

Coastal Ecosystem Vulnerability to Climate Change

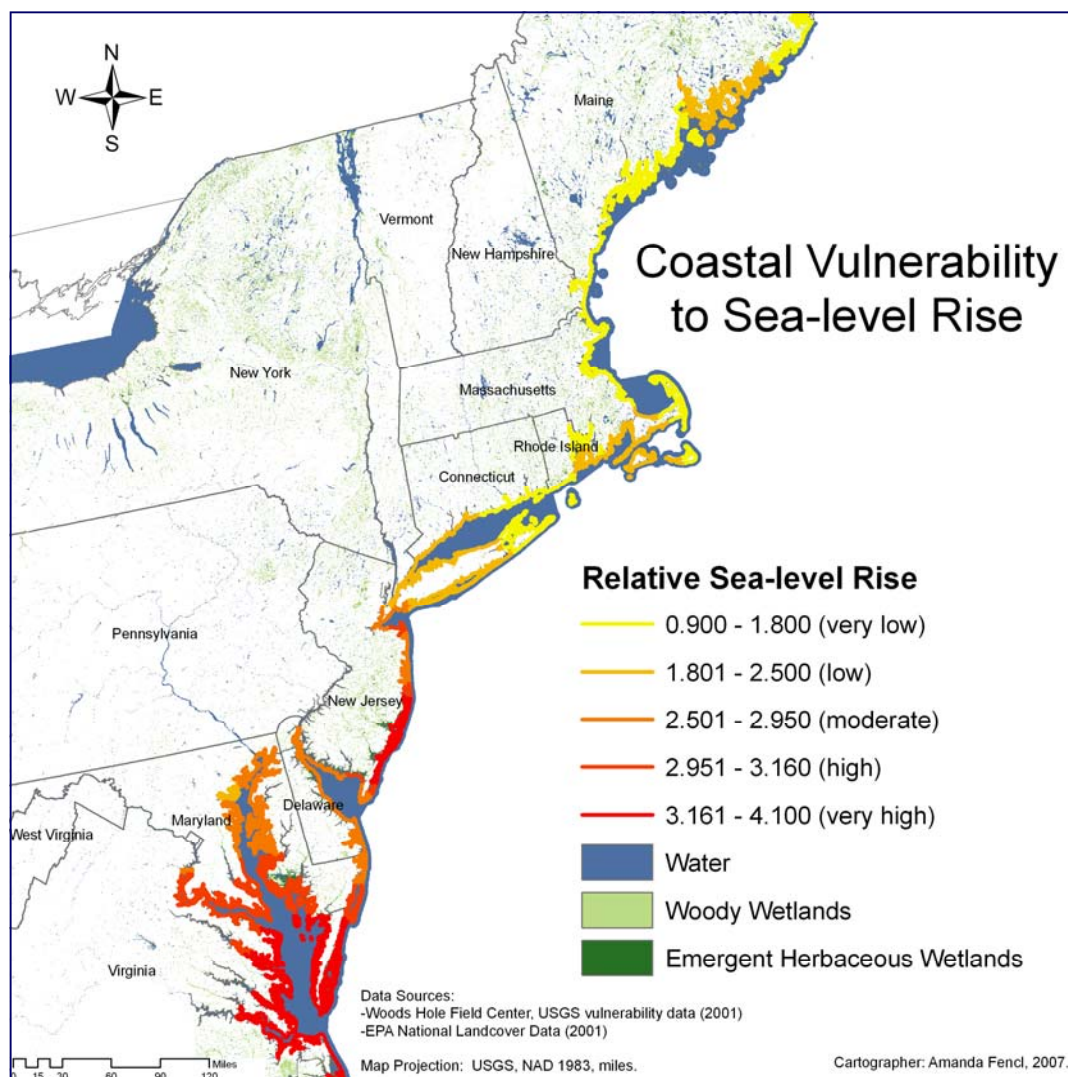
Introduction

Coastal wetlands ecosystems are vulnerable to large-scale impacts of climate change, because of their sensitivity to increases in sea-level rise. Given their vulnerability, the Nature Conservancy has asked a UEP field project team to make recommendations regarding investment (of time and money) in conservation of new and existing coastal sites in Virginia through Maine.

