Bankbusters: A Nature-based Solution engineered tidal marsh river banks, beneficially re-using soft dredged sediments

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Introduction: Socio-economic development activities along the tidal river Scheldt ubiquitously require dredging maintenance works in the access channel. Currently, during dredging maintenance the coarser sandy dredged material is mainly reused, while large volumes of fine dredged sediment are disposed without beneficial reuse, due to economic, logistical, legislative and/or environmental constraints.
Further deepening of the access channel induces a steepening towards the borders and their estuarine habitat. Consequently, productive ecosystems are under pressure, leading to severe habitat deterioration, especially in lowly elevated tidal marshes that flood frequently. Increasing erosion can alter these habitats into non-vegetated mudflats, with an unfavorable steep transition to highly elevated marshes. As estuarine tidal marshes provide various ecosystem services like natural flood protection lessening the impacts on embankments, the above anthropogenic and natural pressures in the Scheldt estuary will result in increased flood risk, tidal amplification and strong erosion. Moreover, these bare and steep riverbanks water and riparian plants offer only limited opportunities to rich vegetation growth. Consequently, fish and small aquatic animals have nowhere to hide or "low quality" spawn areas. The result is an impoverished ecosystem.

Fig. 1: R&D Consortium Bankbusters

Methods: The R&D project "Bankbusters" consolidates and acquires knowledge on ecosystem processes, boundary conditions and beneficial re-use of soft dredged material, in order to facilitate tidal marsh habitats restoration in previously eroded environments, enhancing ecosystem services delivery. A public private consortium researches and designs an eco-engineered tidal marsh, beneficially re-using soft dredged sediments.
Innovation is actively pursued in detailed biological process insights, global ecosystem understanding, more sustainable technological solutions and resilient operational features with a strong emphasis on developing synergies and integration to tackle the high risks linked to the highly dynamic and complex environment this project is situated in, i.e., erosive tidal rivers embankments of the Scheldt river, driven to enhance biodiversity. Dedicated living lab prototypes validate and regulate the experimental containment of soft dredged materials, while real-time flux sensors monitor the evolution of the newly placed marsh.

Results: The industrial dredging partners are designing DRECO (Dredged Ecological Compartment) unit, using well-known bundles of braided willow wood connected to mat configurations to hold the dredged finer sediments.
Dedicated living lab prototypes validate and regulate the experimental containment together with the marsh-soil development of the beneficially re-used fine dredged materials. Real-time lab-on-chip flux sensors monitor the groundwater dynamics of the newly placed marsh soils. A pioneering vegetation monitoring completes the observation of the critical, initial marsh land development stage.

Fig. 2: Marsh land development along the Scheldt

Doing so, a framework for the integration of boundary conditions for ecosystem services – taking into account the biological complexity and ecosystem functioning - in engineering design is delivered.