Assessment of Future Energy Generation Scenarios on Chesapeake Water Quality

STAC CHANS Workshop

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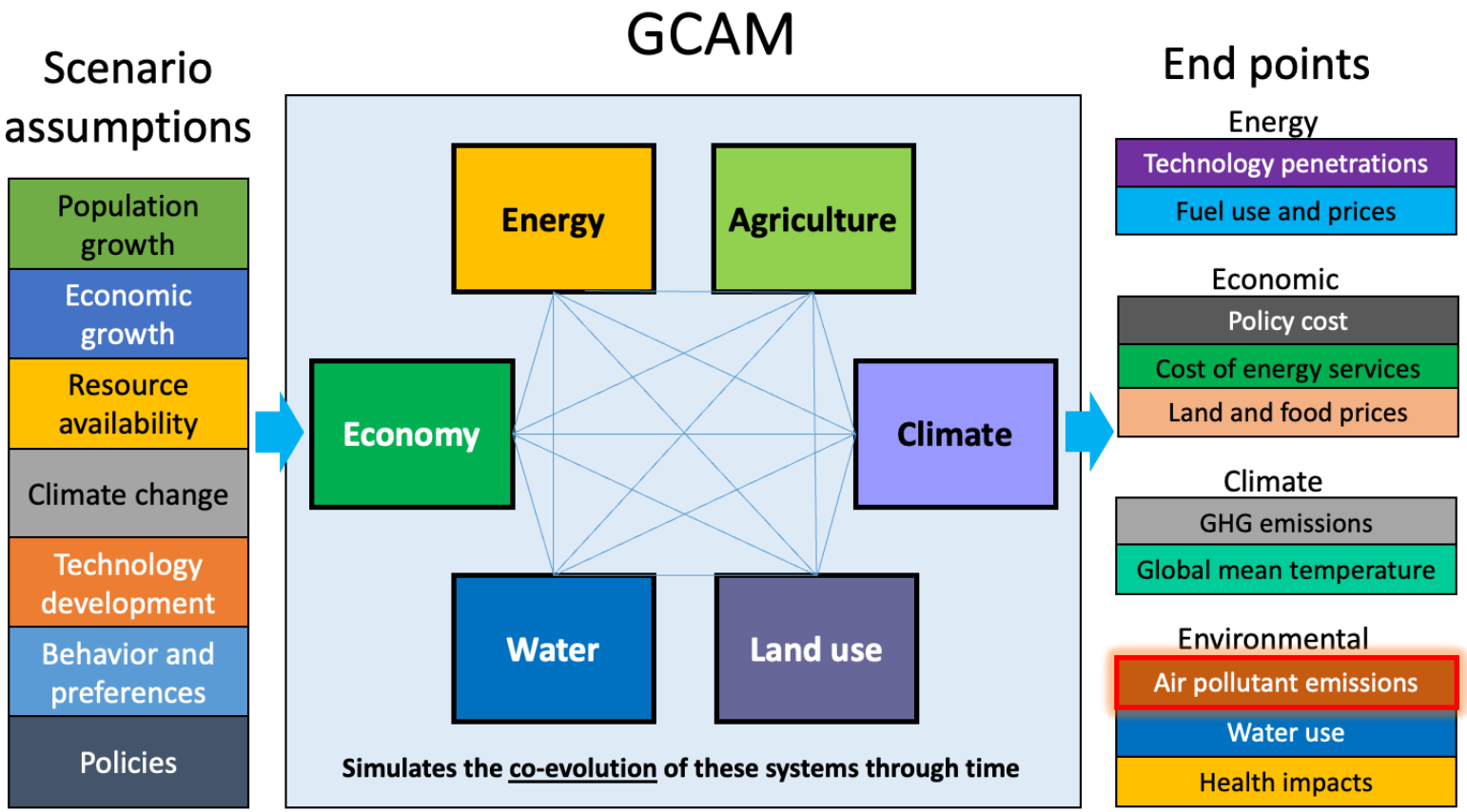
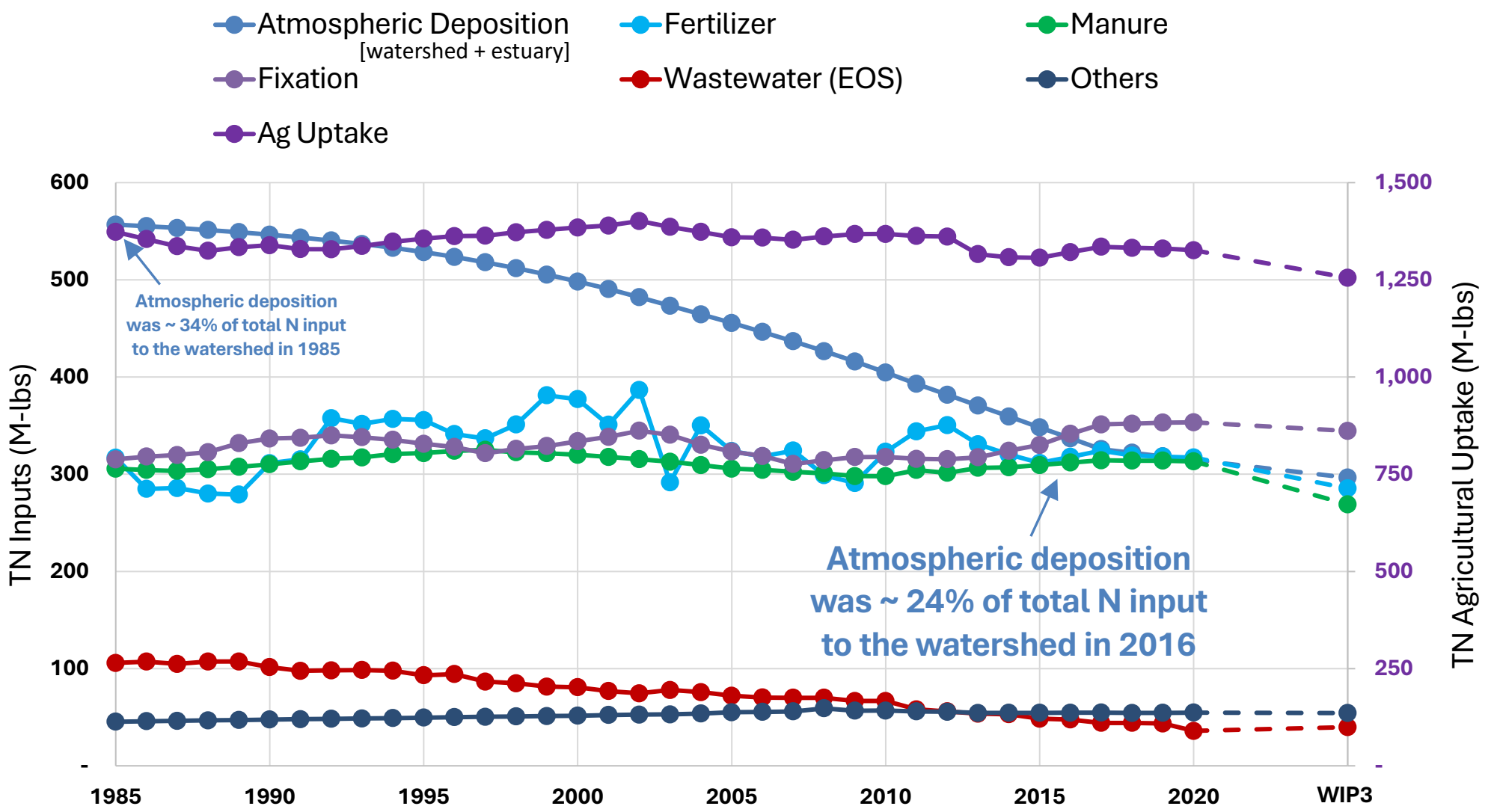
Global Change Analysis Model (GCAM)

