Resilient Coastal Landscapes

Goal:

Identify representative coastal sites that will be resilient to climate change
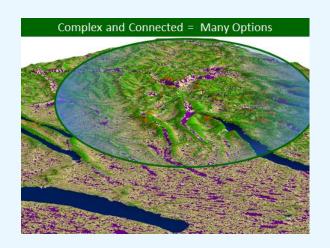
Dr. Mark Anderson
Director of Conservation Science
The Nature Conservancy
Eastern US Division

Two Main Concepts

Conserving Nature's Stage

Focus on the diversity and structure of physical environment

Climate-Resilient Sites

Focus conservation on places with many climate options and high connectedness

Climate-Resilient Sites

Resilient Landscape

An area with sufficient options to enable species and ecosystems to rebound in the face of great stresses without transforming into an undesirable condition
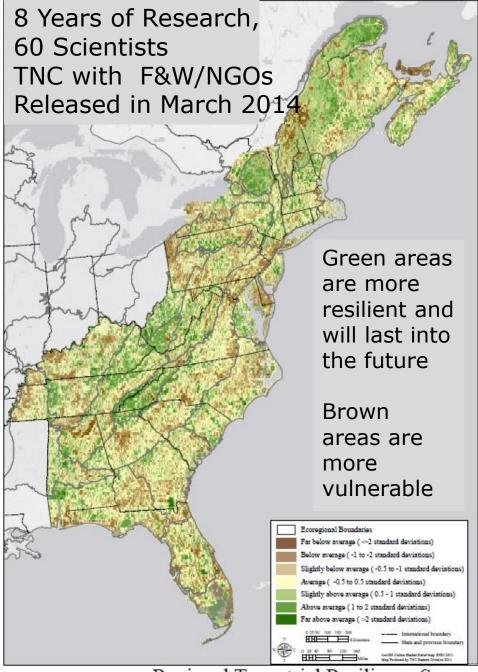

Highly Vulnerable
Disrupted function, low diversity
Few options
Weedy generalists

Highly Resilient
Sustain function and diversity
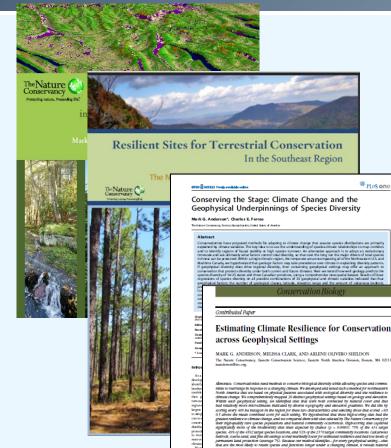**Many options**
Persistence of native species

Site Resilience is the capacity of a site to maintain species diversity and ecological function as the climate changes.

Resilient Site: An intact geophysical setting that sustains a diversity of species and communities, maintains basic relationships among ecological features, and allows for adaptive change in composition and structure.

TNC Climate-Resilient Lands

8 Years of Research,
60 Scientists
TNC with F&W/NGOs
Released in March 2014

Green areas are more resilient and will last into the future

Brown areas are more vulnerable

Regional Terrestrial Resilience Score
Stratified by Setting and Ecoregion with Regional Override

Ecoregional Boundaries
Far below average (<-2 standard deviations)
Below average (-1 to -2 standard deviations)
Slightly below average (-0.5 to -1 standard deviations)
Average (-0.5 to 0.5 standard deviations)
Slightly above average (0.5 - 1 standard deviations)
Above average (1 to 2 standard deviations)
Far above average (>2 standard deviations)
International boundary
State and province boundary

