

Pollution Markers Identified with XRF Provide Parameters to Help Preserve Urban Estuary Marshes

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Coastal marshes in New York City's Jamaica Bay are eroding due to sea level rise, much like marshes in urban estuaries throughout the world. These important environments provide storm protection for nearby communities, enhance water quality, and are a critical habitat for many species. Key to preserving and restoring these ecosystems is a full understanding of their accretion relative to sea level. We will present a detailed analysis of a sediment core from the marsh island, Jo Co, in Jamaica Bay, New York City, including a quantification of mineral and organic flux. Accretion rate over the past 300 years is modeled using two different Bayesian approaches. Input for the accretion rate models is a set of age marker horizons based on pollution and land-use change indicators revealed using a suite of methods including pollen and charcoal analysis, X-ray fluorescence spectroscopy of elemental chemistry, stable isotope analysis, and radiocarbon dating. We find that the flux of organic matter to the sediment from in situ vegetation is sufficient to allow the marsh surface to keep up with rising sea level. However, the flux of mineral sediment has decreased dramatically, resulting in structural weakness and edge failure. Modern infrastructure now prevents natural accumulation of mineral sediment, but this quantitative analysis provides guidelines for artificial sediment addition. Based on these results, recommendations have been made to government agencies regarding thin layer sediment spraying and cessation of dredging elsewhere in the estuary to preserve and restore these estuarine environments.