Land to Water Factors

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Urban Stormwater Workgroup Meeting

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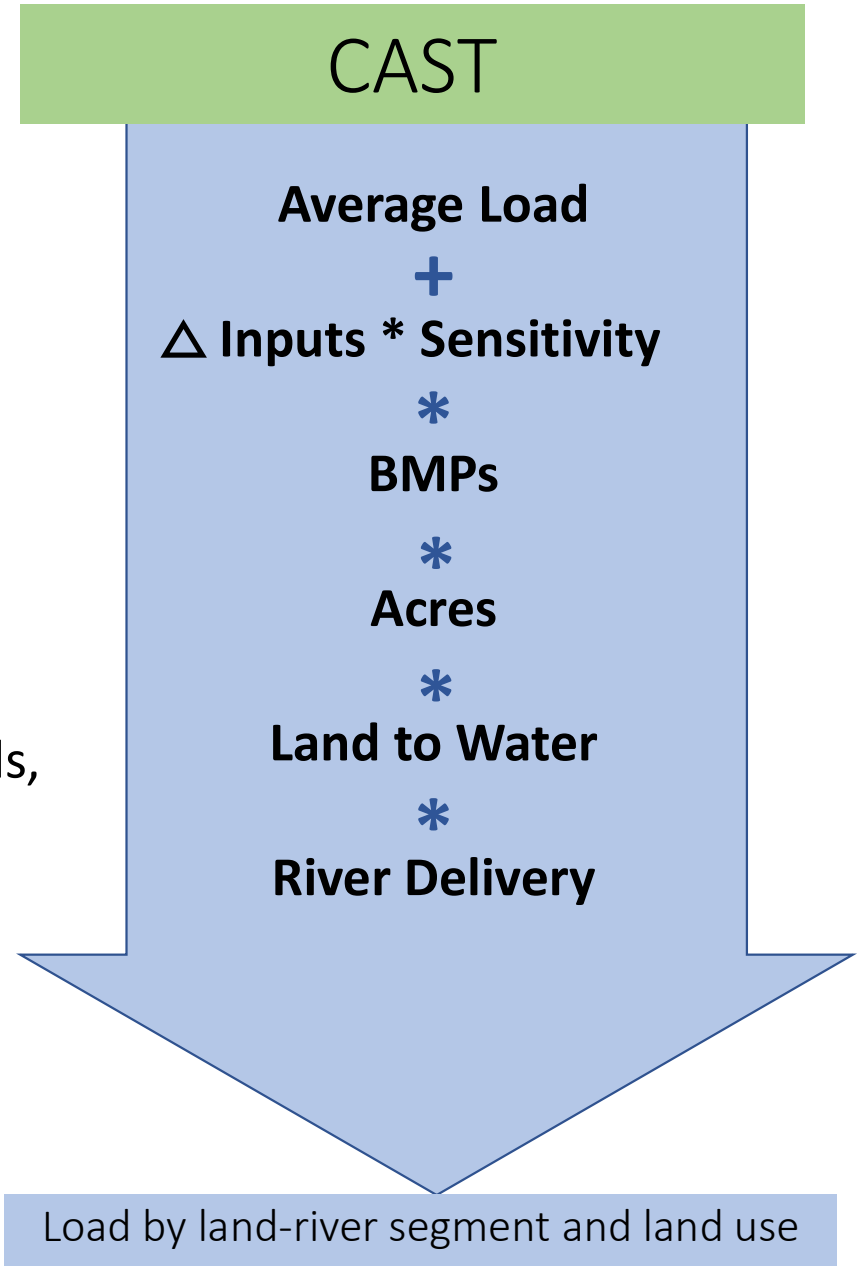
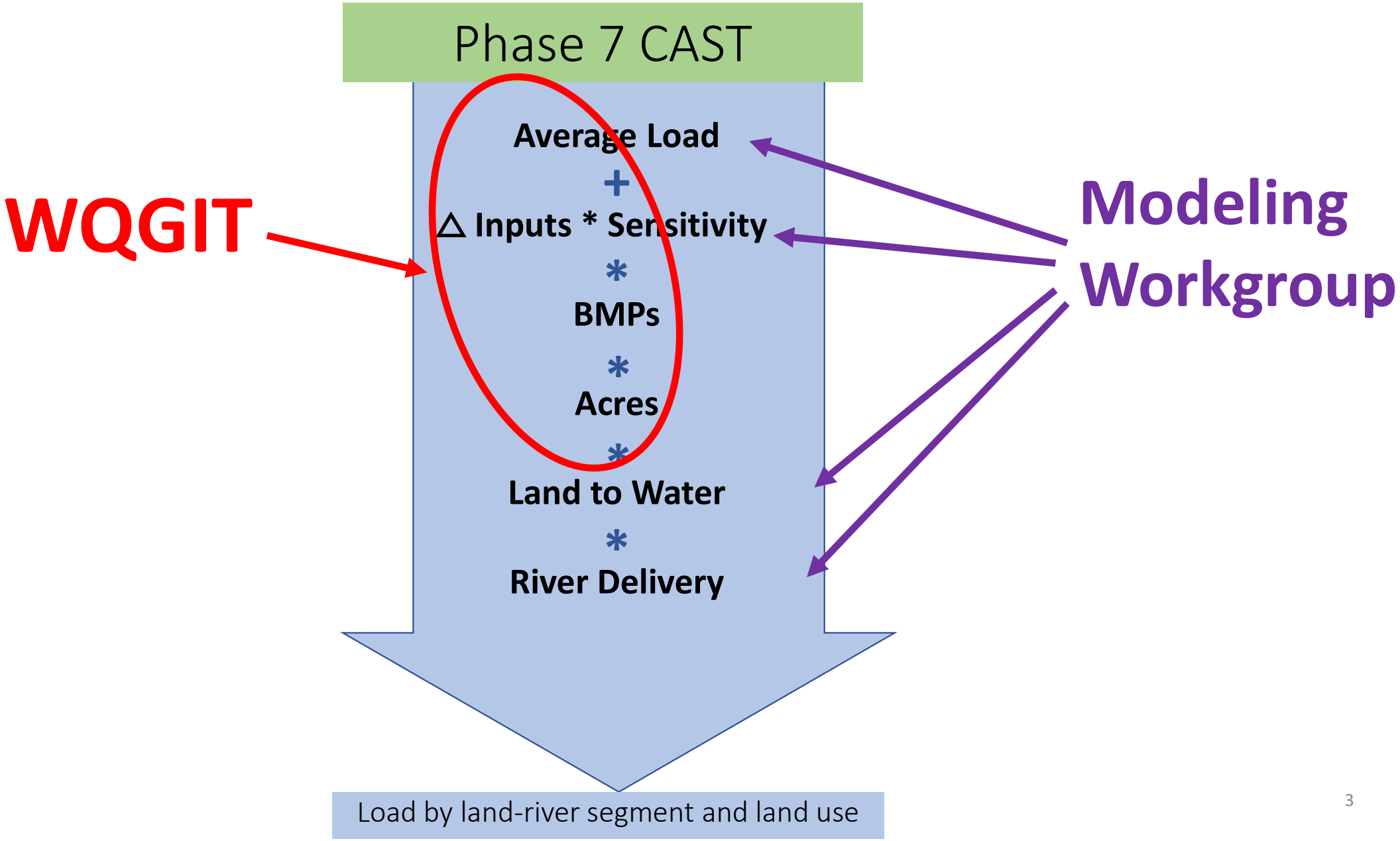
Chesapeake Assessment Scenario Tool (**CAST**)

