



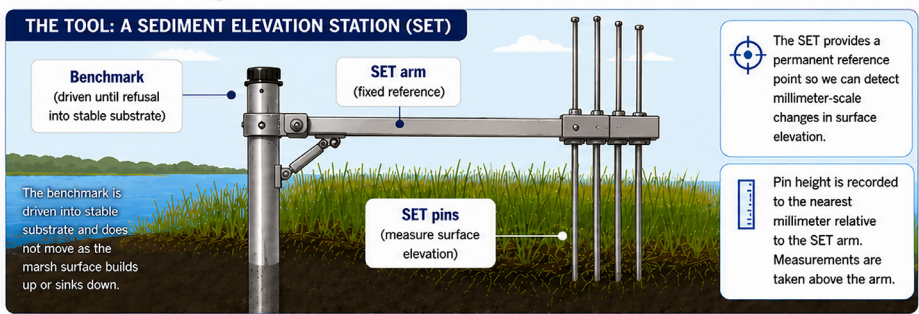
Boston Harbor's Salt Marshes: Keeping Pace or Falling Behind?

Salt marshes can keep up with rising seas—but only if they build elevation fast enough. Monitoring since 2010 shows Boston Harbor marshes are building elevation more slowly than sea levels are rising.



How We Track Elevation Change in Salt Marshes

Sediment Elevation Stations (SETs) let us measure tiny changes in marsh surface height over time.



WHY THIS WORKS:

- Stable benchmarks don't move.
- Millimeter-level measurements detect tiny changes.
- Long-term data reveal trends, not just snapshots.

THE PROCESS

- 1 MEASURE SURFACE CHANGE**
At each visit, pin heights are measured from the same SET arm reference to the marsh surface. Changes in pin height are recorded to the nearest millimeter.
- 2 REPEAT OVER TIME**
Measurements are repeated from the same locations across months and years to track how the marsh surface changes relative to the benchmark.
- 3 COMPARE TO SEA-LEVEL RISE**
Elevation change is compared to local sea-level rise rates to determine whether the marsh is keeping pace, falling behind, or gaining elevation.

IF ELEVATION GAIN CANNOT KEEP PACE WITH SEA-LEVEL RISE OVER TIME, MARSH VULNERABILITY INCREASES.

Recent, regional sea-level rise (2001–2019 average): ~4.6 mm/yr | Long term SLR: ~2.5 mm/yr (1947–2025) | Marsh elevation gain rates derived from 2010—2025 monitoring data.

THOMPSON ISLAND

FLOODING REGIME
Frequent
(Flooded ~23% of the time)

MARSH ELEVATION GAIN
~5.71 mm/yr

CURRENT FLOODING EXPOSURE
Relatively high
Floods more often (23% of the time)

ELEVATION BUFFER (EC)
0.59
Vulnerable Threshold Resilient
Values above 0.5 indicate lower vulnerability

KEEPING PACE WITH SEA-LEVEL RISE?
✓ Keeping pace
Exceeds even recent SLR rates.

TAKEAWAY
Rapid elevation gain may help offset high flooding exposure — but the marsh sits relatively low in the tidal frame.

CALF ISLAND

FLOODING REGIME
Moderate
(Flooded ~10% of the time)

MARSH ELEVATION GAIN
~2.25 mm/yr

CURRENT FLOODING EXPOSURE
Relatively low
Floods less often (10% of the time)

ELEVATION BUFFER (EC)
0.79
Vulnerable Threshold Resilient
Values above 0.5 indicate lower vulnerability

KEEPING PACE WITH SEA-LEVEL RISE?
✗ Not keeping pace
Not keeping pace with recent SLR
Comparable only to lower future SLR scenarios.

TAKEAWAY
Higher elevation reduces flooding exposure now, but slower elevation gain may limit future resilience.

PEDDOCKS ISLAND

FLOODING REGIME
Infrequent
(Flooded ~7% of the time)

MARSH ELEVATION GAIN
~1.15 mm/yr

CURRENT FLOODING EXPOSURE
Relatively low
Floods less often (7% of the time)

ELEVATION BUFFER (EC)
0.85
Vulnerable Threshold Resilient
Values above 0.5 indicate lower vulnerability

KEEPING PACE WITH SEA-LEVEL RISE?
✗ Not keeping pace
Not keeping pace
Slowest elevation gain of the three marshes.

TAKEAWAY
High elevation currently limits flooding, but very slow elevation gain could reduce long-term resilience.

WHAT IS ELEVATION CAPITAL (EC)?
A measure of where the marsh sits within the biologically usable flooding range needed to support healthy salt marsh vegetation.

SEA LEVEL

LOW EC
Sits low in the tidal frame and is at risk of flooding too often and drowning.

HIGH EC
Has high elevation buffer, but still floods enough to function as a stable marsh.

Too little elevation increases flooding stress. Too much elevation can reduce tidal flooding and sediment delivery altering vegetation.

WHY IT MATTERS

- Flooding varies widely.**
Marshes need periodic flooding to deliver sediment and build elevation. Even small differences in elevation can **strongly affect flooding**.
- Even marshes above optimal elevation are at risk.**
Sea level rise may push more areas above the **risk threshold**.
- Marshes are dynamic—but all are vulnerable.**
They respond to flooding and sediment, but without enough gain, **all are vulnerable**.
- High variability increases sensitivity.**
Exposed areas are **more sensitive** to storms and short-term environmental changes.

THE TAKE-HOME MESSAGE

MARSH ELEVATION GAIN
Marshes are building elevation
~1–6 mm/yr

PROJECTED SEA-LEVEL RISE
Sea levels are rising faster
3–33 mm/yr by 2100

MOST MARSHES ARE NOT KEEPING PACE.

Across the Boston Harbor Islands, most marshes are building elevation more slowly than sea levels are rising.

MORE FLOODING
Tides reach marsh more often.

ELEVATION FALLS BEHIND
Marsh can't build elevation fast enough.

HABITAT AT RISK
Salt marsh plants and wildlife are more vulnerable.

BOSTON HARBOR SALT MARSHES

Turning data into action for resilient marshes

WHAT THIS MEANS FOR MANAGEMENT

MARSH RESILIENCE DEPENDS ON BOTH ELEVATION AND BUILD-UP RATE.

- 1 PRIORITIZE MONITORING WHERE GAIN IS LOW.**
Track marshes with slow elevation gain (especially Peddocks Island) before flooding stress increases.
- 2 WATCH FOR CHANGES IN FLOODING FREQUENCY.**
Small vertical elevation differences can cause large shifts in flooding and sediment delivery.
- 3 PROTECT SEDIMENT DELIVERY & NATURAL MARSH RESPONSE.**
Healthy flooding helps deliver sediment and maintain marsh elevation over time.
- 4 PLAN FOR LONG-TERM SEA-LEVEL RISE.**
Even marshes currently above optimal elevation may become vulnerable if elevation gain remains low.

- Early detection helps inform timely action.
- Document patterns to spot trends over time.
- Maintain connections to rivers, tidal creeks, and mudflats.
- Incorporate future risk into planning and restoration strategies.

