JOINT FACTORS & ITAT RETREAT
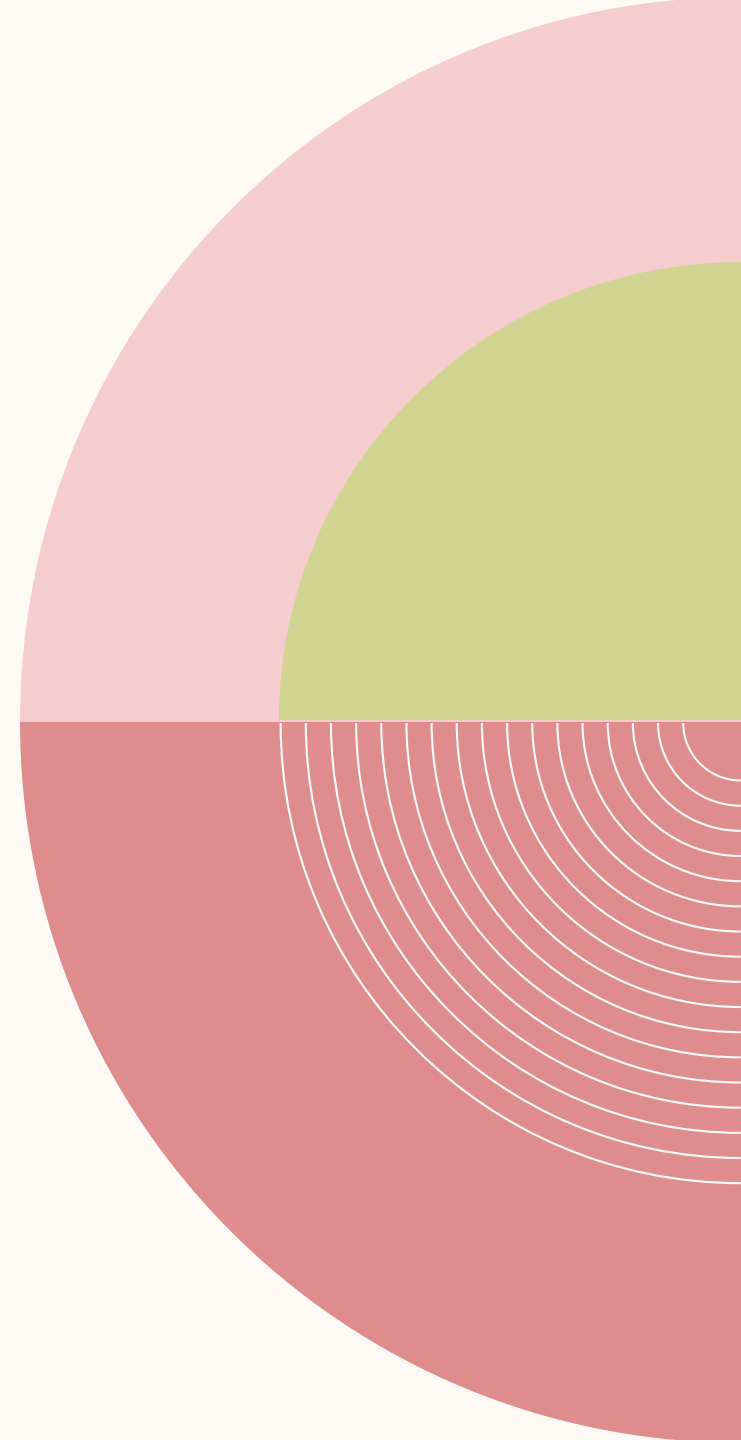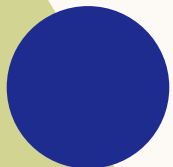
Breck Sullivan (USGS@CBP)

Kaylyn Gootman (EPA@CBP)

John Clune (USGS)

SNOWBALL EFFECT

Write on a piece of paper one thing about yourself or the research you do. Then they crumple the paper up into a 'snowball' and have a snowball fight. At the end of the fight, everyone grabs the closest snowball and has to try to find the person who wrote it.
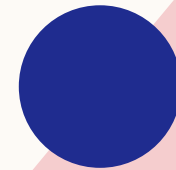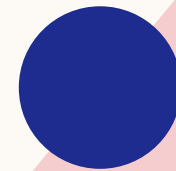
FACTORS

