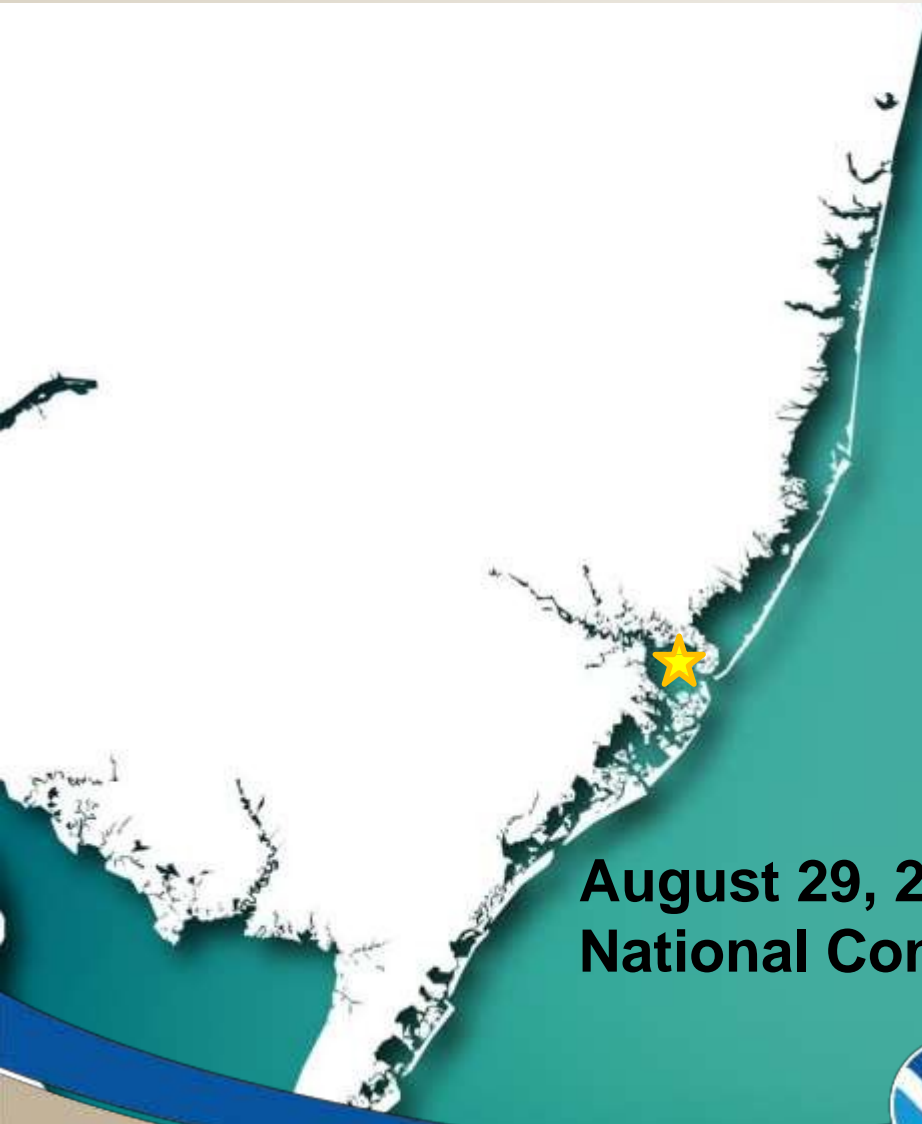


Storm Damage Reduction Benefits of Natural Infrastructure in the JC NERR



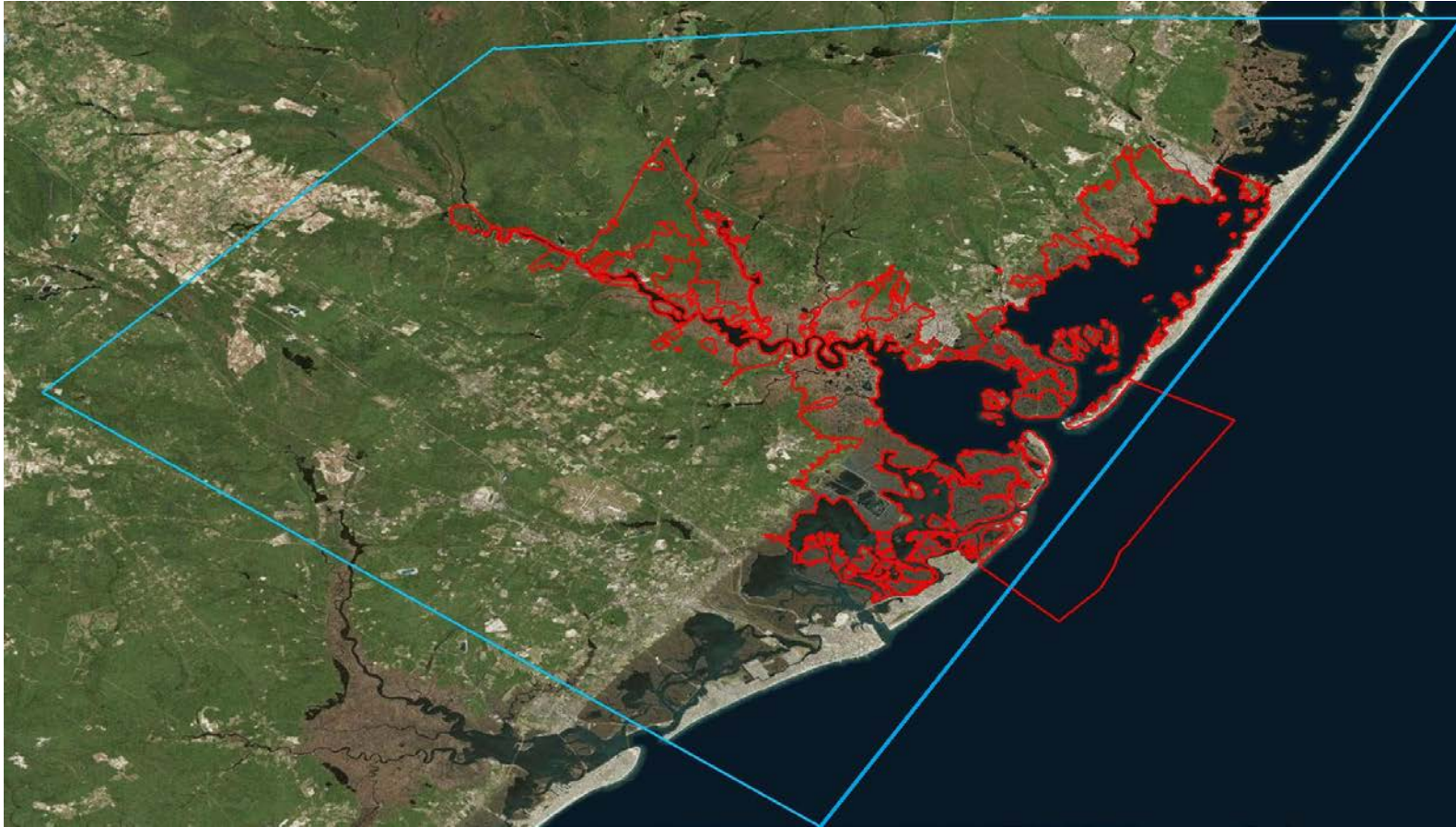
August 29, 2018
National Conference on Ecosystem Restoration



NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

coastalscience.noaa.gov

Storm Damage Reduction Benefits of Natural Infrastructure in the JC NERR



RED = JC NERR boundary

BLUE = Study Area Boundary



NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

coastalscience.noaa.gov

Project Overview

- Ecosystem service valuation
- Site selection process
- Stakeholder engagement
- Inundation modeling and property damage estimation under baseline conditions
- Inundation modeling and property damage estimation under year 2050 conditions
- Storm damage reduction value of the marsh in a 25-yr, 50-yr, and Hurricane Sandy storm events
- Value of flood insurance premium savings attributed to open space preservation



Motivation

Why was this done?

