RESILIENCE AND REGIONAL SEDIMENT MANAGEMENT

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Regional Sediment Management In Progress Review
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OUTLINE

- What is resilience?
- What are some best practices for resilience?
- How is resilience measured?
- R&D Update: Coastal Resilience Metrics & Applications
  - Project I: Southeastern Seaboard Ports and Hurricane Matthew
  - Project II: Dune and Beach Resilience Parameters
  - Project III: Pilot Coastal Resilience Index

RESILIENCE FOR COASTAL SYSTEMS

Definition of Resilience: the capacity to

- Anticipate and plan for disruptions,
- Resist loss in operations and/or absorb the impact of disturbances or stressors,
- Rapidly recover afterwards, and
- Adapt to short- and long-term stressors, changing conditions and constraints.

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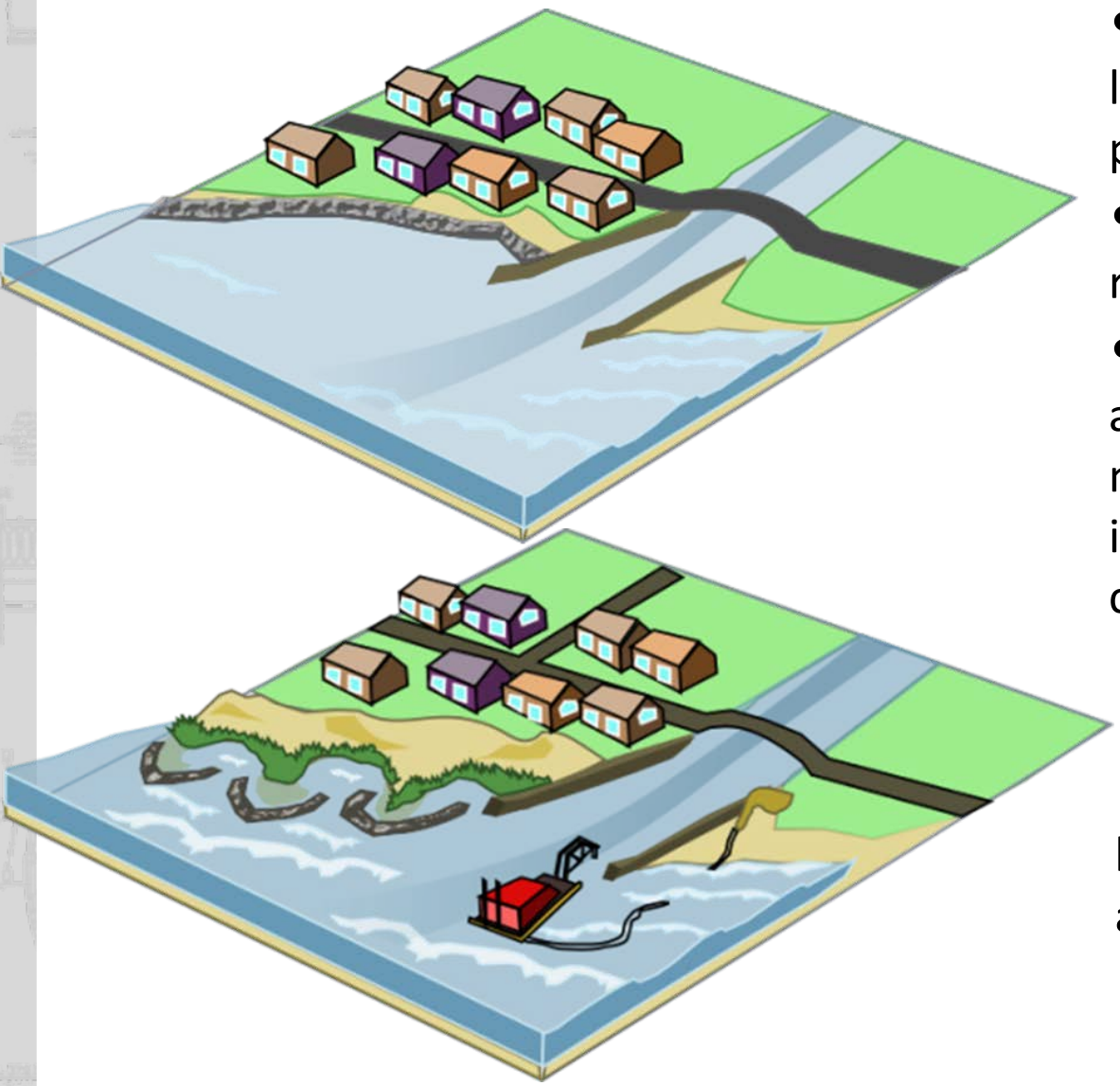
RESILIENCE FOR COASTLINES – EXAMPLE BAY COMMUNITY



- Prepare - Anticipate weak links, be ready to recover, build partnerships.
- Resist - Provide diverse and redundant protection.
- Recover - Ensure availability of alternate networks, prepare independent and complimentary components

- Adapt – foster natural and human actions to facilitate adaptation

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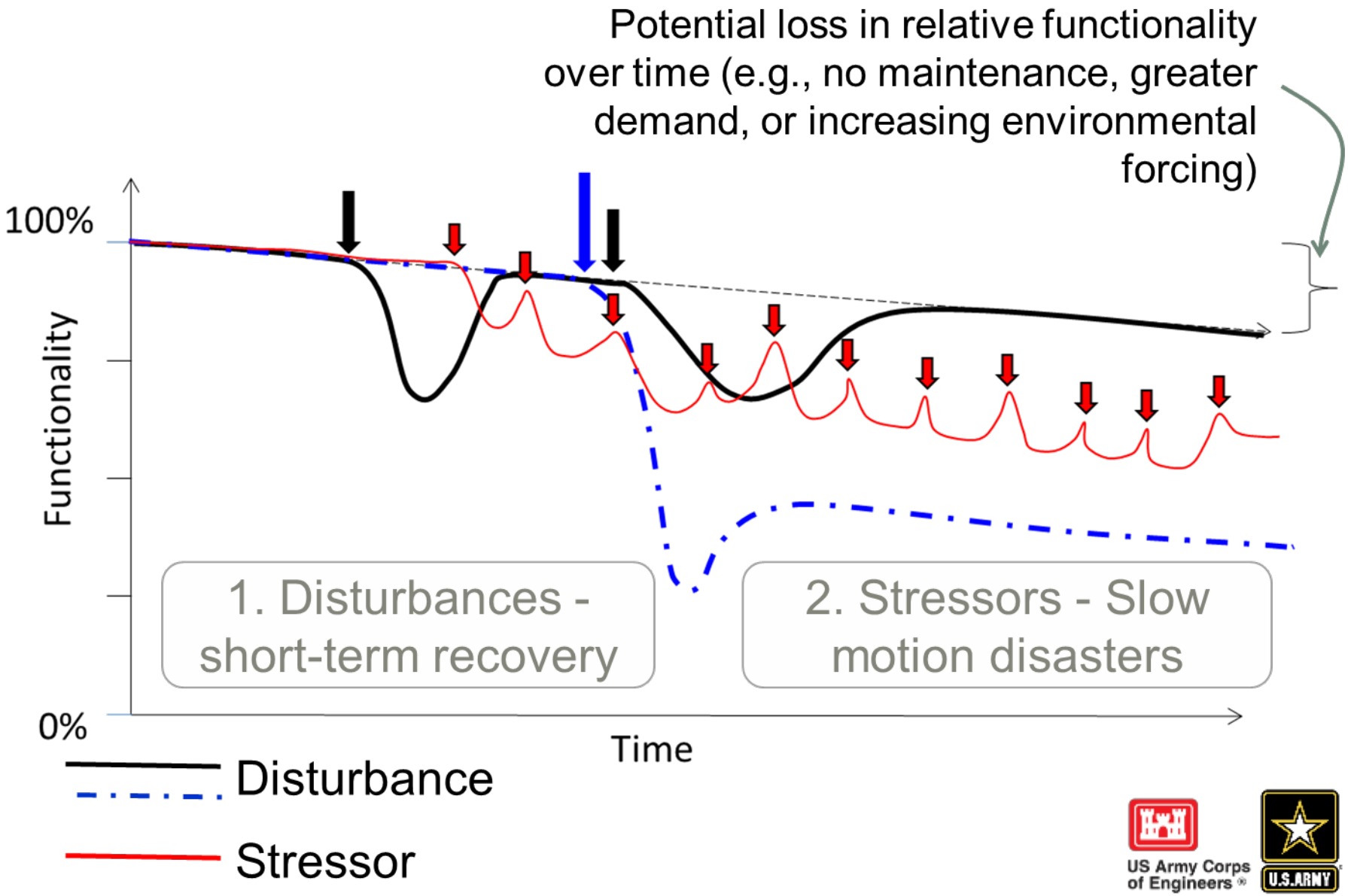
NATURE OF THE BEAST – STRESSORS AND DISTURBANCES



