

A Delicate Balance: Perturbed Saving Drowning Marshes

Coastal marshes, tidal creeks, and bays are the cradle of life. They host a phenomenal diversity of wildlife, and their intrinsic beauty is a balm for the soul. They are nursery grounds for fish and shellfish; home to myriad wildlife; crucial to coastal resiliency, offering protection against damage to property and infrastructure and reducing loss of life during storm surge and flooding. They are the foundation of a complex web that sustains the coastal way of life.

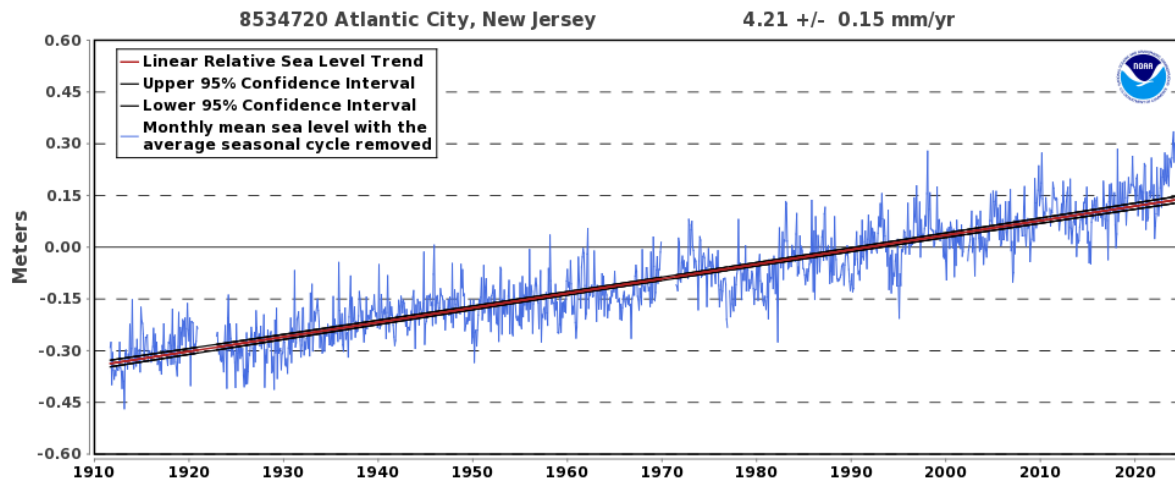
Rapidly rising seas have shifted the delicate balance between our marshes and the life-sustaining tidal waters they need. Tidal marshes flourish on the brink – daily to intermittent flooding brings life; repetitive deep flooding systematically destroys life. **When sea level rises** faster than the marsh surface can build, **tidal marshes are drowned** and replaced by mud flats or open water. The marshes around The Wetlands Institute are drowning and what were lush meadows only a few years ago are changing to mudflats right before our eyes.

It is well-established fact: sea level in our area is rising – and too fast to sustain healthy marshes. The rate of sea level rise is also accelerating dramatically. For the past 100 years or so, scientists directly measured this through local tide gauges that record how high the water level rises and falls each day. More recently, they have been using satellite technology as well. We are fortunate to have several gauges in the area that have relatively long records, so we can see how sea level has changed. Averaged over long time periods, sea level measurements taken in both Atlantic City and Cape May show that sea level is rising at a rate of 4.2 millimeters (or 0.16 inches) per year. This may not seem like much perhaps, but between 1911 and 2023 that is a change of more than 1 ½ feet. Due to a complex set of reasons – most importantly because **southern New Jersey is also sinking** – sea level has risen here at more than twice the global average. Long-term averages only tell us part of the story, though, and downplay the increasing rate of sea level rise. To really understand what is happening today to our marshes, we need to look more closely at the record. **Over the past 15 years**, the rate of sea level rise measured right here **on the 96th St. bridge into Stone Harbor** is more than 6 millimeters (or ¼ inch per year). This means that **sea level has risen nearly 4 inches since 2008**.



Sunny day flooding of the marshes at The Wetlands Institute. Frequent flooding is drowning marshes converting area of marsh to mudflats and open water at the expense of the marsh itself.

Salt marsh grasses are very sensitive to water depth and flooding levels. They experience optimum growth over a very narrow depth range. If the water gets too deep or too shallow, or there are other stressors to healthy marsh grass growth, growth rates slow. When this happens, the marsh's ability to maintain its level relative to sea level declines. Scientists working here in our back bays in the Seven Mile Island Innovation Lab have directly measured the rate our **marshes build up** – which is only **4 millimeters (0.15 inches)** per year. Yet **sea level is rising** at a rate of more than **6 millimeters (or 0.25 inches)** per year. We have reached the tipping point and the trained eye (and The Wetlands Institute's detailed monitoring programs) can see this.



