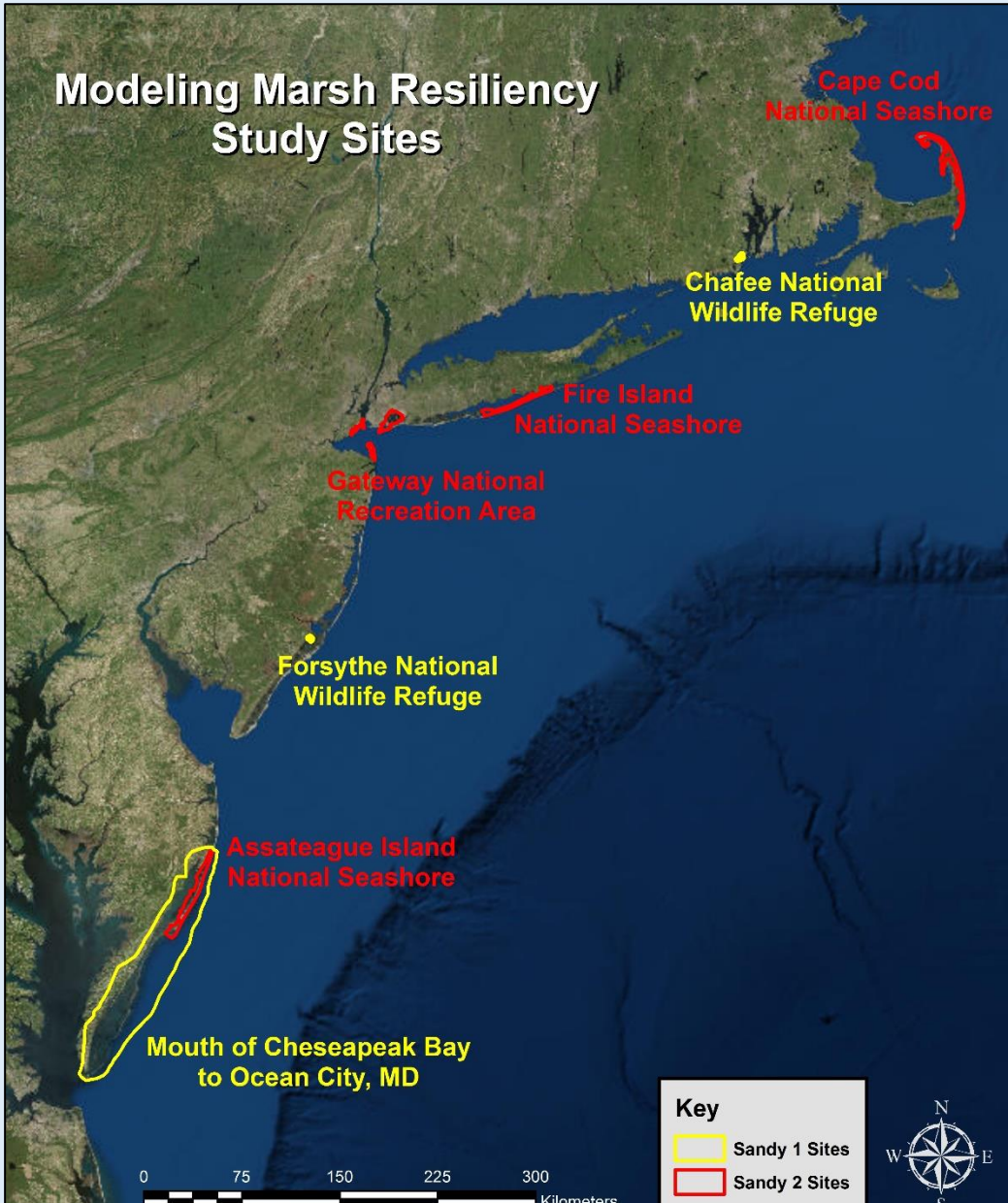
Hurricane Sandy Marsh Modeling Progress

1. *Parametric Modeling of Marshes* (“Sandy 1”)
Sites: Chafee NWR; Forsythe NWR; Ocean City, MD to Chesapeake Inlet; Plum Island
PIs: Jim Morris, Scott Hagen

