recognizing that the land can no longer support traditional agriculture, this project trained 50 forest-dependent women in textile upcycling, converting waste fabric into marketable products. This intervention does not merely provide economic aid; it represents a strategic shift from climate-vulnerable land dependence to climate-resilient circularity. By bridging hard science (diagnosing the degradation of the soil) with social innovation (creating off-farm value chains), this work demonstrates how geochemistry can serve as an early warning system for policy intervention, turning data into a defence mechanism for frontline communities.



