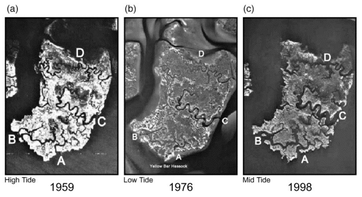
Visualizing Factors in Salt Marsh Disappearance

Anthropogenic-Induced Stresses in Jamaica Bay, New York

BACKGROUND

Jamaica Bay is a 20 square mile tidal wetland on the outskirts of New York City, straddling the boroughs of Brooklyn and Queens. The Bay is one of the largest and most varied collections of fish and both migrating and nesting birds on the Eastern Seaboard, even though it is located wholly within the borders of the largest city in the U.S. Many islands and salt marshes dot the bay, most of which are part of the Gateway National Recreation Area – a division of the National Park Service that protects the region.

Over the past century, the salt marshes have been disappearing at an alarming rate – a rate that has been increasing in recent decades. Less than half of the island wetlands present in 1900 still exist, as their cumulative size has decreased from 2,300 to 1,000 acres. Current estimates predict that, without intervention, all of the marshes could be gone by 2024.



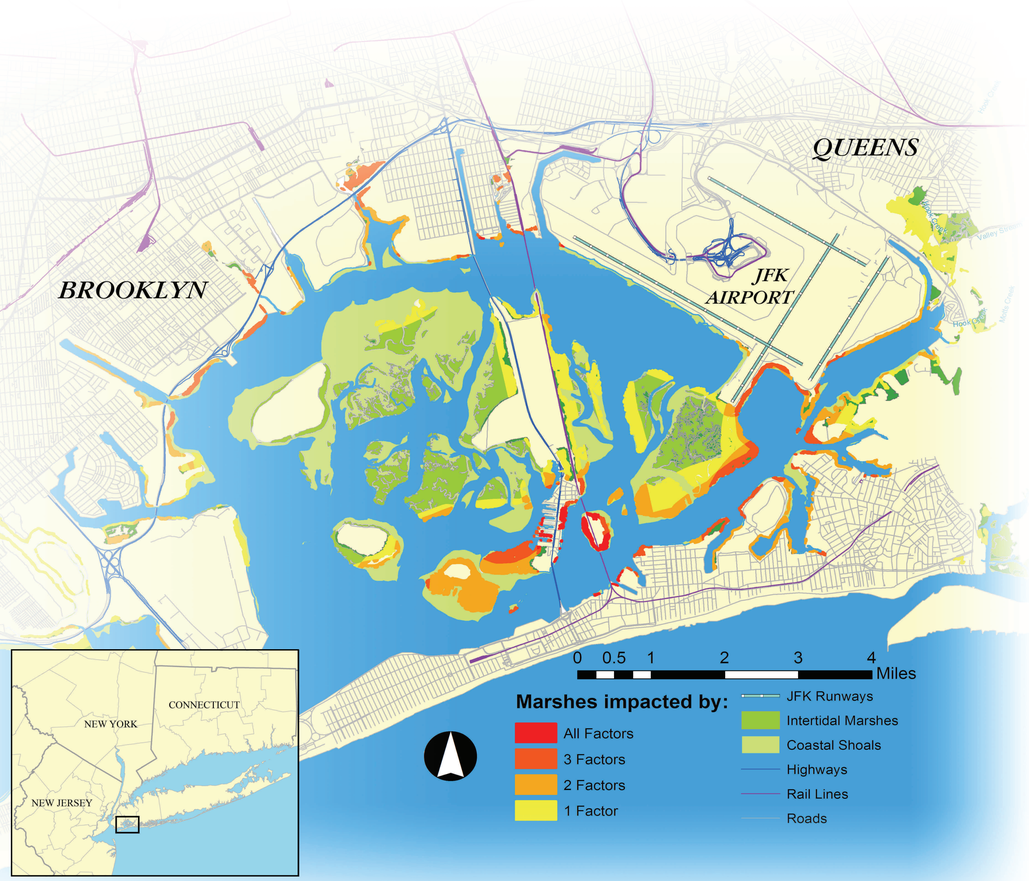
Yellow Bar Hassock, Gateway National Recreation Area, NY

In 2006, the U.S. Army Corps of Engineers undertook a marsh restoration effort that added sediment, sand, and native vegetation in order to restore a 48-acre marsh site. Plans for future action include spraying a thin layer of sediment onto marshes to elevate them, and examining the effect contaminants have on the ecosystem. Understanding where the marshes are most vulnerable is important for pinpointing the next potential sites for restoration.
Healthy salt marshes significantly contribute to the overall environmental health of the region, as they offer nurseries for fish, birds, and other wildlife, as well as counterbalance global warming and urban pollution by trapping carbon and chemicals.

METHODOLOGY

Scientists and researchers first noticed marsh disappearance through studying aerial photographs and noticing unusually high mussel counts, which suggests increased water logging in the marshes. While scientists and researchers have not yet arrived at a definitive conclusion as to why they are disappearing, most agree that the greatest contributing factors are various types of anthropogenic-induced stress. This is evident in research that highlights a much faster rate of marsh disappearance in Jamaica Bay compared to other tidal wetlands in less developed areas on Long Island.

