

Tidal marsh vegetation die-off: spatial developments and feedback mechanisms

Schepers Lennert¹, Matthew Kirwan², Glenn Guntenspergen³ and Stijn Temmerman¹

- ¹ Ecosystem Management Research Group (ECOBE), University of Antwerp, Universiteitsplein 1, 2610 Wilrijk, Belgium
E-mail: lennert.schepers@uantwerpen.be
- ² College of William and Mary, Virginia Institute of Marine Science, Greate Rd 1375, 23062 Gloucester Point, VA, USA
- ³ Patuxent Wildlife Research Center, U.S. Geological Survey, Center Road 308, 20705 Beltsville, MD, USA

The Blackwater marshes (Maryland, USA) have experienced large-scale vegetation die-off over the last century, resulting in a spatial gradient of increasing vegetation die-off with distance to the mouth of the Blackwater river. Marsh vegetation has several feedback mechanisms for keeping its elevation relative to sea level, compensating sea level rise: (i) marsh vegetation reduces flow velocities and attenuates waves, thereby promoting sedimentation. (ii) The plants produce above and below ground biomass, contributing in this way also to marsh accretion. When this vegetation disappears, however, these feedbacks are reversed: higher current velocities and waves keep sediment in suspension, and organic material is no longer accumulated. Moreover, higher current velocities and waves can erode the (degraded) soil.

However, we hypothesize that these feedback mechanisms all depend on the spatial patterns of vegetation die-off as these patterns determine the hydrodynamic forces: the size of the pools and how these pools are positioned relative to the tidal channel system will influence the currents and wave action. As an example, small pools surrounded by vegetation will experience low hydrodynamic forces compared to large pools that are directly connected to the tidal creek network. These hydrodynamic regimes will determine sedimentation and erosion processes and will affect in the long term the elevation of the marshes.

We studied the spatial patterns of vegetation die-off by remote sensing analysis, and the long-term effects of these patterns on sedimentation and erosion processes were investigated by field topography measurements.

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