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This study examines composition, source, and amount of organic matter at the Sprague River salt marsh in southern Maine in order to gain insight into the history of carbon cycling, sea level change, alterations in paleoenvironmental conditions, and salt marsh dynamics. The organic matter within the different sediment layers in a sediment core taken from Sprague Marsh has been analyzed, thus providing an integrated 4,000 year record of organic carbon cycling. These long-term records of carbon cycling are essential to comprehend natural fluctuations of the biosphere in a coastal salt marsh.

In this study, a multi-proxy approach is utilized to detect the shifts in carbon deposition and preservation, by determining bulk indicator (rhizomes, %LOI, %carbon) trends and geochemical (fatty acids, stable isotopes, and C/N values) trends downcore. These multiple proxies were coupled within the four distinct stratigraphic units in the core in order to assess fluctuations in carbon cycling as Sprague Marsh evolved thousands of years ago.

Diagenetic processes occurring within the salt marsh peat allows for carbon accumulation and sequestration at Sprague Marsh to be approximated. Because rates of accumulation are extremely high in salt marsh environments, net carbon sequestration is potentially substantial (Chmura, et al., 2003) once the carbon becomes buried. The total carbon accumulation in the peat at Sprague Marsh was calculated to be about 6 tons of carbon per year. A rapid and significant rise in sea level in response to an increase in greenhouse gases could prevent the vertical accretion of sediment in the marsh, resulting in the submergence of soil surfaces, thus subjecting the edges of the remaining marsh area to lateral erosion, ultimately releasing carbon stored from their deposits (Chmura, et al., 2003). Therefore, improving our understanding of carbon cycling and deposition in coastal environments is important in providing a baseline for assessing recent human impact on salt marshes.