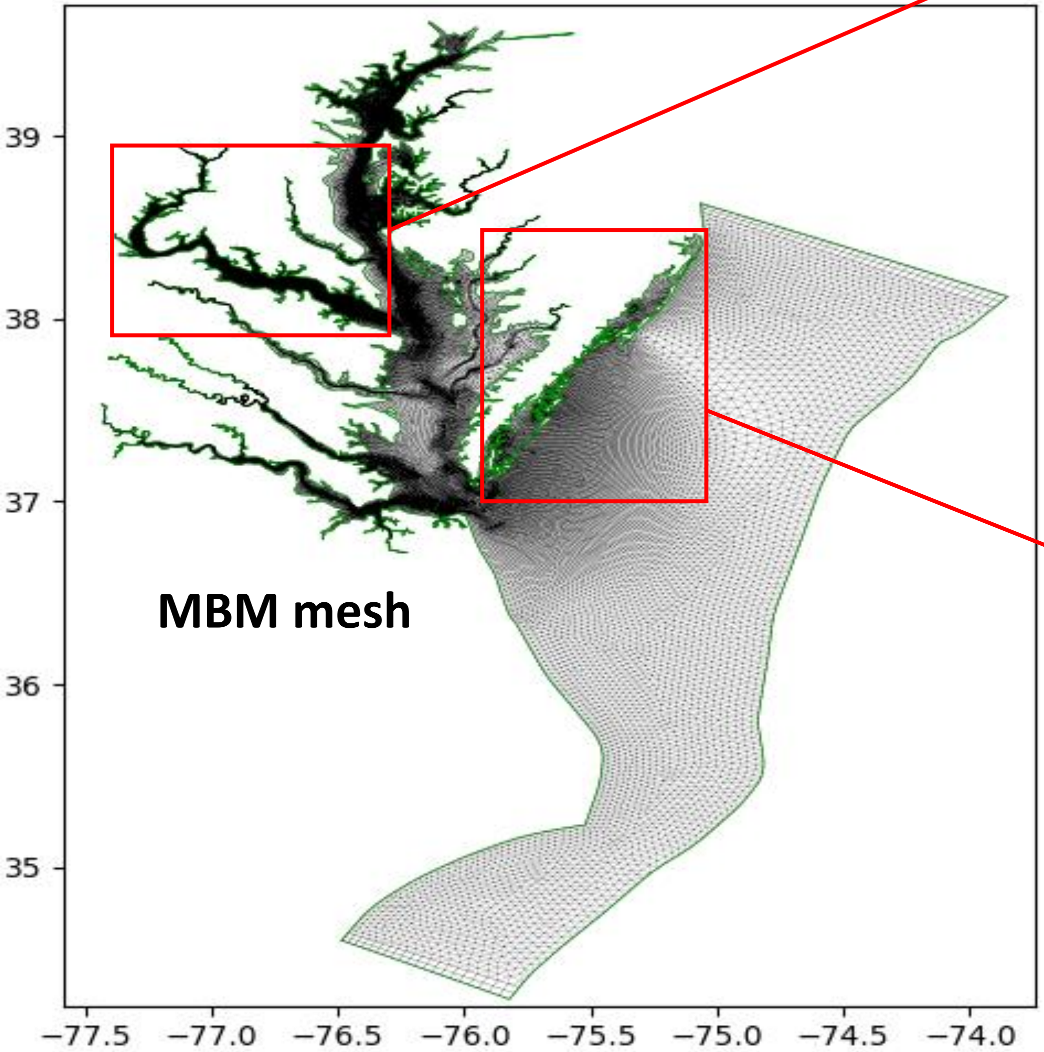
CBP Estuary Model

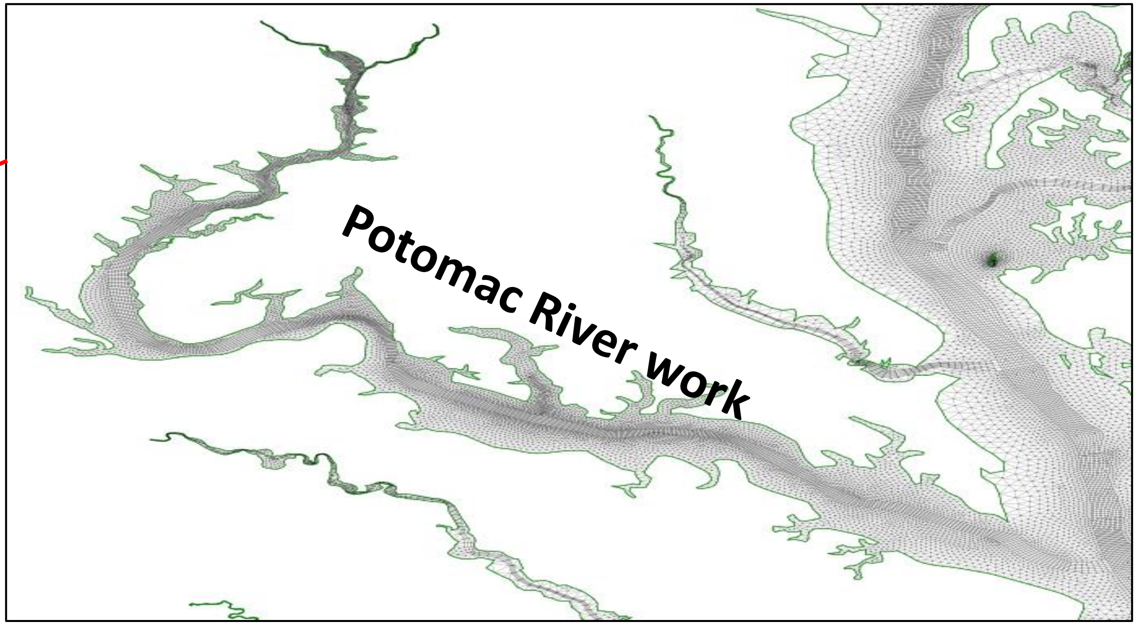
Chesapeake Bay Program

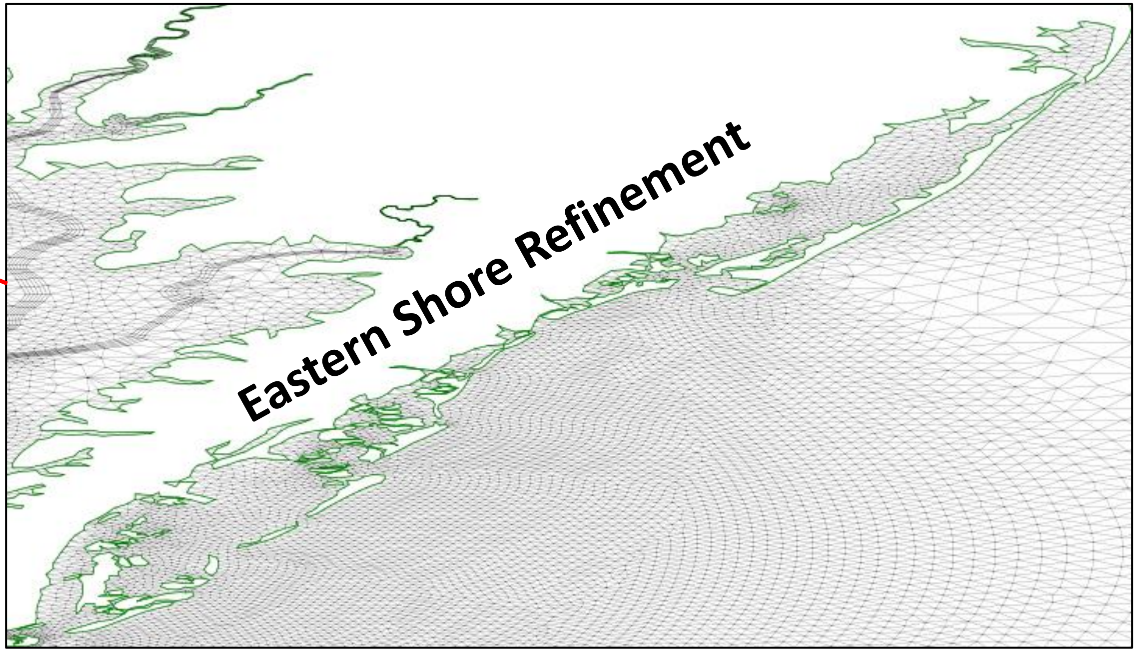
40 years of science, restoration and partnership

Mesh improvement

- We further refined the MBM mesh in Potomac River and eastern shore based on VIMS shoreline
- Also corrected errors made in a few islands and added some minor access channels (e.g. Baltimore)

