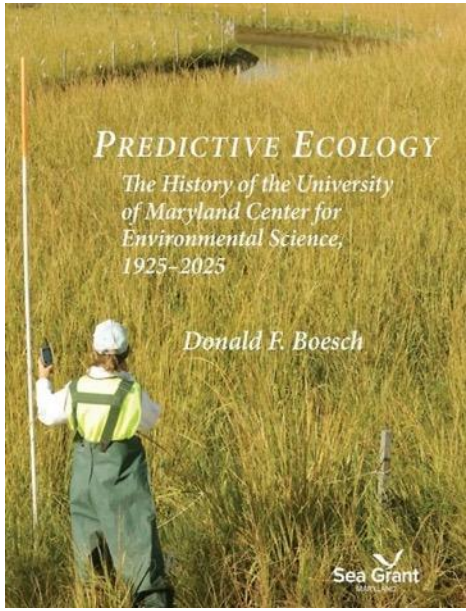
Maryland Coastal Bays:
Science and Management

Worcester County Planning Commission

10 Apr 2025

Bill Dennison

Reginald Truitt, from Snow Hill, founded UMCES one hundred years ago.



… Reginald V. Truitt established the Chesapeake Biological Laboratory in 1925.

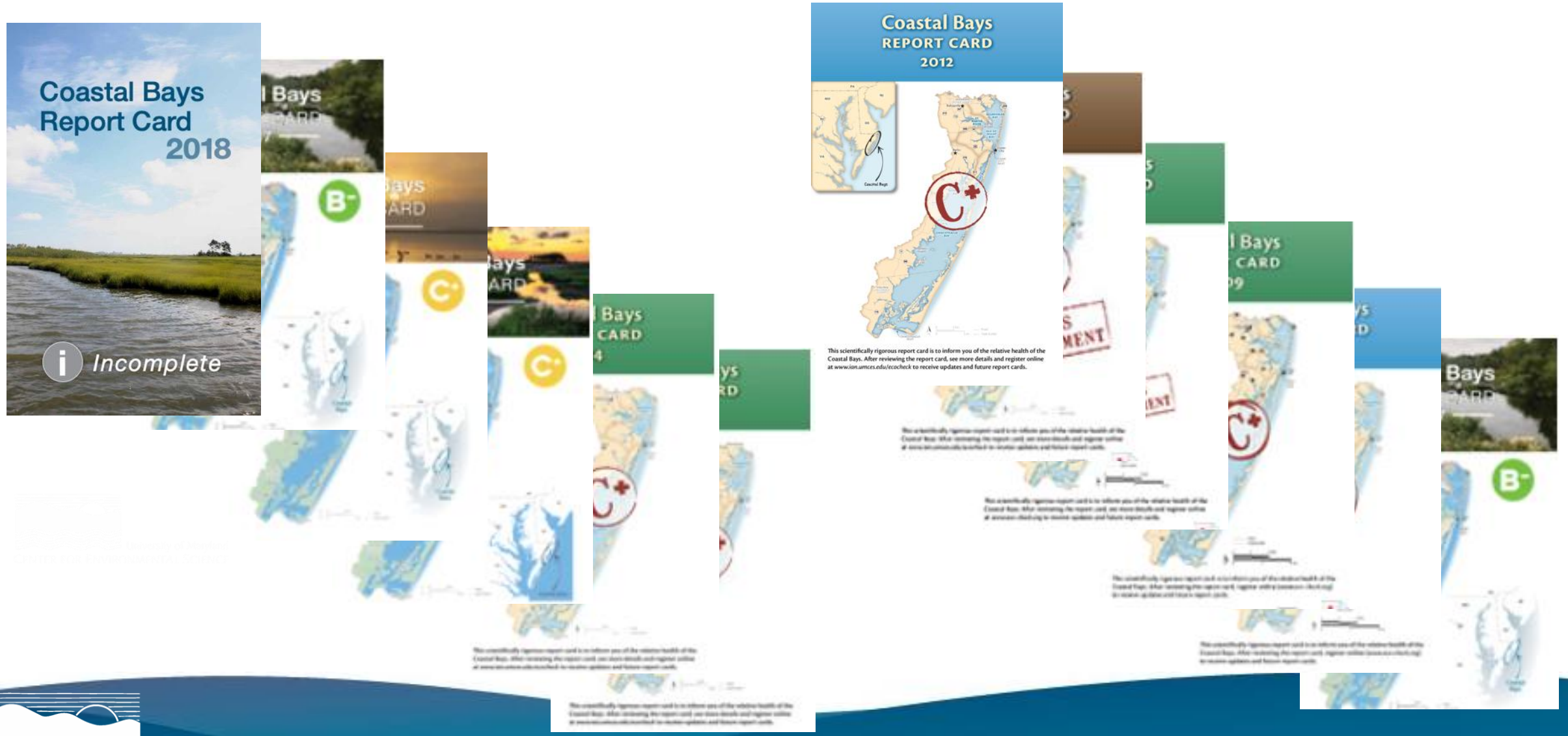
Truitt's father was an oyster farmer and UMCES scientists have been messing around with oysters for 100 years

Strong, enduring science partnership

MARYLAND
DEPARTMENT OF
NATURAL RESOURCES

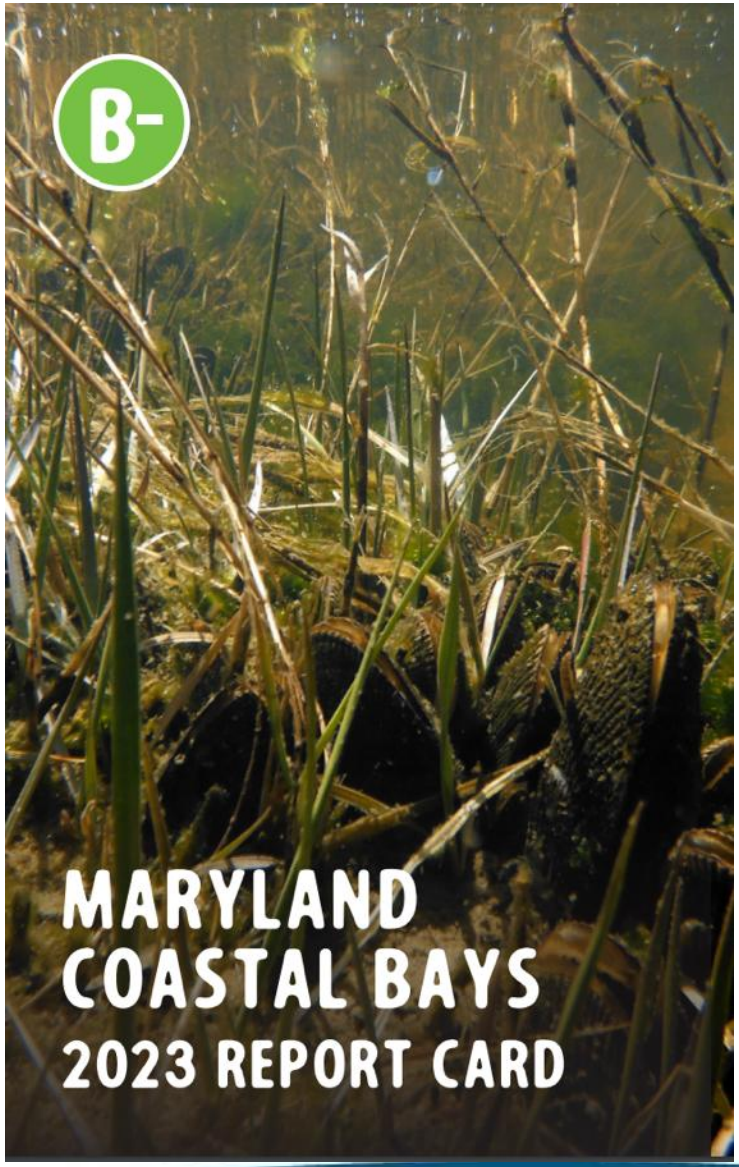
University of Maryland
CENTER FOR ENVIRONMENTAL SCIENCE

Annual report cards




C+
MARYLAND
COASTAL BAYS
2021 REPORT CARD


Maryland Coastal Bays
2022 Report Card
B-


B-
MARYLAND
COASTAL BAYS
2023 REPORT CARD

Preservation of waterways & sea level rise are key features of Worcester County Comprehensive Plan

Preserving Community Character – Focus on enhancing what already exists within Towns (infill) as well as building community through the support for small businesses.

Loss of Natural Features – Encourage the preservation of farmland, waterways, and open space, benefiting residents as well as the environment overall.

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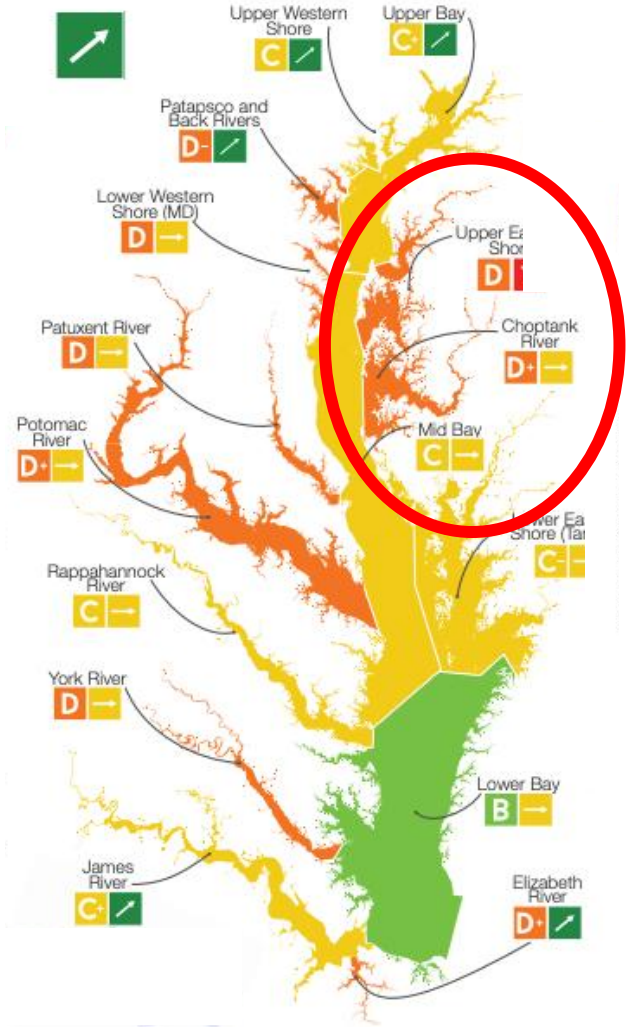
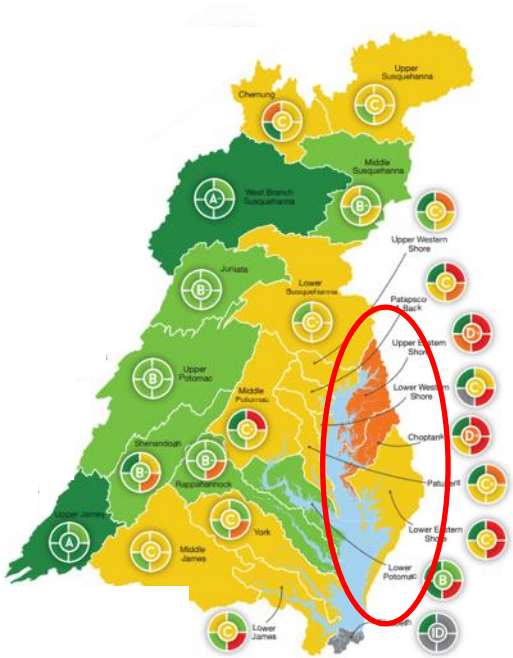
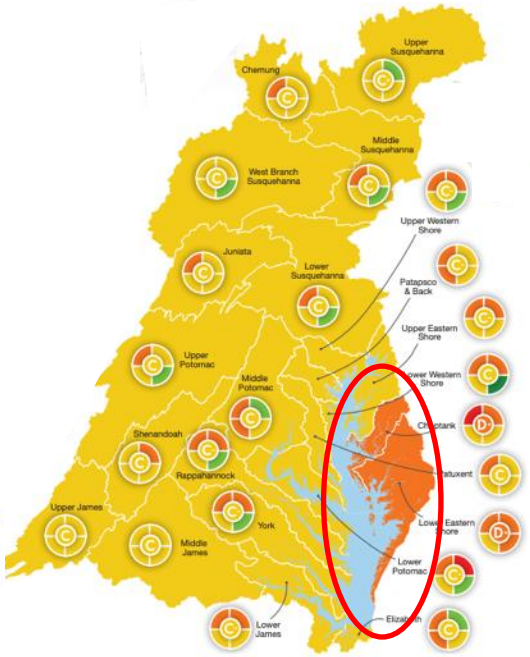
2022: Systematic failure on Eastern Shore