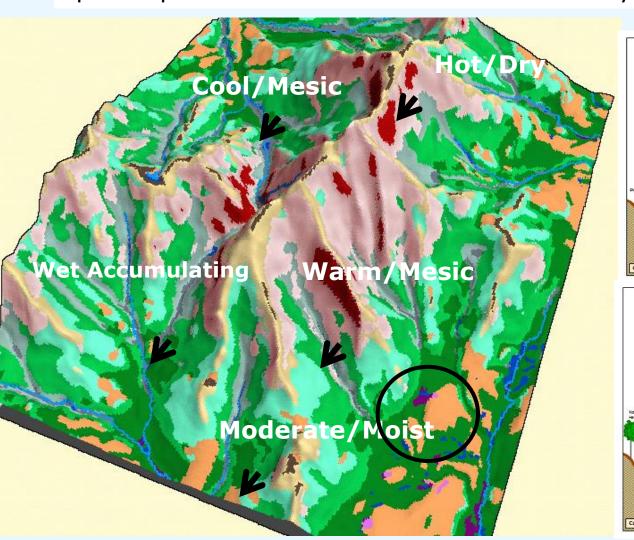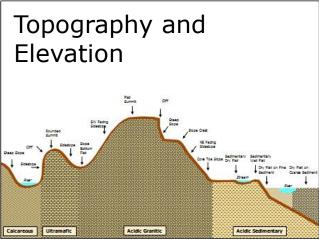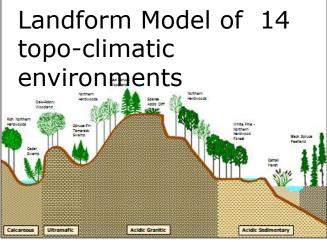Four peer reviewed papers and reports

Landscape Diversity

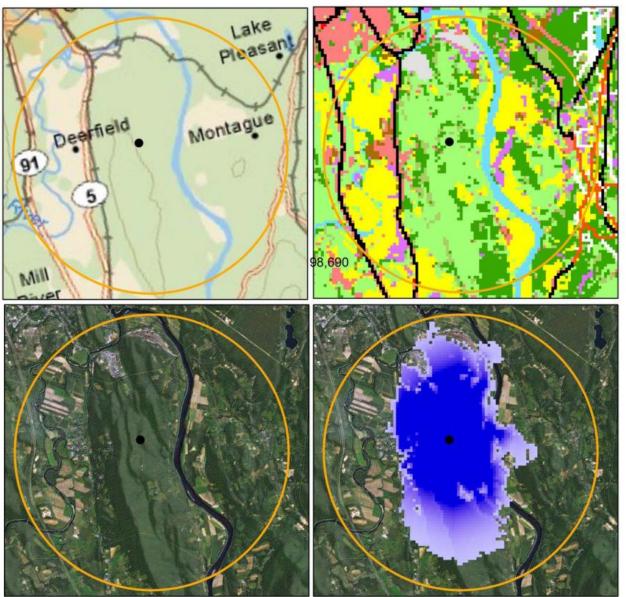**Microclimatic buffering:** many local climates enhance species persistence and slow down the velocity of climate change

Hot/Dry

Cool/Mesic

Wet Accumulating

Warm/Mesic

Moderate/Moist

Topography and Elevation

Landform Model of 14 topo-climatic environments

Local Connectedness

Developed by Brad Compton: UMASS CAPS/Landscape Ecology

The degree to which the landscape allows for species movement and other natural processes
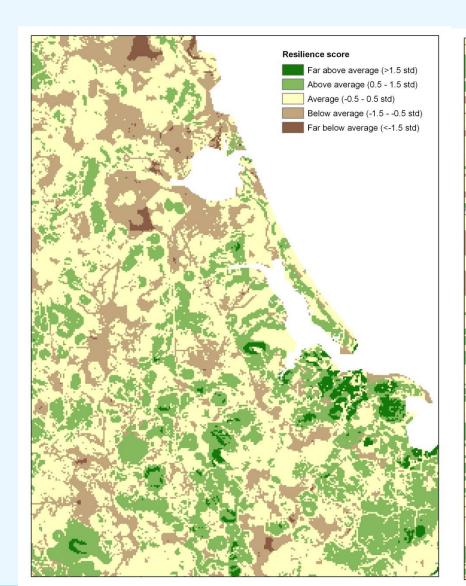
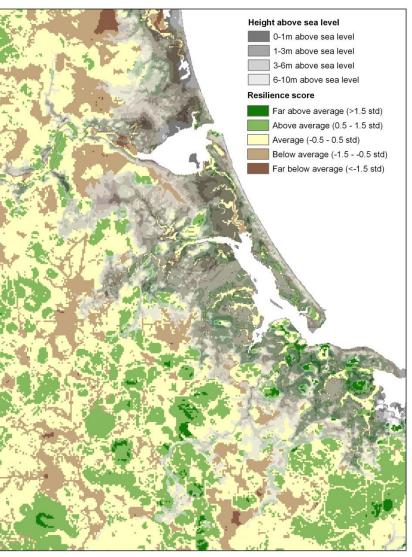**Highly Connected Landscapes** provide many options

