Hydrology in a peaty high marsh: hysteretic flow and biogeochemical implications

Jody Stecher, Jessica Moon, Bob McKane, Ted DeWitt

Terrestrial nutrient input to coastal waters is a critical water quality problem worldwide, and salt marshes may provide a valuable nutrient buffer (either by removal or by smoothing out pulse inputs) between terrestrial sources and sensitive estuarine habitats. One of the major challenges in characterizing whether salt marshes provide this ecosystem service is quantifying the role of subsurface nutrient processing. This in turn depends on tidal/rain infiltration, water movement through variably porous layers of the marsh, and biogeochemical processing within those layers. To address the hydrologic controls, we installed groundwater and piezometric wells in various portions of a well-studied, 2-hectare, meso-haline salt marsh in Yaquina River (Oregon) estuary. Analysis of sediment cores for texture, organic content and bulk density revealed 10-20cm of porous, compressible peat overlying approximately 1.5 m of relatively impermeable clay/silt in the high marsh, which comprised >80% of marsh area. Water infiltrated the surface peat layer very rapidly on overtopping tides and rain events, and pore space remained filled for hours to days depending on precipitation. The water holding capacity in the upper 15 cm along with dry period percolation data was used to estimate flow rate through the system under both dry and saturating precipitation conditions. The implications for solute introduction and transport, along with how this may affect nitrogen dynamics, will be discussed.