A large-scale field experiment on salt marsh construction in the Ems estuary, the Netherlands

M.J. Baptist[1], P. Dankers[2], J. Cleveringa[3], L. Sittoni[4,8], P. Willemsen[4,5,6,7], K. Elschot[1], M. van Puijenbroek[1], M. Hendriks[6]

[1] Wageningen Marine Research, Den Helder, Netherlands. martin.baptist@wur.nl
[2] Royal HaskoningDHV, Nijmegen, Netherlands
[3] Arcadis, Zwolle, Netherlands
[4] Deltares, Delft, Netherlands
[5] Royal Netherlands Institute for Sea Research, Yerseke, Netherlands
[6] Utrecht University, Utrecht, Netherlands
[7] University of Twente, Enschede, Netherlands
[8] EcoShape, Dordrecht, Netherlands

1. Introduction

Salt marshes provide important natural habitats, mitigate effects of subsidence and sea level rise and help in coastal defence (Temmerman et al. 2013). Commissioned by the municipality of Delfzijl, the EcoShape consortium obtained the opportunity to carry out a large-scale field experiment on salt marsh construction as part of their Living Lab for MUD. Through testing of different initial conditions and sowing glasswort seedlings valuable new knowledge on salt marsh biogeomorphology is obtained.

2. Material and methods

2.1 Study area

The city of Delfzijl, the Netherlands is located to the west of the middle part of the Ems estuary. It has a mean semi-diurnal tidal range of 2.99 m and a mean annual suspended sediment concentration of 90 mg/l. Near Delfzijl are large areas of sandflats and mudflats, but land-water boundaries consist of rock protected dikes. A medium-sized port is protected from wave attack by a 4 km alongshore dam. The municipality of Delfzijl started a project to enhance the environment and economy in the region, named Marconi. As part of this project a pioneer salt marsh is constructed attached to the longshore dam bordering the port.

2.2. Design of the salt marsh test site

Local conditions prevent a salt marsh of growing naturally because the bed level is too low and there is too much wave energy. In 2018 the bed level was raised with sand obtained from capital dredging in the estuary and a rockfill dam was built to provide shelter. The new bed height for the projected salt marshes was set around Mean High Water level from 1.65 m to 1.05 m in a gradient of 1:140. In the 15 ha salt marsh site we created test plots delineated with brushwood groynes, Fig. 1. Three plots to the west differ in shape but all have a surface area of 2.3 ha. These plots have one opening in the groynes. They differ with respect to the percentage of clay and silt particles that were mixed through the top 1 m of the sandy bed resulting in 5, 20 and 50% silt. Three plots to the south have equal shapes, slopes and sizes. These plots are 1.8 ha (216 x 85 m) in size and have two openings in the groynes. They also differ in clay and silt percentage and in half of each of these plots seedlings of glasswort (*Salicornia europaea*) were sown. A total of 13,500 glasswort plants were manually collected and cut into about 100 pieces each. The 1,350,000 plant pieces were mixed with sawdust and put in freshwater to germinate. In May 2019 in each of the 9,000 m^2 test plots seedlings were sown with a density of 50 m^{-2}.

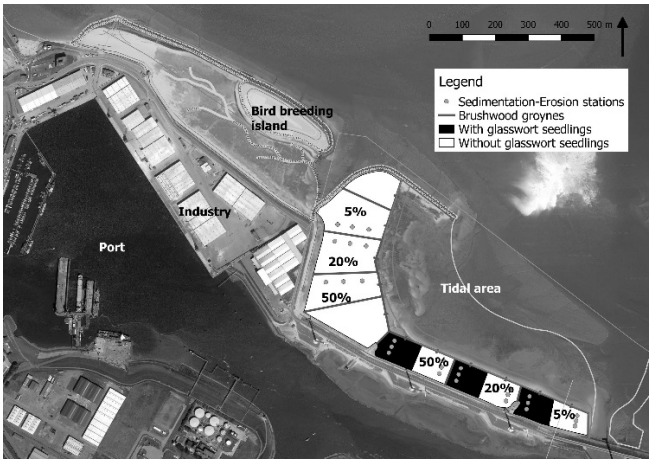

Figure 1: Design of the salt marsh test site.

2.4. Monitoring

A two year monitoring programme in 2019 and 2020 will determine sedimentation-erosion rates, development of drainage channels, bed height, flooding frequency, and density & condition of the glasswort seedlings. The biogeomorphodynamic developments will be analysed with respect to a.o. heights, slopes, silt percentages, and vegetation cover. Instruments include a.o. LiDAR drone, RTK-DGPS, Sedimentation-Erosion Bars, and Acoustic Surface Elevation Dynamics (ASED) sensors.

3. Conclusions

The presentation will elucidate preliminary results of the ongoing research.

Acknowledgments

This work was supported by the Dutch Waddenfonds. Cash and in-kind co-funding was received from the consortium partners of EcoShape. Manuscript writing is supported by the Wageningen UR Knowledge Base programme KB-36-003-009.

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