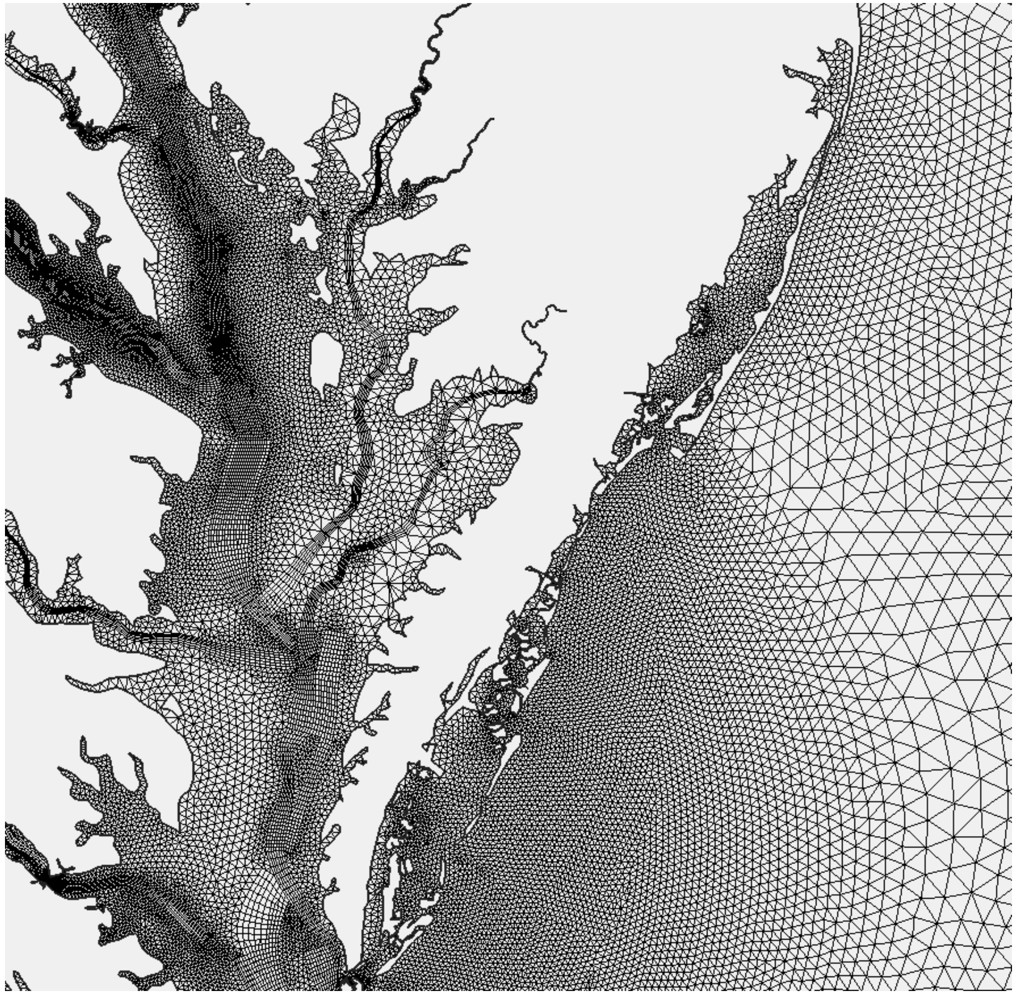


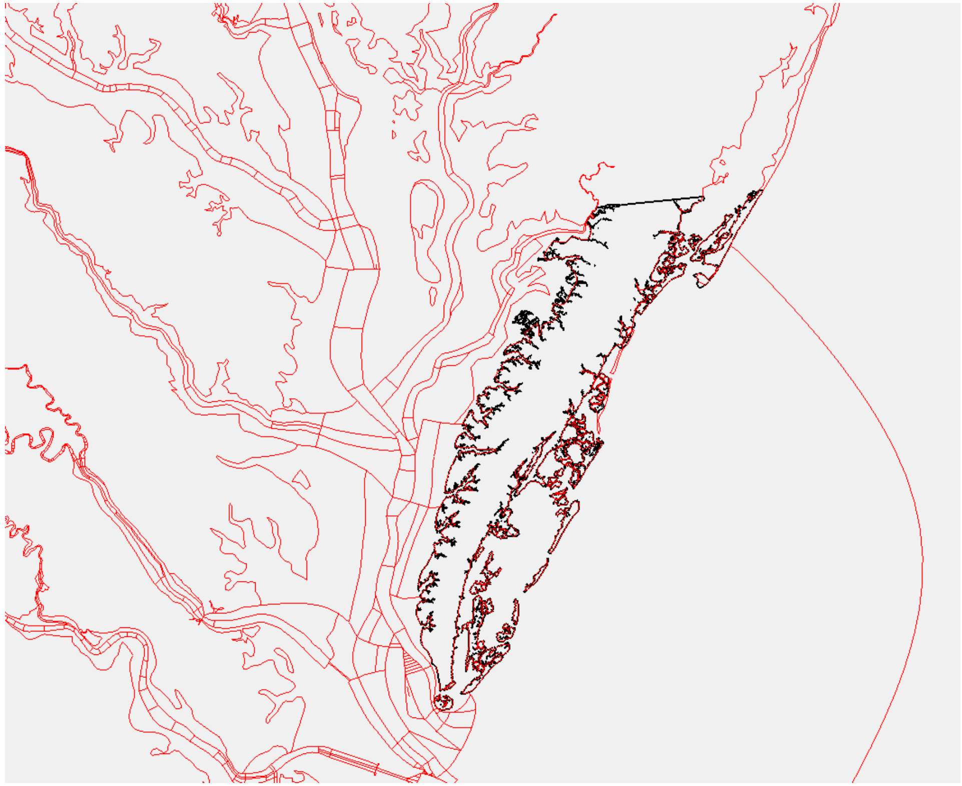


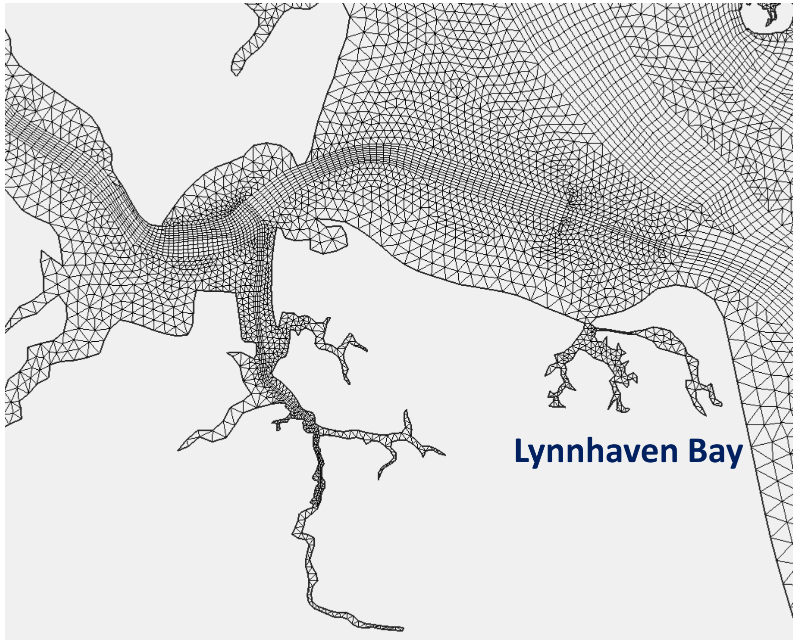


Mesh improvement: eastern shore & Lynnhaven

- Used a preliminary version of new shoreline from Karinna for the Bay including eastern shore
- Simplified the shoreline to keep the mesh size modest

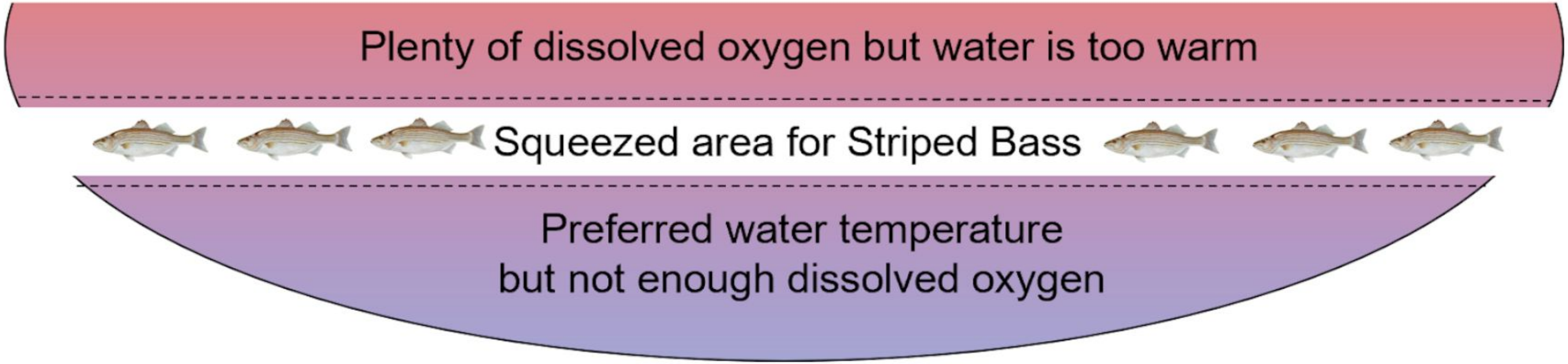






Striped Bass Squeeze

In warmer summer months, elevated surface water temperatures and increasing amounts of oxygen poor bottom waters force striped bass into a very narrow band of cooler water with adequate oxygen.



Revised Striped Bass Categories and Thresholds for Dissolved Oxygen (DO) & Water Temperature (WT)

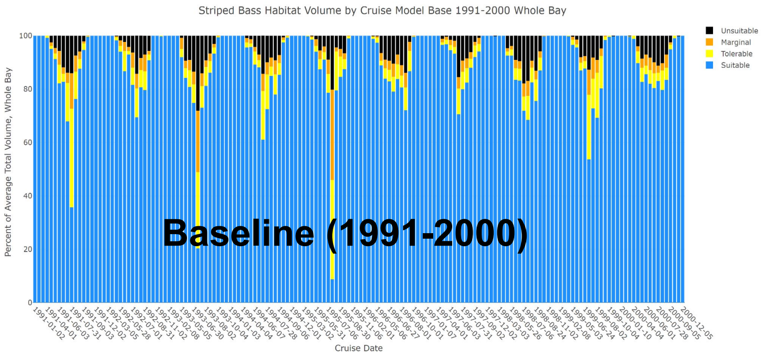
Suitable - Supports "normal" occupancy and growth potential
DO ≥4 mg/l, WT ≤82.4°F (28°C)

Tolerable - Supports occupancy for a modest period of time with limited growth potential (~1 month)
DO <4 mg/l & ≥3 mg/l, WT >82.4°F(28°C) & ≤84.2°F (29°C)

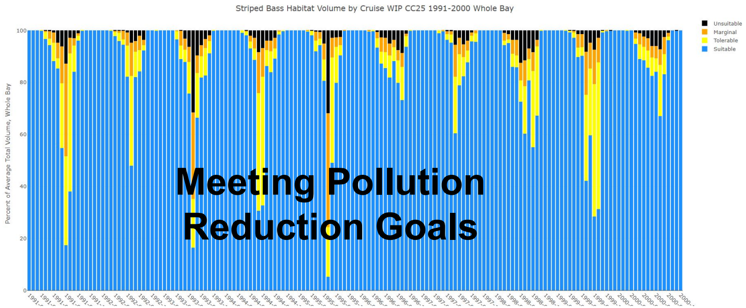
Marginal - Supports occupancy for a short period with little or no growth potential (Just passing through)
DO <3 mg/l & ≥2 mg/l, WT >84.2°F (29°C) & ≤86°F (30°C)

Unsuitable - Not suitable conditions experiencing either hypoxia or excess water temperature
DO <2 mg/l, WT >86°F (30°C)