- Time-averaged (1991-2000 hydrology)
- Deterministic
- Main use: Management/scenario assessment

- In P6, model coefficients were informed by multiple lines of evidence (e.g., multiple models, literature reviews, expert panels)



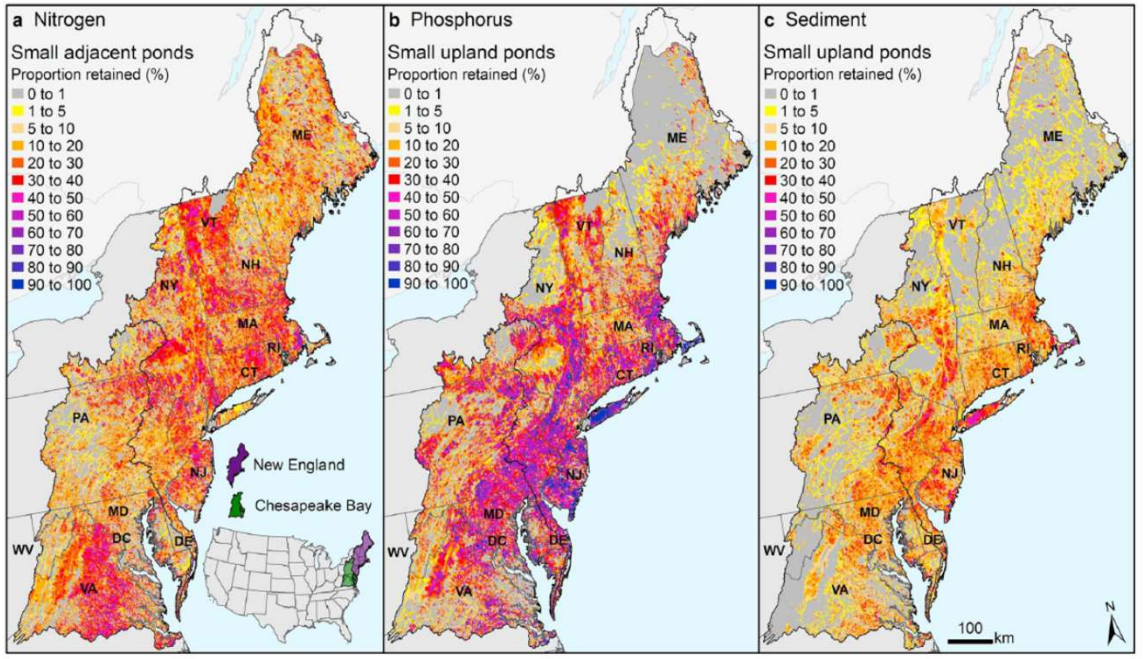
https://cast.chesapeakebay.net/Documentation/


Phase 7 CAST
Average Load
+
Δ Inputs * Sensitivity
*
BMPs
*
Acres
*
Land to Water
*
River Delivery
WQGIT
Modeling Workgroup
Load by land-river segment and land use

Land to water factors

Variables that represent how physical watershed characteristics affect spatial variability in load transport and delivery

For example, regions of the watershed with larger pond density may be more efficient at retaining nitrogen, phosphorus, and/or sediment



Schmadel et al., 2019

Figure 2. Proportion of nitrogen, phosphorus, and sediment source retained by small ponds in the Northeastern United States. Small adjacent ponds are significant mass sinks for (a) nitrogen while small upland ponds are significant mass sinks for (b) phosphorus and (c) sediment.

Land to water factors in P6

In P6, land to water factors affecting nitrogen and phosphorus load delivery across the Bay watershed were identified using the SPARROW* model

