Carbon Sequestration in the Oldest Tidal Wetland Restoration Projects Along the West Coast, USA

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Tidal wetland restoration, often implemented by re-introduction of tidal flow, is a critical tool to increase coastal wetland area and enhance ecosystem services and resiliency to sea level rise in tidal wetlands. Although billions of dollars have been spent on restoration over decades, we still have limited information on some of the oldest projects and how their condition can inform future restoration efforts. Restoration practitioners, managers, scientists, and coastal policy makers need data on restoration outcomes and trajectories to plan future projects and quantify restoration benefits. Working with four west coast NERRS reserves, regional blue carbon working groups, and other partners, we compiled data on wetland elevation, vegetation communities, and carbon sequestration in eleven older restoration sites (10 to 60 years, post-restoration) and adjacent reference wetlands in California, Oregon, and Washington. We also used existing data sets and conducted targeted new sampling to examine restored site condition and relationships between vegetation, elevation, estuary landscape features, and carbon sequestration and storage. The rate of carbon sequestration is the product of sediment carbon density and the rate of sediment accretion. We found that over all sites, restored and reference, sediment accretion, rather than carbon density, was the best predictor of carbon sequestration. Additionally, rates of sediment accretion equaled rates of sea level rise in nine of the eleven restored sites and all eleven reference sites. While rates of sediment accretion and carbon restoration were similar in the reference and their paired restored sites, carbon densities were still lower in the restored sites, even decades after restoration. Finally, we describe a “blue carbon restoration trajectory” wherein rates of accretion and carbon sequestration are initially high in the restoration sites (often higher than in the paired reference sites) and then decrease and stabilize over time. Conversely, carbon densities start low in the restoration sites and gradually increase over time.