Preparing for Phase 7 Calibration: CalCAST Estimated Parameters

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4/7/2026

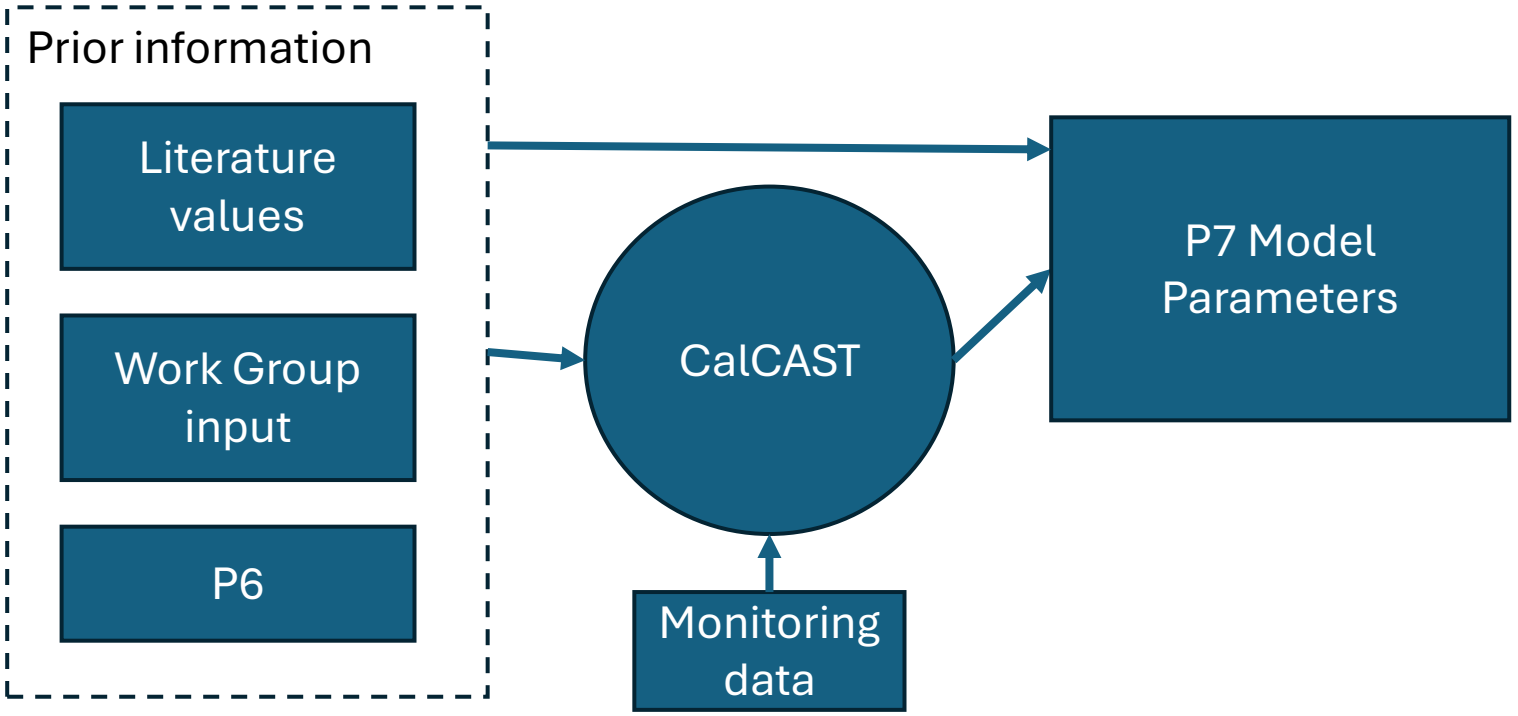
Agenda

- Review of CalCAST

- Review of all CalCAST estimated parameters for P7

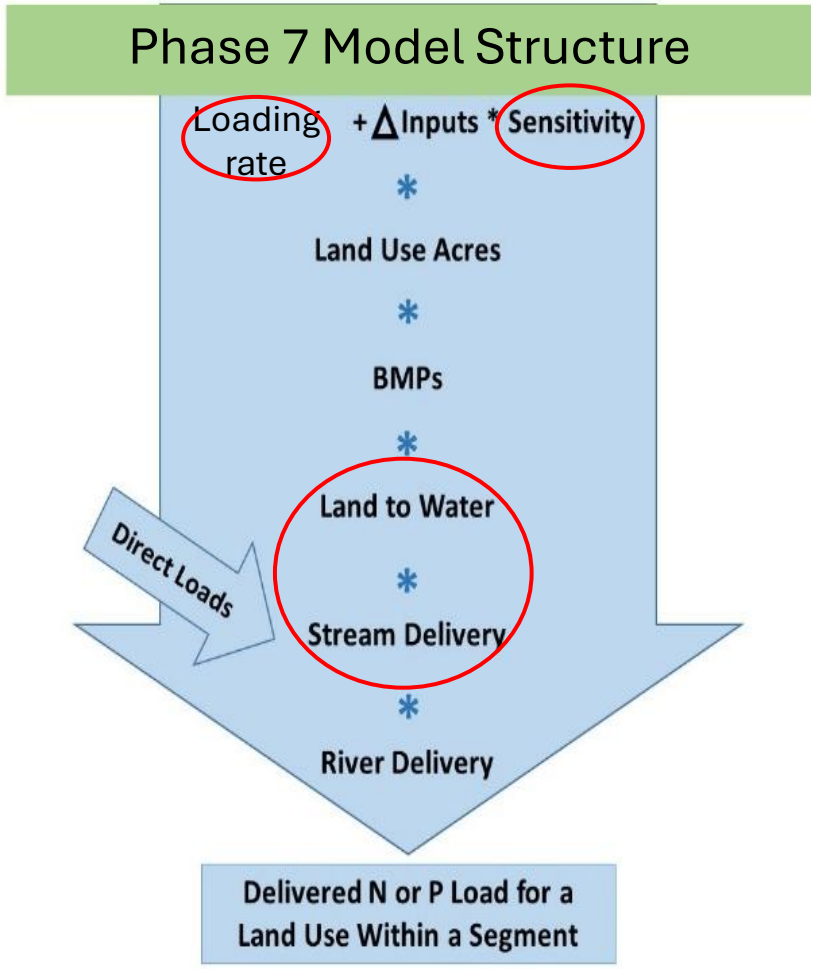
CalCAST: Quantifying P7 model parameters