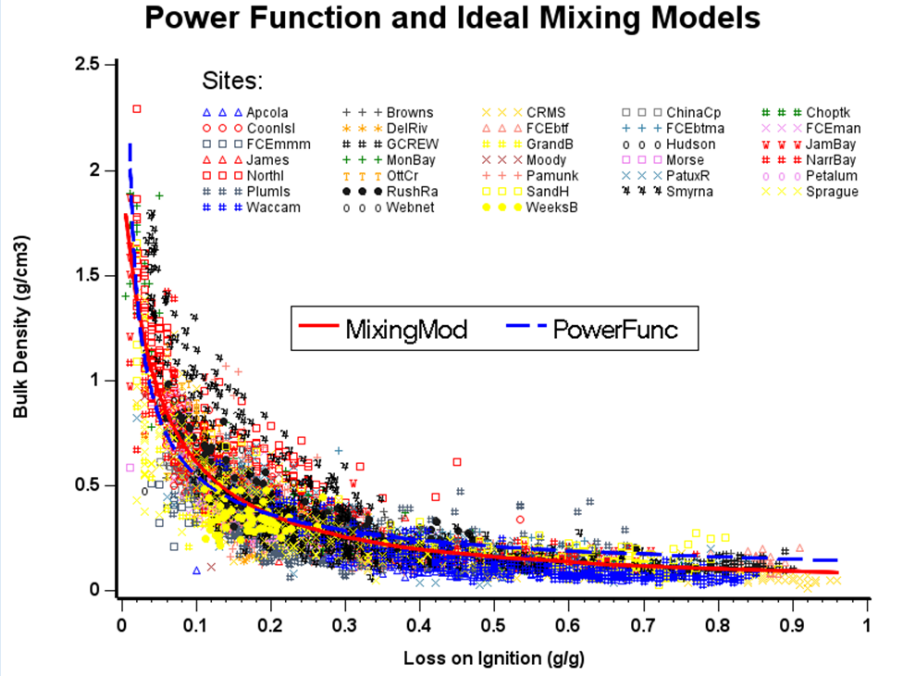
2. *Modeling Salt marsh conditions and resiliency in four National Parks* (“Sandy 2”)
Sites: Cape Cod National Seashore; Fire Island National Seashore; Gateway National Recreation Area; Assateague Island National Seashore
PIs: Jim Morris



The Marsh Equilibrium Model v5.4

Plant growth is distributed approximately between MSL and MHHW with a sweet spot in the middle.

Allows for biovolume growth within sediment

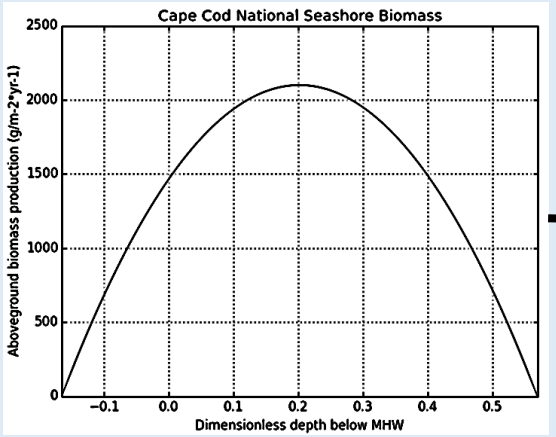


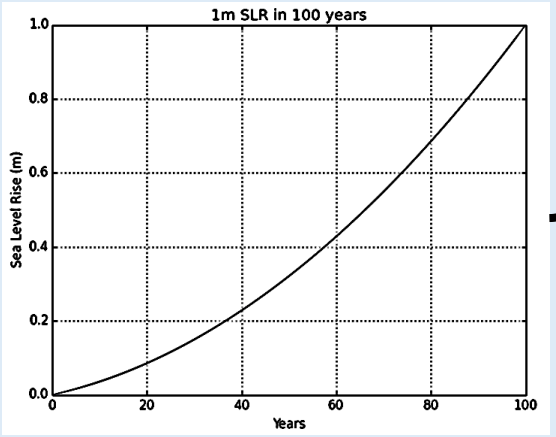
Sediment volume from bulk density derived from the analysis shown here (n=5075). BD is calculated from LOI.