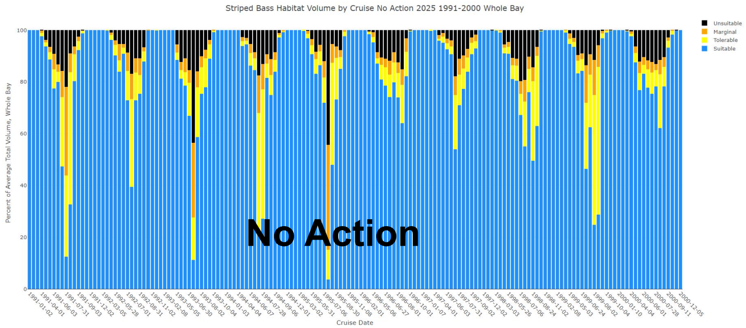
Habitat - Baywide



Where we were

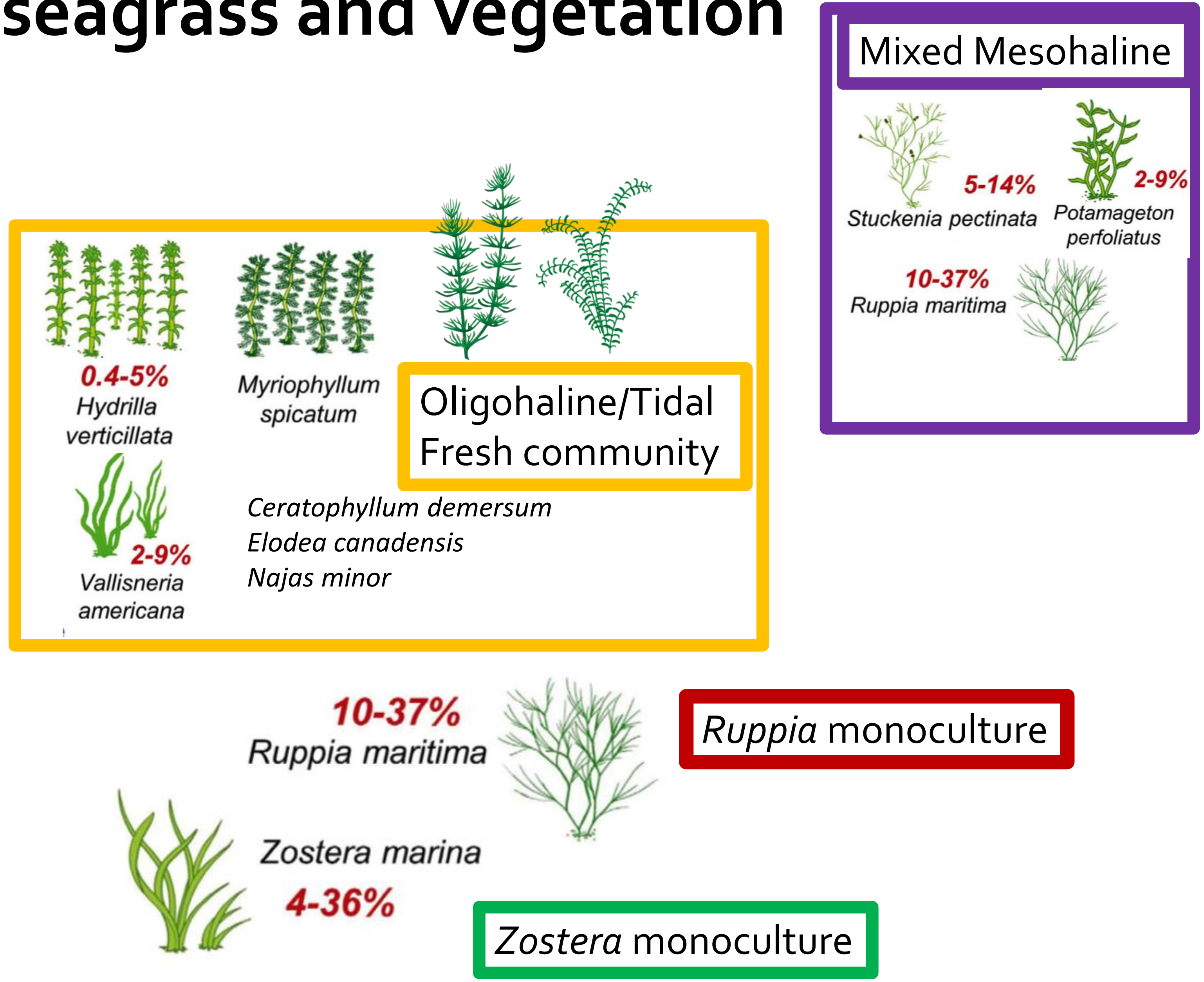


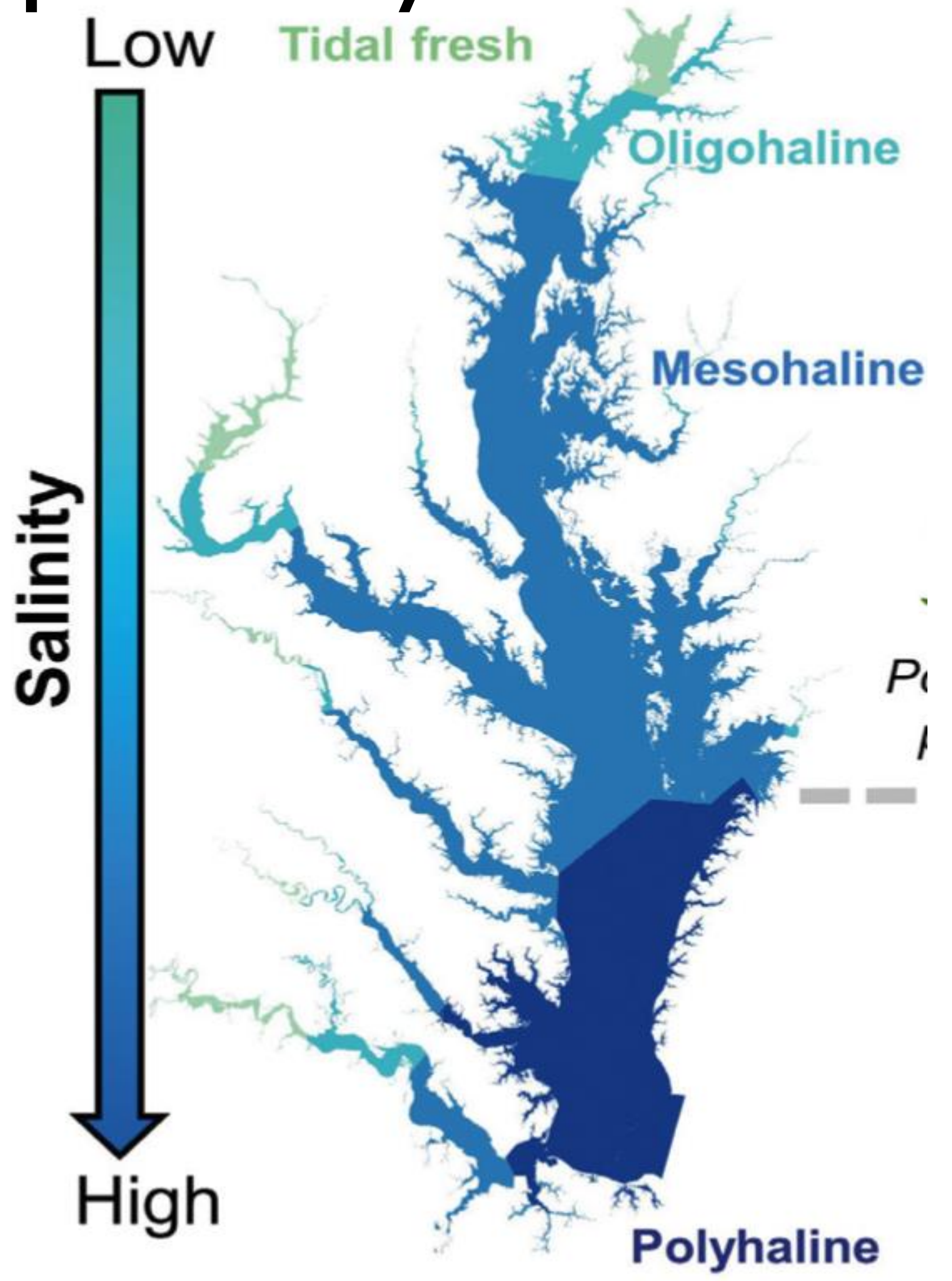
Where we want to be (2025)