Factors Team

Fostering collaborative research to better explain the factors behind trends in water quality to guide resource management in the Chesapeake Bay watershed

INTEGRATED TRENDS ANALYSIS TEAM (ITAT)

ITAT aims to combine the efforts of the Chesapeake Bay Program analysts with those of investigators in governmental, academic, and non-profit organizations to identify potential research synergies and collaborations that will enhance our understanding of spatial and temporal patterns in water quality.

QUESTIONS

DRIVERS

What are the patterns and
drivers of the observable
nutrient and sediment
trends and do they match
CAST predictions?

BMPS

Which BMPs are having
a meaning effect on
water quality and how do
we target at local scale?

LEGACY

Can we quantify the
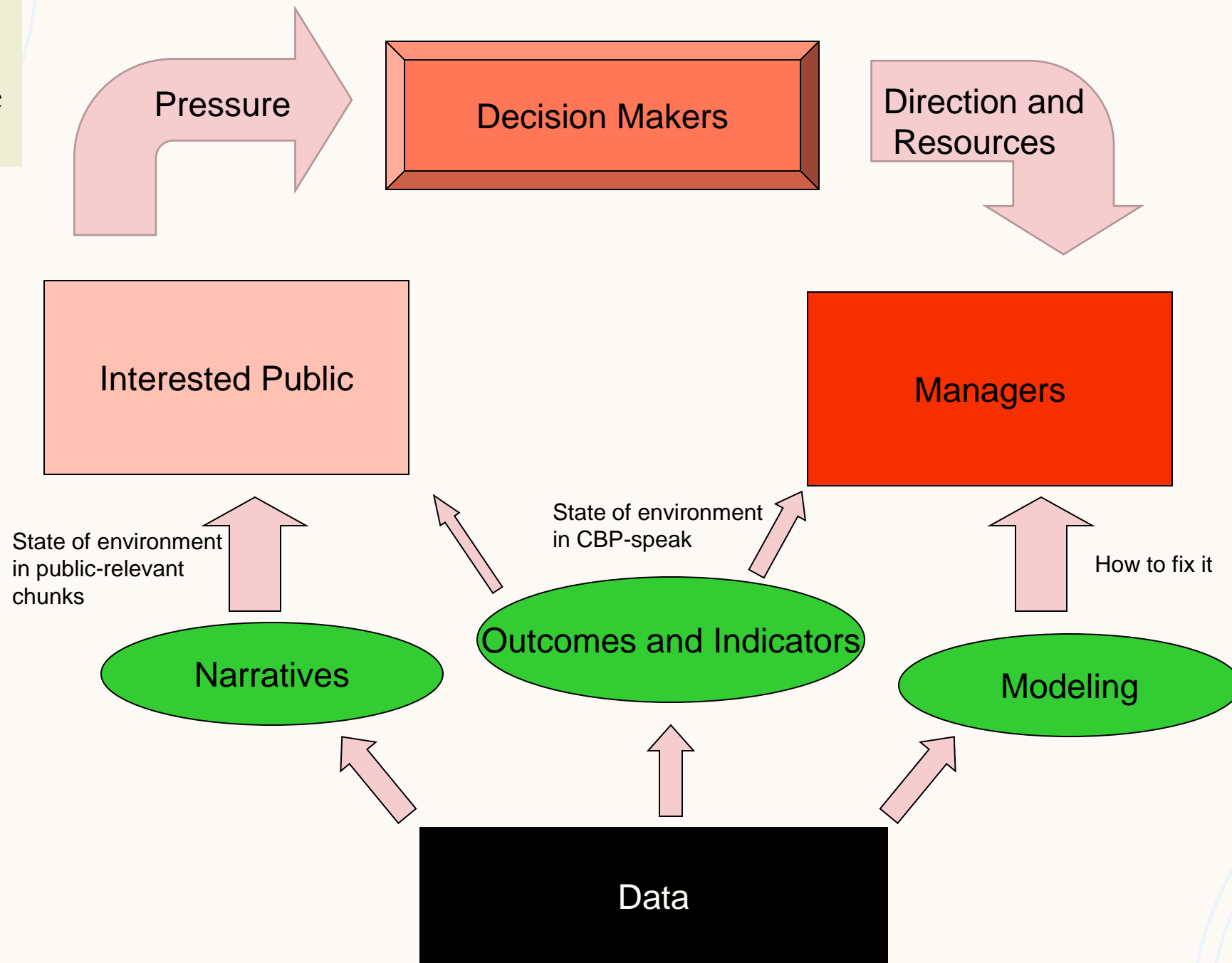presence and effects of
legacy nutrients and
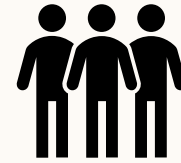sediment?

