Contribution of Cultural Eutrophication to Marsh Loss in Jamaica Bay (NY)

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Loss of salt marsh area in the Jamaica Bay Estuary (NY) has accelerated in recent years, with loss rates as high as 45 acres per year. A contributing factor to this acceleration is likely cultural eutrophication due to over 6 decades of sewage effluent inputs. We examined marsh soils for a eutrophication signal using stable nitrogen isotope ratios and radiometric dating in Jamaica Bay. A noticeable increase in the stable nitrogen isotope ratio was observed in the soils beginning in the 1850s corresponding with an increase in people settling in the surrounding watersheds. Both human population and stable nitrogen isotope ratios increased until the 1930s, which coincided with the initiation of sewage treatment operations in the Jamaica Bay watersheds. Significantly higher soil respiration rates were measured at the disappearing Black Bank marsh compared to the stable JoCo marsh. In addition, Black Bank soils were sapric (more decomposed), and had significantly higher bulk densities and lower organic matter than JoCo. Significant loss of roots, rhizomes, and organic matter was also observed in the deeper soils at the Black Bank marsh. These data suggest that salt marsh losses in this system may in part be a result of loss of belowground peat and support the idea that the marshes are deteriorating from the bottom up, with subsidence and ponding contributing to marsh loss. With the additional stress of climate change (e.g., accelerated sea level rise, increases in storm and precipitation events), eutrophication effects in northeastern United States urbanized areas may cascade into even more accelerated losses of marsh areas.