Incorporate data-driven lines of evidence into modeling approach



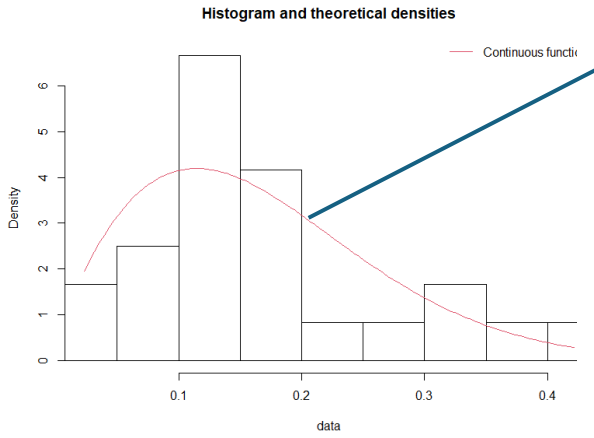
CalCAST: CAST represented in a framework for statistical calibration to monitoring data.

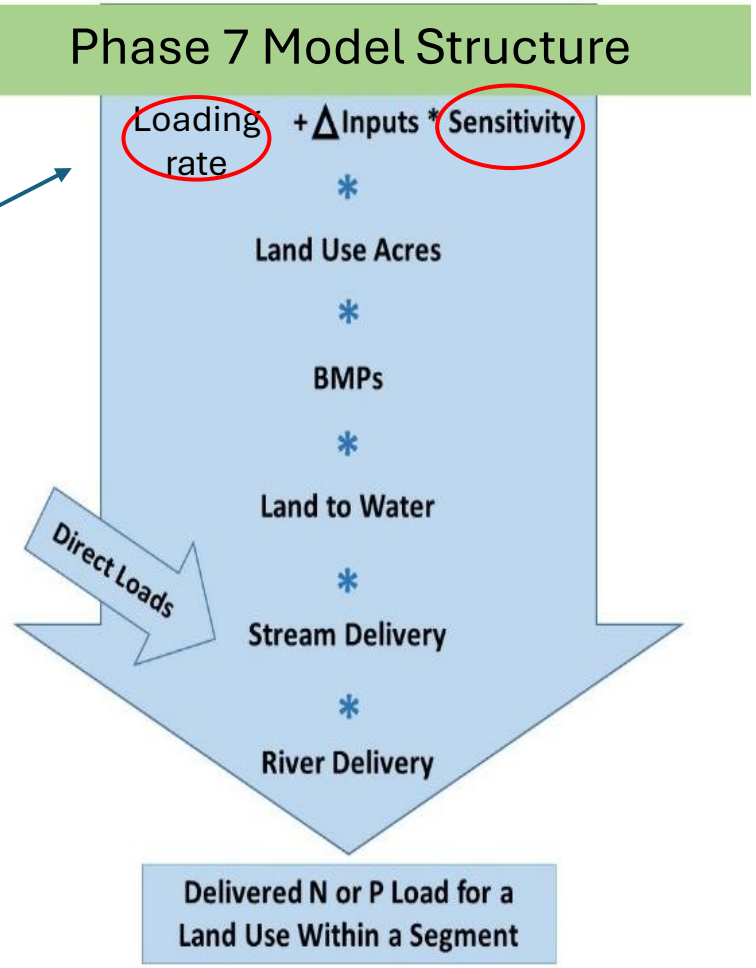
Calibrate loading rates, select sensitivities, and coefficients of delivery factors.



CalCAST: Utilizing prior information

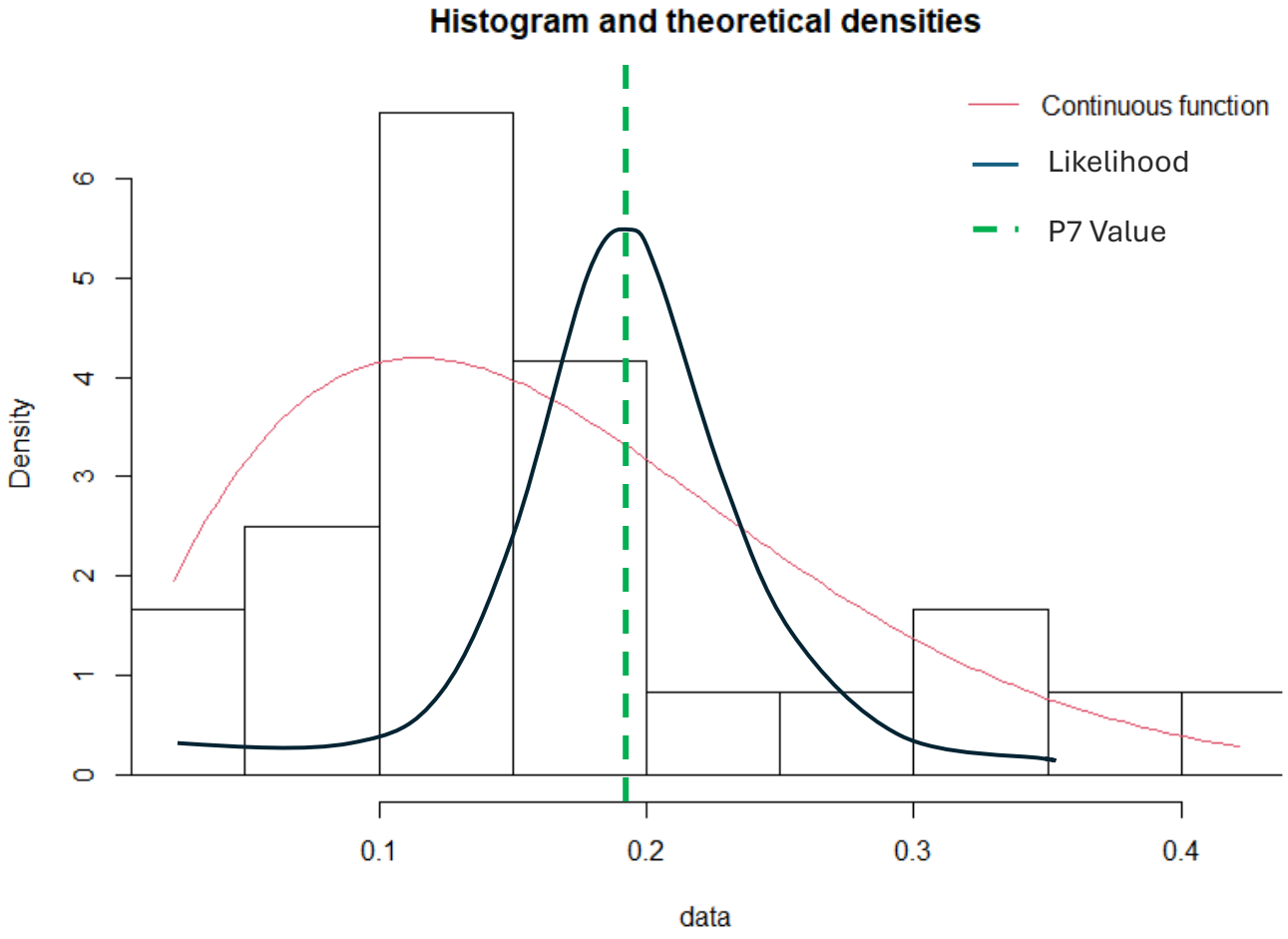
- Literature and modeled parameter values are summarized as a probability distribution.
- This distribution of values is randomly sampled hundreds of times to select values to run through CAST.
- Values are perturbed iteratively across multiple parameters hundreds of times within conditional bounds.