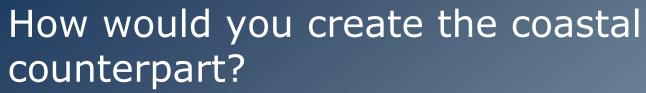**Fragmented Landscapes** Provide few options for movement and processes

SHALE

LIMESTONE

How would you create the coastal counterpart?
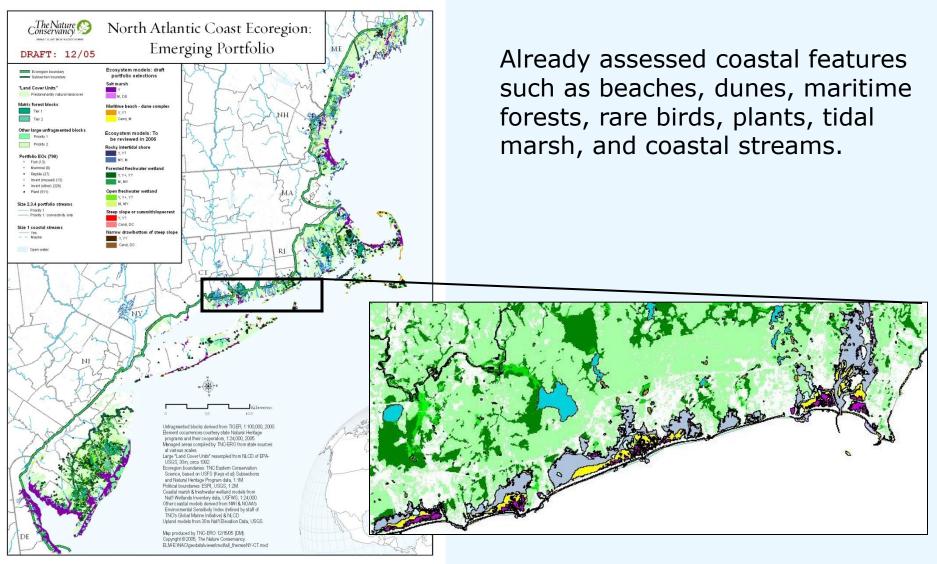
Is it essentially a fine scale version of the
Coastal Vulnerability Index?

	Ranking of coastal vulnerability index				
	Very low	Low	Moderate	High	Very high
VARIABLE	1	2	3	4	5
Geomorphology	Rocky, cliffed coasts Fiords Fiards	Medium cliffs Indented coasts	Low cliffs Glacial drift Alluvial plains	Cobble beaches Estuary Lagoon	Barrier beaches Sand Beaches Salt marsh Mud flats Deltas Mangrove Coral reefs
Coastal Slope (%)	> .2	.2 −.07	.07 −.04	.04 −.025	< .025
Relative sea-level change (mm/yr)	< 1.8	1.8 − 2.5	2.5 − 2.95	2.95 −3.16	> 3.16
Shoreline erosion/ accretion (m/yr)	>2.0 Accretion	1.0 −2.0	−1.0 − +1.0 Stable	−1.1− −2.0	< − 2.0 Erosion
Mean tide range (m)	> 6.0	4.1 − 6.0	2.0 − 4.0	1.0 −1.9	< 1.0
Mean wave height (m)	<.55	.55 −.85	.85 −1.05	1.05 −1.25	>1.25

❖ Thieler and Hammar-Klose 1999

Coastal Assessments: Terrestrial
ERA based on ecosystems and species

Already assessed coastal features such as beaches, dunes, maritime forests, rare birds, plants, tidal marsh, and coastal streams.

