

Global-change effects on early-stage decomposition processes in tidal wetlands-implications from a global survey using standardized litter

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Abstract

© Author(s) 2018. Tidal wetlands, such as tidal marshes and mangroves, are hotspots for carbon sequestration. The preservation of organic matter (OM) is a critical process by which tidal wetlands exert influence over the global carbon cycle and at the same time gain elevation to keep pace with sea-level rise (SLR). The present study assessed the effects of temperature and relative sea level on the decomposition rate and stabilization of OM in tidal wetlands worldwide, utilizing commercially available standardized litter. While effects on decomposition rate per se were minor, we show strong negative effects of temperature and relative sea level on stabilization, as based on the fraction of labile, rapidly hydrolyzable OM that becomes stabilized during deployment. Across study sites, OM stabilization was 29% lower in low, more frequently flooded vs. high, less frequently flooded zones. Stabilization declined by ~ 75% over the studied temperature gradient from 10.9 to 28.5°C. Additionally, data from the Plum Island long-term ecological research site in Massachusetts, USA, show a pronounced reduction in OM stabilization by > 70% in response to simulated coastal eutrophication, confirming the potentially high sensitivity of OM stabilization to global change. We therefore provide evidence that rising temperature, accelerated SLR, and coastal eutrophication may decrease the future capacity of tidal wetlands to sequester carbon by affecting the initial transformations of recent OM inputs to soil OM.

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