Sedimentation enhancing strategies for sustainable deltas: local adaptation to radical transformation

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Coastal river deltas around the world are at risk of relative sea-level rise driven by global sea-level rise, human-induced compaction, and natural subsidence. Deltas naturally accumulate sediment when the accommodation space for aggradation is made available through relative sea-level rise, but this process is often prevented by human activities prohibiting flooding and therefore sediment deposition on delta land. Without sedimentation, deltas lose elevation relative to sea level, causing salinization and land loss. Sedimentation enhancing strategies aim to reduce or prevent these issues and improve delta sustainability by encouraging the natural delta-building process of sediment deposition, thereby combating relative sea-level rise by building new elevation.

The implementation of sedimentation enhancing strategies presents both challenges and opportunities for delta system management from biophysical and societal perspectives. We explore the barriers to and enablers of sedimentation enhancing strategies from a transdisciplinary perspective to identify conditions for success. Key biophysical issues include rapid rates of relative sea-level rise, reduced fluvial sediment delivery, and lack of detailed knowledge about spatially and temporally variable sediment deposition, erosion, and coastal sediment delivery. From a societal perspective, conditions for successful sedimentation enhancing strategy implementation include social acceptance and local inclusion in decisions surrounding land use management, available finance including loss compensation, and institutional capacity, coordination, integration, and fit to the biophysical systems involved.

We suggest that, while sedimentation enhancing strategies can be successfully employed at small scales to promote the achievement of sub-delta management goals, they can also be used as a springboard to transform delta management and environments to support long-term sustainability. This transformation requires re-integrating societal and biophysical systems rather than attempting to isolate and exclude them from each other. Delta-scale solutions will require
imagination, engineering, and collaborative experimentation and learning to enhance resilience and reduce vulnerability in the face of environmental changes.