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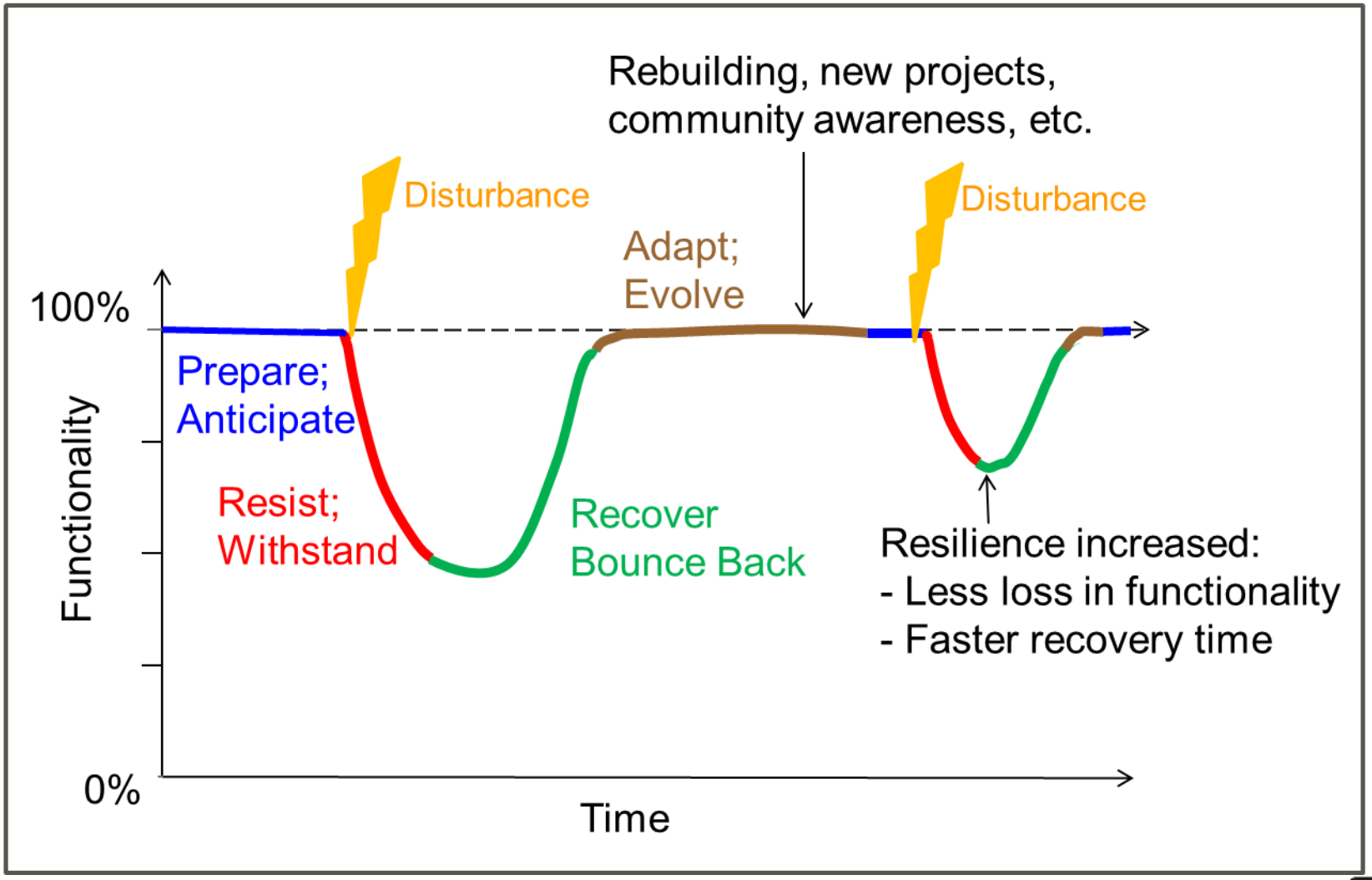
RESILIENCE TIMELINE



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QUANTIFYING RESILIENCE

Knowledge and Frameworks to Assess Resilience

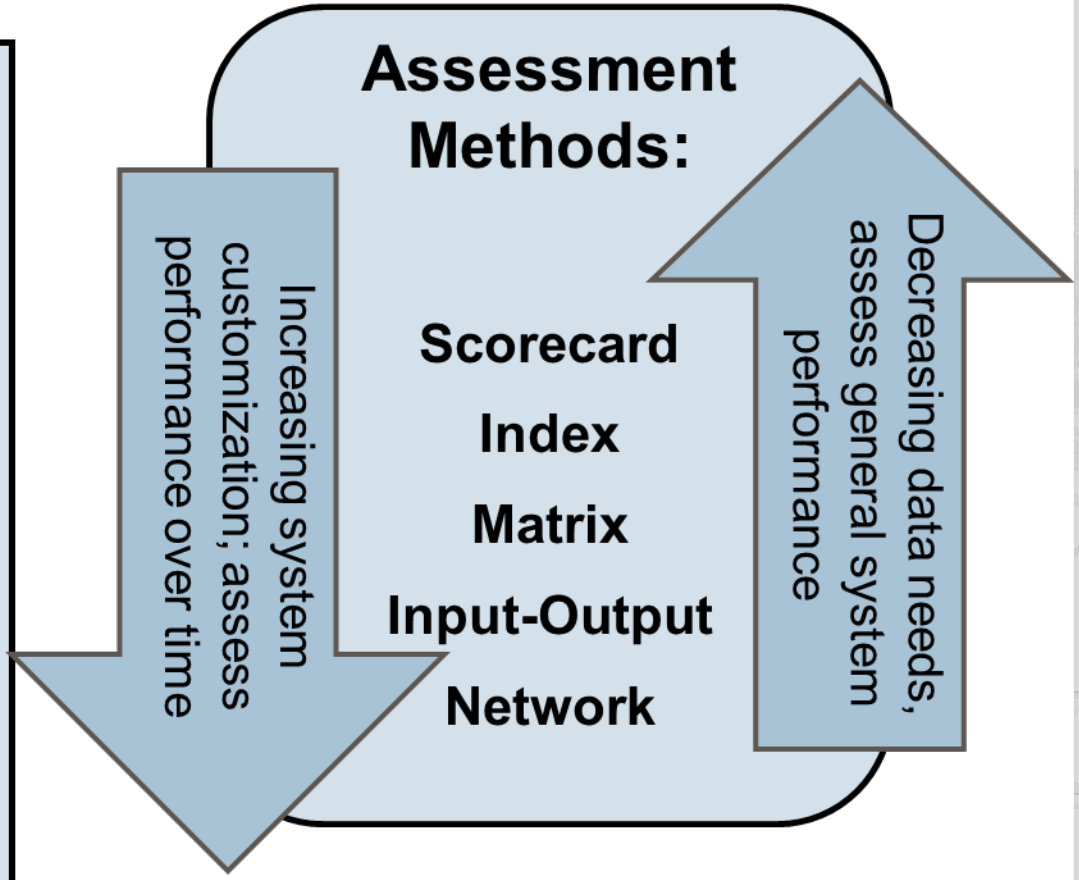
Parameters of Resilience Assessments:

Critical Function *– component function essential to system performance*

Threshold *– level of acceptable performance*

Time *– stages of event cycle, including impact, recovery, and adaptation*

Memory *– understanding past performance and progressive change in the system*



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PROJECT I: IMPACTS OF HURRICANE MATTHEW ON THE SOUTHEASTERN SEABOARD

Katherine Touzinsky, Brandon Scully, Marin Kress, Ned Mitchell, ERDC-CHL

RSM and Resilience: Define resilience metrics for navigation mission; proxy indicators for port function and performance of navigation channel. How can RSM actions improve preparations and recovery for coastal storms?