3 CONCEPTUAL MODELS

ITAT/Factors 10/25/2023

Box's famous quote applies to conceptual models as well

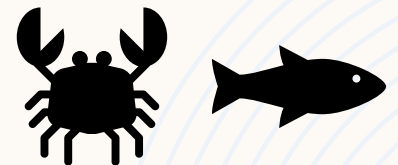Model 1
How does this create change in the environment?

Pressure

Decision Makers

Direction and Resources

Interested Public

Managers

State of environment in public-relevant chunks

State of environment in CBP-speak

How to fix it

Narratives

Outcomes and Indicators

Modeling

Data

Management questions

Human actions

Local outcomes

Tidal outcomes

Model 2
Question/Analysis mismatch

Management questions

Weather

Local landscape

Human actions

Local outcomes

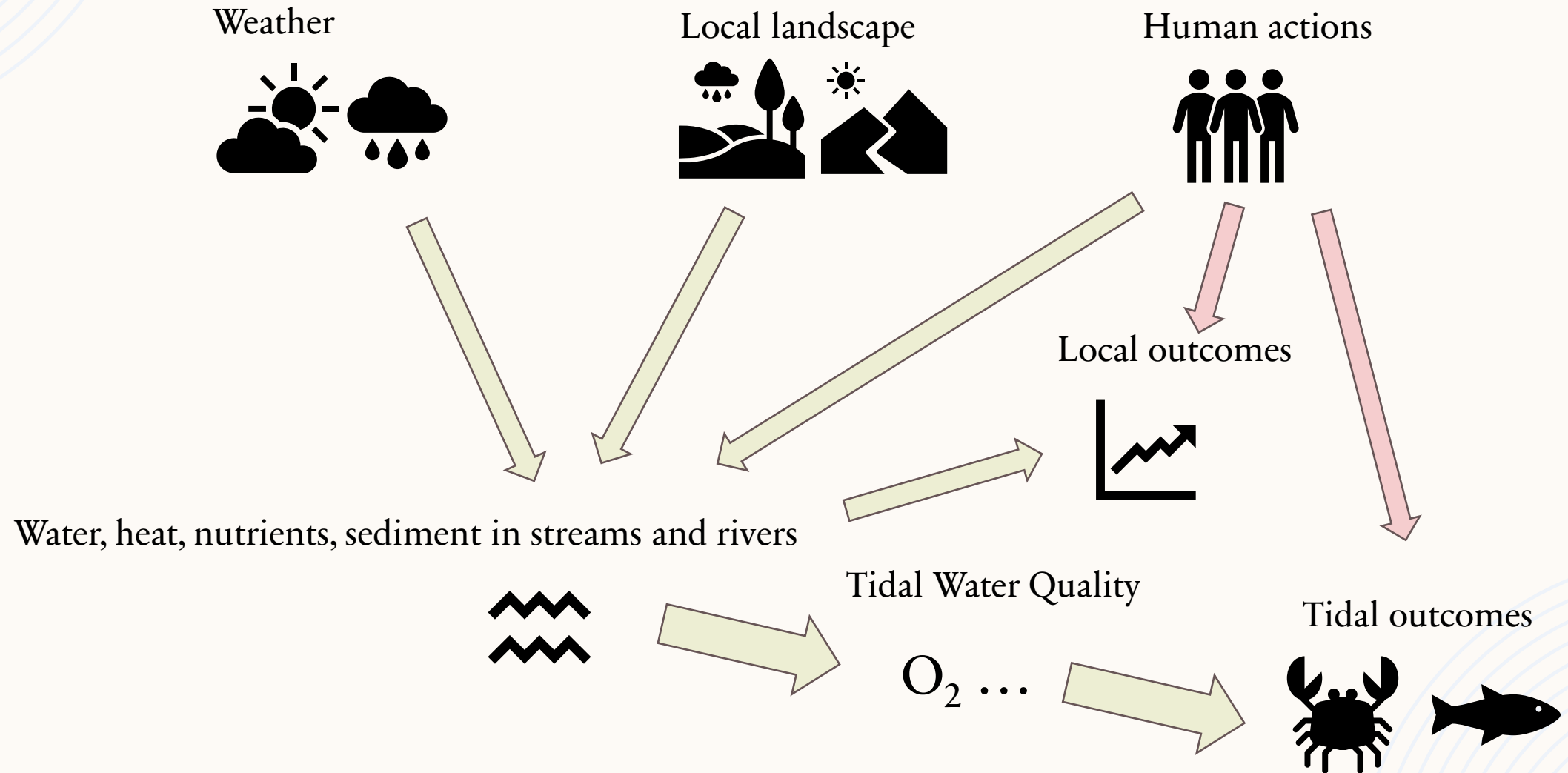Water, heat, nutrients, sediment in streams and rivers
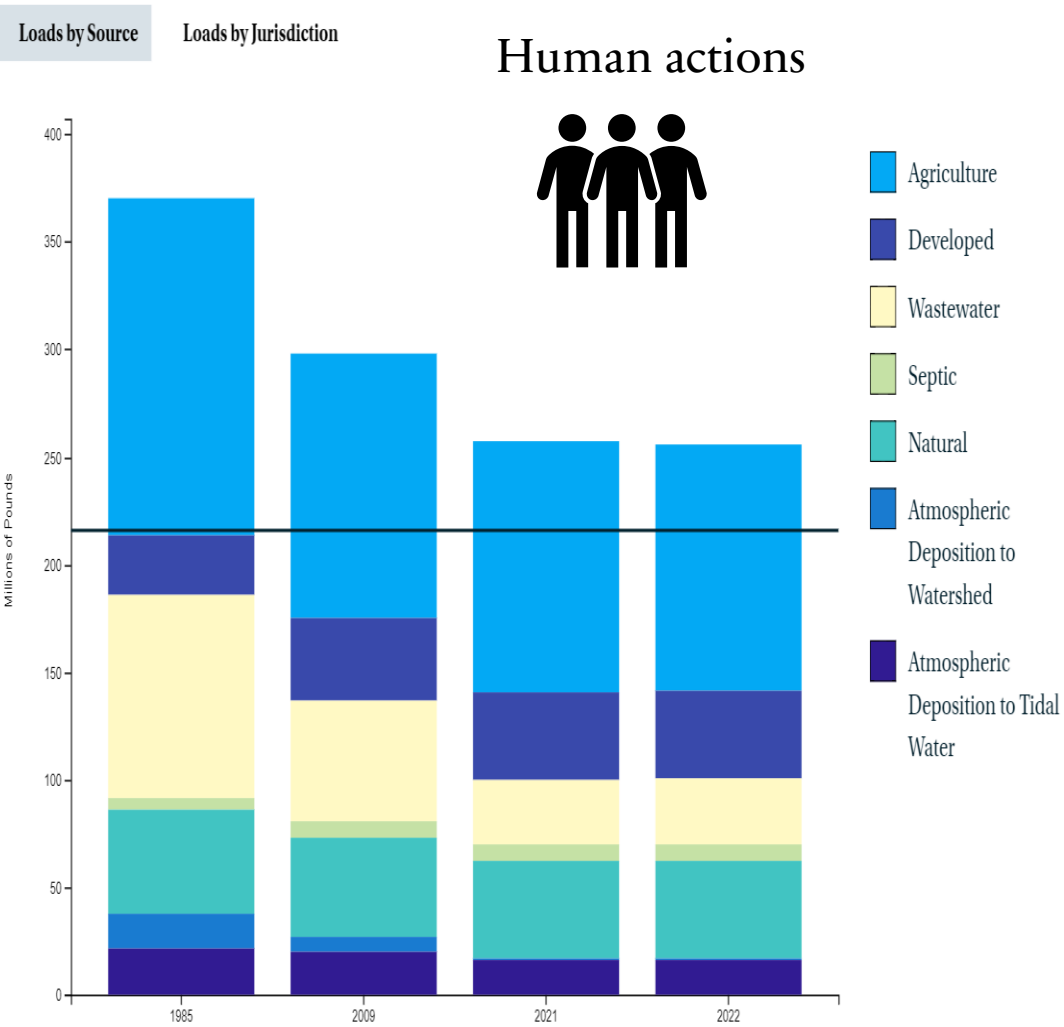
Tidal Water Quality

