NALCC Coastal Resiliency Mapping and Tools

Bartholomew Wilson, P.G., Ph.D.
USFWS

North Atlantic Landscape Conservation Cooperative

Increasing Resiliency of Tidal Marsh Habitats and Species in the Face of Storms & SLR

- Develop/refine models for understanding impacts of sea level rise and storms on tidal marshes and marsh species
  - Vegetation and wildlife response (SHARP)
  - Modeling marsh community response (USC, LSU, USGS)
- Decision support models and incorporation into decision model framework
  - UMass, TNC
- High/low marsh mapping, elevation surveys
  - SHARP (U Maine, U Del)
- Monitoring and assessment of effectiveness of restoration for marsh resiliency
  - USFWS, NPS, SHARP (U Maine, U Conn, U Del, SUNY)
- Delivery of results to partners
  - NROC, MARCO

North Atlantic Landscape Conservation

Salt marsh Habitat and Avian Research Program (SHARP)

Tidal wetlands after Hurricane Sandy: baseline restoration assessment and future conservation planning

University of New Hampshire
University of Delaware
State University of New York
University of Maine

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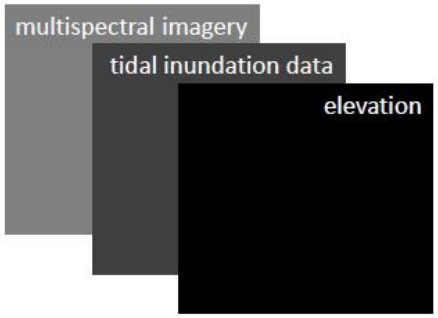
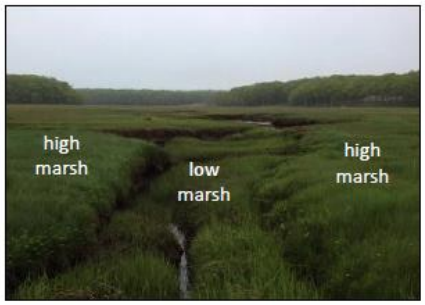
Classification of coastal vegetation communities: Maine to Virginia

Vegetation community prediction

Data inputs





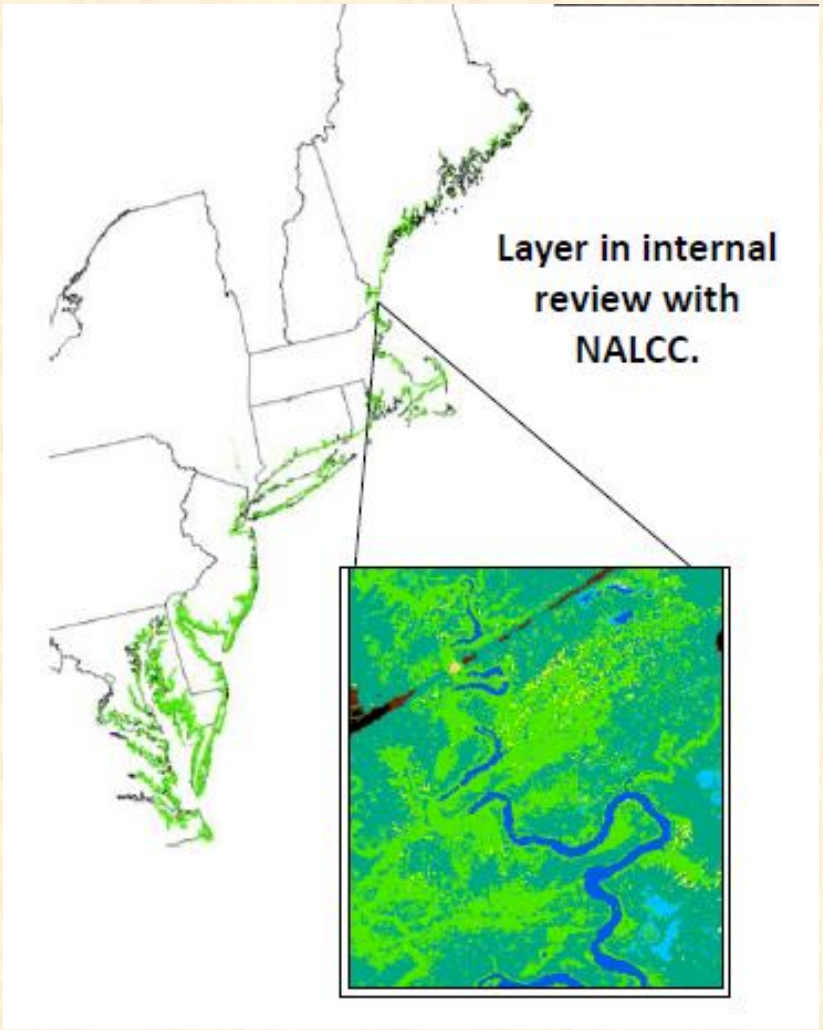
National Agriculture Imagery Program (NAIP)
1 meter resolution

National Elevation Dataset (NED)
1/9 arc-second

NOAA tidal gauge information

Delineation of coastal marshes from Maine to Virginia:

high marsh	*Phragmites*
low marsh	pools/pannes
open water	mudflat
terrestrial border	upland (catch-all)



