# Tidal connectivity and coastal wetland biogeochemistry

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The biogeochemistry of coastal marshes is strongly influenced by the balance of marine and freshwater inputs. Coastal development can tip this balance by restricting tidal hydrology and converting salt marshes into freshwater wetlands. Removing tidal restrictions restores saltwater flow and has the potential to return impacted wetlands back into salt marshes. We investigated the efficacy of removing tidal restrictions in restoring salt marshes using a chronosequence, or space-for-time substitution design. We characterized plant communities and soil processes in 7 temperate marshes that had been tidally restricted for 100 y before the restrictions were removed 4-14 y ago, as well as in two unrestored wetlands. Each restored or unrestored marsh was paired with a nearby natural site. Soil pore water chemistry was similar between natural and restored sites, regardless of time-since-restoration, reflecting the reestablishment of tidal connectivity and suggesting that microbial communities responded rapidly. Saltwater inputs altered plant species composition and community characteristics, as freshwater species became rare and abundances of salt tolerant grasses increased within 4 y. The shift in the dominant plant species altered soil properties and organic matter composition. Mirrored shifts in plant and soil properties were often independent of the time-since-tidal restoration gradient. Instead, site specific characteristics, such as elevation, were important predictors of ecosystem properties. Overall, marsh biogeochemistry responded rapidly to tidal restoration but local hydrology may be better a predictor of recovery rate than time-since-restoration.