O_2 …

Tidal outcomes

Modeled Nitrogen Loads to the Chesapeake Bay (1985-2022) ◢

Loads simulated using CAST-19 and jurisdiction-reported data on wastewater discharges. *The natural sector includes, in part, forests and wetlands which are preferable land use types with the lowest loading rates among sources.

VIEW CHART   VIEW TABLE

Loads by Source   Loads by Jurisdiction

Human actions

Legend:
- Agriculture
- Developed
- Wastewater
- Septic
- Natural
- Atmospheric Deposition to Watershed
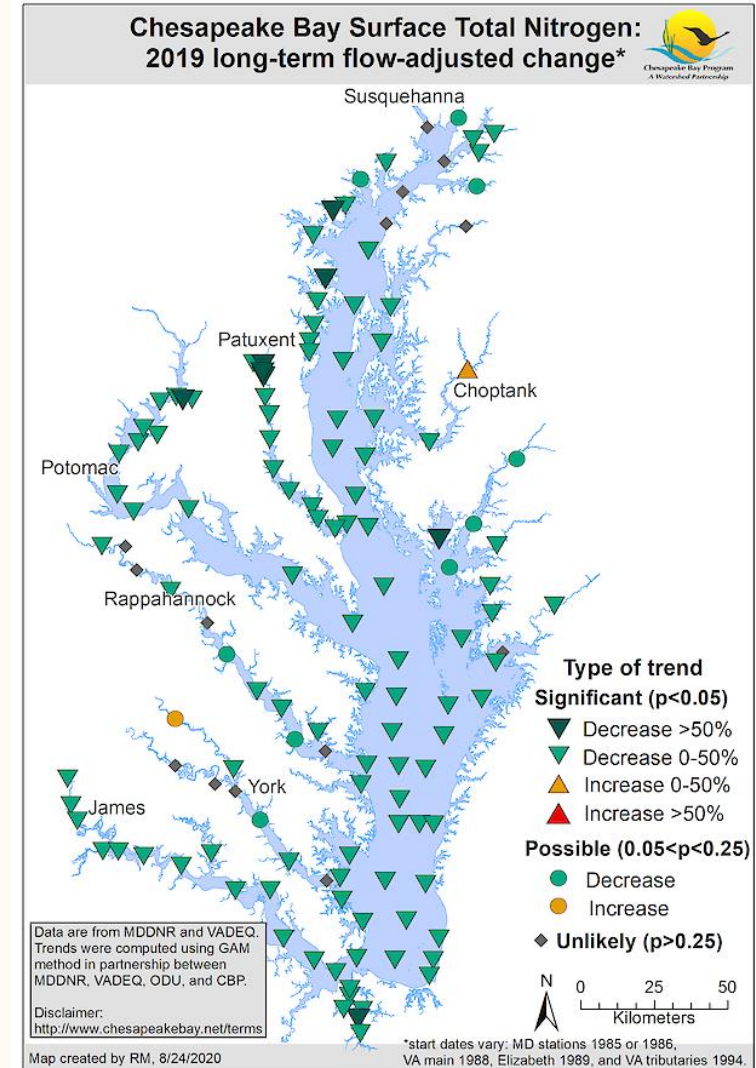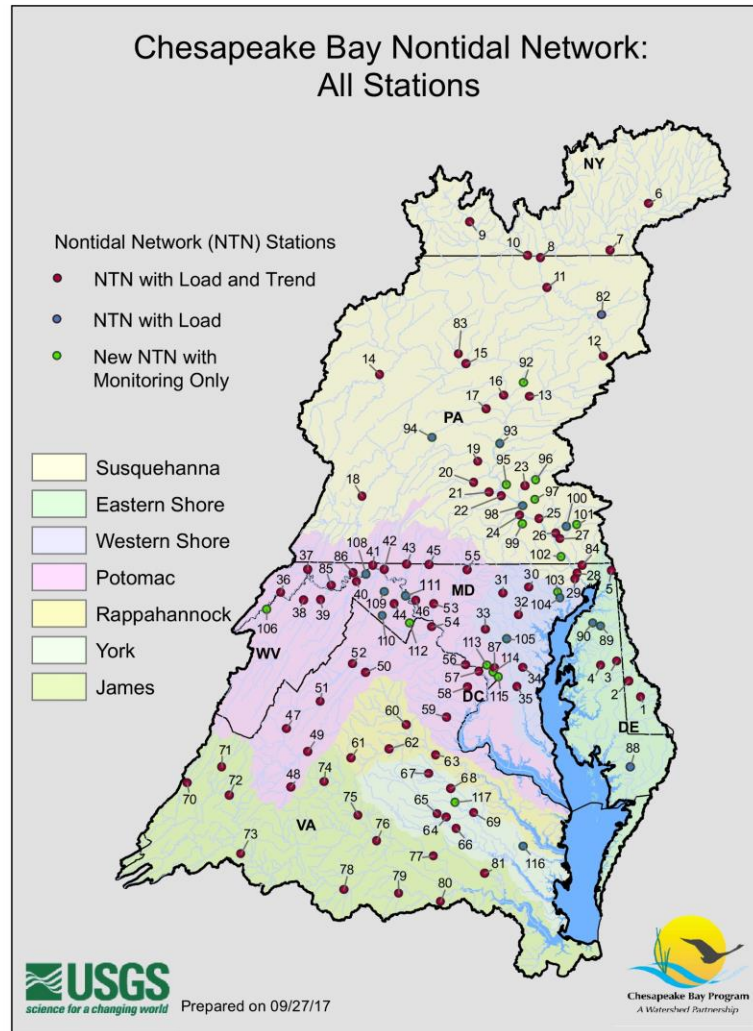- Atmospheric Deposition to Tidal Water

Water Quality Standards Attainment (1985-2021) ◢

Water quality is evaluated using three parameters: dissolved oxygen, water clarity or underwater grass abundance, and chlorophyll a (a measure of algae growth).

