2019-2020 Climate Change Analysis

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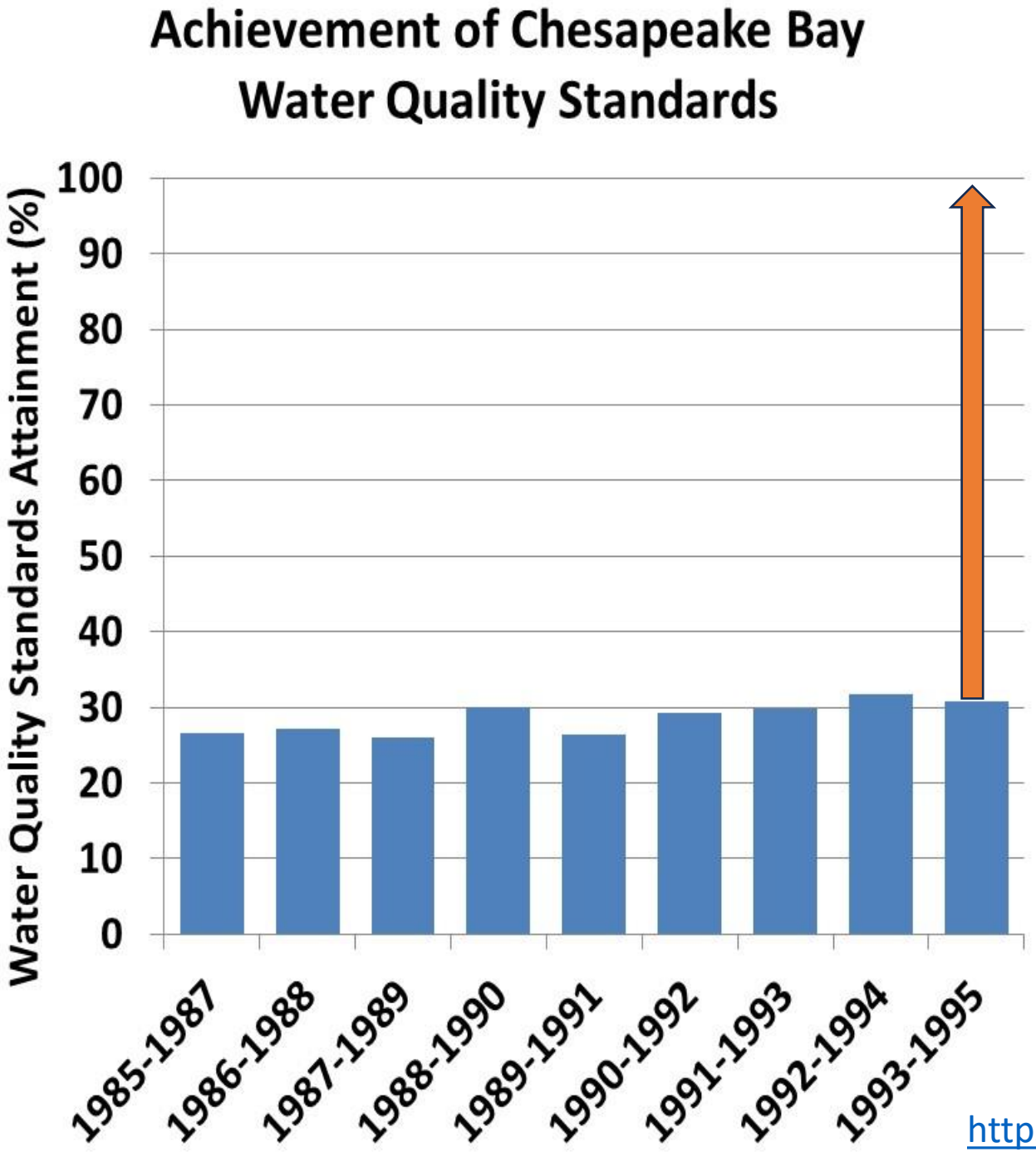
CBPO

STAC Climate Modeling 3.0 Workshop

5/7/2024

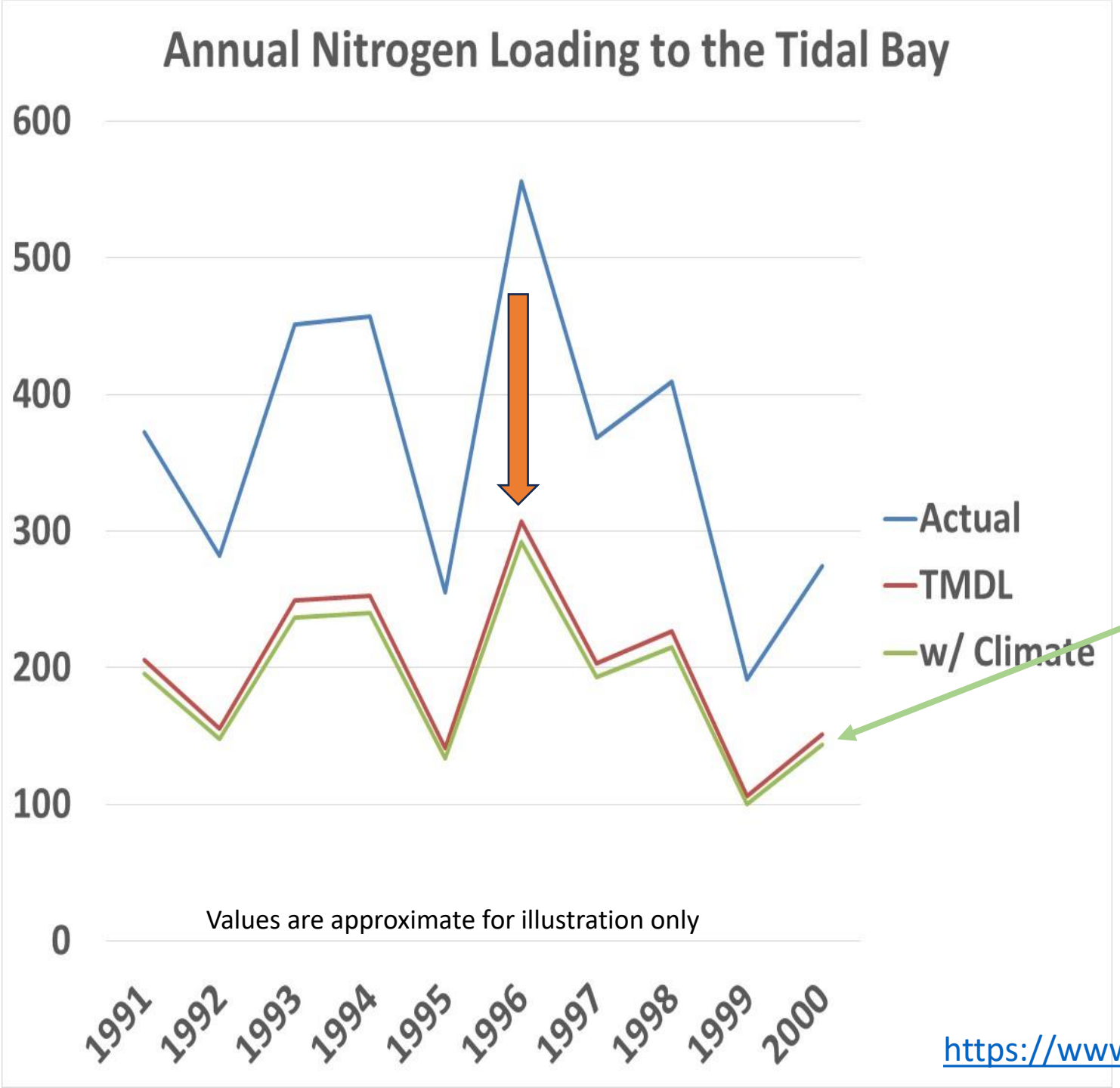
TMDL modeling question with climate change