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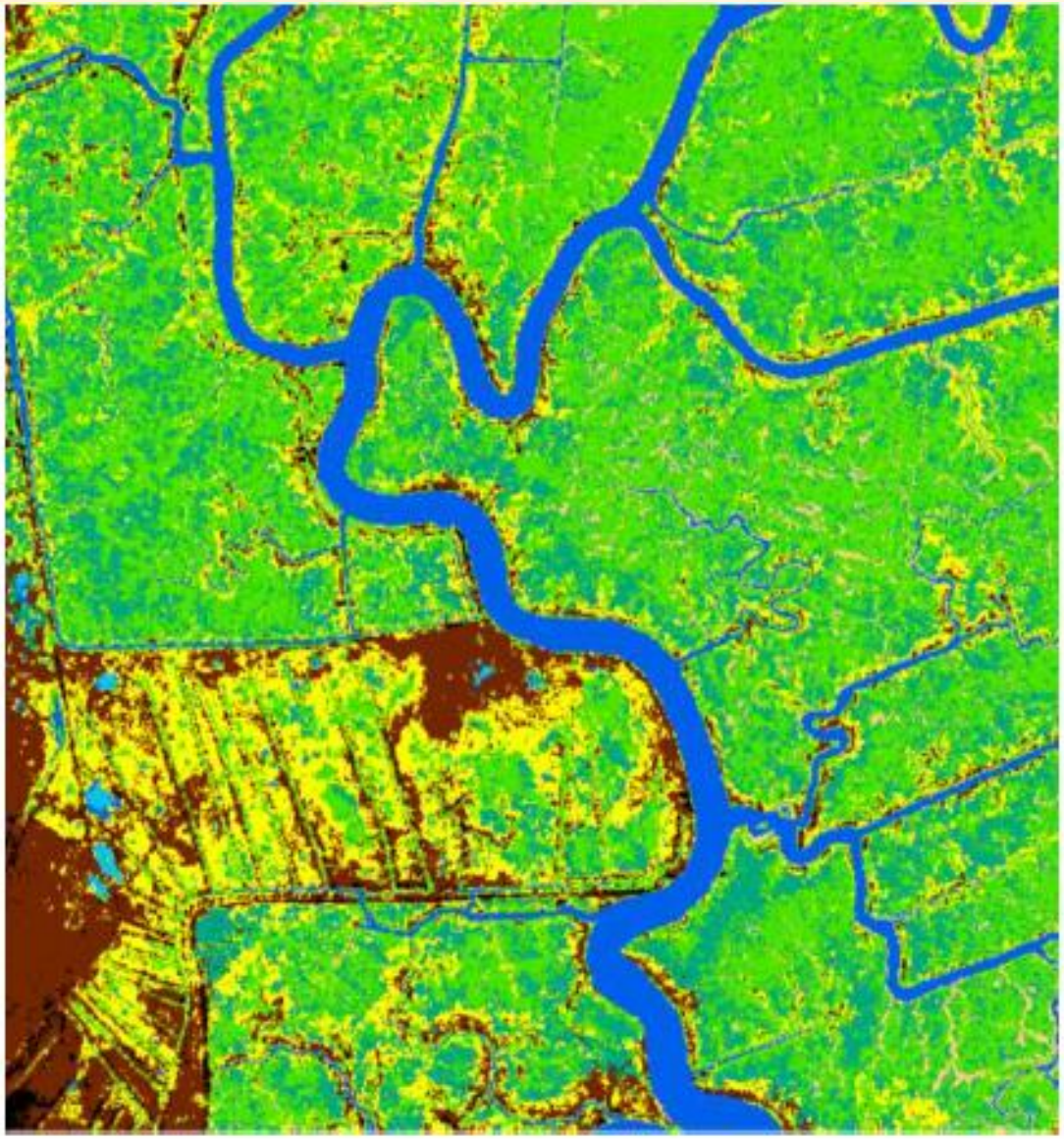

- High Marsh
- Low Marsh
- Terrestrial Border
- Mudflat
- Phragmites
- Pool\Panne
- Stream
- Upland

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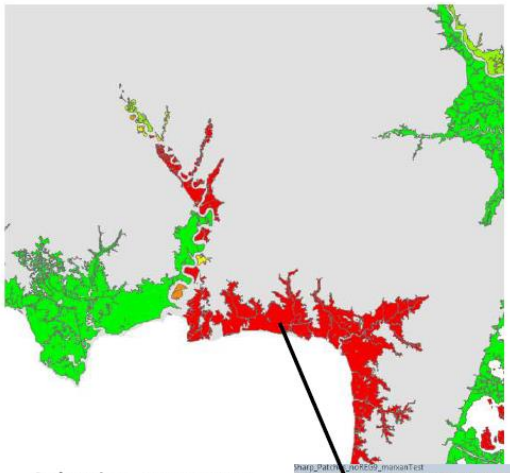
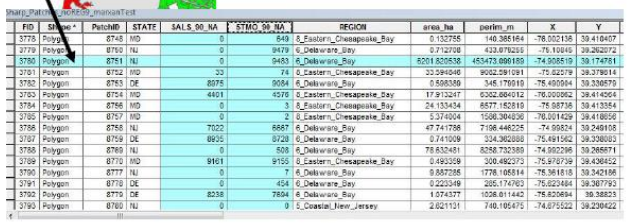
Saltmarsh Prioritization Layer for Tidal Marsh Bird Conservation

Prioritization Scenarios



Conservation Target:

90% of SALS



FID	Shape *	PatchID	STATE	SALS_00_NA	SALS_00_NA	REGION	area_ha	perim_m	X	Y
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3779	Polygon	8749	NJ	0	9479	6_Delaware_Bay	0.712708	433.676259	-75.10945	39.262072
3780	Polygon	8751	NJ	0	9483	6_Delaware_Bay	8201.820638	453473.099189	-74.988519	39.174781
3781	Polygon	8752	MD	33	74	8_Eastern_Chesapeake_Bay	33.596846	9062.591091	-75.92579	39.378614
3782	Polygon	8753	DE	8975	8984	6_Delaware_Bay	0.588369	345.179918	-75.480984	39.336579
3783	Polygon	8754	MD	4401	4576	8_Eastern_Chesapeake_Bay	17.913247	6382.884012	-76.000962	39.414564
3784	Polygon	8756	MD	0	3	8_Eastern_Chesapeake_Bay	24.153434	8577.152818	-75.98736	39.413354
3785	Polygon	8757	MD	0	2	8_Eastern_Chesapeake_Bay	5.374004	1586.304836	-76.001429	39.418656
3786	Polygon	8758	NJ	7022	8667	6_Delaware_Bay	47.741788	7198.448225	-74.99824	39.249108
3787	Polygon	8759	DE	8935	8728	6_Delaware_Bay	0.741009	334.362888	-75.491962	39.338693
3788	Polygon	8760	NJ	0	508	6_Delaware_Bay	76.633481	8258.732389	-74.992296	39.266871
3789	Polygon	8770	MD	9161	9159	8_Eastern_Chesapeake_Bay	0.493359	300.492373	-75.979739	39.436452
3790	Polygon	8777	NJ	0	7	6_Delaware_Bay	9.887285	1778.105814	-75.361815	39.342186
3791	Polygon	8778	DE	0	454	6_Delaware_Bay	0.222349	205.174763	-75.622484	39.367793
3792	Polygon	8779	DE	8238	7804	6_Delaware_Bay	1.674377	1036.611442	-75.620694	39.38823
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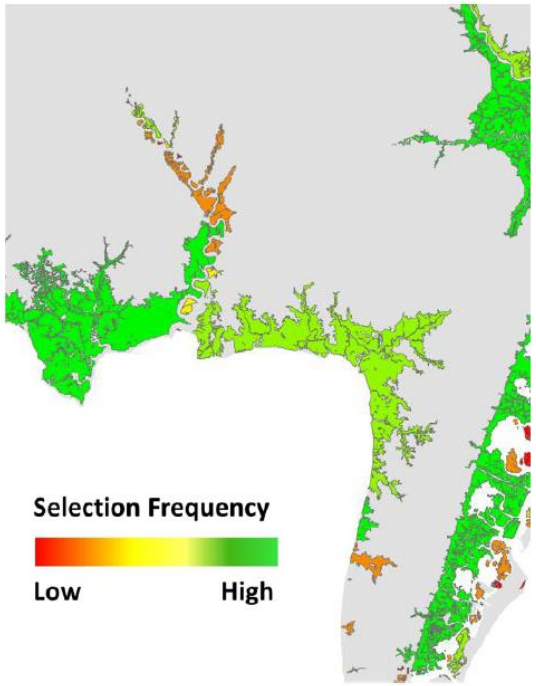