If a coastal wetland is arguably underwater in 50-60 years, is it really worth investing in its conservation today?

Research Questions:

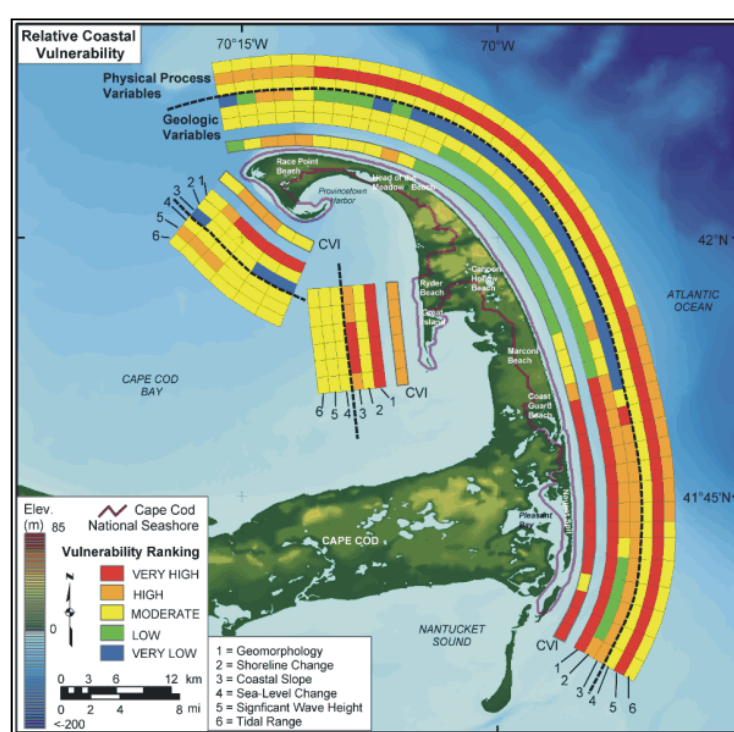
- 1) Which coastal ecosystems are vulnerable to climate change?
- 2) Which Nature Conservancy properties or future properties could be affected by climate change?



Data analysis layers:

- National Land Cover Data:* Coastal ecosystems and human development nodes. (NLCD)
- The Nature Conservancy Public Land:* (TNC) categorizes parcels based on TNC involvement. (Parcels displayed are within 8km coastline)
- Coastal Vulnerability Index (CVI):* visualizes the “relative susceptibility” of the coast to climate change based on a composite CVI value.

e.g. Cape Cod National Seashore



CVI classification is based on:

- geomorphology
- shoreline erosion & accretion rates (m/yr)
- coastal slope (percent)
- rate of relative sea-level rise (mm/yr)
- mean tidal range (m)
- mean wave height (m)



Coastal Wetlands

VARIABLE	Ranking of coastal vulnerability index				
	Very low	Low	Moderate	High	Very high
Geomorphology	Rocky, cliffed coasts	Medium cliffs	Low cliffs	Cobble beaches	Barrier beaches
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	1.0 - 2.0	-1.0 - +1.0	-1.1 - -2.0	< -2.0
Mean tide range (m)	> 4.0	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

The combination of these variables conveys where physical changes are likely to occur due to climate change.

(Source: <http://woodshole.er.usgs.gov/project-pages/cvi/>)