- TMDL question
  - What would the average loads be in 1991-2000 such that the relatively wet period 1993-1995 would have met water quality standards?
- Climate change question
  - What would the average loads be in 1991-2000 such that the relatively wet period 1993-1995, projected through 30 years of climate change to 2023-2025 would meet water quality standards.
- Say what?



- What reductions in N and P would it take to raise dissolved oxygen to the point where standards were met in 1993-1995?

https://www.chesapeakeprogress.com/clean-water/water-quality



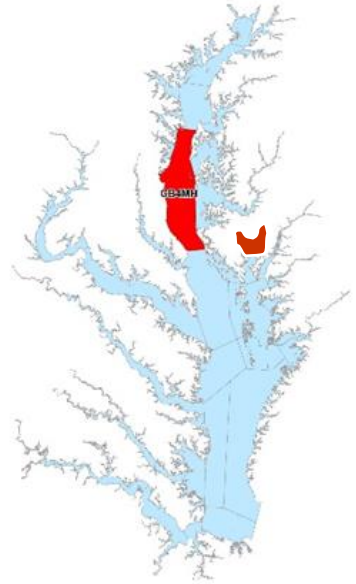
- Reductions would push the loads from a decadal average of ~360 million lbs to ~200 million lbs
- Adding climate change would make a further reduction necessary.
- These are the estimated loads in 1991-2000 such that if the weather patterns of 1993-1995, projected ahead through 30 years of climate change, occurred again, WQS would be met

https://www.chesapeakeprogress.com/clean-water/water-quality

△Achievement of Deep Channel DO Water Quality Standard

Achievement of **Deep Channel DO** water quality standard (1mg/l instantaneous minimum) expressed as ***an incremental increase*** over the PSC agreed to 2025 planning targets

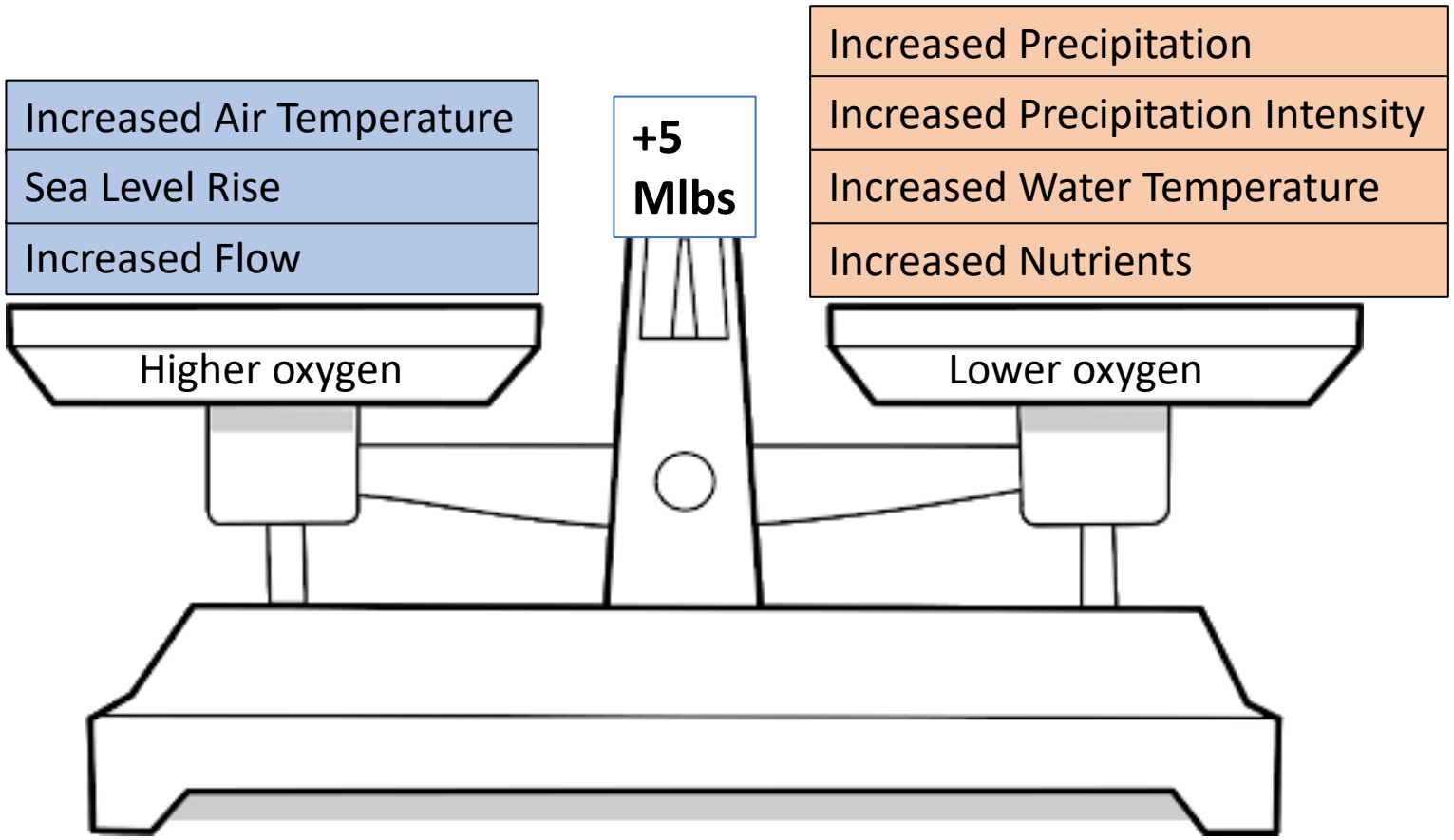
CB Segment	State	2025	2035	2045	2055
CB3MH	MD	0.00%	0.00%	0.00%	0.00%
CB4MH	MD	1.47%	3.15%	4.62%	7.31%
CB5MH	MD	0.00%	0.00%	0.00%	0.00%
CB5MH	VA	0.00%	0.00%	0.00%	0.00%
POTMH	MD	0.00%	0.00%	0.00%	0.00%
RPPMH	VA	0.00%	0.00%	0.00%	0.00%
ELIPH	VA	0.00%	0.00%	0.00%	0.00%
CHSMH	MD	0.01%	0.92%	1.08%	2.34%