Conservation Target:

90% of SALS, SESP, NESP, CLRA and WILL

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Products

Sensitivity analysis for conservation planning

manuscript submitted to Conservation Biology

Tidal marsh bird conservation spatial layer

ranking of patches by conservation target

extension to patch layer – Wiest et al.

appendix to manuscript (Conservation Letters)

submit in Jan/Feb

Effects of SLR on tidal marsh bird conservation

manuscript in prep – submit in March/April

Designing Sustainable Coastal Landscapes in the Face of Sea-level Rise and Storms

Kevin McGarigal of the University of Massachusetts Amherst

Assessing the capability of current and potential future landscapes, to support ecosystems and suitable habitat for a suite of 30 representative wildlife species, and provide guidance for strategic habitat conservation.

- Index of Ecological Integrity
  - Combing a set of key metrics for intactness and resilience to measure the potential for individual sites to support biodiversity
- Stressor metrics:
  - Tidal restrictions
  - Salt marsh ditching

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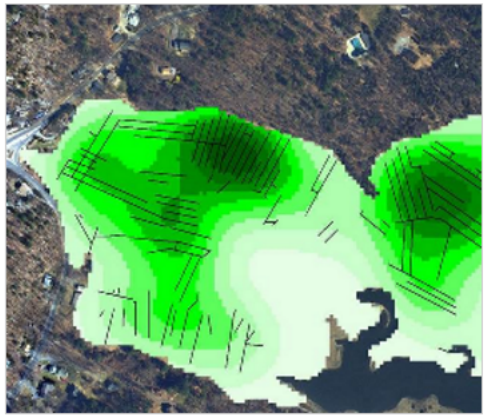
Hurricane Sandy Coastal Resilience, Designing Sustainable Landscapes

Created by Conservation Biology Institute

Nov 11, 2015 (Last modified Oct 5, 2016)



About

The overall purpose of this project (known colloquially as the **Designing Sustainable Landscapes** project, or DSL for short) is to assess the capability of current and potential future landscapes, currently within the extent of the Northeast (13 states), to provide integral ecosystems and suitable habitat for a suite of focal (e.g., representative) species, and provide guidance for strategic habitat conservation. To meet this goal, we are developing a Landscape Change, Assessment and Design (LCAD) model, as described in the documentation. This project is supported primarily by the North Atlantic Landscape Conservation Cooperative (NALCC) with additional support from the Northeast Climate Science Center (NECSC) and the University of Massachusetts - Amherst.

Phase one of this project, which began in December 2010 and was completed June 2012, focused on developing the overall modeling framework for simulating landscape change and assessing the ecological consequences of those changes (i.e., landscape change and assessment), and piloting the model in three study landscapes: 1) Kennebec River watershed in Maine, 2) middle Connecticut River watershed in Massachusetts, New Hampshire and Vermont, and 3) combined Pocomoke and Nanticoke River watersheds in Maryland and Delaware.

Phase two of this project, which began in July 2012 and will continue through June 2014, focuses on extending the landscape modeling to the entire Northeast (13 states), modeling an additional 20 representative species, expanding the ecological integrity assessment, coupling the landscape change model with a third party sea level rise model, improving the vegetation succession modeling, and developing an approach for integrating the results of the landscape change assessment into decision support for landscape design (i.e., landscape conservation design).

For more information, please click here.

Tags

sustainable landscapes, tidal restoration, marsh ditch, landcover, coastal resilience, hurricane sandy

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- 3 Galleries

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Designing Sustainable Landscapes Datasets

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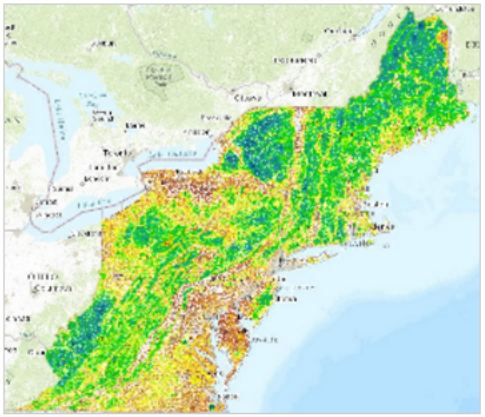

About

The Designing Sustainable Landscapes project is assessing the capability of current and potential future landscapes, currently within the extent of the Northeast (13 states), to support ecosystems and suitable habitat for a suite of representative wildlife species, and provide guidance for strategic habitat conservation. This gallery highlights some of the many spatial products of the project.

During the current phase of the project (2012-2014), habitat models are being developed for 30 wildlife species based on current conditions and scenarios of potential future conditions based on scenarios of climate change and urban growth. The species models are complemented by an analysis of ecological integrity. The species and ecosystems results are also being integrated into a landscape design tool, currently being tested in the Connecticut River Watershed. The species and ecosystem models are nested within a Landscape Change, Assessment and Design (LCAD) model that also includes a number of other spatial datasets.