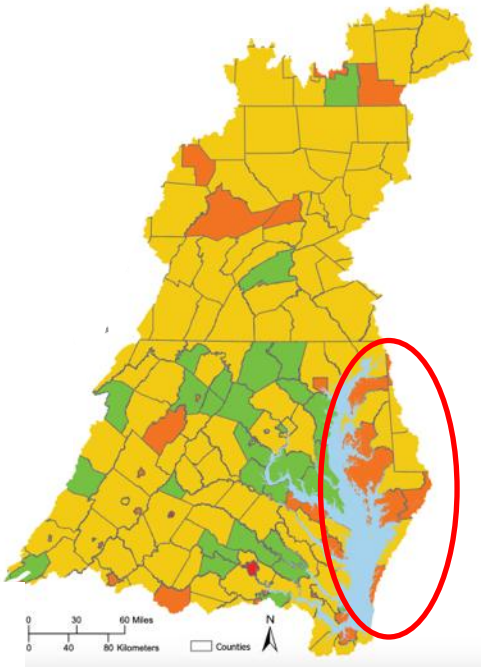
Ecological



Social



Economic



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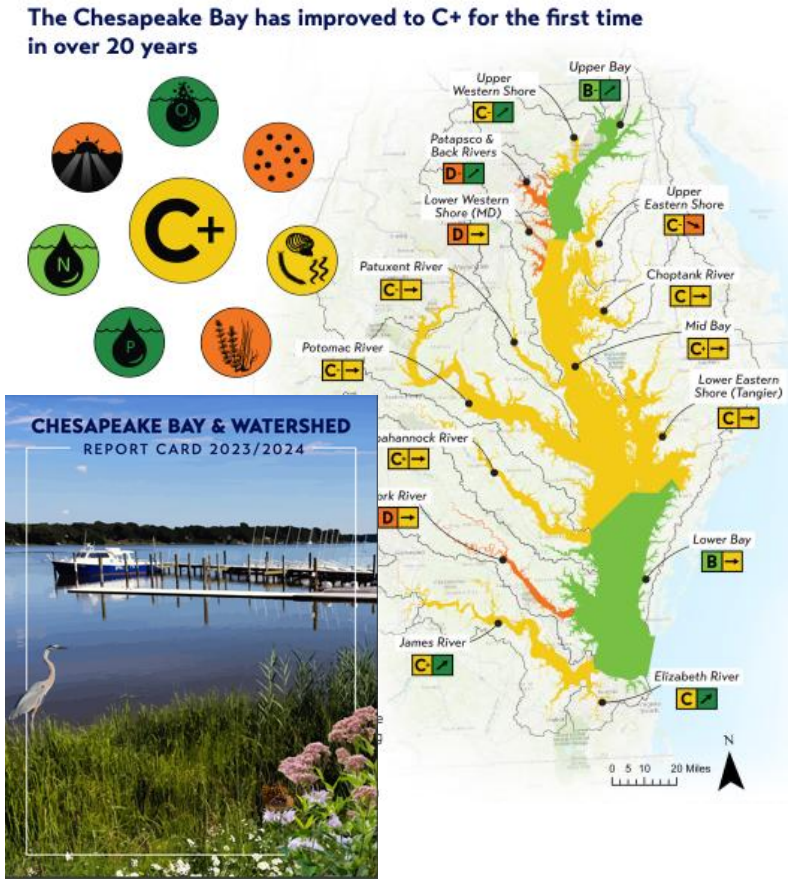
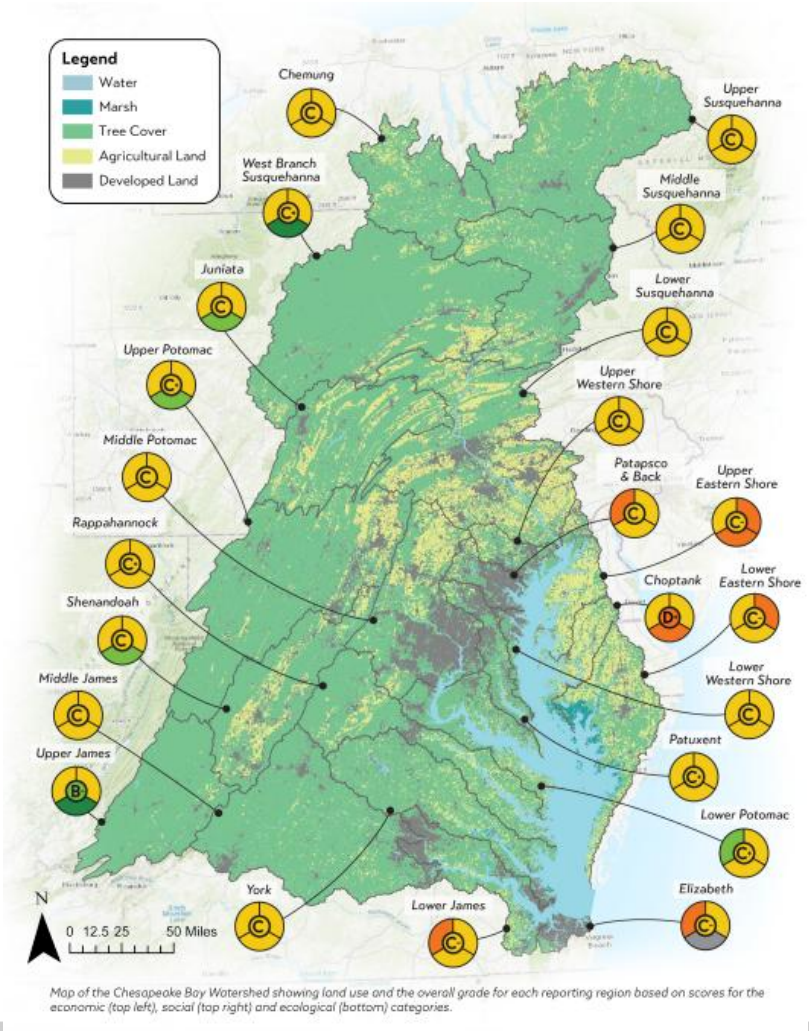
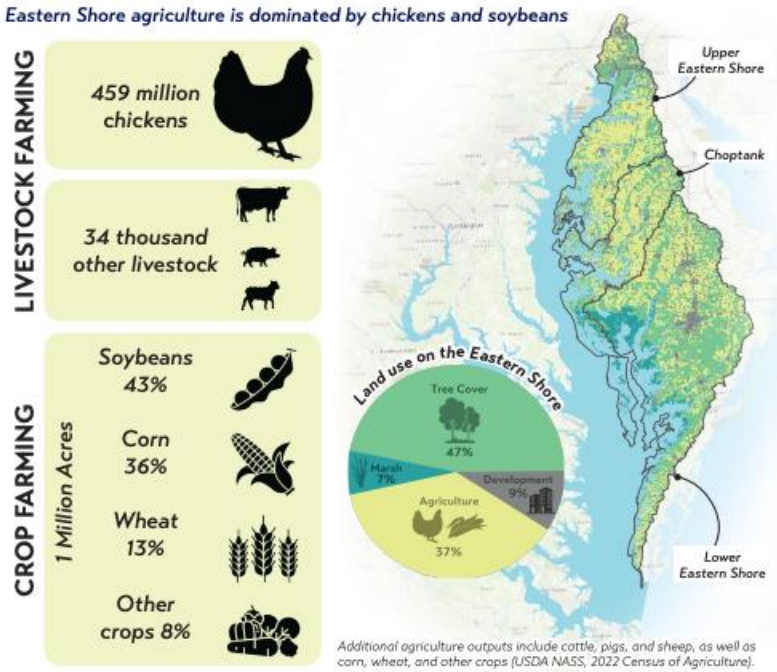
2023-4: Delmarva focus





Map of the Chesapeake Bay Watershed showing land use and the overall grade for each reporting region based on scores for the economic (top left), social (top right) and ecological (bottom) categories.



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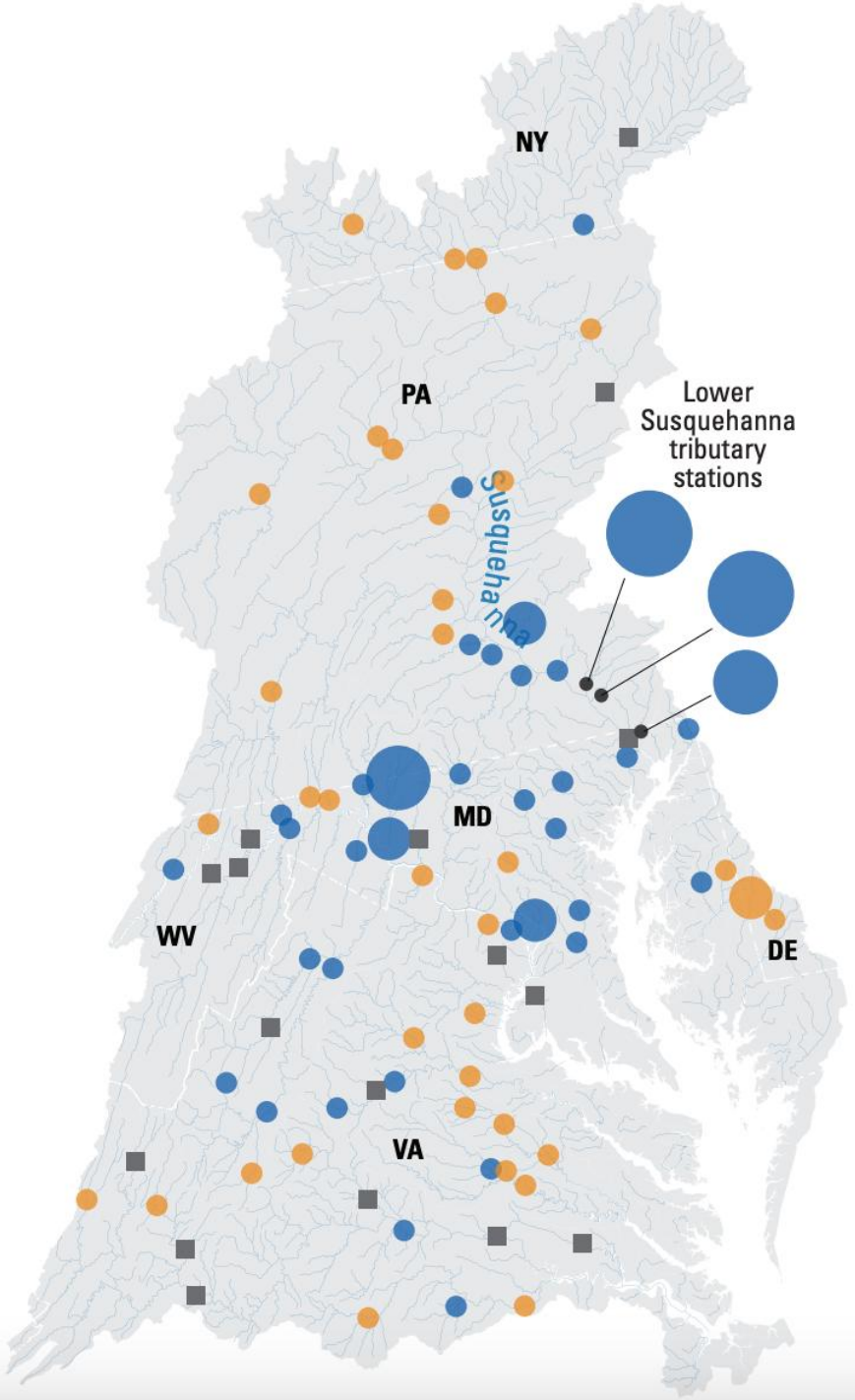
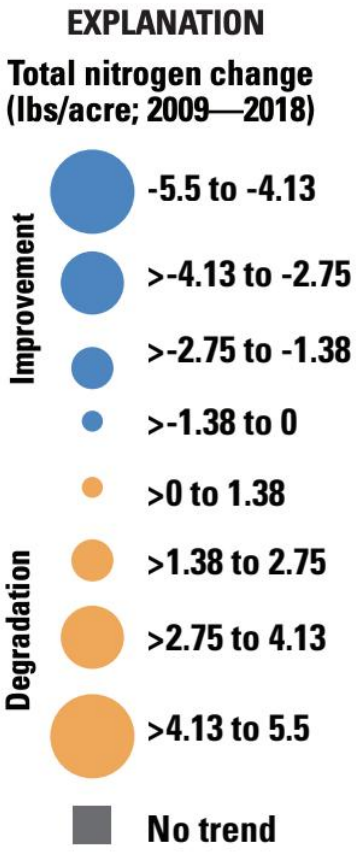
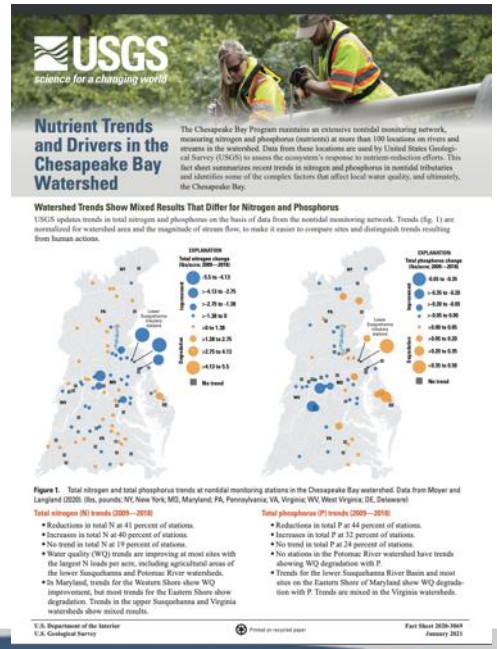
Douglas et al., in prep

Nitrogen trends







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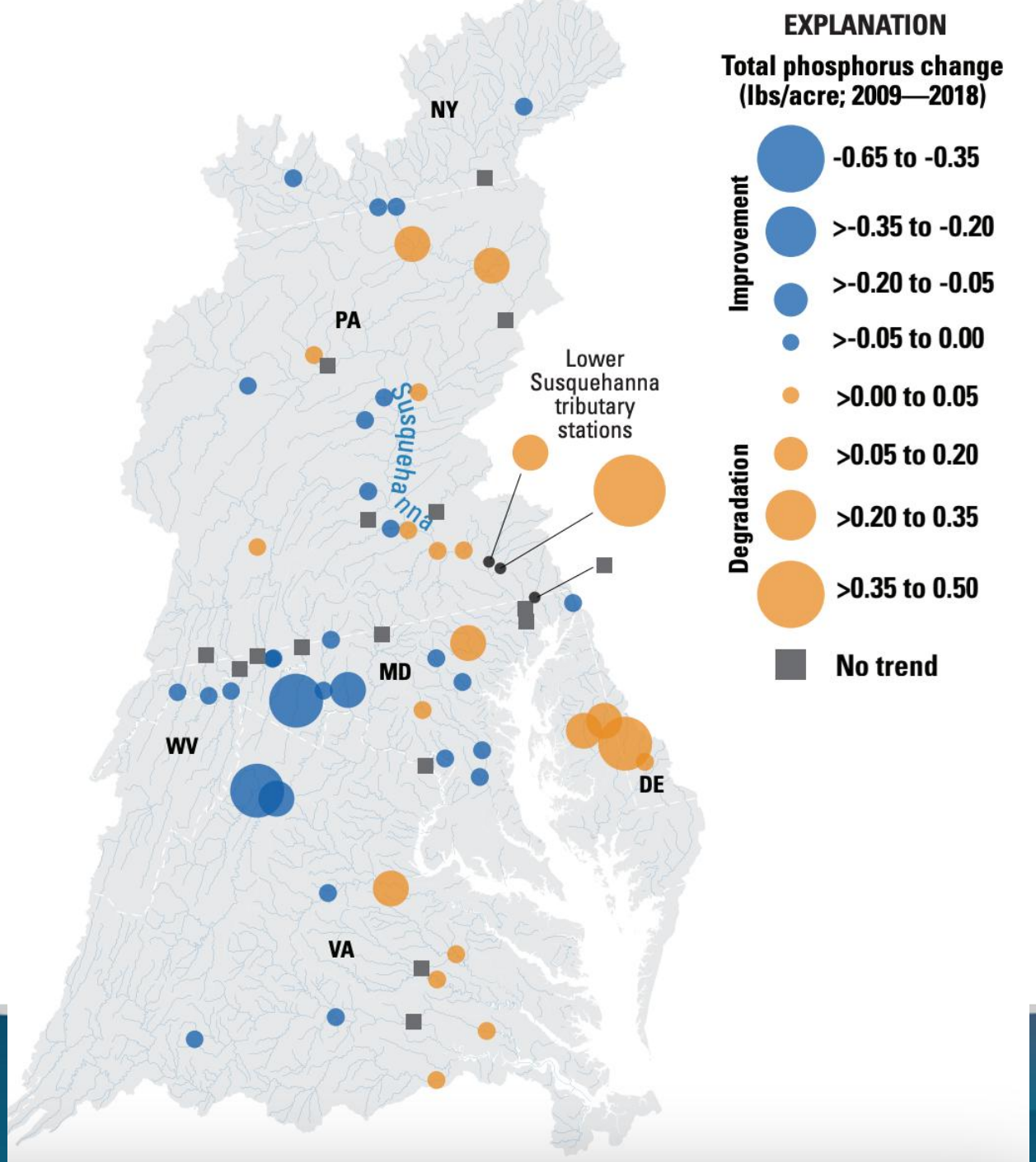
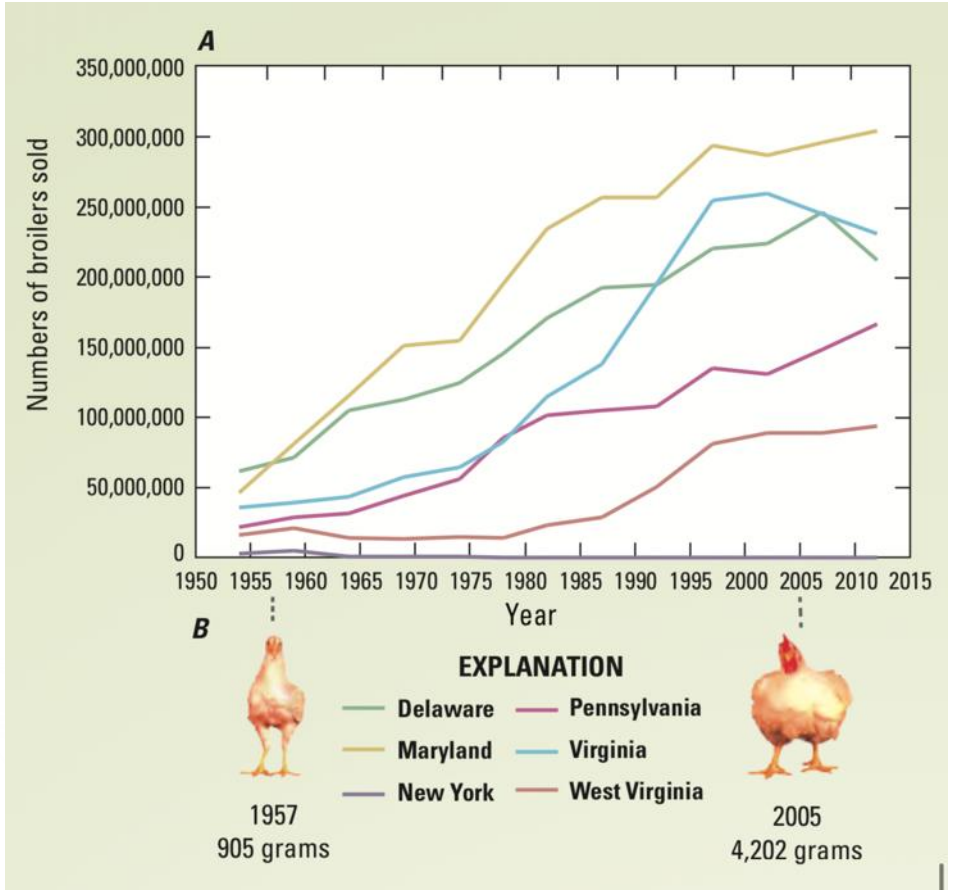
Phosphorus trends