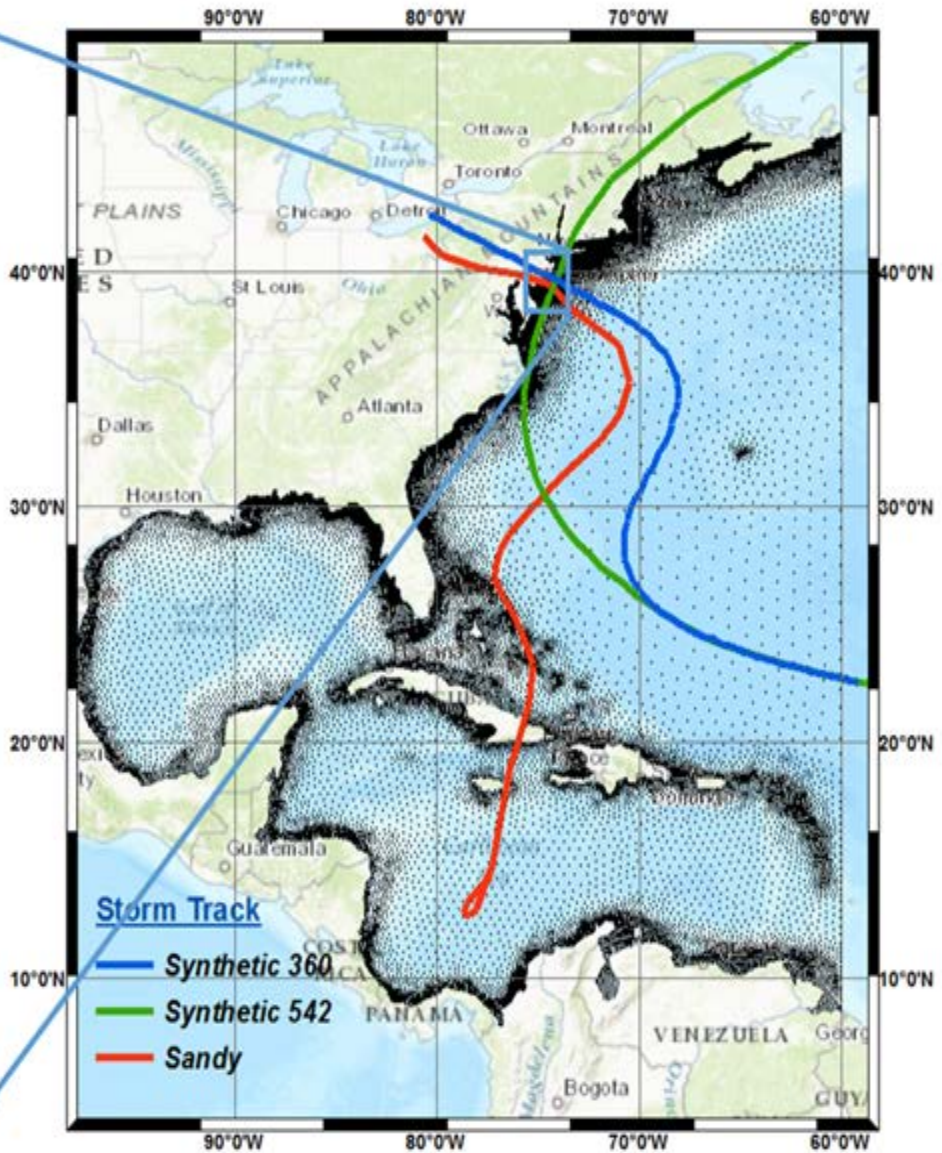
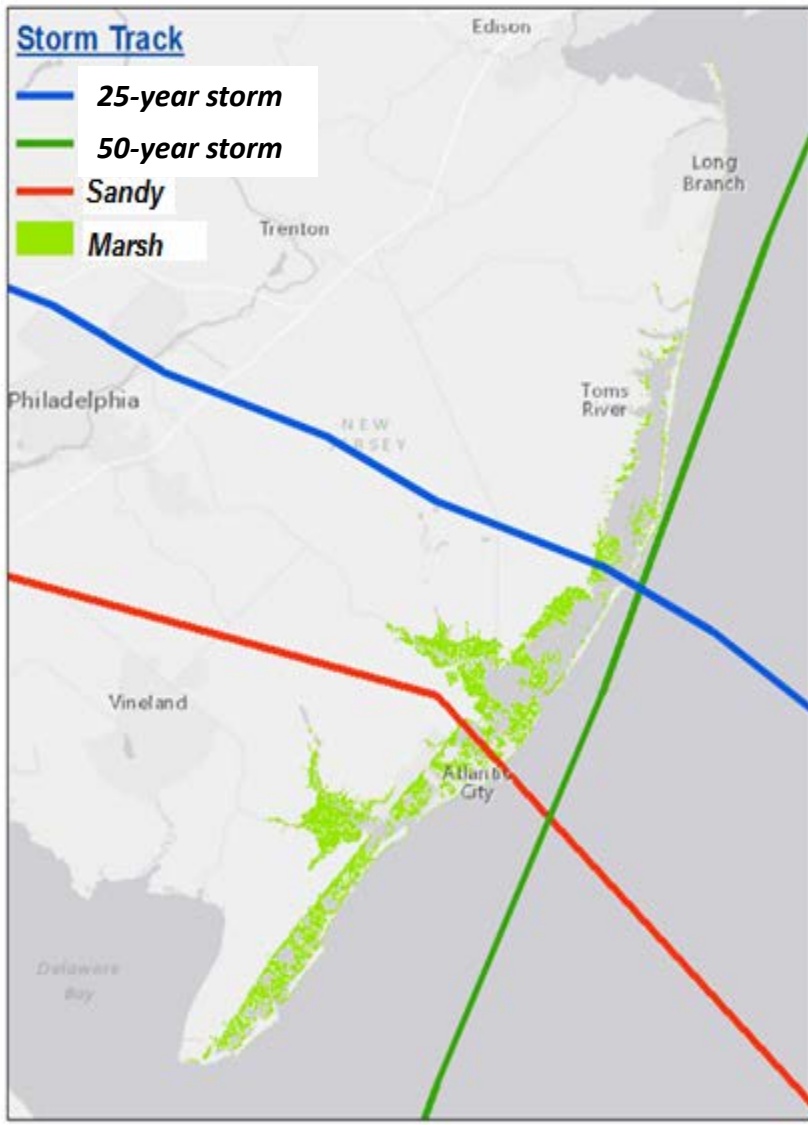
- Increase knowledge and awareness of ecosystems and their contribution to human wellbeing
- Promote necessity of protecting ecosystems to provide benefits for future generations
- Gain support for restoration and for future projects that will help protect the ecosystem



