Estimated Riverine Scour Under Future Climate Conditions

Modeling Workgroup Meeting – January 2020

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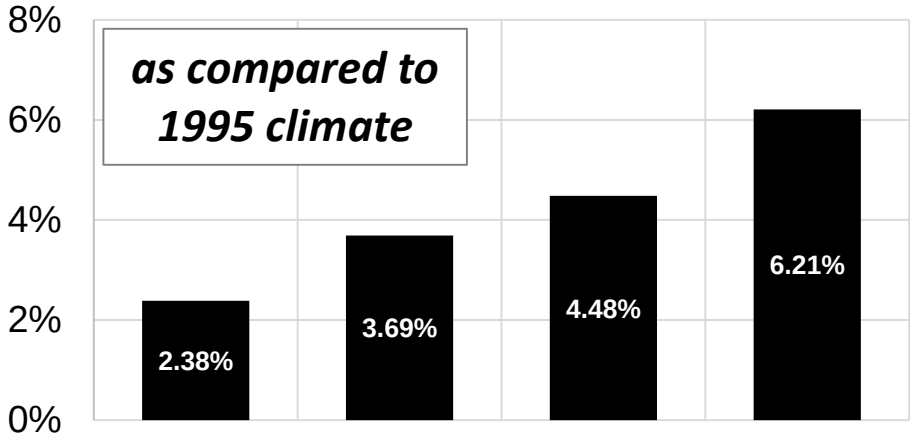
Presentation outline

1. **Summary of marginal changes in delivery for 2025, 2035, 2045, and 2055 climate scenarios**

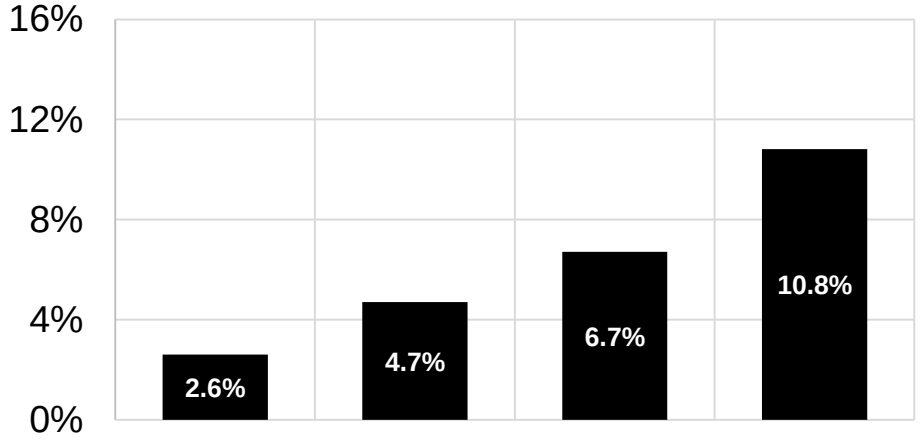
2. **Watershed processes impacting the changes in total nutrient delivery and speciation**
   - **Changes in Edge of River (EOR) loads**
   - **Nutrient budget for the rivers**
   - **Combined assessment of the watershed processes**

Estimated Water Quality Responses

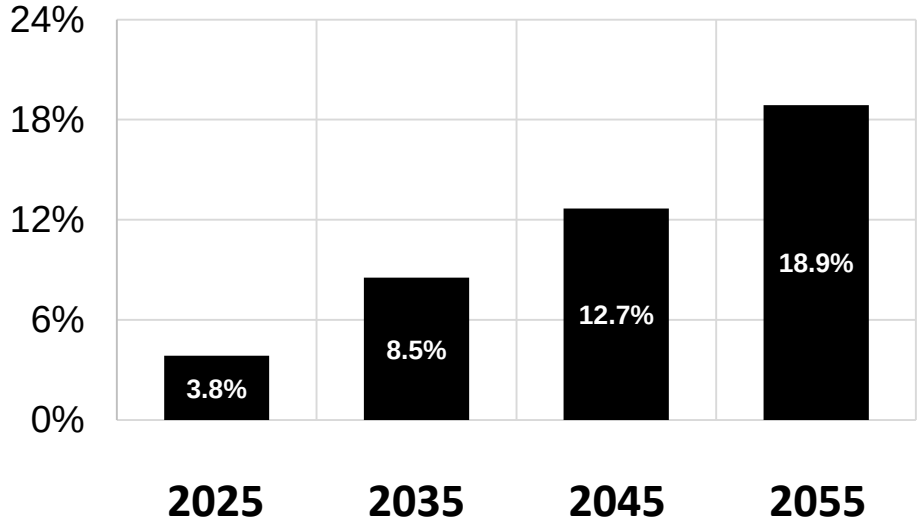
Marginal Differences in **Freshwater** Delivery



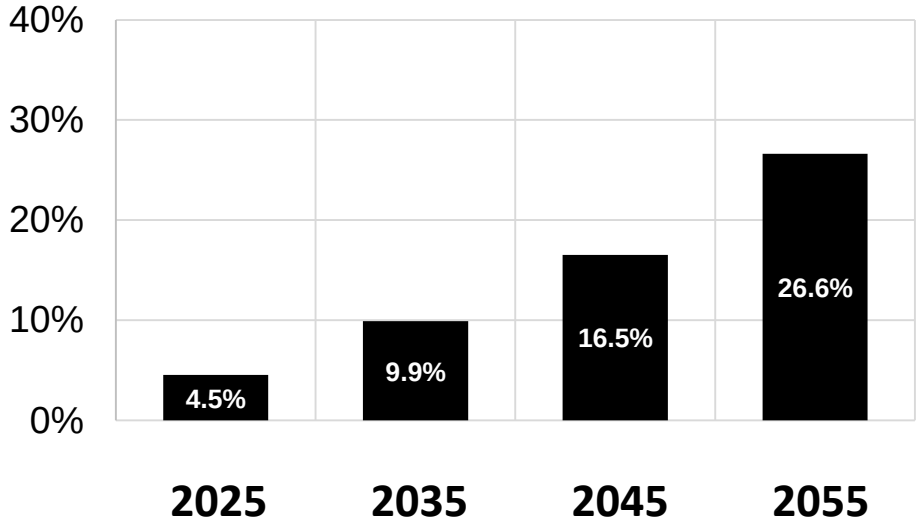
Marginal Differences in **Nitrogen** Delivery



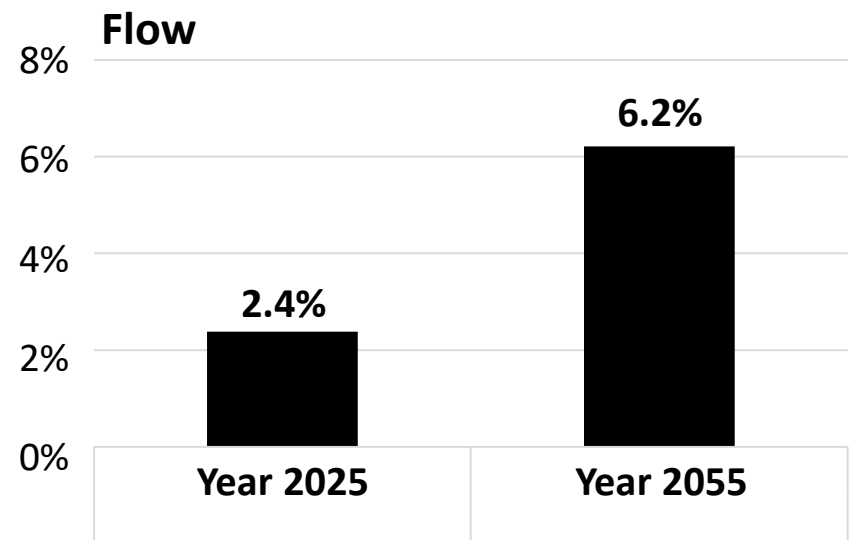
Marginal Differences in **Sediment** Delivery

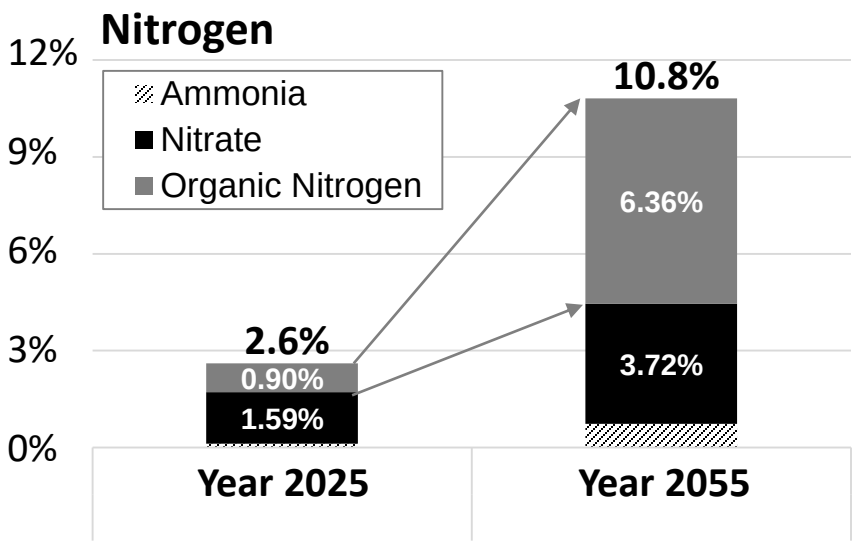


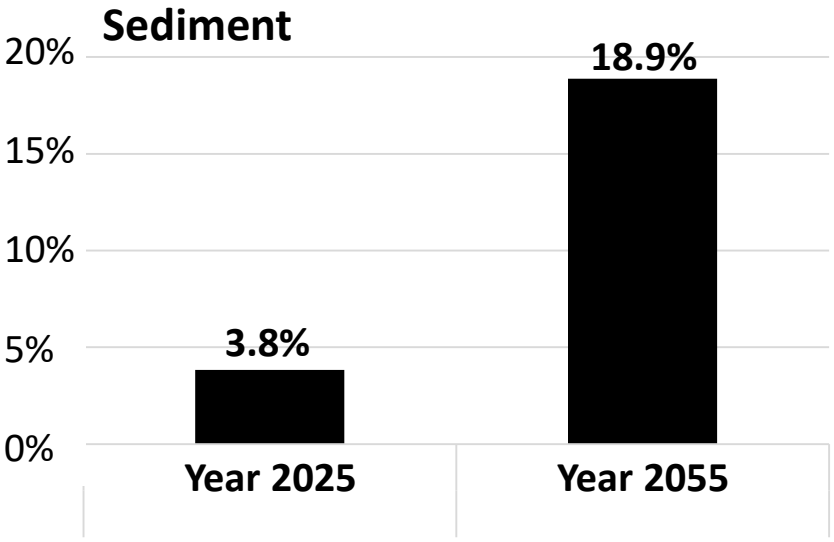
Marginal Differences in **Phosphorus** Delivery

