Assessing Salt Marsh Greenhouse Gas Fluxes by Planting Treatment Across Salinity and Elevational Gradients

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Management interventions involving sediment addition are applied to tidal marshes to raise the marsh elevation, reduce inundation frequency, and support wildlife habitat and carbon-based functions. Sediment addition alters marsh salinity and inundation regimes which are both linked to carbon cycling. The response of greenhouse gas emissions to sediment additions, however, is understudied. We leveraged a recent sediment addition project that created 14 experimental hummocks (mounds of sediment that varied from 1.15 - 1.71 meters above sea level) that were planted with different native grass species combinations and densities in Stratford, Connecticut (USA) to investigate how carbon gas fluxes varied along elevational and salinity gradients, and vegetation type. We quantified CO_2 and CH_4 emissions (2023, 2024) and net ecosystem exchange (2024) using static flux chambers from 140 plots subjected to varied sediment addition depths and planting treatments. We observed positive methane emissions across most plots with high variation (median = 15.22 mg/m^2 per day; range = -8.47 to 3993.88 mg/m^2 per day), but emissions were not significantly correlated to gradients of salinity, elevation, or planting treatments. In contrast, CO_2 emissions were positively correlated with elevation and negatively correlated with salinity. The relationship between salinity and CO_2 emissions also varied among planting treatments, which may be linked to the observed positive correlations among species diversity, total vegetation cover, and CO_2 emissions. We are in the process of analyzing carbon emissions and net ecosystem exchange data from the third growing season post-restoration (2024), which will provide more information about temporal heterogeneity in carbon fluxes and whether the carbon sink strength varies among plots. Our preliminary findings suggest that CO_2 emissions from experimental hummocks were influenced by elevation, salinity, and vegetation communities, whereas CH_4 fluxes were net positive but not well explained by studied parameters. Results will be synthesized to inform salt marsh carbon storage considerations for future conservation interventions involving sediment addition.