- GCAM simulates the co-evolution of climate, economy, energy, agriculture, land use, and water systems through time.
- GCAM's energy related changes were incorporated as state and sector specific emissions through scaling factors into Community Multistate Air Quality (CMAQ) model.



Jesse Bash, Chris Nolte, Dan Loughlin, and Ben Murphy

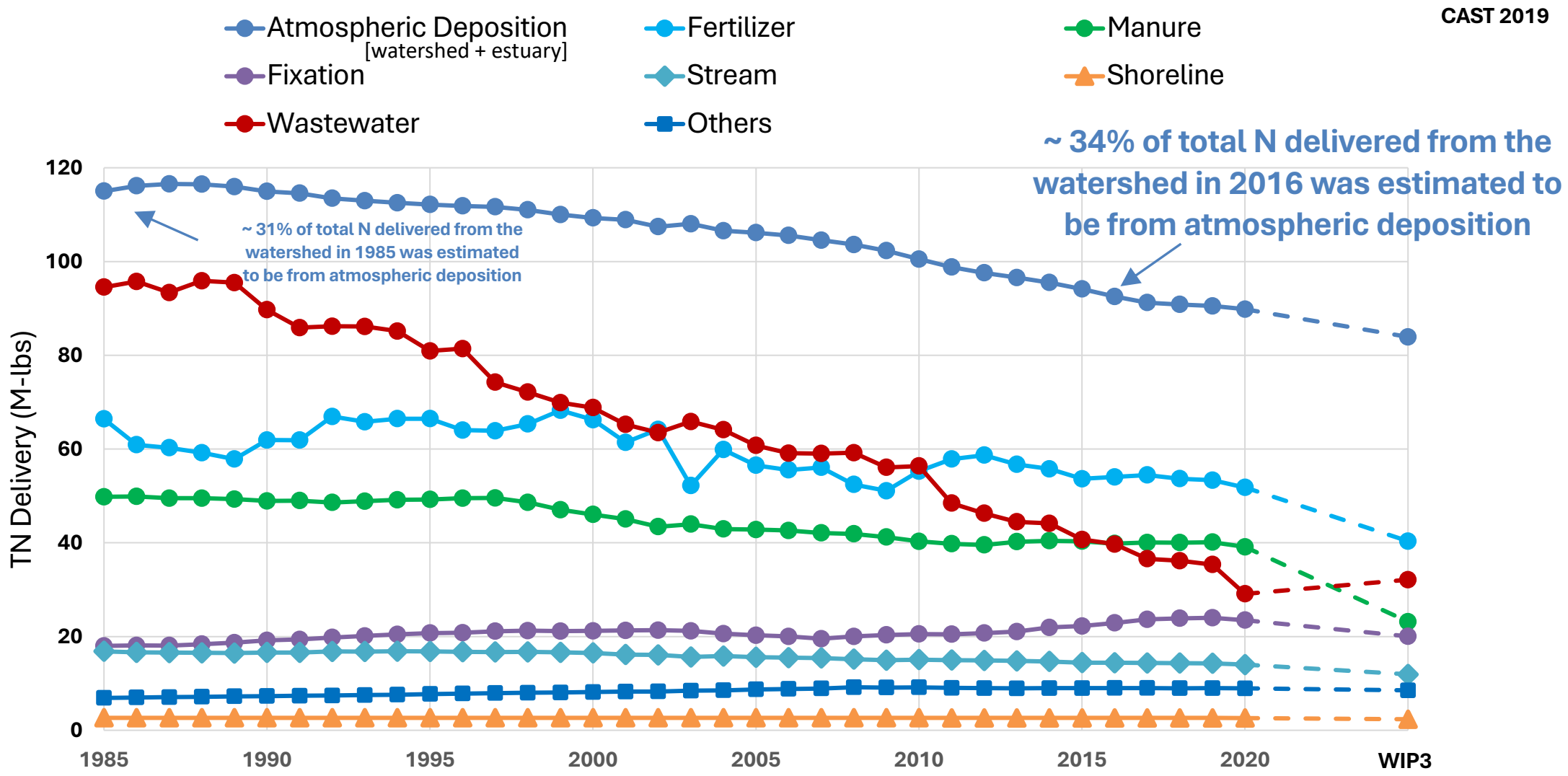
Phase 6 estimates of Total Nitrogen (TN) input to the Chesapeake Bay Watershed



Others include Septic, Biosolids, Rapid Infiltration Basin, and Urban Spray Irrigation.

https://d18lev1ok5leia.cloudfront.net/chesapeakebay/documents/20231017-BHATT-Integrated-Source-Apportionment-Analysis-of-Atmospheric-N-Deposition.pdf