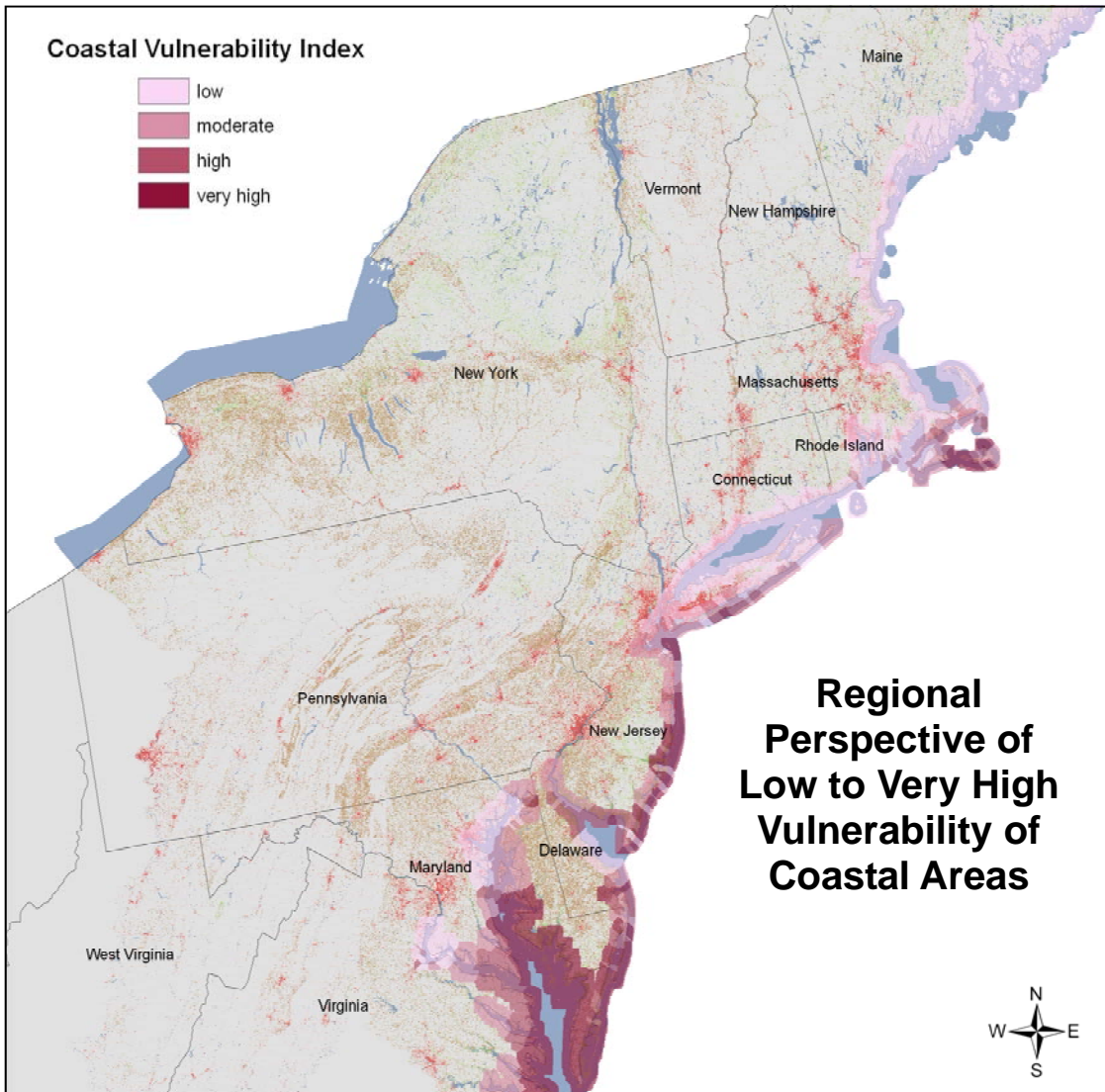
Findings

- The Chesapeake Bay, certain parts of the New Jersey Shore and Massachusetts (Cape Cod) are the most vulnerable areas on the Northeastern Coast.
- Based on the map to the right, and TNC can review the vulnerability of parcels they have are involved and not involved with and base conservation priorities on the ecosystem’s vulnerability