CalCAST: Utilizing prior information

- Literature and modeled parameter values are summarized as a probability distribution.
- This distribution of values is randomly sampled thousands of times to select values to run through CAST.
- Values are perturbed iteratively across multiple parameters hundreds of times within conditional bounds.
- How well each of these sets of values describes the observed monitoring data is defined and final parameter values are selected.



CalCAST: Utilizing prior information

- Relationships between parameters are defined or constrained by work groups (conditional data).

Example conditional data:

Loading ratios (e.g., grain w/ manure is 1.4* grain w/o manure)

$S_{(\text{harvested forest})} = \min(7*S_{(\text{forest})}, S_{(\text{construction})})$

Example: Test for total nitrogen

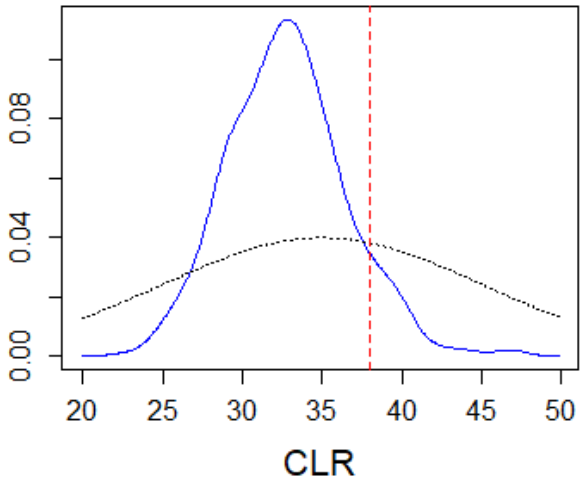
CLR = Average CROP loading rate (lbs/ac)

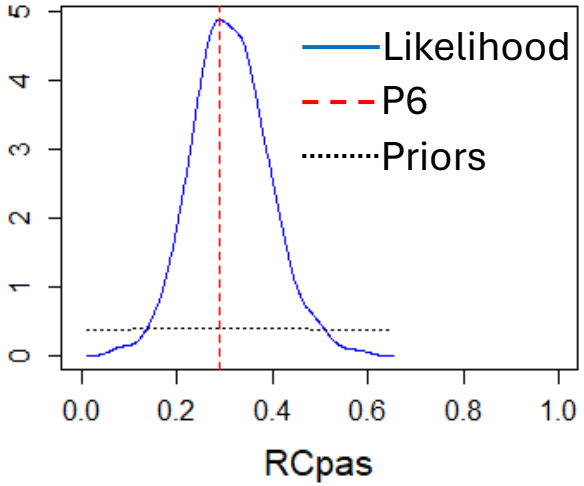
RCpas = Ratio of PASTURE loading rate to CROP loading Rate

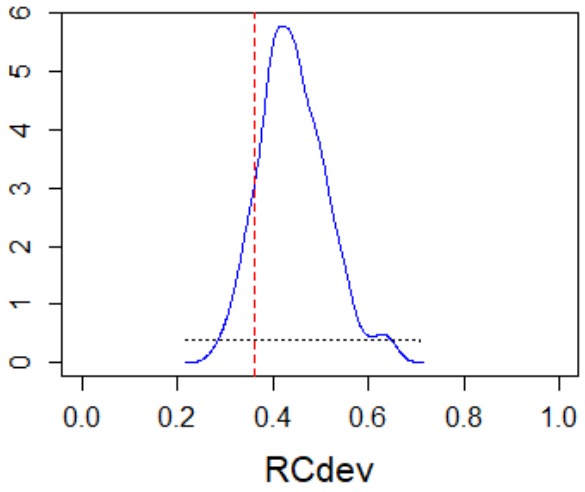
RCdev = Ratio of DEVELOPED loading rate to CROP loading Rate

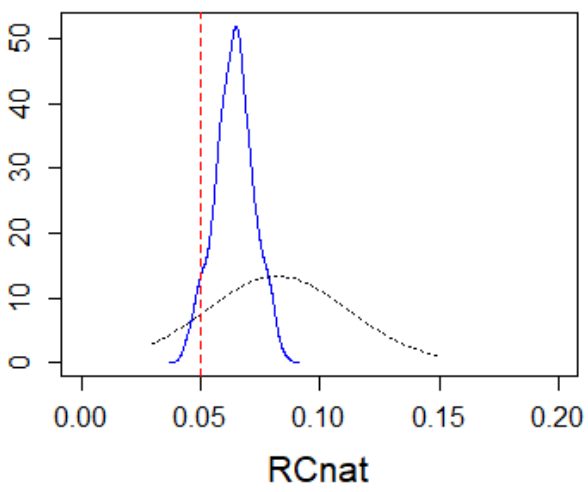
RCnat = Ratio of NATURAL loading rate to CROP loading Rate