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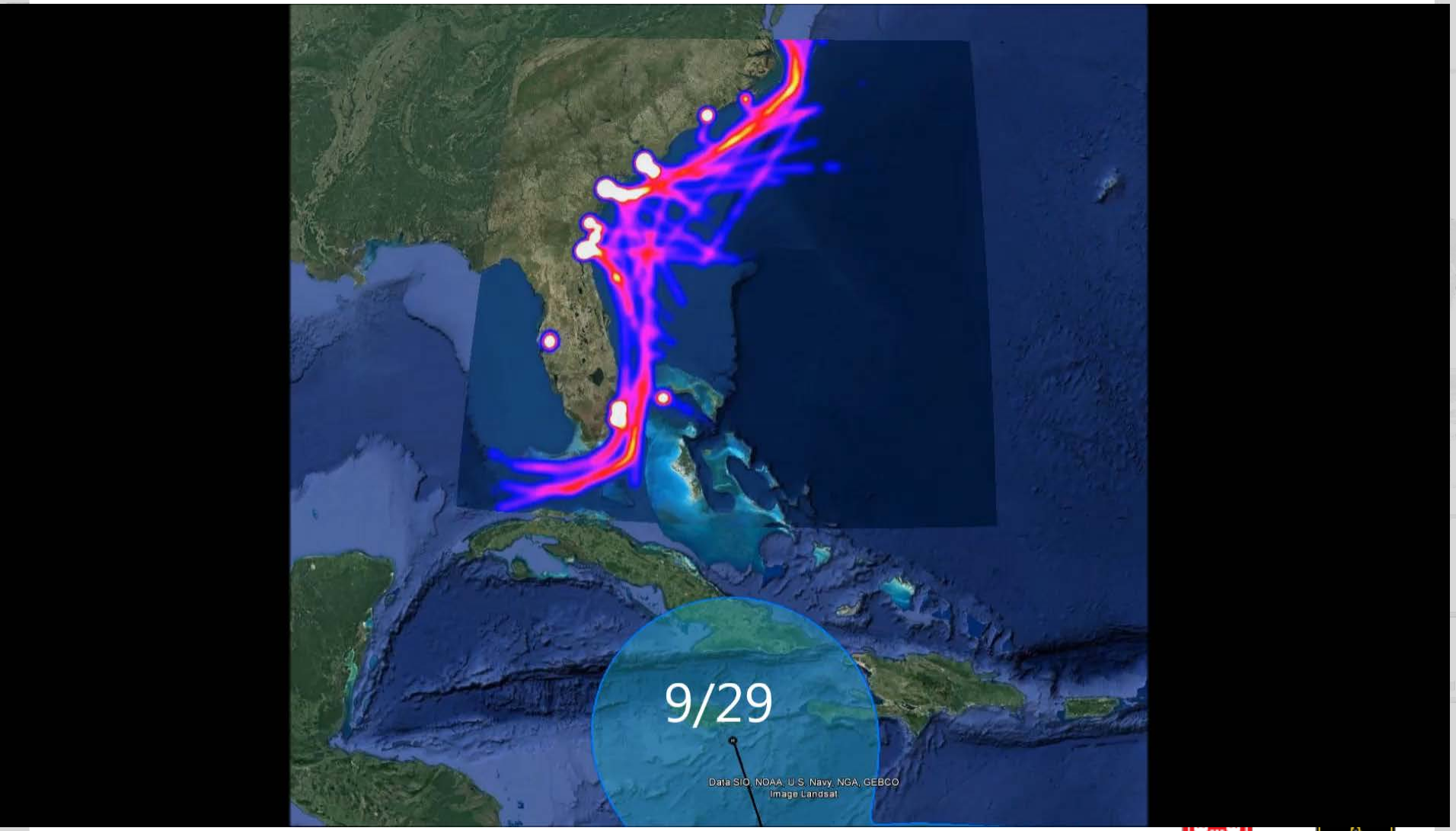
TANKER AND CARGO VESSEL HEAT MAPS