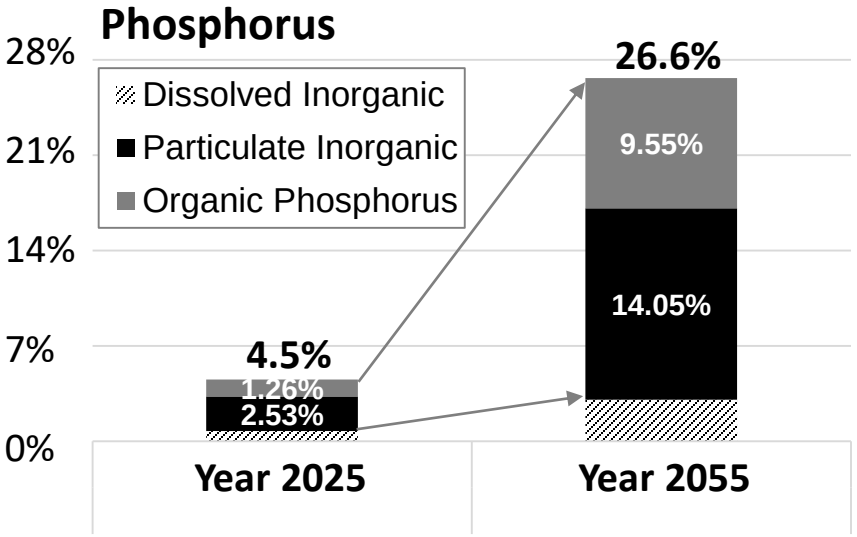


Nutrient Speciation – 2025 and 2055

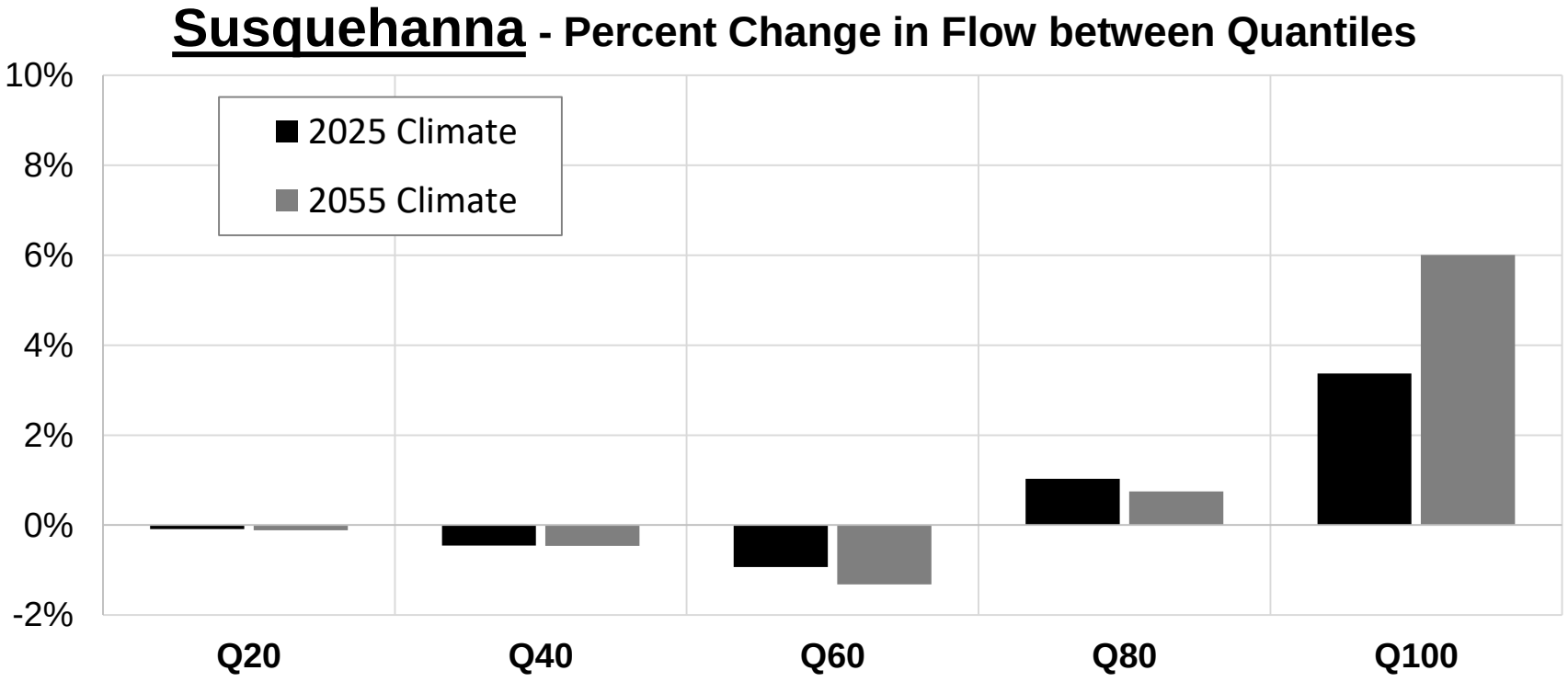






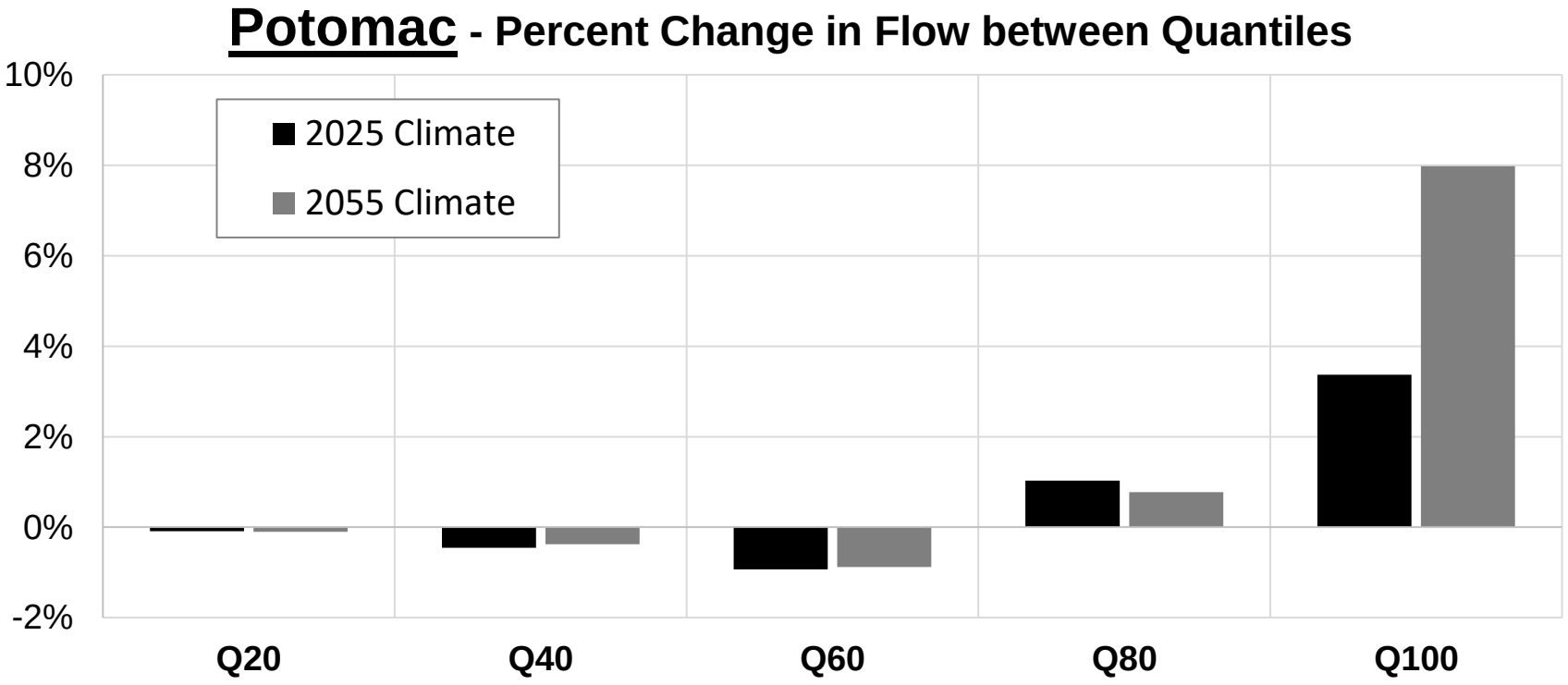


Changes in Flow Regime



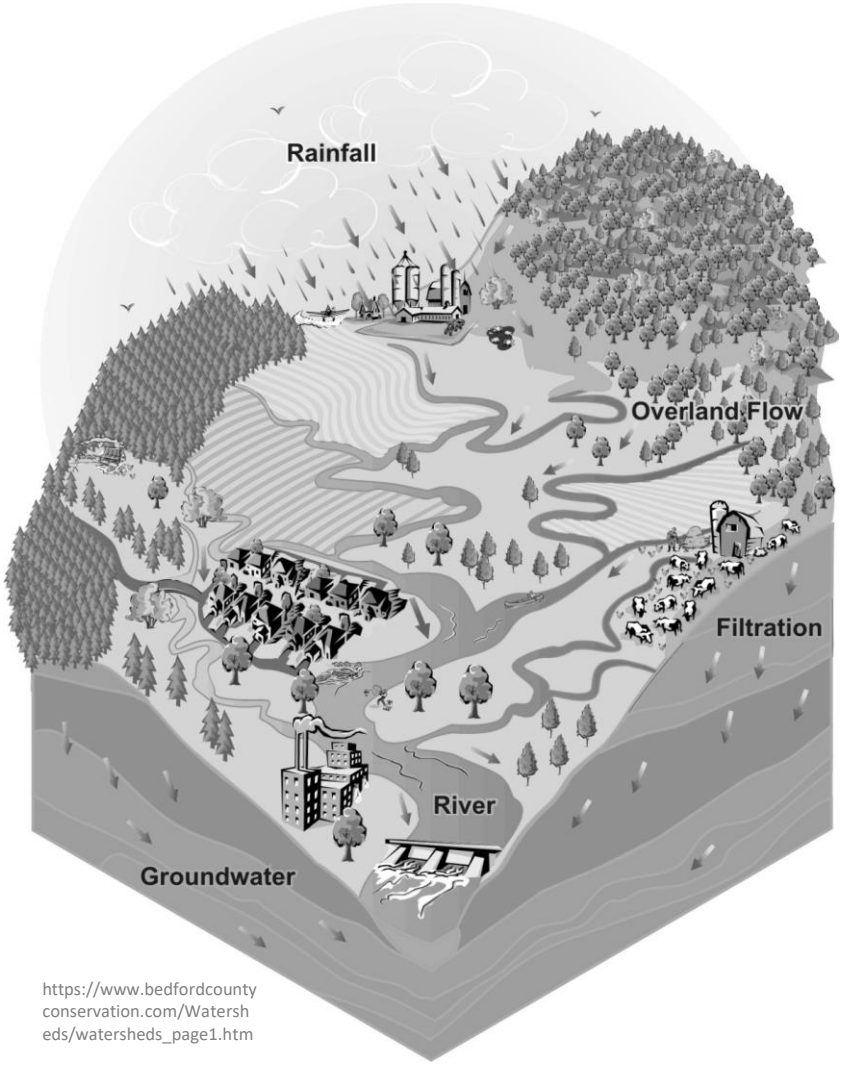
Increases in higher flow quantiles impact mobilization and transport of sediment and nutrients (in particulate form) – "*riverine nutrient competency*".

Changes in Flow Regime



Increases in higher flow quantiles impact mobilization and transport of sediment and nutrients (in particulate form) – "*riverine nutrient competency*".