Optimistic – assumes 100% capture efficiency of all inorganic suspended sediment

Assumes SLR of 1 m over 100 years

The MEM in 2D





Digital elevation model

Biomass coefficients

Inorganic suspended sediment load

Rate of SLR

Tidal data: MLW, MSL, MHW

MEM 2D

Future surface elevations relative to MSL at specified intervals

Data Inventory: What we have at USC

	Sandy 1				Sandy 2			
	Chaffee NWR	Forsythe NWR	Inlet of Chesapeake to Ocean City, MD	Plum Island	Assateague Island NS	Cape Cod NS	Gateway NRA	Fire Island NS
Site Boundary shp	x	x	x	x	x	x	x	x
Sub-marsh unit boundary shp		NA			x	x	x	x
Salt marsh community inventory				x				
NAIP imagery	x	x	x	x	x	x	x	x
pre-Sandy lidar				x	2004; 2011	2002; 2011		2002
post-Sandy lidar				x	Nov-12	2013	2013	Nov 2012; 2014
RTK elevations								
Aboveground biomass	x	x		x		x		
Belowground biomass				x		x		
TSS	x	x		x		x		
OSS	x	x						
ISS	x	x						
SOM				x				
Tidal datum				x	x	x	x	x
SLR rate				x	x	x	x	x
water surface elevation					NA	NA	NA	NA

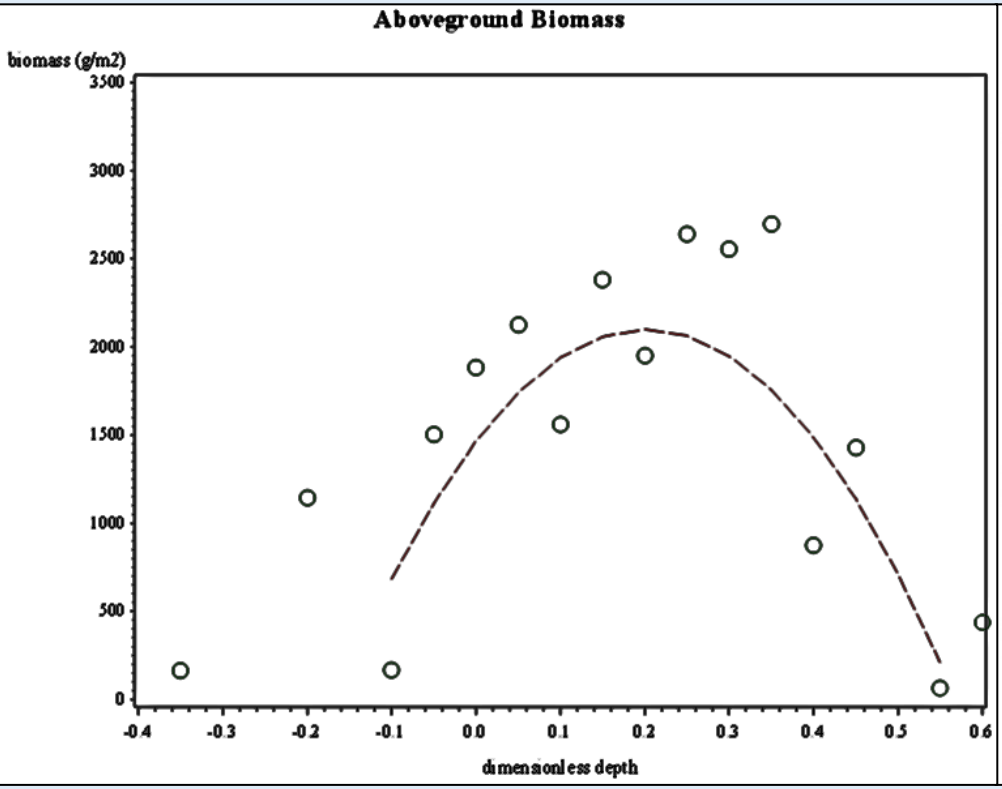
Data Inventory: What we have at USC

	Sandy 1				Sandy 2			
	Chaffee NWR	Forsythe NWR	Inlet of Chesapeake to Ocean City, MD	**Plum Island**	Assateague Island NS	**Cape Cod NS**	Gateway NRA	Fire Island NS
Site Boundary shp	x	x	x	**x**	x	**x**	x	x
Sub-marsh unit boundary shp		NA			x	**x**	x	x
Salt marsh community inventory				**x**				
NAIP imagery	x	x	x	**x**	x	**x**	x	x
pre-Sandy lidar				**x**	2004; 2011	**2002; 2011**		2002
post-Sandy lidar				**x**	Nov-12	**2013**	2013	Nov 2012; 2014
RTK elevations								
Aboveground biomass	x	x		**x**		**x**		
Belowground biomass				**x**		**x**		
TSS	x	x		**x**		**x**		
OSS	x	x						
ISS	x	x						
SOM				**x**				
Tidal datum				**x**	x	**x**	x	x
SLR rate				**x**	x	**x**	x	x
water surface elevation					NA	**NA**	NA	NA