Phase 6 estimates of Total Nitrogen (TN) delivery to the Chesapeake Bay



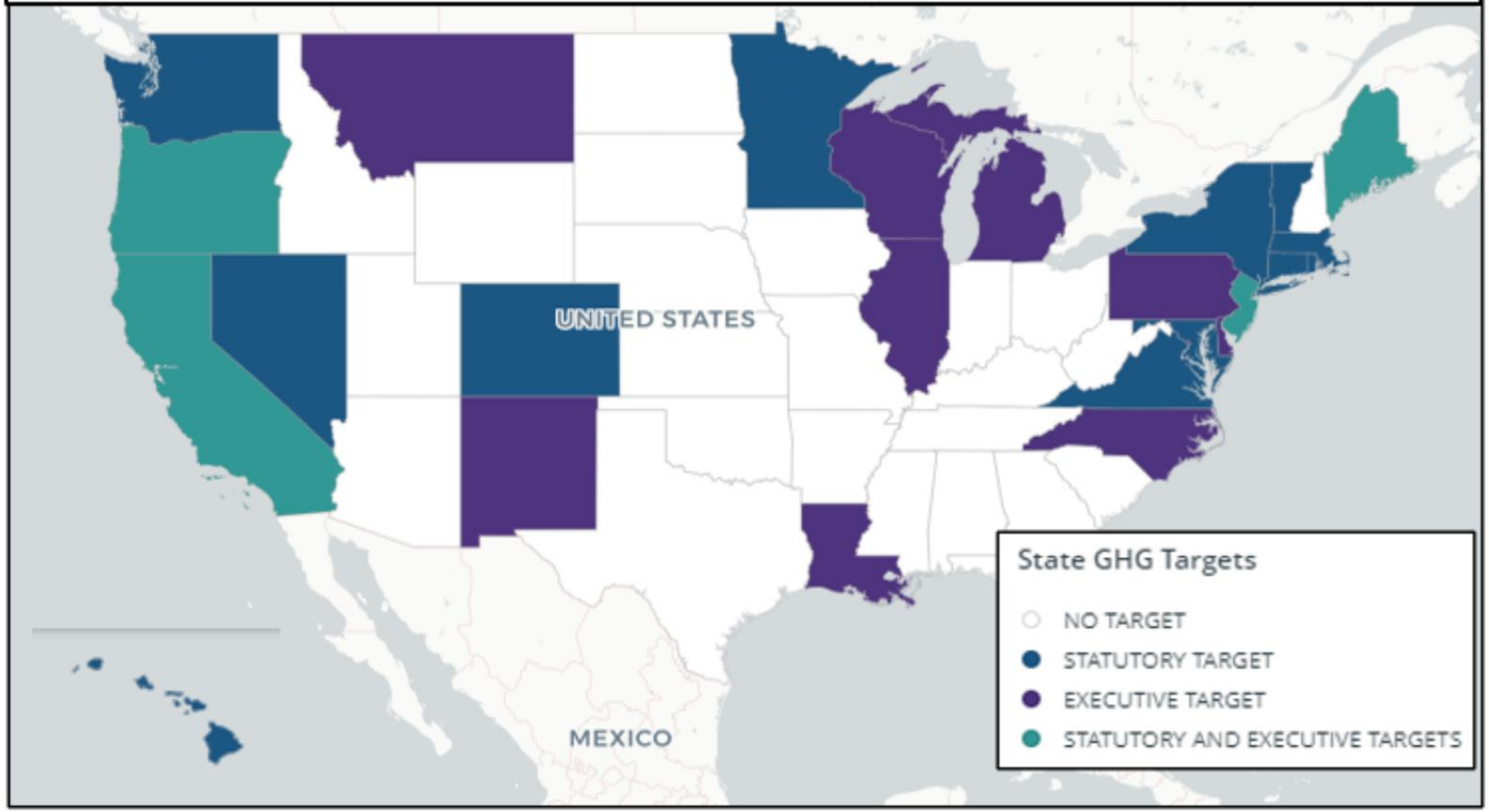
Others include Septic, Biosolids, Rapid Infiltration Basin, and Urban Spray Irrigation.

Estimated decreasing TN delivery is due to a combination of changes in inputs, BMPs, and management actions.