Deep Water More Affected

Load reductions return to same average state

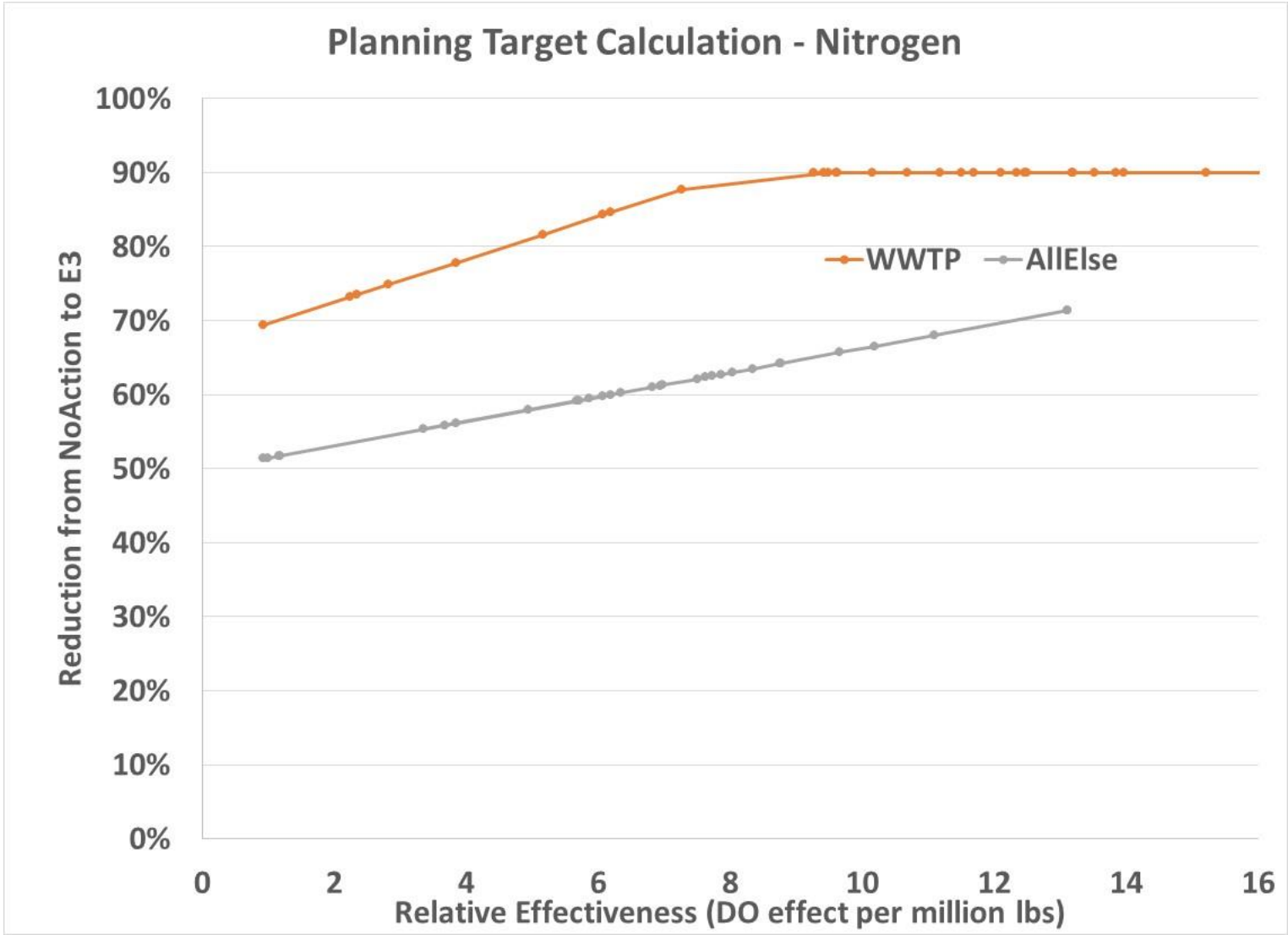
Balance of effects – Science Question



CBP studied 21 different effects producing an overall lower level of oxygen

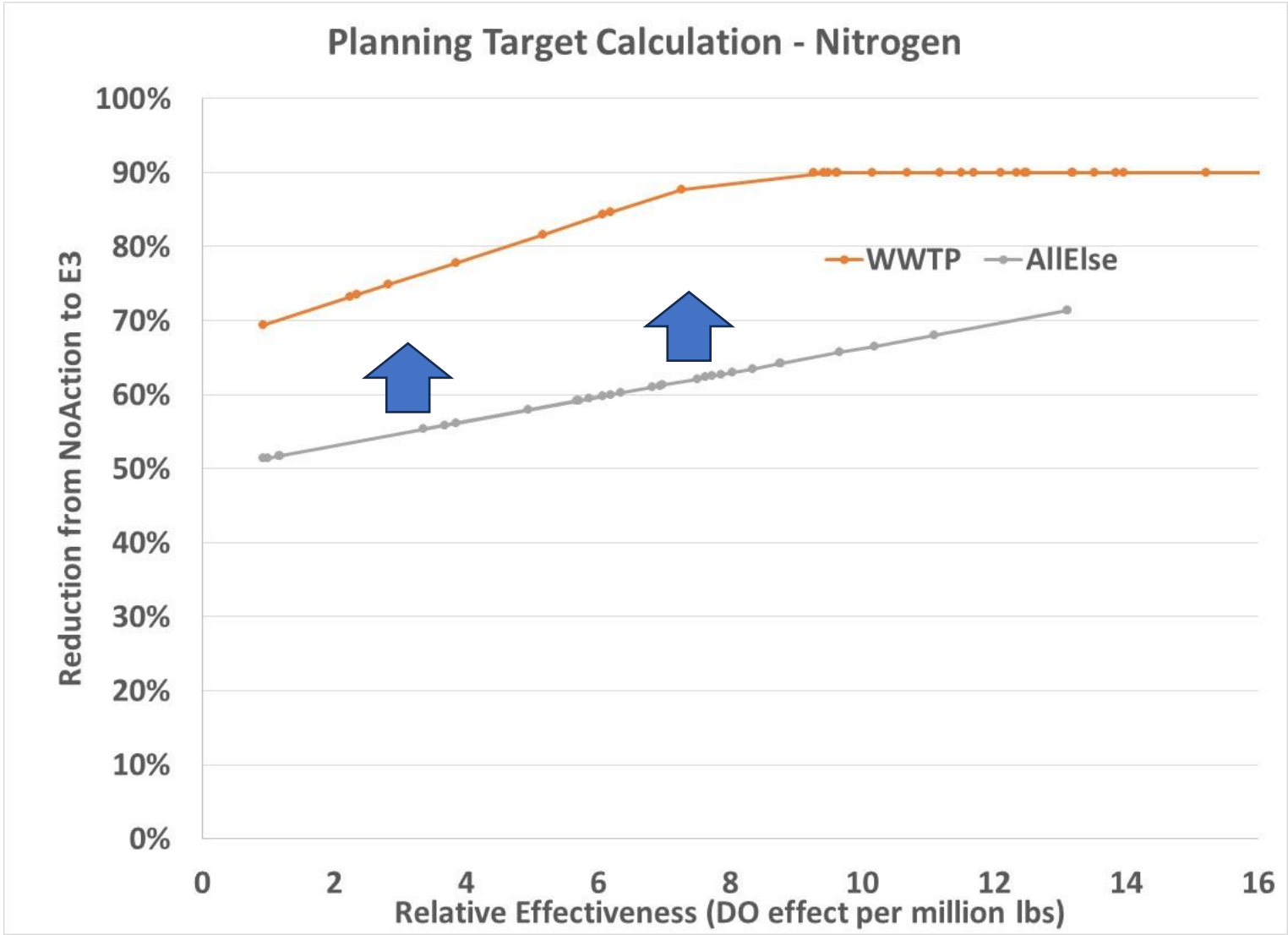
Who must do what? – Option 1

- Use 2010 allocation and 2017 planning target methodology



Who must do what? – Option 1