Watershed Scale Budgets



https://www.bedfordcountyconservation.com/Watersheds/watersheds_page1.htm

↓ △ Climate

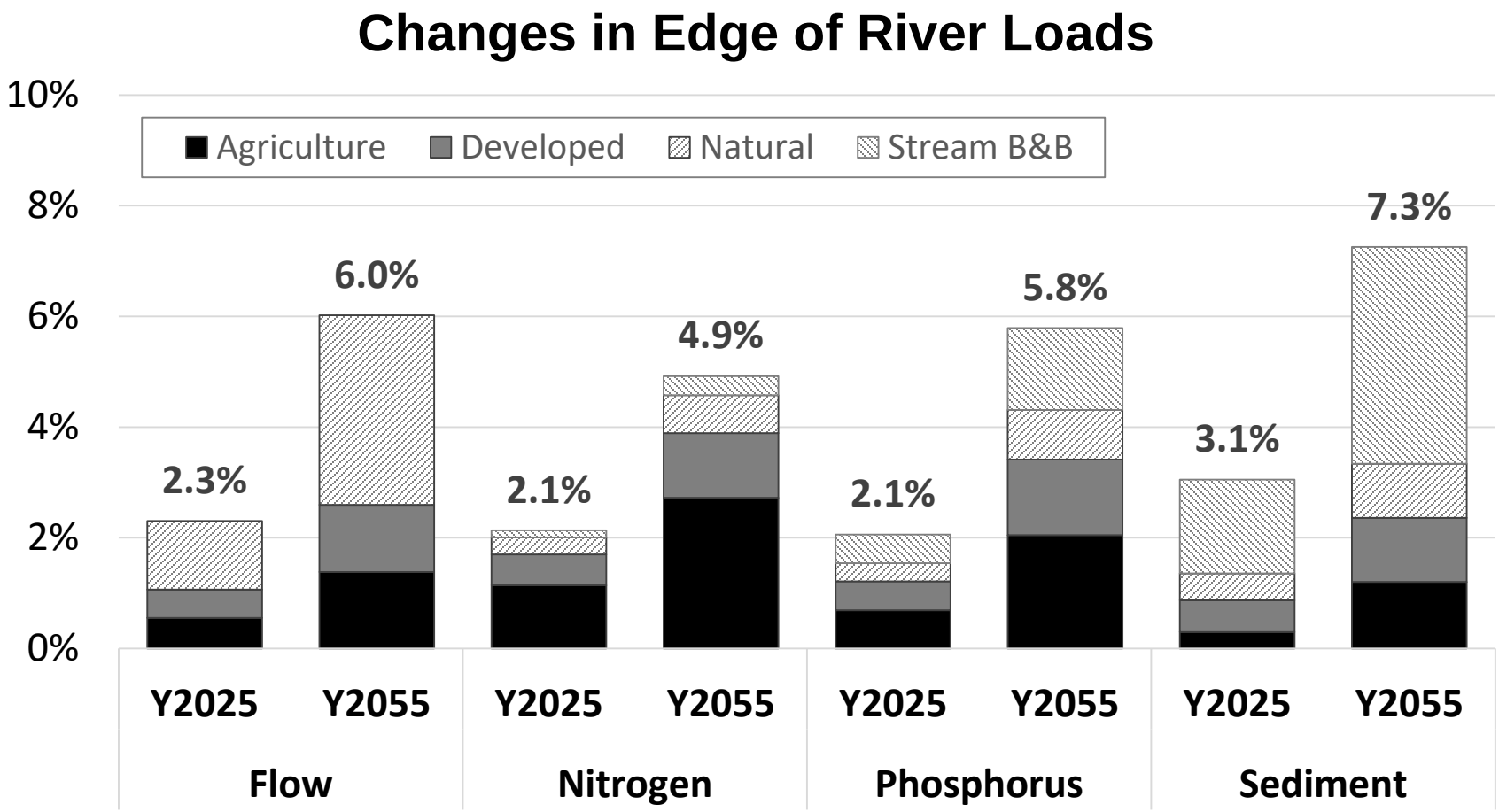
Changes in Land/Stream Response

↓ △ Edge of River Loads

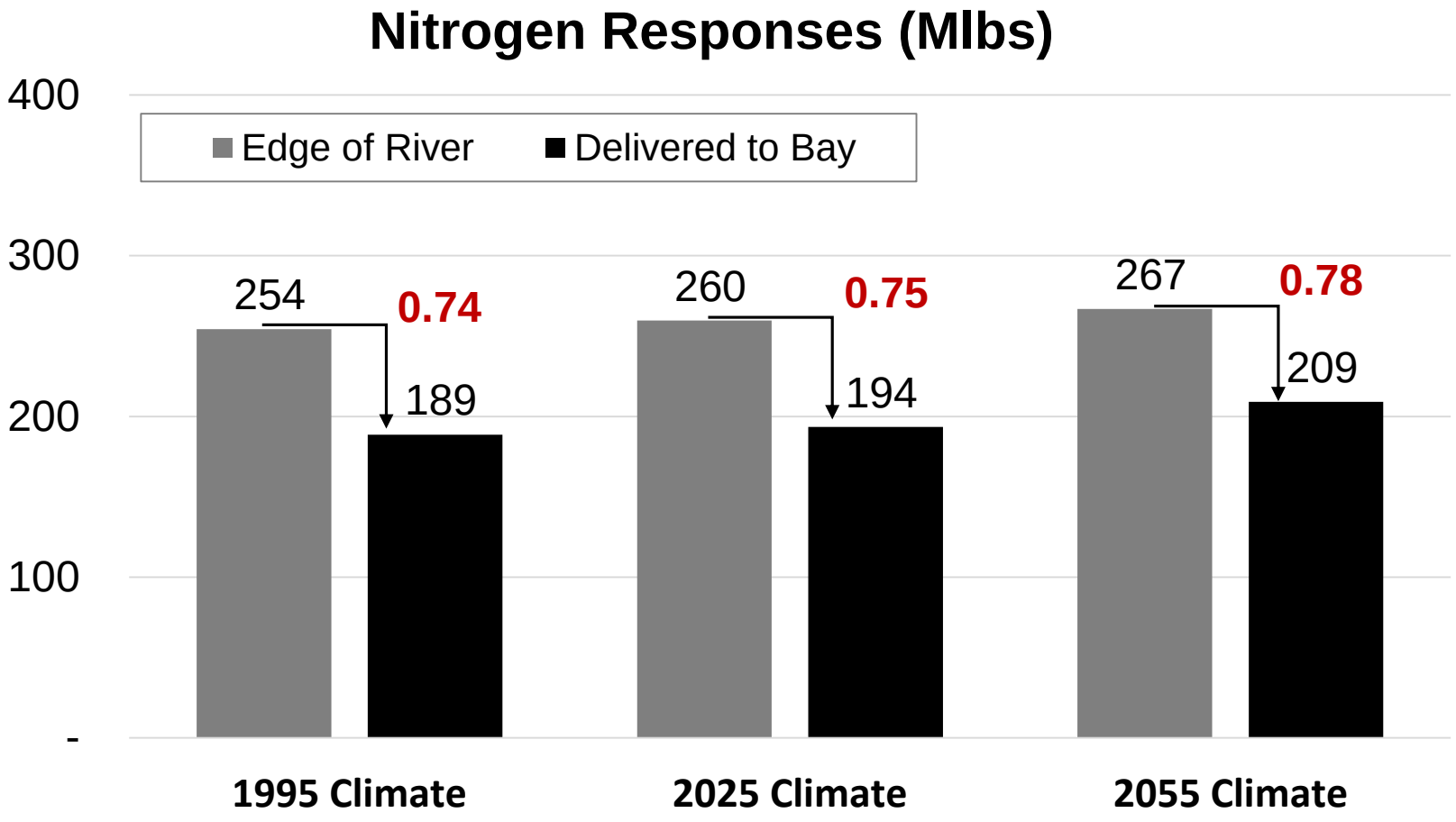
Changes in Riverine Response

↓ △ Delivered to Bay

Edge of River Loads

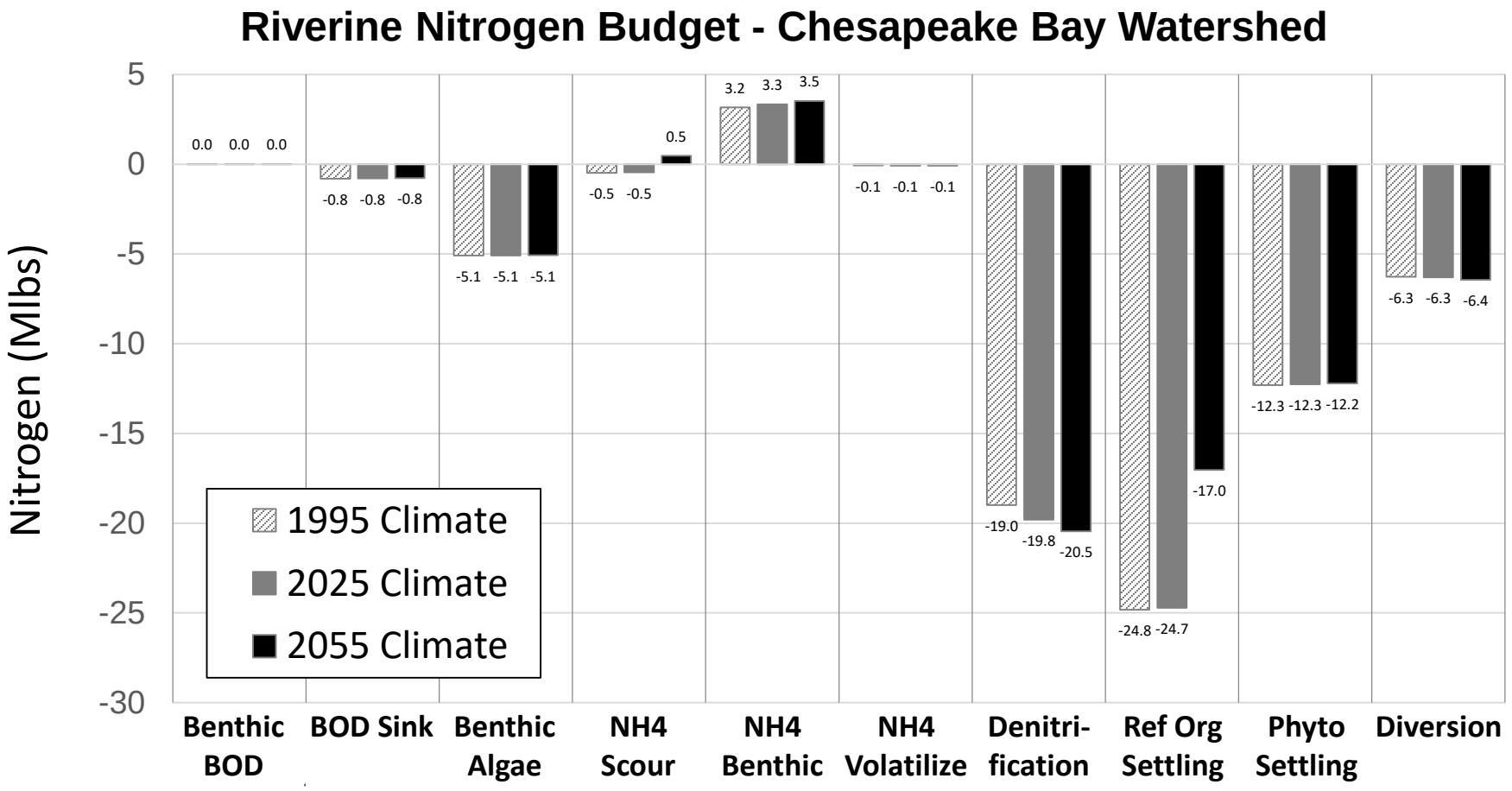


(2a) NITROGEN: Edge of River and Delivery to Bay

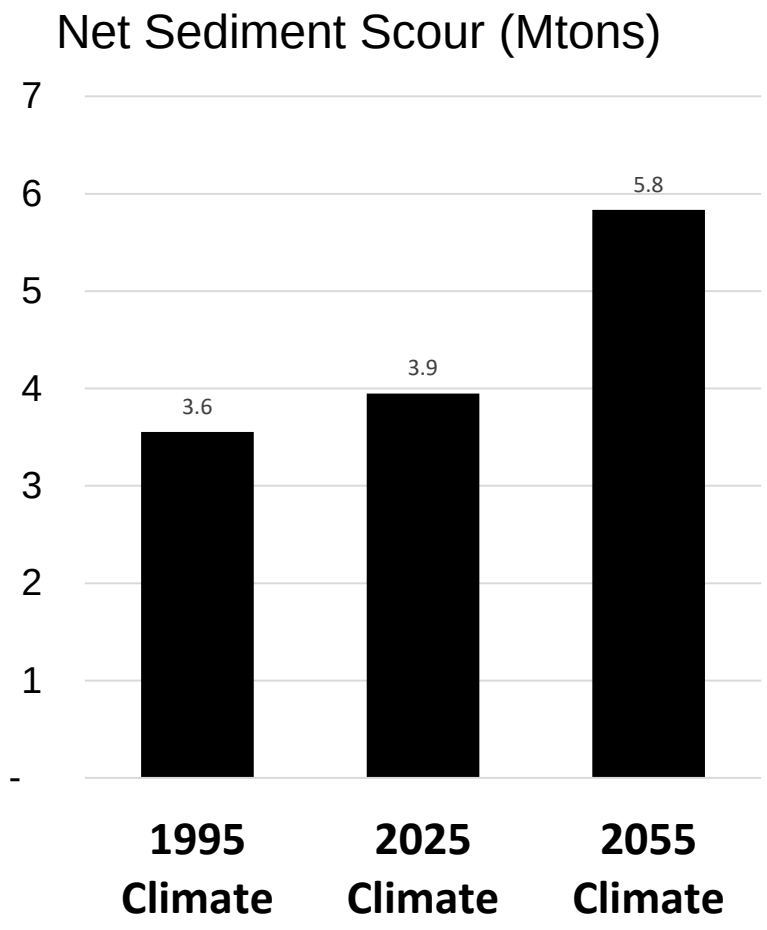