Motivation

- To understand the water quality effects of future energy scenarios.
- Improve our future analyses and assessments of future environmental conditions, growth, and management scenarios.
- Four scenarios: 1) 2016 Base, 2) Current Statutes, 3) State Targets (or IRA-LM) and 4) Net Zero 2050.

24 states + DC have specified GHG reduction targets



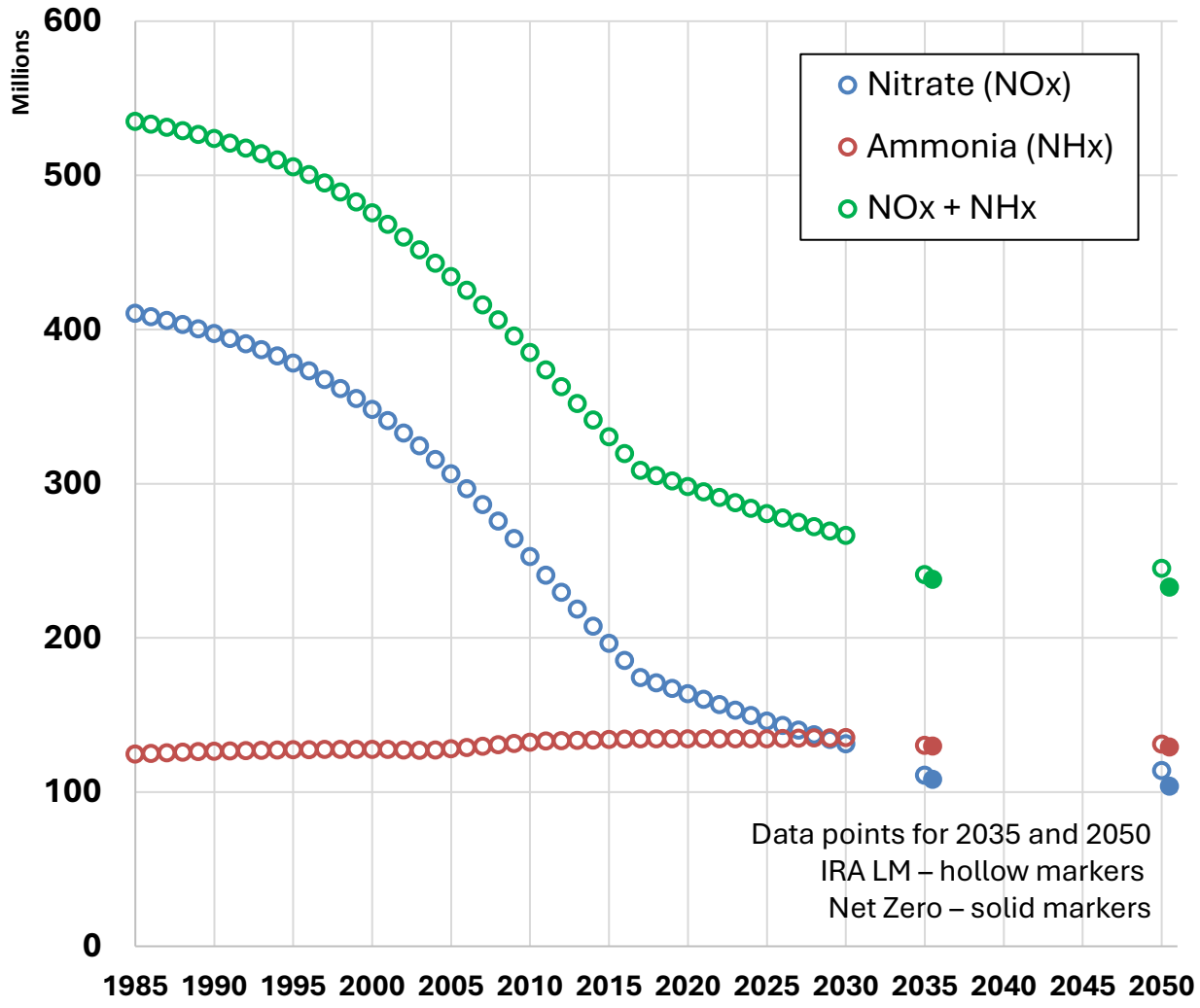
Atmospheric N-deposition Inputs

Atmospheric Deposition	2016 Air	2030 Air	2035 IRA LM	2035 Net Zero	2050 IRA LM	2050 Net Zero
Chesapeake Bay Watershed	319.80	266.70	241.39	238.28	245.25	233.26
Direct to Chesapeake Bay	17.15	14.77	14.16	13.99	14.35	13.75
Total Input	**336.95**	**281.47**	**255.55**	**252.27**	**259.60**	**247.00**

