Chesapeake Bay Program
Science. Restoration. Partnership.

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How Monitoring Data Informs CAST

Agriculture Workgroup

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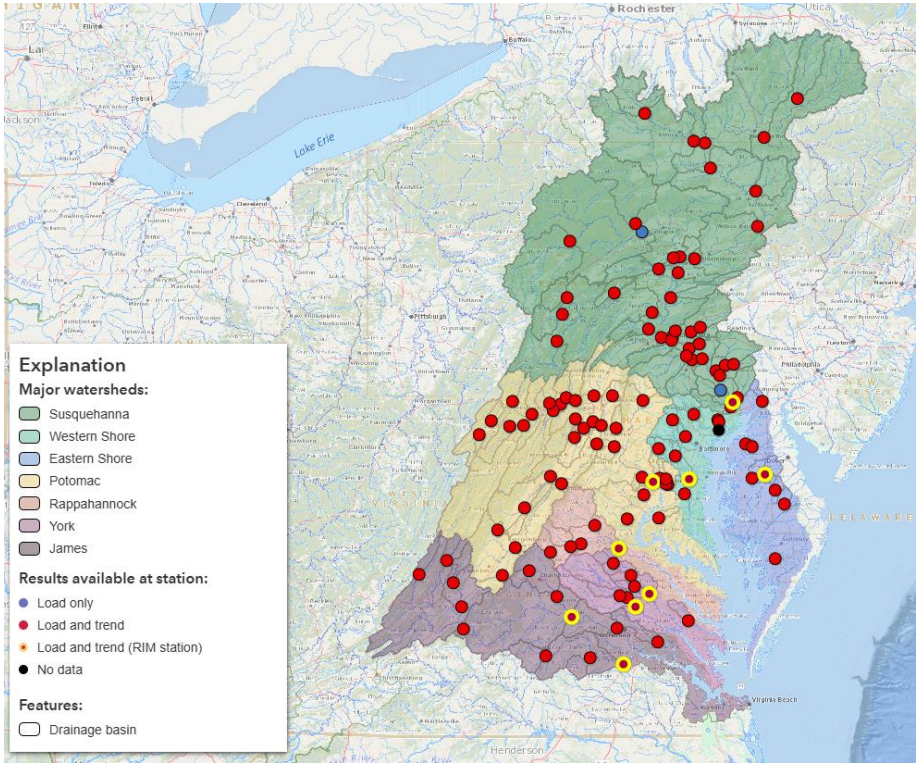
Introductions

Olivia Devereux
she/her

Olivia is an environmental scientist with expertise in developing management systems that enhance, maintain, protect, and improve land and water resources. Such systems track stormwater projects through the lifecycle of plan submittal, design, construction, fees, permits, inspections, post-construction maintenance, and reporting. She is an expert in developing linked watershed and BMP modeling systems. She has performed water quality assessments and facilitated environmental planning efforts. She is the scientific lead in developing CAST and was the scientific lead in developing the first Chesapeake Bay Program Scenario Builder, the system that distributes nutrients to the land and was used to create inputs to the Phase 5.3 Watershed Model. She also has played a key role in other environmental planning and modeling initiatives.



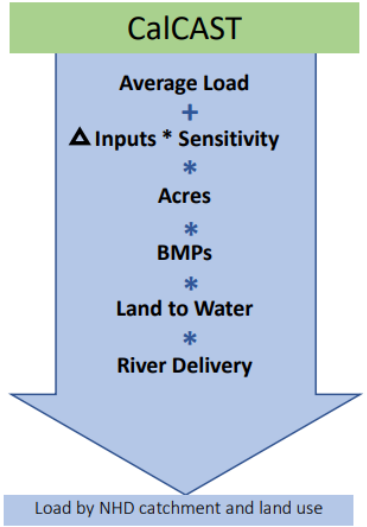
https://va.water.usgs.gov/geonarratives/ntn/

CAST is developed by calibrating to the monitoring stations

Total Nitrogen - Inputs

The following P6 inputs were downscaled from CAST to NHDPlus catchment scale (thank you **Jess Rigelman** and **Olivia Devereux**!):

- Atmospheric Deposition
- Crop Cover
- Fertilizer
- Manure
- Nitrogen fixation
- Plant Uptake
- Direct Deposit on pasture
- Riparian Pasture Deposition
- Rapid Infiltration Basins
- Feeding Space
- Biosolids
- Wastewater
- CSO
- Septic



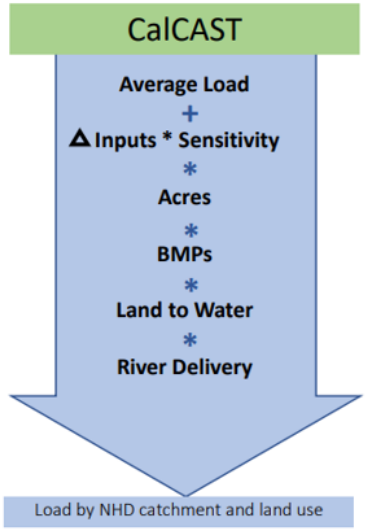
Downscaling methods based on Devereux et al. 2022 (with modifications)
https://www.sciencebase.gov/catalog/item/60be31b3d34e86b938910b2f

Slide from Isabella Bertani

Total Phosphorus - Inputs

The following P6 inputs were downscaled from CAST to NHDPlus catchment scale (thank you **Jess Rigelman** and **Olivia Devereux**!):