Methodology – Scenario Selection

Sea level/marsh conditions	Storm Event	Marsh Scenario
Current sea level/marsh conditions	Hurricane Sandy	Marsh present
		Marsh absent (converted to open water)
	50-year storm	Marsh present
		Marsh absent (converted to open water)
	25-year storm	Marsh present
		Marsh absent (converted to open water)
Year 2050 sea level/marsh conditions	Hurricane Sandy	Marsh present
		Marsh absent (converted to open water)
	50-year storm	Marsh present
		Marsh absent (converted to open water)
	25-year storm	Marsh present
		Marsh absent (converted to open water)





Methodology – Inundation Modeling

- Advanced Circulation Model (ADCIRC)
 - Outputs:
 - Water velocity
 - Water elevations
 - Water depth
- Simulating Waves Nearshore (SWAN)
 - Outputs:
 - Wave height
 - Period
 - Direction



Methodology – Inundation Modeling

- Sea Level Affecting Marshes Model (SLAMM)
 - Used to “predict” sea level and marsh coverage in the future
- ADCIRC and SWAN models are then both ran again in the “2050” environment



Methodology - Damages Avoided

- By combining outputs from:
 - The ADCIRC and SWAN models
 - New Jersey parcel data
 - US Army Corps of Engineers depth damage functions
- The storm damage reduction benefits provided by natural infrastructure in the JC NERR study area is calculated



Methodology – Community Rating System

- The Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum NFIP requirements
 - Discounted flood insurance premium rates
- “Credit Points” are issued to communities that engage in these floodplain management activities



Methodology – Community Rating System

- One of the CRS activities is Open Space Preservation (OSP)
- The JC NERR is considered preserved open space
- The preservation of Open Space leads to NFIP discounts in CRS-participating communities
 - Saving money on flood insurance premiums = Additional discretionary income
- Marginal Propensity to Consume
- Economic Ratios and Multipliers