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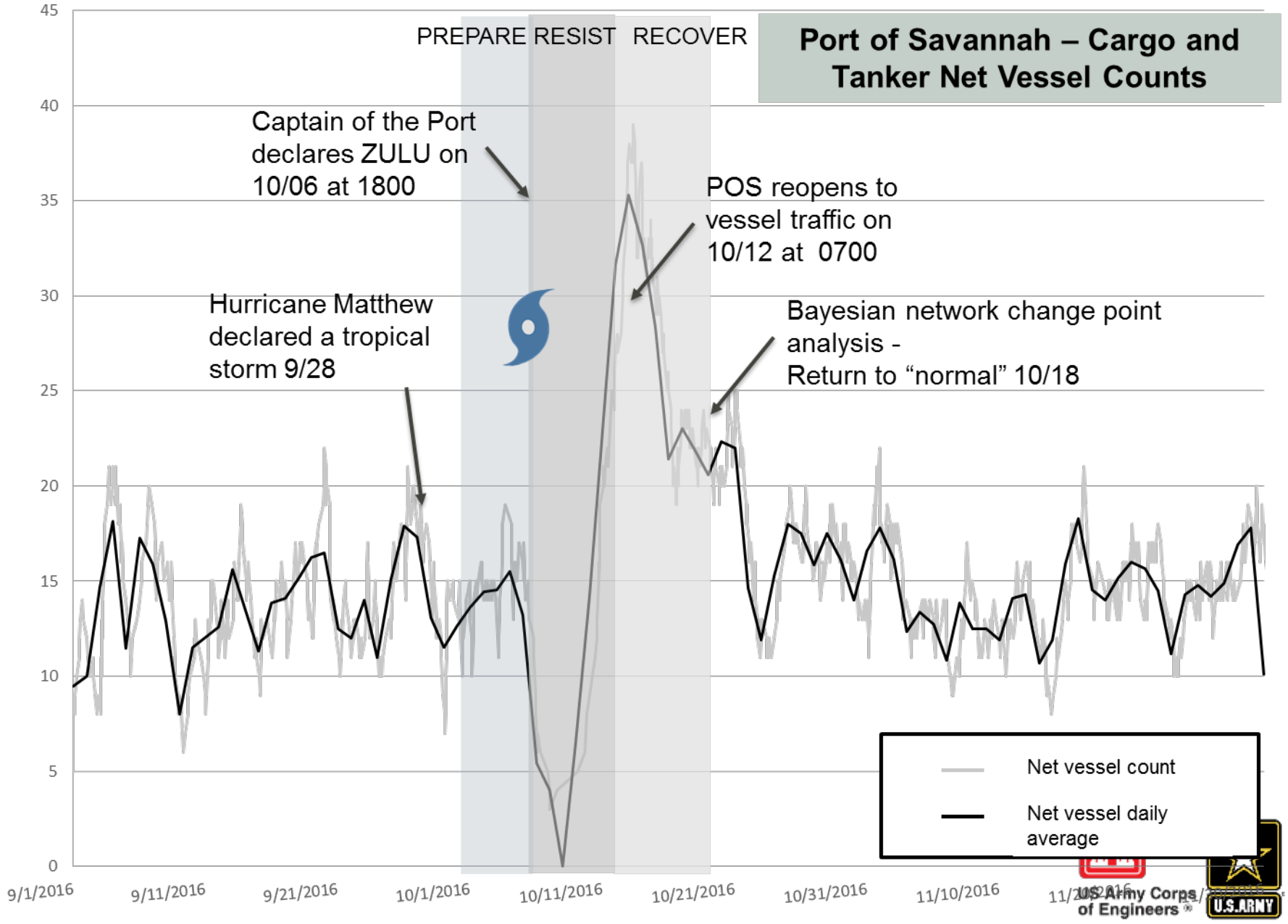
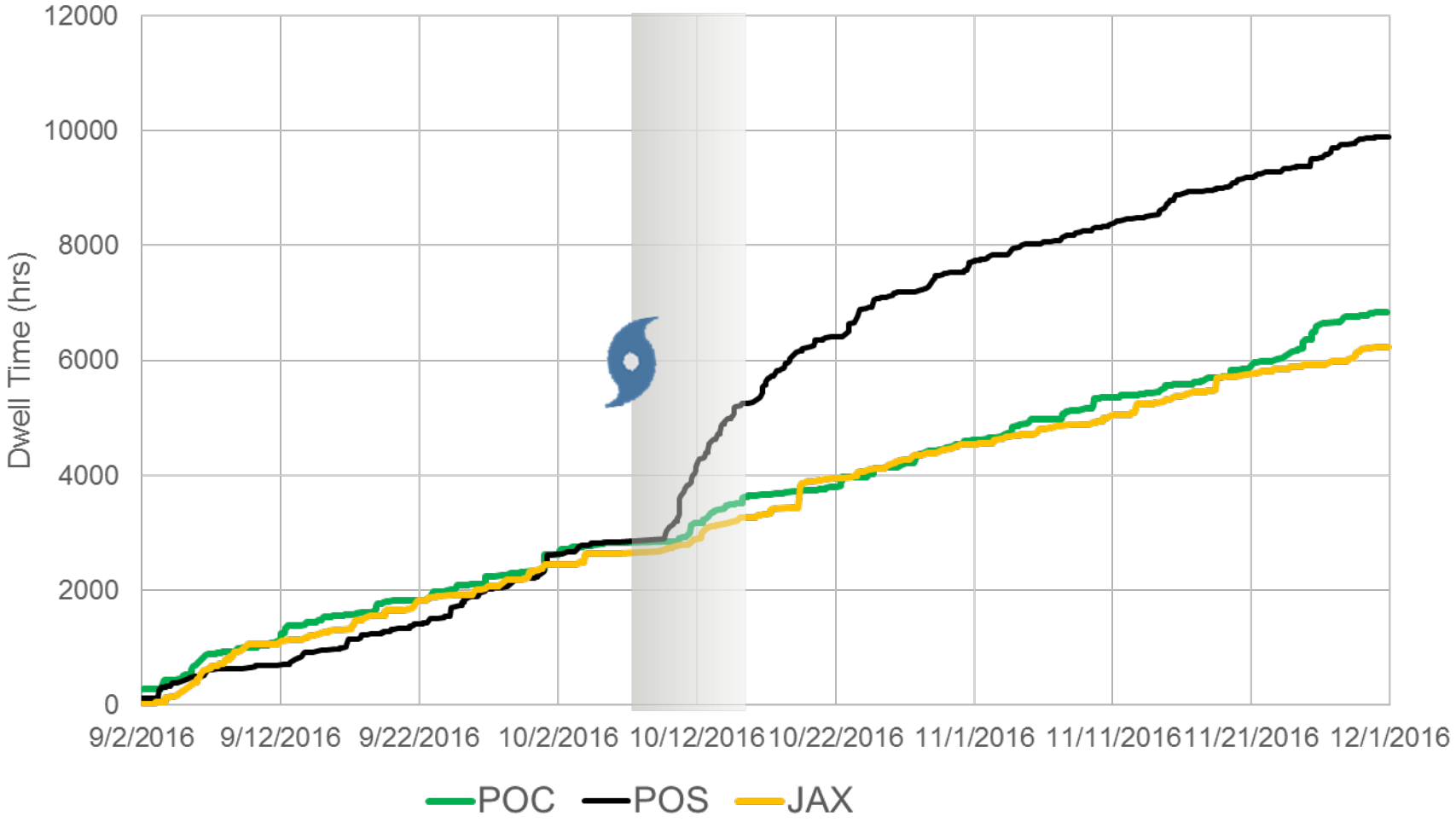
NAVIGATION RESILIENCE METRIC – NET VESSEL COUNT



NAVIGATION RESILIENCE METRIC – CUMULATIVE DWELL TIME



POS dwell time greatly increased because channel was unavailable until 10/12 – 6 days after closure

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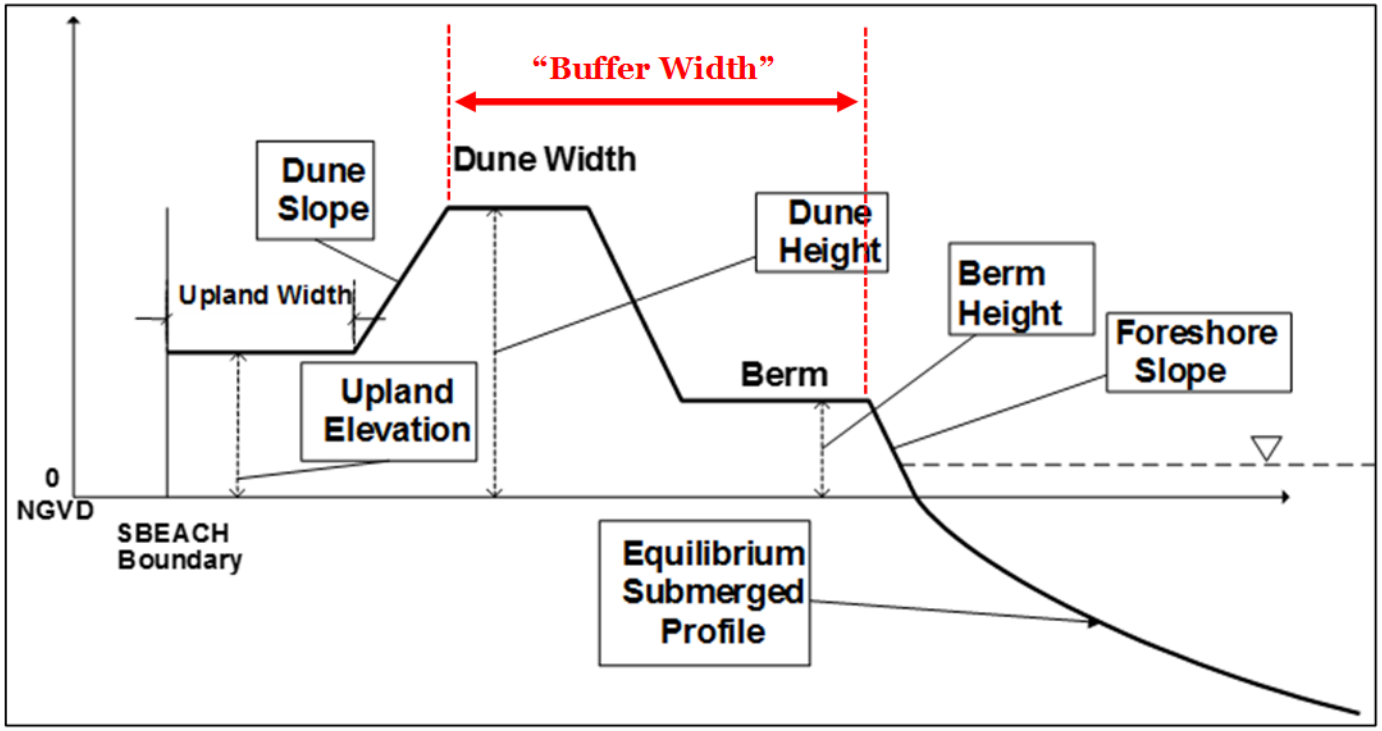
PROJECT II: DUNE AND BEACH RESILIENCE METRICS

