Disentangling the Effects of Salinity on Coastal Forest Carbon Balance: from Genes to Landscapes

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Coastal forests are not usually considered part of blue carbon projects. However, a recent paper made the case that all coastal tidal wetlands should be considered blue carbon. Coastal forests store large amounts of carbon and are vulnerable to sea level rise and climate change. We have been studying the effects of salinity and flooding on carbon stores and fluxes from coastal forests across multiple temporal and spatial scales. Increased salinity and flooding alter emissions of greenhouse gases, and the direction and magnitude vary depending on their interactions. While most studies have found that methane decreases with increasing salinity, we have found that low salinity increases can lead to increased methane emissions. In microcosm experiments, sulfate did not change microbial community composition, or gene expression, while other cations in saltwater led to changes. Across landscapes, flooding, salinity, and elevation led to plant communities shifting from forest to marshes, creating ghost forests in the process. Snags that are common in ghost forests can facilitate the movement of CO_2 but also serve as sites of CH_4 oxidation. Microbial communities found in snags confirm their CH_4 oxidation potential. Using remote sensing, we have identified trajectories of change, which can be used to prioritize conservation and restoration practices in the face of climate change and sea level rise. Overall, we postulate that coastal forests can play an important role in the blue carbon space, but more information is needed on how changing water levels and salinity will alter greenhouse gas emissions and carbon stocks to fully account for the permanence of these systems. Protection of existing coastal forests provides many other ecosystem services beyond carbon storage, such as biodiversity habitat and storm surge protection, and should be promoted.