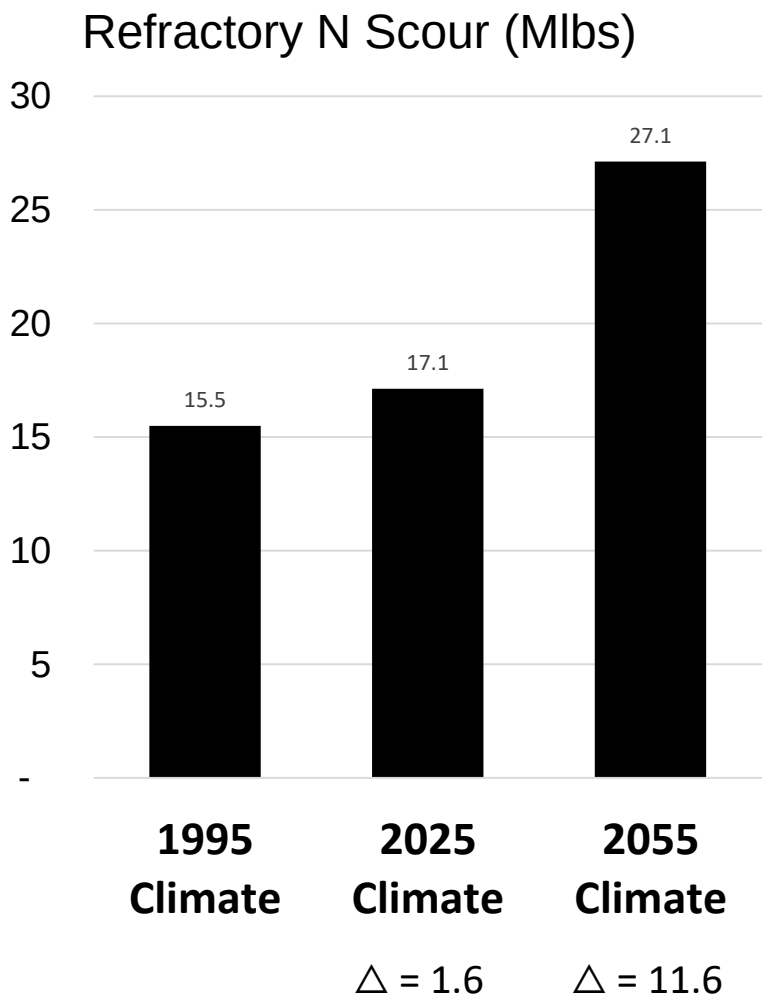
EOR: +5.4 Mlb-N for 2025, and +12.5 Mlb-N for 2055
DEL: +4.9 Mlb-N for 2025, and +20.4 Mlb-N for 2055

Riverine Processes

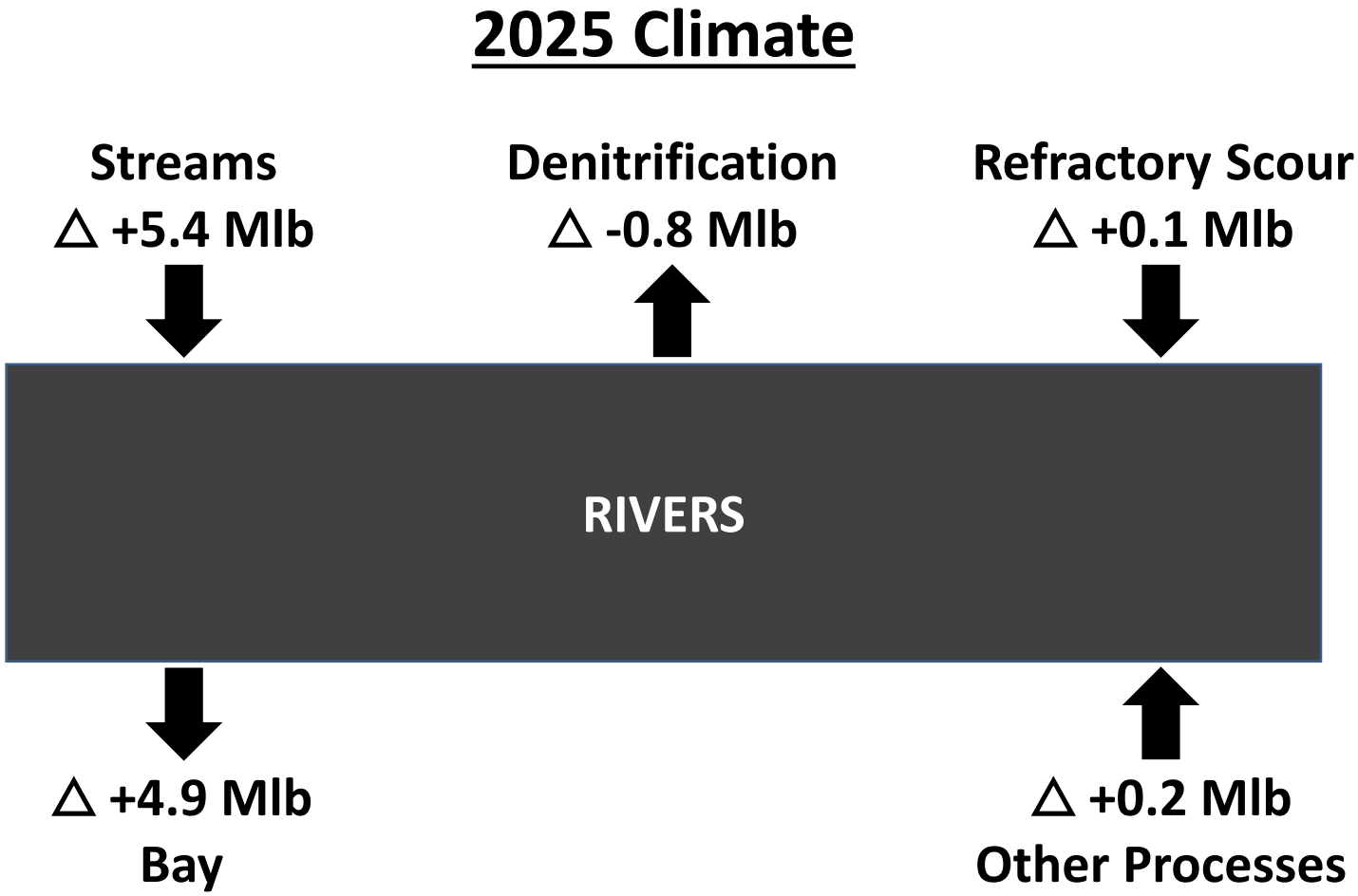


Riverine Processes – simulated refractory organic scour





Summary of Nitrogen Budget



Deltas (△) show change with respect to 1995 climate.

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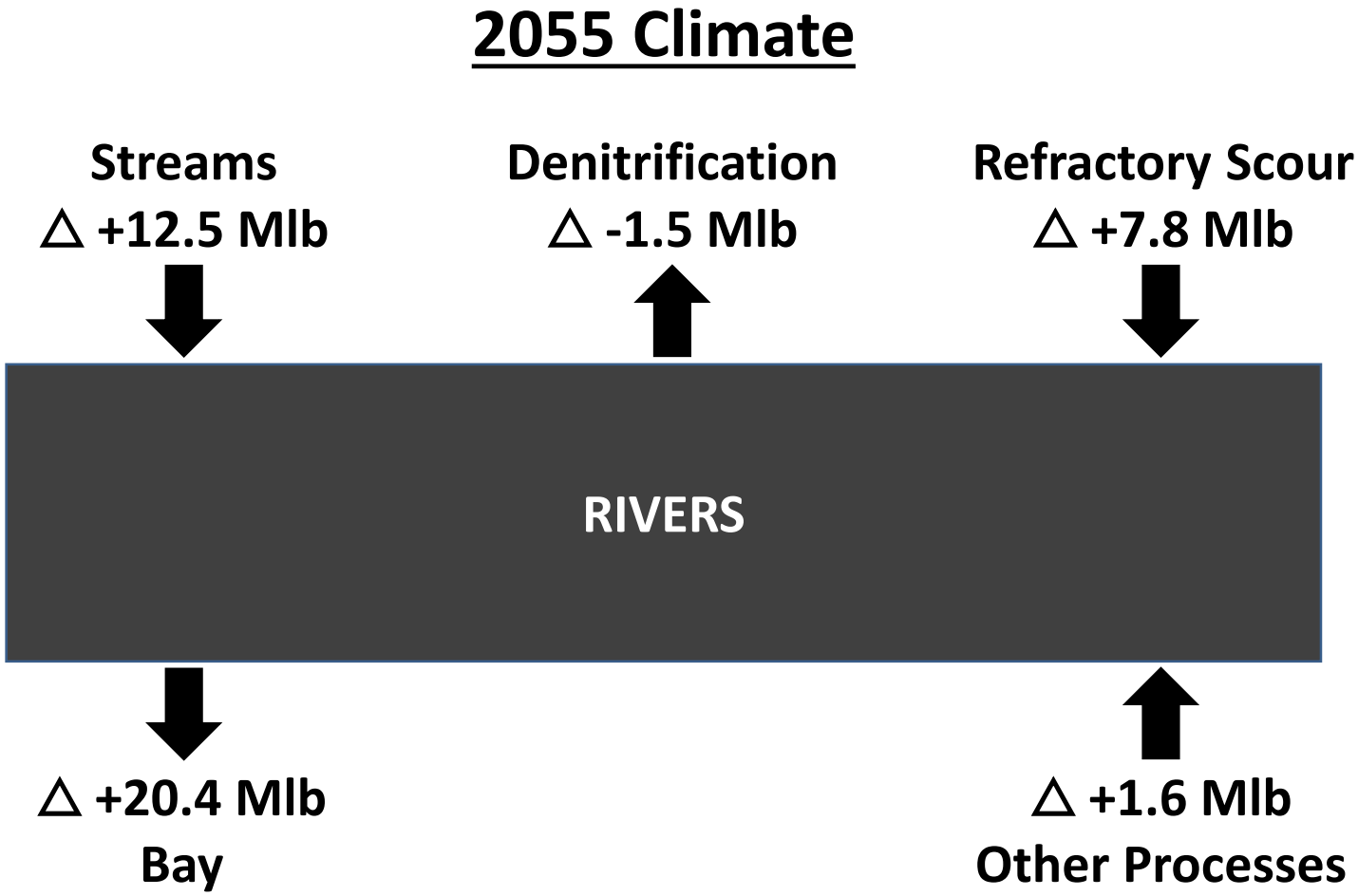

