

Controls on the chemical hydrology and associated ecological structure and function in mangroves, Indian River Lagoon, Florida.

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Recent studies indicate that hydrological processes control ecosystem structure and function in mangroves systems. To date, however, few ecological processes have been directly related to variations in hydrological conditions in mangrove systems. In Florida, many of these mangrove systems are on barrier islands in the Indian River Lagoon, a series of connected estuaries that extends ~250 km along the east coast of Florida. In this study area salinities vary spatially, with surface water and groundwater salinities ranging from ~10 in the upland, to ~30 in the regularly-flushed mangroves, to ~75 in the irregularly-flushed mangroves. However, salinities do not significantly differ seasonally, and cation and anion concentrations do not vary spatially or seasonally. Resistivity and electromagnetic geophysical surveys have also been completed to examine terrain conductivities. The survey results show that there is no fresh water present in the substrate until the vegetation transition from mangrove to maritime hammock. These results indicate that salinity variations in the mangrove ecosystem are largely due to mixing between precipitation and lagoon water and the subsequent evapoconcentration in the irregularly-flushed areas rather than to precipitation and subsequent freshwater runoff and recharge. The spatial variations in salinities correlate with spatial variations in species composition and abundance, with maritime hammock, red mangrove, dense black mangrove, sparse black mangrove, and salt pan being arranged on a gradient of increasing salinities. In turn, spatial variations in nitrogen mineralization, nitrification, and denitrification correlate with spatial variations in species composition and abundance. In particular, denitrification rates are lowest in the areas with salinities in the range of 30 and 75, corresponding with red mangrove and salt pan habitats. Denitrification rates in the black mangrove and maritime hammock are very similar. Microbial activity studies also show species clusters correlating with habitats and the subsequent salinity ranges.

Keywords: hydrology, mangroves, nitrogen, evapoconcentration

Challenge Addressed: ecosystem health and function and water sustainability.