Red dashed line = P6
Black dashed lines = P532, SPARROW, CEAP







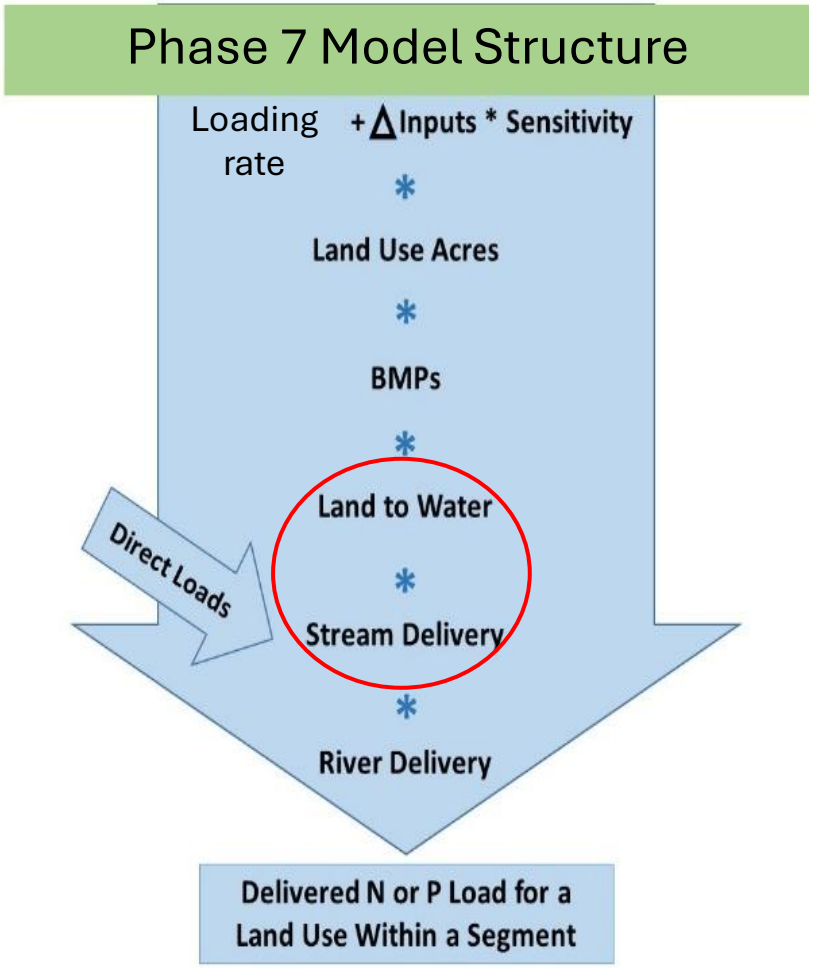


These values will change as CAST and inputs are updated.

CalCAST: Delivery factors

Delivery factors describe the transport and attenuation of nutrients and sediment from the edge of field to rivers and the Bay.

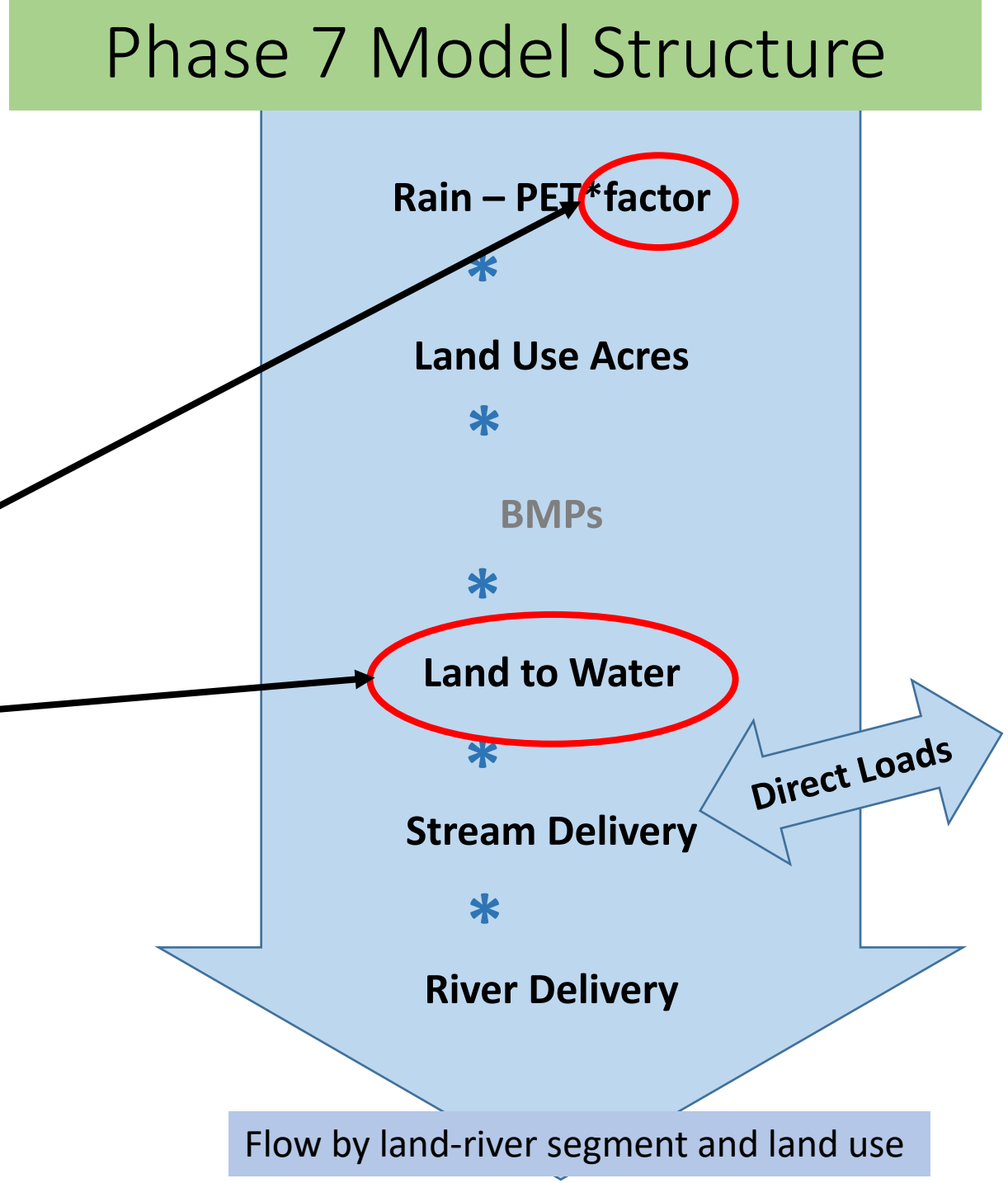
- P6 delivery factors were largely selected and parameterized by other models (SPARROW)
- In P7, CalCAST will allow us to directly test and parameterize delivery factors in CAST.
- This will allow more comprehensive representation of transport and attenuation.
- We have incorporated inputs from work groups, model review, STAC, and the literature to establish an expansive set of factors to test.
- **Includes two stages: feature selection and calibration**