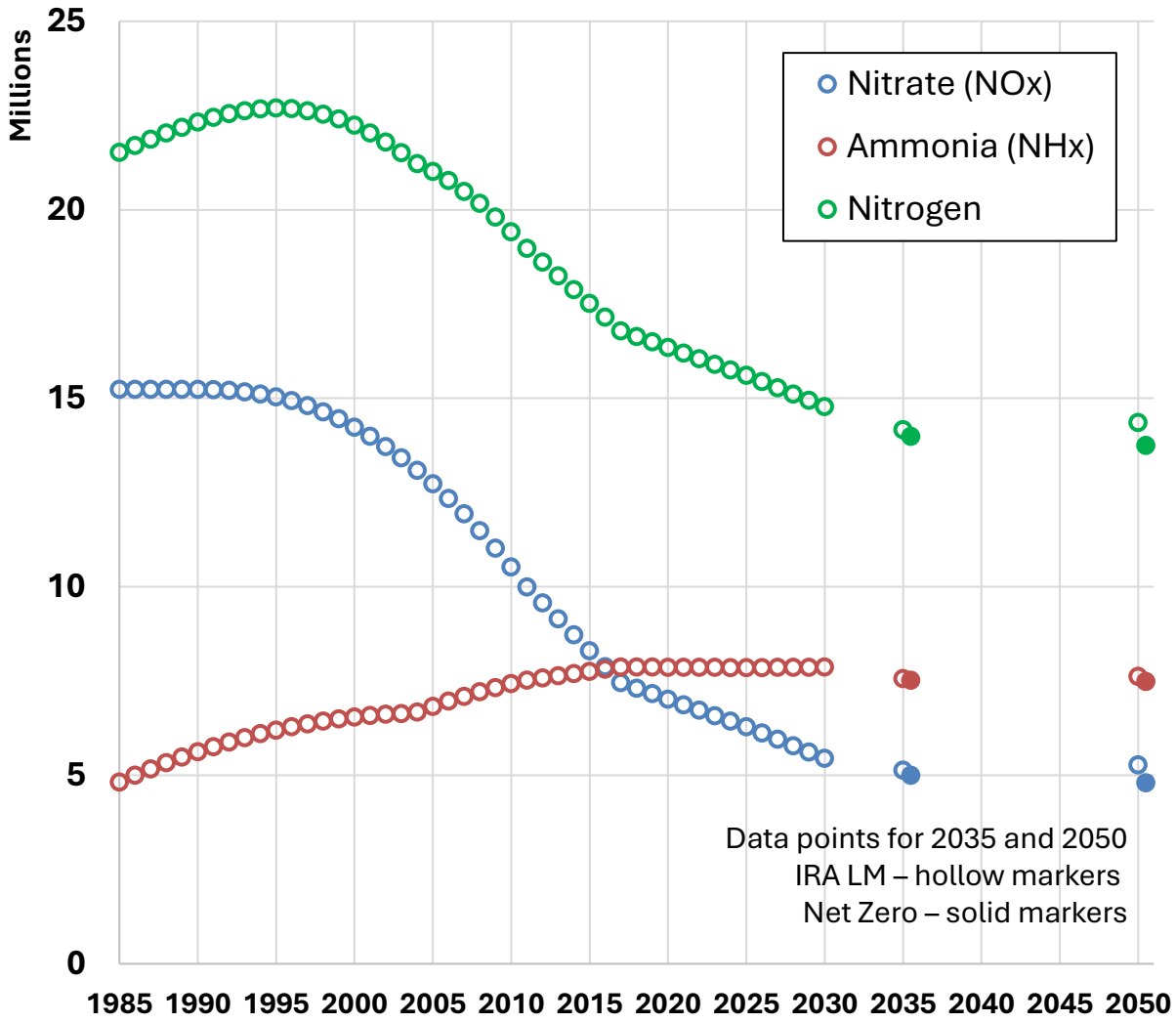
Δ Atmospheric Deposition	2016 Air	2030 Air	2035 IRA LM	2035 Net Zero	2050 IRA LM	2050 Net Zero
Chesapeake Bay Watershed		0	-25.31	-28.42	-21.44	-33.44
Direct to Chesapeake Bay		0	-0.61	-0.78	-0.42	-1.03
Total Input		**0**	**-25.92**	**-29.20**	**-21.87**	**-34.46**

