Dissolved Organic Matter Optical Properties in Treatment Wetlands:

Associations with Plants, Soils and Treatment Performance

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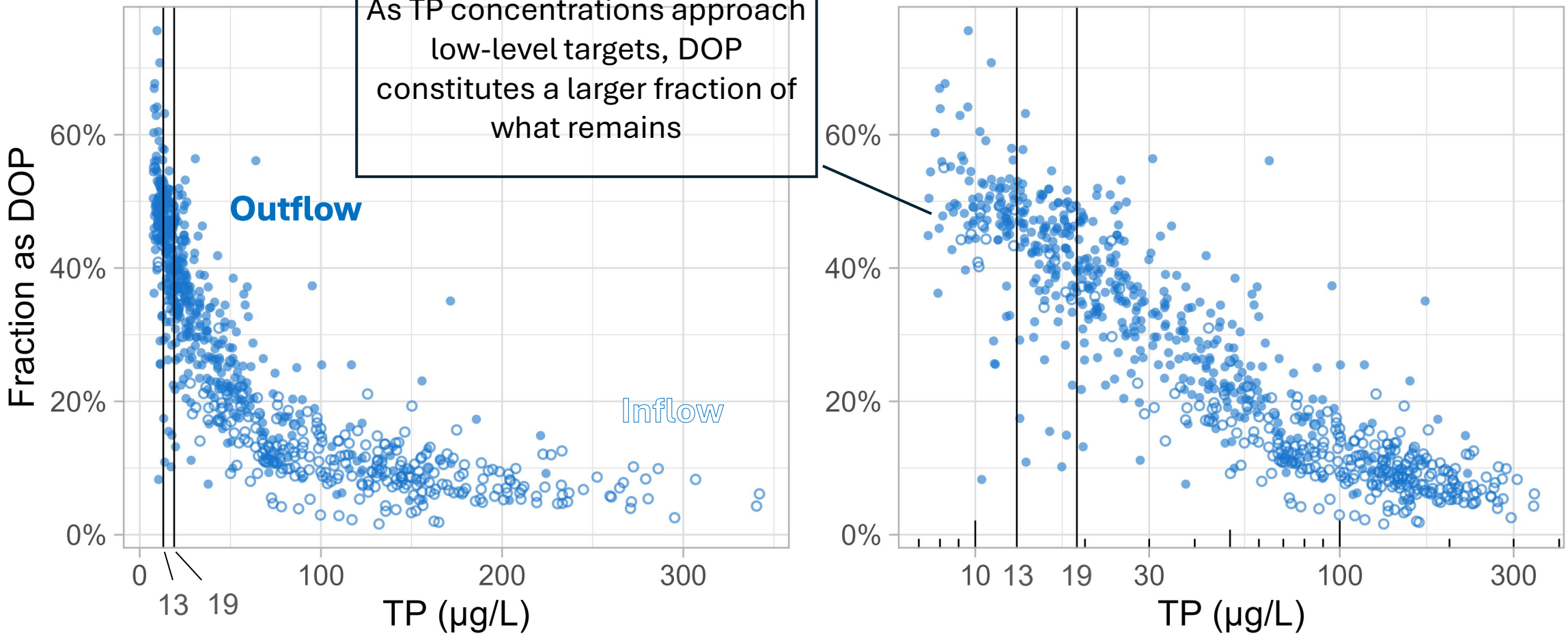
DB Environmental

Background and Rationale

As TP concentrations approach low-level targets, DOP constitutes a larger fraction of what remains