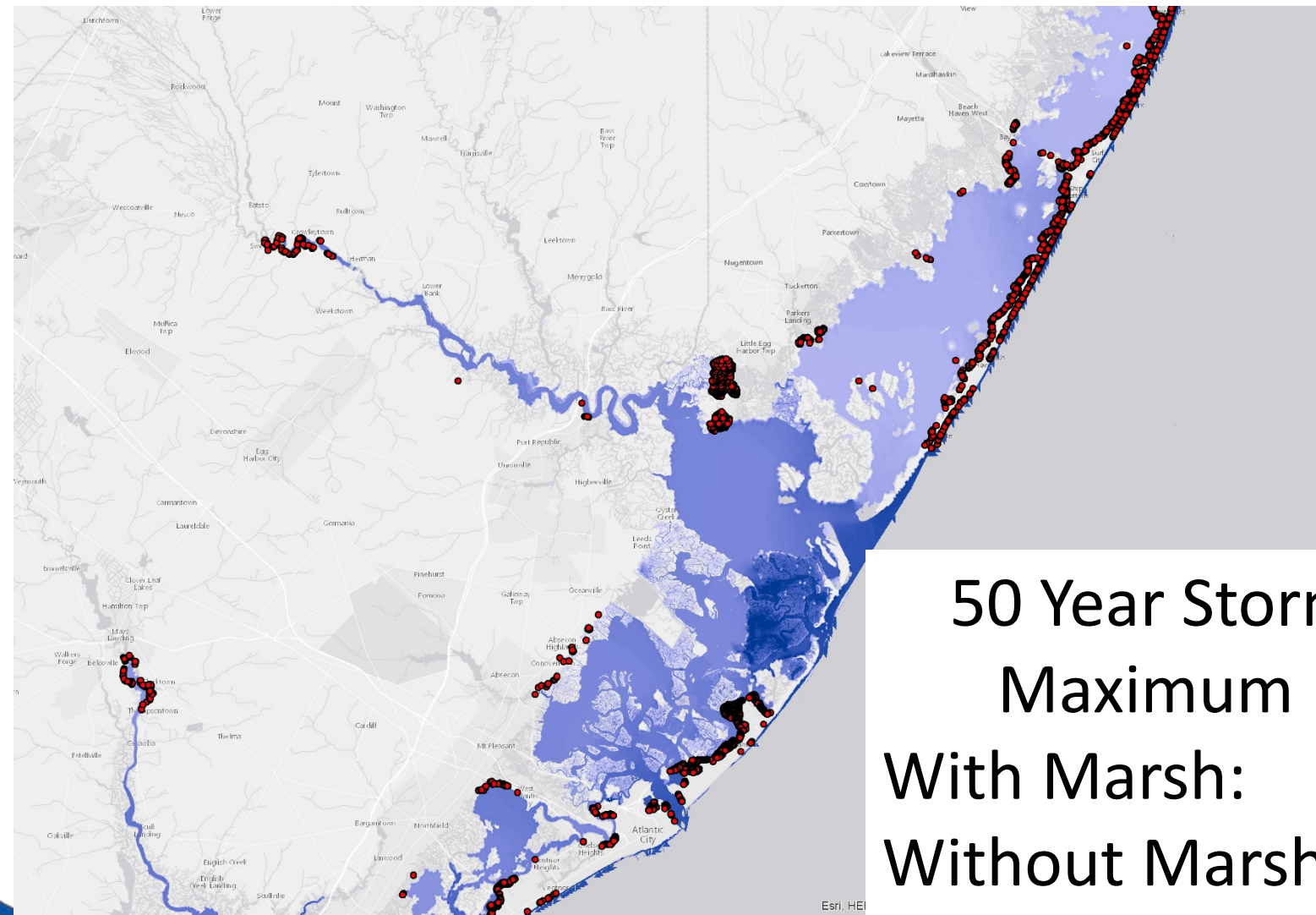
RESULTS



NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

coastalscience.noaa.gov