The project is led by Professor Kevin McGarigal of the University of Massachusetts Amherst. It is supported primarily by the North Atlantic Landscape Conservation Cooperative (NALCC) with additional support from the Northeast Climate Science Center (NECSC) and the University of Massachusetts - Amherst. For more information see also: http://www.umass.edu/landeco/research/dsl/dsl.html and

http://northatlanticlcc.org/projects/designing-sustainable-landscapes-phase-2/designing-sustainable-landscapes-phase-2/

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Tags

ecosystem, wildlife, conservation design

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DATA BASIN | MAPS | TIDAL RESTRICTION METRIC FOR BLACKWATER NATIONAL WILDLIFE REFUGE, MARYLAND

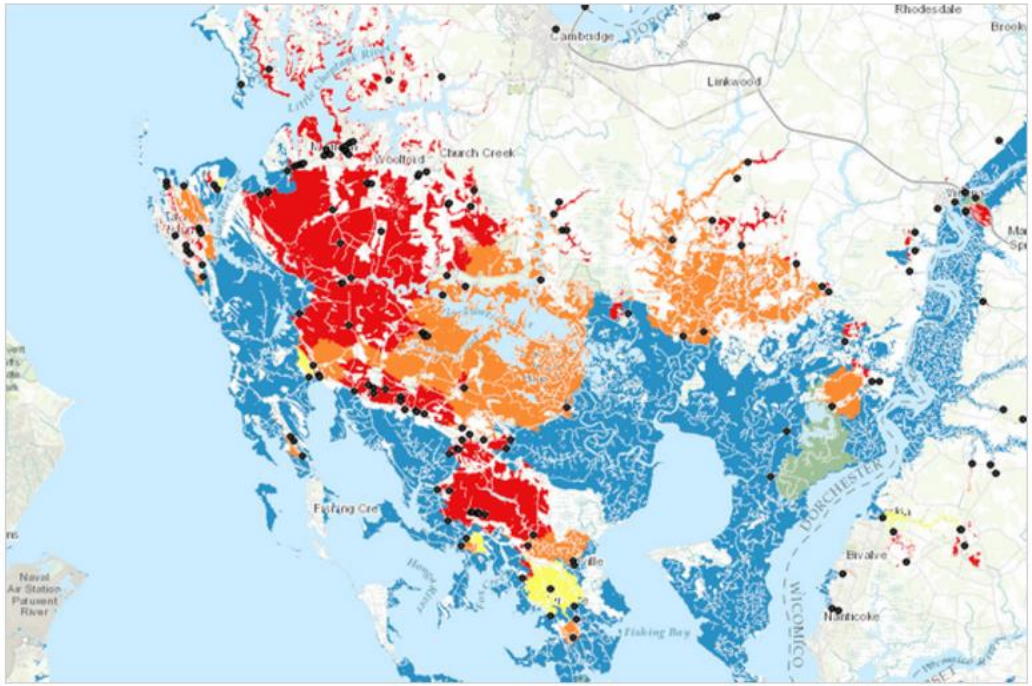
Tidal restriction metric for Blackwater National Wildlife Refuge, Maryland

Created by Conservation Biology Institute

Mar 15, 2017

Export

Open Map



Description

Tidal restrictions metric assigns a value to each cell within the coastal zone (elevation ≤ 5 m) ranging from 0 (no effect of downstream restrictions) to 1 (severe effect). Shown here for Blackwater National Wildlife Refuge, Maryland. Black squares indicate potential tidal restrictions. Colors show the estimated effect of tidal restrictions on estuarine and freshwater wetlands, ranging from blue (0=no effect) to red (1=severe effect).

Location

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DATA BASIN | MAPS | SALT MARSH DITCHING METRIC, SANDY NECK GREAT MASHES, MASSACHUSETTS

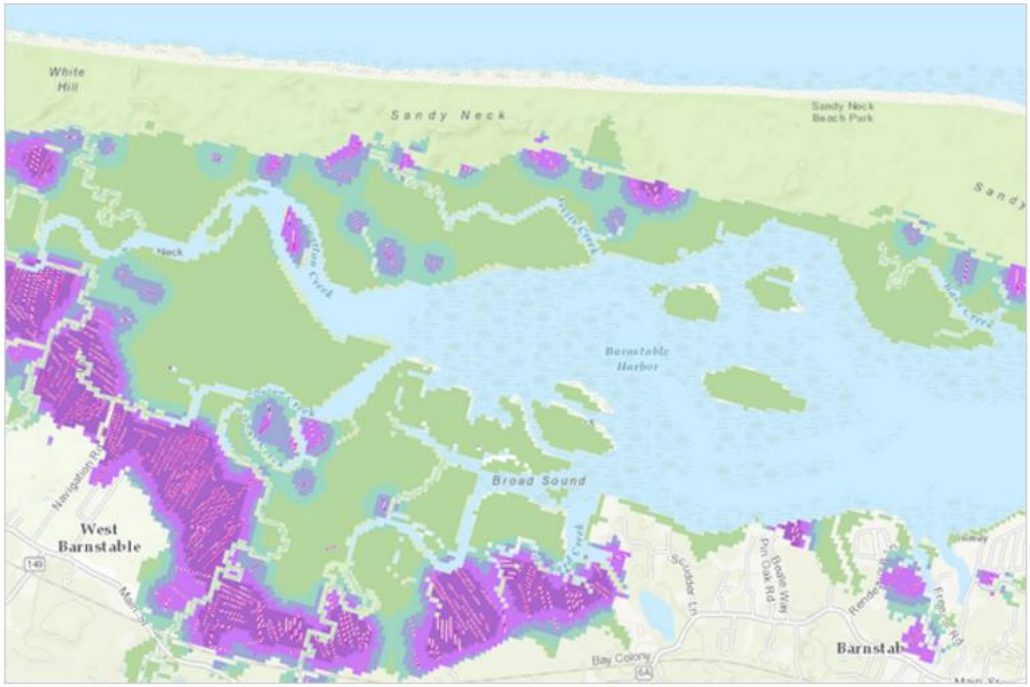
Salt Marsh Ditching Metric, Sandy Neck Great Mashes, Massachusetts

Created by Conservation Biology Institute

Mar 15, 2017

Export

Open Map



Description

Results of salt marsh ditching metric for Sandy Neck Great Marshes, Massachusetts (green = low ditching intensity, purple = high ditching intensity).

