Tarbela Reservoir's Sediment Deposition and Delta Progression: Obstacles and Solutions for Long-Term Sustainability

Nimra Arshad[1], Nausheen Mazhar[1*], Paul Passy[2], Muhammad Ali[3]

[1] *Department of Geography, Lahore College for Women University, Pakistan*
[2] *Department of Geography (UMR PRODIG), Université Paris-Cité (University of Paris), France*
[3] *National Centre of Excellence in Geology, University of Peshawar, Pakistan*
**E*mail: nausheen.mazhar@lcwu.edu.pk

A key component of Pakistan's water management system, the Tarbela Reservoir is essential for flood control, hydroelectric power production, and agriculture. However, sedimentation is a severe issue that affects the reservoir's storage capacity and operating efficiency. This research looks at the patterns of the accumulation of sediment and erosion in the Tarbela Reservoir during the last 30 years, with an emphasis on the migration of the underwater delta and the consequences for reservoir management. The research uses elevation data from range lines throughout the reservoir's upper, middle, and lower portions to identify unique patterns of sediment buildup, notably in the middle and lower regions, whereas the higher area shows a mix of deposition and erosion. Predictive modeling predicts the underwater delta's progress toward the Main Embankment Dam (M.E.D), with a decrease in distance from 3.78 miles in 2023 to 0.58 miles by 2043, if present sedimentation rates continue. The results underscore the vital need of appropriate sediment management measures in reducing the negative impacts on storage capacity and hydropower efficiency. This study gives vital insights into sedimentation patterns, laying the groundwork for future reservoir management and sustainable operation in the face of persistent sediment issues.

Keywords: Erosion; Deposition; Sedimentation; Tarbela Dam; Main Embankment Dam (M.E.D); Underwater Delta