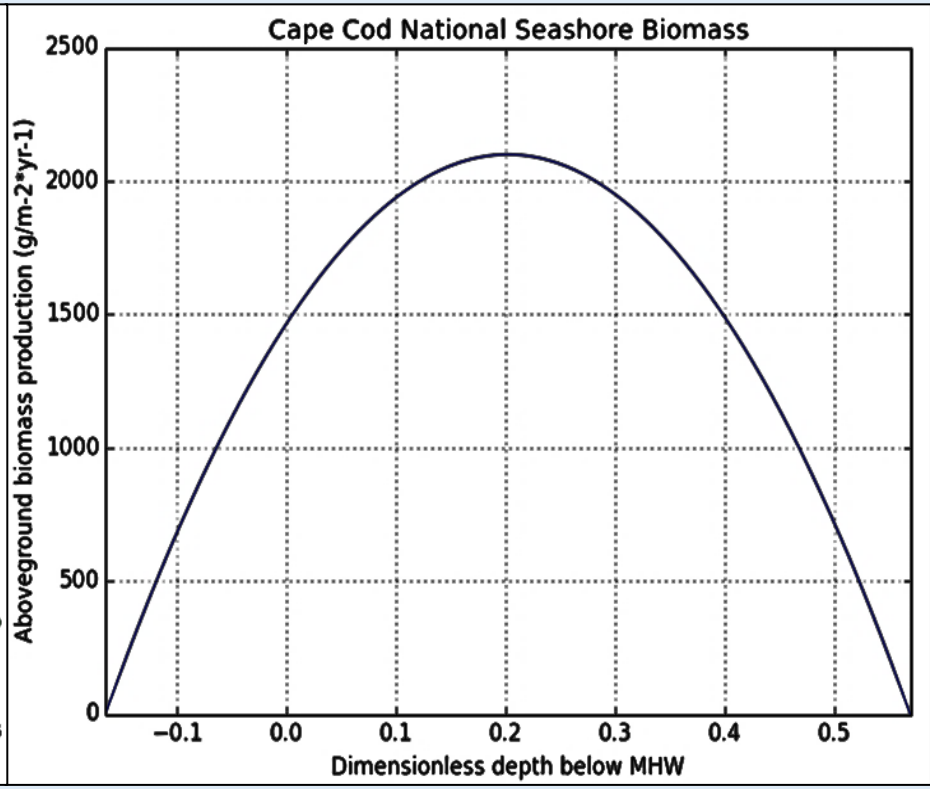
Biomass Data

Field data with fitted curve from which coefficients derived for input into MEM

$B = a^2 + Db^2 + c$