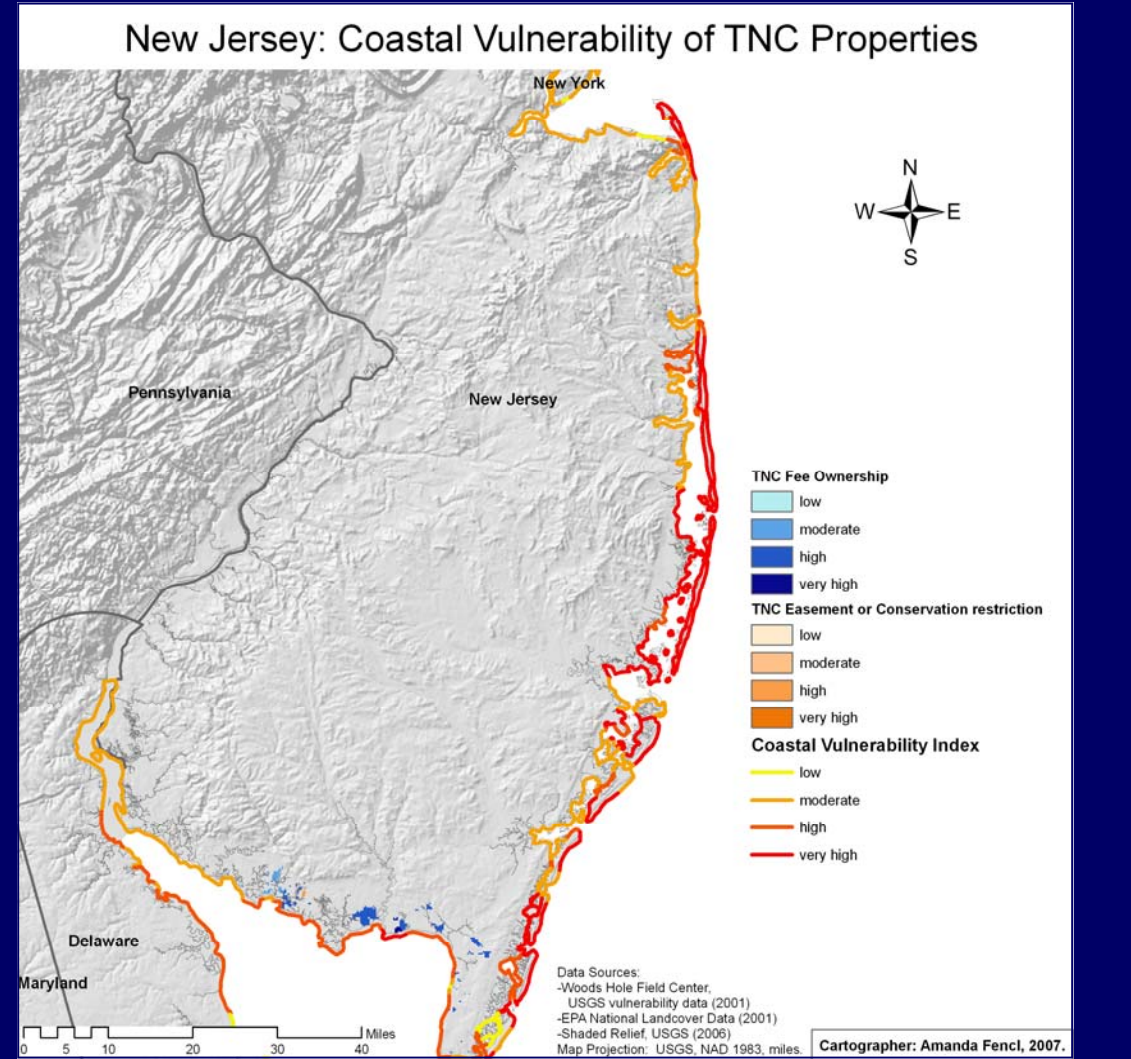
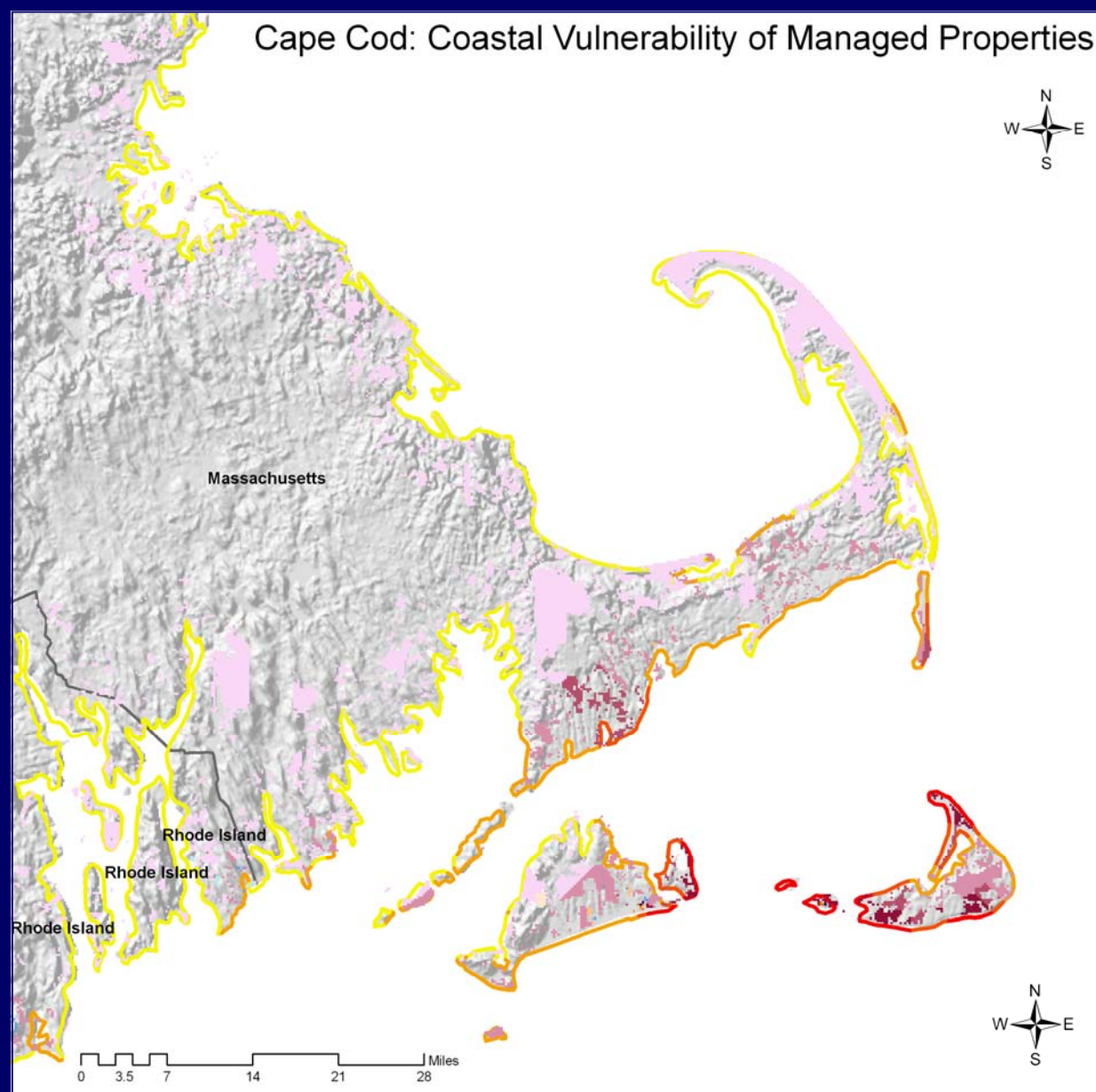