Eastern Shore increasing chicken production and high groundwater nitrate



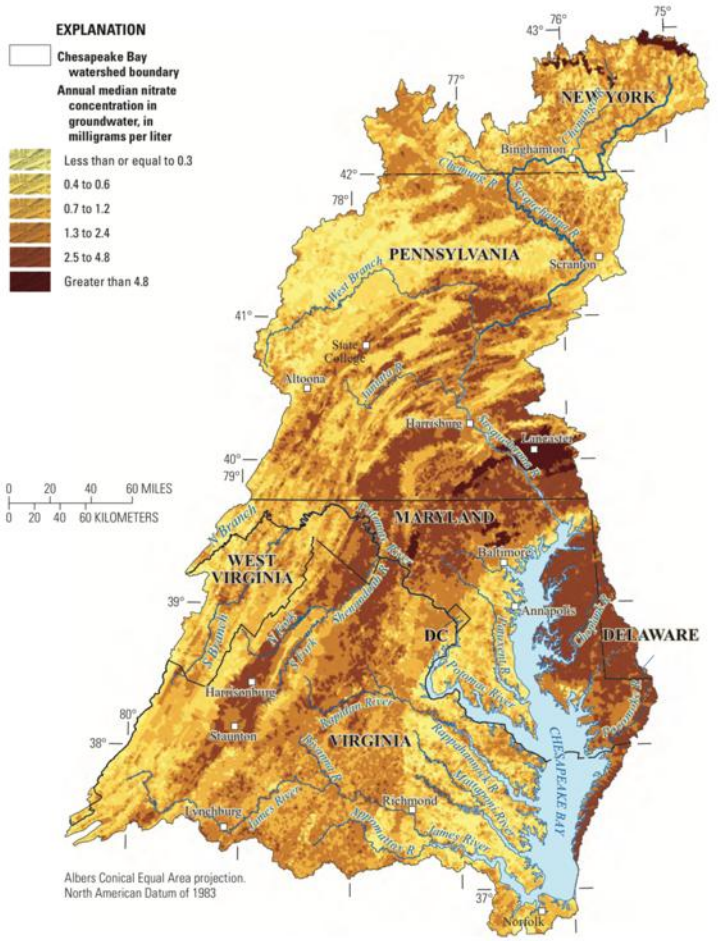
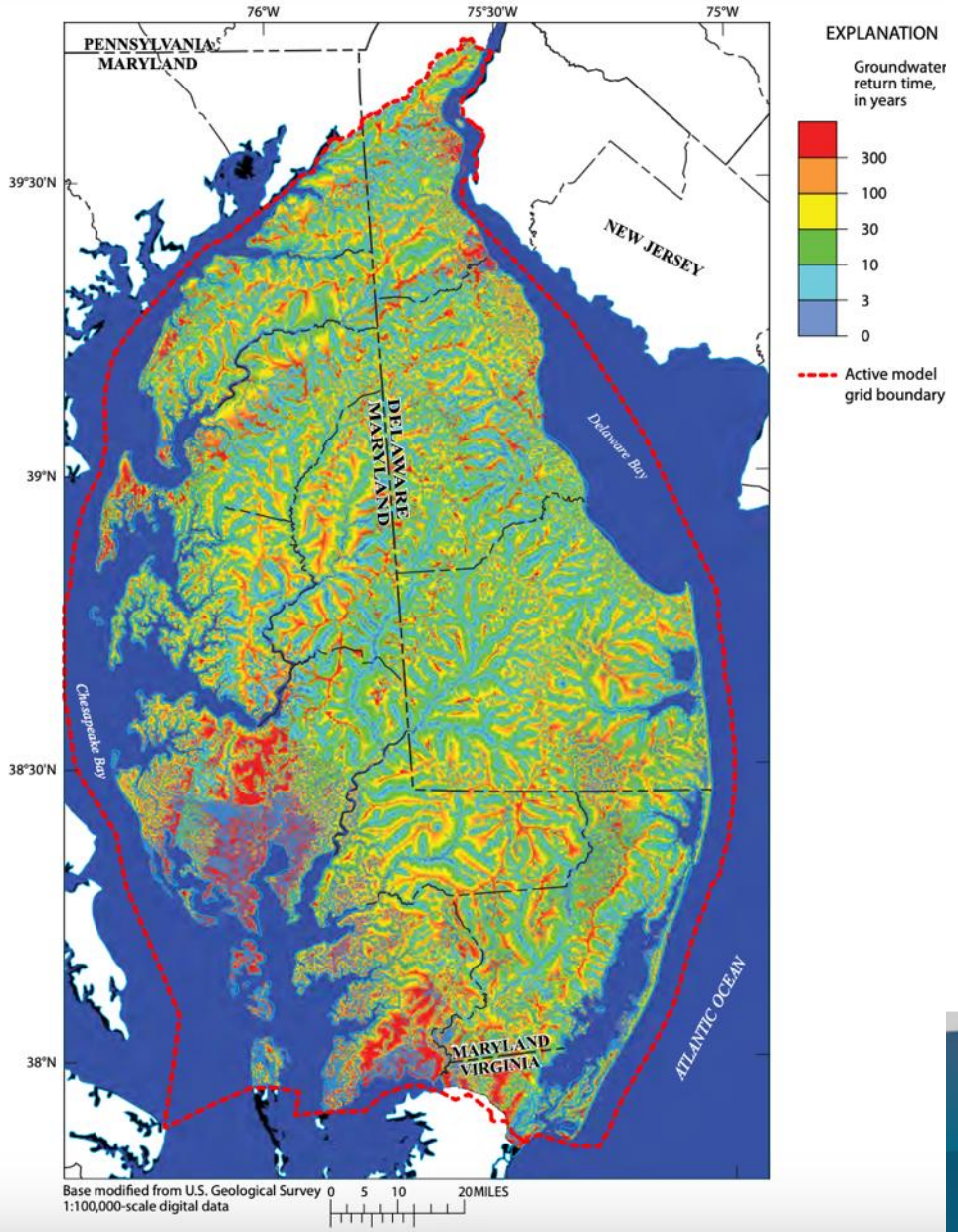
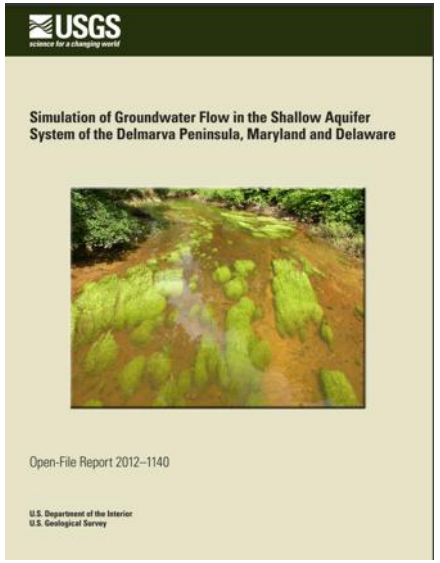


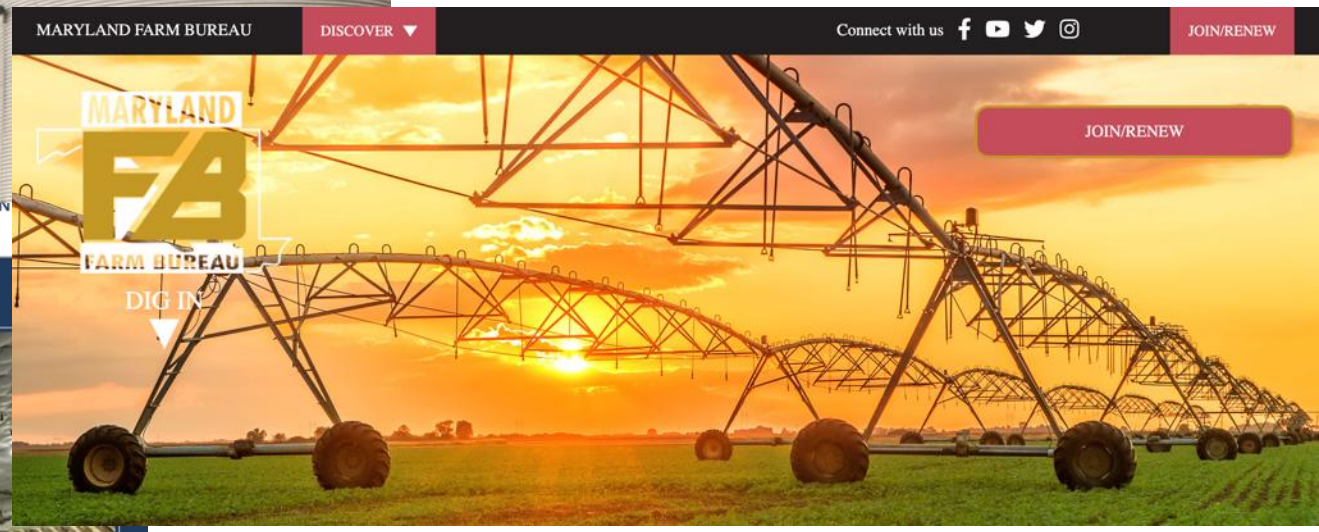
Figure NS.8. The spatial distribution of median nitrate concentrations in groundwater in 2002 (Terziotti and others, 2018).

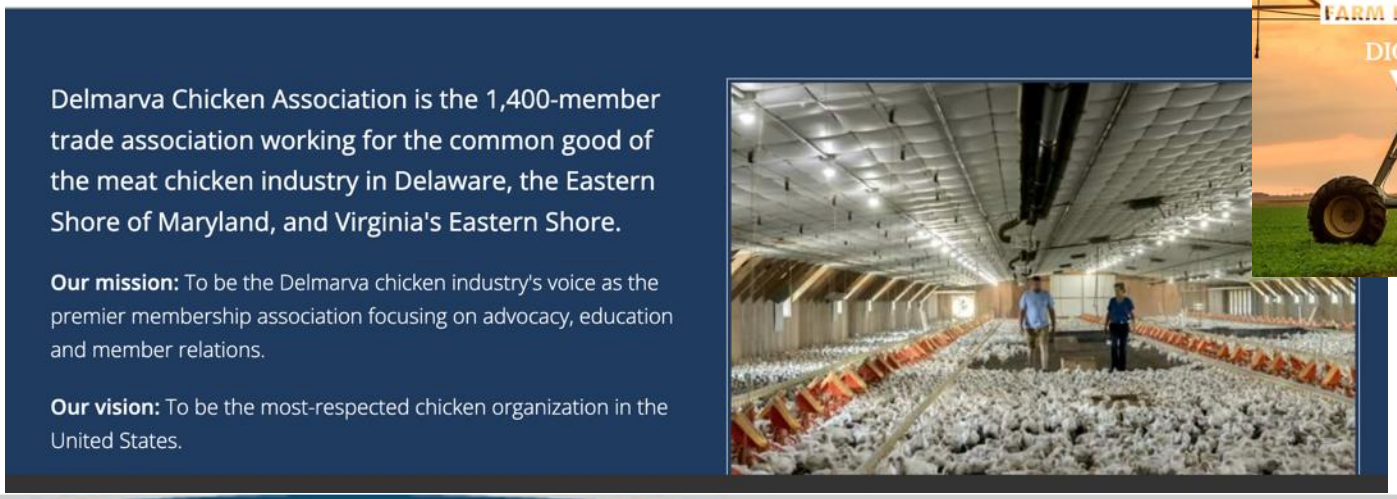
Groundwater residence times are extremely long



