Goldschmidt 2024 Abstract
https://doi.org/10.46247/gold2024.24415

Changes in Soil Organic Matter Composition and Microbial Communities due to Coastal Wetland Migration

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Coastal wetlands are rapidly disappearing or migrating under pressure from sea level rise. In the Chesapeake Bay watershed in the United States, the rate of change is accelerated due to local land subsidence. It is crucial to understand the biogeochemical shifts of these changing wetlands to effectively implement restorations and predict wetland migration patterns. We are partnering with the Maryland Chesapeake Bay National Estuarine Research Reserve to investigate shifts in soil carbon composition and microbial communities from sea level rise. Our hypothesis is that specific microbes and pools of soil organic carbon (SOC), which are associated with higher levels of inundation and saltwater intrusion, can serve as tracers of wetland biogeochemical cycling to help predict trajectories of wetland accretion or collapse. Using Fourier transform ion cyclotron resonance mass spectrometry (FTICR-MS), we are characterizing changes in SOC and how they correlate with microbiome transitions characterized with meta-omics. We are connecting these small-scale biogeochemical shifts to landscape-scale changes in elevation, salinity, and vegetation using over a decade of field observations in the region. Our work will enable new predictions of which marshes may be lost or negatively impacted and where wetlands are likely to migrate.