Results – Flood Depths



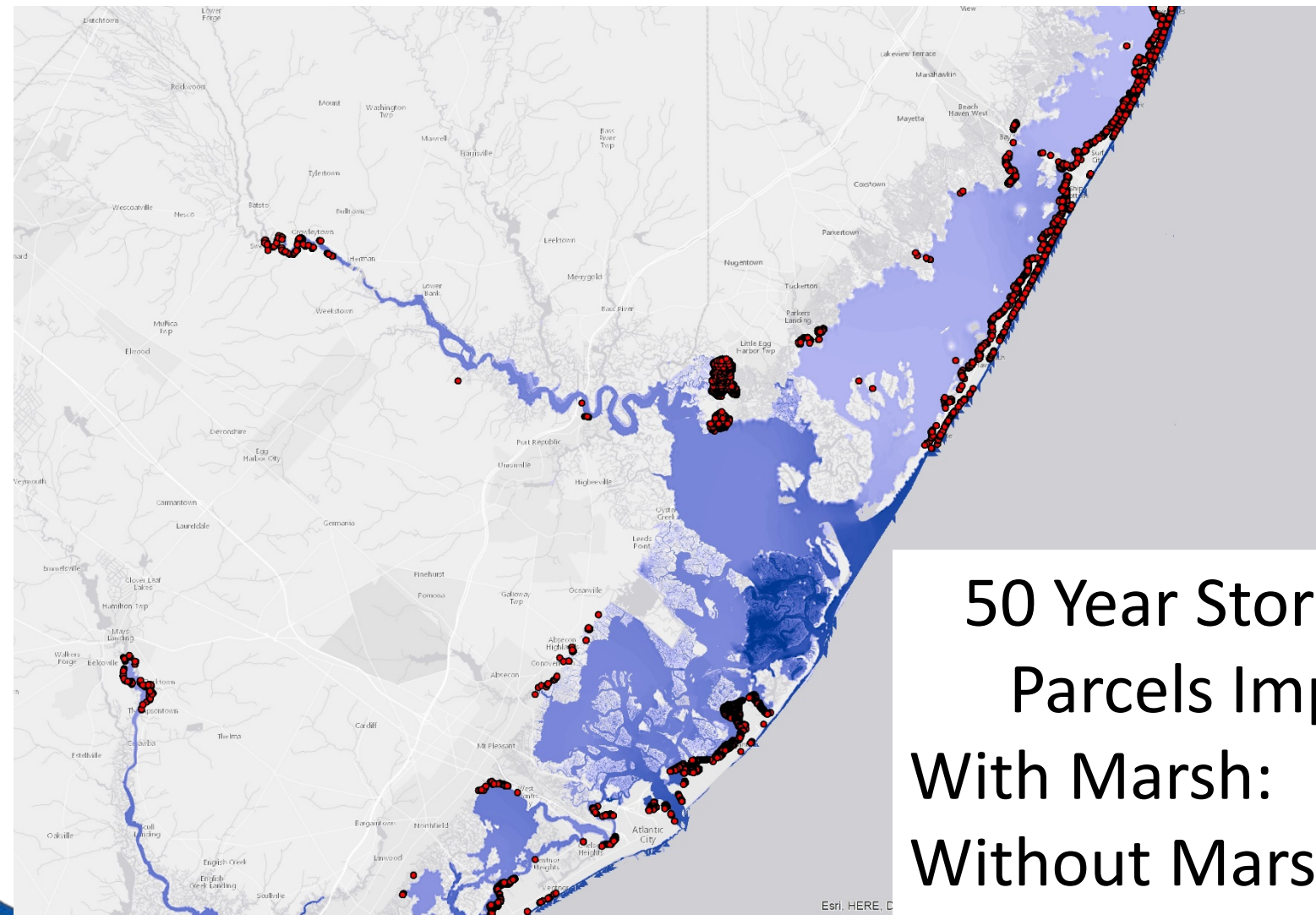
50 Year Storm Event
Maximum Depth
With Marsh: 9.18 ft
Without Marsh: 10.33 ft