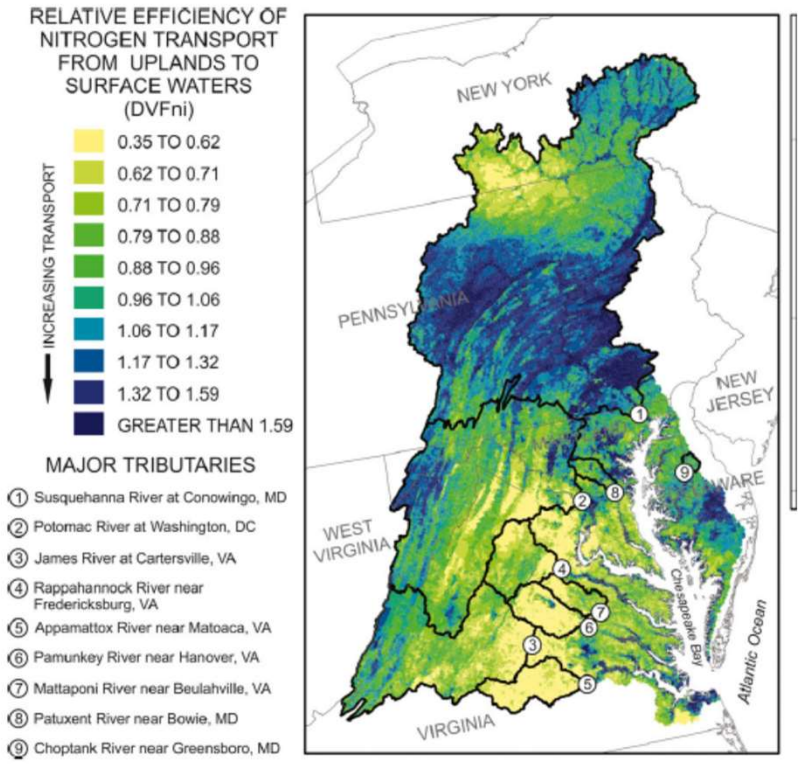
Figure 1: The SPARROW model relates measured nutrient flux (i.e., monitoring points A and B) in rivers and streams to watershed characteristics associated to nutrient sources (point and diffuse) and to nutrient mobilization and decay processes (land-to-water delivery and in-stream decay).

SPARROW = Spatially Referenced Regression on Watershed Attributes

Ator, S.W., Brakebill, J.W., and Blomquist, J.D., 2011, Sources, fate, and transport of nitrogen and phosphorus in the Chesapeake Bay watershed: An empirical model: U.S. Geological Survey Scientific Investigations Report 2011–5167, 27 p.

Land to water factors in P6

Nitrogen	**Effect on load delivery**
• Groundwater recharge	enhancing
• Soil available water capacity	decreasing
• Piedmont carbonate lithology	enhancing
• Enhanced Vegetation Index	decreasing
Phosphorus	
• Well-drained soils	decreasing
• Soil erodibility	enhancing
• Coastal Plain region	enhancing
• Precipitation	enhancing