Measured sea level from Atlantic City shows water levels rose 1.38' in 100 years with long term average rates increasing to rates faster than marshes can keep up. Data from NOAA (https://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?id=8534720)

The Wetlands Institute scientists, along with our colleagues from the US Army Corp of Engineers, NJDEP, and 5 universities are diligently evaluating and monitoring these marshes. An analysis of the marsh condition at the Institute reveals troubling trends. We are losing marsh to open water. Historical photographs show that in the 1940s the view out what would become the institute – would have been very different. Instead of the open water pools and mudflats of our view today – we would have seen a nearly unbroken carpet of lush green marsh grasses. Equally troubling is the rapid widening and extension of tidal channels dissecting the marsh into smaller pieces. **From 1941 to now, we lost 34% of the marsh acreage** out our window (85 acres to 56 acres) and we are projected to **lose another 33% (down to only 33 acres) by 2050** under the model that assumes that there will be moderate reductions in the greenhouse gases responsible for accelerating sea levels rise.





Top: 1956 imagery showing an extensive marsh platform with small tidal creeks. A few small marsh pools dot the landscape. Blue star is where fill will be placed in the late 1950's for a development that will later become the site of The Wetlands Institute. Orange line is the future site of the Salt Marsh Trail, a former road from the failed development, and the elevated walkway built in 2013.



Left: Over 50 years later, comparative imagery shows extensive areas of marsh loss to open water and mud flats. Tidal creeks are dramatically widened and have expanded resulting in a dissected marsh with more than 30% loss.



Bottom: Drone image of the marsh at The Wetlands Institute looking northwest toward Stone Harbor Blvd. Extensive newly formed mud flats, open water areas, and wide tidal creeks are areas of marsh loss.

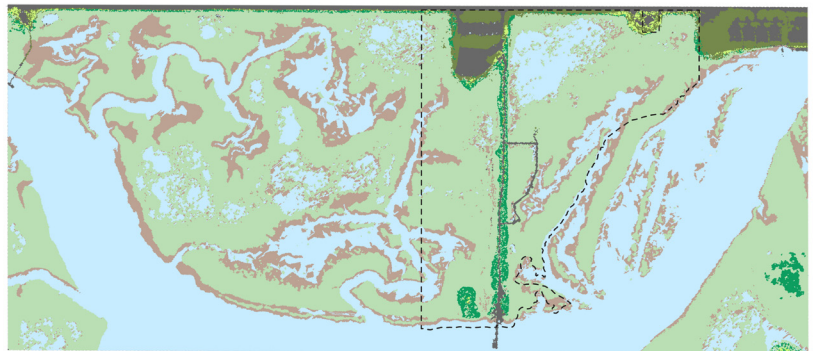
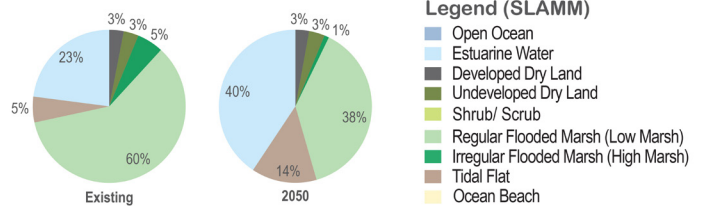


Marsh conversion to mudflats and open water pools in area that was recently lush marsh.

Without intervention, the acceleration of sea level is expected to lead to continued marsh loss. Modeling work by colleagues at the University of Pennsylvania’s Environmental Modeling Lab, using the Sea Level Affecting Marsh Model (SLAMM), shows what the marsh platform could look like by 2050 under moderate sea level rise projections.

The projects of the Seven Mile Island Innovation Lab are working to **help these marshes add elevation** more rapidly, and we are working as fast as we can. New Jersey is now a national leader in marsh restoration using tools developed right here. The negative effects of sea level rise are no longer an “if” or a problem “sometime in the future”. It is here now. **The work of the Innovation Lab has already restored more than 85 acres of marsh** and more work is planned to continue to restore drowning marshes. It’s in our nature to respond and we are!

Elevation-derived habitat distributions via SLAMM:



Modeling shows expansion of open water and mudflats at the expense of marsh at The Wetlands Institute by 2050. Models project more than 30% of additional marsh loss if there is no intervention.