Marty Durkin, SAJ

RSM & Resilience - *Suggest resilience metrics for dune and beach Coastal Storm Risk Management (CSRM) and RSM projects using Beach-fx output data*

DUNE & BEACH RESILIENCE METRIC

- Buffer width (BW) – a measurement similar to the USGS Beach Closure. The combined horizontal distance of the dune width, seaward dune slope, and berm width.
- Based on the simplified representative profiles used in the Beach-fx



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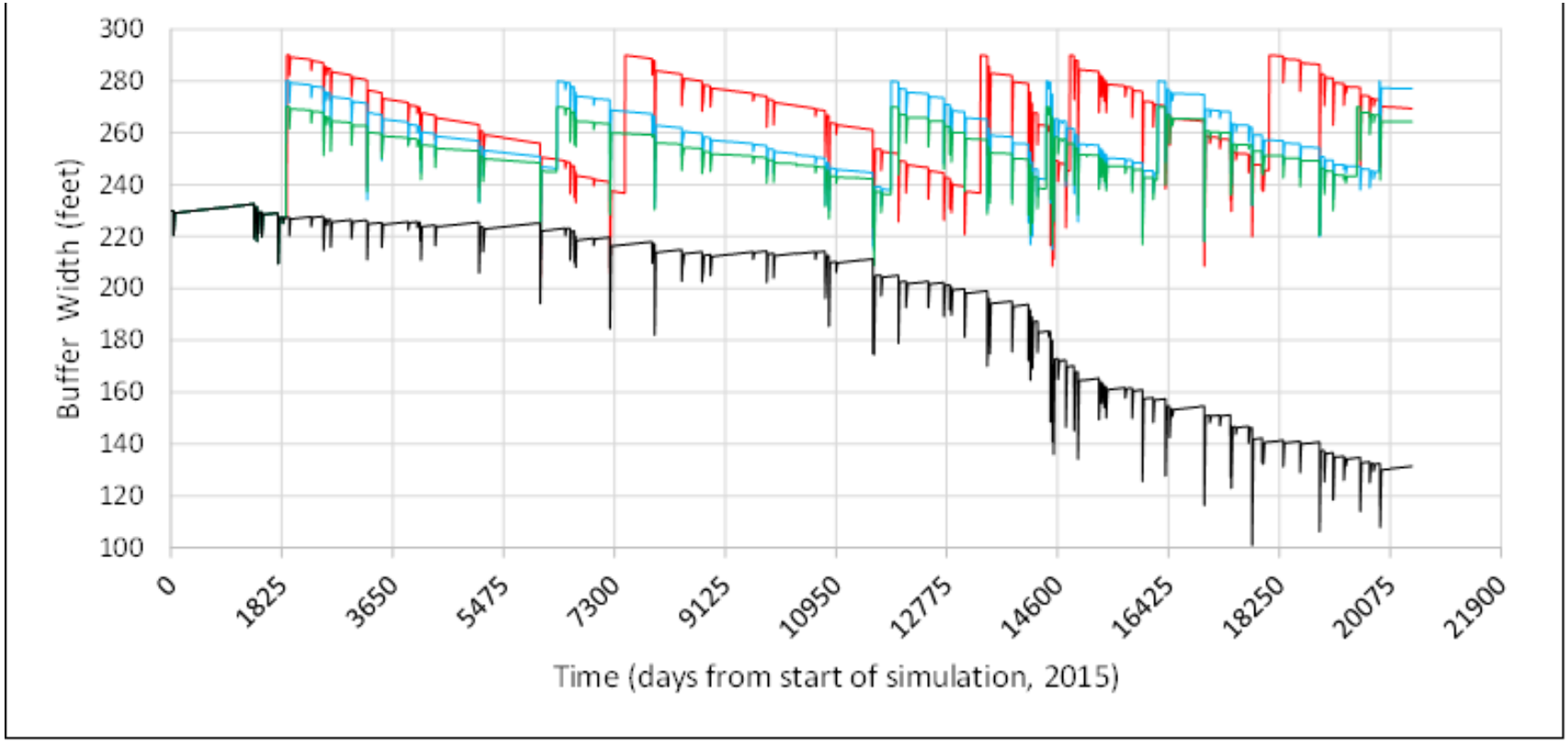
BUFFER WIDTH OVER 50 YEARS FROM BEACH-FX CALCULATIONS



+00'dune_+60'berm
+10'dune_+40'berm
+20'dune_+20'berm
FWOP

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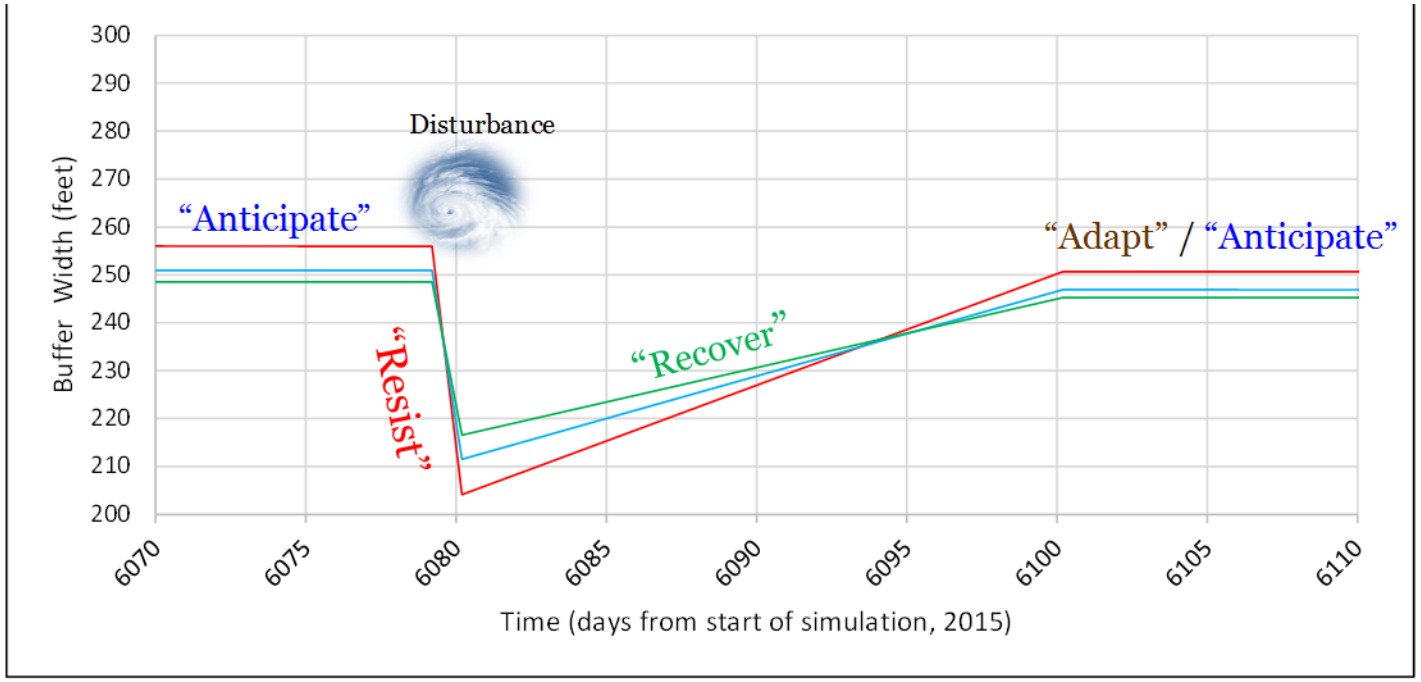
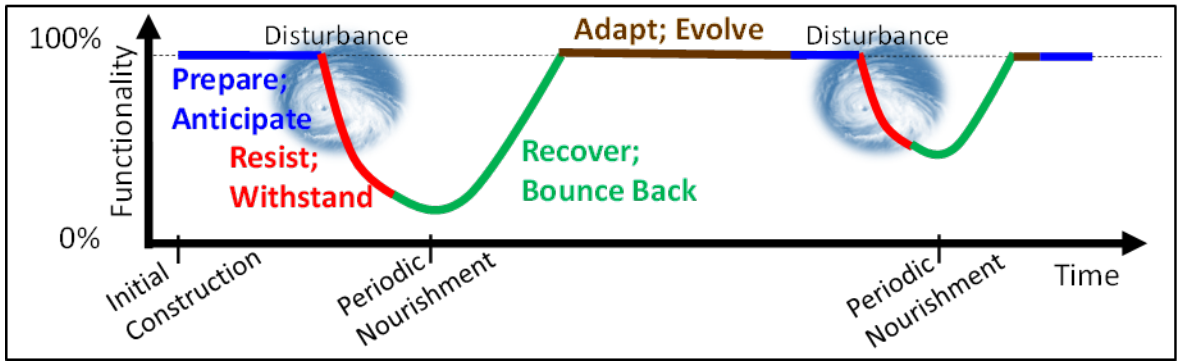
BUFFER WIDTH OVER TIME