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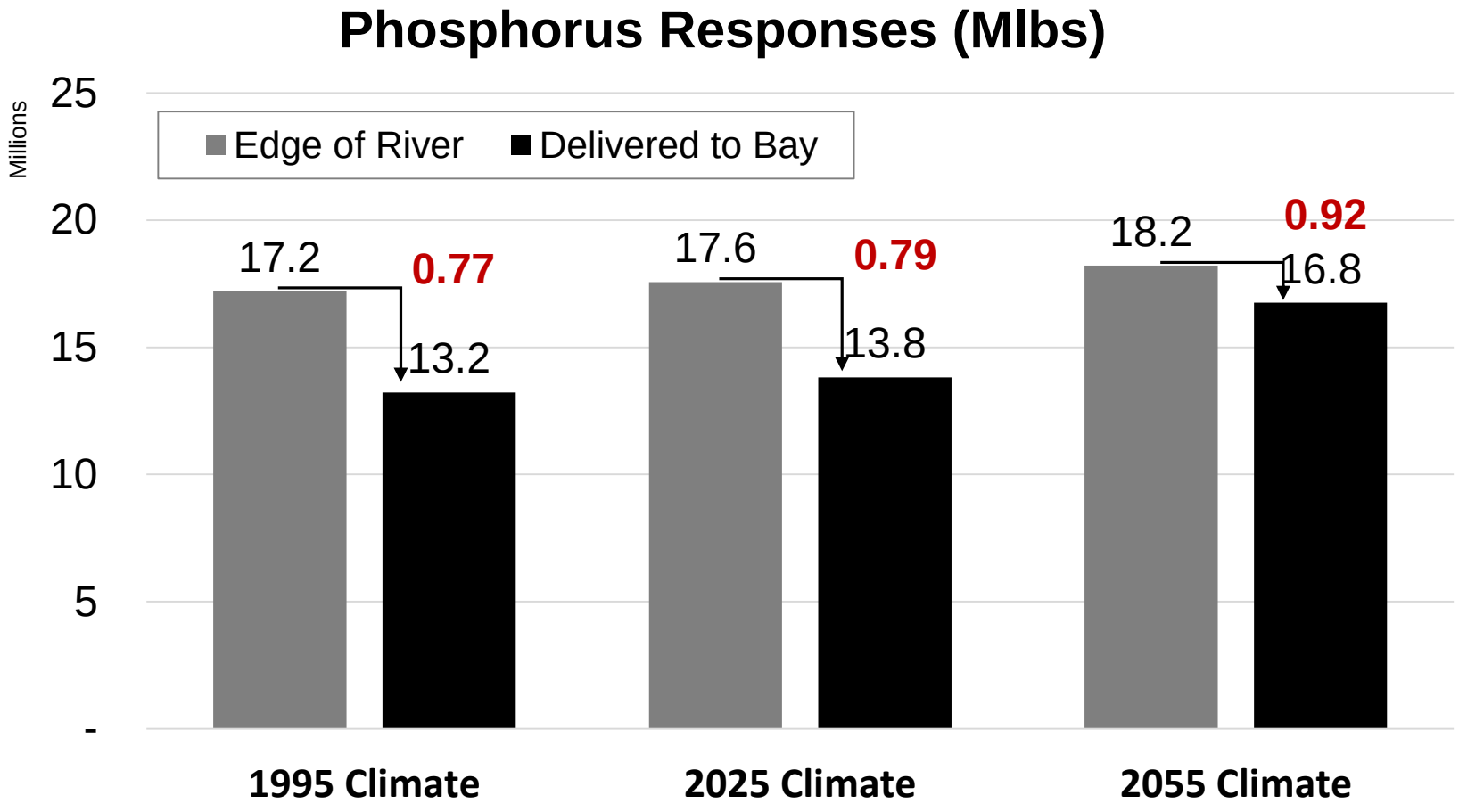
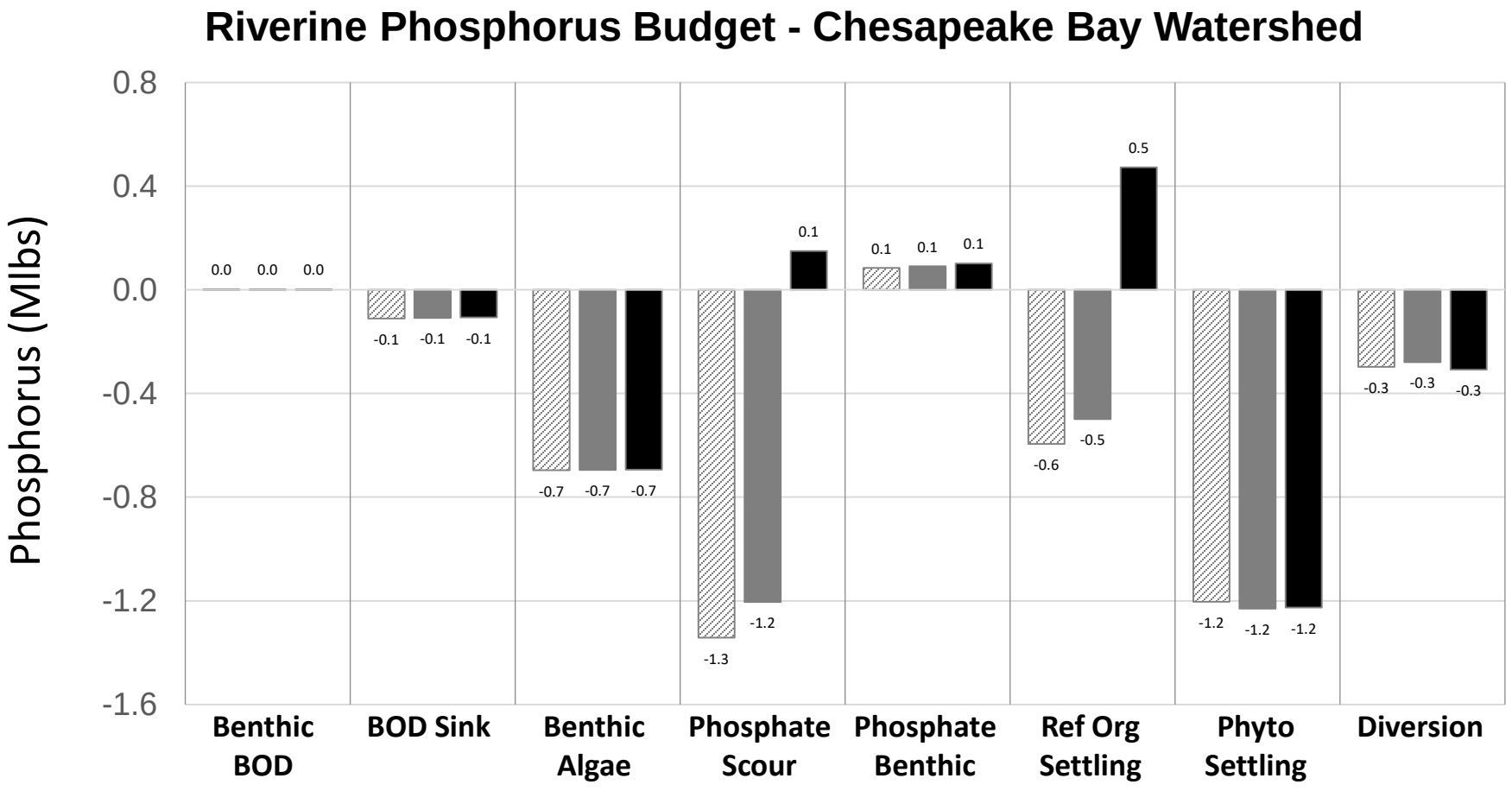
(2b) PHOSPHORUS: Edge of River and Delivery to Bay

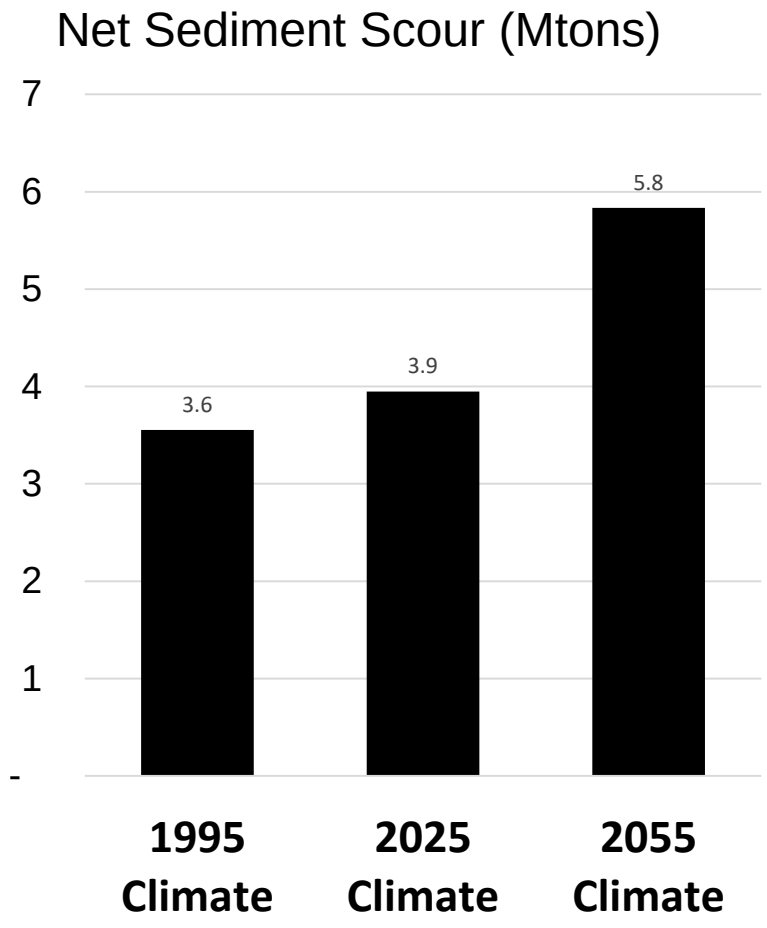


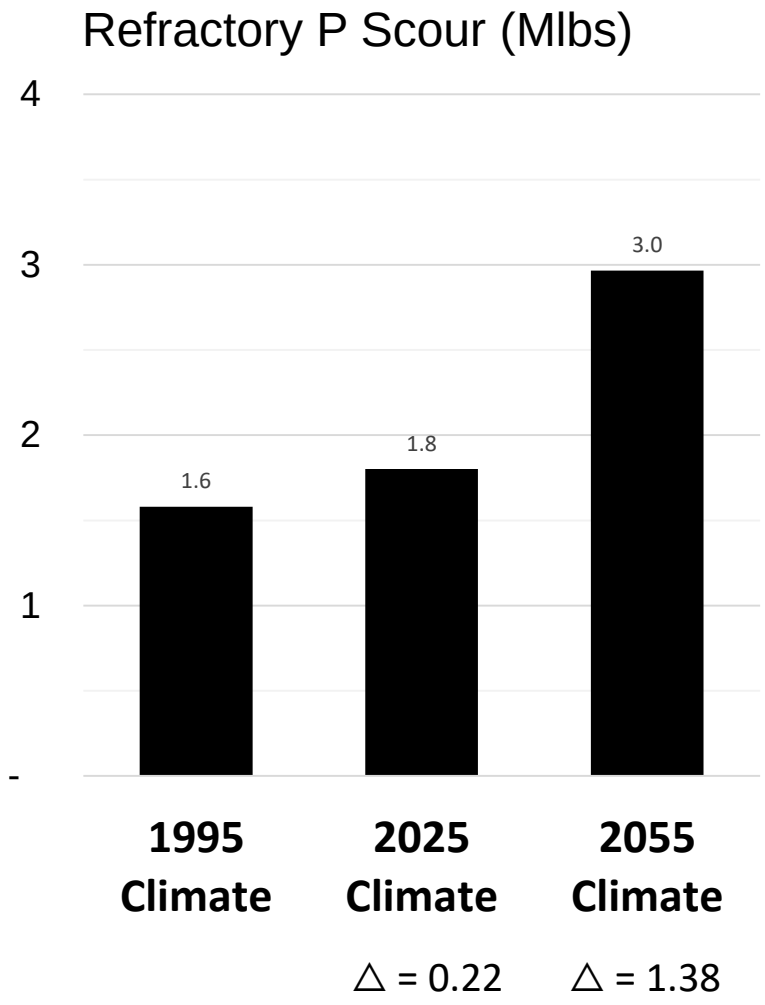
EOR: +0.35 Mlb-N for 2025, and +0.99 Mlb-N for 2055
DEL: +0.60 Mlb-N for 2025, and +3.53 Mlb-N for 2055