NATIONAL CENTERS FOR COASTAL OCEAN SCIENCE

coastalscience.noaa.gov

Results – Parcels Impacted



50 Year Storm Event
Parcels Impacted
With Marsh: 5083
Without Marsh: 5878



Damages Avoided Results

Current Baseline Conditions

Event	Residential Property Damage; 2015\$ (Marsh Absent)	Residential Property Damage; 2015\$ (Marsh Present)	Damages Avoided (Value of the Marsh)	Percent Reduction in Damages Due to Marsh Presence	Per Acre Value of the marsh
Hurricane Sandy	\$2,331,067,963	\$2,322,731,031	\$8,336,932	-0.36%	\$136
50 Year Storm	\$107,972,822	\$94,888,388	\$13,084,434	-13.79%	\$213
25 Year Storm	\$91,894,099	\$82,062,657	\$9,831,442	-11.98%	\$160



Damages Avoided Results

Projected 2050 Conditions

Event	Residential Property Damage; 2015\$ (Marsh Absent)	Residential Property Damage; 2015\$ (Marsh Present)	Damages Avoided (Value of the Marsh)	Percent Reduction in Damages Due to Marsh Presence	Per Acre Value of the marsh
Hurricane Sandy	\$2,594,648,892	\$2,562,559,835	\$32,089,057	-1.25%	\$557
50 Year Storm	\$349,122,514	\$329,190,819	\$19,931,695	-6.05%	\$346
25 Year Storm	\$126,980,226	\$125,436,468	\$1,543,758	-1.23%	\$27



Damages Avoided Results

Statistical Analysis

	Effect of Marsh Presence		Effect of SLR and Marsh Migration	
	Current Conditions	2050 Conditions	Marsh Present	Marsh Absent
Number of parcels inundated (25-year storm)	DECREASE (p<0.01)	N/A	INCREASE (p<0.01)	INCREASE (p<0.01)
Number of parcels inundated (50-year storm)	DECREASE (p<0.01)	DECREASE (p<0.01)	INCREASE (p<0.01)	INCREASE (p<0.01)
Number of parcels inundated (Hurricane Sandy storm)	N/A	DECREASE (p=0.05)	N/A	N/A
Mean parcel inundation depth (25-year storm)	N/A	N/A		
Mean parcel inundation depth (50-year storm)	N/A	DECREASE (p<0.01)	INCREASE (p<0.01)	INCREASE (p<0.01)
Mean parcel inundation depth (Hurricane Sandy storm)	DECREASE (p=0.01)	DECREASE (p<0.01)		
Mean proportional structural damage (25-year storm)	DECREASE (p<0.01)	N/A		N/A
Mean proportional structural damage (50-year storm)	DECREASE (p=0.02)	DECREASE (p<0.01)	INCREASE (p<0.01)	INCREASE (p<0.01)
Mean proportional structural damage (Hurricane Sandy storm)	N/A	DECREASE (p<0.01)		INCREASE (p<0.01)



Community Rating System Results

CRS Community	CRS class (2013)	Total CRS Discount for all NFIP policy holders (2015\$)	Discount dollars attributed to OSP (2015\$)	Expected increase in expenditures due to OSP CRS savings (2015\$)
Barnegat Light	8	\$102,296	\$42,415	\$29,633
Beach Haven	6	\$661,202	\$193,525	\$130,987
Brigantine	6	\$1,242,659	\$621,330	\$460,429
Margate City	6	\$1,215,503	\$355,762	\$244,395
Stafford	6	\$790,873	\$231,478	\$172,132
TOTAL			\$1,444,510	\$1,037,576

