BIOGEOCHEMICAL AND SURFACE ELEVATION CONTROLS OVER TIDALLY INFLUENCED FRESHWATER FORESTED WETLANDS AS THEY TRANSITION TO MARSH

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Many coastal ecosystems along the south Atlantic are transitioning from forested wetlands to marsh due to increasing tidal inundation and saltwater intrusion primarily attributed to global climate change processes. In 2004, we established long-term research sites in Georgia, South Carolina, and Louisiana to understand how climate factors (temperature, precipitation, streamflow, sea-level rise, droughts, and hurricanes) interact to elevate soil salinities and flooding that collectively foster forest dieback and habitat conversion in tidal freshwater forested wetlands of the Southeast. We have documented changes in forest structure and growth of trees in swamps of South Carolina, Georgia, and Louisiana from 1988-2014 subjects to a variety of flooding regimes. We found that as estuarine influence shifts inland with sea-level rise, forest growth becomes linked to salinity and salinity-induced changes in nutrient availability. While litterfall estimates seem to be well defined with 3–5 years of data, stem growth across hydrological gradients in some areas are still not clear even with 10 years of data. We found that salinity, soil total nitrogen, flood duration, and flood frequency affect forest diameter increment, litterfall, and basal area the greatest, and in predictable ways. Even small concentrations of salinity (e.g., < 2 g/L) can drastically decrease basal area increment growth rates and litterfall production, lead to increased nitrogen mineralization, and reduce surface elevation in these intertidal forests with inherently low sedimentation rates and thereby exacerbate encroachment of marsh vegetation. Conversion to oligohaline marsh is associated with increased sediment nutrient inputs that may then increase herbaceous productivity, further increase sediment trapping, and enhance the resilience of tidal wetland surface elevation to sea-level rise. These changes in soil nutrients can be slow to affect the ecosystem, but have long-lasting effects on productivity and permanent changes in the composition of forest stands. Based on long-term data, we will describe processes as determined from two primary river systems in the Southeast, and describe a way forward in understanding whether other river systems transition similarly with increasing salinity.

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