+00'dune_+60'berm
+10'dune_+40'berm
+20'dune_+20'berm

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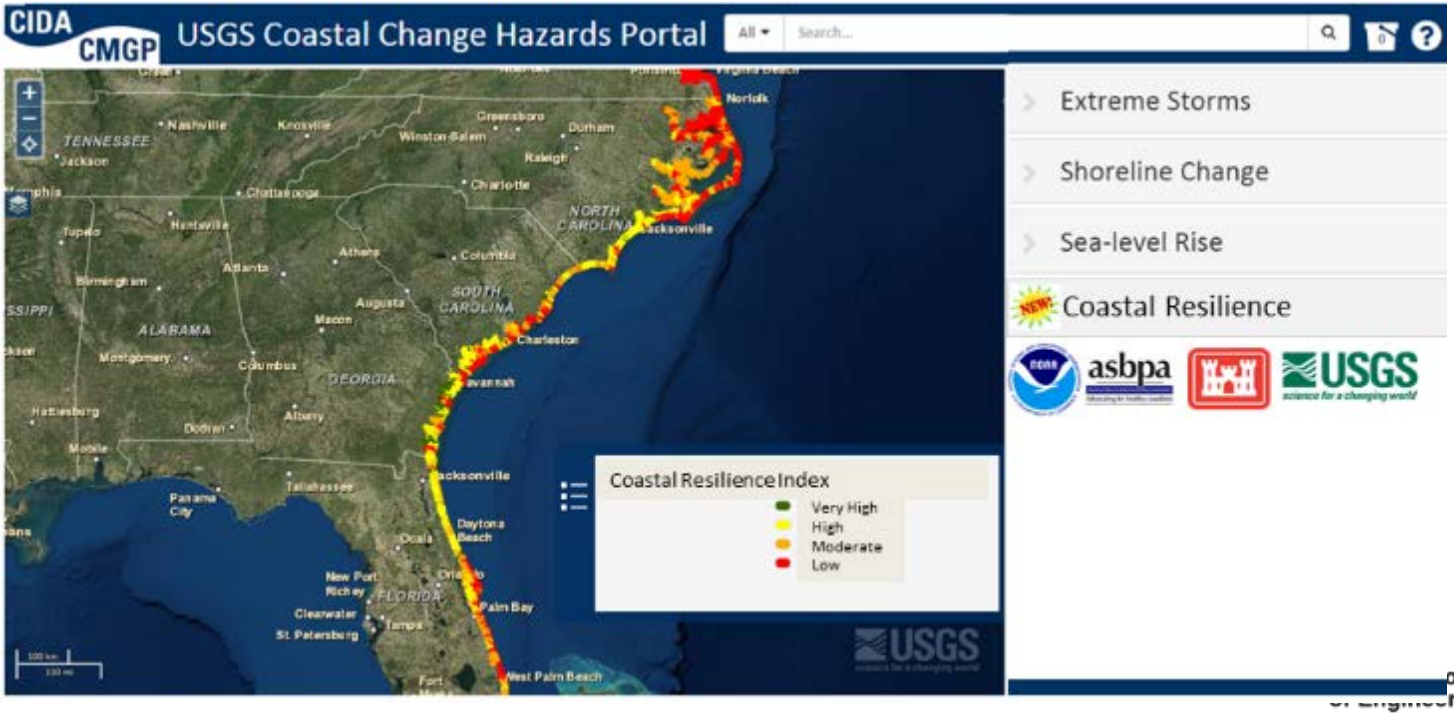
PROJECT III: PILOT COASTAL RESILIENCE INDEX

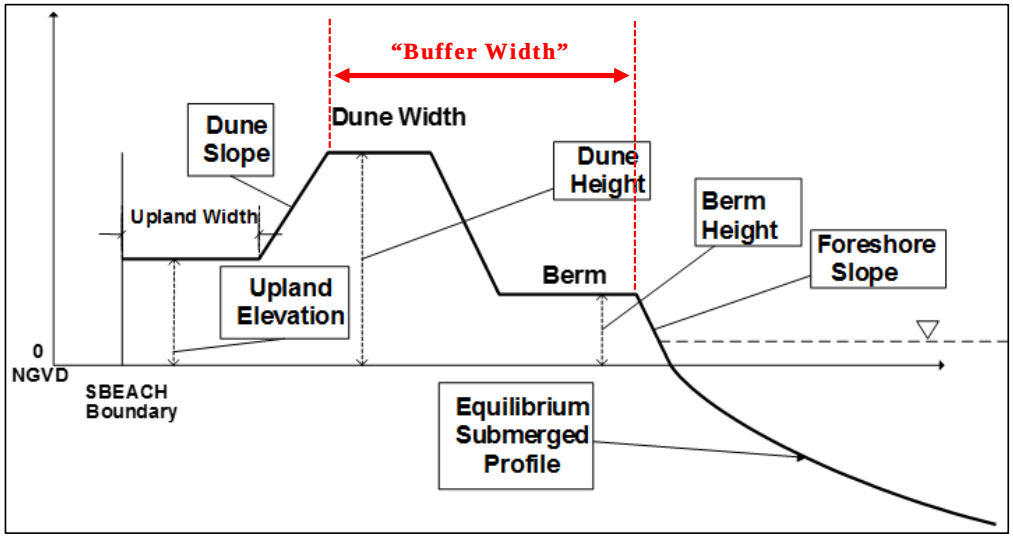
Nicole Elko, ASBPA, Quin Robertson and Zhifei Dong, CB&I

