Understanding Global Environmental Trends in Local Wetland Settings

Alexander S. Kolker[1], Steven L. Goobred[2], J. Kirk Cochran[1], Sultan Hameed[1,2]
Fred Mushacke[4] and Robert C. Aller[1]

Throughout the 20th century, human activity and climate variability interacted with local geomorphology to produce a range of depositional environments salt marshes in Long Island, NY. In a set of physically diverse marshes, accretion rates were determined using the naturally occurring radioisotope, ^{210}Pb. By assuming a constant rate of supply of the isotope to the marsh surface and limited mixing, it was possible to construct detailed accretion rate chronologies that could be compared to climate proxies. The tidal gauge record and indices of global climatic oscillations proved particularly useful. Accretion rates in a high tidal range, fetch- limited environment typically tracked changes in the long term position of annual mean sea level. In contrast, in marshes situated in exposed embayments with lower tidal ranges, accretion rates frequently correlated with short-term changes in mean sea level that are likely forced by meteorological processes. Ironically, rates of salt marsh loss are apparently decoupled from accretion rates, suggesting that accelerated sea level rise is not the principle driver of marsh loss in these Long Island salt marshes. Instead, marsh loss rates closely track patterns of anthropogenic influences. This marsh loss may be driven by eutrophication and organic matter loading, which perturb the salt marsh sulfur cycle and lead to plant die-offs and the deterioration of marsh peat. These findings suggests that the coastal environments that are most impacted by human activities will be those that are most vulnerable to climate change. Wetland restoration is possible, but should address the underlying causes of wetland loss to be most successful.

[1]Marine Sciences Research Center, Stony Brook University, Stony Brook, NY 11794-5000
[2]Department of Earth and Environmental Sciences, Vanderbilt University, Nashville, TN 37235-1805 USA
[3]Institute for Terrestrial and Planetary Atmospheres, Marine Sciences Research Center, Stony Brook, NY 11794-5000

[4]Bureau of Marine Resources, New York State Department of Environmental Conservation, East Setauket, New York 11733 USA