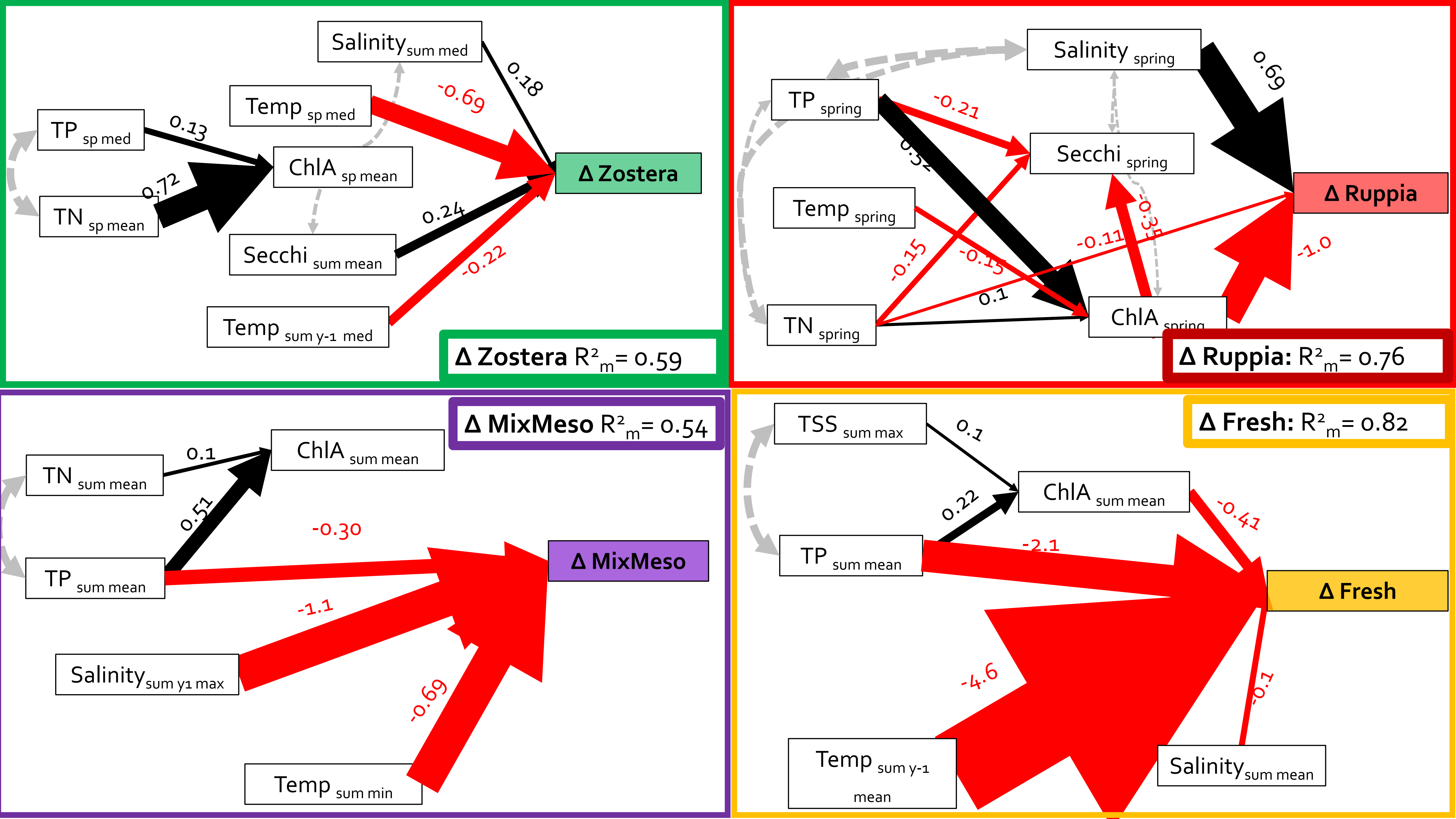


Where we would be in 2025 if we did nothing and there was no Bay Program partnership

Step 1: ID major communities of Chesapeake Bay seagrass and vegetation

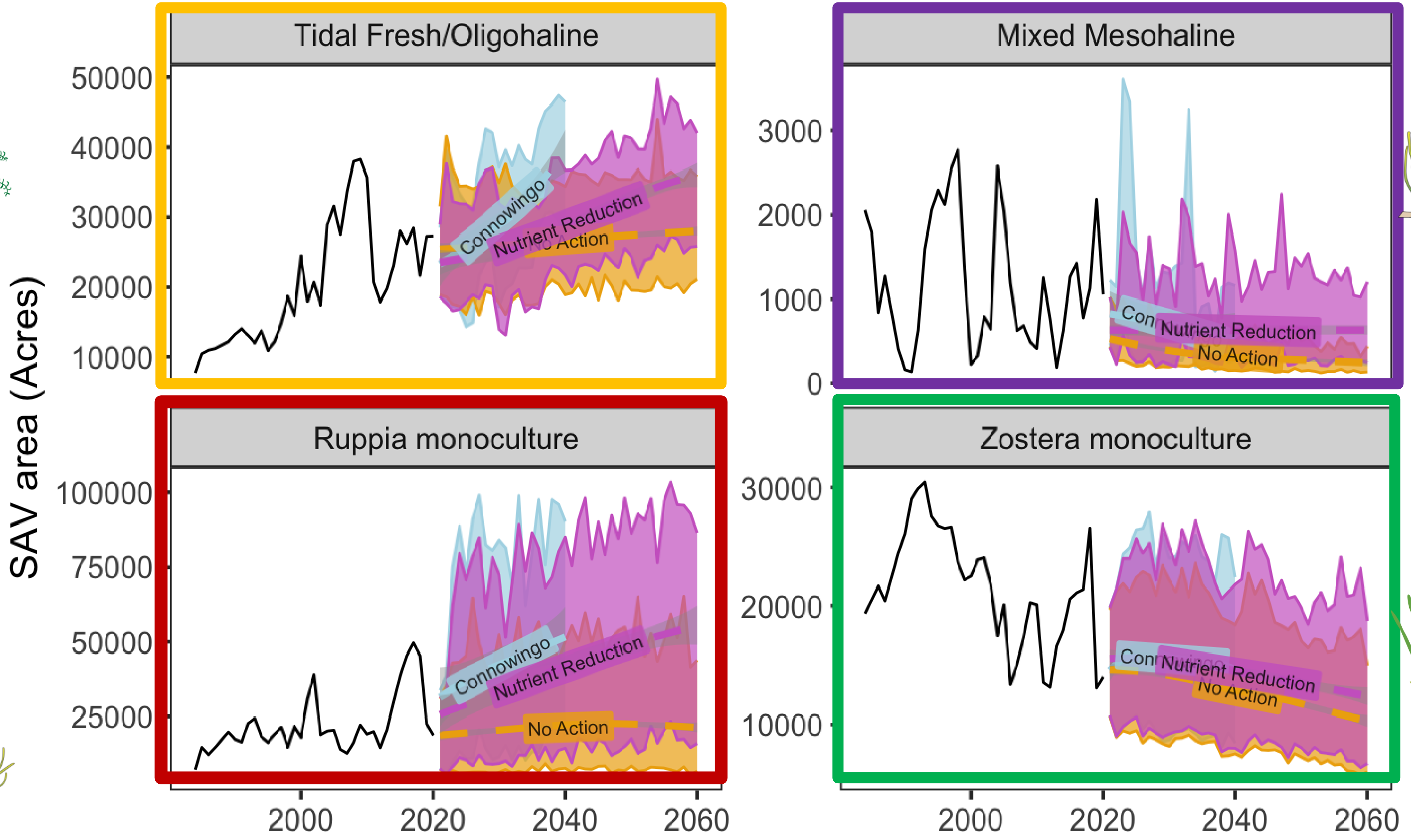


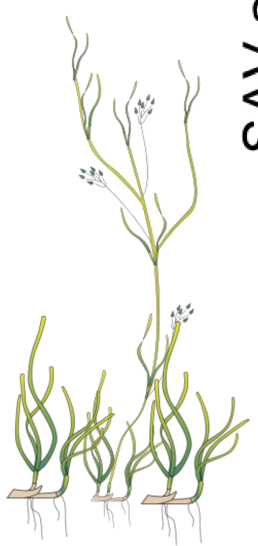




Salinity sum med
Temp sp med
TP sp med
ChlA sp mean
TN sp mean
Secchi sum mean
Temp sum y-1 med
Δ Zostera
0.18
-0.69
0.13
0.72
0.24
-0.22
Δ Zostera R²m= 0.59
Salinity spring
TP spring
Secchi spring
Temp spring
TN spring
ChlA spring
Δ Ruppia
0.69
-0.21
-0.11
-1.0
-0.15
-0.15
0.1
Δ Ruppia: R²m= 0.76
Δ MixMeso R²m= 0.54
TN sum mean
ChlA sum mean
TP sum mean
Salinity sum y1 max
Temp sum min
Δ MixMeso
0.1
0.51
-0.30
-1.1
-0.69
Δ Fresh: R²m= 0.82
TSS sum max
ChlA sum mean
TP sum mean
Temp sum y-1 mean
Salinity sum mean
Δ Fresh
0.1
0.22
-0.41
-2.1
-4.6
-0.1

Step 3: SAV Community Climate change predictions|
New dominants respond most positively to ALL REDUCTIONS



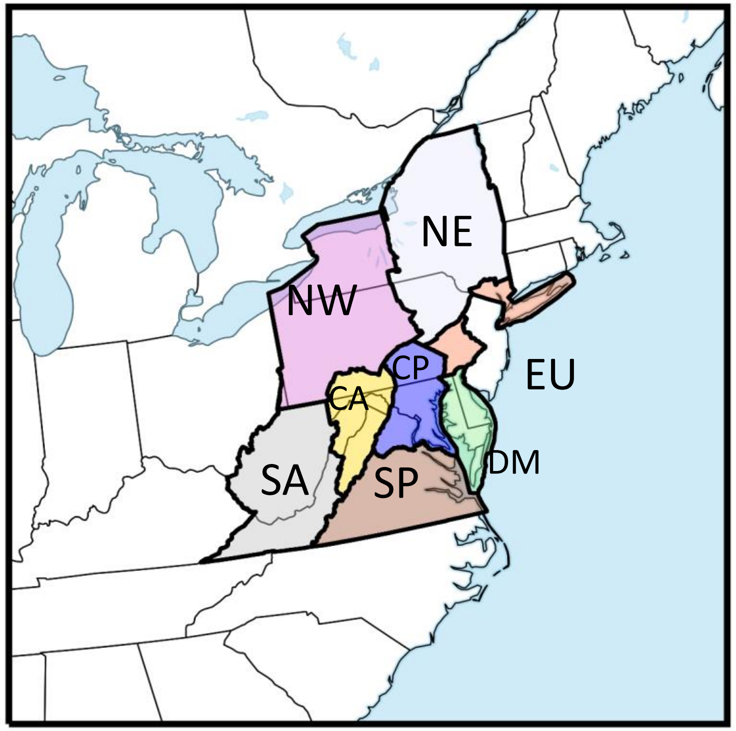


CBP Airshed Model

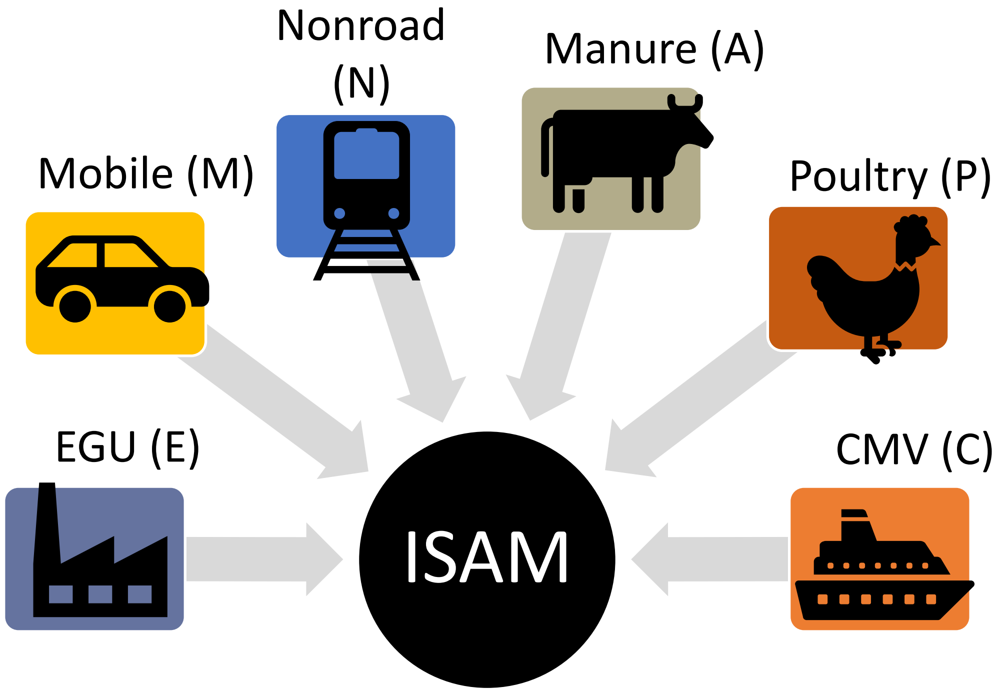
Chesapeake Bay Program
40 years of science, restoration and partnership