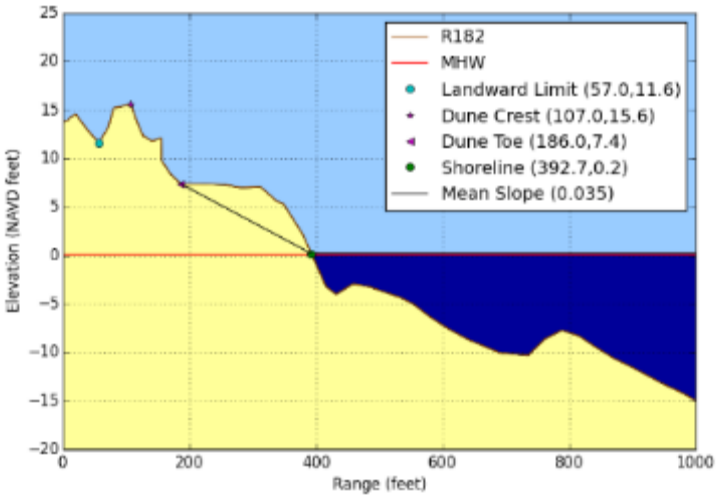
RSM and Resilience: Create the groundwork for a national coastal resilience tool to help understand how RSM and CSDR actions change local and regional resilience



METHOD – BEACH PARAMETERS

- Pilot CRI considers five beach parameters: Protective Width (PW), Protective Elevation (PE), Volume Density (VD), Wave Runup (WR), Crest Freeboard (CF)
- Developed scripts to process LIDAR data or beach surveys to extract parameters and create profile plots:





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COASTAL RESILIENCE INDEX (CRI) MODEL

Five non-dimensional factors based on beach, storm and wave parameters:

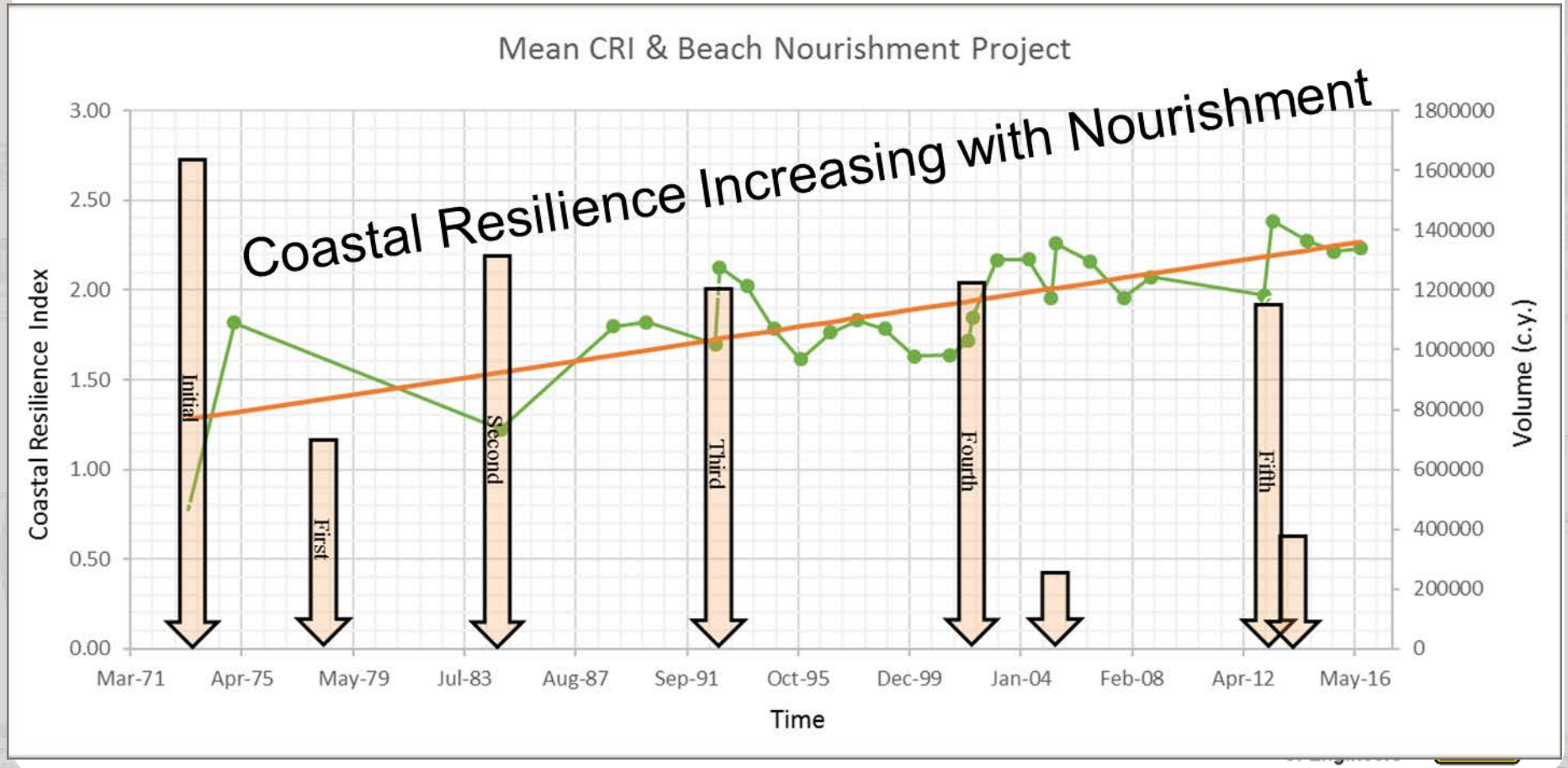
$$\boldsymbol{a} = \frac{PE}{PE_0}; \boldsymbol{b} = \frac{PE * PW * (1 - s)}{PE_0 * PW_0}; \boldsymbol{c} = \frac{PW - MR}{PW_0}; \boldsymbol{d} = \frac{DE - (MS + MHW)}{CF_0}; \boldsymbol{e} = \frac{WR_0}{WR}$$

$$CRI = \boldsymbol{a} + \boldsymbol{b} + \boldsymbol{c} + \boldsymbol{d} + \boldsymbol{e}$$

a = PE (Protective Elevation) factor
b = VD (Volume Density) factor
c = PW (Protective Width) factor
d = CF (Crest Freeboard) factor
e = WR (Wave Runup) factor