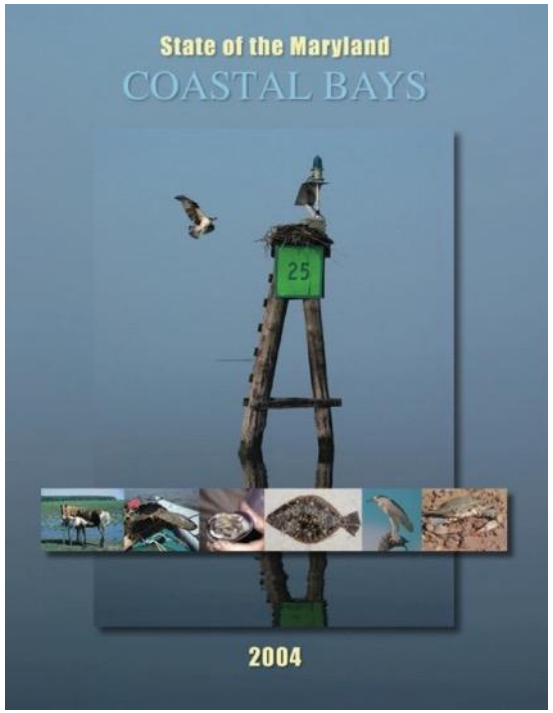


Conversations initiated with farming community



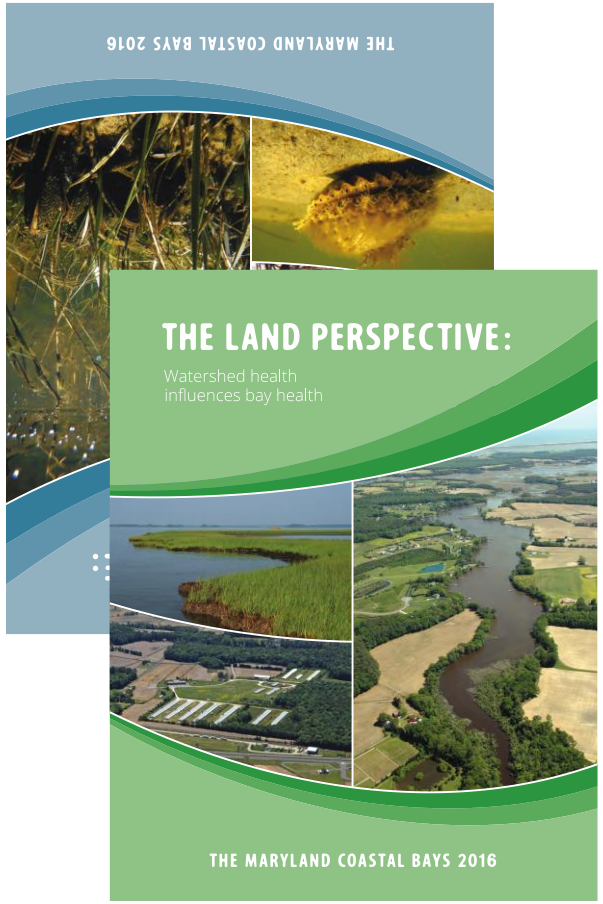


State of the Bays: 5 year syntheses

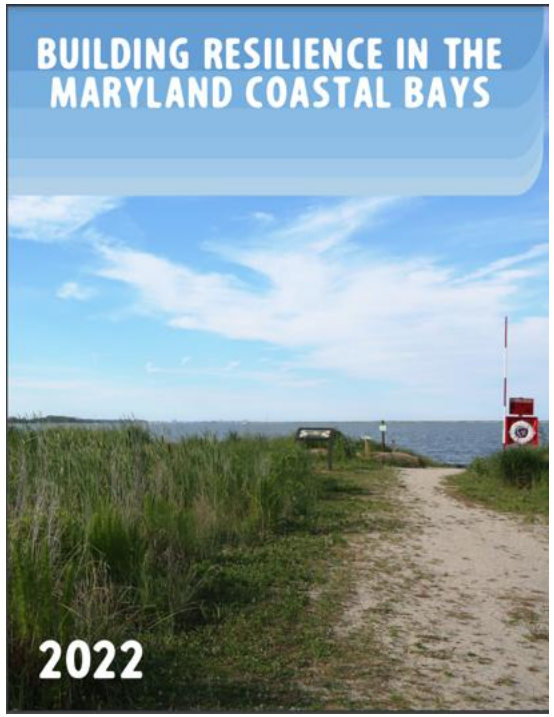


2004

2009

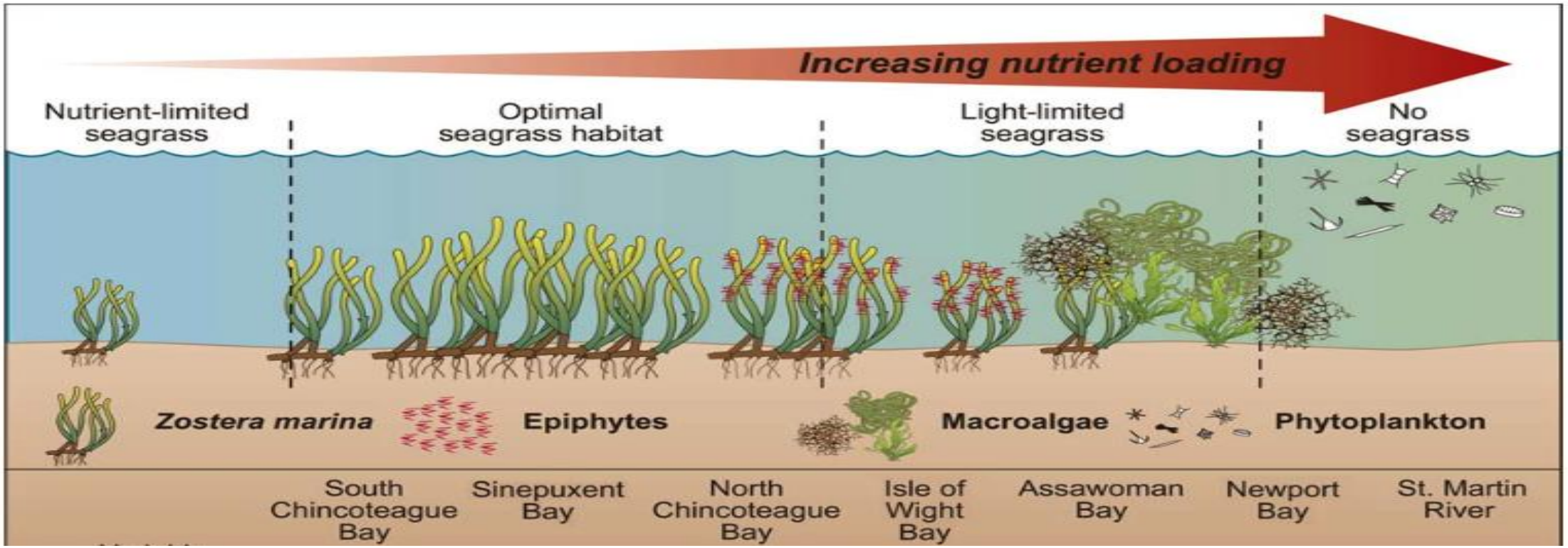


2016

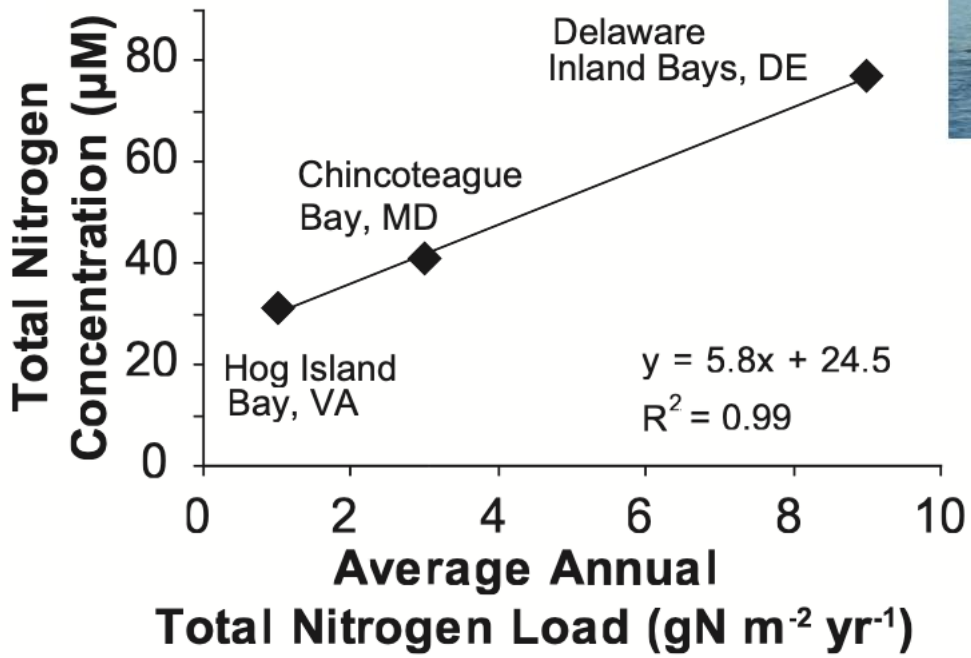


2022

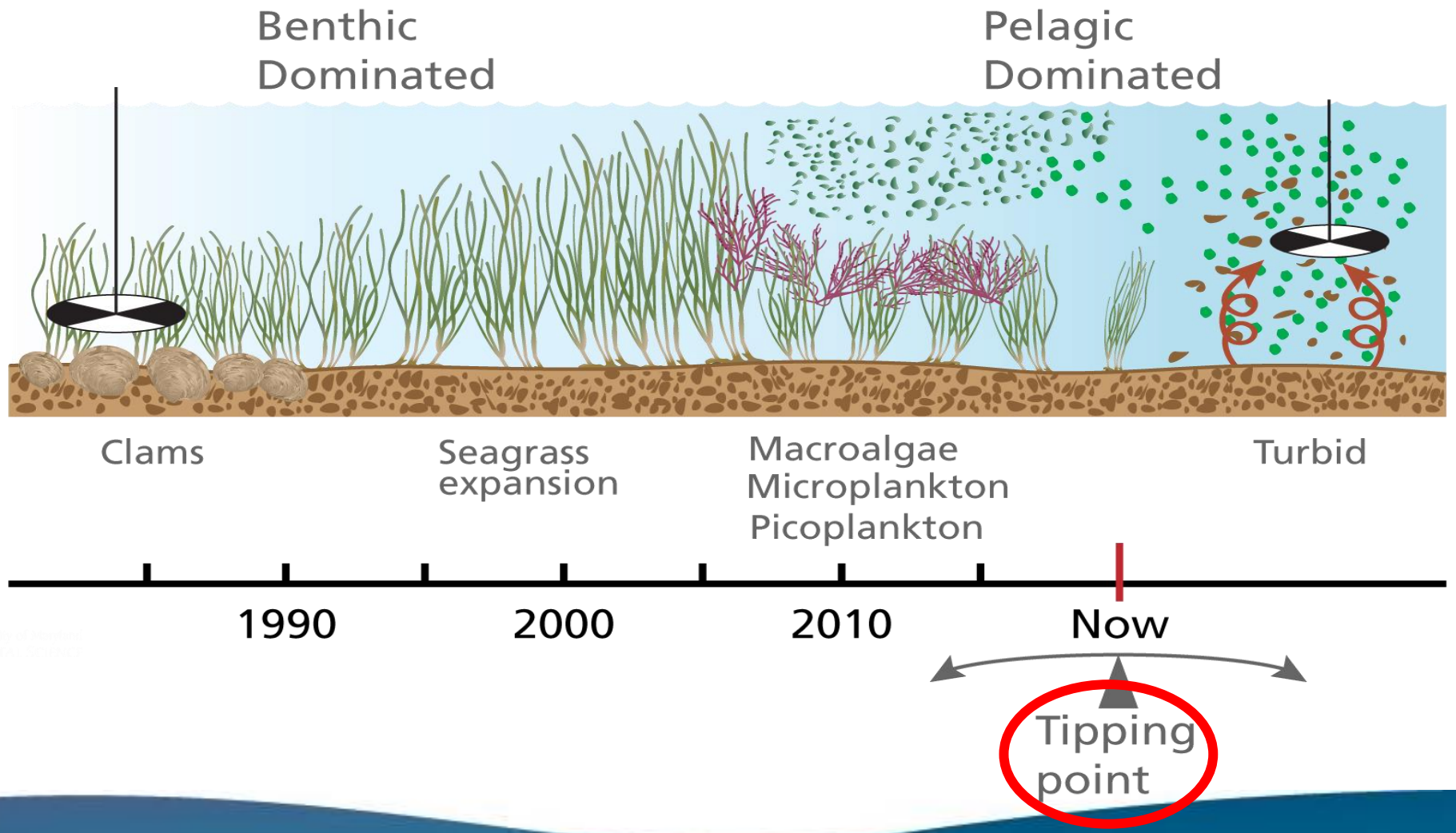
Eutrophication gradient described



Highlighted alternative futures for Maryland Coastal Bays



Maryland Coastal Bays are at a 'Tipping Point'



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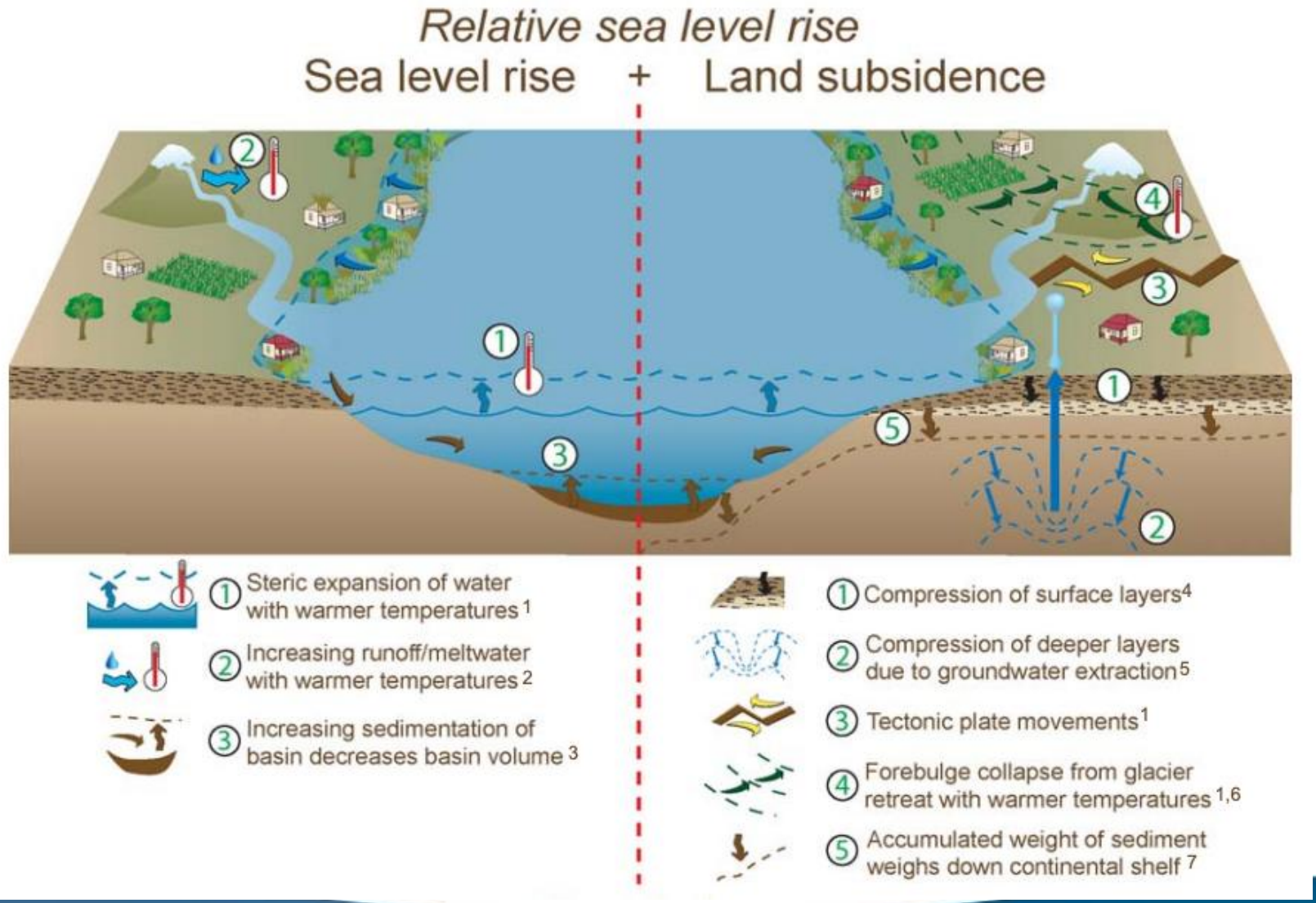
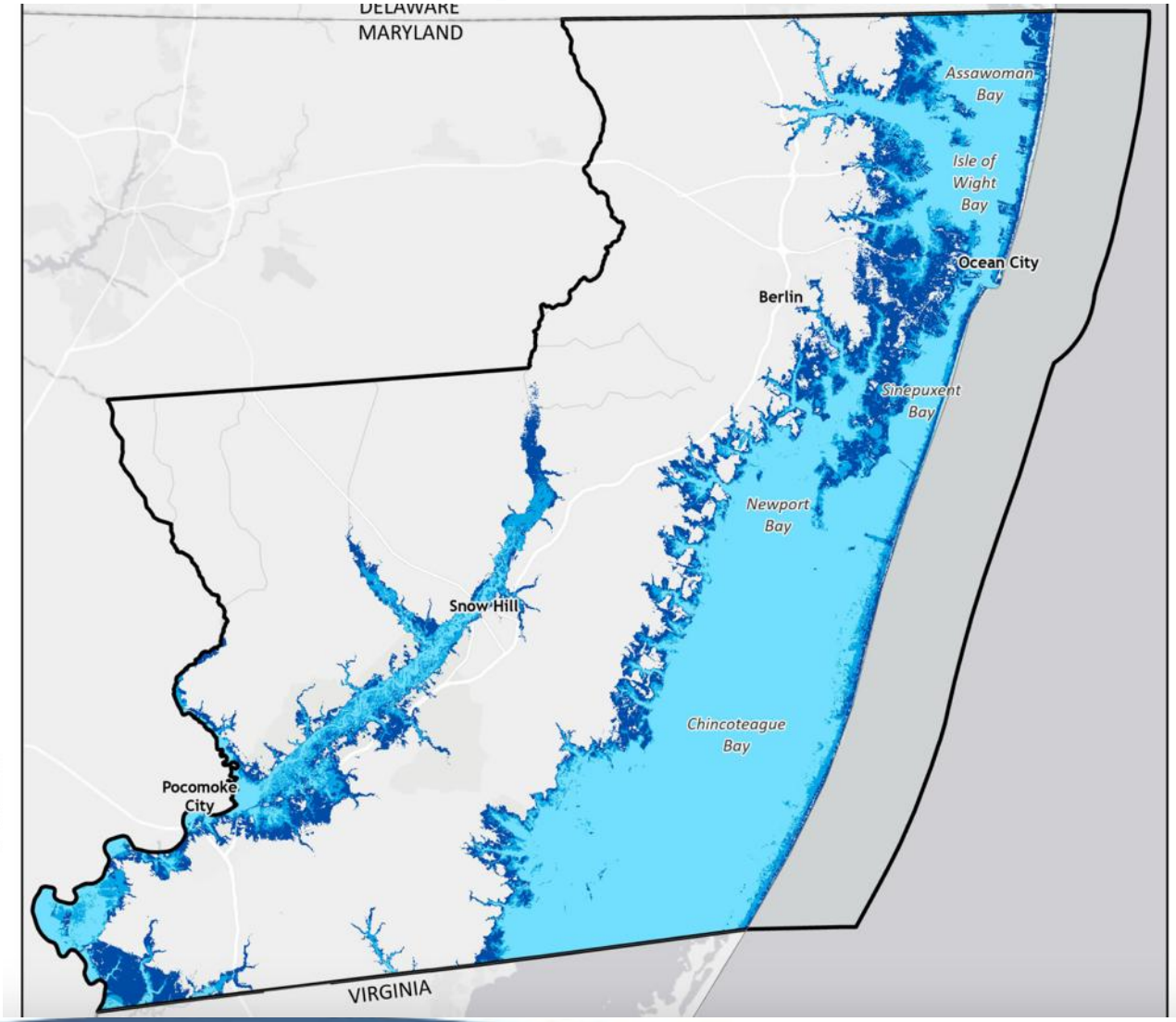
Relative sea level rise is what is important