- Use 2010 allocation and 2017 planning target methodology
- Modify one or both curves
- Spread the effort out to all

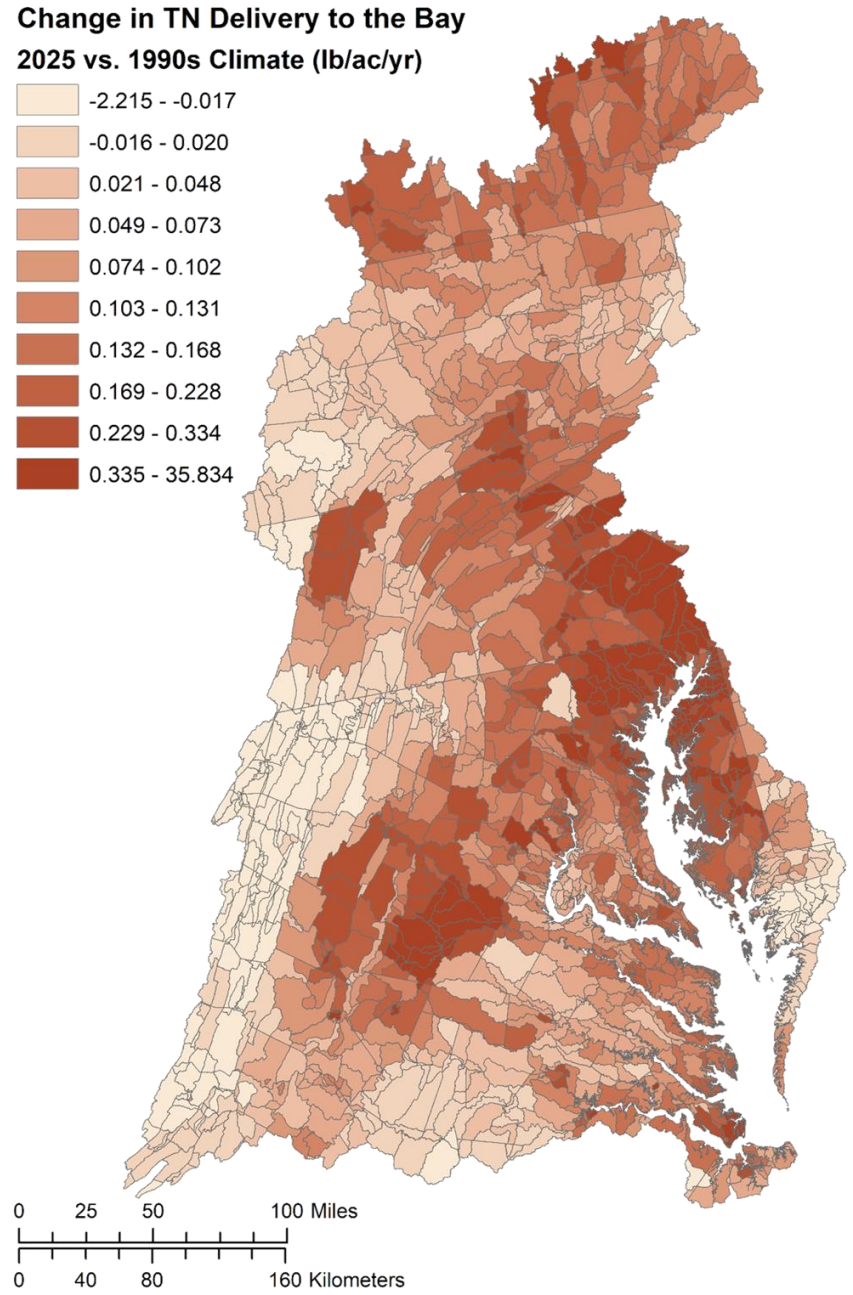


Who must do what? – Option 2

- Reductions expected from States and Basins where increases occurred

- Some understandable spatial variance
- Some unexplained spatial variance
- Unequal increase in effort