CMAQ Integrated Source Apportionment Method (ISAM)

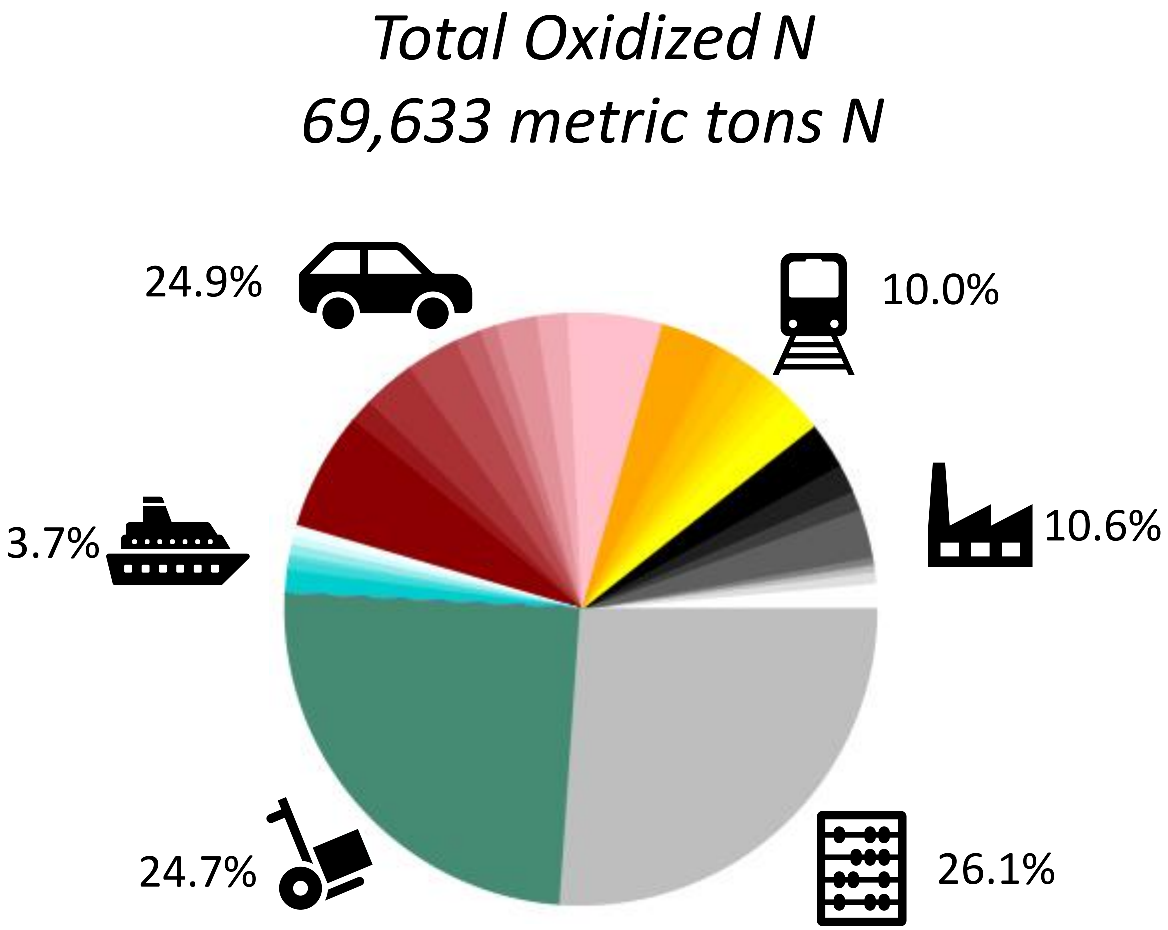
Geographic emission source regions



Emission source categories



CMAQ Integrated Source Apportionment Method



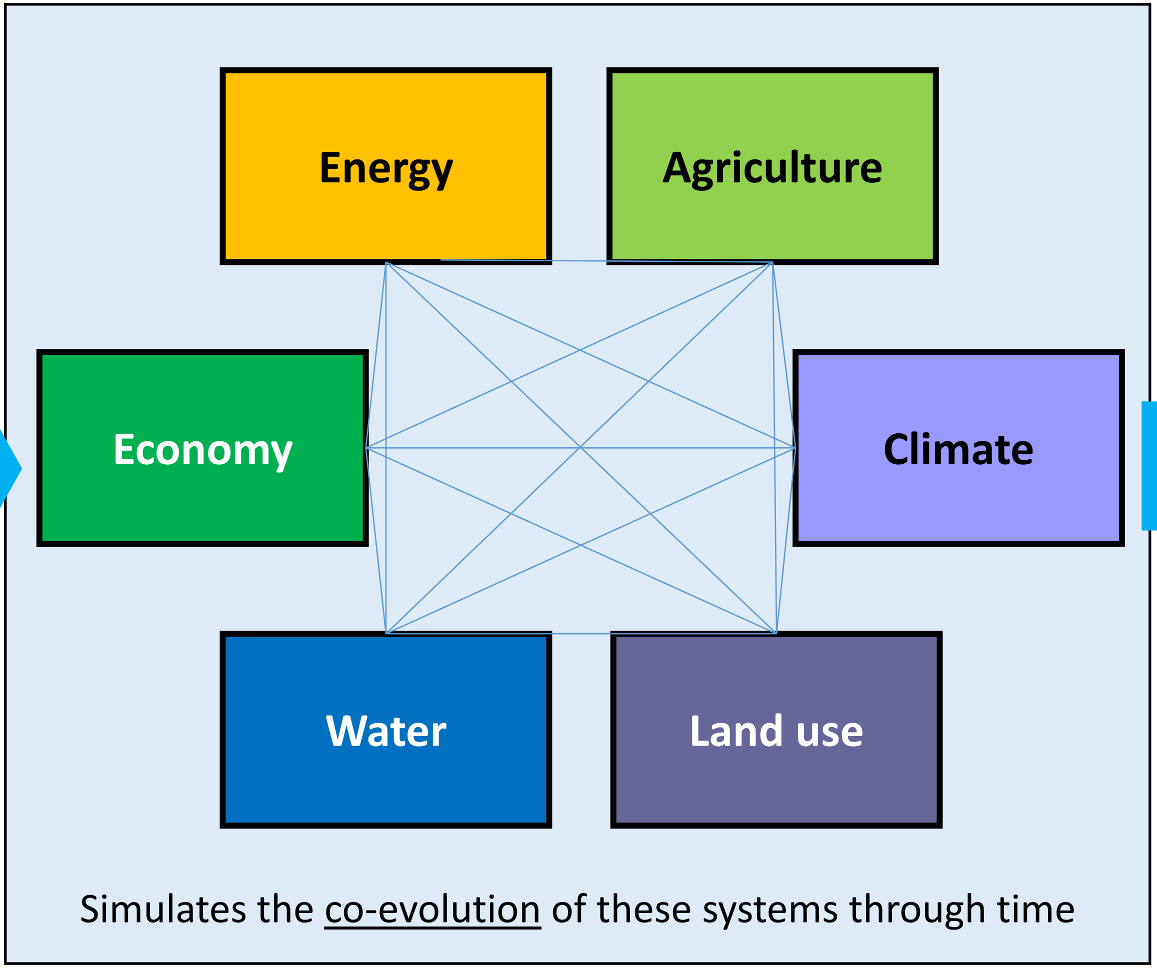
- Oxidized N deposition is largely unchanged
- Mobile on-road is the dominates deposition source of the tracked emissions
- The existing airshed appears to still capture the emission region for 75% of the deposition for oxidized N

Global Change Analysis Model

Scenario assumptions

- Population growth
- Economic growth
- Resource availability
- Climate change
- Technology development
- Behavior and preferences
- Policies

GCAM



End points

Energy
- Technology penetrations
- Fuel use and prices

Economic
- Policy cost
- Cost of energy services
- Land and food prices

Climate
- GHG emissions
- Global mean temperature

Environmental
- Air pollutant emissions
- Water use
- Health impacts

GCAM documentation: http://jgcri.github.io/gcam-doc/

EPA United States Environmental Protection Agency

Global Change Analysis Model

Scenario assumptions

- Population growth
- Economic growth
- Resource availability
- Climate change
- Technology development
- Behavior and preferences
- Policies

GCAM

Lead developer: Pacific Northwest National Lab

Time Horizon: 2010–2100, 5-yr increments

Spatial Resolution:

- **GCAM (core):** 32 global regions
- **GCAM-USA:** 31 global regions, 50 states + DC
- **GCAM-China:** 31 global regions, 23 provinces
- **GCAM-Canada, GCAM-Korea, GCAM-India** …