Worcester Co. is particularly vulnerable to relative sea level rise



Legend

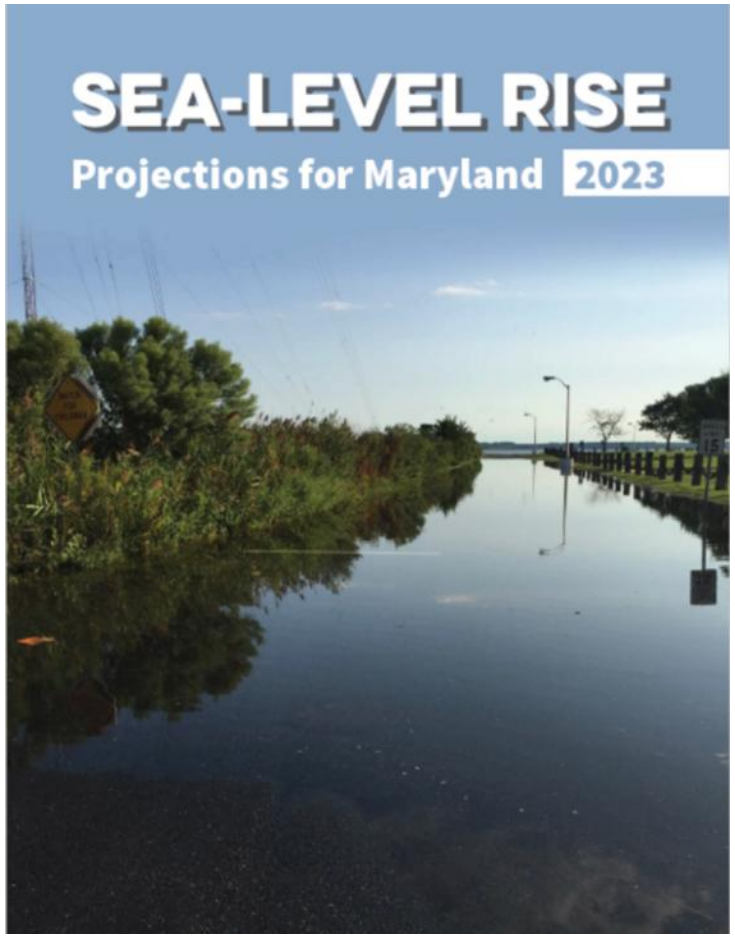
- State Lines
- Worcester County
- 2 to 5 Foot Inundation
- 5 to 10 Foot Inundation

Sea Level Rise

- 0 to 2 Foot Inundation

Figure 10. Vertical land motion (mm/yr) estimated by NOAA from tide-gauge records in Chesapeake Bay and adjacent Atlantic coast.

Relative sea level rise is accelerating



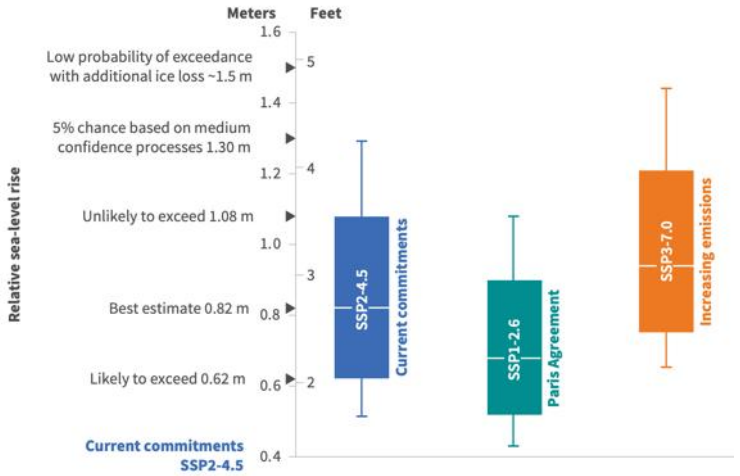
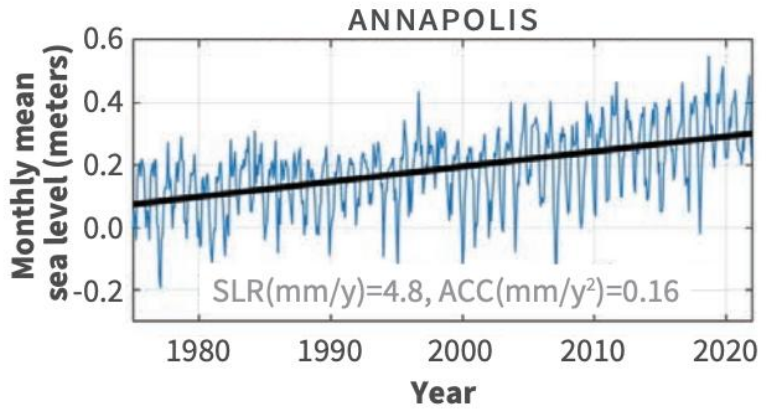
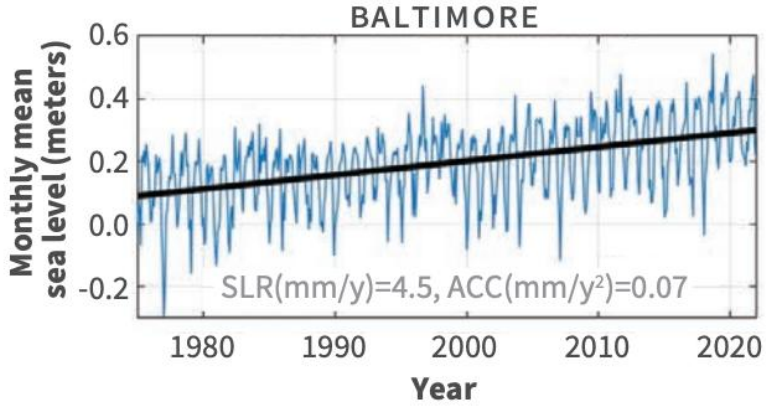
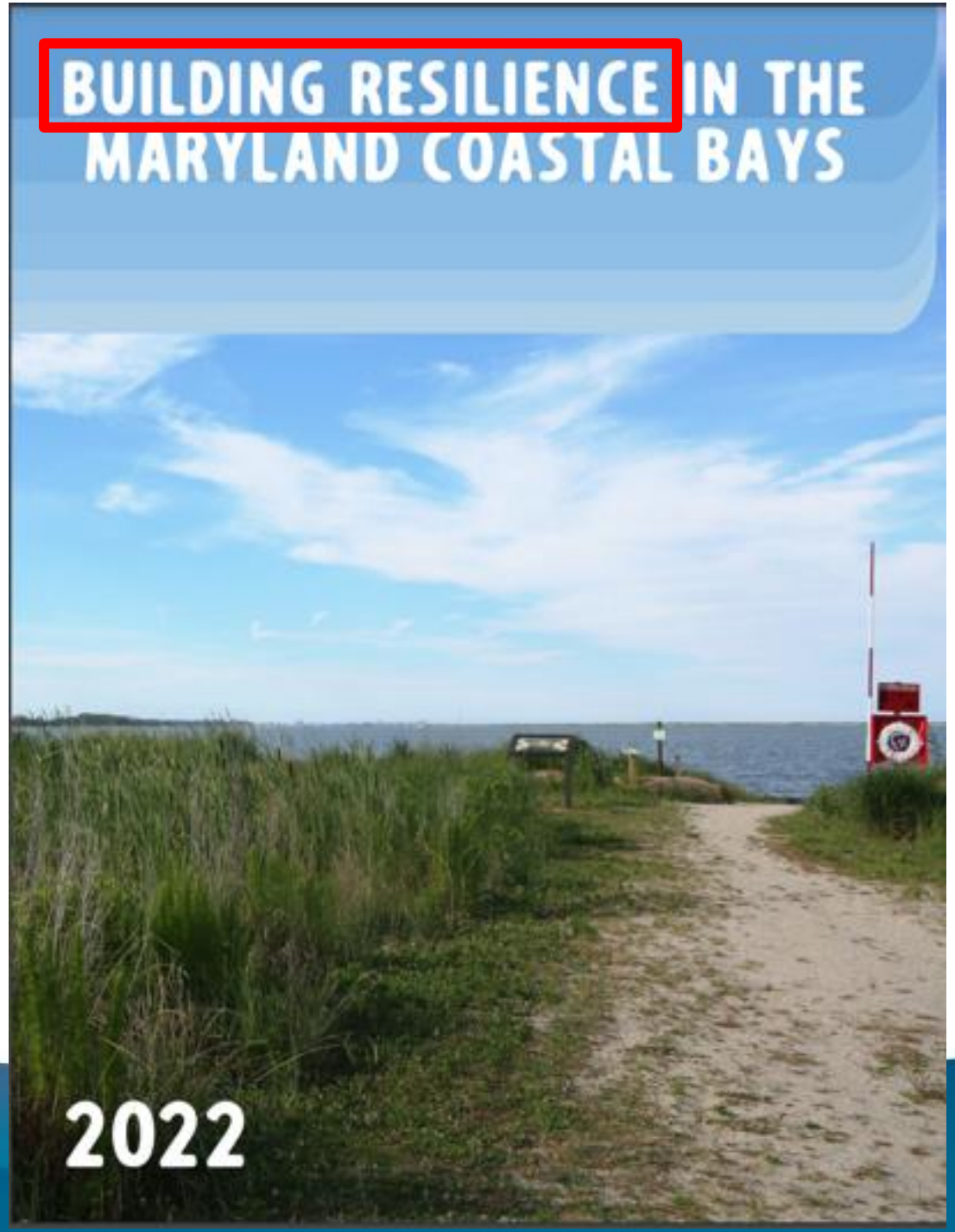


Figure 5. P-box probabilities for projected sea-level rise at Baltimore in 2100 under the three most plausible emissions pathways. Bars represent *likely* (17th–83rd percentile) ranges, vertical lines the 5th–95th percentile ranges, and white crossbars the medians.







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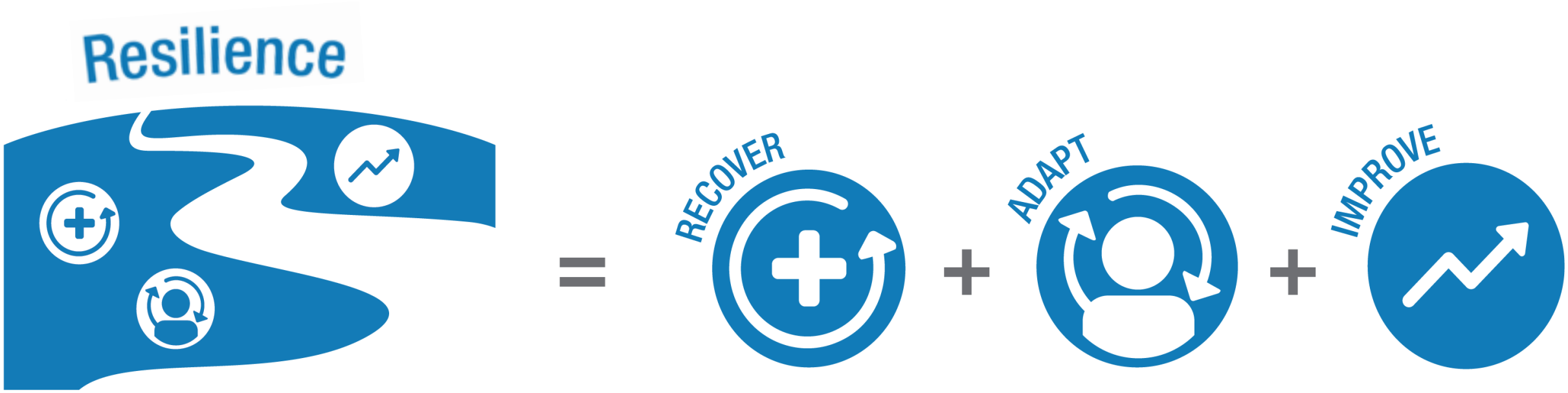
Resilience is a NEW way of thinking



Resilience = The capacity of a system and its associated communities to quickly ***recover*** from disturbances, ***adapt*** to changes without collapsing, and to ***improve*** through innovation and implementation of resilience strategies.

Resilience is a NEW way of thinking

- Traditionally, we manage for ***ecosystem condition***
- And our protection and restoration efforts are focused on maintaining good ecosystem condition
- But the increasing development pressures and climate change impacts mean that the ***pace of change is increasing***
- Managing for current ecosystem condition needs to be replaced with managing for ***resilience*** to these changes
- Therefore, in the State of the Maryland Coastal Bays report, we plan to emphasize ***managing for resilience***

HEALTHY AND RESILIENT SYSTEM

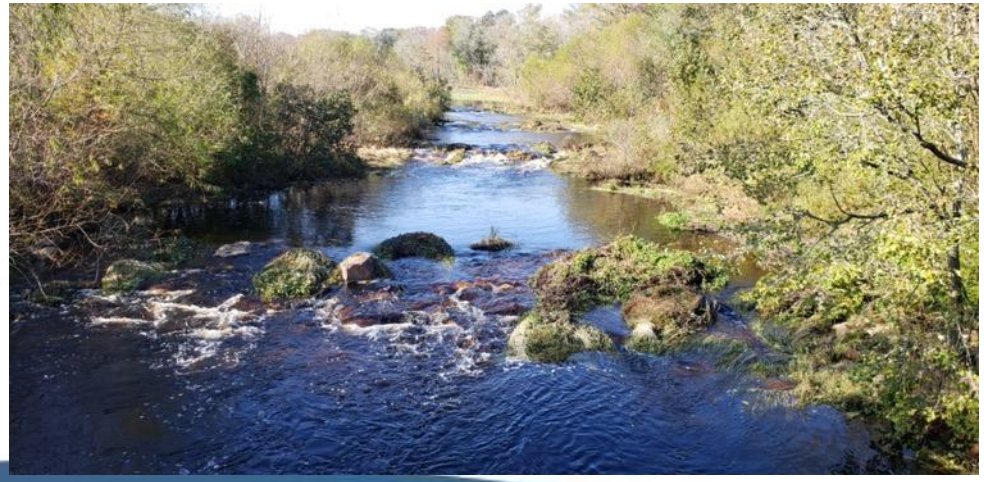
In this scenario, nutrient sources from agriculture and houses with sewer systems are mitigated. In addition, upland migration of salt marshes and seagrasses is facilitated. Good water quality leads to abundant fish, birds, clams, and clear water.