Riverine Processes

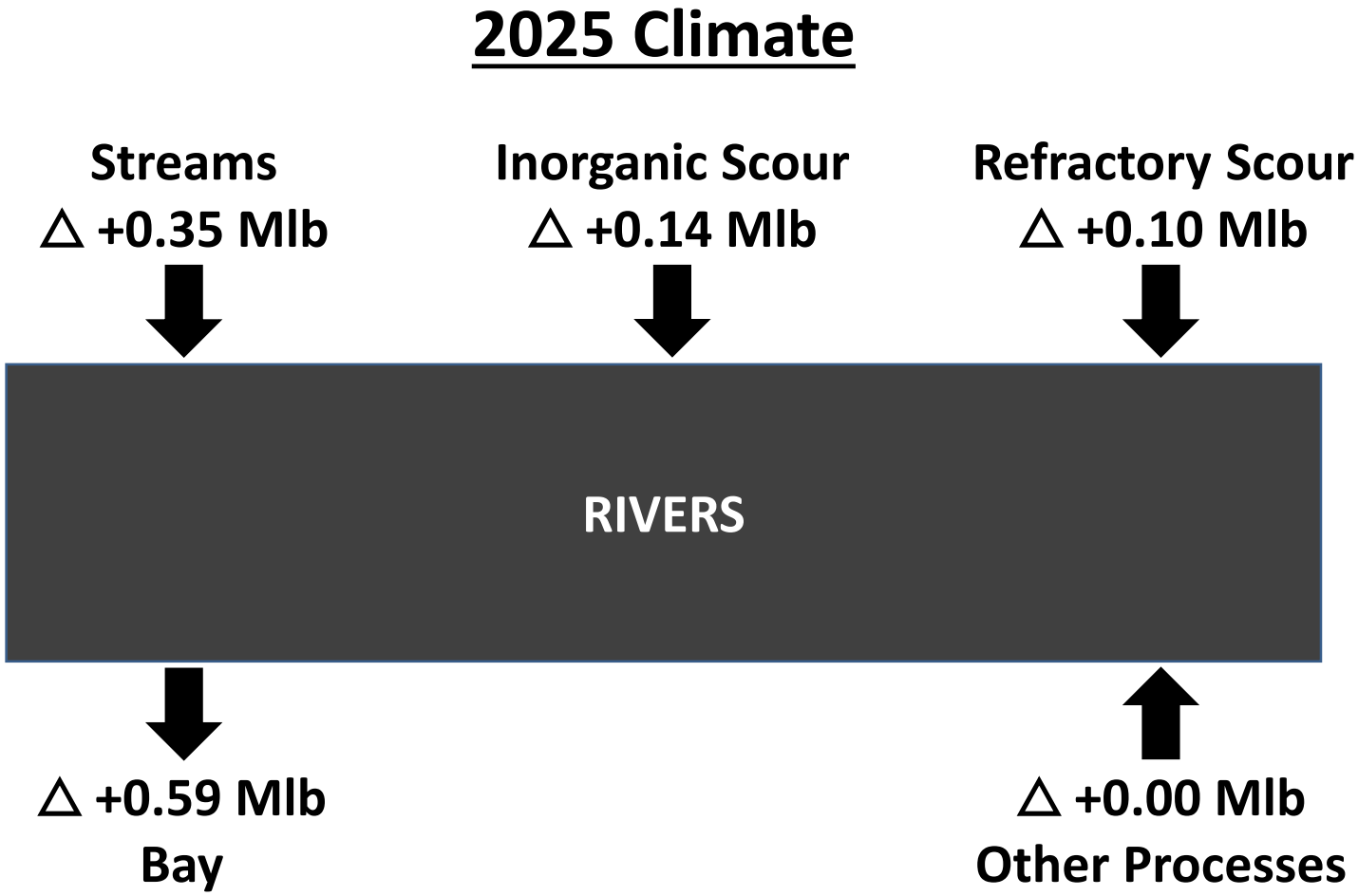


Riverine Processes – simulated refractory organic scour



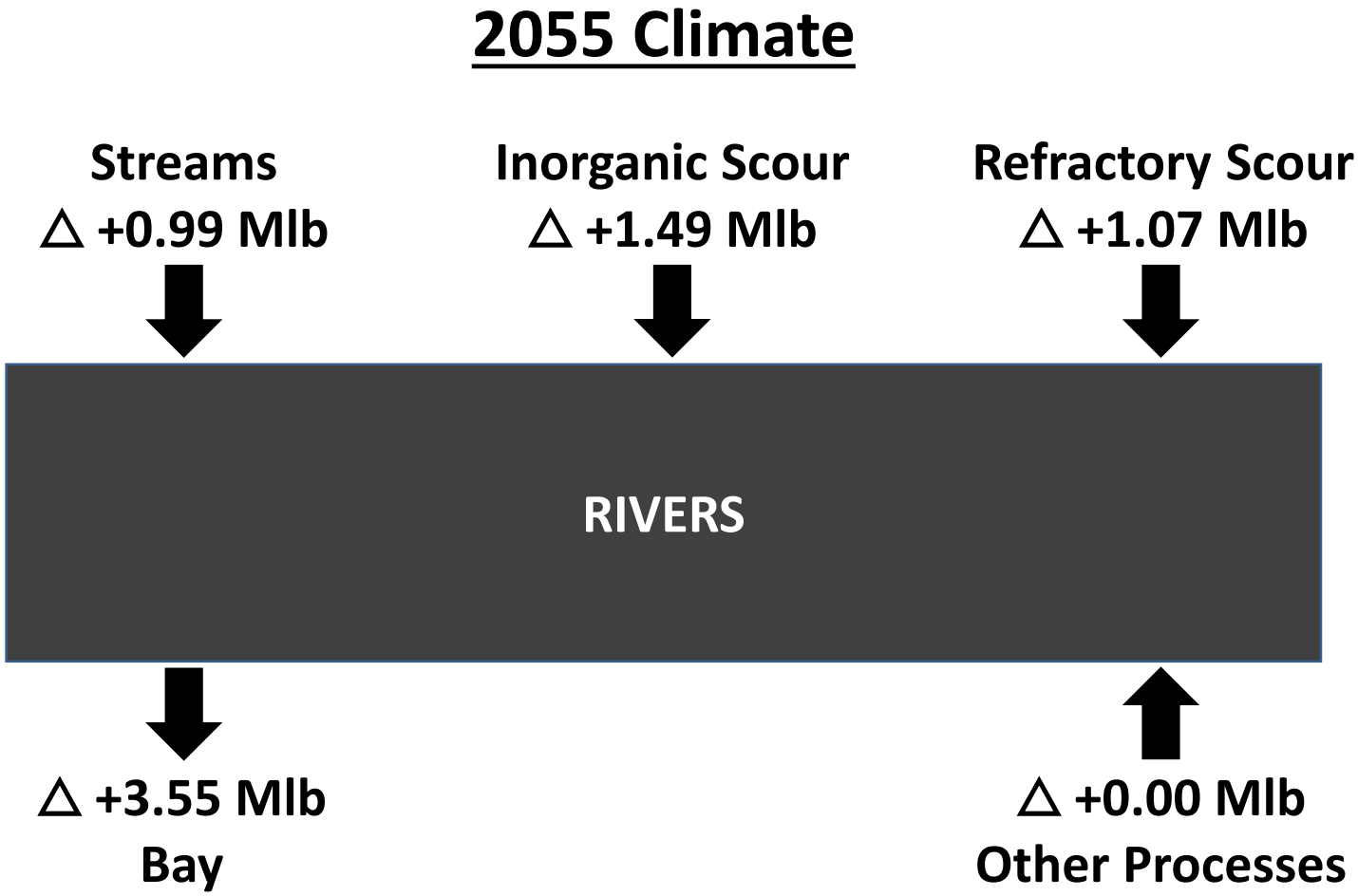


Summary of Phosphorus Budget



Deltas (△) show change with respect to 1995 climate.