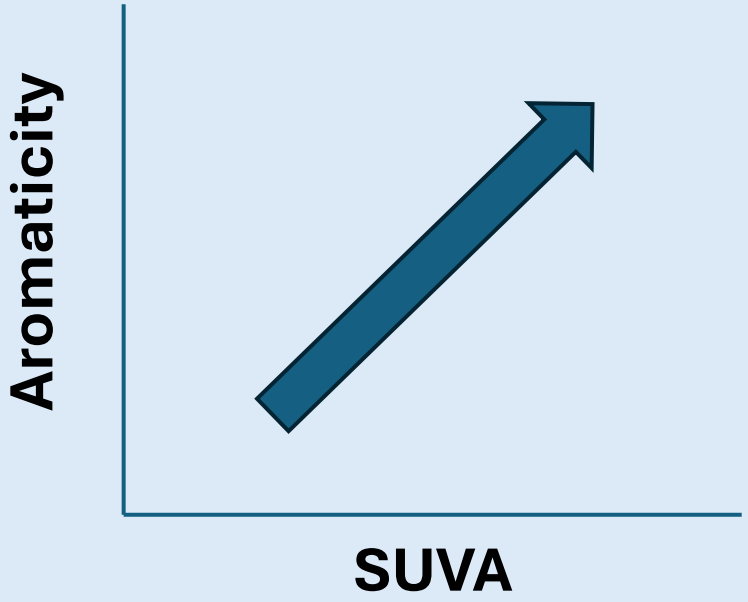


DOM optical properties

- Inexpensive; easy to add to routine P, DOC monitoring

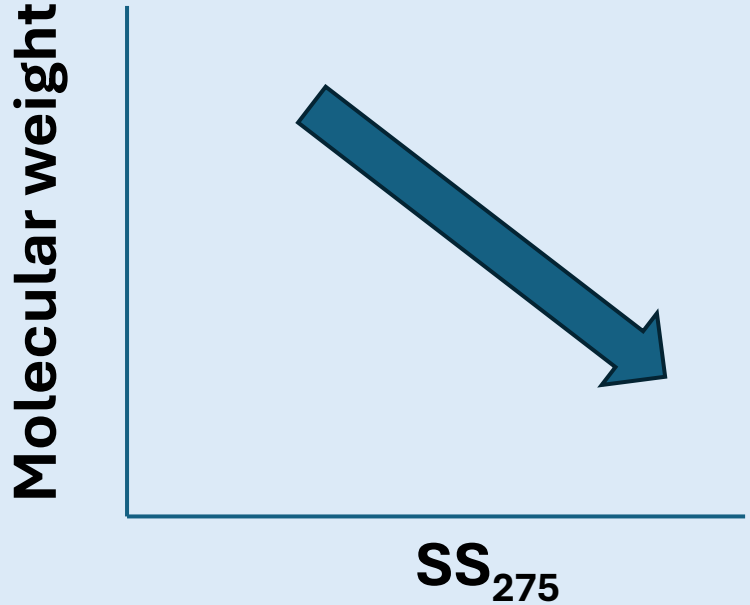
SUVA

Specific ultraviolet (254 nm) absorbance



SS_{275}

Spectral slope 275-295 nm



Typical STA ecosystem

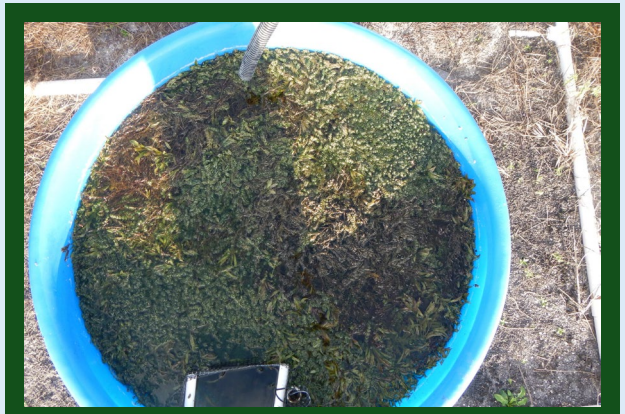
Abundant macrophytes growing in muck soil