Location

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Identifying Resilient Sites for Coastal Conservation

Mark Anderson
Analie Barnett
The Nature Conservancy

- **Identify** the coastal areas that will be the most resilient to climate change and create tools to explore where conservation strategies will have the greatest benefit on sustaining natural diversity.

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Site Condition and Coastal Resilience

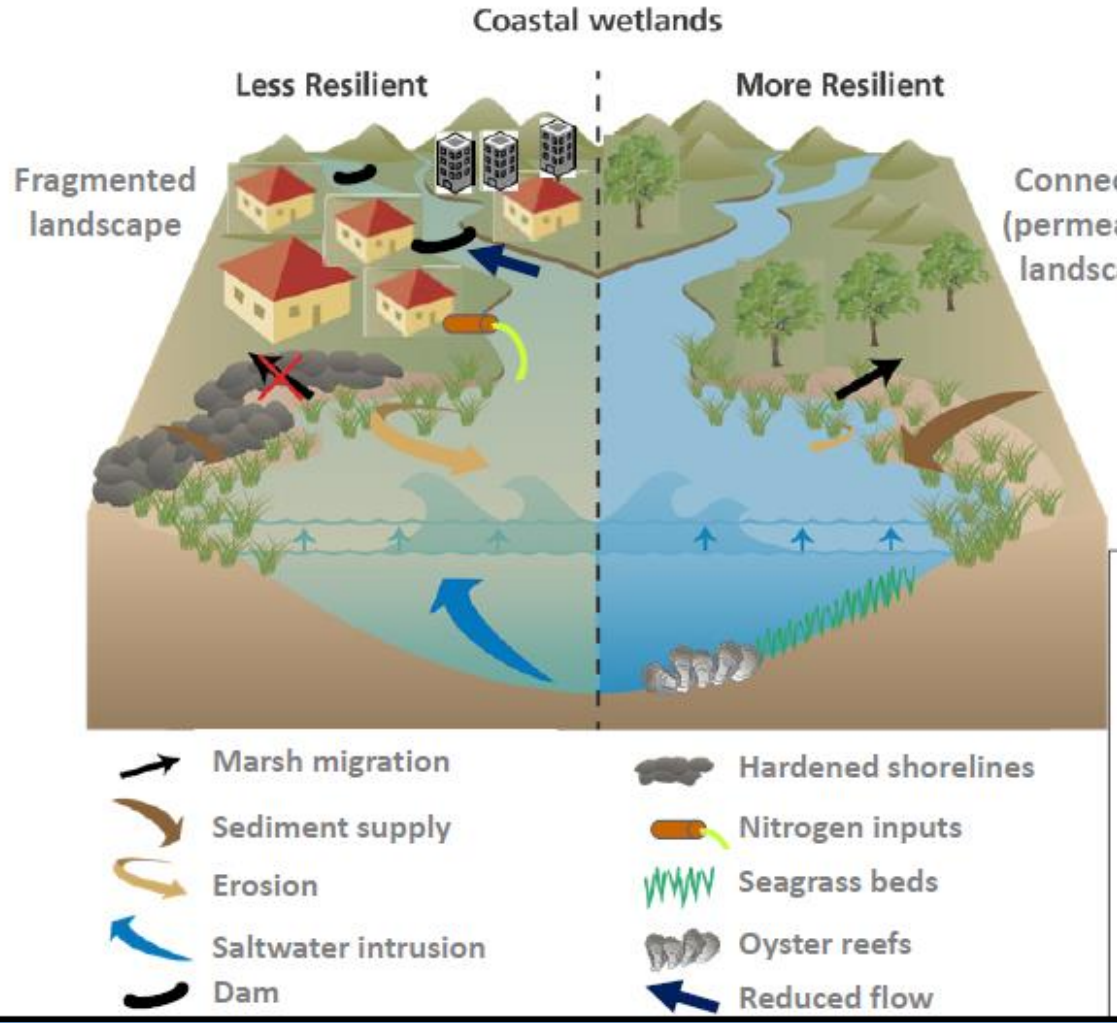

Image credit: *Modification of image from Alexandra Fries, Integration and Application Network, University of Maryland Center for Environmental Science (ian.umces.edu/imagelibrary/).*

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Conserving Nature's Stage

(measuring the resilience of a physical site, not its individual elements)

Site Resilience: The capacity of a coastal site to support diversity, productivity, and ecological function as it adjusts to a changing climate.

A site's resilience is estimated from it physical characteristics and current condition. For example:

Physical

- Space for migration and movement,
- A diversity of physical habitats, microclimates, and gradients that provide options for species as the system changes.

Condition

- A high quality "stage" with unimpaired soil and water.
- Connectedness among natural systems that allows for flexibility .

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Site Resilience

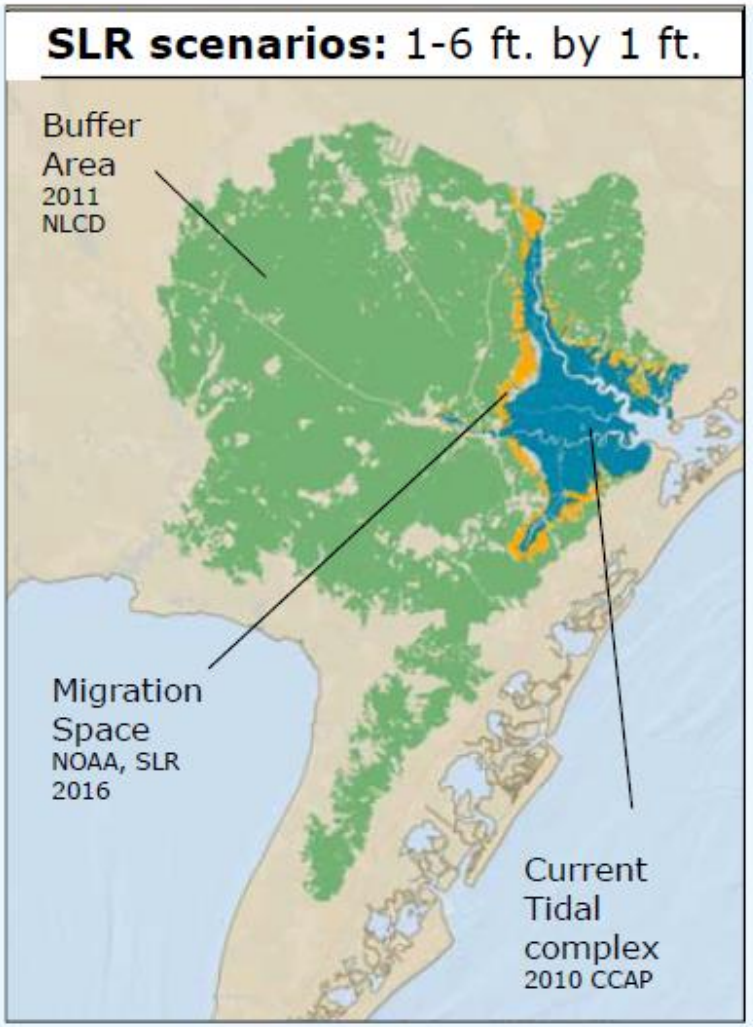
We estimated site resilience from:

Physical Characteristics that are likely to endure under climate change.

