5.5 national average

MARSH RESILIENCE SCALE

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

2.2 state average

1.7 reserve average

MARSH RESILIENCE AT THE LANDSCAPE SCALE

How does the Narragansett Bay Research Reserve compare?

Both current condition and the adaptive capacity of marshes at Narragansett Bay Reserve are exceedingly low. This results in an overall resilience less than the state, Northeast region, and national averages.

Management recommendations: Narragansett Bay Reserve provides opportunities for restoration or adaptation projects that aim to improve marsh resilience. It is also a good area to investigate innovative science techniques.

Current conditions

Marsh resilience depends largely on current composition and exposure to stressors such as development and agriculture.

Current condition of tidal marshes in and around the Reserve are slightly poorer than marshes in the rest of Rhode Island, and quite a bit poorer than marshes throughout the Northeast and the nation. This is primarily due to the very high amount of impervious surfaces and agriculture surrounding marshes and, conversely, the relatively low amount of natural surrounding lands. These marshes also tend to have relatively more marsh edge than core.

	TOTAL (1 TO 10)
National average	5.65
Northeast	4.46
State of Rhode Island	2.37
Narragansett Bay Reserve	2.00

Vulnerability

Marshes are more vulnerable to sea level rise when more of their vegetation is lower in the tidal frame and they have soils that are likely to erode.

Tidal marshes in and around the Narragansett Bay Reserve are more vulnerable than marshes throughout the Northeast and the nation, though not as vulnerable as marshes in the rest of the state. The most marked difference is the lower soil erodibility, but this is more than offset by the high amounts of vegetation below the mean tide level.

	TOTAL (-10 TO -1)
National average	-5.21
Northeast	-5.97
State of Rhode Island	-7.95
Narragansett Bay Reserve	-7.00

Adaptive capacity

Marshes with more space and fewer barriers to migration have a greater capacity to survive sea level rise.

The capacity for tidal marshes in and around the Narragansett Bay Reserve to adapt to future sea level rise is lower than marshes throughout Rhode Island, and far lower than the Northeast, and the nation. Marshes in this area tend to have high amounts of straight, hardened shoreline.

	TOTAL (1 TO 10)
National average	5.65
Northeast	4.83
State of Rhode Island	3.05
Narragansett Bay Reserve	2.00

CURRENT CONDITIONS | VULNERABILITY | ADAPTIVE CAPACITY

— **LESS RESILIENT**

MORE RESILIENT ✚

ABOUT THIS PROJECT

What do we mean by tidal marsh resilience?

Tidal marshes buffer against storm surge, reduce erosion, fortify upland property, and—together with other wetlands—provide an estimated $23.2 billion in storm protection annually. Marshes also improve water quality, create habitat for fish and wildlife, provide opportunities for outdoor recreation, and boost local economies.

These coastal ecosystems are characterized by hypoxic and saline soil conditions with plant communities that are largely driven by precipitation and flooding regimes. Small changes in these regimes—for example, in inundation duration—can have large impacts on marsh composition. The ability of marshes to resist or recover from such changes is an indication of their resilience. Sea level rise is a significant, long-term disruption that affects most tidal marshes. In this assessment, resilience is an integrative measure of a marsh's capacity to persist as rates of sea level rise accelerate into the future.

Where do the scores and maps come from?

Rankings for tidal marsh resilience to sea level rise at the landscape scale were calculated using GIS-based metrics of current marsh condition, vulnerability to sea level rise, and potential for adaptation. The assessment protocol used standardized comparisons over consistent watershed areas (HUC 12) along all coastal areas that contained salt marshes.

- Current marsh conditions included measures of a marsh's core area compared to its exposed and unvegetated edges and the surrounding impervious, agricultural, and natural land cover. More edges, especially if not vegetated, expose more of the marsh to potential erosion. Impervious and agricultural cover can contribute to runoff and pollutants that degrade marsh conditions, while increased natural cover mitigates those effects. Based on NOAA's Coastal Change Analysis Program (C-CAP) 2011 land cover data.

- Vulnerability included soil erodibility, total tidal range, and the percentage of marsh below mean high water and mean sea level. Marshes are more vulnerable to sea level rise when more of their vegetation is lower in the tidal frame, especially when that frame is not large. Erosion of marsh soils could increase with more frequent inundation. Based on NOAA Sea Level Rise viewer elevation data and NRCS SSURGO soils.

- Adaptive capacity included shoreline sinuosity and armoring (hardening), available space for migration, and future marsh connectedness. The more complex, (sinuous) a shoreline, the more protection it provides, while a hardened shoreline impedes migration. The more connected a marsh is, the higher its adaptive capacity. By combining elevation with projected sea level rise scenarios, we estimate available space for migration. Based on NOAA C-CAP and elevation data combined with Environmental Sensitivity Index (ESI) shoreline data.

How can I use this information?

To find the detailed scores and supporting data for the marshes in your Reserve or state, visit the Digital Coast. Being able to compare the vulnerability, current condition, and adaptation potential of individual marshes across the country allows users to conduct comparative studies, analyze how watershed and marsh level conditions impact vulnerability, and develop consistent approaches to ensuring tidal wetlands can adapt to sea level rise. The scores are derived from consistent data over broad geographies, making them useful for screening large areas for marshes with particular characteristics, targeting fieldwork and monitoring, and strengthening experimental design. Because they take future conditions into consideration, they can be used to identify marsh restoration and migration pathway conservation opportunities that are cost effective and sustainable for the long term. The results can be used to assess the degree to which site-specific data represents other marshes in the state or region and to prioritize sites for new Reserves or new components of existing Reserves. Used in tandem with other NERRS-based marsh assessment tools, these rankings provide an integrated continuum of assessment to inform efforts to study, restore, or protect tidal marshes at the local, state, regional, and national scales.

What should I keep in mind?

This assessment is based on data from the coastal areas of the lower 48 United States. It does not include the Great Lakes. The results are regional in scope and should be used as screening level information at the local scale. The team has created a framework to perform similar assessments using more detailed local data and information. With high resolution data, the same protocol can be implemented at the local level to inform site specific decision making and support long term marsh resilience strategies.