Alternative ecosystem: Periphyton-based STA

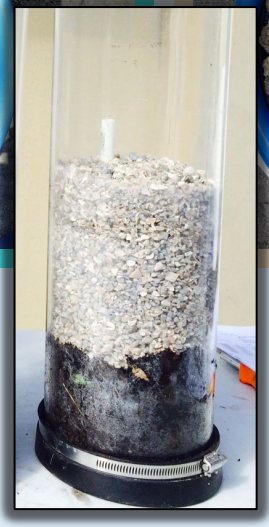
Abundant periphyton biomass, reduced macrophyte biomass, limerock substrate

Study systems

Muck soil
Abundant plants
Limited periphyton



Capped muck soil
Abundant plants

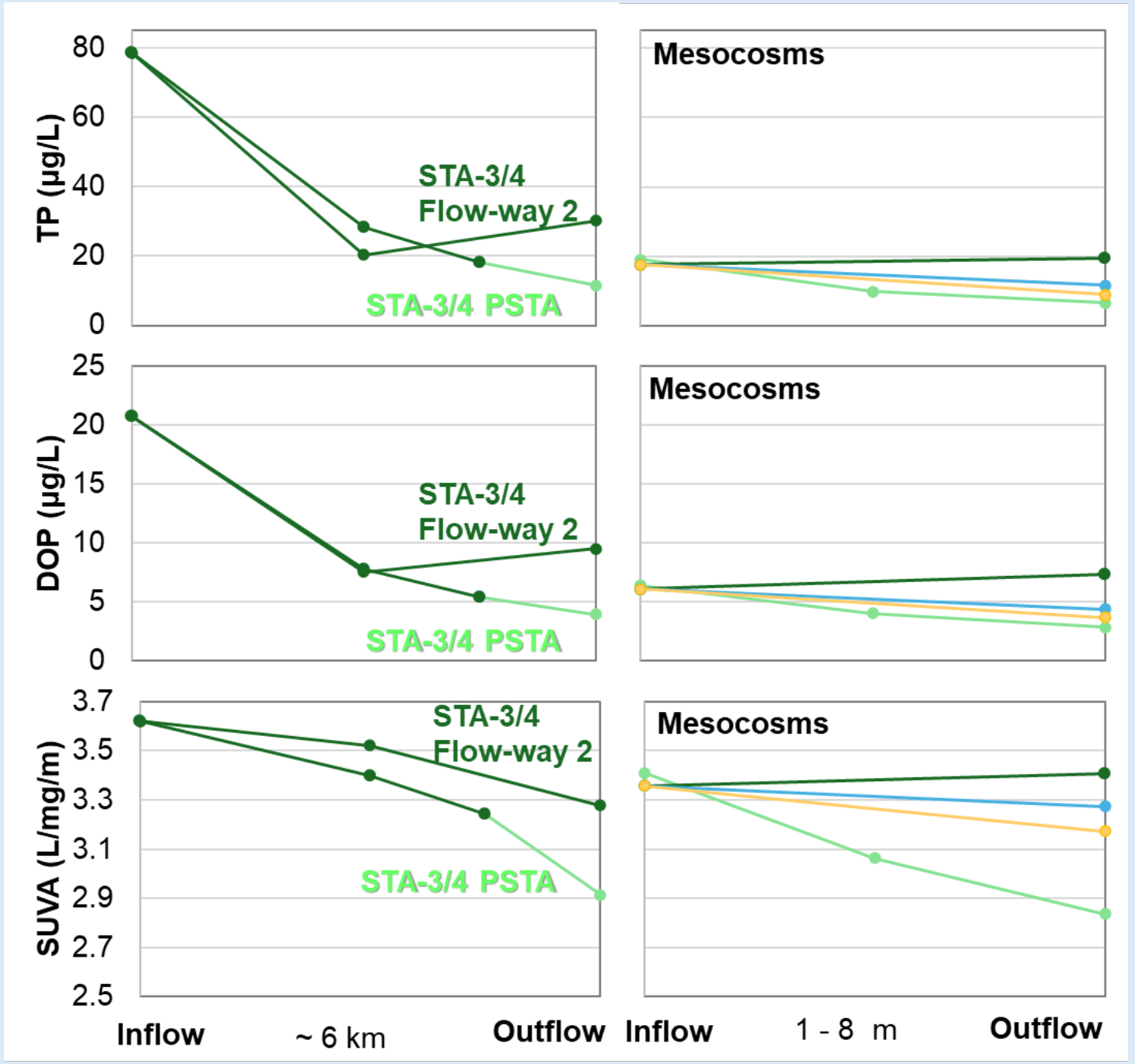


Capped muck soil
Abundant peri.

