Bio-geomorphic controls on seaward marsh expansion and accretion

Silinski Alexandra[1], Erik Fransen[2], Tjeerd J. Bouma[3], Patrick Meire[1] and Stijn Temmerman[1]

[1] ECOBE, Department of Biology, Universiteit Antwerpen, Universiteitsplein 1C, 2610 Wilrijk, Belgium
E-mail: alexandra.silinski@uantwerpen.be

[2] StatUA Center for Statistics, Universiteit Antwerpen, Prinsstraat 13, 2000 Antwerp, Belgium

[3] Royal Netherlands Institute for Sea Research, Korringaweg 7, 4400 AC Yerseke, The Netherlands

Little is known on the mechanisms controlling horizontal seaward expansion of marshes and on the vertical sediment accretion rates that are associated with it. Key questions to resolve are: i) whether simple geomorphological conditions such as elevation are a major predictor of clonal marsh expansion rates; ii) whether there are seasonal vegetation-induced effects in sedimentation and erosion rates; and iii) how steep the spatial gradient in sedimentation and erosion rates is from the bare tidal flat into the vegetated marsh? These questions have been addressed with a two-scale study approach performed on two contrastingly wave-exposed marshes in the Scheldt Estuary (SW Netherlands and N Belgium) where *Scirpus maritimus* is the dominant pioneer species. On the one hand (i), we investigated the relations between large-scale, geomorphological parameters (elevation, slope) and clonal marsh expansion rates at both sites. On the other hand (ii), we performed a small-scale monthly field monitoring during two years at the same two marshes where we investigated the relations between spatio-temporal variations in vertical elevation change and spatio-temporal variations in vegetation properties along cross-shore transects. We found that at the sheltered site, clonal expansion rates were almost twice as high as at the exposed site. Furthermore, expansion rates at the sheltered site related well to elevation. At the exposed site, this relation was less strong as wave exposure might cause a dominant disturbance here. Moreover, we found clear seasonal sedimentation and erosion patterns that followed well the seasonal vegetation cycle, with prevailing sedimentation in summer when aboveground biomass was maximal and erosion in winter when plant shoots had largely decayed. Especially at the exposed site, the presence of vegetation had a positive effect on sedimentation within the marsh. Finally, our results show that clonal marsh expansion succeeded at elevations for which previous studies at the same locations showed that transplants of individual shoots could not establish, emphasising the importance of clonal integration for both survival and lateral expansion in disturbance-driven ecosystems.

Keywords: clonal marsh expansion; Scirpus maritimus; waves