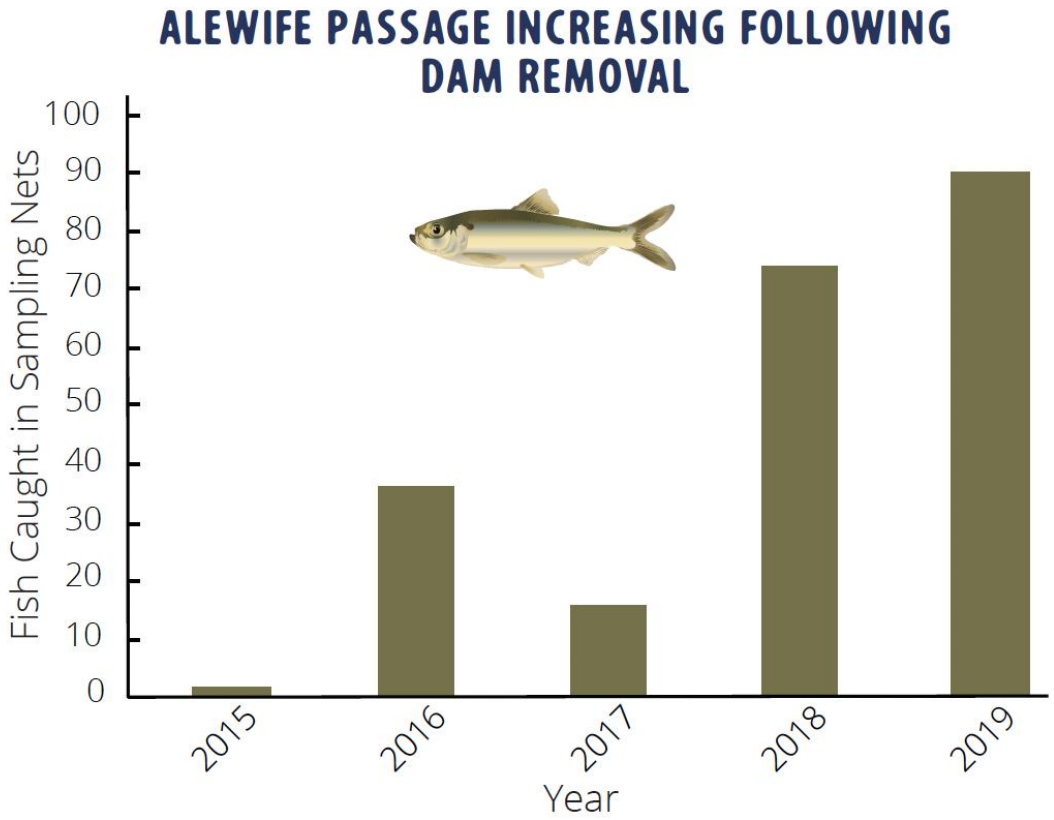
UNHEALTHY AND NON-RESILIENT SYSTEM

In this scenario, nutrient sources from agriculture , houses with septic systems , and atmospheric deposition are unabated. In addition, upland migration of salt marshes and seagrasses is impeded by hardened shorelines and degraded by animal grazing . Poor water quality leads to harmful algal blooms , low dissolved oxygen , turbid water , and sparse fish .

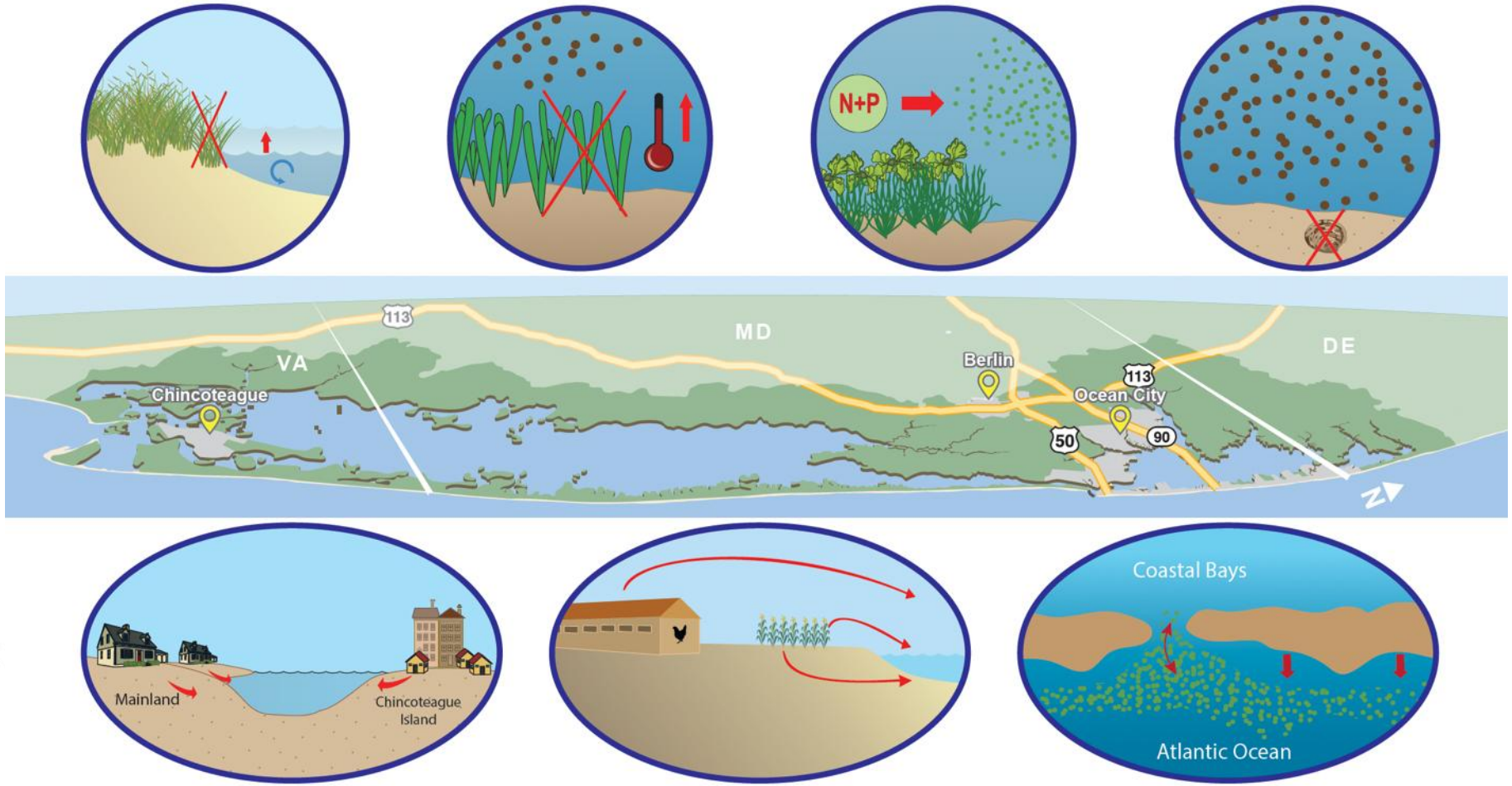
Building resilience . . .

Bishopville Dam removal builds resilience & enhances fish passage



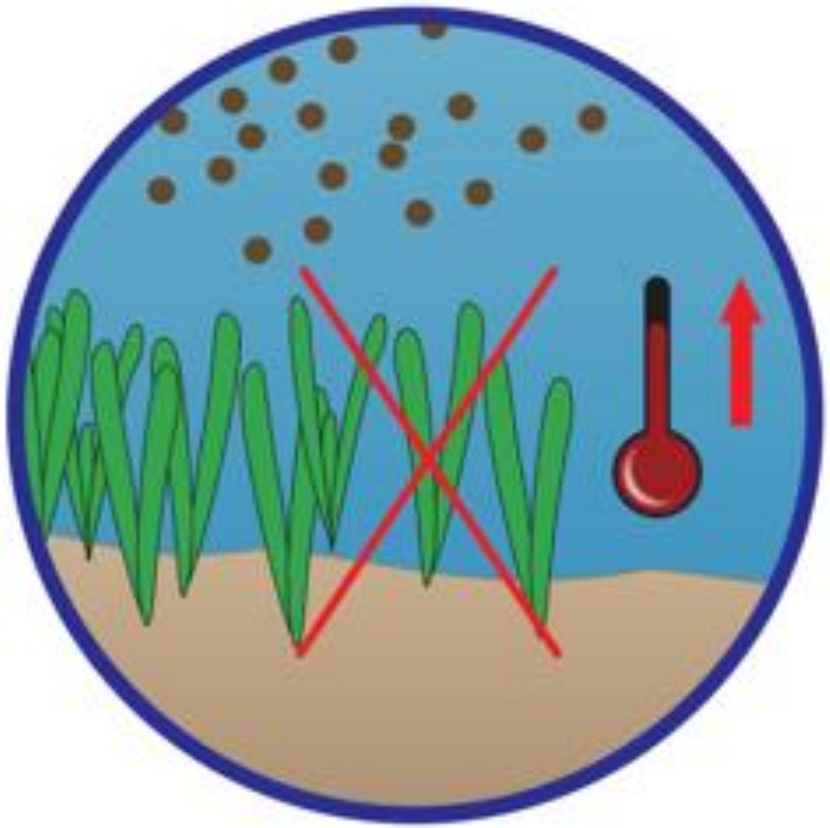


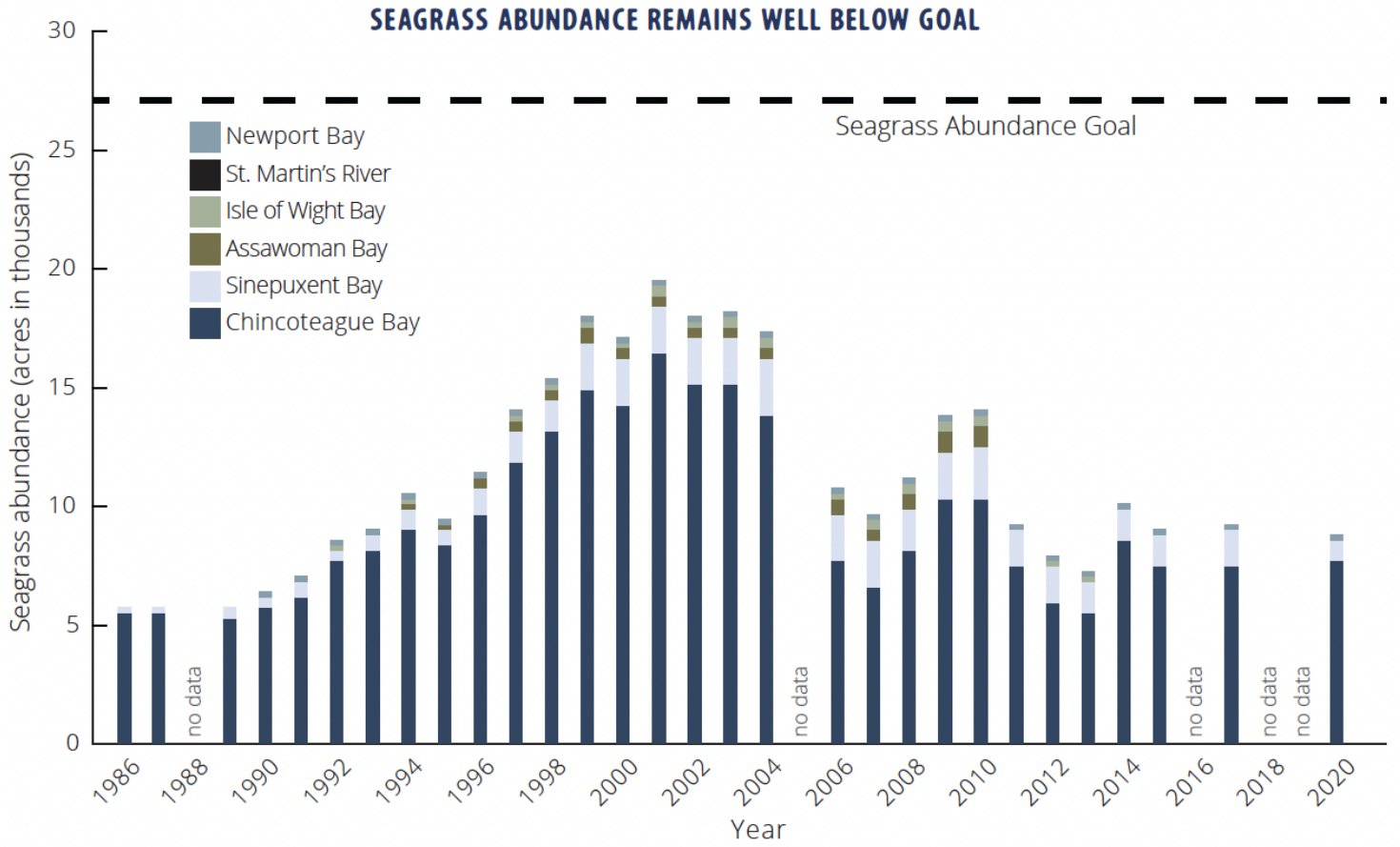
Major threats to Maryland Coastal Bays resilience



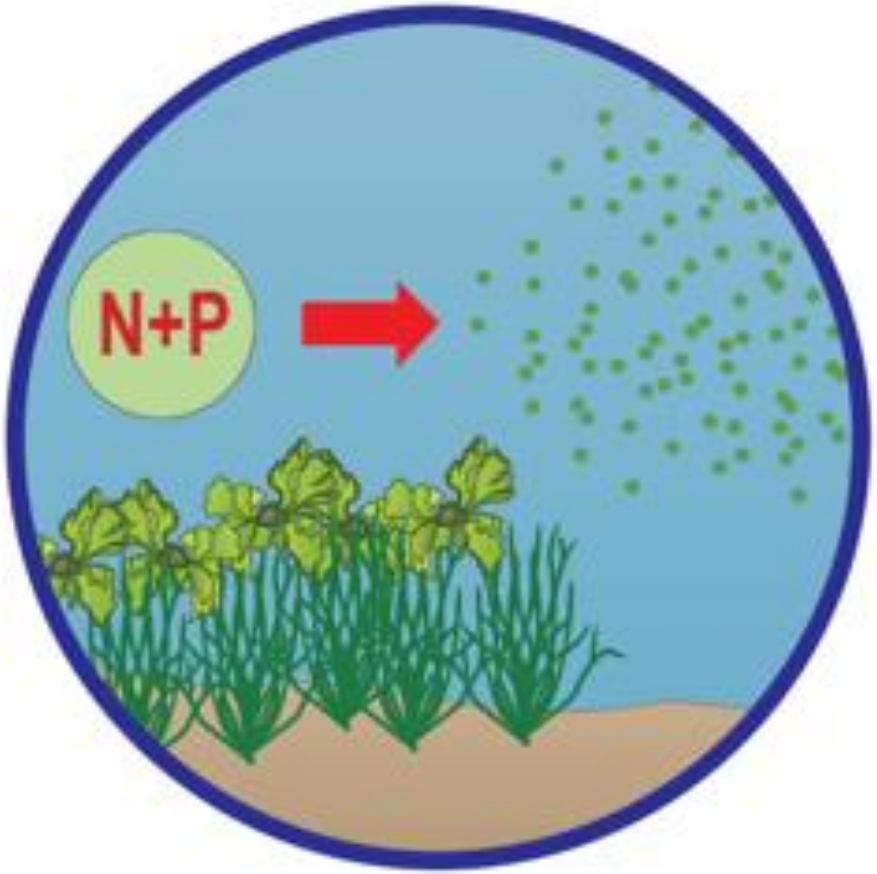
Erosion and relative sea level rise leading to salt marsh and island loss