- Partnership selected Option 2



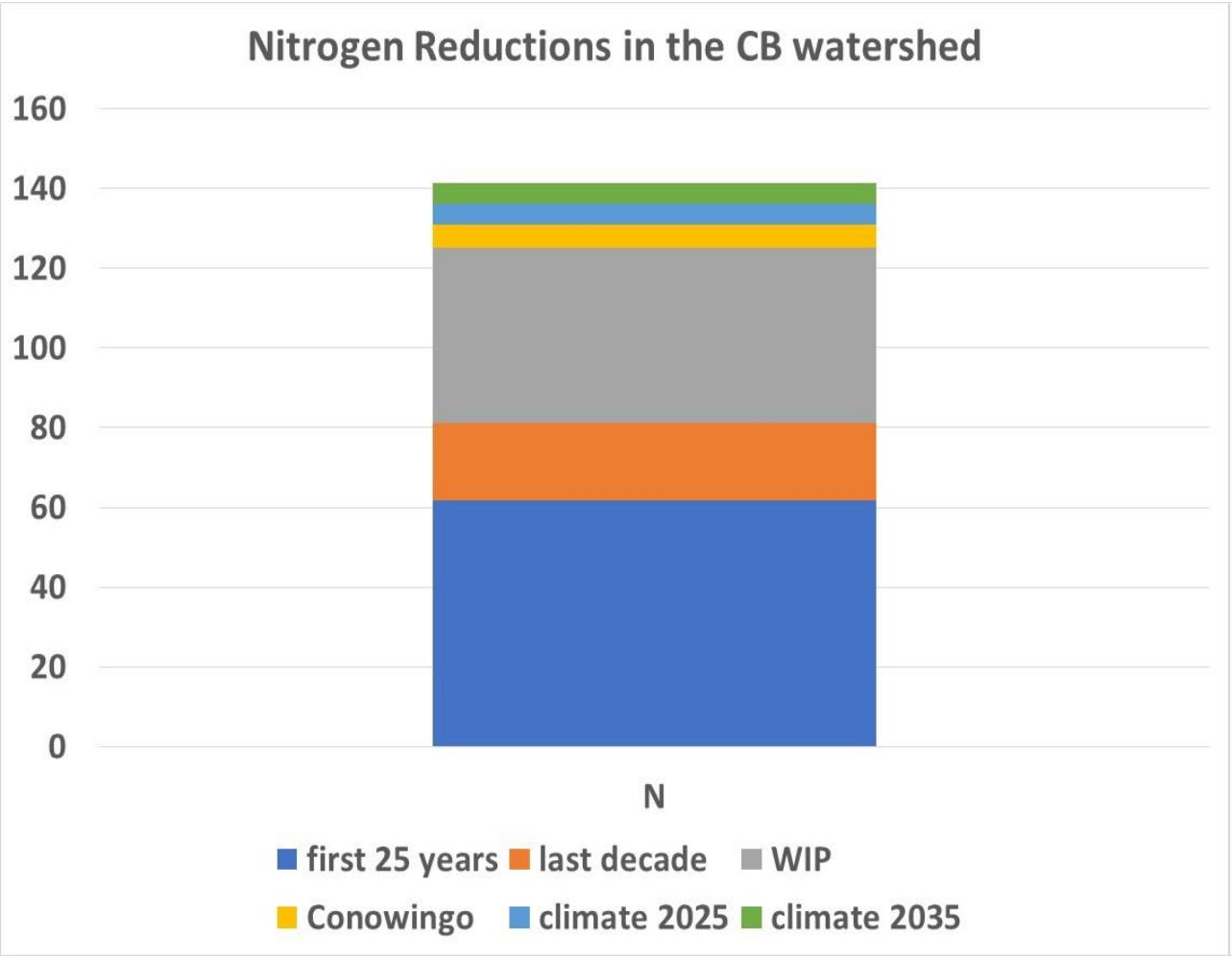
Final Decision

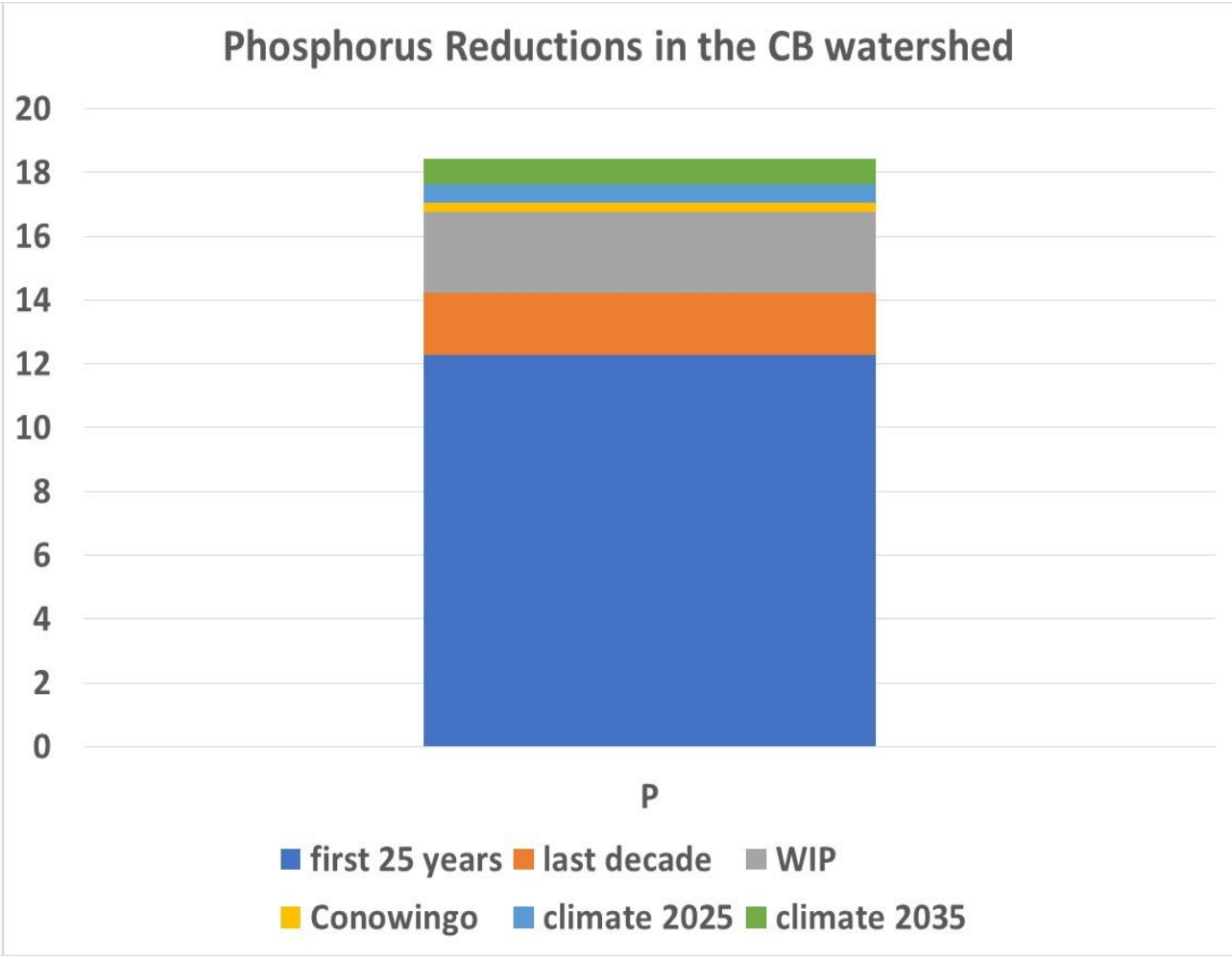
State	TN			TP		
	Dec 2017 PSC	L1st Climate increase	Adjusted L1st Proposed	Dec 2017 PSC	L1st Climate increase	Adjusted L1st Proposed
DC	0.006	0.006	0.007	0.001	0.001	0.001
DE	0.397	0.036	0.039	0.006	0.003	0.003
MD	2.194	1.061	1.142	0.117	0.111	0.111
NY	0.400	**0.699**	0.399	0.015	0.044	0.044
PA	4.135	1.683	1.811	0.143	0.095	0.095
VA	1.722	1.476	1.589	0.187	0.337	0.337
WV	0.236	**-0.054**	0.000	0.017	0.009	0.009
Total	9.089	4.908	4.986	0.485	0.599	0.599