Summary of Phosphorus Budget



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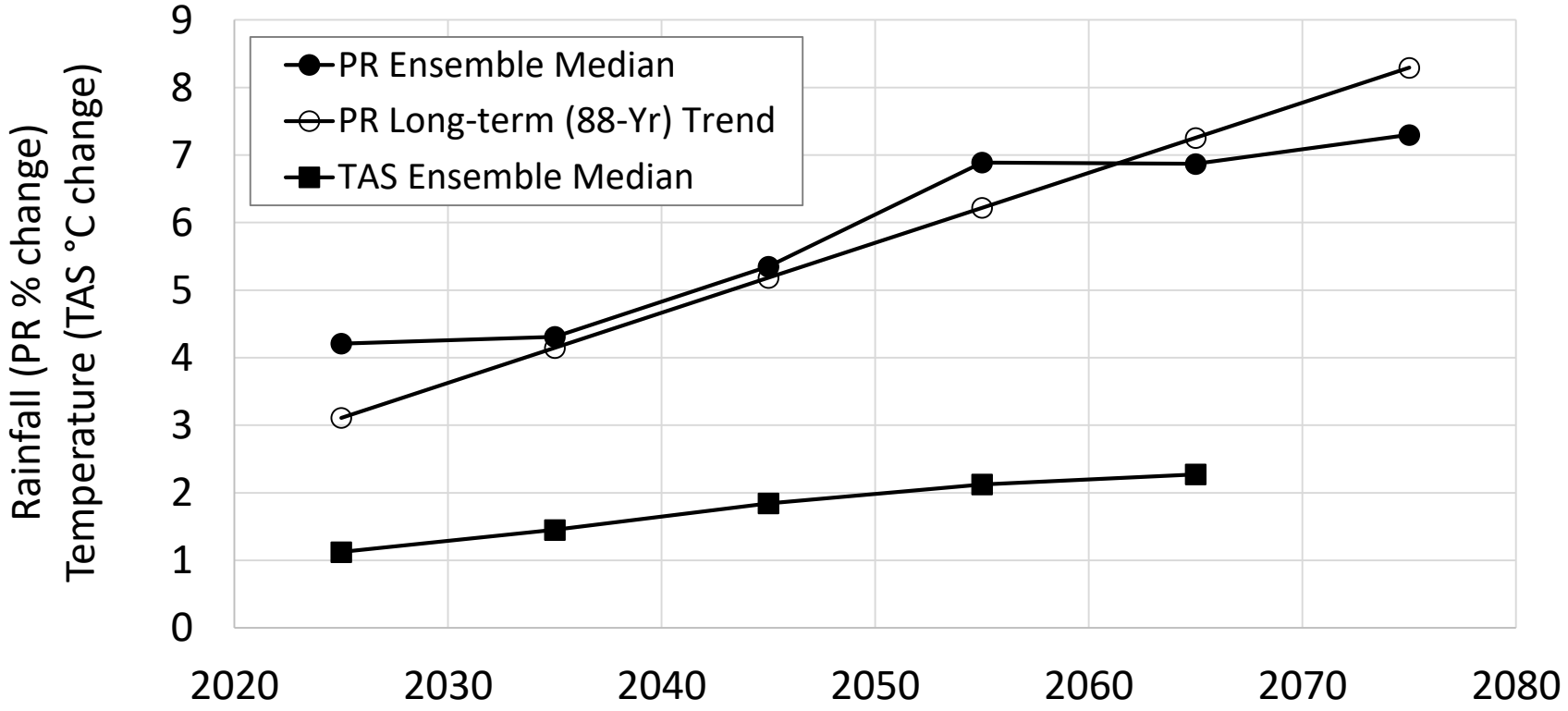
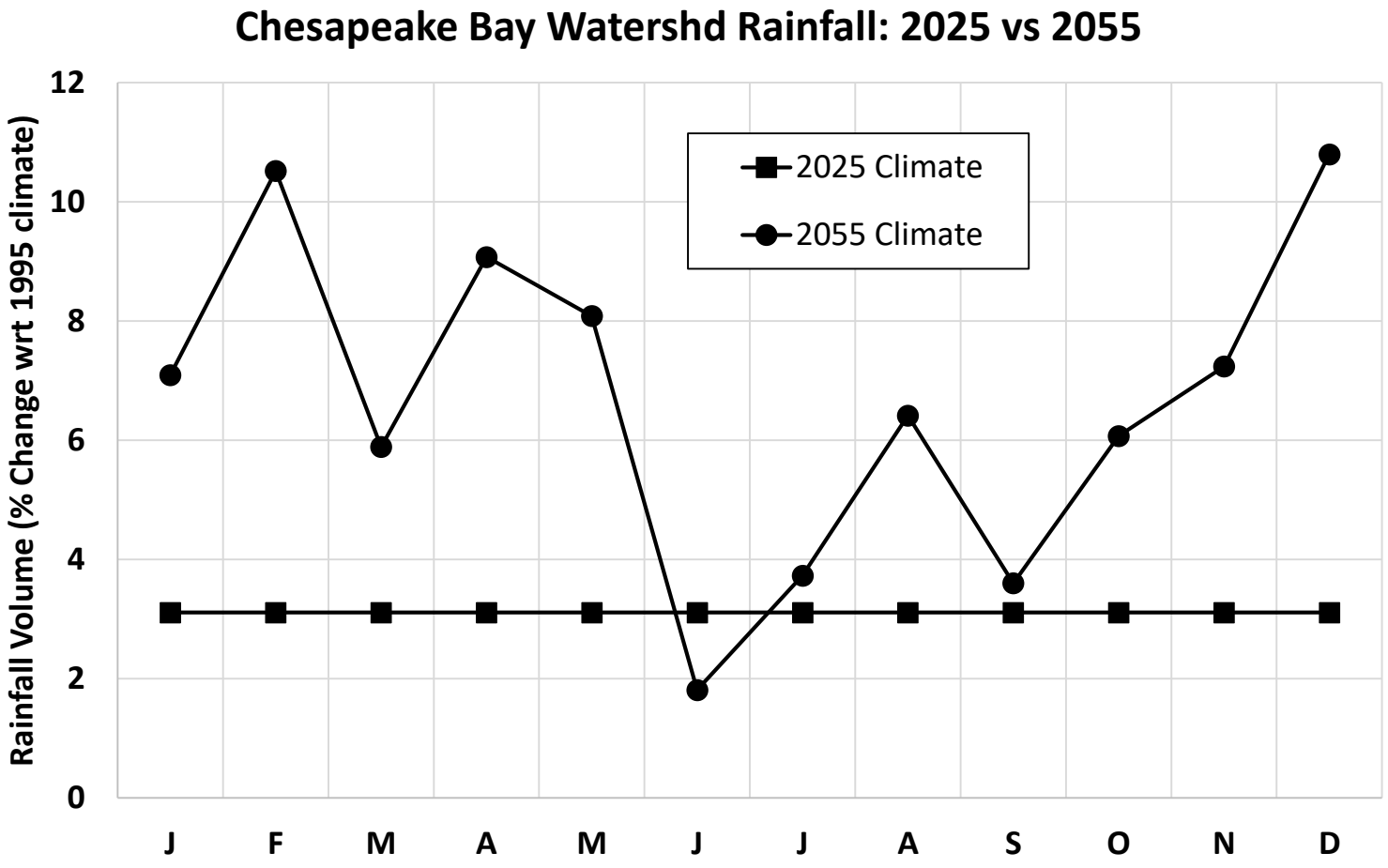
Summary

- **Both land and riverine processes contribute to changes in nitrogen and phosphorus deliveries.**
  - **More EOR loads with higher flow**
  - **An overall decrease in net trapping in the rivers**
- **Relatively higher proportions of particulate nitrogen and phosphorus with increasingly wetter climate are due to the mobilization and transport of refractory organics with sediment under higher flows.**