VIEW CHART   VIEW TABLE

Tidal Water Quality

$O_2 \ldots$
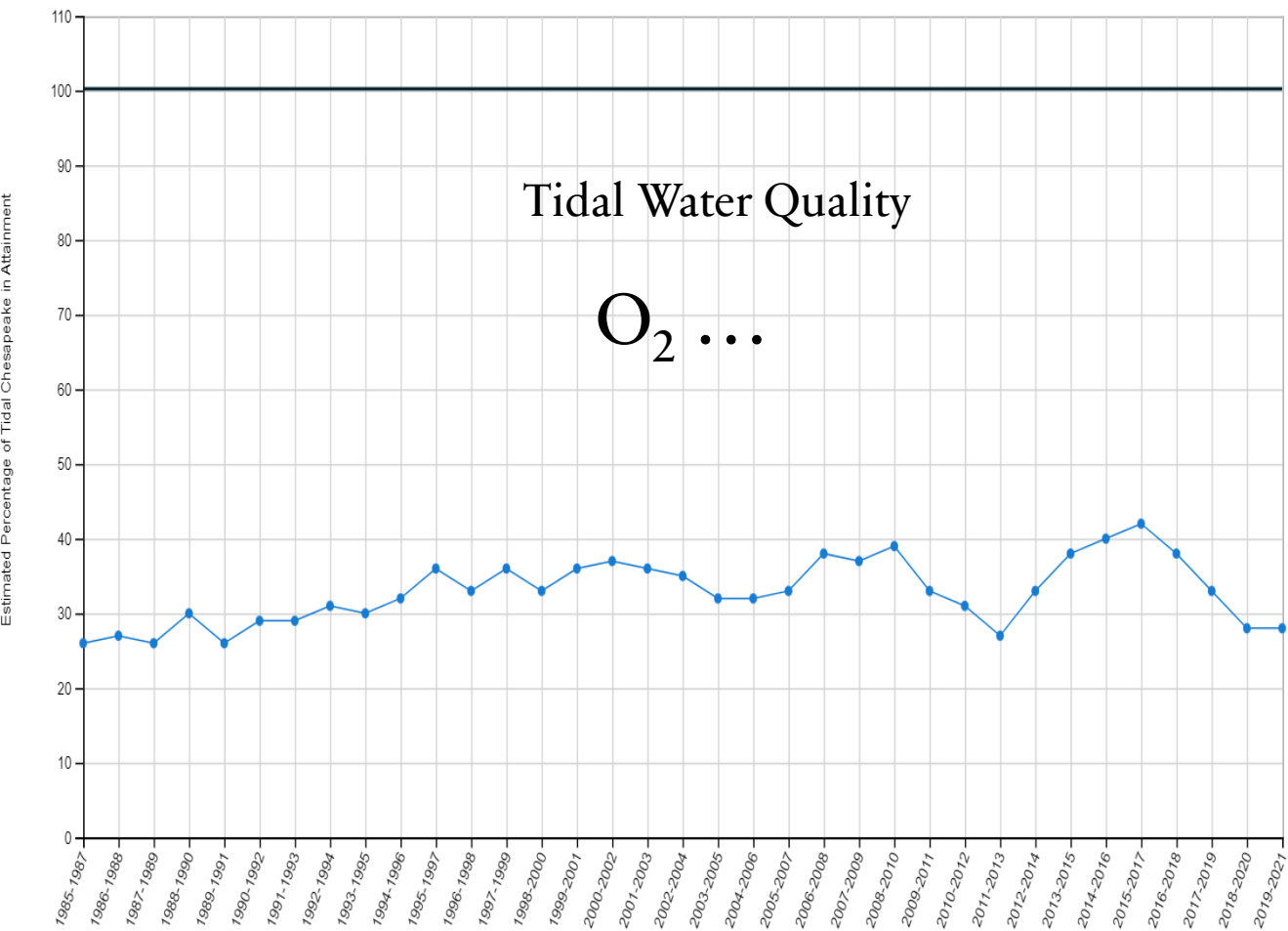
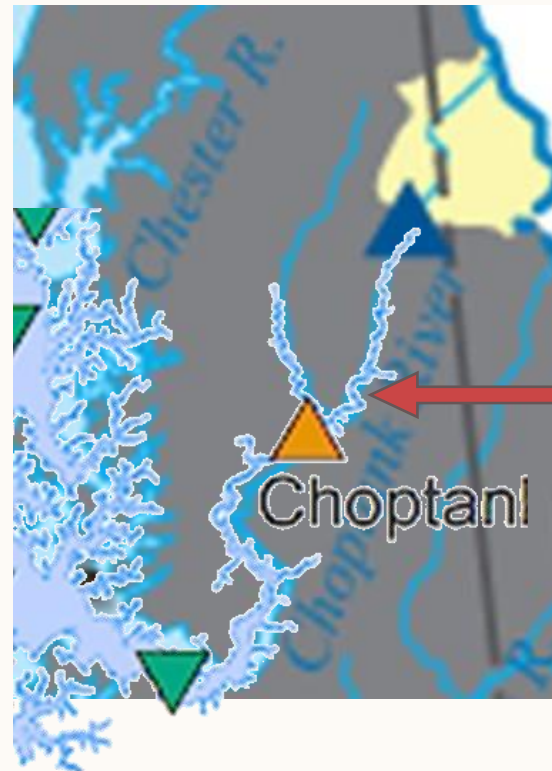# CADILLAC OF MONITORING PROGRAMS

