Meta-Analysis Describing How Plant Species Composition Drives Salt Marsh Greenhouse Gas Fluxes

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Salt marshes are considered net carbon sinks, yet there is substantial uncertainty about the factors driving variability in greenhouse gas (GHG) fluxes, which may offset their net climate benefits. Salt marsh plants fix carbon dioxide (CO_2) into organic carbon that can be buried and stored long term. Salt marshes also emit CO_2, methane (CH_4), and nitrous oxide (N_2O). Because plants differ in their tolerance to stress and competitive ability, their presence or absence indicates salt marsh environmental conditions. Additionally, plants shape the environmental conditions in which they grow, which can, in turn, alter GHG fluxes. We hypothesize that plant species composition integrates long-term salt marsh conditions and thus will be a strong predictor of GHG fluxes. Although individual studies compare salt marsh GHG fluxes across different vegetation types, a global synthesis is needed to determine if the relationship between vegetation and GHG fluxes can be used as a predictor of fluxes in order to estimate the GHG sink capacity of salt marshes. Here we will present the results of a global meta-analysis of 118 peer reviewed studies that measure salt marsh GHG fluxes across different vegetation types. We extracted the study location, month of sampling, method of sampling, plant species composition, respiration (CO_2), net ecosystem exchange (NEE, CO_2), CH_4 flux, and N_2O flux. We also extracted environmental parameters (e.g., salinity, tidal range, photosynthetically active radiation, soil temperature, pH, etc.). We used Hedge's *g*, an approach used to calculate standardized mean differences in meta-analyses, to calculate pairwise comparisons of fluxes between *Spartina alterniflora* and different species within a marsh. Additionally, we ran mixed-effects meta regression models with study ID as a random effect to explore potential factors driving differences in fluxes. Plant species, season, salinity, tide, and sampling method were included as moderators in the model and explain heterogeneity in effect sizes. These results can be used by coastal managers to more accurately estimate the carbon sink capacity of salt marshes, enabling better-informed conservation and management strategies.