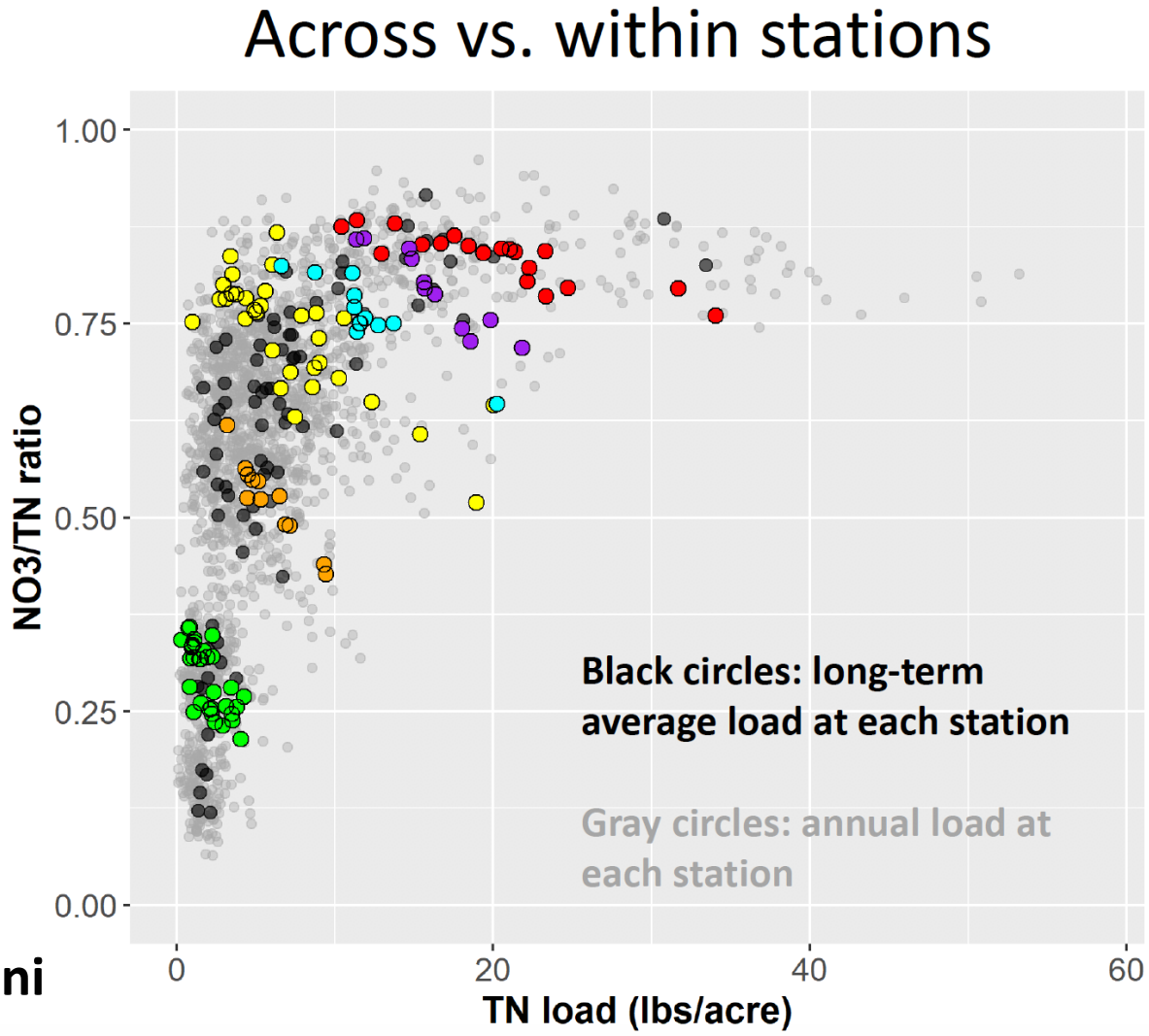
RCP 4.5 Ensemble Median vs. Trends





3.11% average annual increase for 2025
6.89% average annual increase for 2055

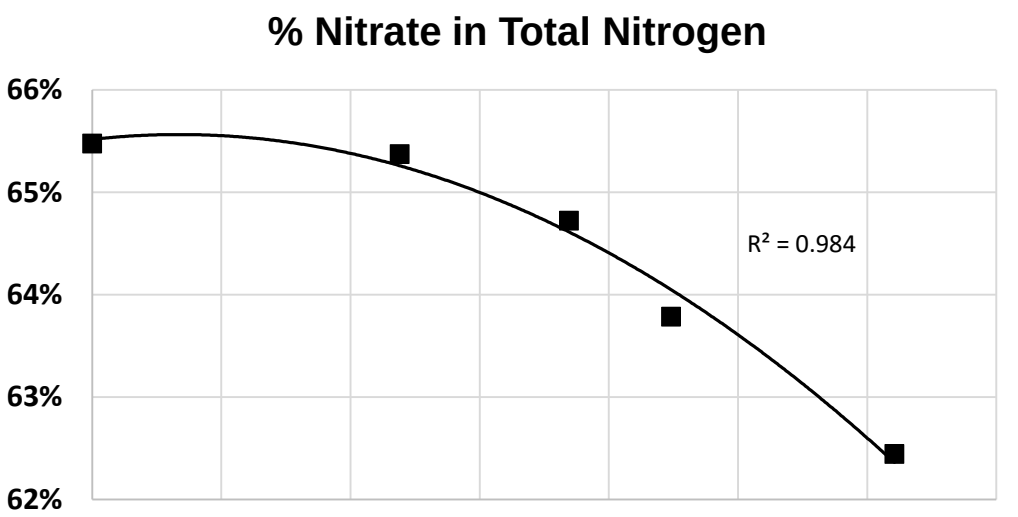
Edge of River Nitrogen Response

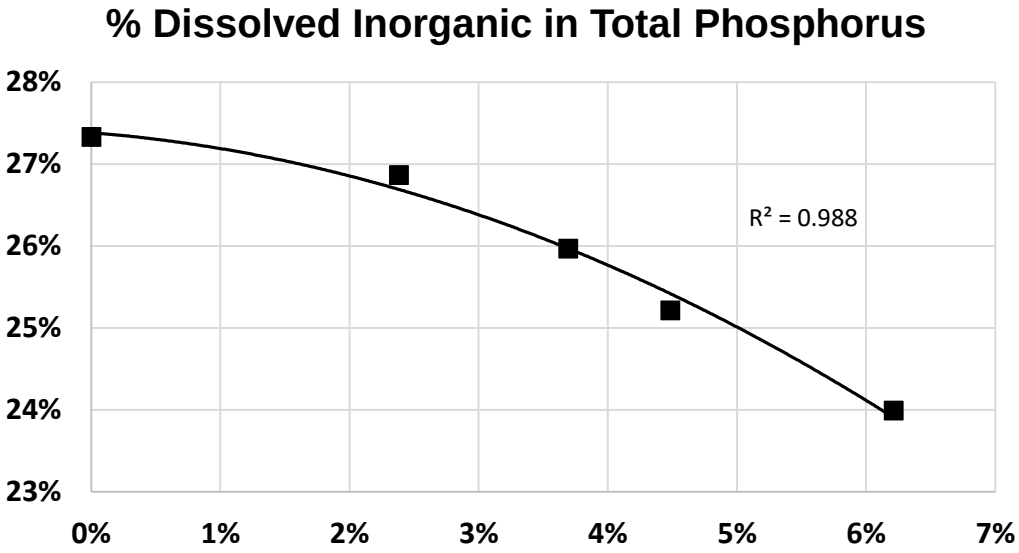


Isabella Bertani

USGS data source: https://doi.org/10.5066/F7RR1X68

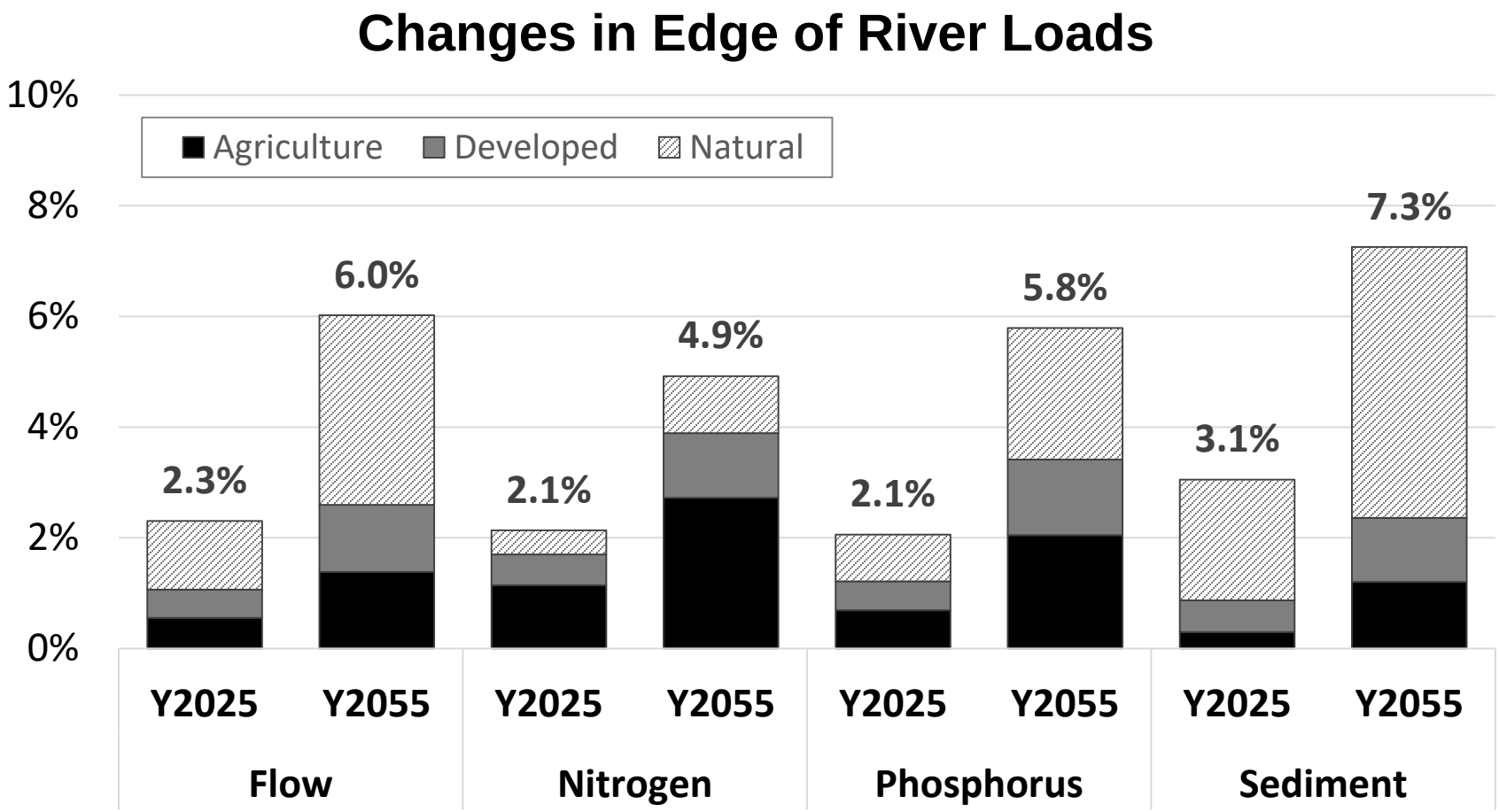
Nutrient Speciation



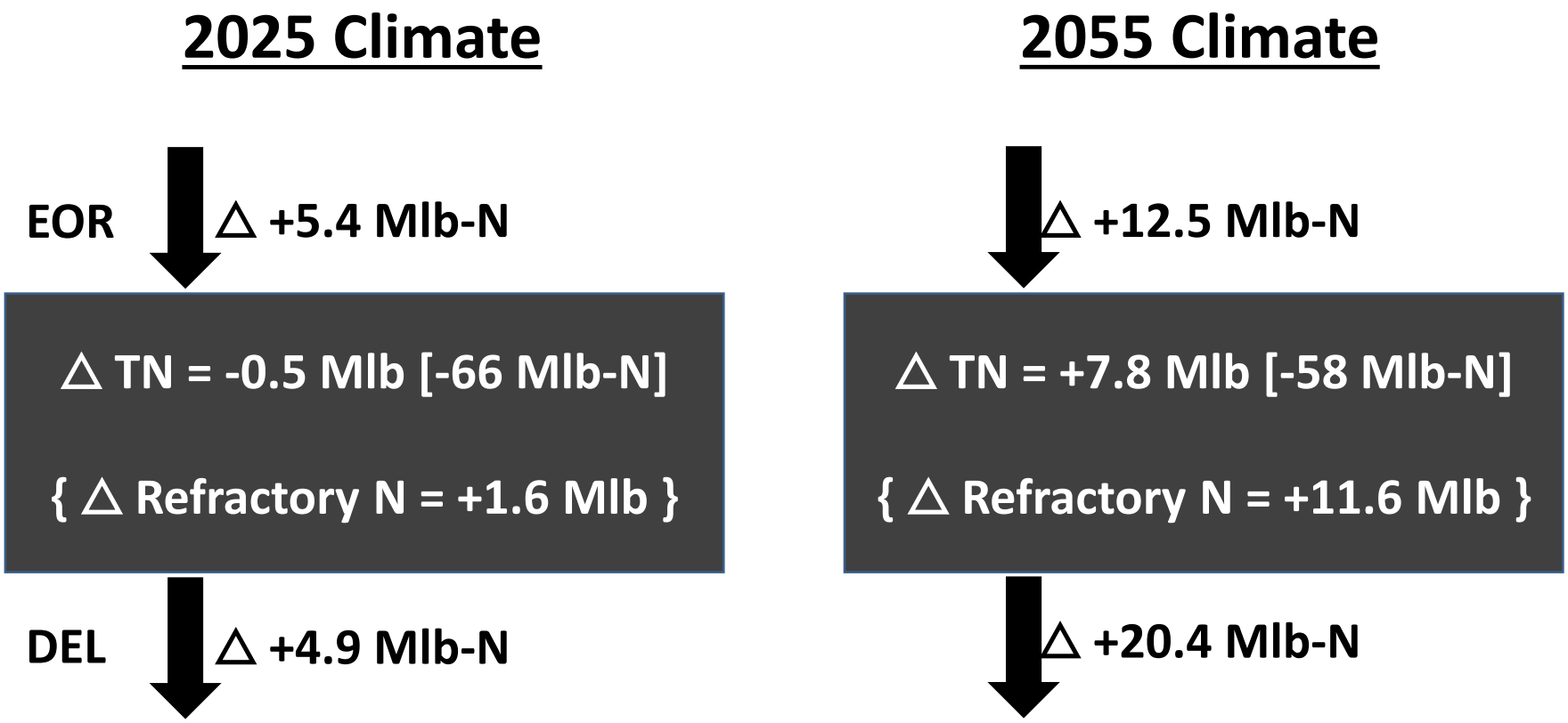


Flow →

Edge of River Loads

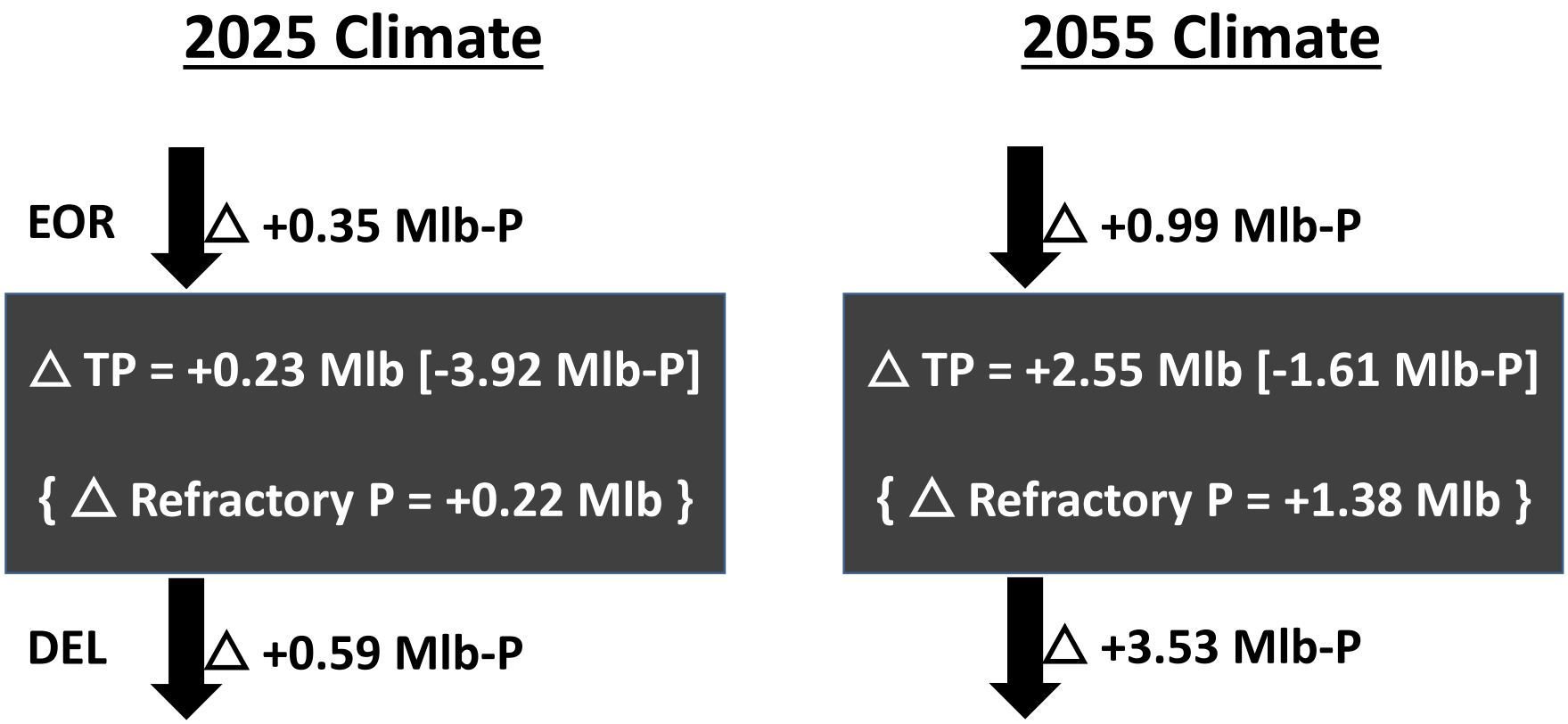


Summary of Nitrogen Budget



Deltas (△) show change with respect to 1995 climate.
Numbers in [square brackets] show the amount of nutrient processed in rivers.

Summary of Phosphorus Budget



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