Identifying marshes that potentially protect people, property and infrastructure

This analysis and interactive results are available by clicking on the Habitat Explorer app on that is part of the Coastal Resilience decision support system at **www.maps.coastalresilience.org/nyct.** For more information, please contact the Coastal Resilience team at coastalresilience@tnc.org.

Marsh Protection Potential Index:

This analysis identifies tidal marshes that potentially protect people, property, and infrastructure across New York and Connecticut. The marsh protection potential index is based on marsh size and proximity to critical infrastructure, private property, and population. This index is based on the following variables per upland basin area of each marsh complex:

Each marsh's upland area ("protection zone") was created by delineating the upland drainage basin for each marsh, up to 5 meters of elevation. In reality, not all people and property above each marsh up to 5 meters would directly be protected by a marsh under all inundation scenarios, but this approach was nonetheless useful for characterizing which marshes are adjacent to the most people and property at risk. This approach is also limited in that areas outside of a given marsh's protection zone, as identified here, could also benefit from a marsh's protective services, so, in some cases, this analysis might underestimate the people and property benefiting from a marsh's protective services. The 5 meter cutoff for each marsh's protection zone was selected because it was near the elevation of a Category 3 storm surge on the south shore of Long Island - a storm surge similar to the "Long Island Express" hurricane that was experienced in NY and CT in 1938.

The index is a summation of the following five variables, which were classified "low = 1"; "medium = 2"; and "high = 3" based on a three-class quantile classification technique:

-# of people exposed (2010 census block data)
-total building replacement cost for all infrastructure (HAZUS; assumes full replacement costs)
-average social vulnerability (SoVI)
-miles of road exposed
-# of critical facilities exposed

This analysis assumes that the larger the marsh, the more protective capacity that it has. It does not factor in additional variables that affect a marsh's ability to attenuate storm surge waves such as shape, roughness, hydrological dynamics, contiguity, etc.

Marsh Size

Marsh area was calculated in square meters and classified from high to low based on a three class quantile classification technique.

Marsh Upland Basin Area
Each marsh's upland area ("protection zone") was created by delineating the upland drainage basin for each marsh, up to 5 meters of elevation. In reality, not all people and property above each marsh up to 5 meters would directly be protected by a marsh under all inundation scenarios, but this approach was nonetheless useful for characterizing which marshes are adjacent to the most people and property at risk. This approach is also limited in that areas outside of a given marsh's protection zone, as identified here, could also benefit from a marsh's protective services, so, in some cases, this analysis might underestimate the people and property benefiting from a marsh's protective services. The 5 meter cutoff for each marsh's protection zone was selected because it was near the elevation of a Category 3 storm surge on the south shore of Long Island - a storm surge similar to the "Long Island Express" hurricane that was experienced in NY and CT in 1938.

Marsh upland areas identified here also contain some errors due to underlying issues in the digital elevation data. Most commonly, some "protection zones" will cover open water areas. These errors have minimal impact on the final analysis as open water areas erroneously identified as upland marsh area rarely contain "property" or "people" as identified in this analysis.

Costs of buildings exposed
The costs of buildings exposed analysis is based on the estimated total building replacement cost for all infrastructure within the marsh protection zone. These values assume a total replacement cost of all buildings within each census block. This is based on HAZUS block level data as defined here:
Existing total building replacement cost is an estimate based on full replacement of the building structure. This is not the assessed, market or retail value of the property and does not include land value. The maximum scale these data should be viewed is 1:100k due to issues of data accuracy. Source: FEMA HAZUS-MH 2008.

Estimated cost was determined by assuming even distribution of replacement cost across the census block, and adjusting for the amount of the block/area occurring within the protection zone. For example, if a block had a total replacement cost of $100,000 and the protective zone covered half of the block, a replacement cost value of $50,000 would be attributed to the marsh protective zone. The final calculation was then classified from high to low based on a three class quantile classification technique.

Amount of critical facilities exposed
The amount of critical facilities exposed is based on the number of critical facilities occurring within each marsh protective zone. The critical facilities information comes from the HAZUS Critical Facilities Database 2008. The final calculation was then classified from high to low based on a three class quantile classification technique.

Amount of roads exposed
This analysis calculates the miles of roads occurring within each protective zone.
The final calculation was then classified from high to low based on a three class quantile classification technique.

Amount of people exposed

The amount of people exposed is based on the 2010 census block scale population statistics statistics. Estimated population was determined by assuming even distribution of population across the census block, and adjusting for the amount of the block/area occurring within the protection zone. For example, if a block had a total population of 100, and the protective zone covered half of the block, a population of 50 would be attributed to the marsh protective zone. The final calculation was then classified from high to low based on a three class quantile classification technique.

Average social vulnerability

The average social vulnerability was determined by averaging the social vulnerability index (SoVI) scores for each marsh protective zone. The SoVI is at the block group scale and based on the analysis by Cutter et al. The final calculation was then classified from high to low based on a three class quantile classification technique.

Likelihood of shoreline armoring

This calculation shows the likelihood of shoreline armoring for each marsh based on a 1-meter sea level rise under current "business as usual" regulations. The shoreline armoring likelihood data is based on Titus et al. 2009. The final calculation was then classified from high to low likelihood of armoring based on Titus' classification of "shore protection almost certain = high"; "shore protection likely = medium"; "shore protection unlikely = low".