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Integrating biogeomorphic feedbacks in the coastal zone to bolster coastal resiliency

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Living shorelines, defined in this study as narrow marsh fringes with adjacent sills, have been gaining traction as the preferred management strategy to mitigate shoreline erosion. These nature-based features provide the same ecosystem services as natural marshes while protecting coastlines. However, they also are threatened by the same environmental changes (sea-level rise, changing sediment supply) as natural marshes and may change characteristics of adjacent subtidal sediments. This study evaluates the role of plants in both the created marshes of living shorelines and, where present, beds of submersed aquatic vegetation (SAV) in the adjacent subtidal in the effectiveness, impacts, and resiliency of living shorelines over ~10 years in mesohaline Chesapeake Bay. At study sites, there is a net seaward movement of shorelines with living shoreline installation due to construction technique. This movement replaces shallow-water habitat immediately adjacent to the pre-existing shoreline; farther offshore, sedimentological changes vary among sites but do not appear to drive changes in the presence/absence of subtidal SAV. While current accretion rates in the created marshes are greater than local relative sea-level rise, there is evidence that accretion rates increase with marsh age, suggesting that living shorelines are most vulnerable in the first few years after installation. Because nutrient burial is maximized when SAV occur next to living shorelines, a management strategy that considers the subtidal and intertidal as integrated components of the coastal system is needed to optimize co-benefits of coastal protection.