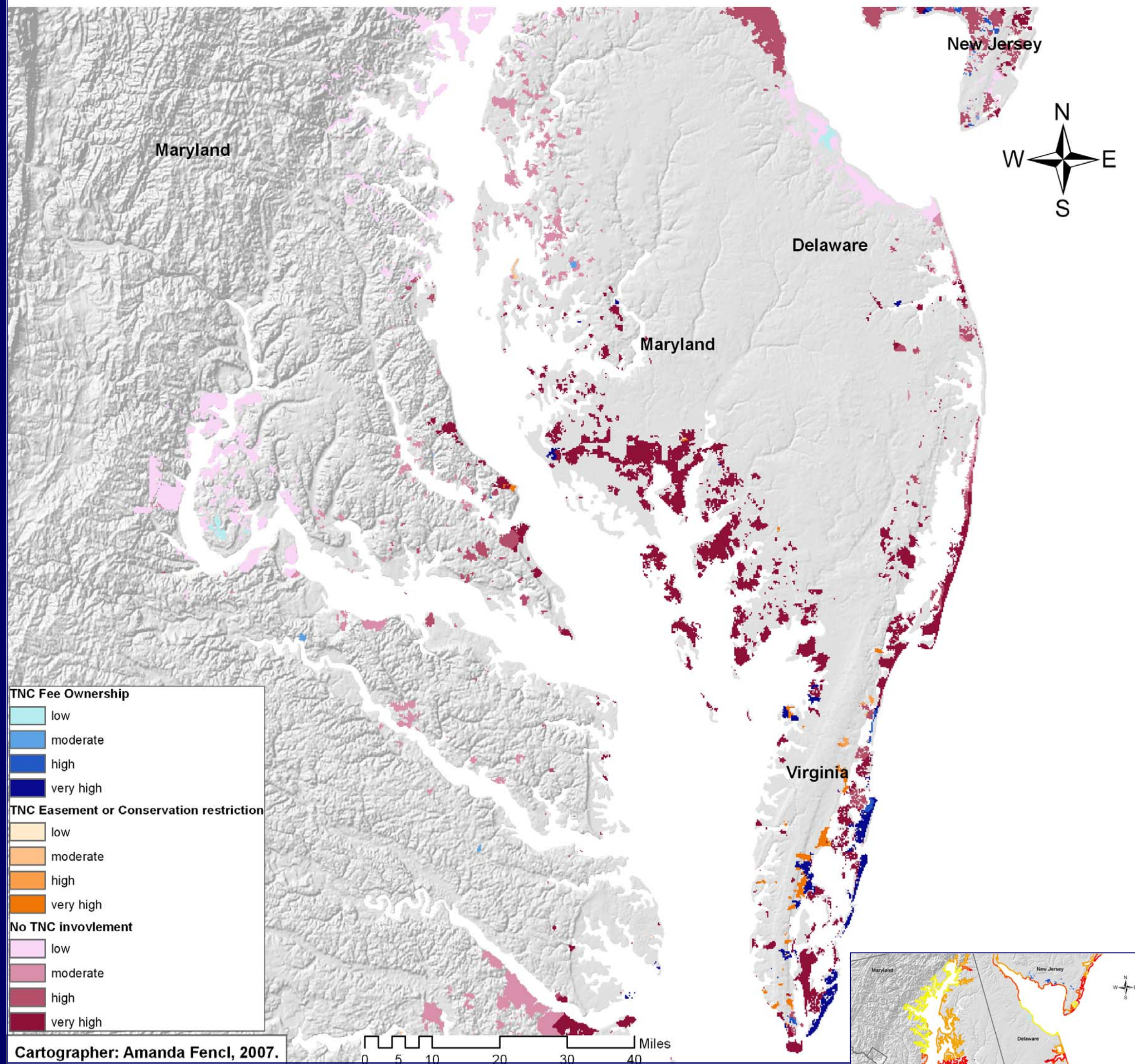