Condition Characteristics that reflect their current state and context.

Scenarios:
We don't know exactly how climate and SLR will play out over the next century so we ran our resilience model with six different SLR scenarios (1',2', 3', 4', 5', 6')

The results shown here are for the one foot scenario, but the final results will be a weighted average of all six scenarios, weighted towards those most likely to occur.



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Project Process Recap

Held seven steering committee calls since April 2016, reviewed:

- **Marsh Migration** and **Coastal Response** models

- **Resilience Metrics** (does it influence resilience and can we measure it?):
  - Migration space and buffer size
  - tidal classes
  - erosion/accretion
  - exposure/dynamic response
  - water quality
  - water quantity
  - sediment inputs
  - habitat buffering
  - hardened shoreline
  - hydrologic ditching
  - wetland connectedness
  - landform and soil diversity

The draft results we are presenting represent the synthesis and application of our discussions. The underlying datasets, methods, call summaries, etc. are readily available.

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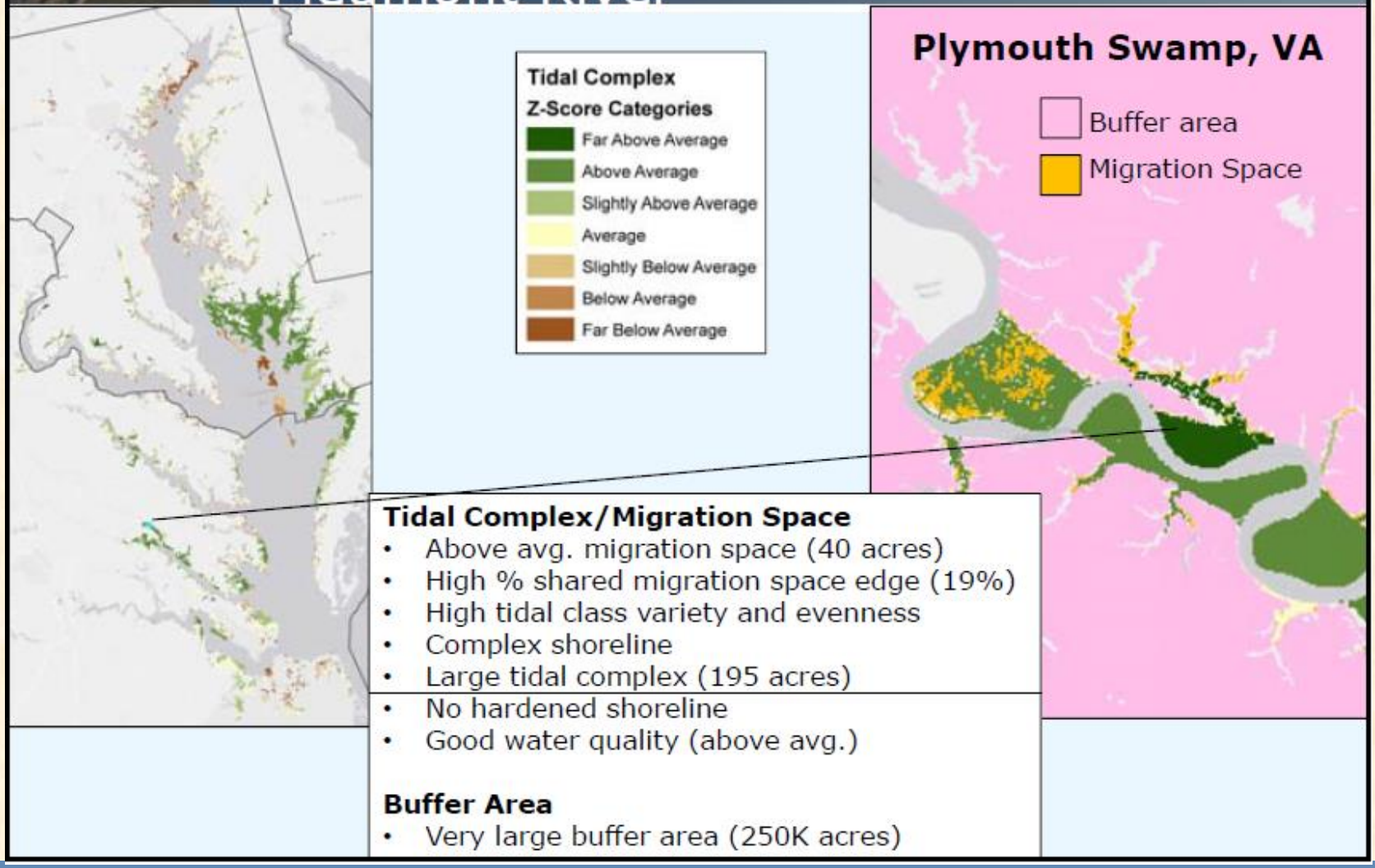
Coastal Resilience Results: Highest Scoring Chesapeake Bay & Piedmont River



Tidal Complex/Migration Space

- Above avg. migration space (40 acres)
- High % shared migration space edge (19%)
- High tidal class variety and evenness
- Complex shoreline
- Large tidal complex (195 acres)
- No hardened shoreline
- Good water quality (above avg.)

