Wetland loss patterns and inundation-productivity relationships prognosticate widespread salt marsh loss for southern New England

Elizabeth Burke Watson, E.B.[1,2✉], Cathleen Wigand[1], Earl W. Davey[1], Holly M. Andrews[3], and Joseph Bishop[1]

[1]Atlantic Ecology Division, ORD-NHEERL, U.S. Environmental Protection Agency, Narragansett, RI, USA

[2] current address: Department of Biodiversity, Earth & Environmental Sciences, Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA

[3]Department of Ecology and Evolutionary Biology, University of Michigan, Ann Arbor, MI, USA

[✉]corresponding author: elizabeth.b.watson@gmail.com, 831.345.6353

Abstract

Tidal salt marsh is a key defense against, yet is especially vulnerable to, the effects of accelerated sea level rise. To determine whether salt marshes in southern New England will be stable given increasing inundation over the coming decades, we examined current loss patterns, inundation-productivity feedbacks, and sustaining processes. A multi-decadal analysis of salt marsh aerial extent using historic imagery and maps revealed that salt marsh vegetation loss is both widespread, and accelerating, with vegetation loss rates over the past four decades summing to 17.3%. Seaward retreat of the marsh edge, widening and headward expansion of tidal channel networks, loss of marsh islands, and the development and enlargement of interior depressions found on the marsh platform contributed to vegetation loss. Inundation due to sea level rise is strongly suggested as a primary driver: vegetation loss rates were significantly negatively regressed with marsh elevation (r^2=0.96; p=0.0038), with marshes situated below mean high water (MHW) experiencing greater declines than marshes sitting well above MHW. Growth experiments with *Spartina alterniflora*, the Atlantic salt marsh ecosystem dominant, across a range of elevations and

inundation regimes further established that greater inundation decreases belowground biomass production of this species, and thus negatively impacts organic matter accumulation. These results suggest that southern New England salt marshes are already experiencing deterioration and fragmentation in response to sea level rise, and may not be stable as tidal flooding increases in the future.