Coastal Assessment: Marine
NAMERA: seafloor and coastal themes

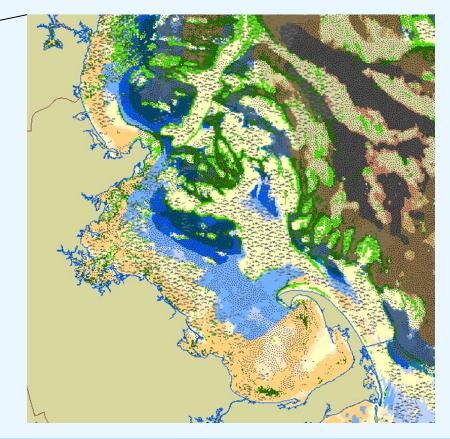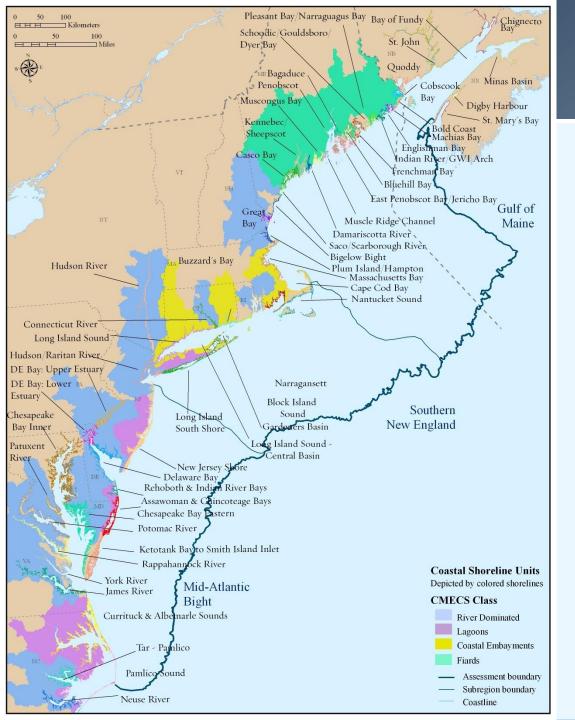Topographic form

Sediments

Bathymetry
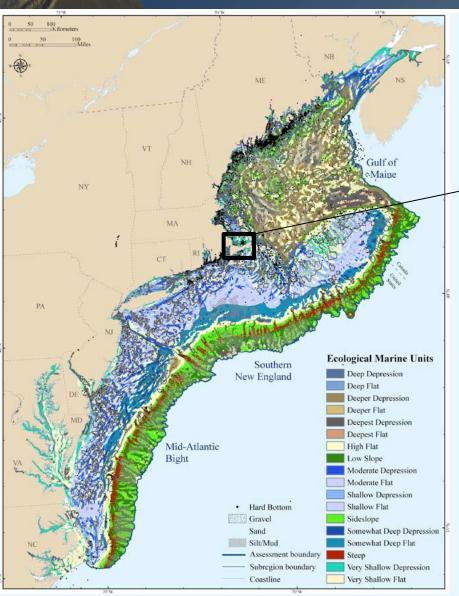
NGDC:CRM & USSeabed

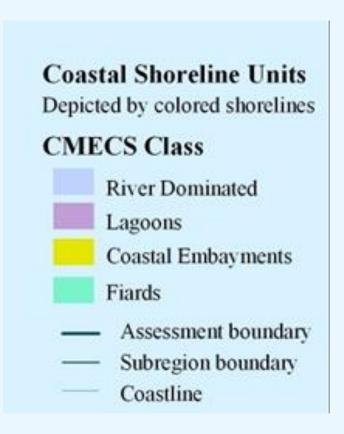# Coastal Assessment: Marine
NAMERA: seafloor and coastal themes

