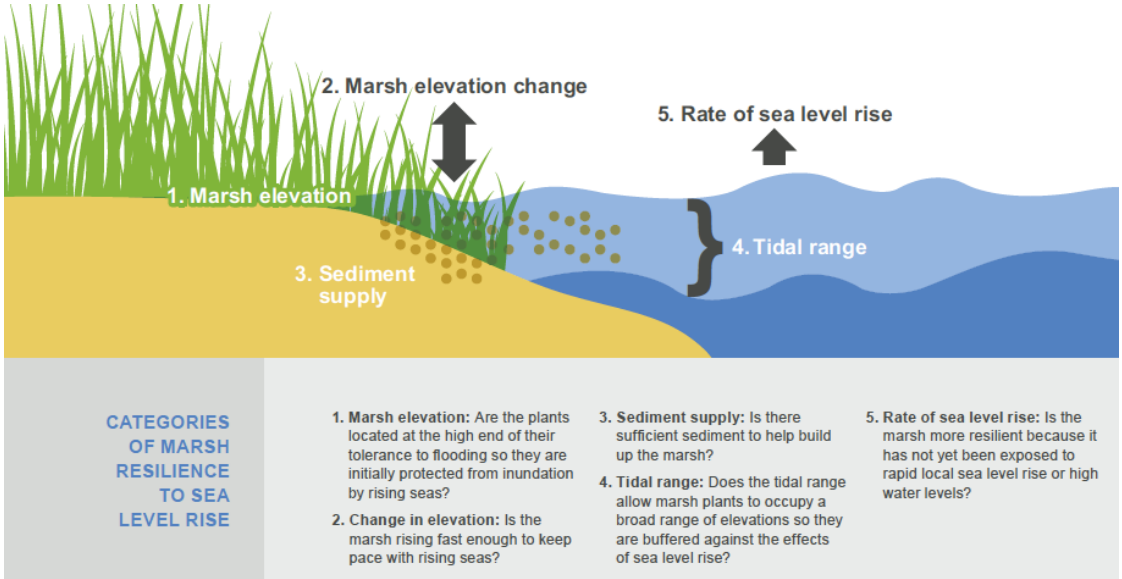
Salt Marshes vs. Sea Level Rise

In the battle of salt marshes vs. sea level rise, which side wins? In a recent study published in the journal, *Biological Conservation*, collaborators from 16 National Estuarine Research Reserves (NERR) around the country used a pioneering new method to gauge the resilience—ability to resist damage and recover quickly—of tidal marshes to sea level rise (SLR). Guess, who joined in this effort? That's right, the research and monitoring program of the North Carolina NERR!

Why are we concerned about salt marshes and SLR in the first place? Salt marshes are incredibly important coastal ecosystems. They provide habitat for many commercially and recreationally important fish and crabs. They act as sponges filtering pollution from our coastal waters and buffering storm surges (nature's flood insurance!). But it is tough out there for salt marshes. Salt marshes occupy very narrow elevation ranges. Like Goldilocks, the vegetation needs conditions that are 'just right' with just the right amount of tidal inundation. Too little inundation and marsh vegetation is outcompeted by species that thrive in less soggy conditions. Too much inundation and the vegetation drowns.

This study took a novel approach to assessing resilience in a couple of ways. The first was the scope of collaboration for this study. The National Estuarine Research Reserve System (NERRS) invests heavily in coordinated monitoring efforts across the 29 Reserves within the System. This project exemplifies the incredible capacity of the NERRS network to work together to assess trends. Due to this broad collaboration, this study is the first of its kind to create a national-scale comparison of marsh resilience to SLR by examining 16 salt marshes within the System located throughout the U.S.

The other way that this study was unique was its methodology. The researchers developed a simple, effective analysis tool, called marsh resilience to sea-level rise (MARS), that allows users to compare resilience across different marshes. Using ten different metrics, researchers scored marshes as low, moderate or highly resilient. The tool takes into account marsh elevation (higher elevation = more resilient), marsh elevation change (elevation change needs to be greater than or equal to SLR), sediment supply (sediment helps increase elevation), tidal range, and the rate of SLR. This is crucial information to have when informing the



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development of conservation, restoration, and adaptation strategies through coastal management and policy.

Here in North Carolina, we assessed the resilience of a marsh within the Masonboro Island Reserve (near Wilmington where the rate of SLR is ~ 1.7mm/yr), which scored moderately resilient to SLR. This was largely due to losses in marsh surface elevation. Marshes in the southeast region of the U.S. scored similarly to the Masonboro Island marsh we studied. The average score across all 16 marshes included in the study revealed moderate resilience to SLR.

How is this information helpful as coasts experience SLR? Assessing the resilience of these marshes can help inform decision-making by coastal managers and policy makers. For example, marshes that received a high resilience score (such as in Great Bay, N.H.) are likely to thrive and provide value for a long time, therefore ensuring that they are protected and conserved is a good investment for the future. For a marsh that received a moderate score, like at Masonboro Island, coastal managers might consider taking action to enhance resilience. For instance, waterlogging can sometimes be reduced by improving drainage and creating fringing oyster reefs can facilitate sediment accretion. For tidal marshes that scored least resilient (such as in Narragansett Bay, R.I.), the truth is they may not persist in their current location and management strategies should take this reality into account.

Brandon Puckett, research coordinator for the NCNERR and one of the authors on the paper reflects on the study. “Development of this tool is the culmination of years of hot and muddy field work by the Reserve’s research staff, as well as a significant investment in coordinated monitoring across the NERRS. The tool holds promise not only for assessing resilience of marshes to SLR in the Coastal Reserves, but more broadly in the state of North Carolina and across the nation. Indeed, a broader application of the tool is needed to assess how resilience varies among marshes within Masonboro Island, as well as those located along the 12,000 miles of estuarine shoreline in the state. As for the marsh where we applied the tool, we are already thinking about management actions we can take to potentially increase its resilience to SLR.”

The researchers wanted to design a tool that could be used by any scientist or organization collecting relevant monitoring data. The objective was also to make the results transparent for coastal managers to understand. This methodology is now an open source tool that can be used by anyone! To learn more about the study and the free calculation tool visit: www.nerra.org/marsh