



Elevation change and tidal marsh resilience at Colonial National Historical Park



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Summary:

Since 2012, the National Park Service, Northeast Coastal & Barrier Network has been collecting elevation, accretion, and hydrology measurements at four oligohaline tidal marsh sites on, and adjacent to, Jamestown Island, Virginia (Colonial National Historical Park).

Jamestown Island has semi-diurnal tides with a tide range of about 58 cm. The Back river is a prominent feature on the north side of the island and marshes along the Back river have a greater freshwater influence and lower salinities. Wetland vegetation at the four sites are assemblages of *Spartina cynosuroides*, *Peltandra virginica*, and/or *Typha angustifolia*. Three Surface Elevation Table (SET) sampling stations were established in each of the four marshes and have been sampled twice a year.

The four sites (M1, M2, M3 and M4) range in height above local sea level by 35cm, with M1 having the highest elevation (0.409 m) and M4 having the lowest elevation (0.065 m). M2 and M3 have elevations of 0.302 m and 0.156 m, respectively. Differences in elevation affected marsh flooding among the four sites, with M1 being flooded the least (16%) and M4 being flooded the most (58%).

M1 and M2 have rates of elevation change of 3.4 (std error = 0.3) and 6.3 (0.6) mm/yr. M3 and M4, have more variable rates of elevation change of 5.4 (2.1) and -4.8 (1.0) mm/yr, which may be partially attributed to increased disturbance from muskrat activity at these locations (J. Lynch, personal observation).

Long term rates of sea level rise (SLR) in the southern Chesapeake Bay range from 3.6 to 5.9 mm/yr. M1, M2 and M3 have rates of elevation change similar to the rates of SLR. Elevation change at M4 is not keeping pace with SLR.

Resilience of these marshes is dependent upon their ability to maintain their vertical position under changing hydrologic conditions. One of these marshes does not appear to be keeping up with sea level rise though there is no visible evidence of decline in the habitat.

Regional map:

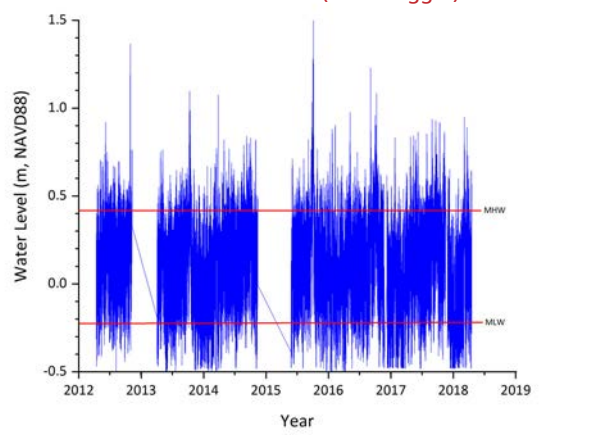


Jamestown Island: Study sites

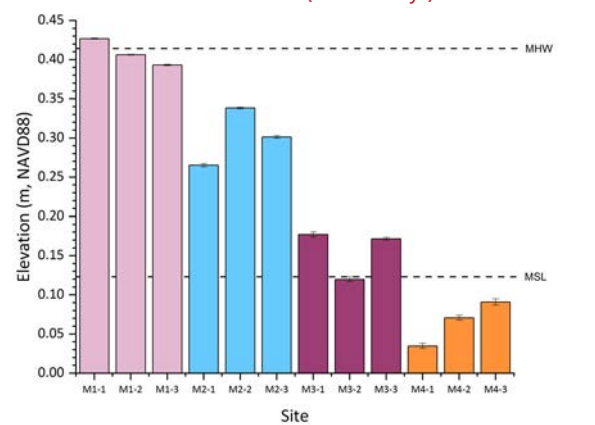


Data Collection:

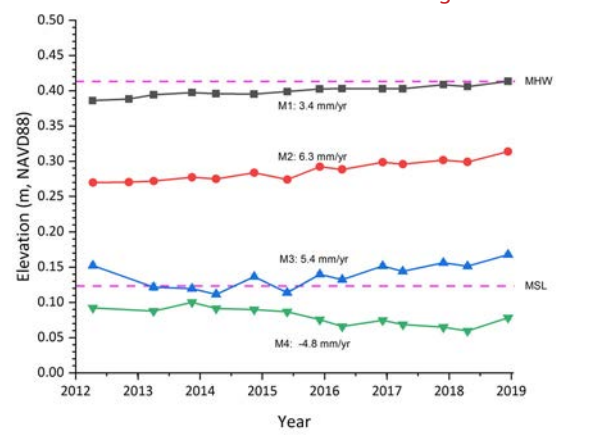
Water Level Data (Hobo logger)



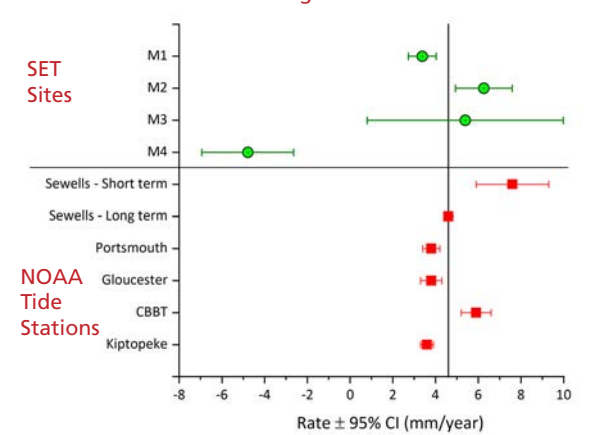
Marsh elevation (RTK surveys)



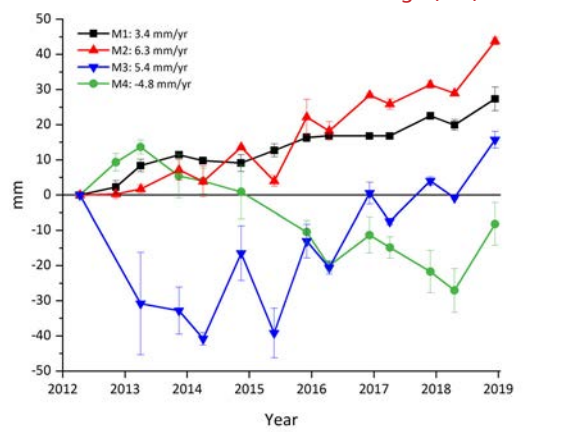
Marsh Surface Elevation Change



Elevation Change Rates versus SLR



Marsh Surface Elevation Change (SET)



Jamestown Island Sites	Marsh Elevation (m, NAVD88)	Marsh Flooding (%)	Elevation Change rate (mm/yr)
Marsh 1	0.409	15.7	3.4
Marsh 2	0.302	29.5	6.3
Marsh 3	0.156	47.9	5.4
Marsh 4	0.065	57.6	-4.8

Conclusions

- 1) Three of the four sites have average rates of surface elevation change that are similar to long term rates of sea level rise in this region of the Chesapeake Bay.
- 2) Two or more of the sites are lagging behind recent rates of SLR (Sewells Pt gauge : 2000-2017).
- 3) Site M3 and M4 have highly variable rates of elevation change, are very low in elevation and are flooded much more frequently than M1 and M2.
- 4) M3 and M4 have the lowest resilience of the four sites on Jamestown Island. This is especially true for M4 which has an extremely low elevation and has a negative rate of surface elevation change.
- 5) There are no visible indicators that any of these marshes are under stress.

Elevation Change Rates versus Marsh Elevation