Hydrology: Total Flow

Total long-term flow

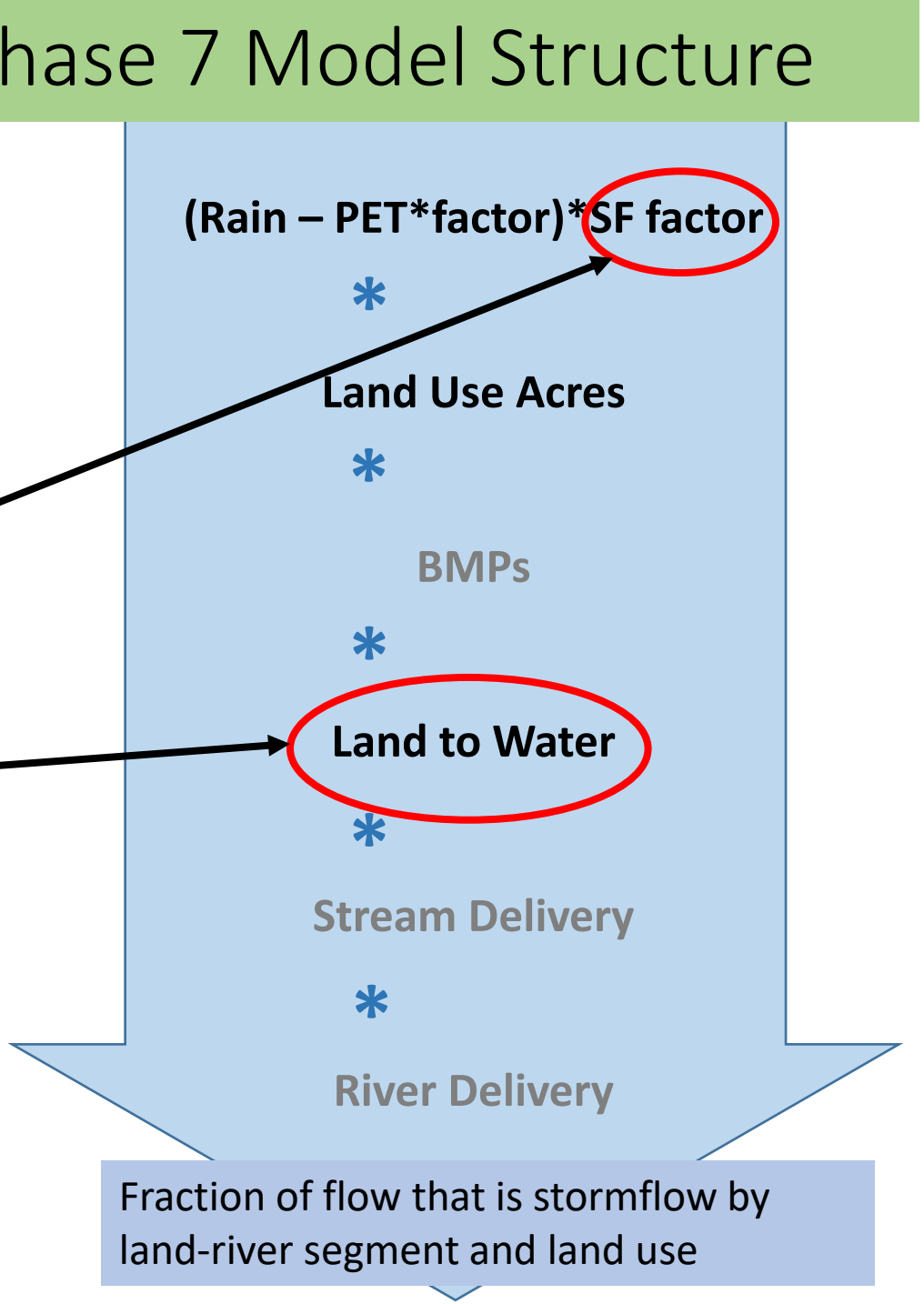
- Calibrated to 446 stations of 584 candidate stations
- Land use specific factor (by summary land uses)
- Delivery variance factor by model unit



