Tidal wetland restoration for the generation of optimal ecosystem service delivery: nitrogen cycling in the Scheldt estuary

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In terms of ecosystem service provisioning, tidal wetlands are considered to be among the most productive ecosystems. However, over the last three centuries significant global wetland area has been lost. Nowadays, a trend of large-scale wetland restoration is in place in many countries. Wetland reclamation has the potential to restore ecosystem service delivery, but whether restored wetlands actually deliver a comparable quality and quantity of these services remains an important question. That is why it is crucial to continue the monitoring of restored ecosystems. Additionally, the optimal circumstances for tidal wetland restoration with respect to ecosystem service delivery within the estuarine environment are still unknown.

In this study, we will investigate optimal tidal marsh restoration circumstances with regards to water quality and nutrient cycling by focusing on wetlands in the Scheldt estuary that have been restored recently, or will be restored in the near future. This PhD research proposal aims to gather insights in the effect of organic soil amendments in restored wetlands on water quality and nutrient cycling capacities through the study of N cycling. Building further upon pioneering research conducted in our research group, we will prepare the technique of soil amendments for widespread implementation in wetland restoration by performing a lab experiment, a mesocosm experiment and a field experiment. Focus will be laid on soil and water nutrient concentrations as well as on gas fluxes, including emissions of the potent greenhouse gas N_2O. First, a lab experiment will be conducted on the effects of a variety of parameters ranging from salinity, to inundation frequency and duration on tidal marsh nutrient cycling capability. Next, the long-term effects of these organic soil organics on the nutrient cycling capacity of restored tidal marshes will be evaluated using a mesocosm installation in the Scheldt in Kruibeke. Last, a field experiment will take place on the Ketenisseschor in the context of the Bankbusters project. Here, organic soil amendments will be implemented on a large scale during the restoration of a tidal marsh to assess their effect on ecosystem service delivery. Last, a lab experiment will be conducted on the effects of a variety of parameters ranging from temperature, over salinity, to inundation frequency and duration on tidal marsh nutrient cycling capability. All together, these experiments should grant novel insights into the effects of organic soil amendments on tidal wetland nutrient cycling, and help determine the feasibility of its future application.

Ultimately, the knowledge base gathered by this research project could be used to optimize the conservation and restoration of these valuable ecosystems.

Keywords
Tidal Marsh; Ecosystem Services; Nitrogen Cycling; Soil Amendments