GHGs: CO_2, CH_4, N_2O, HFCs

Air pollutants: NOx, SO_2, $PM_{2.5}$, VOCs, CO, NH_3

Runtime: 1 to 5 hours for EPA's GCAM-USA v5.4

Requirements: Desktop PC, Mac, Linux, or Cloud

Availability: Public domain, open source, free

End points

Energy
- Technology penetrations
- Fuel use and prices

Economic
- Policy cost
- Cost of energy services
- Land and food prices

Climate
- GHG emissions
- Global mean temperature

Environmental
- Air pollutant emissions
- Water use
- Health impacts

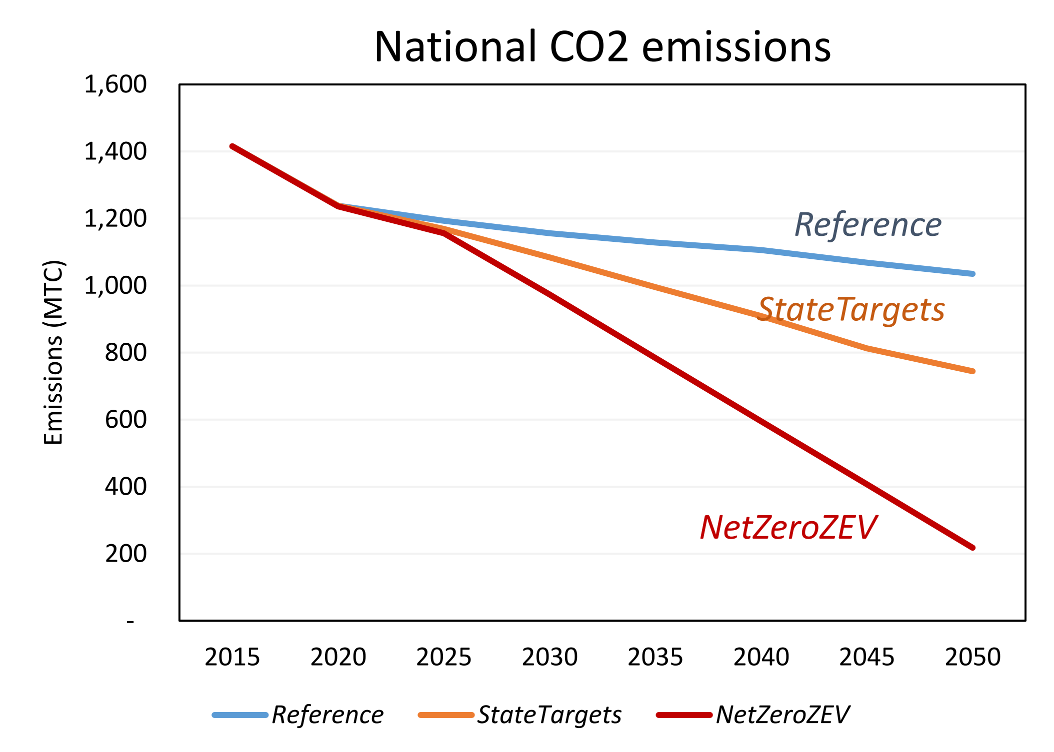
GCAM documentation: http://jgcri.github.io/gcam-doc/

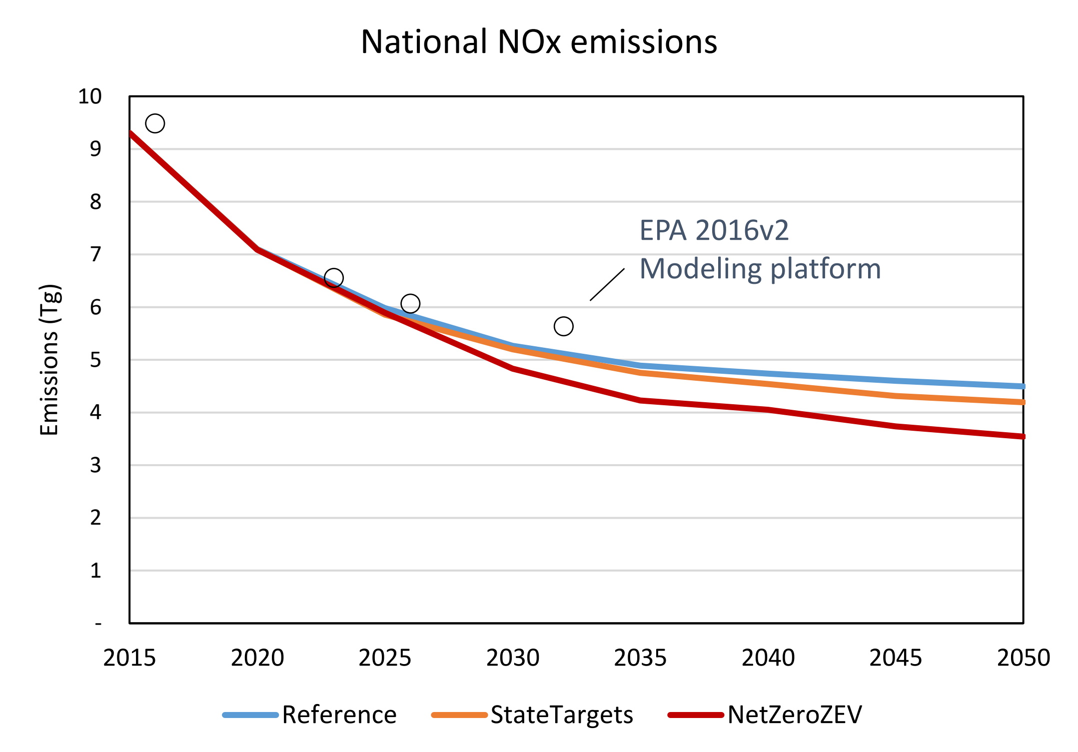
United States Environmental Protection Agency

Scenario Design

- ***Reference***: A baseline scenario that includes:
  - limited GHG mitigation and no additional air pollutant control requirements
- ***StateTargets:*** A mitigation scenario that includes:
  - State GHG reduction goals, implemented as regional CO_2 targets
  - New CA light-duty electrification targets adopted by Section 177 states
  - Medium- and Heavy-Duty Electrification MOU adopted by signatory states
- ***NetZeroZEV***: A mitigation scenario that includes:
  - A national, economy-wide declining CO_2 cap reaches Net-Zero by 2050
  - Transportation electrification targets in *StateTargets* adopted nationally

National CO2 and NOx projections from GCAM



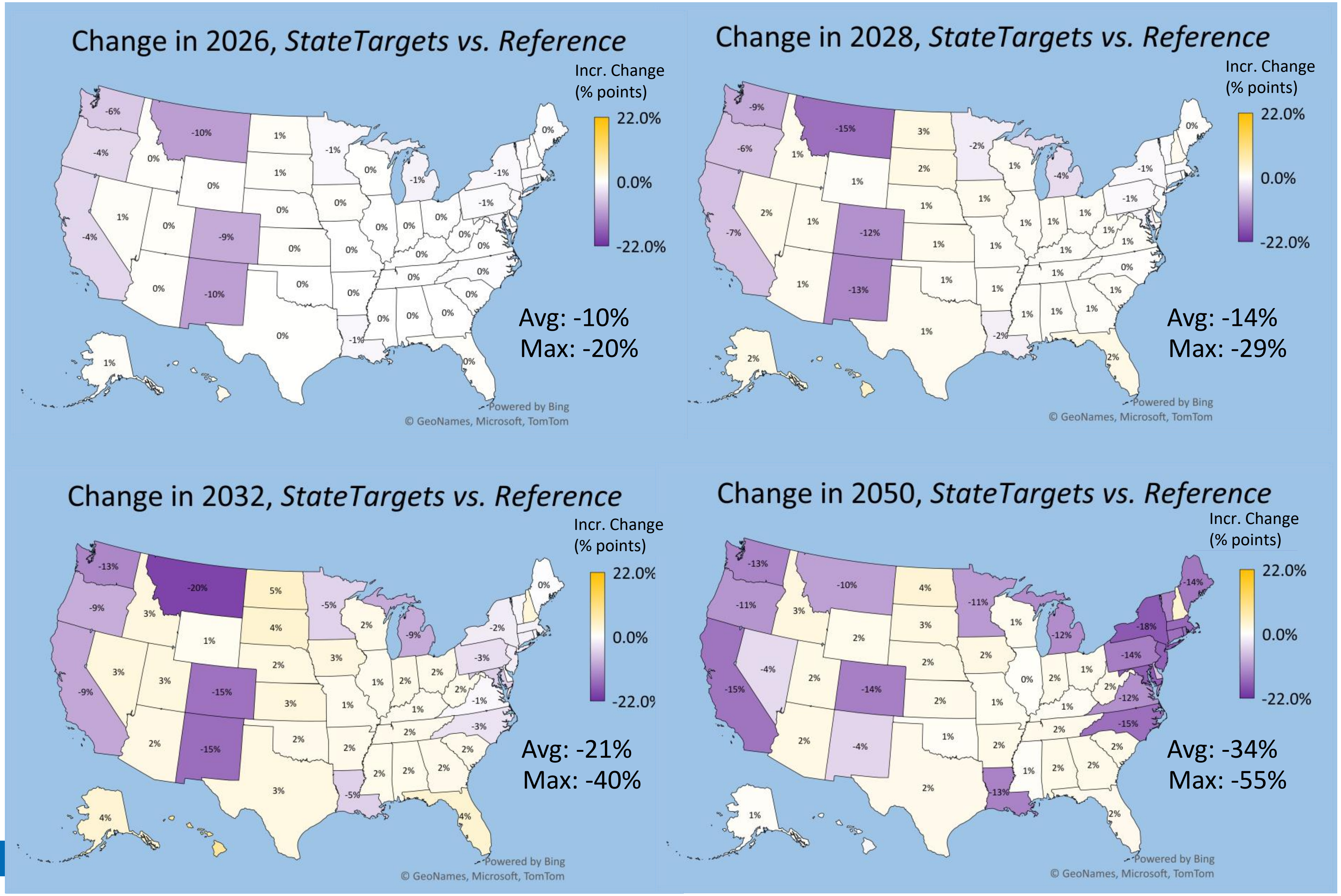


	2023	2026	2028	2032	2050
StateTargets	-1.2%	-2.9%	-4.5%	-8.4%	-28%
NetZeroZEV	-1.9%	-5.6%	-11%	-22%	-79%

	2023	2026	2028	2032	2050
StateTargets	-1.2%	-2.0%	-1.8%	-2.2%	-7.0%
NetZeroZEV	-0.9%	-2.7%	-5.3%	-10%	-21%

