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Binding the Ganges-Brahmaputra-Meghna Braids: A review of geomorphic change in the world's largest delta

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The Ganges-Brahmaputra-Meghna (GBM) rivers deliver the greatest sediment flux to the world's oceans, generating the Earth's largest delta system, which is home to over 170 million people. Despite its scale and complexity, the GBM delta system remains a relatively under-researched region, with geomorphic dynamics often overlooked in studies of its vulnerability. A synthesis of these research efforts remains absent, resulting in most geomorphic studies being spatially, temporally, and topically fragmented. In this research, we therefore bind these studies together, providing a holistic, delta-wide account of the GBM's prevailing dynamics and evolution, as well as identify key areas for future research. We built a sample of 427 peer-reviewed articles published from 1863 to 2020, and applied the Driver-Pressure-State-Impact-Response (DPSIR) framework to the geomorphic dynamics of the delta. We find that the delta has been responding to complex natural and anthropogenic perturbations in the form of subsidence, shifting river flows and sedimentation patterns. These processes subsequently impact on the extent and magnitude of flooding, result in losses to biodiversity, and most critically, severely disrupt local livelihoods. Amongst other key systemic gaps identified in this research, this study finds that (i) the GBM delta is typically assessed and modelled as a physical system with limited recognition of the dynamic interaction with human actions; and (ii) only 5% of studies assessed how the morphology of the delta may change in the future. Ultimately, this systematic review argues that although climate change and sea-level rise remain major concerns for the delta in the coming decades, multi-scale management and policy decisions have a more direct influence on the future geomorphic balance of the GBM delta.