CESR

A Comprehensive Evaluation of System Response

Model 3
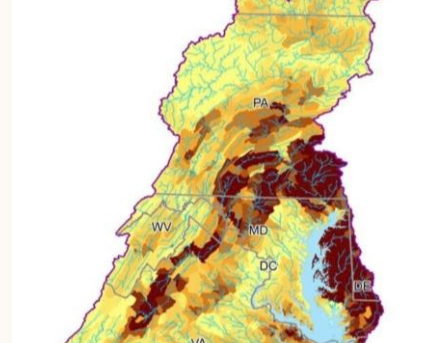Triblets

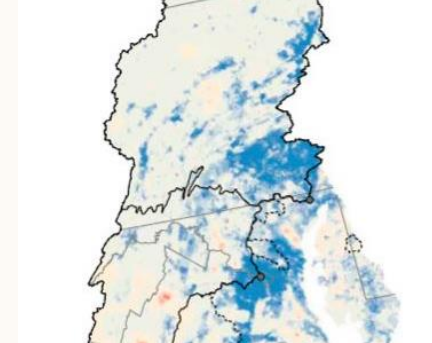"The Triblet Connection" –
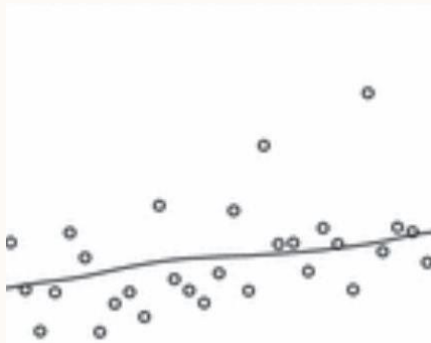STAC workshop 2018

METHODS

CAST

ESTUARY MODEL

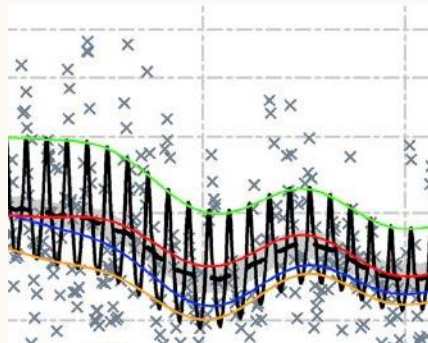**SPARROW**
Watershed Transport

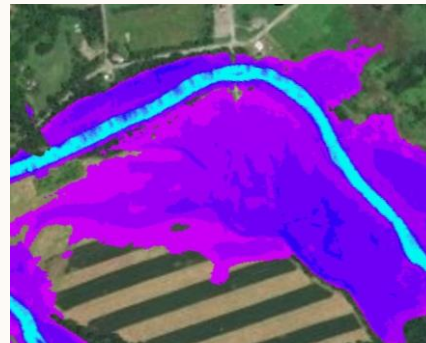**SWAN**
Accumulated Net Effect

WRTDS
Flow Normalized Trends

GAMS
Additive Non-Linear Covariates

FACET
Floodplain and Channels

AI/Machine Learning
Random Forest
SEMs
Bayesian Hierarchical Models
Seasonal Mann Kendal
Groundwater Modeling
Geochemical Modeling
Dynamic/CTM SPARROW

OTHER
Current and Future

BREAKOUTS

Questions to Consider:

- What research questions arise from the trends?

- What are some next studies to implement?

- What resources could be used to support a science need?

- How can we better integrate tidal/non-tidal trends?

- Any hypotheses are you considering?

SCIENCE TO INFORM MANAGERS

- Lightening Examples (5 min each)

- Guided Discussion

  - Denise Coleman (NRCS) for a federal perspective

  - Kristin Wolf (PADEP) for state perspective

  - Adrienne Hobbins (Ches Conservancy) for NGO

  - Karen Karrh (ShoreRivers) for tidal perspective.

FUTURE DIRECTION