



Tidal wetland conservation and restoration for flood mitigation in estuaries and deltas: examples and global potential

Stijn Temmerman, Sven Smolders, Jeroen Stark, and patrick meire

University of Antwerp, Ecosystem Management research group, Antwerp, Belgium (stijn.temmerman@uantwerpen.be)

Low-lying and densely populated deltas and estuaries are world widely exposed to flood risks caused by storm surges. On the one hand, global change is increasing these flood risks through accelerating sea level rise and increasing storm intensity, but on the other hand, local-scale human impacts on deltas and estuaries are in many cases even more increasing the vulnerability to floods. Here we address the degradation and reclamation of tidal wetlands (i.e. salt marshes in the temperate zone and mangroves in the tropical zone) as a major source for increasing vulnerability to flooding of estuaries and deltas. Firstly, we present examples of flood mitigation by tidal wetland conservation and restoration, and secondly we explore the potentials and limitations for global application of this approach of ecosystem-based flood defense (see Temmerman et al. 2013).

First, we use the Scheldt estuary (SW Netherlands and Belgium) as an example where historic wetland reclamation has importantly contributed to increasing flood risks, and where tidal marsh restoration on the previously reclaimed land is nowadays brought into large-scale practice as an essential part of the flood defense system. Based on data and hydrodynamic modelling, we show that large-scale historic marsh reclamation has largely reduced the water storage capacity of the estuary and has reduced the friction to propagating flood waves, resulting in an important landward increase of tidal and storm surge levels. Hydrodynamic model scenarios demonstrate how tidal and storm surge propagation through the estuary are affected by tidal marsh properties, including the surface area, elevation, vegetation and position of marshes along the estuary. We show that nowadays tidal wetland creation on previously reclaimed land is applied as an essential part of the flood defense system along the Scheldt estuary.

Secondly, a global analysis is presented of the potential application of tidal wetlands in flood mitigation in estuaries and deltas worldwide. We discuss the societal benefits and drawbacks of wetland creation for flood defense, and provide an estimation of where on Earth this approach could be feasible. This shows that many of the largest urban populations that are at risk from coastal flooding, are located in large deltas and estuaries, such as in Southeast Asia, North America and Europe. We argue that many of these vulnerable areas are potentially well suited to include wetland conservation and restoration as an essential part of adaptation and mitigation strategies against storm surge flood risks.

References:

Temmerman S., Meire P., Bouma T.J., Herman P.M.J., Ysebaert T., De Vriend H.J. (2013) Ecosystem-based coastal defense in the face of global change. *Nature*, 504, P. 79-83, doi:10.1038/nature12859.