Estimated trends in atmospheric N-deposition

N-deposition to the watershed

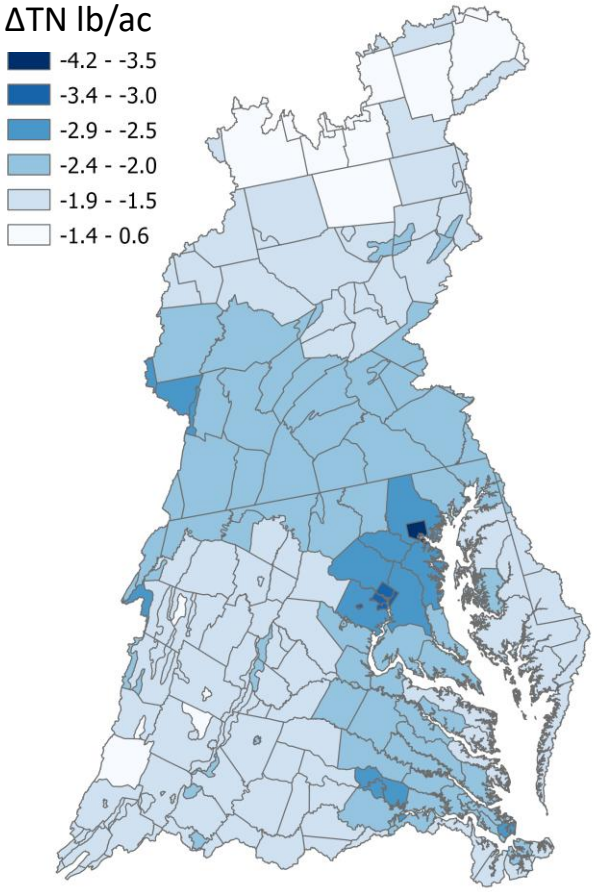


N-deposition to the Bay

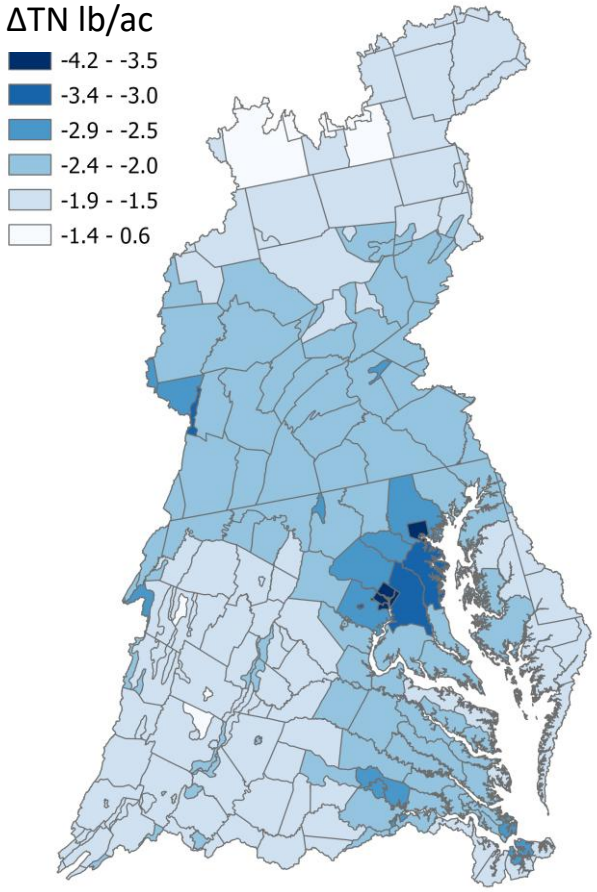


- Three deposition pathways: (1) watershed, (2) direct to Bay, and (3) mid-Atlantic bight
- Delta change in **wet** and **dry**, **oxidized** and **reduced**, N depositions were calculated for **(i) land segments** and (**ii) the Bay**, and then incorporated then into CBP Phase 6 Airshed Model estimated rainfall normalized trends.