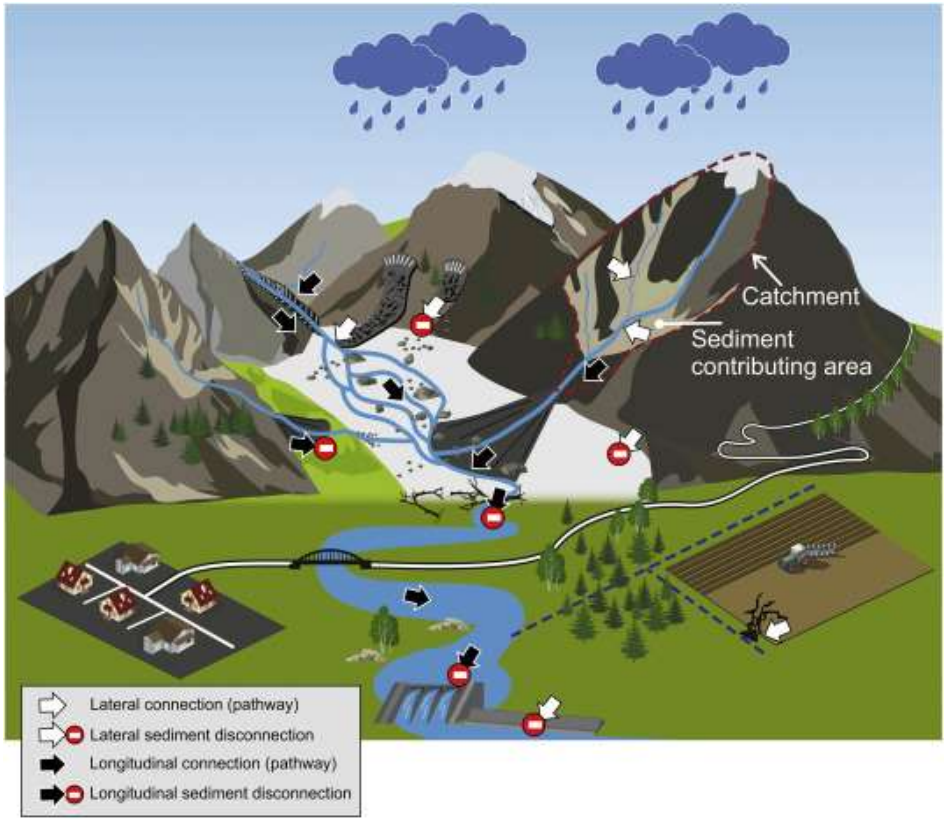


Ator et al., 2016

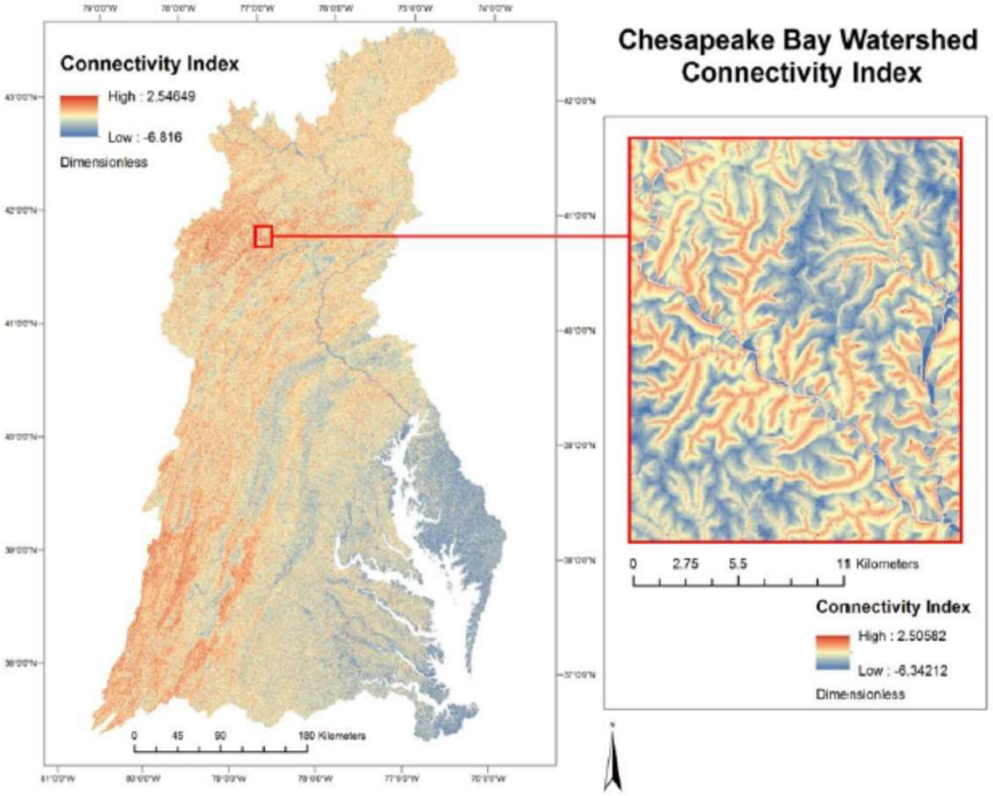
Land to water factors in P6

Sediment

- Measure of propensity of the landscape to transport sediment



Heckmann et al., 2018



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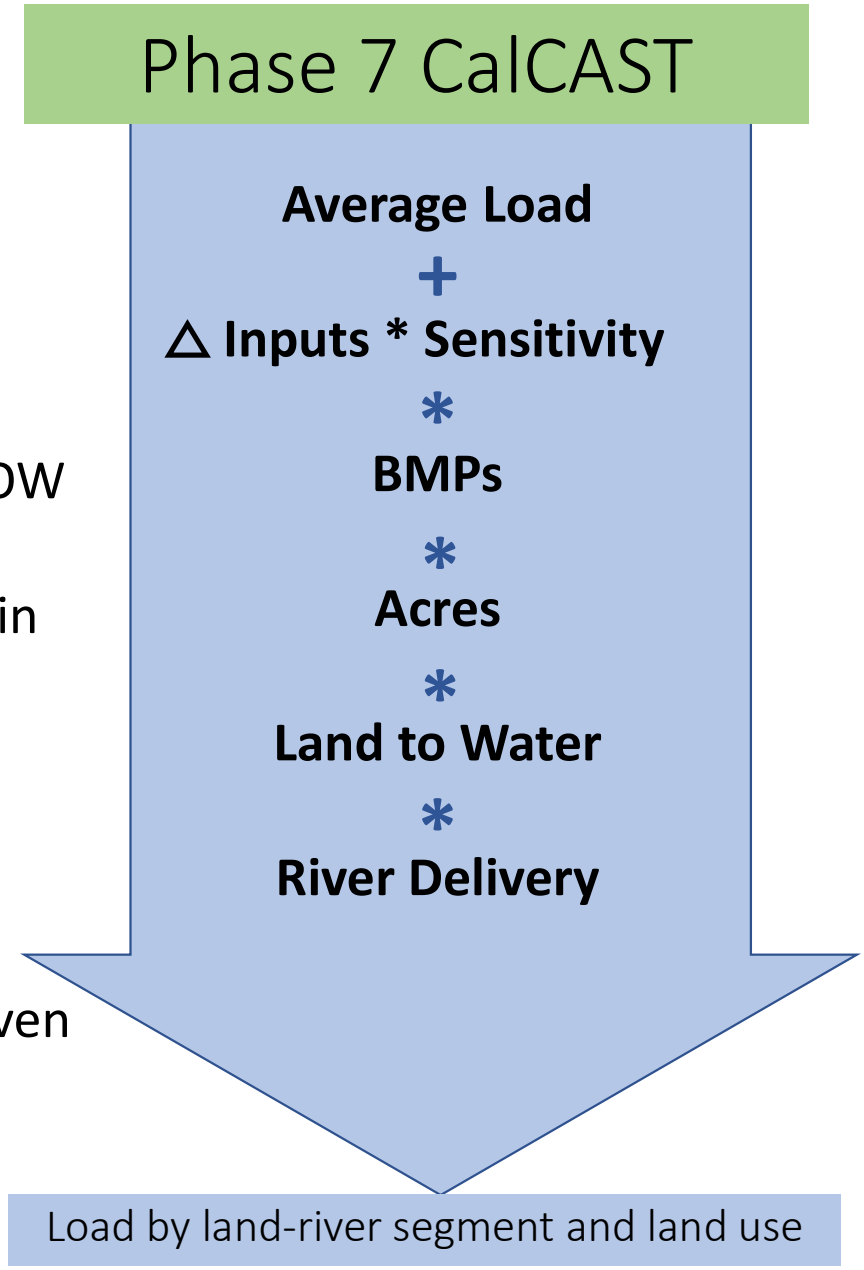
CalCAST (new to P7)

- Time-averaged and annual
- NHDPlus 1:100,000-scale
- Statistical model (Bayesian) inspired by SPARROW
- Main use: Calibration – probabilistically test hypotheses on factors driving spatial variation in contaminant loads within a formal statistical, largely data-driven framework

- Estimate coefficients that will inform CAST and the Dynamic Model through a largely data-driven approach (partially replacing multiple lines of evidence used in P6)



CalCAST (new to P7)

Input from the Urban Stormwater Workgroup on watershed processes/variables that may affect load delivery in urban areas and that we may want to test in CalCAST would be very welcome!