- **Each jurisdiction makes additional reductions equal to the increase due to climate change.**
- **NY's nitrogen efforts are decreased by .3 million lbs, WV's negative nitrogen loads are eliminated**
- **All other jurisdiction loads reduction requirements are increased by 8% to account for the balance**

Modeled load reductions from CAST-2019

Climate effects in perspective

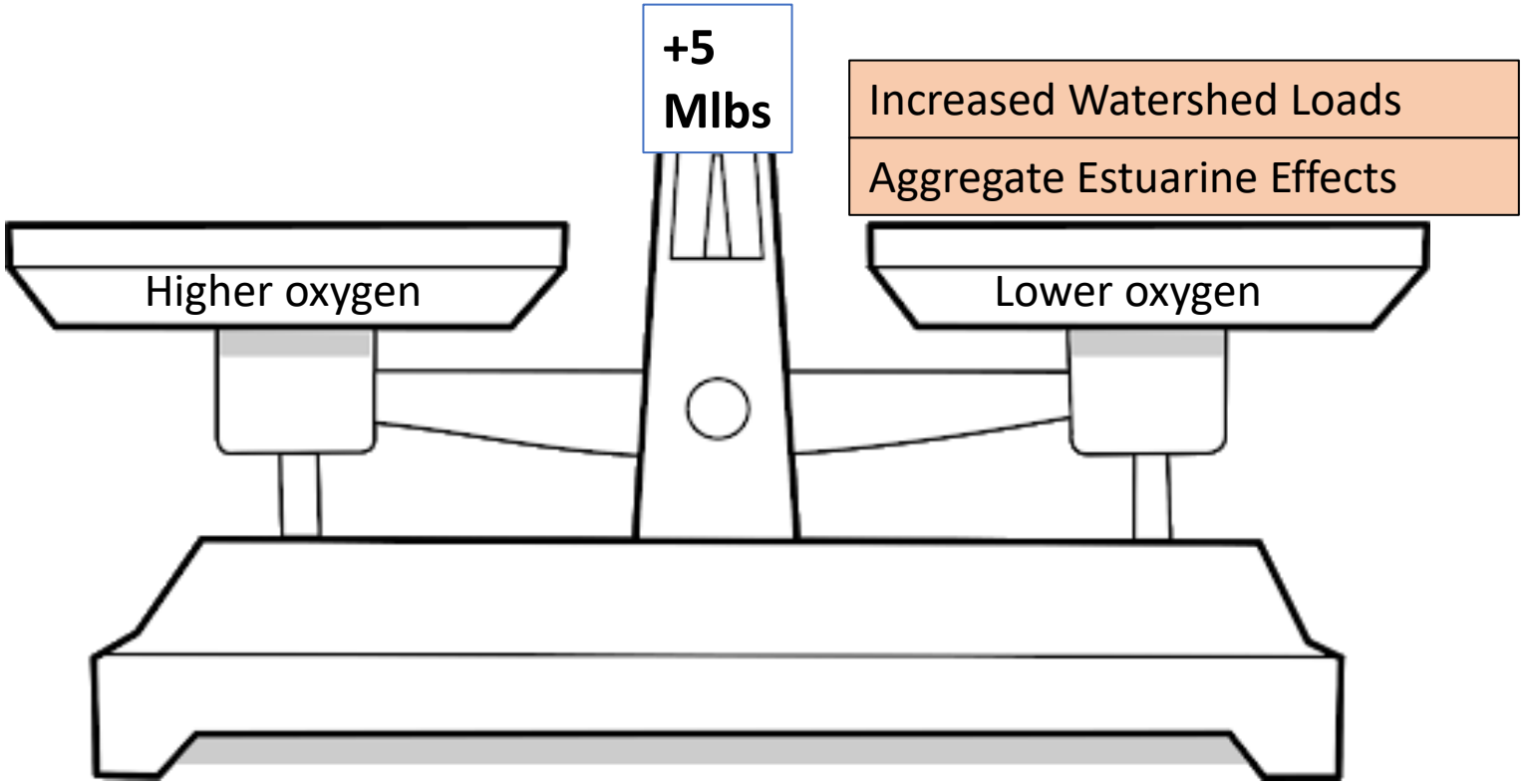




3 thoughts

- 1 + 1 = 1
- Uncertain about uncertainty