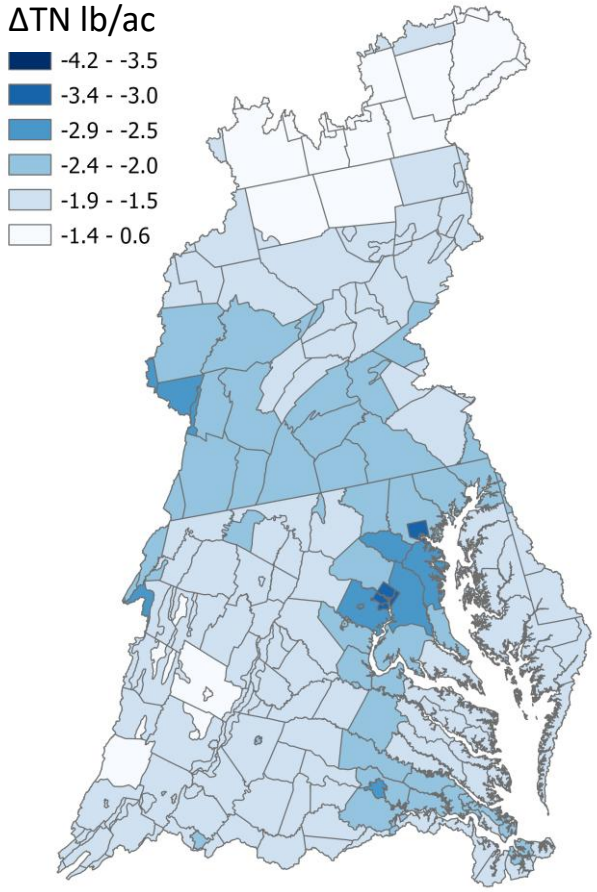
2035 IRA LM



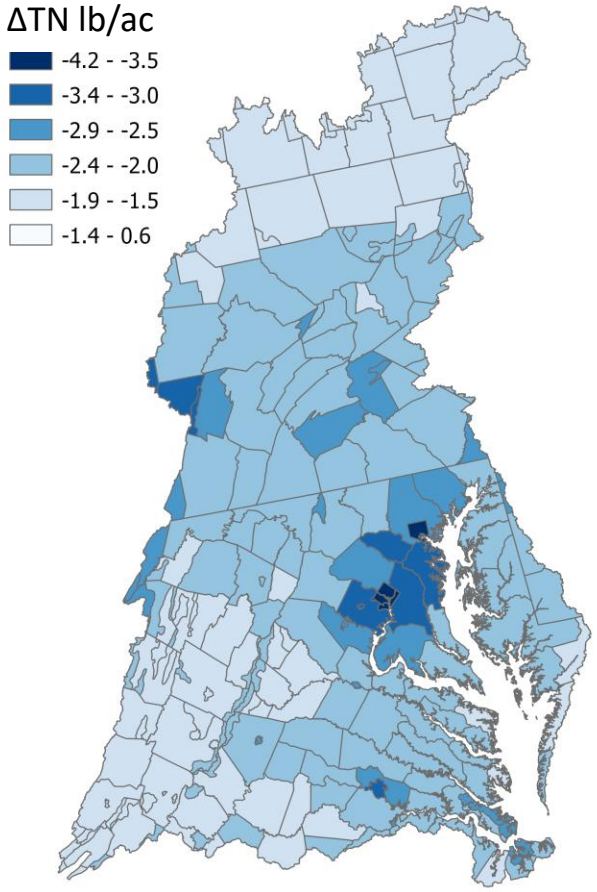
2035 Net Zero



2050 IRA LM



2050 Net Zero



Δ from 2016 are shown

- We received CMAQ data for 2016 along with the data for 2035 and 2050 under scenarios of **(a)** Inflation Reduction Act & Limited GHG Mitigation (**IRA LM**) and **(b)** Net Zero by 2050 with national scale implementations of state GHG reduction goals (**Net Zero**).