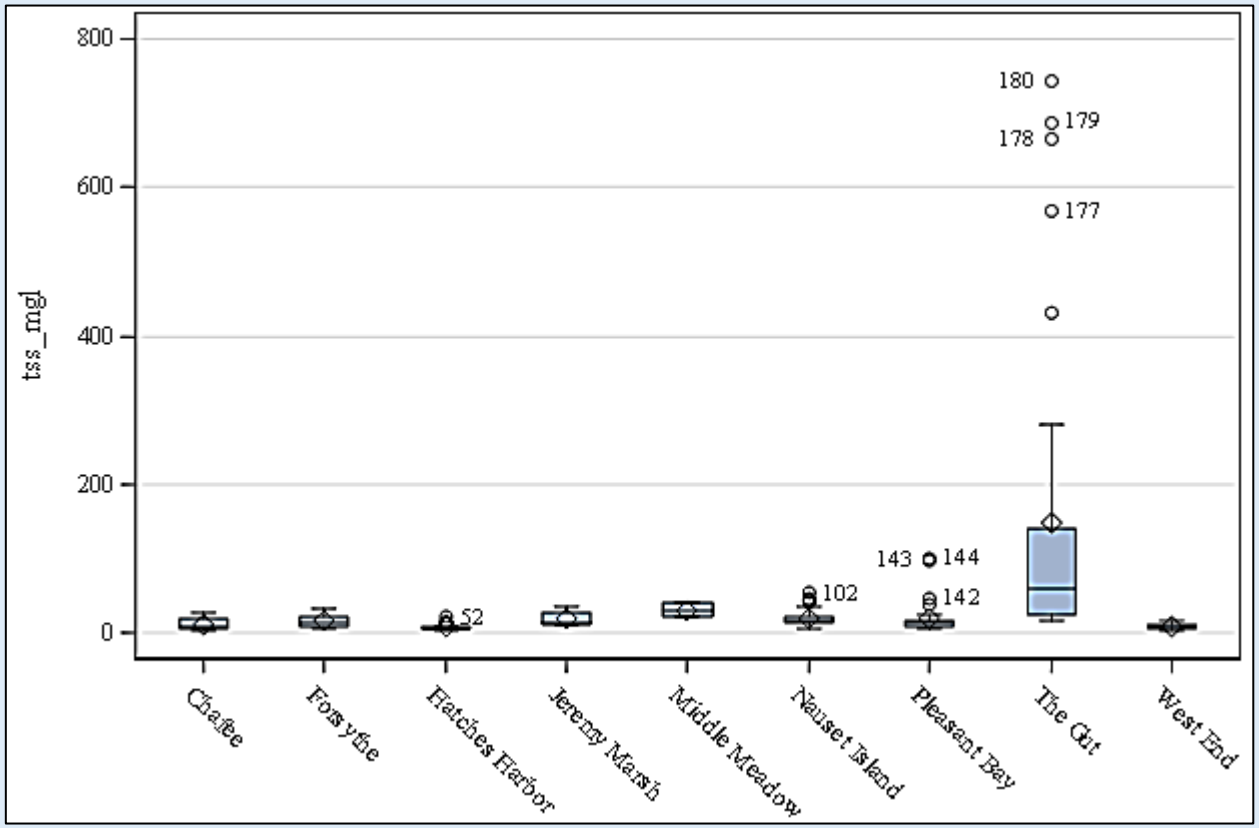


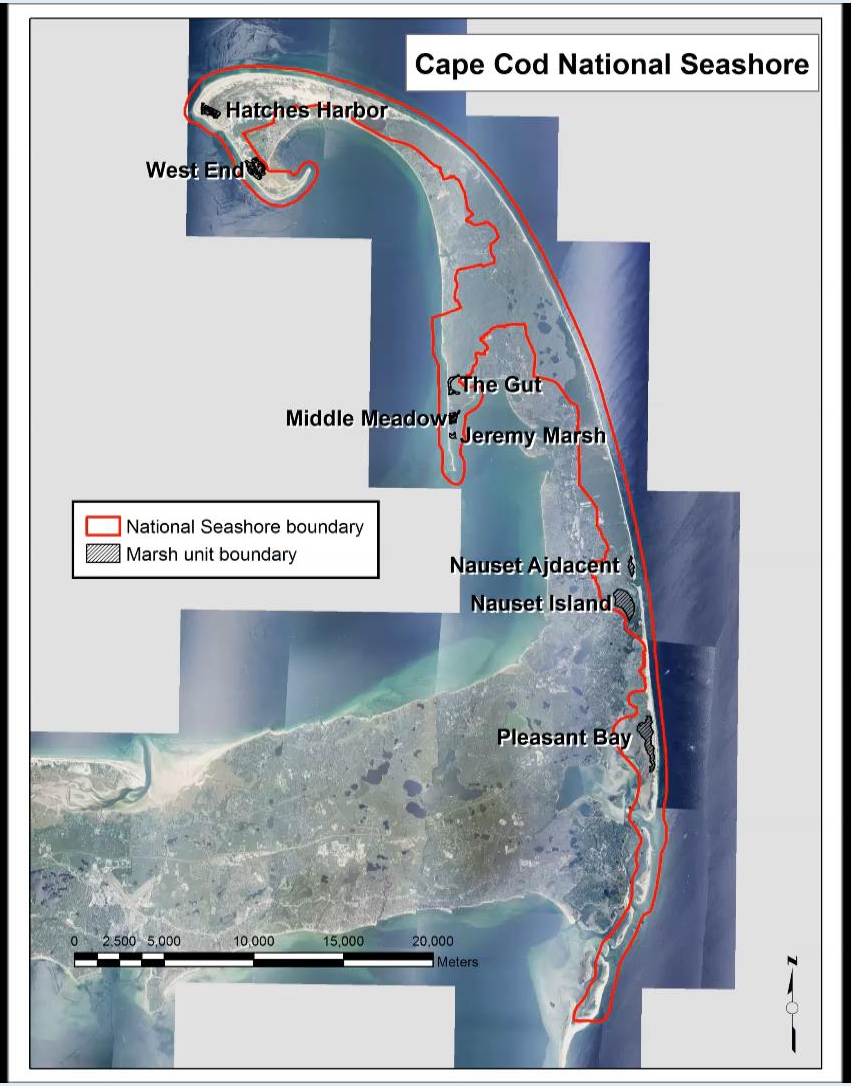
Idealized biomass curve showing upper and lower elevation limits for marsh vegetation