Soil P
Water Extractable P
Fertilizer
Sediment loss (RUSLE)
Stormflow (from Stormflow-CalCAST)
Riparian Pasture Deposition
Rapid Infiltration Basins
Feeding Space
Wastewater
CSOs
Atmospheric Deposition (on water bodies)



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Slide from Isabella Bertani

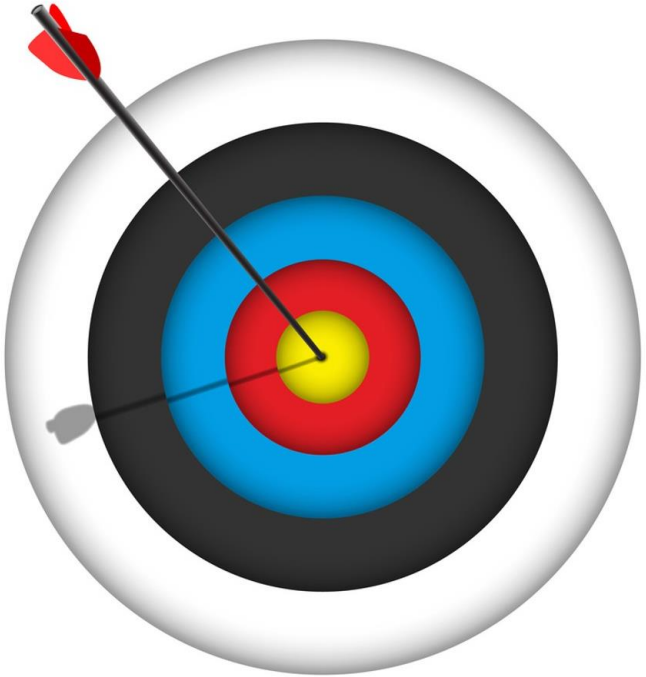
Purpose of a Model

- The monitoring Non-Tidal Network (NTN) measures the concentration of N, P, S and flow in waterbodies
- Monitoring data does not directly indicate the source of the N, P, or S
- Monitoring data does not directly separate the load by whether it is impacted by a BMP or not

- Models help identify the sources of N, P, and S based on additional information used as model inputs
- CAST accounts for the expected effect of management practices

- The monitoring data are used to calibrate the model. CAST is calibrated; other models do not even have a calibration dataset.
- Modeled loads are subject to modification through the calibration process
- The total load modeled matches the monitored load, accounting for hydrological shifts over time and spatial variability

Role of Targets in Calibration



- Used to calibrate the land use runoff rates in CAST

Initial calibration load = target * BMPs * land to stream to river delivery

Target = literature target + ∑(Sensitivity(input – average))

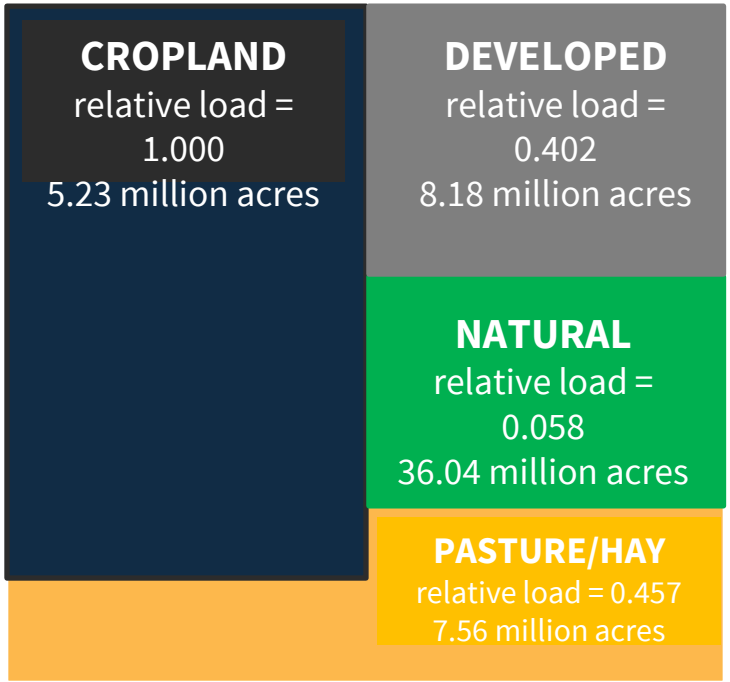
- Data needed for targets
  - Measured load
  - Relative rates for major land use groups
  - Relative rates for land uses within a major land use group
  - Acres for Phase 6 land uses
  - Inputs to the model by land use and land segment
  - Sensitivity of nutrient export to inputs

Three Aspects Anchor the Nutrient Targets to Data

The first anchor to the data is the use of the observed long-term 1985 – 2024 NPS loads as represented by this box.

Total average TN or TP loads minus point source, septic, atmospheric deposition to water, and animal feeding operations.

Second Anchor to the Data: Multiple Models Set the Relative Loads



These Phase 6 Data show the 4 major sectors

Third Anchor to the Data:

Expert Groups Set the Relative Loads of the Land Uses within Each Major Land Use Group

These Phase 6 Data show the 4 major sectors plus the individual load sources in each sector

CROPLAND
relative load = 1.000
5.23 million acres

DEVELOPED
relative load = 0.402
8.18 million acres

NATURAL
relative load = 0.058
36.04 million acres

PASTURE/HAY
relative load = 0.457
7.56 million acres

Thank you!

Any questions?
You can contact me at
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