Ecological Marine Units

❖ Depth, Sediment grain size, Seabed forms
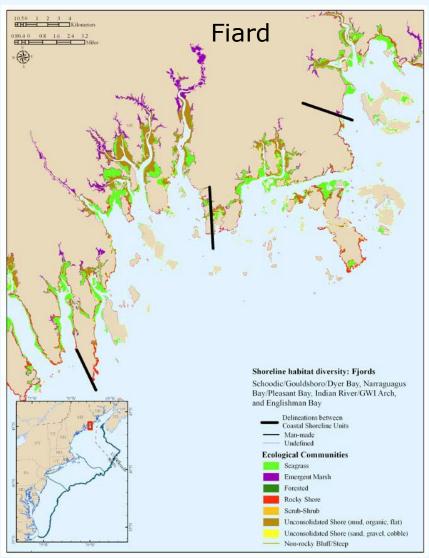
Stratification
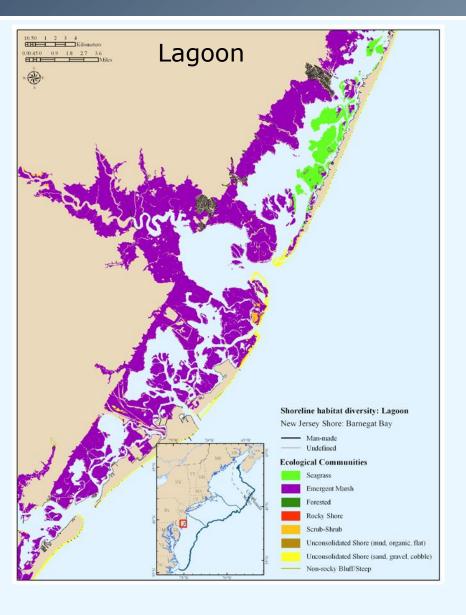
62 Coastal Shoreline Units (CSUs)

Shoreline Units

Fiard

Lagoon

Shoreline habitat diversity: Fjords

Schoodic/Gouldsboro/Dyer Bay, Narraguagus Bay/Pleasant Bay, Indian River/GWI Arch, and Englishman Bay

— Delineations between Coastal Shoreline Units
— Man-made
— Undefined

Ecological Communities
- Seagrass
- Emergent Marsh
- Forested
- Rocky Shore
- Scrub-Shrub
- Unconsolidated Shore (mud, organic, flat)
- Unconsolidated Shore (sand, gravel, cobble)
- Non-rocky Bluff/Steep

Shoreline habitat diversity: Lagoon

New Jersey Shore: Barnegat Bay

— Man-made
— Undefined

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A Fine Scale Version of CVI?

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- ❖ Coastal Slope

- ❖ Geomorphology, topographic, elevation diversity (10 m, 30 m)

- ❖ Surficial Substrate (SSURGO)

- ❖ Bedrock Geology (States)

- ❖ Rivers (freshwater flushing rates, Olivero)

- ❖ Ecological system / Land cover

- ❖ Connectedness, Anthropogenic barriers, migration space

- ❖ Offshore: Bathymetry, Substrate

Data Needs: Do these exist?
What scale? 30 m? CSU? Watershed?

❖ Inundation (relative rate of SLR) Lentz et al?

❖ Mean tidal height and tidal range

❖ Mean wave height

❖ Sediment supply (external/internal sediment inputs)

❖ Land subsidence

❖ Accretion/erosion rates

We can allocate considerable effort to creating/compiling these at the regional scale. Would they be useful to others? What are the priorities?

THANK YOU

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Landscape Conservation Cooperative
and The Nature Conservancy