

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

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The Blackwater marshes (Maryland, USA) have experienced large-scale vegetation die-off over the last century, with a spatial gradient of increasing die-off over a relatively short distance. The vegetation die-off has resulted in a complex mosaic of marsh vegetation and open water areas. These spatial patterns of vegetation die-off determine the hydrodynamic forces acting on these marshes: the size and the position of the die-off areas relative to the tidal channel system will influence the current and wave action. This will in turn affect geomorphic processes such as sedimentation and erosion.

We hypothesize that along the spatial gradient of increasing vegetation die-off, the die-off occurs initially in the marsh basins furthest away from channels, and then expands towards the higher-elevated natural levees along the channels. The pools coalesce and form bigger areas, and become increasingly connected to the tidal system. As a consequence, the initial effect of vegetation die-off on the hydrodynamic forces will be minimal. However, when the pools reach a certain size, or when they become sufficiently connected to the tidal channel, the hydrodynamic forces will become increasingly important.

We test these hypothesized patterns by quantifying the spatial and temporal patterns of vegetation die-off on aerial images from 1938 to 2010 with GIS analyses.