Heat stress and poor water quality leading to seagrass loss





Increased nutrients leading to algal blooms



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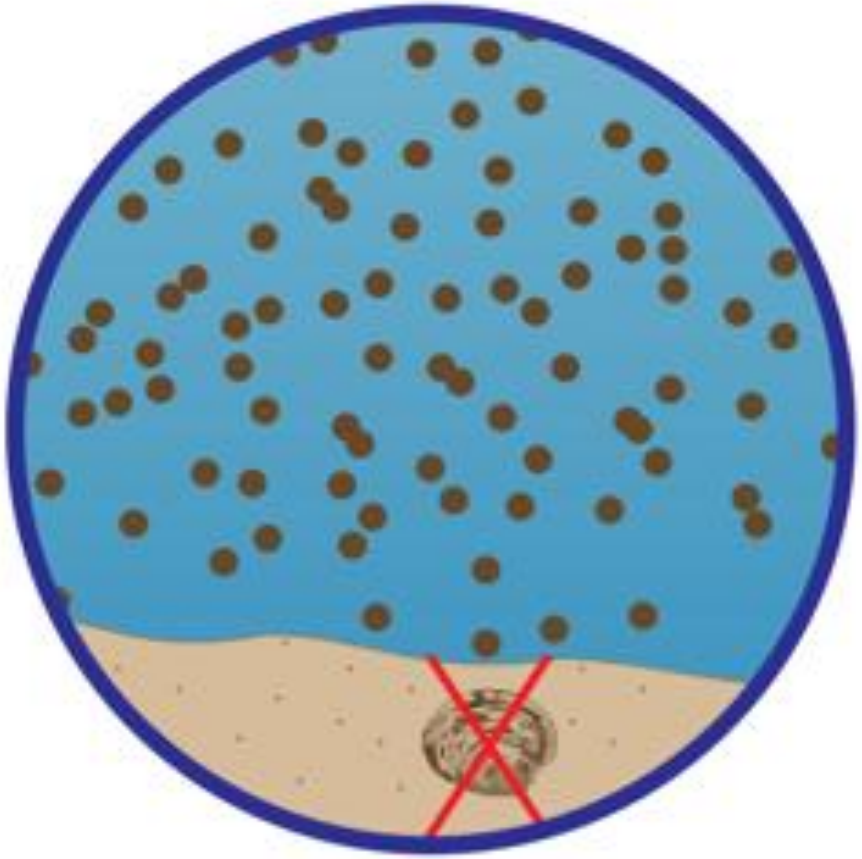
Chronic brown tide blooms degrading water quality



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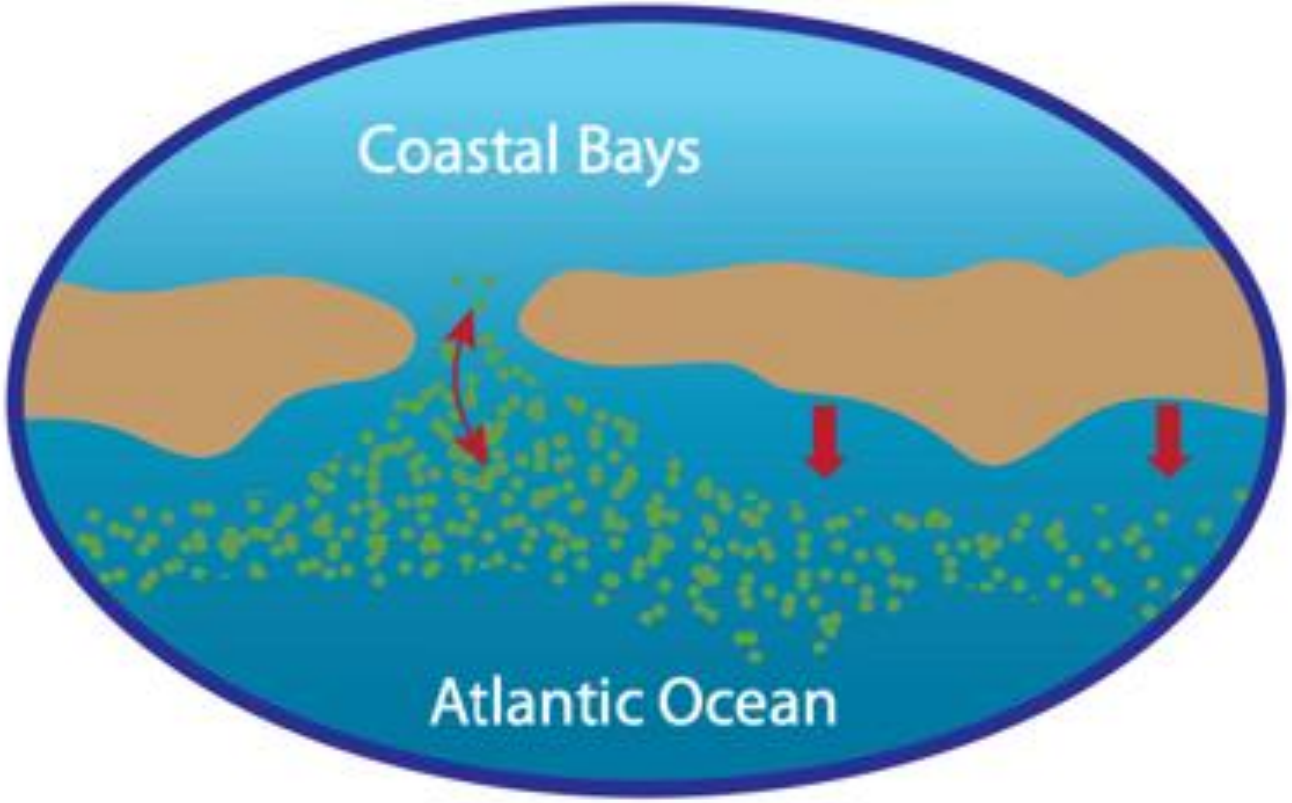
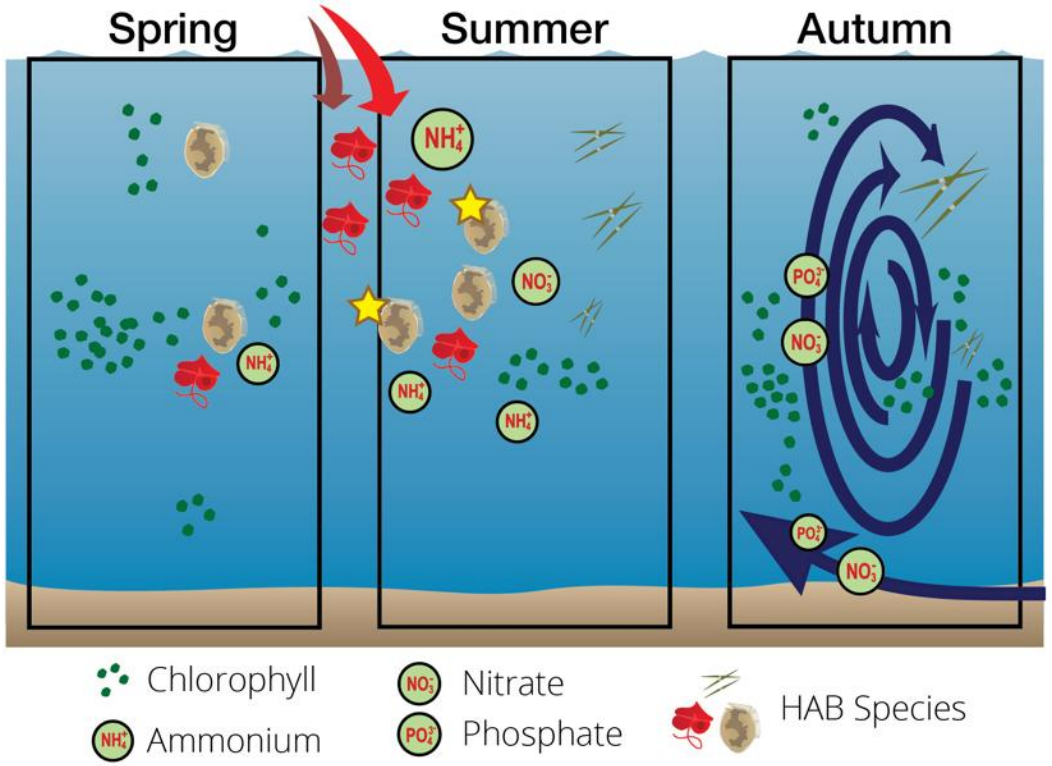
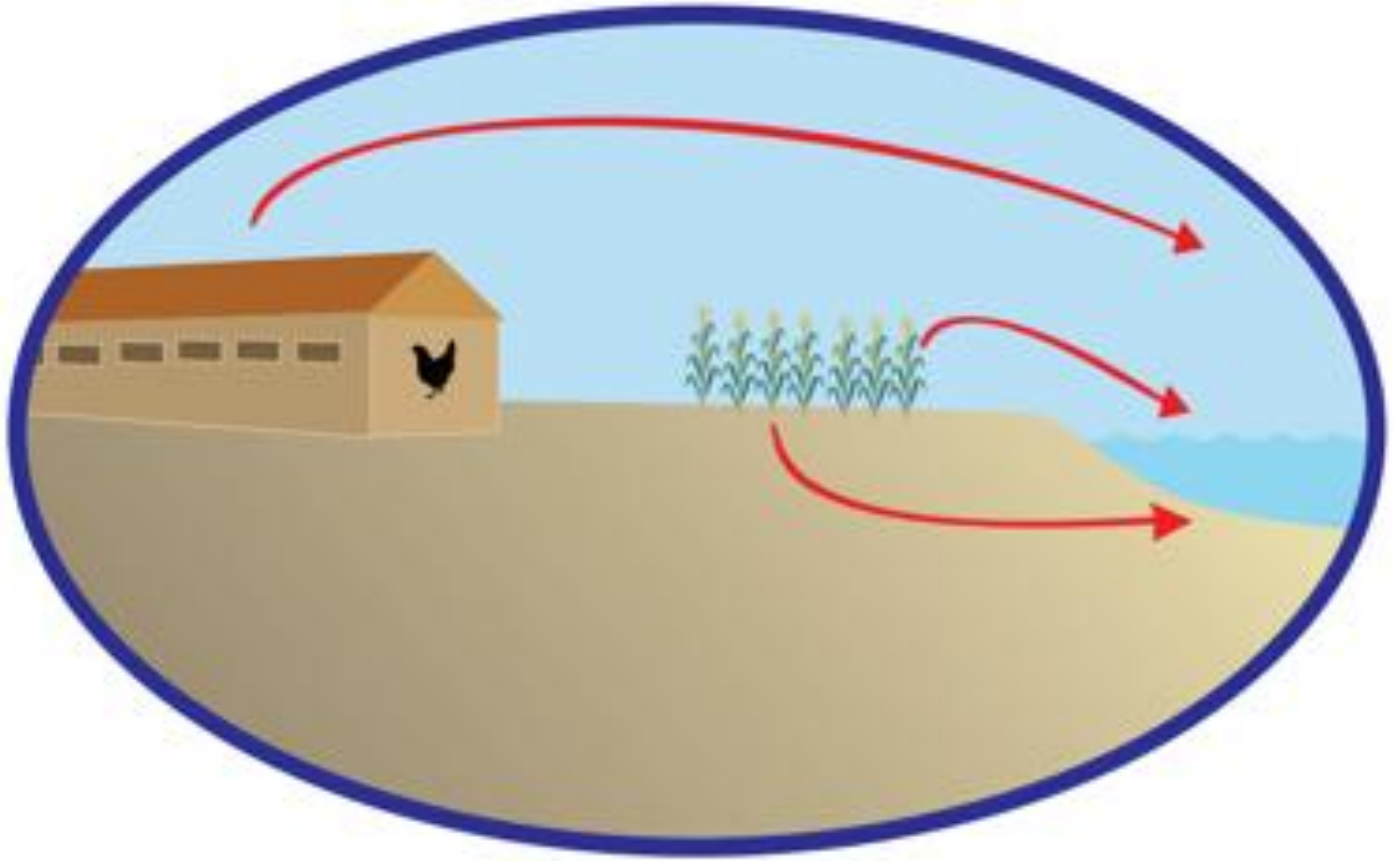
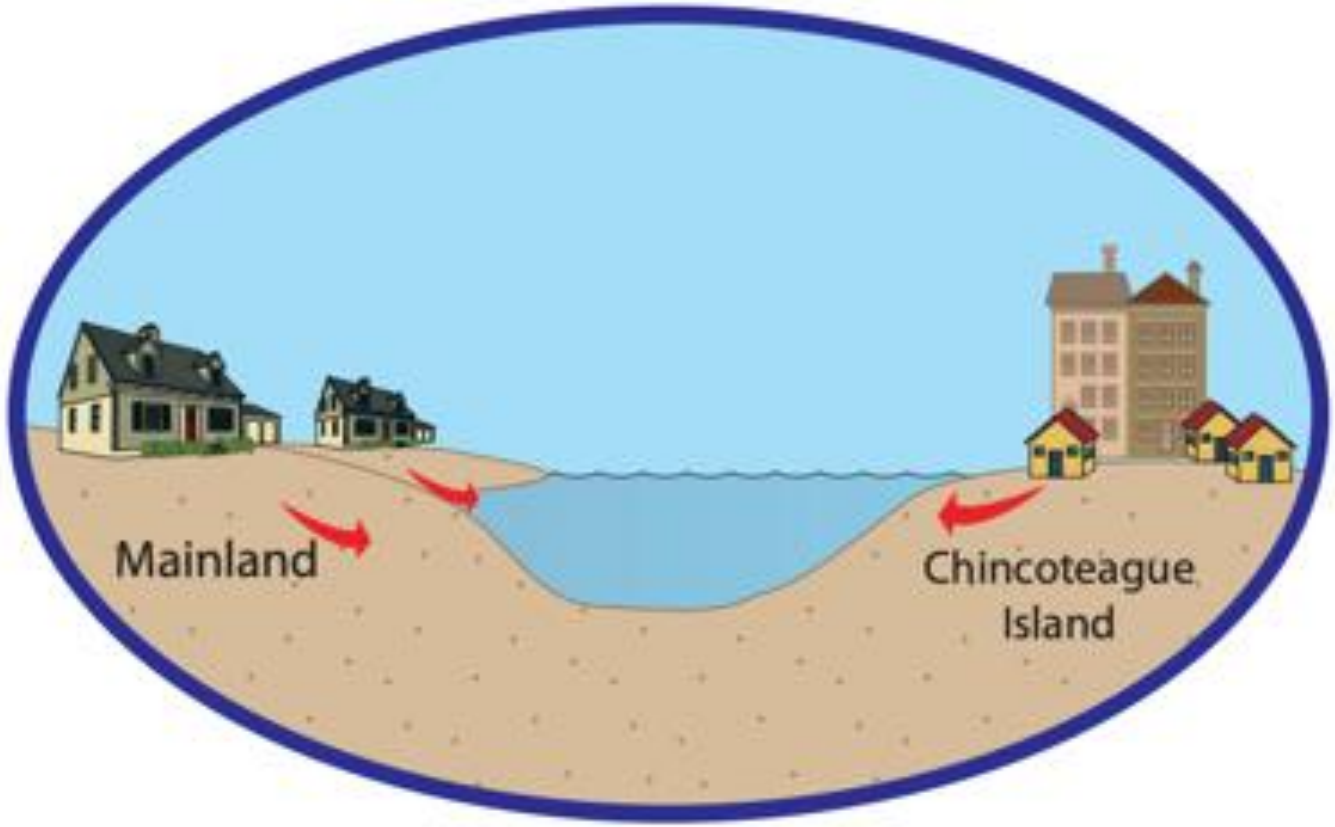