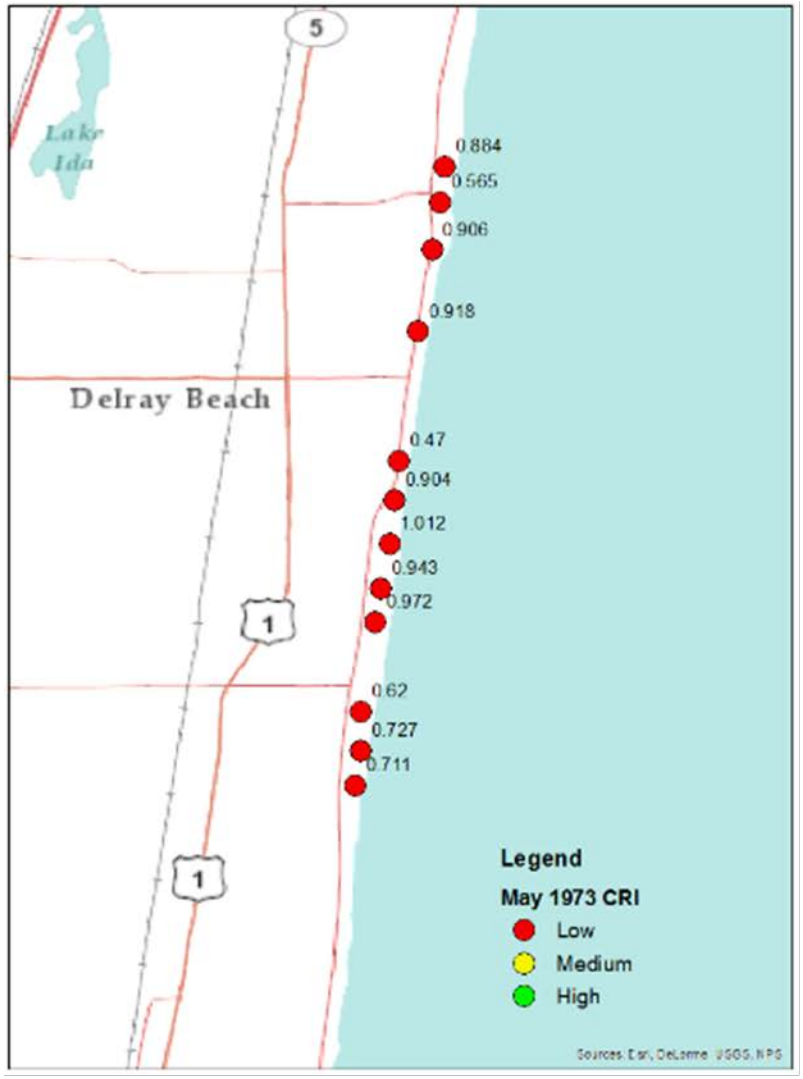
CALCULATING CRI FOR DELRAY BEACH, FL

32 survey datasets between 1975 and 2016
6 periodic beach (re)nourishment projects and 2 storm repair projects
Storm and wave parameters set as constant during calculation
CRI<1.5, Low resilience; 1.5<CRI<2.0, Medium resilience; CRI>2.0, High resilience

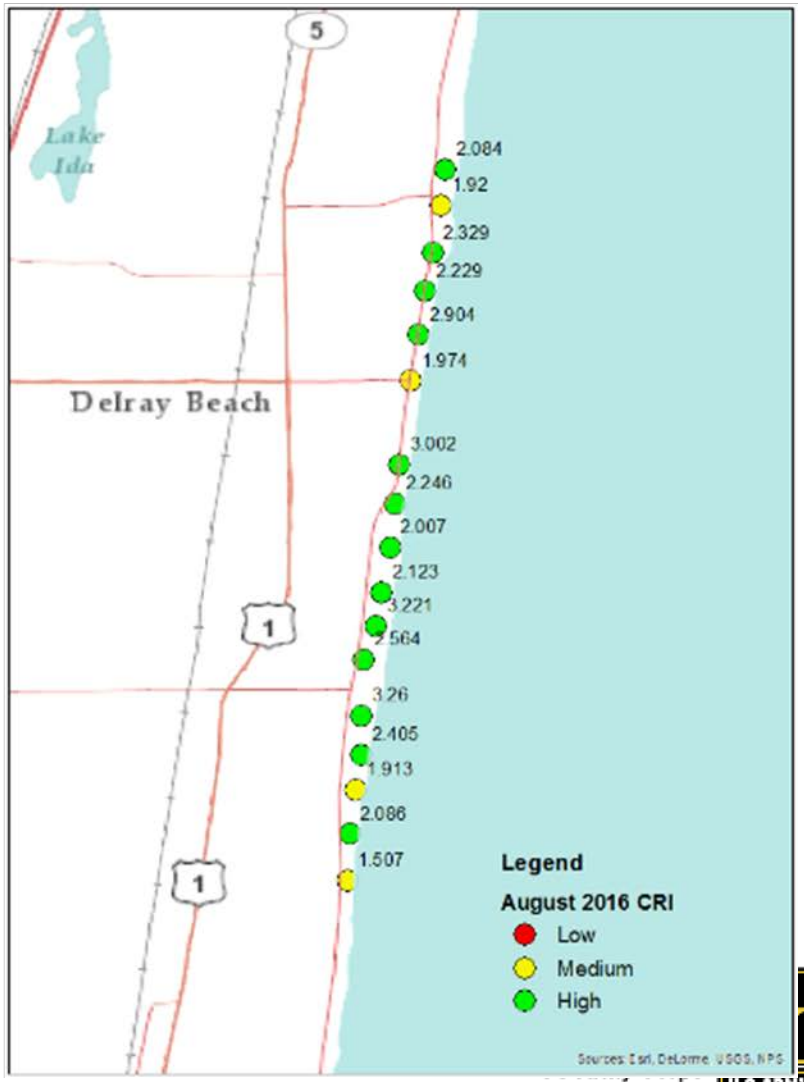


DELRAY BEACH APPLICATION

May 1973 before the first project



August 2016



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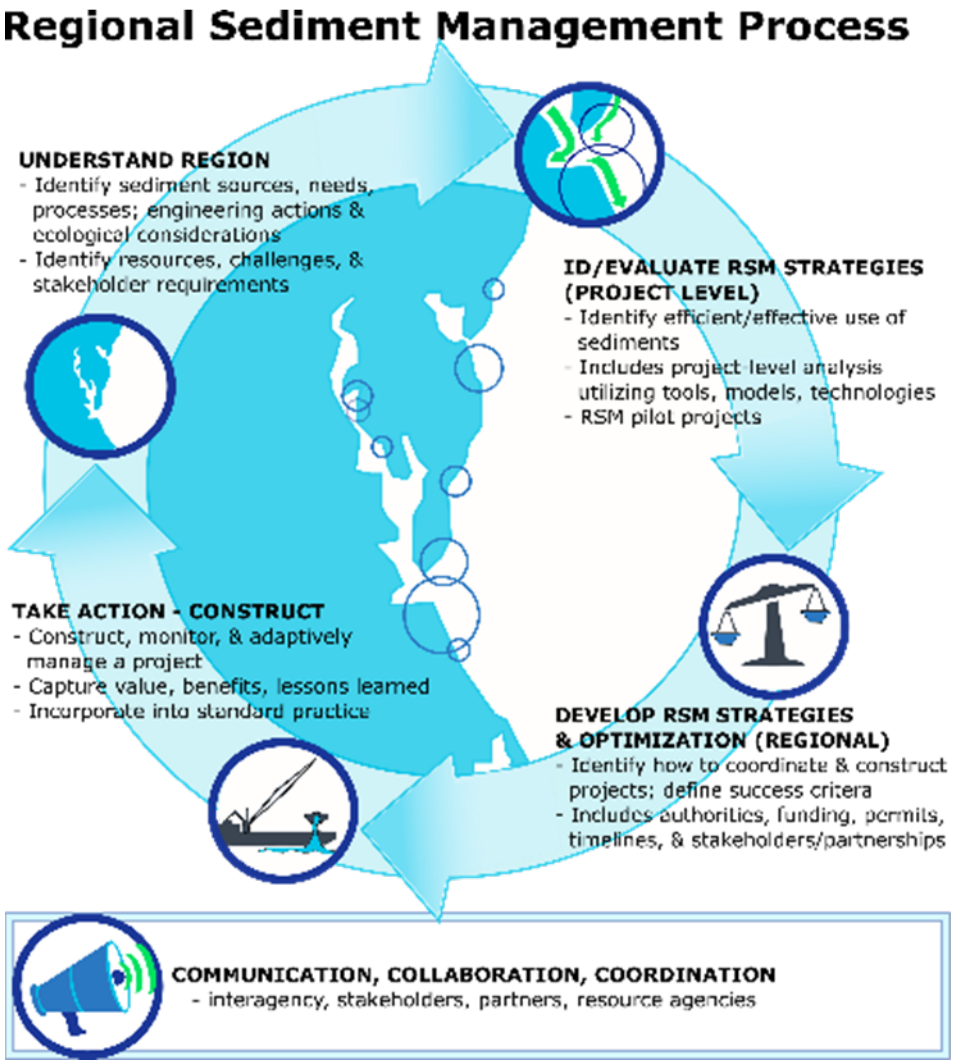
RSM & RESILIENCE - CONCLUSION



PREPARE
- Understand Region
- Understand Project – level functions
- ID resources, challenges, requirements
- Understand how to coordinate and construct projects; include authorities, funding, permits, partnerships, etc.
- Plan for rapid recovery

RESIST

RECOVER

ADAPT
- Pre-define success criteria
- Monitor and adaptively manage
- Capture value, benefits, and lessons learned

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THANK YOU

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