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Soil, Plant, and Microbiome Tracers of Coastal Wetland Migration

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Coastal wetlands store carbon, protect coastlines from storm impacts, maintain biodiversity, mitigate organic and heavy metal contamination, and fuel local economies. Caught between rising seas and urban development, coastal wetlands may disappear without timely management decisions. Wetlands of the mid-Atlantic region of the USA are especially at risk due to local land subsidence following the last ice age, causing relative sea levels to rise at a rate greater than the global average. We are partnering with the Maryland Chesapeake Bay National Estuarine Research Reserve (CBNERR-MD) to better predict patterns of wetland migration in the region. Our hypothesis is that specific microbes and pools of SOC, including mineral-associated organics, can serve as both short-term and long-term tracers of wetland biogeochemical cycling to help predict trajectories of wetland accretion or collapse under various stressors. We are investigating the use of these biogeochemical tracers to predict marsh accretion and plant dynamics during rapid sea level rise. Using Fourier transform ion cyclotron resonance mass spectrometry (FTICR-MS), we are studying the evolution of these tracers 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, where wetlands are likely to migrate, and which farms and homes will be especially vulnerable to flooding and saltwater intrusion under different climate-change scenarios.