- \$1.4 million in flood insurance savings attributed to open space preservation
 - Leads to over \$1 million in additional direct expenditures in the community
- Output contribution = \$938,973
- Income contribution = \$451,500
- Employment contribution = 12 full time jobs



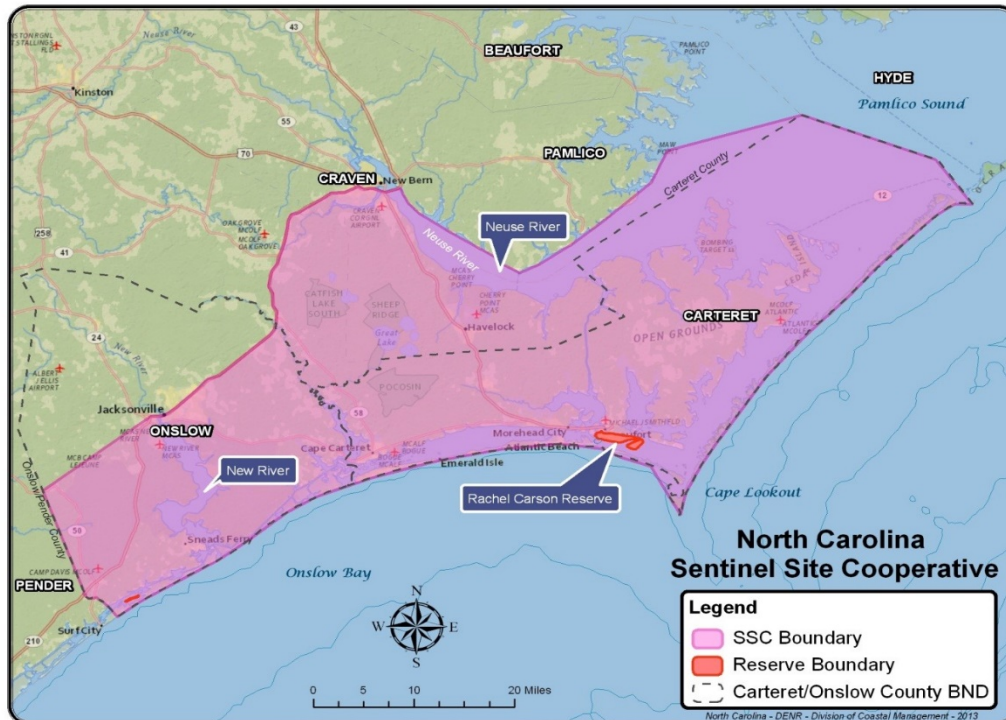
Summary of Results – The Takeaways

- Residential property damage is predicted to be **GREATER** with marsh absent when compared to marsh present for all storm events
- Residential property damage is predicted to be **GREATER** in 2050 when compared to current times for all storm events
- The CRS is a valuable tool for saving money on flood insurance premiums which induces economic stimulus



Next Steps

Continuation of research at the North Carolina Sentinel Site Cooperative



- Residential properties
- Critical infrastructure
 - Schools
 - Hospitals
- Roads

July – Sept 2018: Scenario Development

Oct 2018 – July 2019: Analysis

Aug-Nov 2019: Deliverables



Thank you!

Project Partners

- NOAA NCCOS
- Jacques Cousteau National Estuarine Research Reserve
- National Estuarine Research Reserve System
- George Mason University
- Rutgers University



For more information:

Matt.Gorstein@noaa.gov
Jarrod.Loerzel@noaa.gov

Report Link:

<https://repository.library.noaa.gov/view/noaa/16081>



Project Webpage:

<https://coastalscience.noaa.gov/project/economic-valuation-shoreline-protection-natural-infrastructure-coastal-community/>