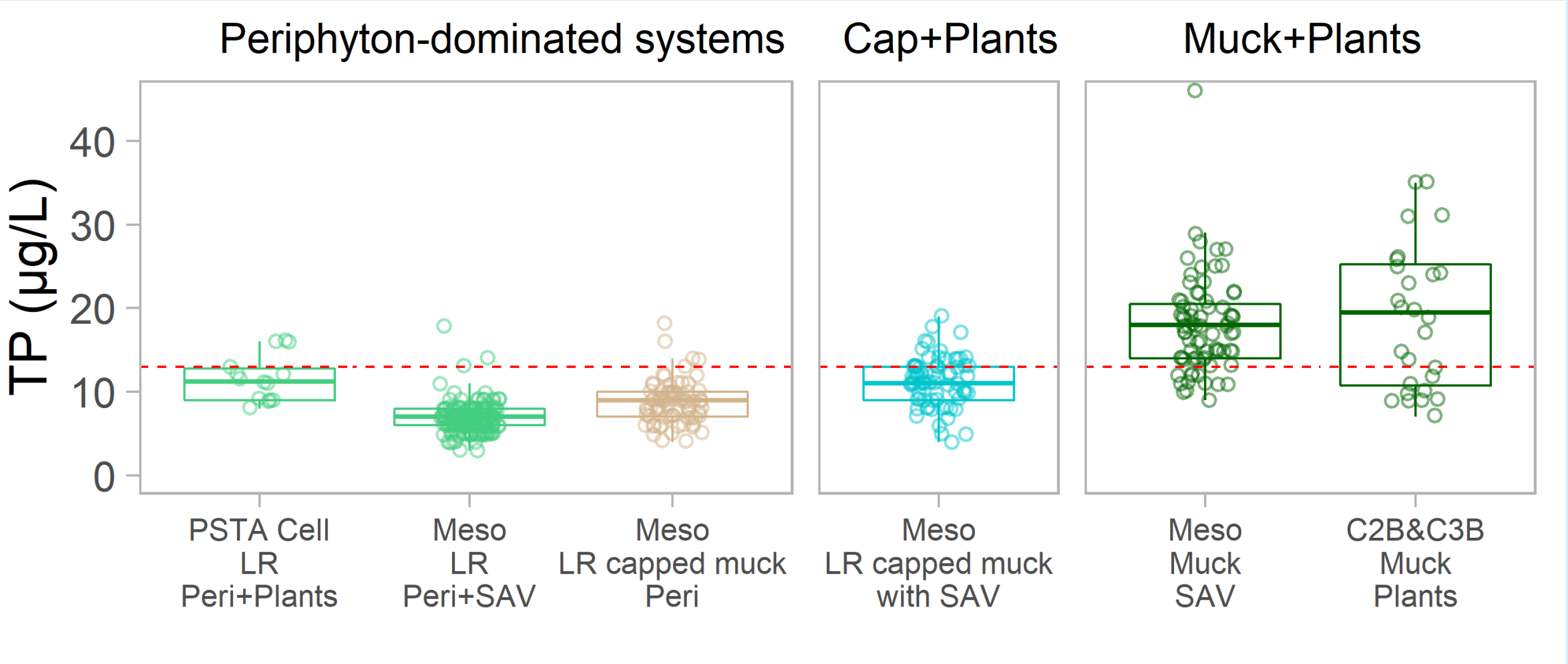
Limerock (LR)
Abundant periphyton
Limited plants