For this study, the four most commonly cited anthropogenic-induced stresses were chosen for in-depth analysis: wave action from boat wakes, the sewage released from Combined Sewer Overflows (CSOs), the presence of Wastewater Treatment Plants and Hazardous Waste Landfills, and runoff from transportation infrastructure. A final map was created that highlights where the factors overlap, and thus where the U.S. Army Corps of Engineers and other restoration groups should focus their marsh rebuilding efforts.

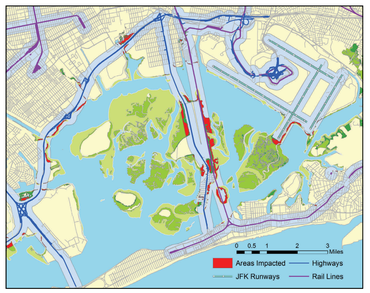


RESULTS & CONCLUSIONS

The final map highlights areas where salt marshes are impacted by one or more factors included in the study. It appears these areas in most danger (highlighted in red) are located in the areas closest to urban development, particularly those located near Broad Channel, the island that bisects the bay. This island contains many docks for recreational boats which must navigate through the marshes to reach open water. The resulting boat wakes churn up sediment, which in turn erodes and inundates salt marshes. These areas are also close to the multiple CSOs, sewage treatment facilities, hazardous waste sites, and transportation corridors that leech toxins unhealthy to both the marsh grass and the overall ecosystem.

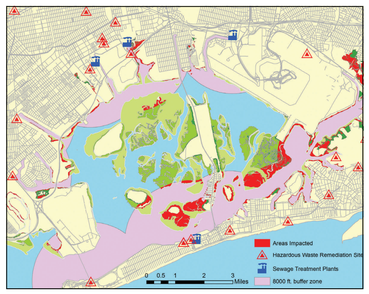
While this study highlights particular marshes in the greatest current danger, and thus areas where restoration efforts should focus, it is by no means a definitive answer as to what specific factors are causing marsh disappearance throughout the bay. Using buffers with specific sizes is useful for determining the immediate effect of each factor; however, it is much more difficult to determine the extent to which toxins will affect the bay as a whole. In addition, some researchers cite the dredging that occurred pre-1970 as still having an effect on salt marsh disappearance today. Others point to sea level rise due to climate change, a global occurrence. Future studies could attempt to account for these more distant factors, both in time and scale, through looking at other similar marshes on Long Island and elsewhere that have not experienced the same level of marsh disappearance as Jamaica Bay.

TRANSPORTATION INFRASTRUCTURE



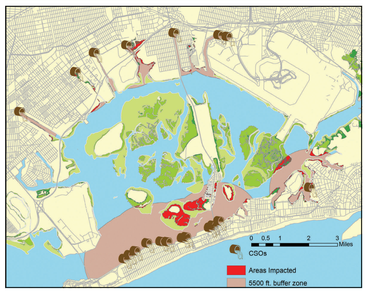
Urban infrastructure for multiple modes of transportation surrounds the bay, including highways and major roads, subway train tracks, and runways at JFK airport. Motor oil and diesel fuel runoff can be damaging to the aquatic ecosystems vital to marsh health.

SEWAGE TREATMENT PLANTS & HAZARDOUS WASTE SITES



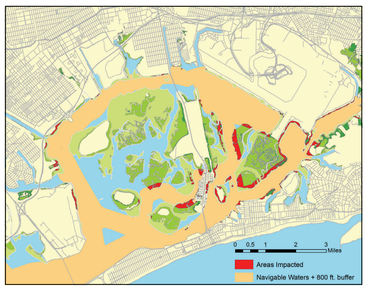
Wastewater treatment sites load the bay with excess nutrients, including nitrogen and hydrogen sulfide. This leads to an increase in the abundance of mussels that waterlog marshes and destabilize their root network. Hazardous Waste Landfills leach toxins into the bay that can undermine overall marsh health and sustainability.

COMBINED SEWER OVERFLOWS (CSOs)



CSOs are opened up when the city sewer system experiences particular stress, typically during rainstorms. During those times, they release mixtures of domestic sewage, storm water runoff, and industrial wastewater. They also may contain toxic chemicals and pollutants that can pose risks to aquatic health.

NAVIGABLE WATERS FOR SHIPPING AND RECRATION



While dredging projects in the bay were halted in the 1970s, there remains one channel in the bay that is deep enough for shipping boats and a few more that are suitable for recreational boating. Boat wakes create wave action that loosens sediment and can drown marsh grass.

Cartographer: Benjamin Silverstein

Data Sources: New York City Department of Information Technology & Telecommunications; New York State GIS Clearinghouse, 2010; NOAA, 2011; RITA National Transportation Atlas Database, 2012

Projection: NAD1983 State Plane New York Long Island FIPS 3104 Feet

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