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On the ability of plant life-history strategies to shape bio-geomorphologic interactions

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Previous work studying bio-geomorphologic interactions in intertidal habitats underlined the importance of wetland vegetation shaping their environment (e.g. tidal channel networks). Up to this point the potential of wetland vegetation to shape their environment was linked to their physical plant properties, such as stiffness, stem diameter or stem density. However the effect of life-history strategies, i.e. the mode of plant proliferation such as sexual reproduction from seeds, non-sexual lateral expansion or a combination of the former two was hitherto ignored. We present numerical experiments based on a wetland ecosystem present in the Western Scheldt Estuary (SW, the Netherlands) showing the importance of life-history strategies shaping bio-geomorphologic interactions. We specifically compare two extremes in life-history strategies, (1) one species solely establishing from seeds and relying on their mass recruitment (Salicornia europea); And a second species (Spartina anglica) which relies on a mixed establishment strategy consisting of seed dispersal and asexual lateral expansion through tillering, with a very low seed recruitment success per year. Based on conducted numerical experiments using TELEMAC2D we show that the Spartina-case facilitates relative low channel densities with pronounced channel networks, whereas the Salicornia-case favors high channel densities with less pronounced intertidal channels. The conducted numerical experiments are the first indication showing that plant proliferation strategies exert a major control on emerging patterns in bio-geomorphologic systems. This provides a deeper understanding in the constraining factors and dynamics shaping the emergence and resilience of bio-geomorphologic systems.