Hydrology: Stormflow

Stormflow fraction

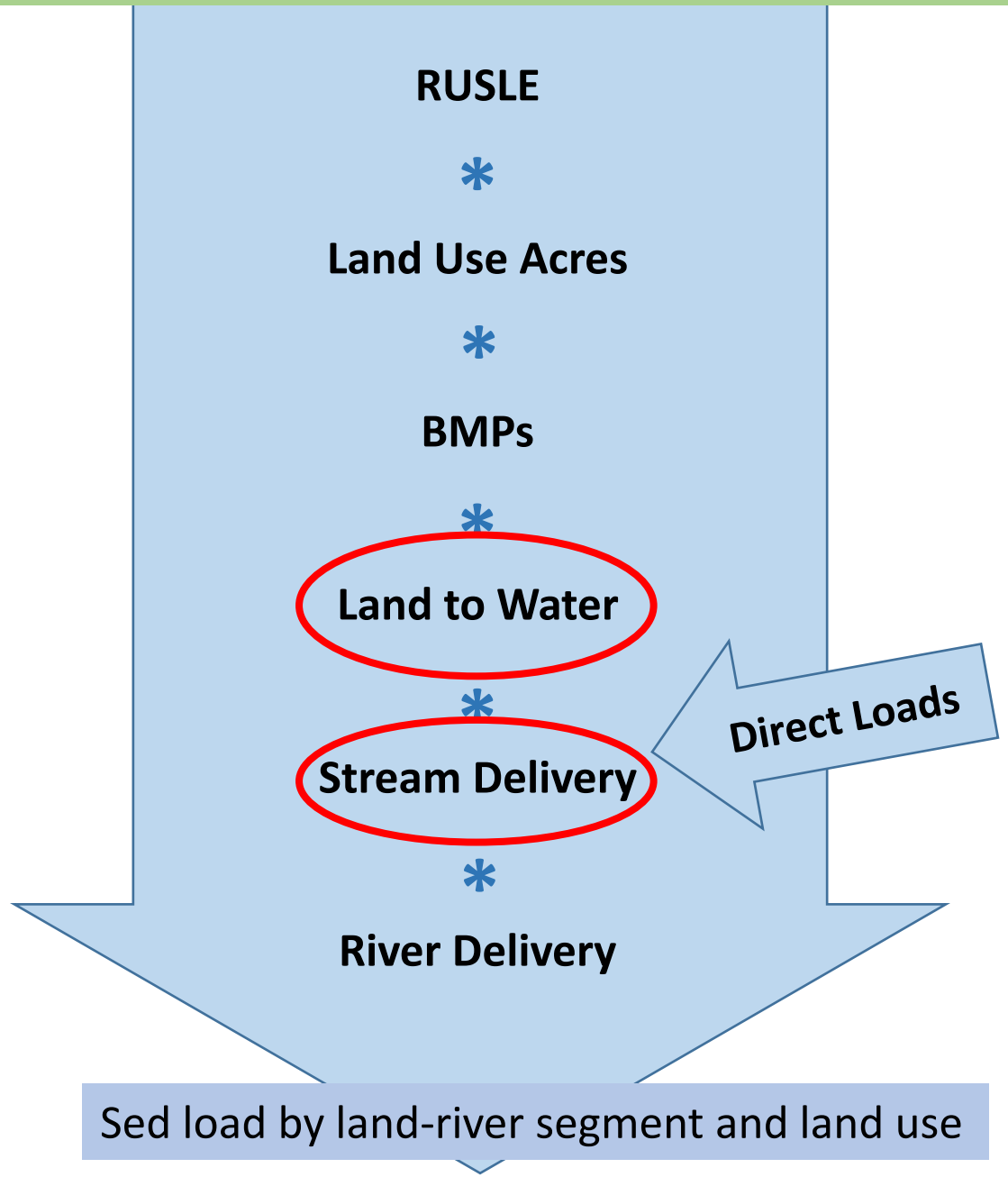
- Calibrated to 446 stations of 584 candidate stations
- Land use specific stormflow factor (by summary land uses)
- Delivery variance factor by model unit



Phase 7 Model Structure

Sediment

- RUSLE recalculation (to new land uses)
- There are six RUSLE land uses, and these are cross walked to summary land use categories (WG provided)
- Calibrated to 144 stations of 263 candidates
- Land to water
  - Index of Connectivity $EOS_{lu}=EOF_{lu}*(alpha*IC_{lu}+gamma)$
  - Other factors, e.g., influence of ponds
- Stream delivery
  - E.g., Noe et al stream erosion and deposition estimates