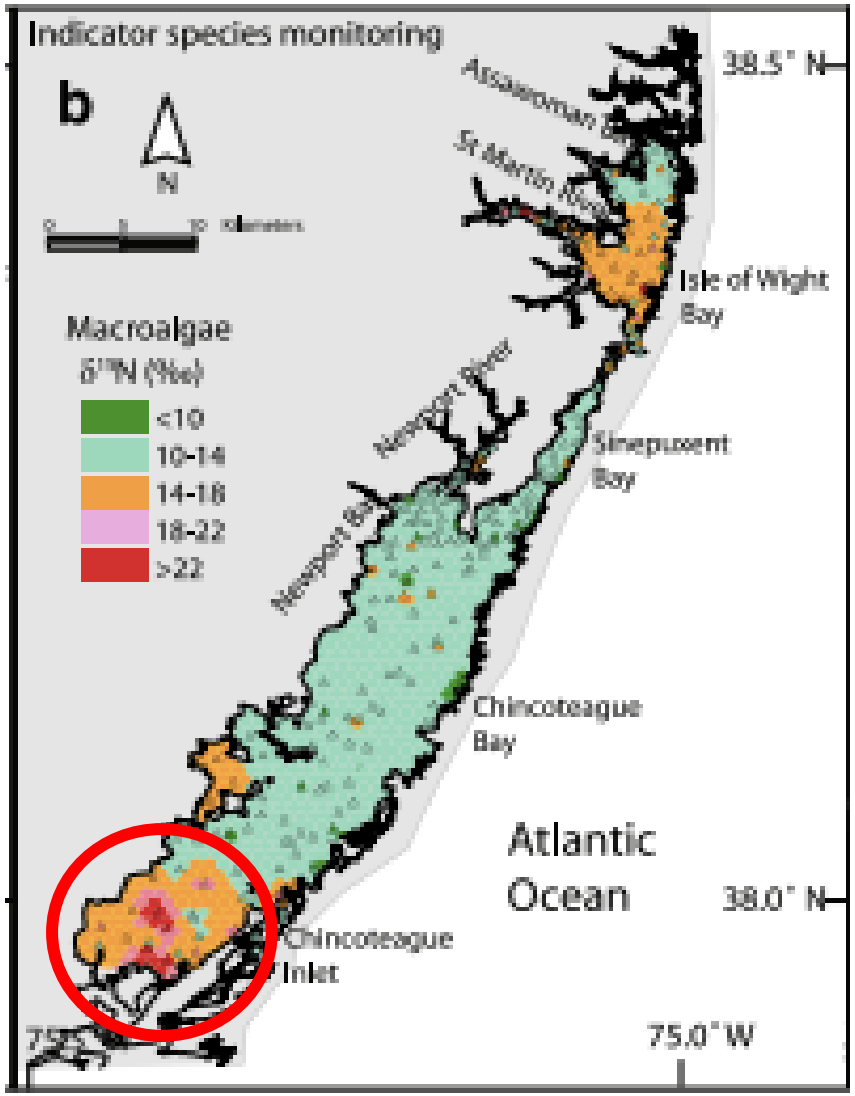
Offshore nutrients from upwelling, Delaware Bay, and sewage discharge can enter the bays via tidal exchange; nutrients from the bay can also flush out to the ocean



Agriculture nutrient inputs via atmospheric, surface runoff, and groundwater pathways

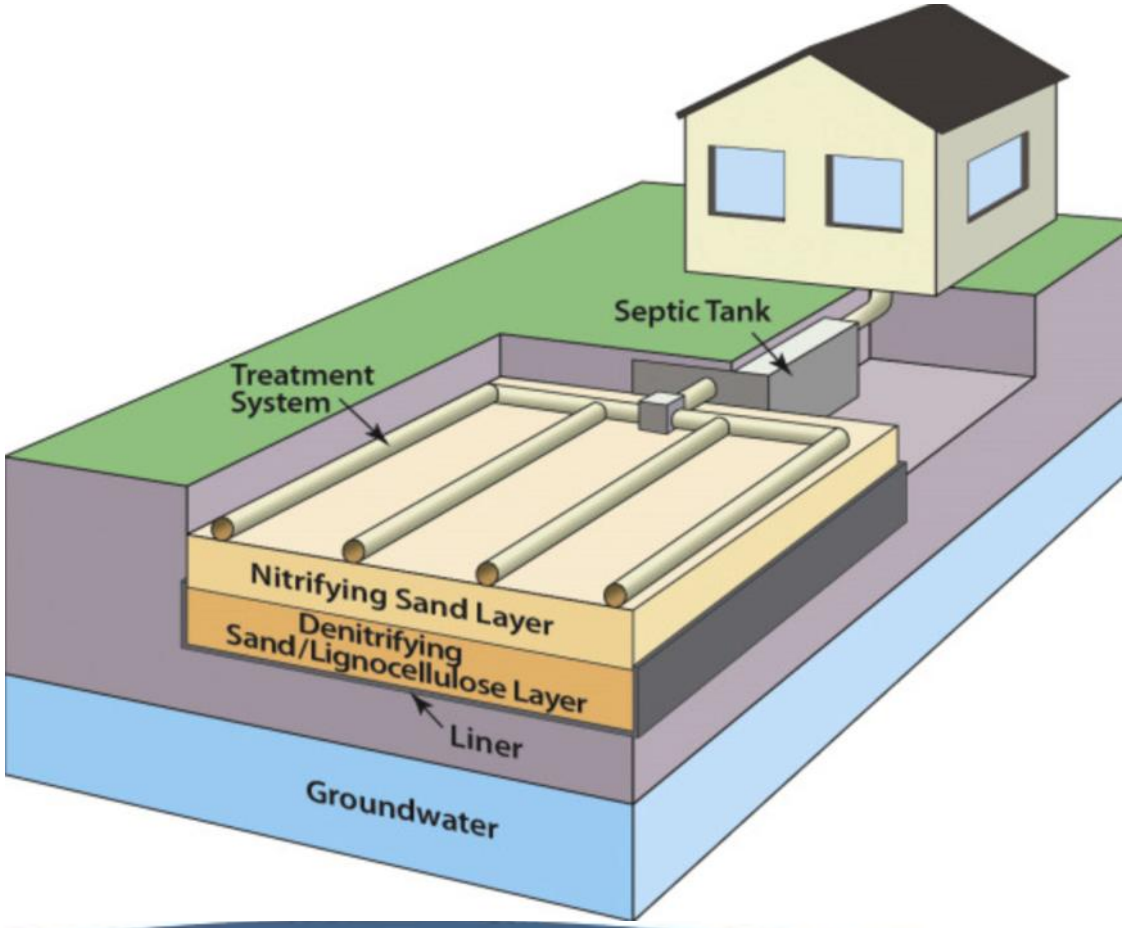


Nutrient inputs from septic systems via groundwater percolation

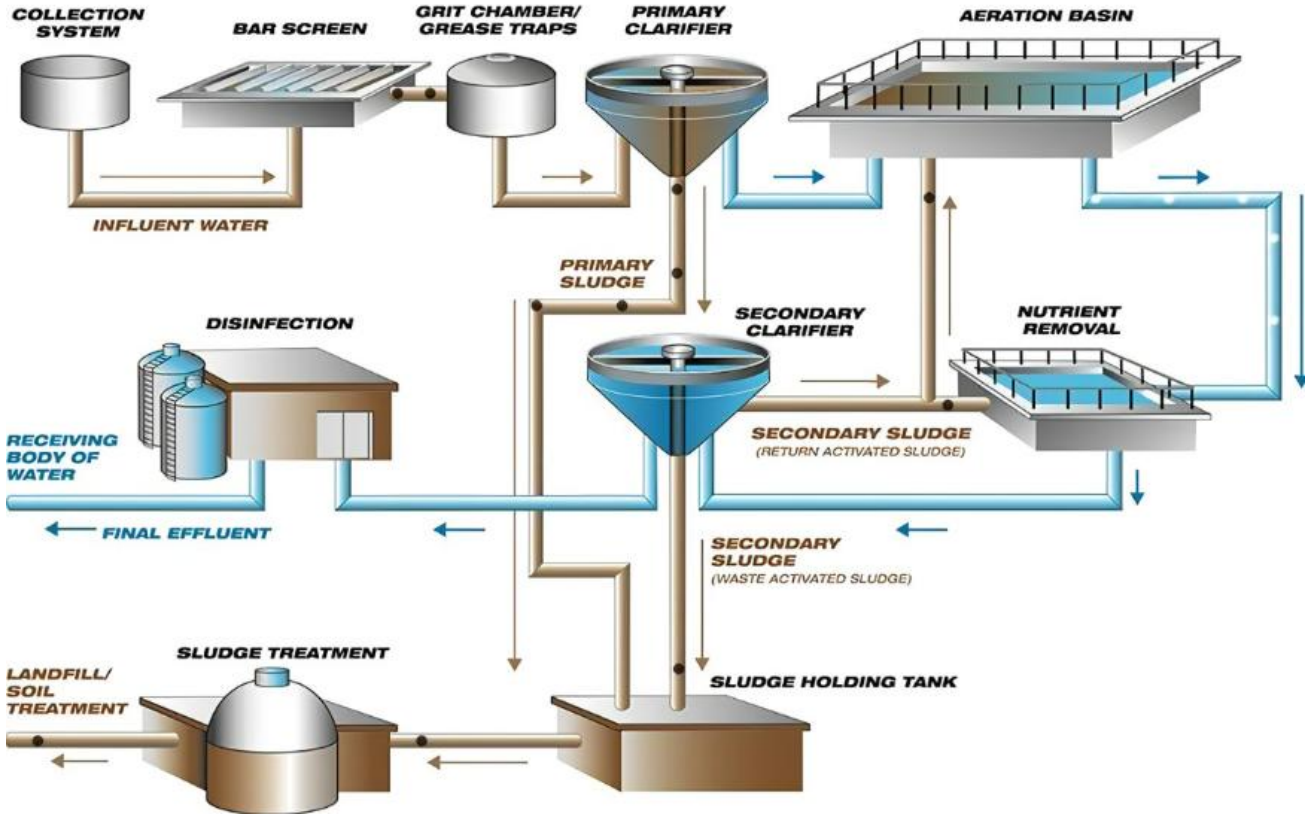


Septic systems (10-20 N mg/L) vs. sewage treatment plants (3 N mg/L)

Best case scenario: Well maintained (regular pump-outs); or denitrifying septic systems



Enhanced Nutrient Removal (ENR): Industry standard for Chesapeake Bay
Ocean City is only Biological Nutrient Removal (BNR)



Developing a climate action plan to build resilience

Climate Change Vulnerability Assessment of the Maryland Coastal Bays Program Comprehensive Conservation & Management Plan October 2018

Goals	Number of Risks		
	Red	Yellow	Green
Decrease nutrient loading throughout the watershed (WQ1)	17	7	2
Decrease inputs of toxic contaminants (WQ2)	2	3	15
Implement a strategy to meet TMDL restrictions (WQ3)	4	0	2
Characterize, monitor, and manage fishery resources and habitats (FW1)	21	9	6
Characterize, monitor, and manage estuarine resources and habitats (FW2)	10	3	1
Characterize, monitor, and manage terrestrial resources and habitats (FW3)	14	1	1
Expand upon the coordinated effort to collect and report on Coastal Bays geomorphic and biometric info (FW4)	1	0	0
Improve recreational opportunities and access to the Coastal Bays and tributaries (RN1)	0	2	2
Balance resource protection with recreational use (RN2)	5	0	2
Continue to implement the Ocean City Water Resources Study recommendations (RN3)	3	2	1
Manage sediment alterations in a manner beneficial to the local economy and natural resources (RN4)	2	0	1
Manage the watershed to maximize economic benefits while minimizing negative resource impacts (CE1)	5	7	3
Enhance the level of sustainability in land-use decision making (CE2)	1	3	8
Educate and inform the population so it can make knowledgeable decisions for the community and its future (CE3)	0	1	0
Total: 168 Risks	86	38	44

Emerging problem: Plastics

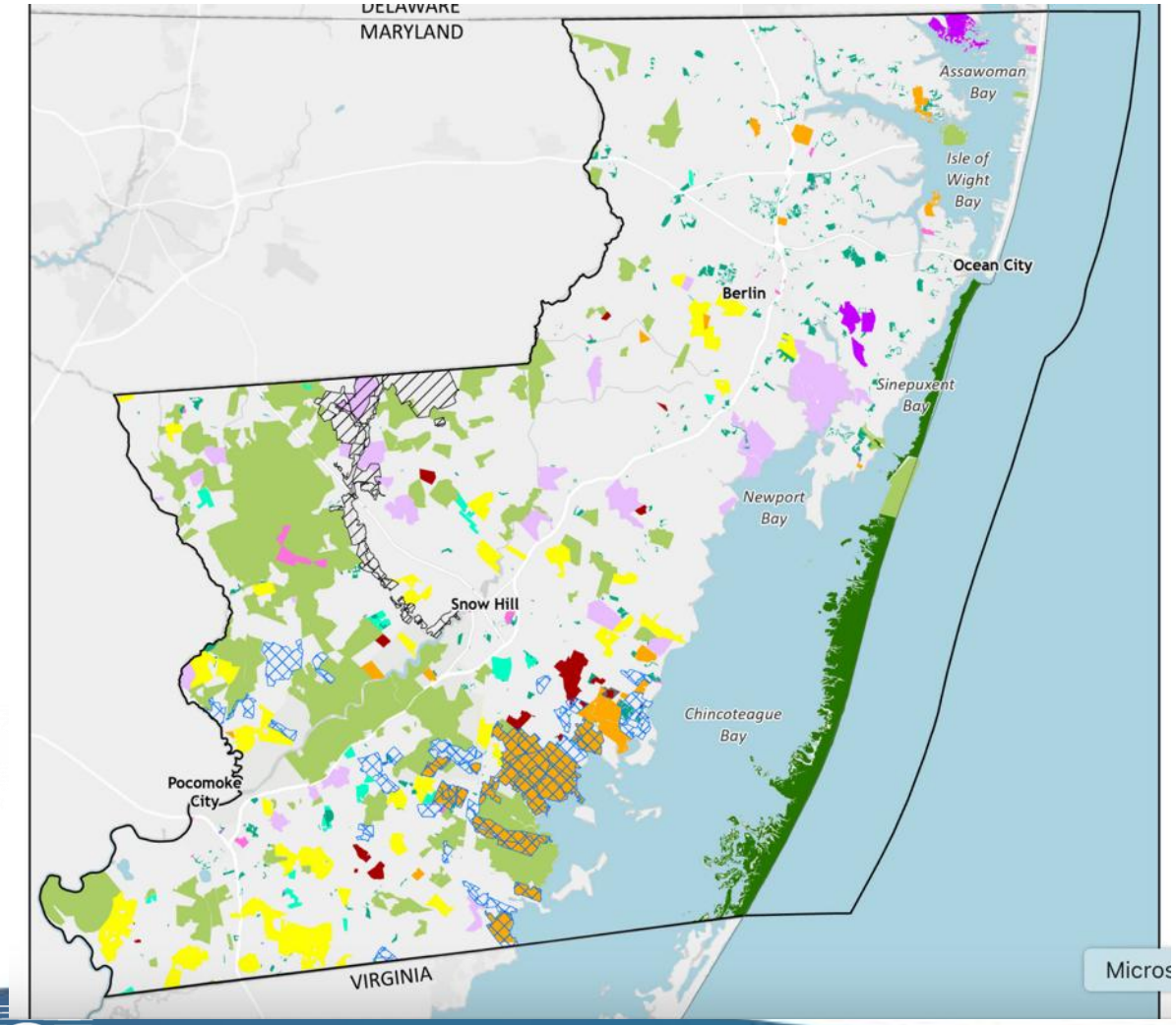
Emerging problem:

- PFAS: Per- and Polyfluoroalkyl substances (PFAS)
- New species of toxin producing Harmful Algal Blooms (HABs)
- Eroding marshes- runnels helping, but shorter term solution…
- Temperature squeeze of seagrasses

Some improvements spots:

- Fish survey: large diversity richness of fish in seagrasses including tautog
- Macroalgae decreasing
- Continued increased clam abundance in northern Coastal Bays since hydraulic dredge ban in 2008
- Scallops at 21 sites for first time! (previously year, only 3!)

Land protection is a key in providing resilience



Legend

- State Lines
- Worcester County
- Water Bodies
- Rural Legacy Properties
- Private Conservation Lands
- MD Environmental Trust Easements
- Forest Conservation Act Easements
- MD Agricultural Land Preservation Foundation Easements
- Local Protected Lands
- Coastal and Estuarine Land Conservation Program
- Protected Federal Lands
- Transfer Development Rights
- Purchase Development Rights

DNR Owned Lands and Conservation Easements

- DNR Owned Properties
- DNR Owned Properties - Submerged
- Conservation Reserve Enhancement Program
- Forest Legacy
- Other

We need to ensure that we do NOT exceed the 'Tipping Point'