Influences of Soil Composition and Measurement Time Span on Marsh Accretion Rates

Brandon Boyd & Christopher K. Sommerfield

School of Marine Science and Policy, University of Delaware, 700 Pilottown Rd, Lewes, DE 19958

Marsh accretion studies are increasingly undertaken by coastal scientists and managers to address questions of wetland sustainability in the face of accelerated sea-level rise and human pressures. Linear accretion rates (length/time) driven by some combination of organic and mineral mass accumulation rates (mass/area/time) are frequently the focus of such studies. Mass accumulation varies widely within and among different types of wetlands, thus understanding the nature of accumulation is essential when interpreting measured accretion rates. Additionally, mass accumulation and accretion rates exhibit methodological differences related to the time span of averaging. Rates are generally higher on short time spans (weeks to years) when measured using sediment plates or marker beds than rates averaged over longer time spans (decades to millennia) by radionuclide chronometry. While the inverse relationship between accumulation rates and time span is a truism of stratigraphy, it is not squarely addressed in the marsh accretion literature.

This study explores influences of marsh accretion rates on soil composition and averaging time span using a large suite of data from the tidal wetland coasts of Delaware Estuary and Barnegat Bay. For wide range of tidal freshwater, brackish and salt marshes we show that organic accumulation sets the lower limit of marsh accretion rates whereas mineral accumulation sets the upper limit. Moreover, we demonstrate that mass accumulation and marsh accretion rates are inversely related to the period of averaging and exhibit rate vs. time-span trends similar to other types of coastal and marine sedimentary environments. These findings have important implications to the use of marsh accretion rates in restoration projects and projections of wetland stability under scenarios of sea-level rise.