- Some models are useful

Balance of effects – Science Question



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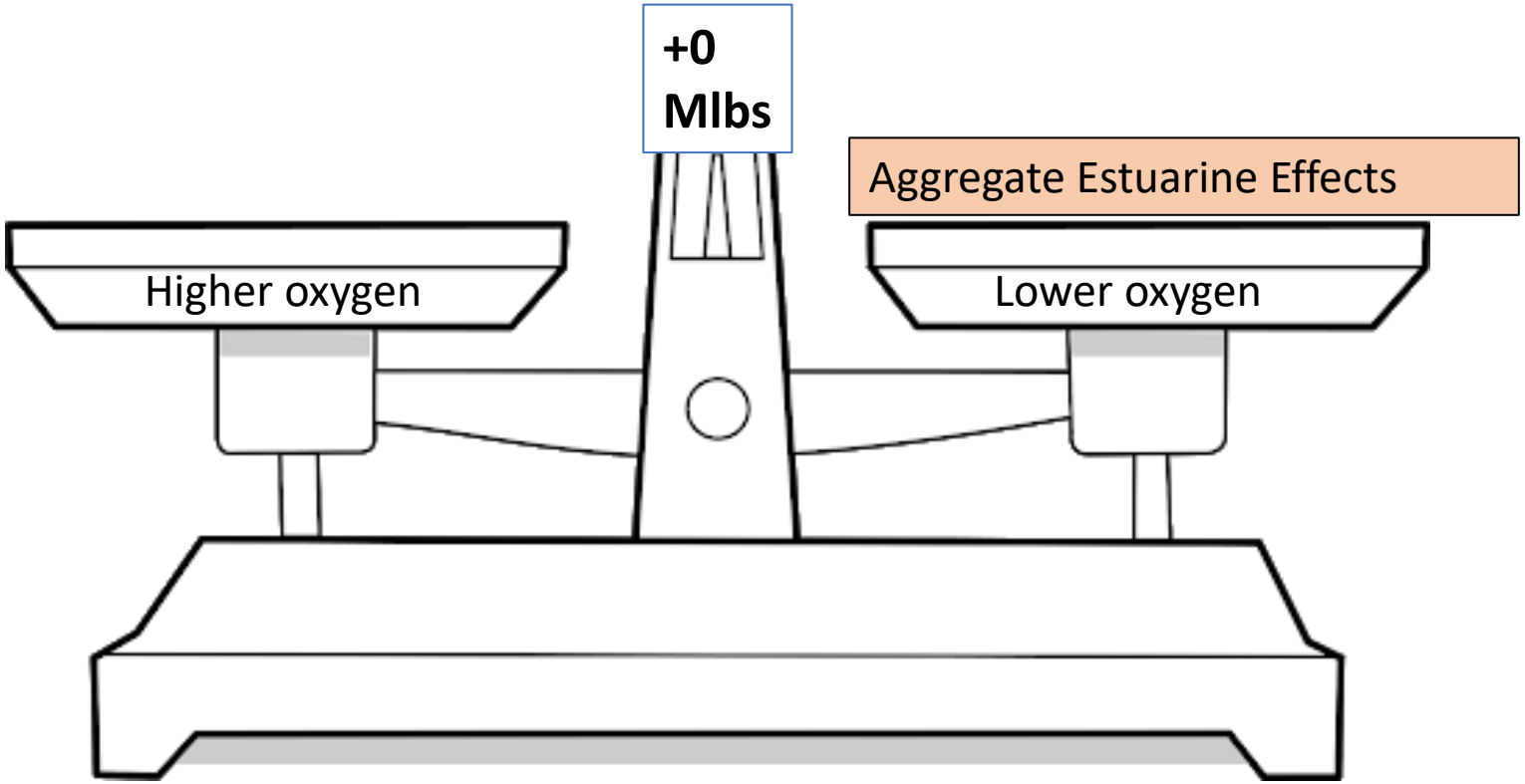
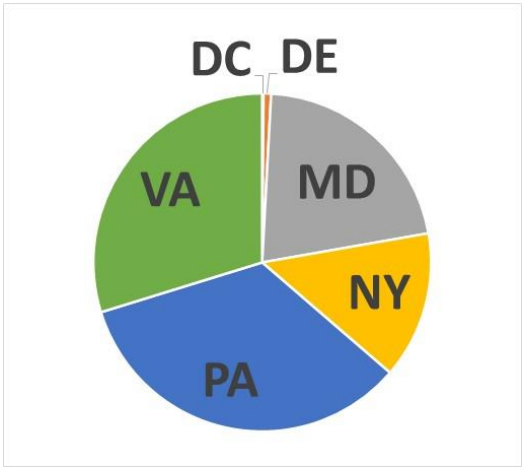
Balance of effects – Science Question



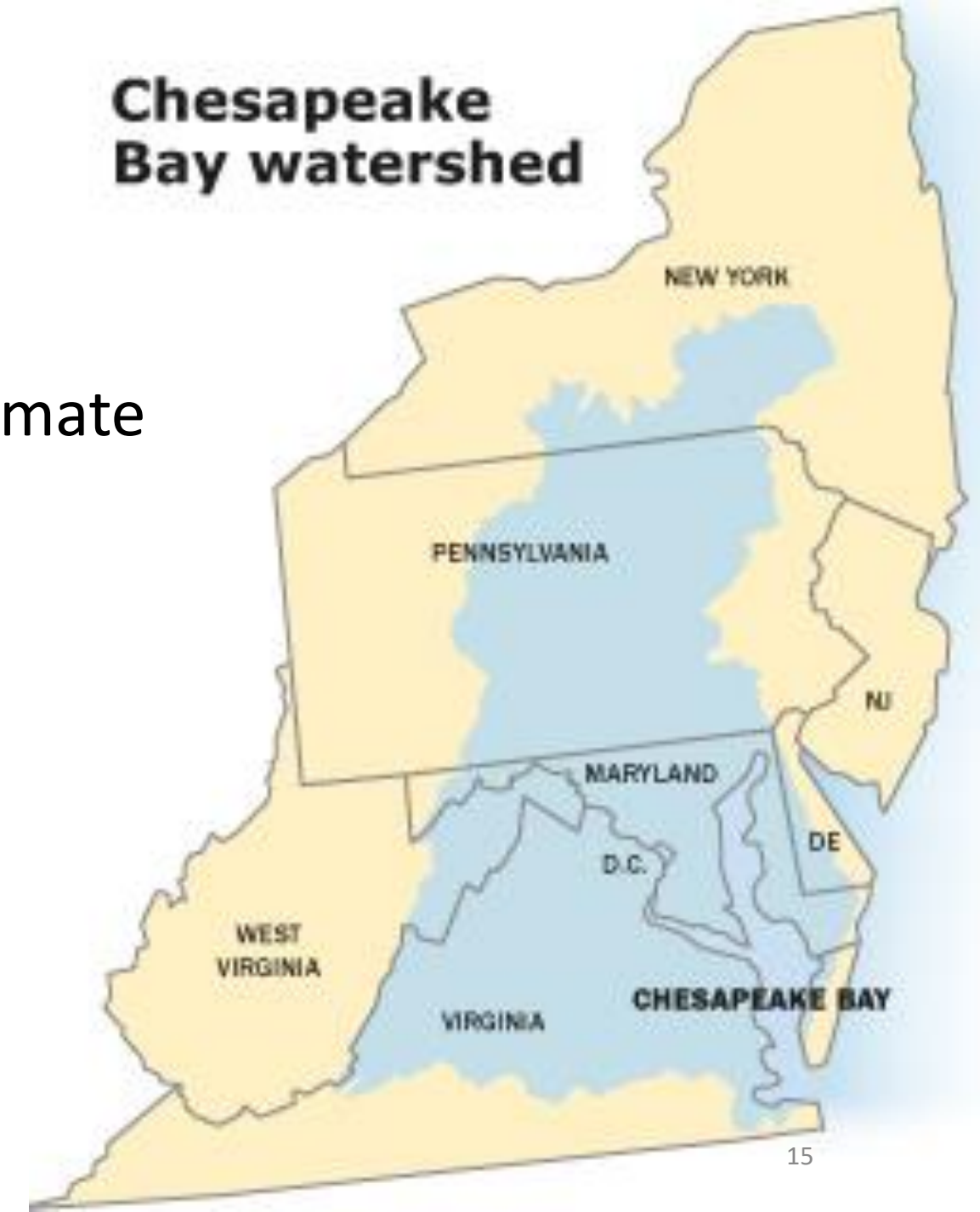
CBP studied 21 different effects producing an overall lower level of oxygen

- Why just '*communicating the uncertainty*' does not help

- Divide this 12" pie of climate change 'damage'