EPA United States Environmental Protection Agency

Additional NOx reductions from *StateTargets*



National NOx vs. 2023

Scenario	2026	2028	3032	2050
Reference	-9%	-14%	-21%	-30%
StateTargets	-10%	-14%	-21%	-34%

State-level NOx vs. 2023

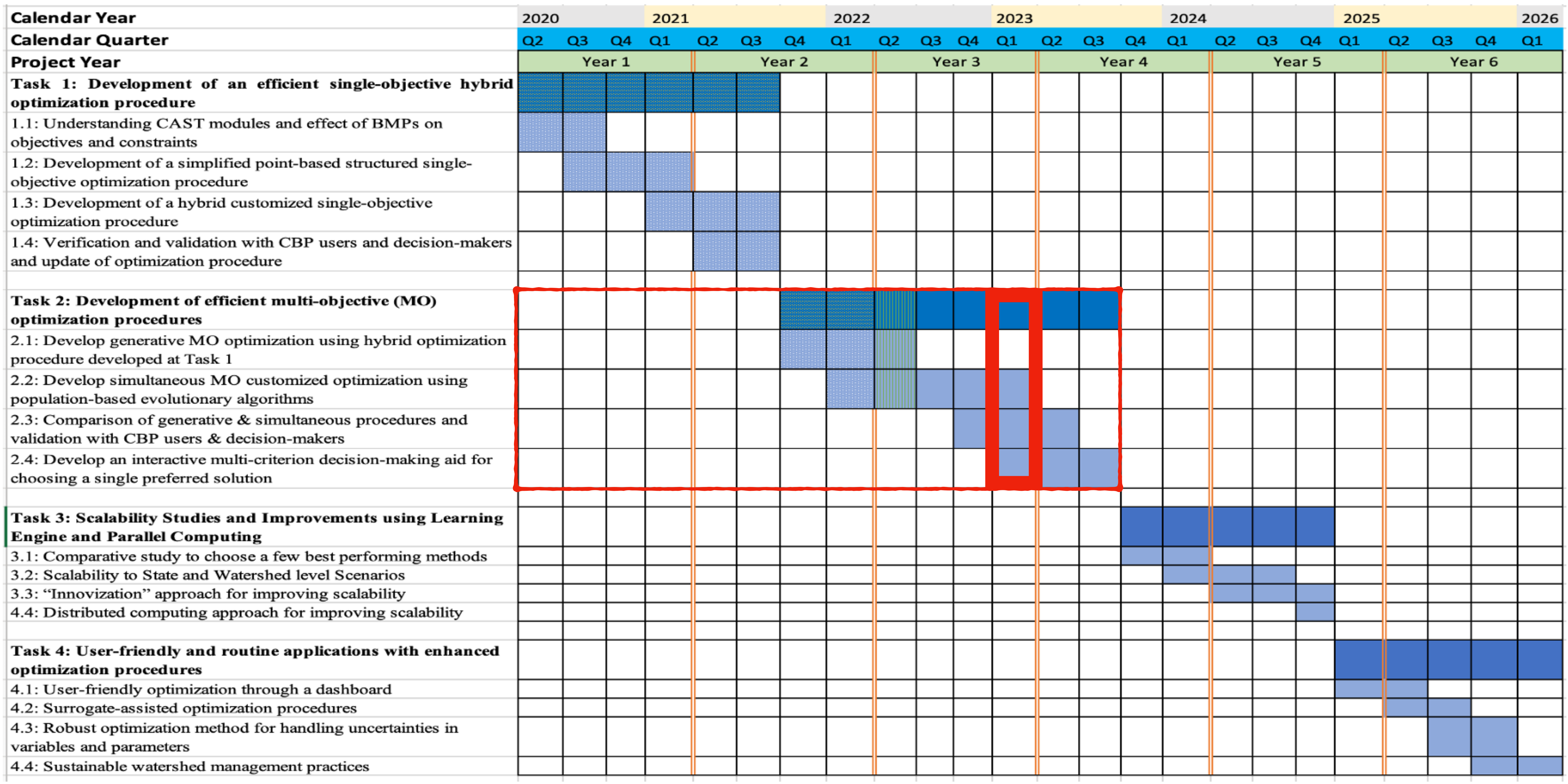
	2026	2028	2032	2050
NY	-10%	-15%	-23%	-47%
NJ	-12%	-17%	-27%	-50%
PA	-10%	-14%	-24%	-47%
CT	-13%	-18%	-27%	-51%
OH	-10%	-14%	-21%	-38%
WV	-6%	-8%	-12%	-38%
VA	-11%	-16%	-25%	-45%
MD	-13%	-19%	-32%	-55%
MI	-10%	-17%	-29%	-44%
KY	-9%	-14%	-21%	-36%
IN	-8%	-12%	-18%	-33%
Other	-1%	-2%	-3%	-5%
Total	-6.4%	-9.3%	-15%	-28%

CBP Optimization

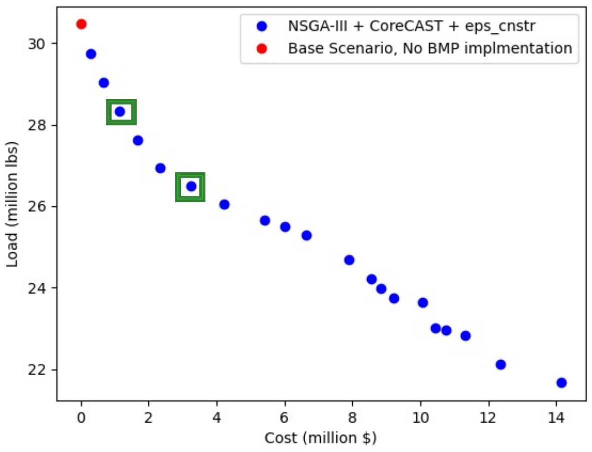
Chesapeake Bay Program

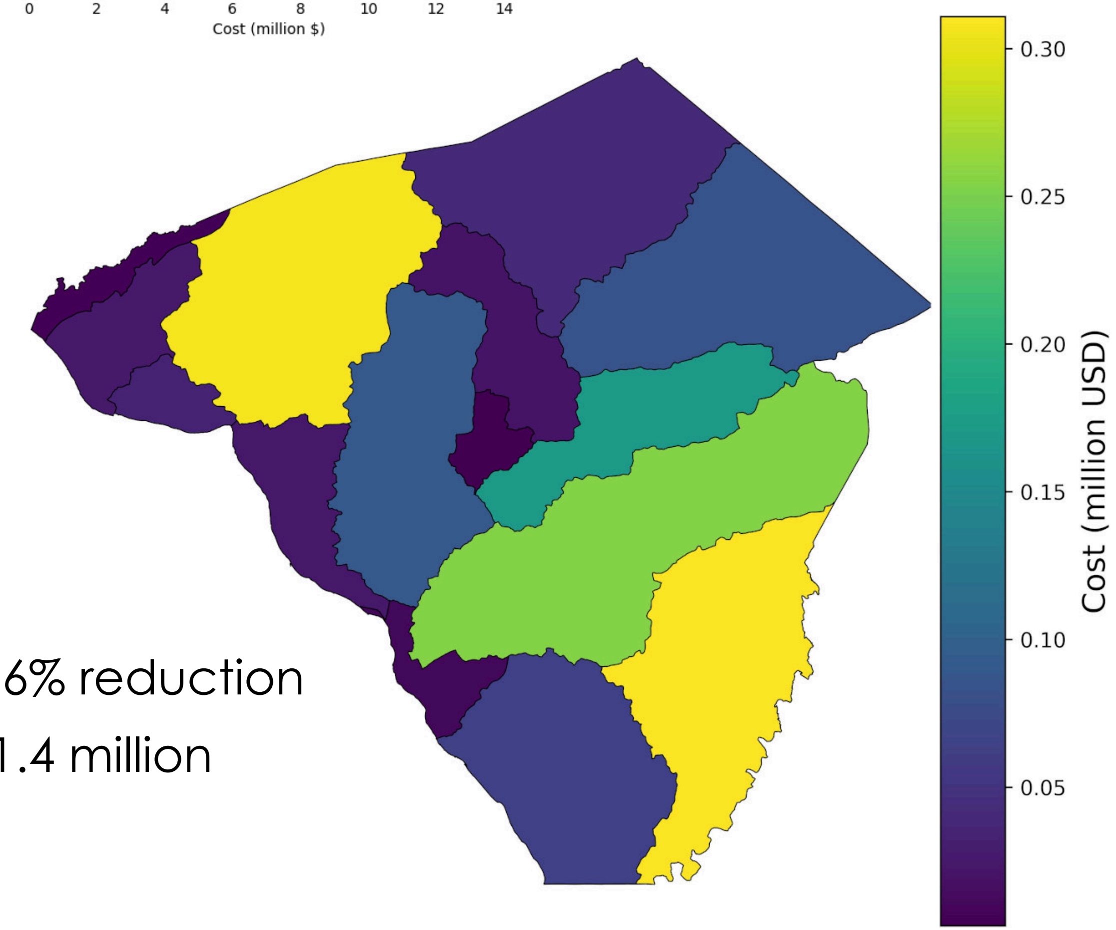
40 years of science, restoration and partnership