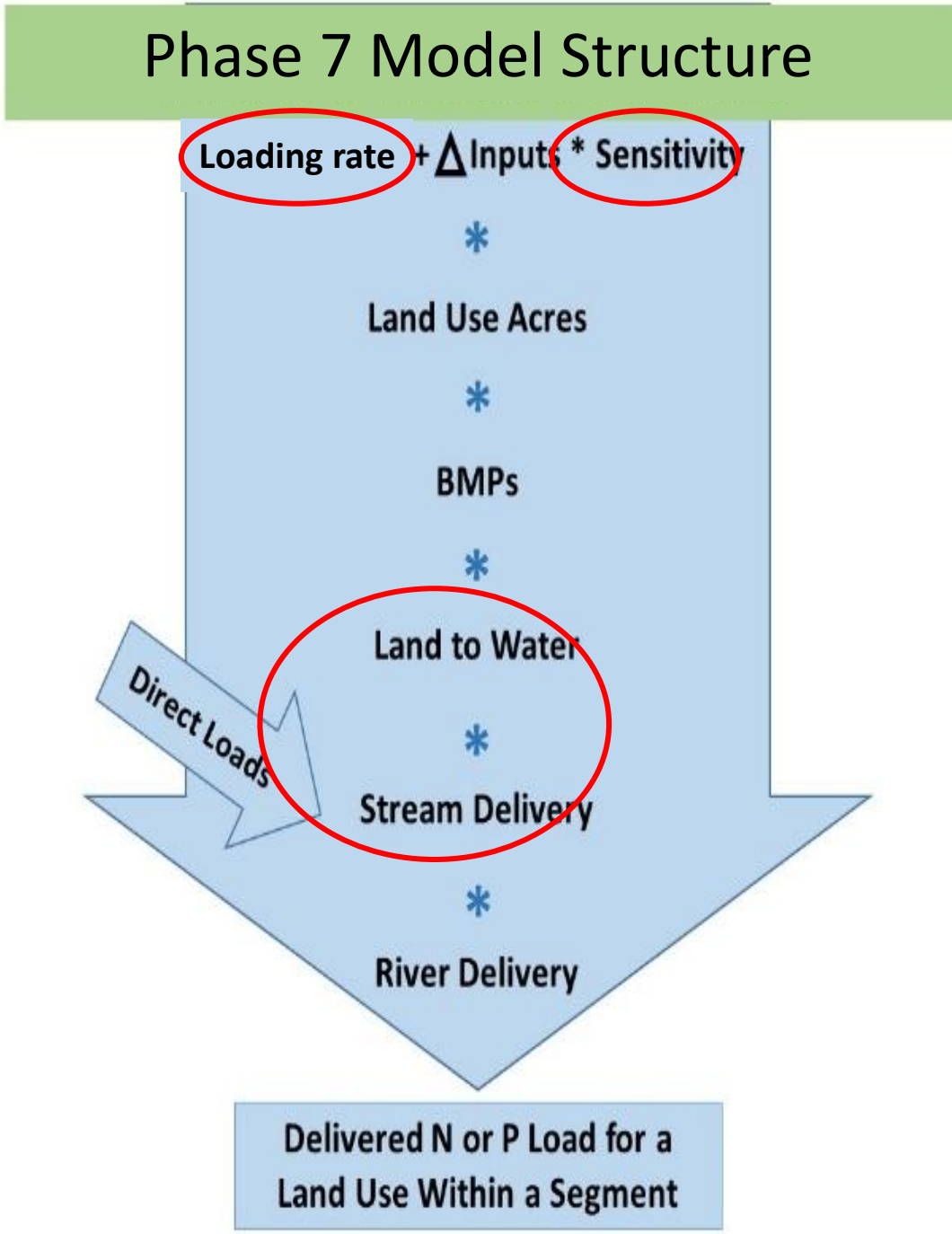


Notes on Hydrology and Sediment

- The hydrology and sediment models are inputs to the soil P workflow and nutrient models.
- These will need to be finalized quickly to provide ample time for subsequent steps.

Nutrient Models

- “Global” loading rates
  - Cropland
  - Pasture
  - Developed
  - Natural
- TN Calibrated to 212 stations of 269 candidates
- TP Calibrated to 192 stations of 267 candidates
- Select loading sensitivities to inputs
- Delivery factors
  - Land to water
  - Stream delivery

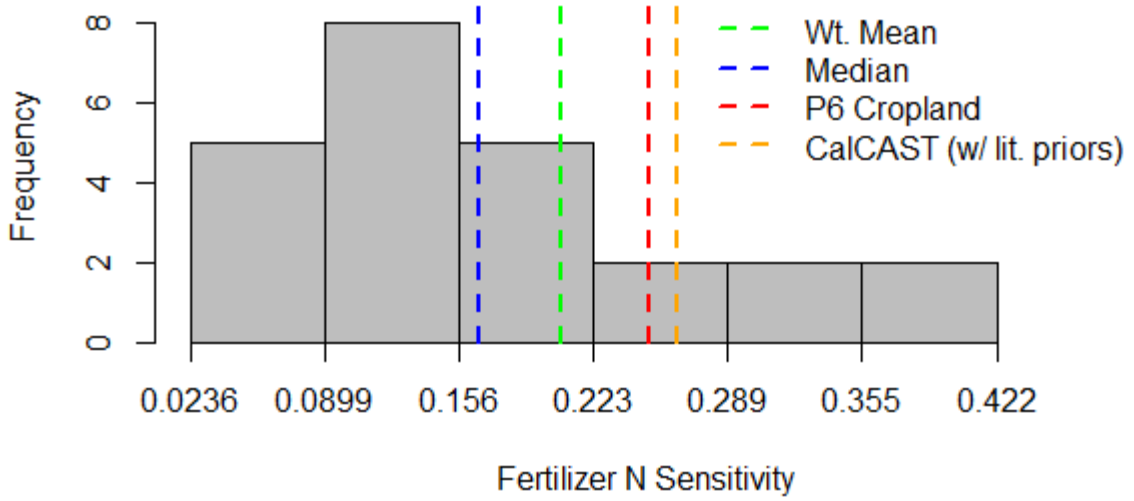


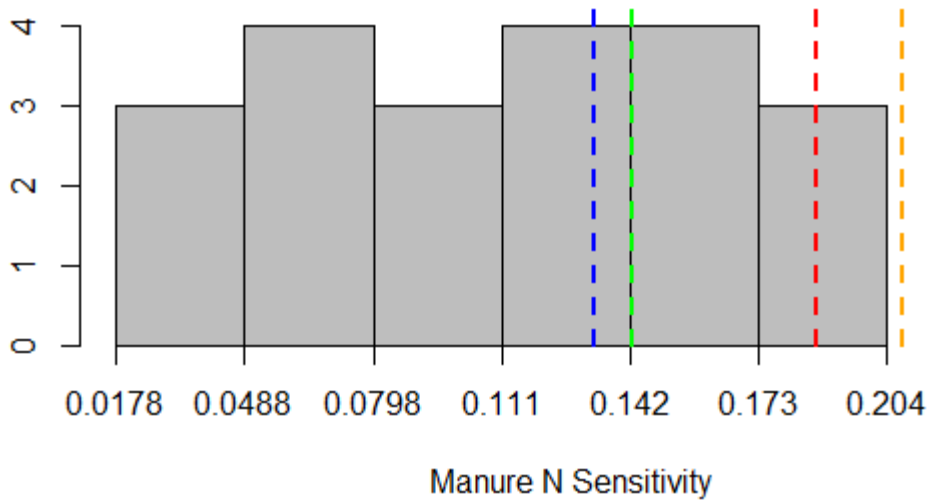
Select Loading Sensitivities: Total Nitrogen

- Atm. deposition to forest:
  - Calibrated with CalCAST and extensive priors, not to exceed the field literature value and imposing the Forestry Work Group's proposed conditional relationships on other values.
  - In testing it has generated a significant improvement in temporal trend prediction.

Select Loading Sensitivities: Total Nitrogen

- Fertilizer and manure application to cropland
  - Calibrate in CalCAST with extensive priors, but default to literature value if calibrated value does not provide clear model performance benefit.