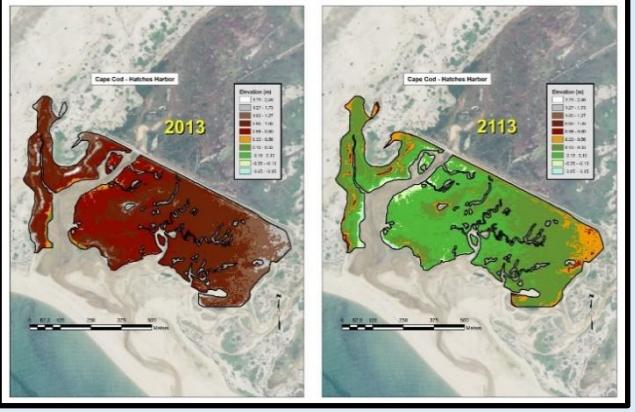


Total Suspended Solids

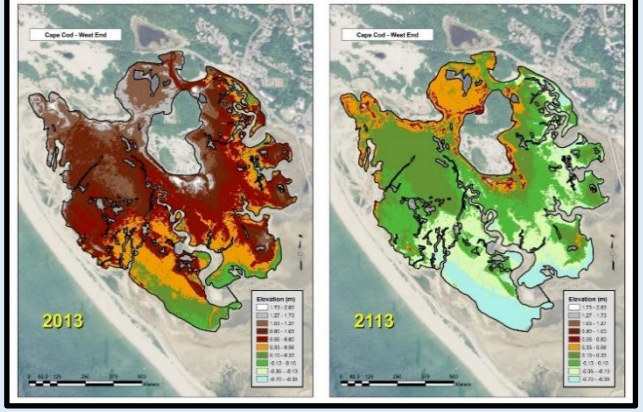
- TSS for all CACO sites except Nauset Adjacent
- Use ratio of ISS:TSS (=0.46) from Chafee and Forsythe to determine ISS for CACO sites
- For units except The Gut, ISS = 11.34 mg/L
- For The Gut, ISS = 31.65 mg/L



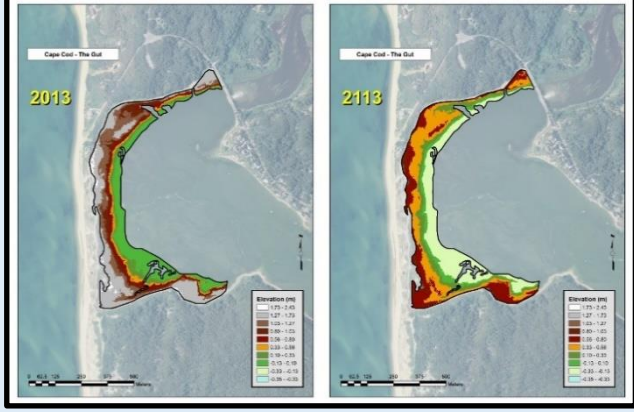

Cape Cod National Seashore
Hatches Harbor
West End
The Gut
Middle Meadow
Jeremy Marsh
National Seashore boundary
Marsh unit boundary
Nauset Ajdacent
Nauset Island
Pleasant Bay
0 2,500 5,000 10,000 15,000 20,000
Meters
N