Rising sea level is contributing to the erosion of wetlands.

Source: Hartig et al. Wetlands, in *Climate Change and a Global City*, 2001. (ccir.ciesin.columbia.edu/nyc/ccir-ny_q2a.html)



Chesapeake Bay: Coastal Vulnerability of Managed Properties



Damage in Virginia from Hurricane Isabel (2003)



20th Century Hurricanes/Tropical Storms in Chesapeake Bay (1976-2000)

Source: <http://www.climate.org/topics/weather/isabel/21-storm-tracks.shtml>

Rising sea level means higher storm surges, even from relatively minor storms, which increases coastal flooding and subsequent storm damage along coasts.

Recent scientific evidence suggests a link between the destructive power (or intensity) of hurricanes and higher ocean temperatures, driven in large part by global warming.

(http://www.ucsusa.org/global_warming/science/hurricanes_and_climate_change.html)

Sources:

- .NLCD: national land-cover data, EPA, <http://www.epa.gov/mrlc/nlcd.html>
- .TNC: “Managed Areas”, The Nature Conservancy, (1/1/2006).
- .CVI: USGS, <http://pubs.usgs.gov/dds/dds68/>, (2001)
- .Shaded Relief: USGS (2006)
- .Map projection: NAD 1983
- Cartographer: Amanda Fencl, Intro. to GIS, 2007