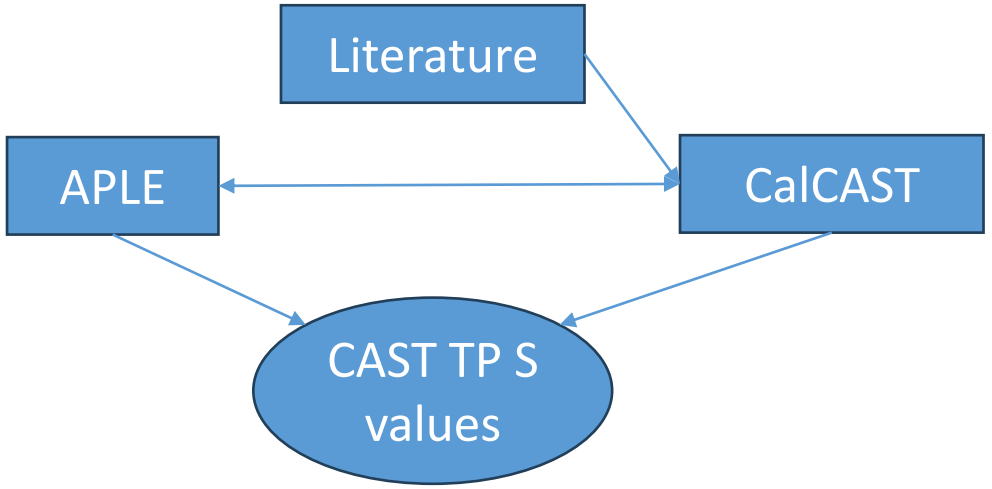
Select Loading Sensitivities: Total Nitrogen

- Crop uptake
  - Limited literature suggests P6 values were low, however an extensive literature review was not possible.
  - Calibrate in CalCAST with weak literature priors and P6 priors. Default to P6 values unless there is significant model performance benefit.

Select Loading Sensitivities: Total Phosphorus

$Coef * (WEP, Soil\ P, Sediment, Stormwater)$

- APLE defines the relative contribution from each pathway
- CalCAST calibrates the magnitude of the S values ($Coef$)
- The literature provides priors to CalCAST



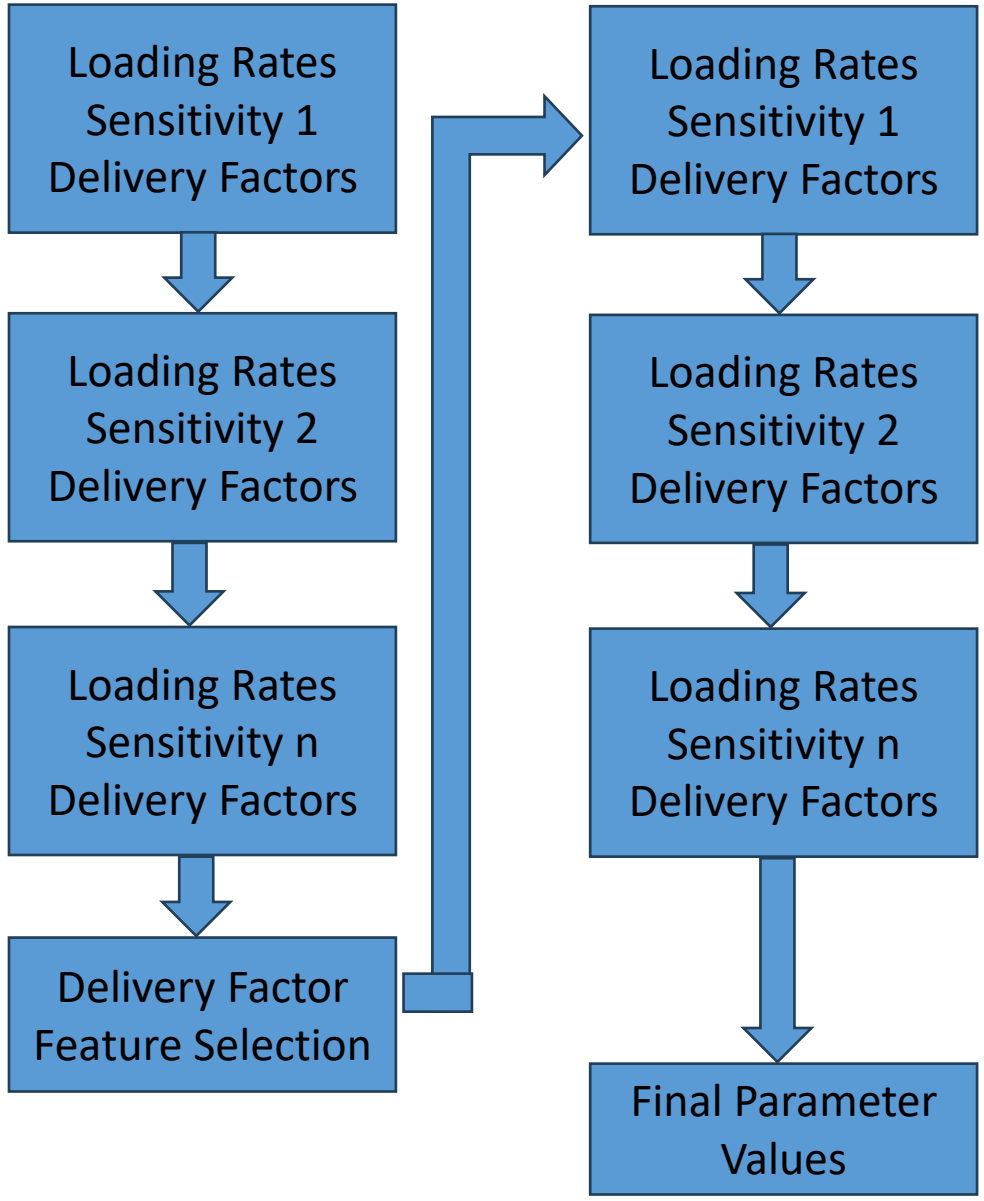
Basic Workflow

Currently not all components and parameters can be calibrated together.

- Model components will be calibrated sequentially.
- Model parameters within each component will be calibrated iteratively through a step wise process which isolates sensitivities.

1. Total Flow
2. Stormflow
3. Sediment
4. Total Nitrogen
5. Total Phosphorus

Starting with the highest loading input for sensitivities and a minimal set of delivery factors



Discussion

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