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High Resolution Mapping of Carbon Stocks and Sequestration and Organic Matter Sources over the last 2000 Years in the Sprague River Marsh, Phippsburg Maine

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Salt marshes are regarded as key blue carbon stocks with high rates of carbon sequestration due to tidal inundation. However, the impacts that rising sea levels and human development and alterations to salt marshes have on carbon stocks and organic matter deposition have yet to be fully understood. The Sprague River Marsh, in Phippsburg Maine, has been subject to many alterations through the last 400 years (ditching, the building of a tidal restriction and the dredging and redirection of the natural tidal channel). This study analyzes the geochemical records (carbon density and sequestration, d13C, d15N, and C:N ratio) of 40 previously collected sediment cores and 3 new sediment cores, from the Sprague River Marsh. The carbon density data were used to identify areas of high carbon stocks within the upper meter of the marsh. The northernmost area of the Sprague Marsh had significantly higher carbon stocks than elsewhere. The stable isotope data were parsed into different time intervals (0-50, 50-100, 100-200, 200-300, 300-500, 500-1000, 1000-2000 YRS BP) based on an age model derived from 7 radiocarbon dates. Marsh surfaces were mapped using ArcGIS and Empirical Bayesian Kriging to identify areas and times where organic deposition was dominated by high salt marsh, upland plant input, or marine input. These marsh surface reconstructions illuminate shifts in organic matter deposition with changes in relative sea level rise (in agreement with Johnson et al., 2007), the dredging of the tidal channel, marsh evolution and colonization, and growth of the marsh prior to European Colonization. This detailed history of Sprague Marsh can be used to identify areas of high carbon content and the number of sediment cores needed to accurately reconstruct marsh history and analyze and predict carbon stocks.