EROSION PROTECTION BY WINTER STATE OF SALT MARSH VEGETATION

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Abstract

The potential of vegetation to provide coastal protection services, e.g. acting as wave/tidal energy buffer or stabilizing sediment, is now widely recognized. However, the lack of scientific data that quantifies the efficiency of ecosystem-based coastal protection and assesses the potential of coastal ecosystems to provide these services under changing climate conditions presently hampers their integration in coastal defense strategies. Of particular interest in this context is the efficiency at which coastal ecosystems can provide their protective services during winter, when coastal protection is most required but vegetation is least vital and mainly comprises of its root system and dead above ground biomass. To quantify how different salt marsh species stabilize the sediment during winter, experiments were conducted in a wave flume at Ludwig-Franzius-Institut. Inside the 2 m wide flume, a 1:10 slope was constructed which allowed the installation of soil samples at the still water level (60 cm). A total of six different samples were installed comprising of Spartina anglica and Elymus athericus sods with and without above ground biomass, respectively, and unvegetated soil in two states of compaction. Samples were exposed to irregular wave treatments with significant wave heights ranging from 6 to 20 cm for 1.5 hours with erosion measurements taking place every 30 min. Erosion measurements were performed with a sediment erosion table (SET) on each section and photos were taken for structure from motion (SFM) analysis. The SET measurements serve a calibration of the SFM data, which provides information about the erosion patterns and volume for the whole test area. Soil samples were taken to determine soil bulk density, root and organic matter content to explain the observed differences in erosion patterns between the different sections. Results show that erosion was stronger on the unvegetated sods followed by sods without above ground biomass with the least erosion at the sods with above ground biomass suggesting that even degraded above ground biomass has a sheltering effect for the soil surface. Moreover, differences between the two species could be seen under high wave energy conditions, where additionally erosion within the sods with above ground biomass was stronger for S. anglica than for E. athericus. E. athericus buckled under the wave forcing directly above the bed, forming a layer of flat stems and leaves above the bed which is likely to have had a sheltering effect on the soil.

Keywords
Soil stabilization, marsh zonation, bulk density, Spartina anglica, Elymus athericus