Buffer Area

- Very large buffer area (250K acres)

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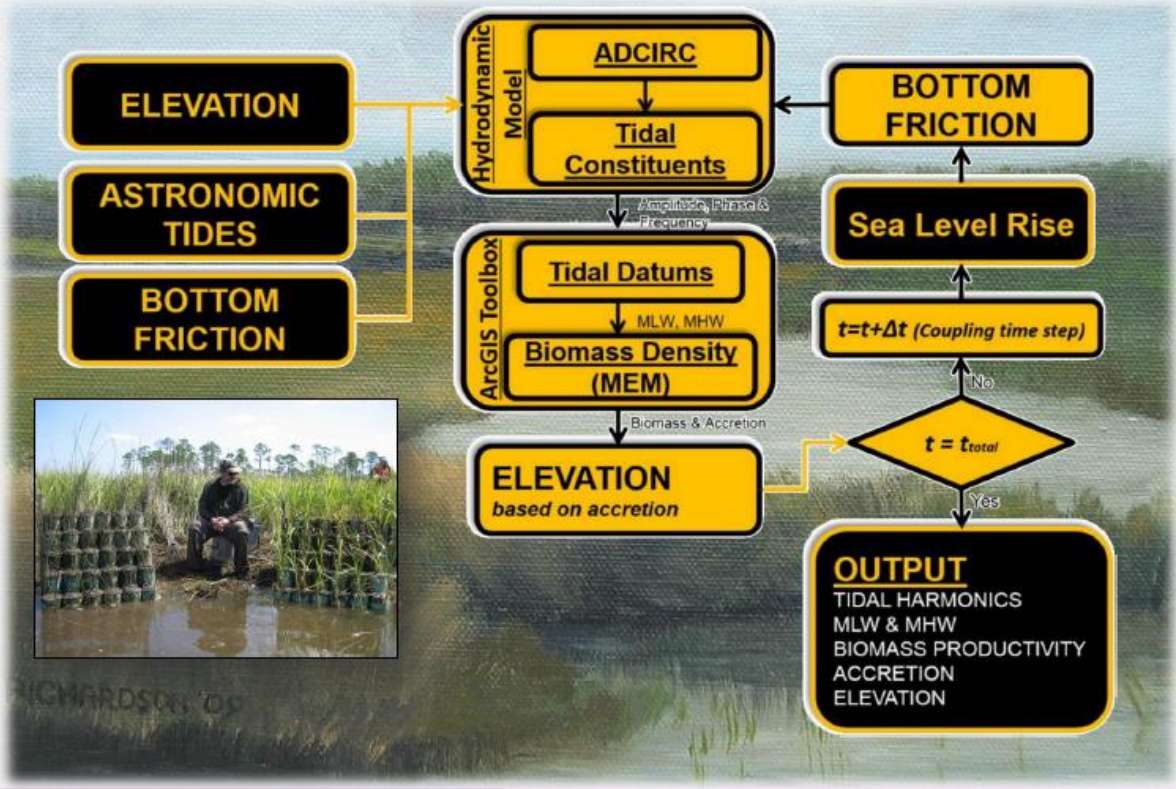
Hydro- Marsh equilibrium model (MEM)

Scott C. Hagen, Louisiana State University
James T. Morris, University of South Carolina

- Marsh equilibrium model (MEM) coupled with the Advanced Circulation (ADCIRC) hydrodynamic model.

Hydro-MEM (Hydrodynamic-Marsh Equilibrium Model

- Alizad, K., S. C. Hagen, Morris, J.T., Bacopoulos, P., Bilskie, M.V., Weishampel, J.F., Medeiros, S.C. (2016). A Coupled, Two-Dimensional Hydrodynamic-Marsh Model with Biological Feedback. *Ecological Modeling, Vol. 327, pp. 29-43.*
- Hagen, S.C., J.T. Morris, P. Bacopoulos, & J. Weishampel. 2013. Sea-Level Rise Impact on a Salt Marsh System of the Lower St. Johns River. *ASCE J. of Waterway, Port, Coastal, and Ocean Engineering, Vol. 139, No. 2, Mar./Apr. 2013, p. 118-125.*
- Morris, J.T., P.V. Sundareshwar, C.T. Nietch, B. Kjerfve, and D.R. Cahoon. 2002. Responses of coastal wetlands to rising sea level. *Ecology 83: 2869-2877.*



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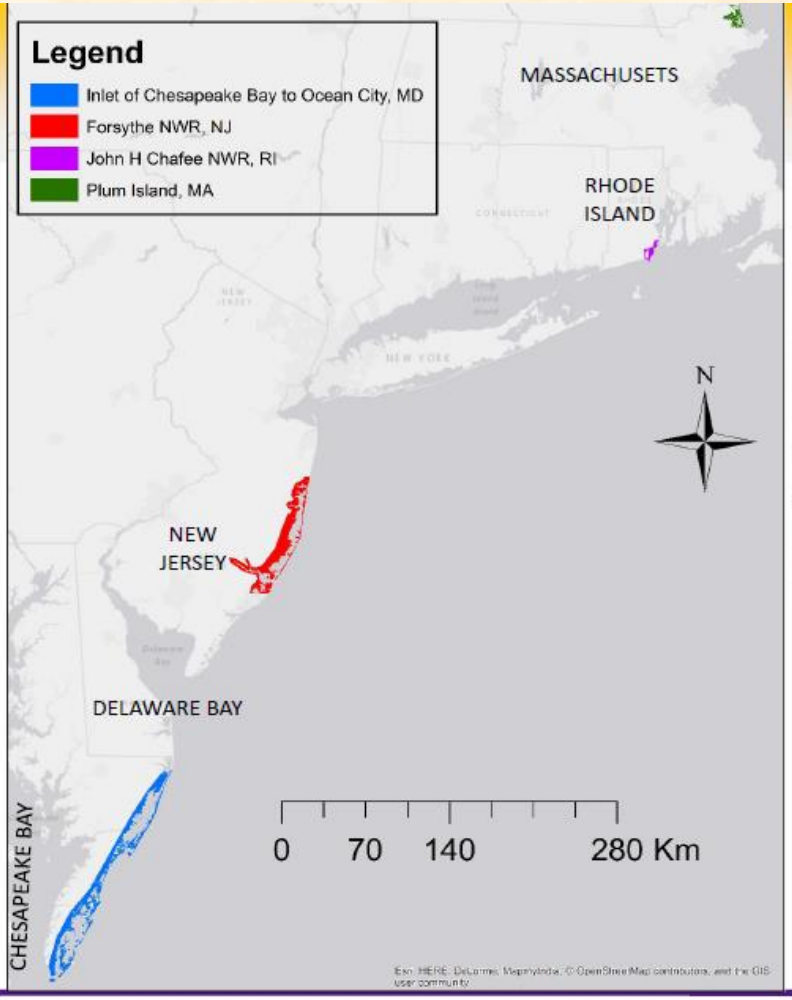
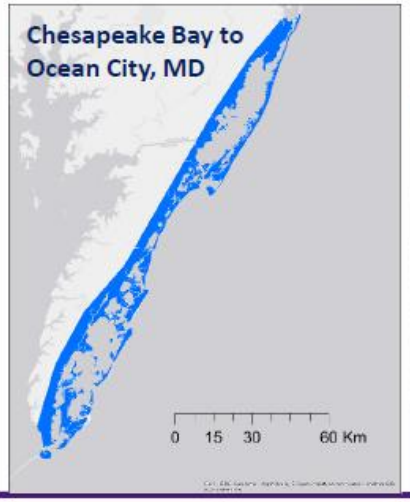
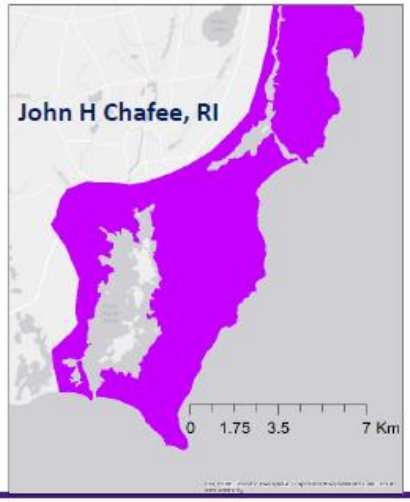
Hydro-MEM Applications