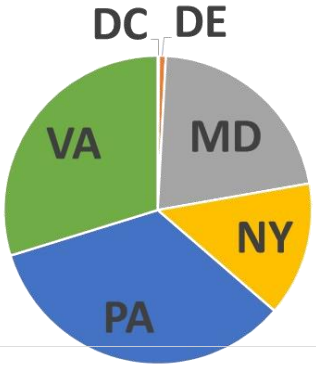


- This is how much damage came from your state



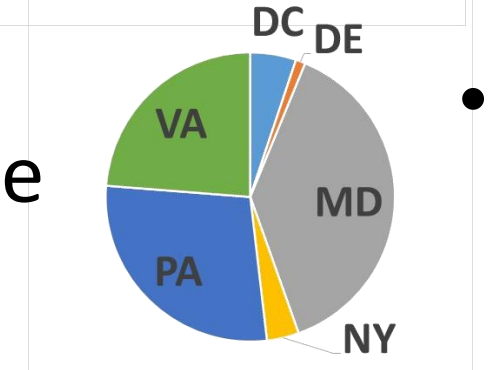
- Why just '*communicating the uncertainty*' does not help

- The pie, if it exists, may or may not be large

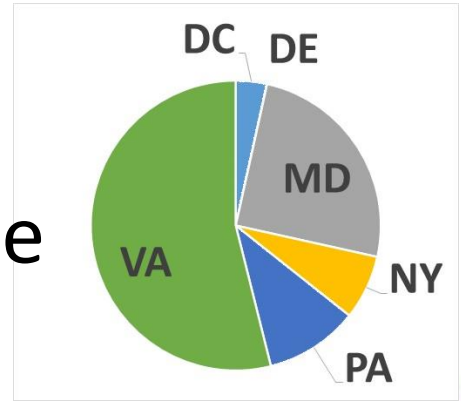


- This might be how much damage came from your state

- Or maybe this



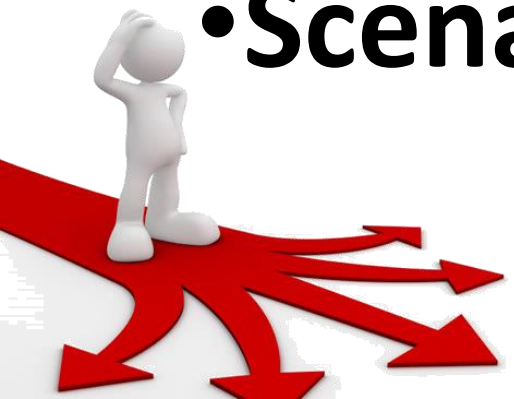
- Or maybe this



Values for illustration only

Types of Models

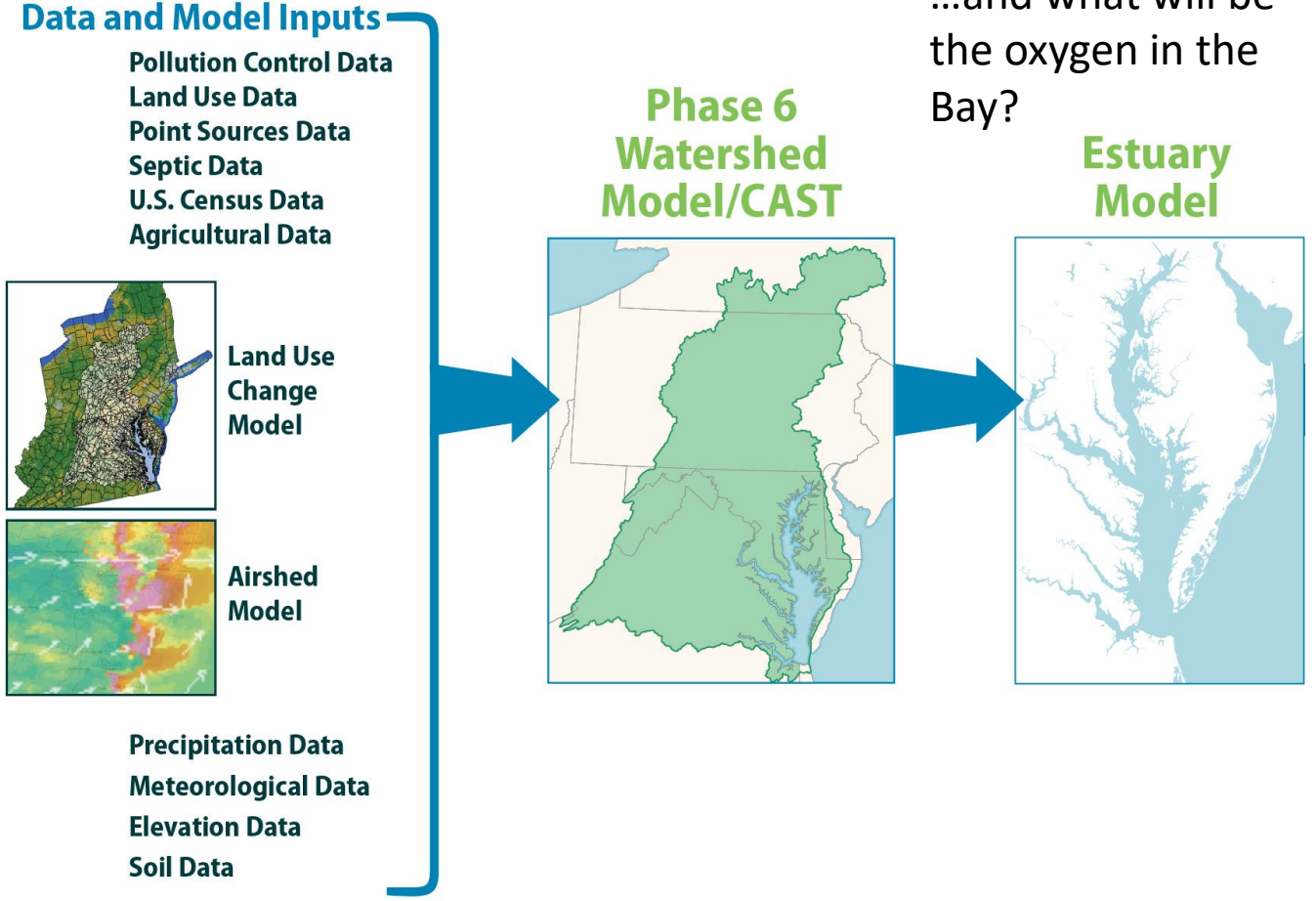
- Prediction
  - Temporal
  - Spatial
- Research
- **Scenarios** ✓



If we change what we do on the landscape…

…how will that change nitrogen, phosphorus, and sediment?

…and what will be the oxygen in the Bay?



Research Model ⇔ Management Model

- Research Model – What can you learn?
  - Statistical Model
    - What can you learn about the system from observations
  - Process Model
    - What can you learn about emergence or inter-process dynamics from combining processes

- Management model – Question is pre-determined
  - Given everything that you've learned, what are the likely effects of potential anthropogenic changes.

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