Current status of the project



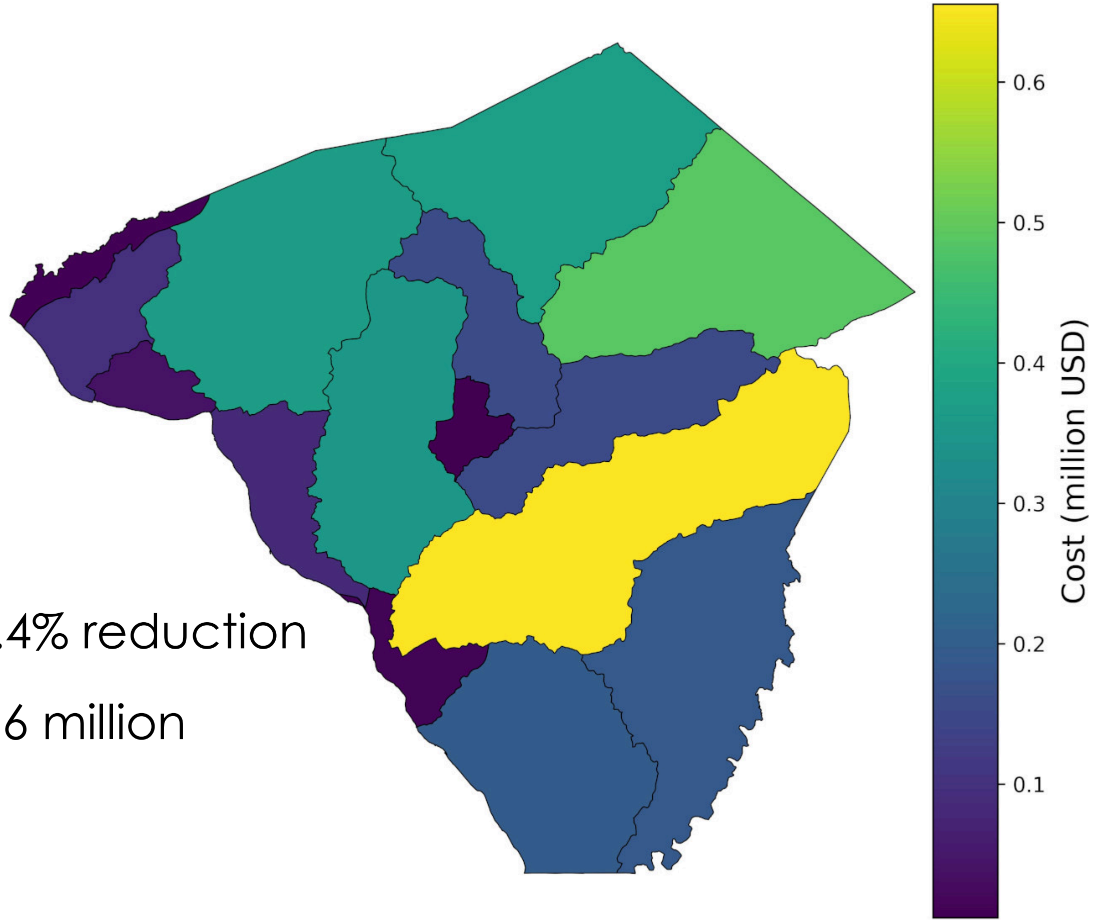
Cost





3.6% reduction

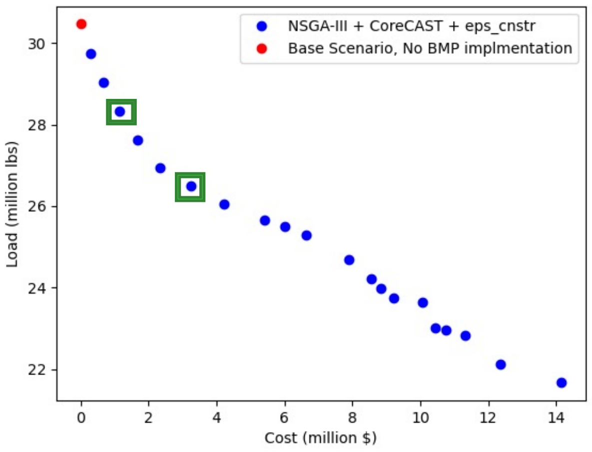
$1.4 million

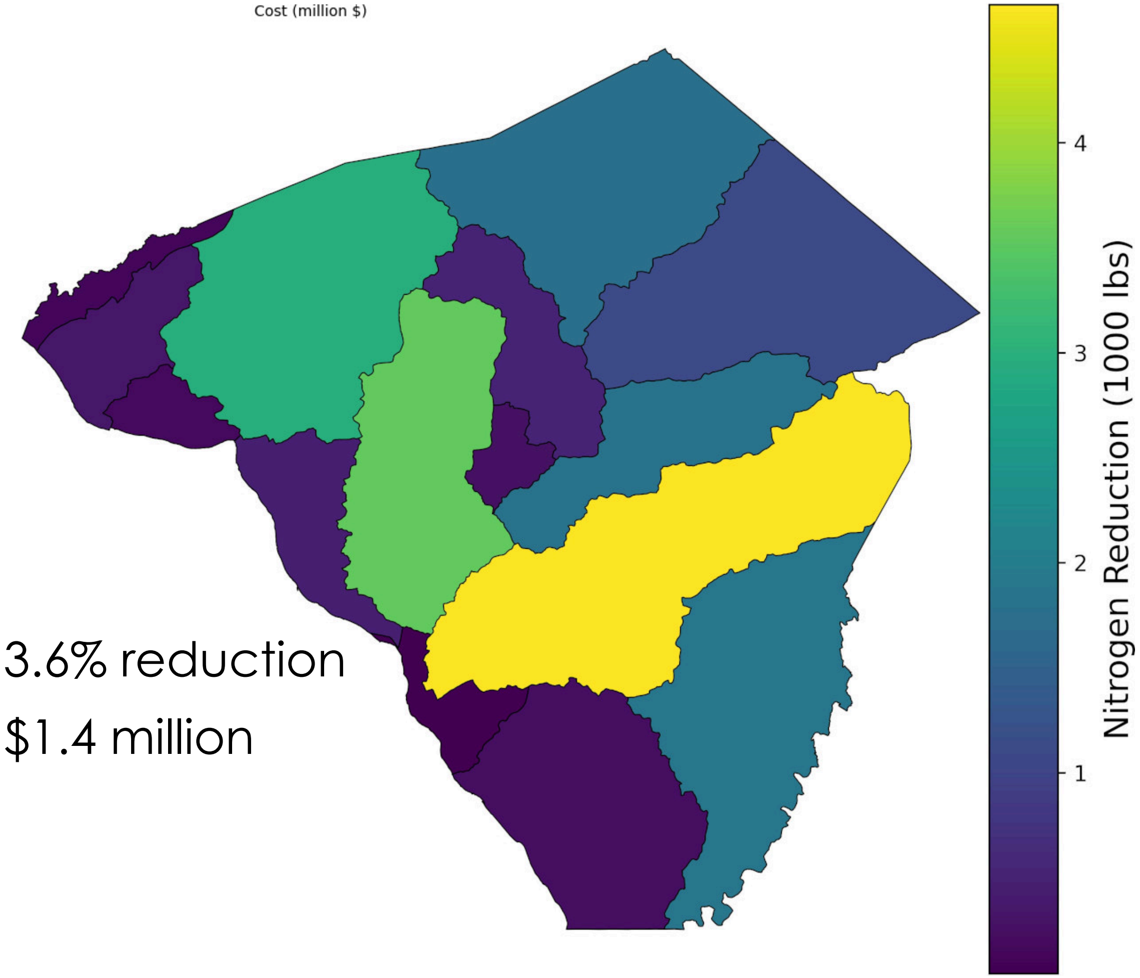


10.4% reduction

$2.6 million

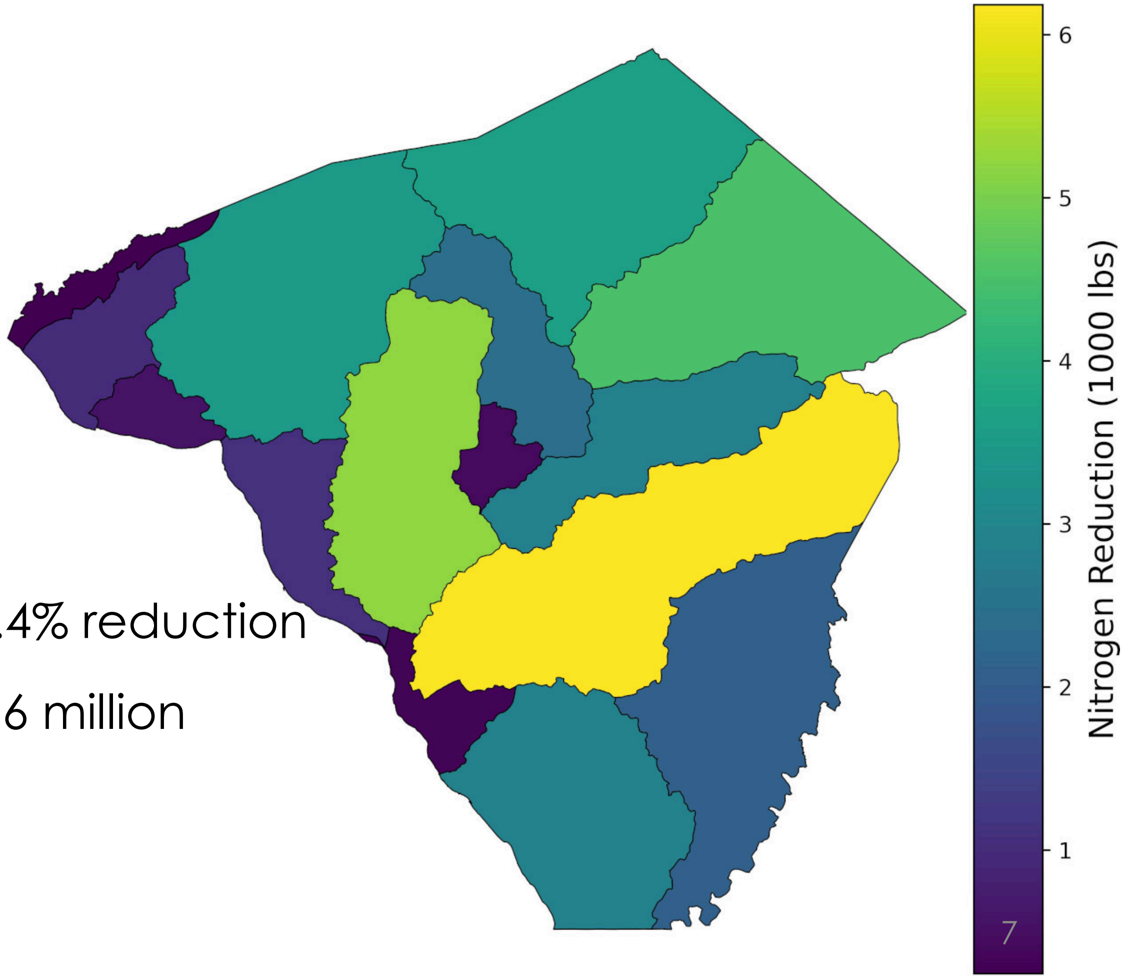
Nitrogen Reduction





3.6% reduction

$1.4 million



10.4% reduction

$2.6 million