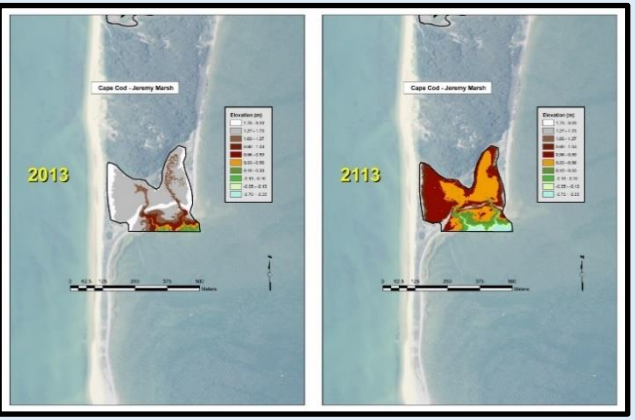
Hatches Harbor



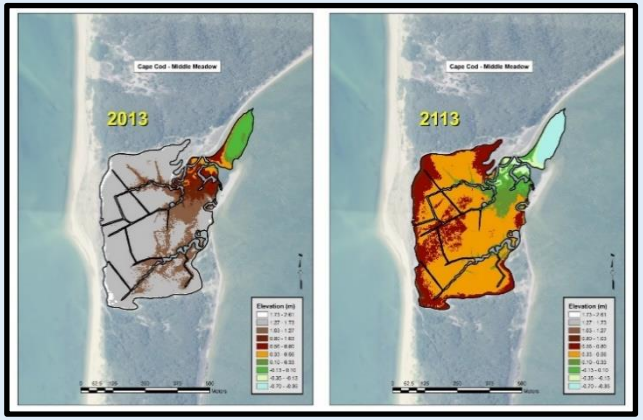
West End



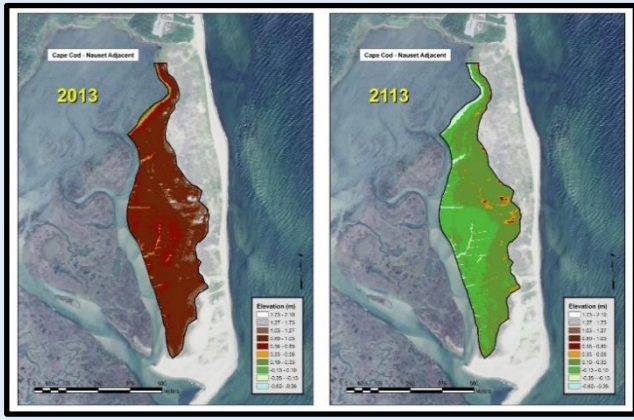
The Gut



Jeremy Marsh

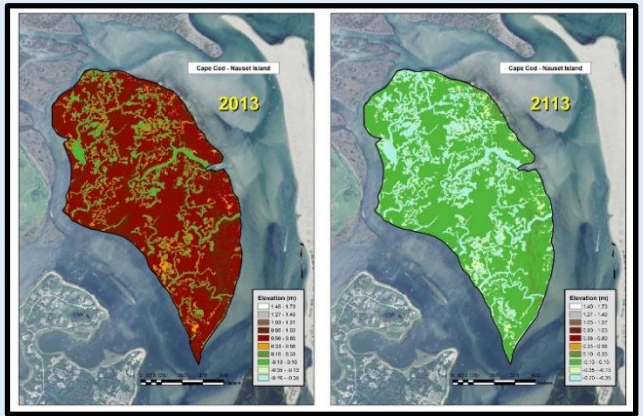


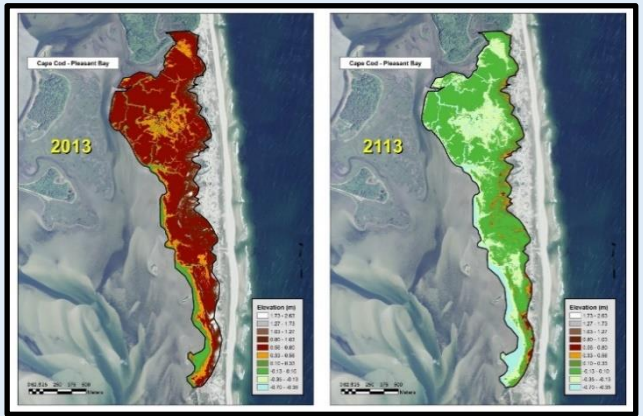
Middle Meadow



Nauset Adjacent

Nauset Island





Pleasant Bay

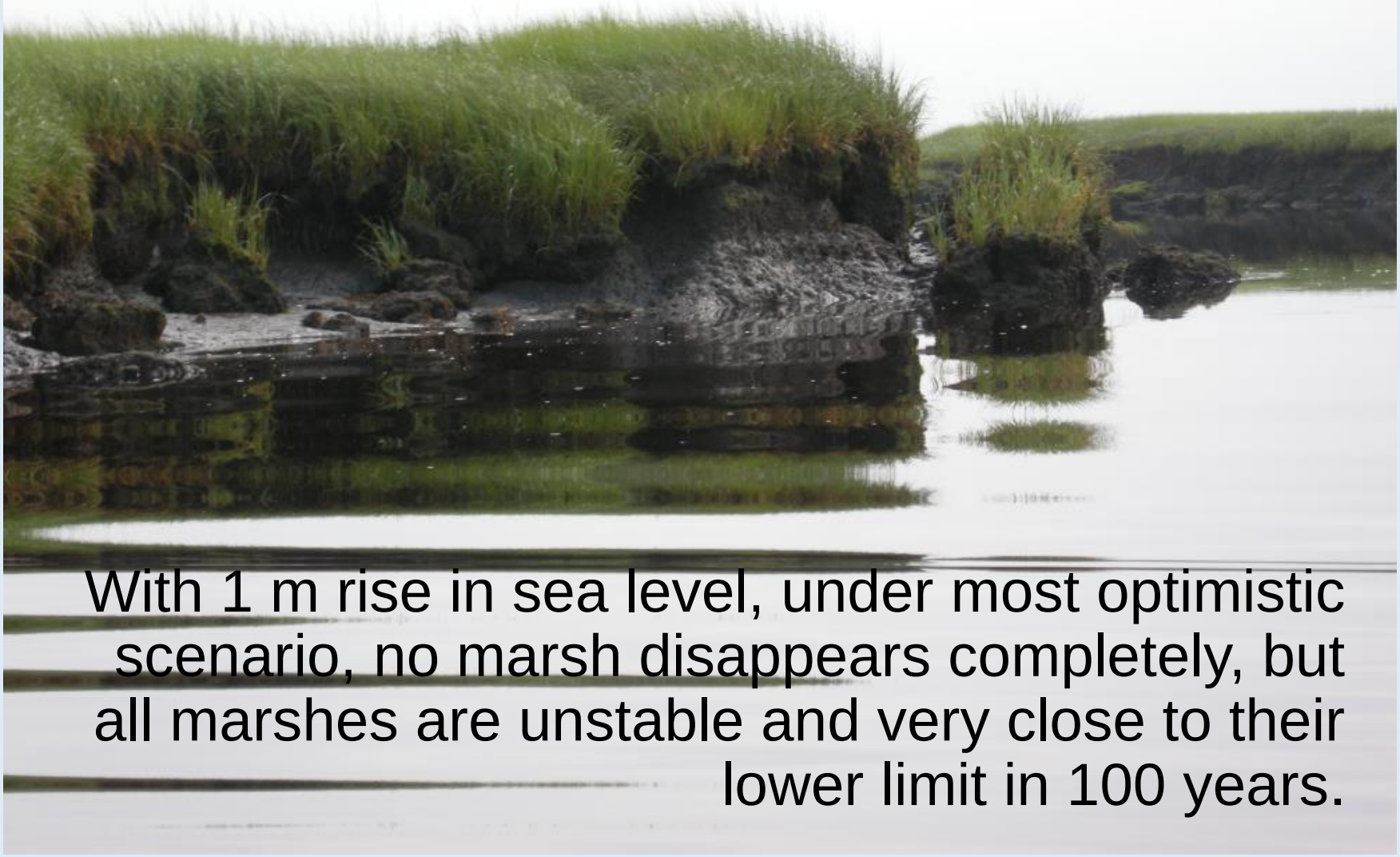
Interpreting the change over 100 yrs

1. All units show increased mudflat area.

2. Two units show increase in vegetated area.

	percent change in mudflat area	percent change in vegetated marsh
Hatches Harbor	0.89	-0.61
West End	12.82	-12.28
The Gut	0.02	1.83
Middle Meadow	6.09	-2.87
Jeremy Marsh	3.66	9.73
Nauset Adjacent	2.15	-2.18
Nauset Island	19.78	-19.79
Pleasant Bay	11.48	-11.02

Summary



With 1 m rise in sea level, under most optimistic scenario, no marsh disappears completely, but all marshes are unstable and very close to their lower limit in 100 years.