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Coastal protection capacity of saltmarshes remains high in the future

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Saltmarshes are acknowledged to be important coastal ecosystems for various ecosystem services they provide. Some of these services contribute to coastal protection which is increasingly accounted for in coastal protection and management strategies. To do so, it is necessary to project the coastal protection capacity of salt marshes into the future when climate change will not only affect hydrodynamic forcing onto the coast but also environmental parameters such as CO_2 content and temperature of the water.

In this study, we exposed the two salt marsh species *Spartina anglica* and *Elymus athericus* as examples for the pioneer zone and mid marsh, respectively, to enhanced CO_2 (800 ppm) and temperature (+3°) levels in the water in a mesocosm experiment for three months. These parameters were changed individually as well as in combination to mimic a future climate scenario and compared against a control treatment with ambient conditions. At the end of the experiment the effect on plant stem growth and biomechanics was assessed using a three point bending test. These plant traits feed into the interaction of vegetation with hydrodynamics and thus form the basis for wave and flow attenuation as important coastal protection ecosystem service.

Our results show that *Elymus athericus* did not respond to any of the treatments with respect to stem diameter, bending modulus, flexural rigidity and breaking force, suggesting that it is insensitive to such future climate changes. *Spartina anglica* does show an increase in diameter for all treatments compared to the control, but this increase only became statistically significant ($\alpha=0.05$) for the combined CO_2 and temperature treatment. Bending modulus as indicator for the stem's material composition showed inconclusive results for the two heights along the stem studied with a decrease under the future climate scenario 5 cm above ground and an increase at 15 cm above ground. Flexural rigidity, incorporating both the geometry as well as the plant material, showed an increase under the future climate scenario at both locations compared to the other treatments, but only at 15 cm above ground was this increase statistically significant. The maximum force experienced during the bending test and thus the force at which structural failure is experienced did not differ between treatments at all.

Overall it can be concluded that even though some differences between the future climate scenario and present conditions could be found, all values still lie within the natural trait ranges

found for the two species and thus traits relevant for the plant's interaction with hydrodynamics and the resulting ecosystem services wave and flow attenuation appear to be unaffected by CO_2 and temperature increases in the water due to climate change. Consequently, it can be anticipated that capacity of salt marshes to provide coastal protection ecosystem services will remain constantly high and will only be affected by future changes in hydrodynamic forcing.