LSU | Center for Coastal Resiliency

Assessing and enhancing salt marsh resiliency under climate change

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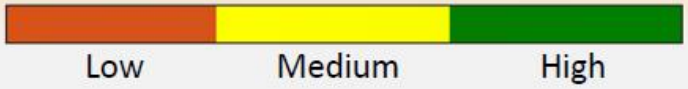
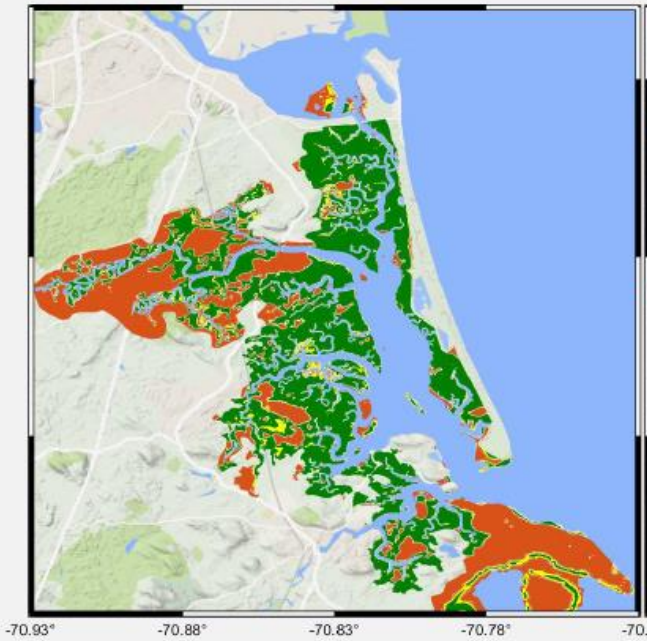
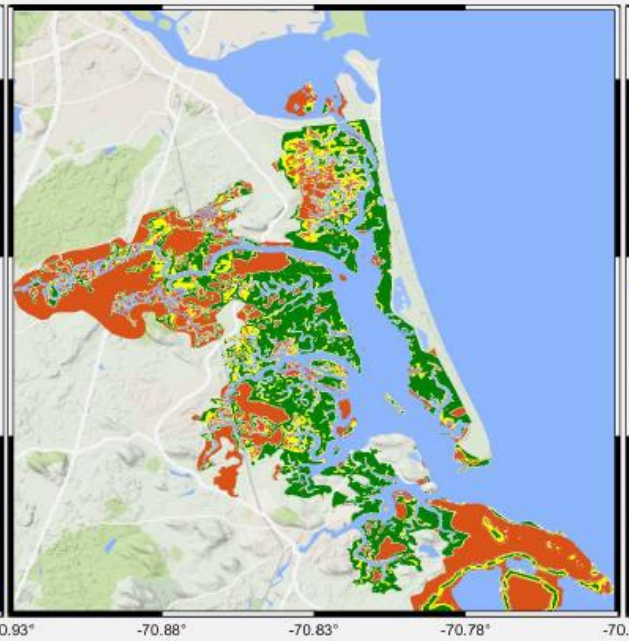
Hydro-MEM: Biomass density

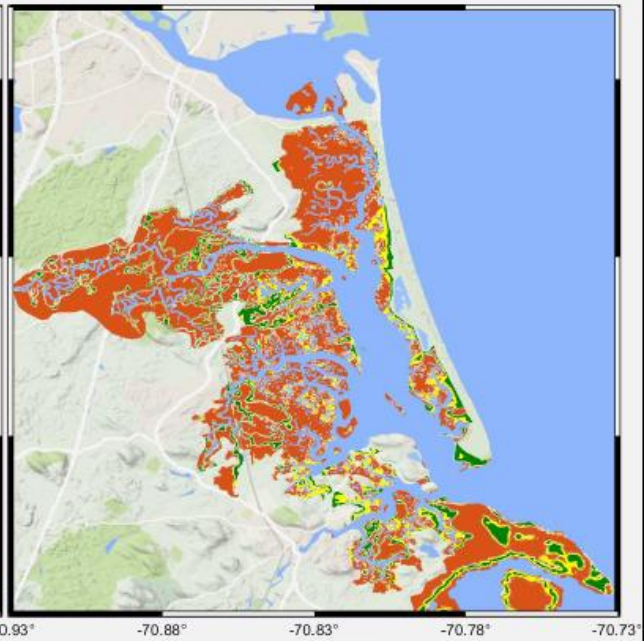




20 cm SLR



50 cm SLR



120 cm SLR

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- http://northatlanticlcc.org/teams/coastal-resiliency
- https://databasin.org/