Operating Conditions

- Net P reduction
- Net DOP reduction
- Net DOM degradation

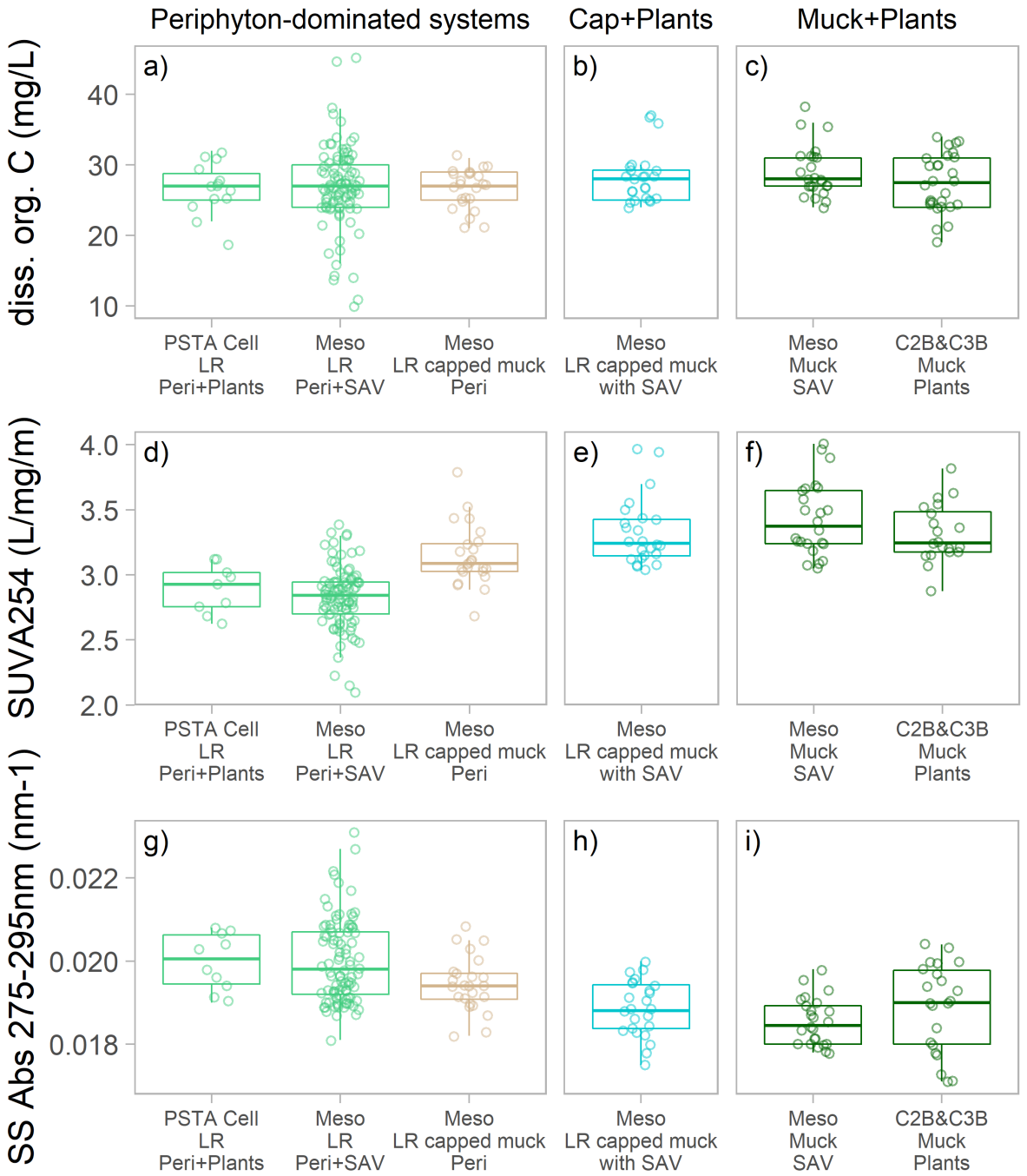


Outflow Total P



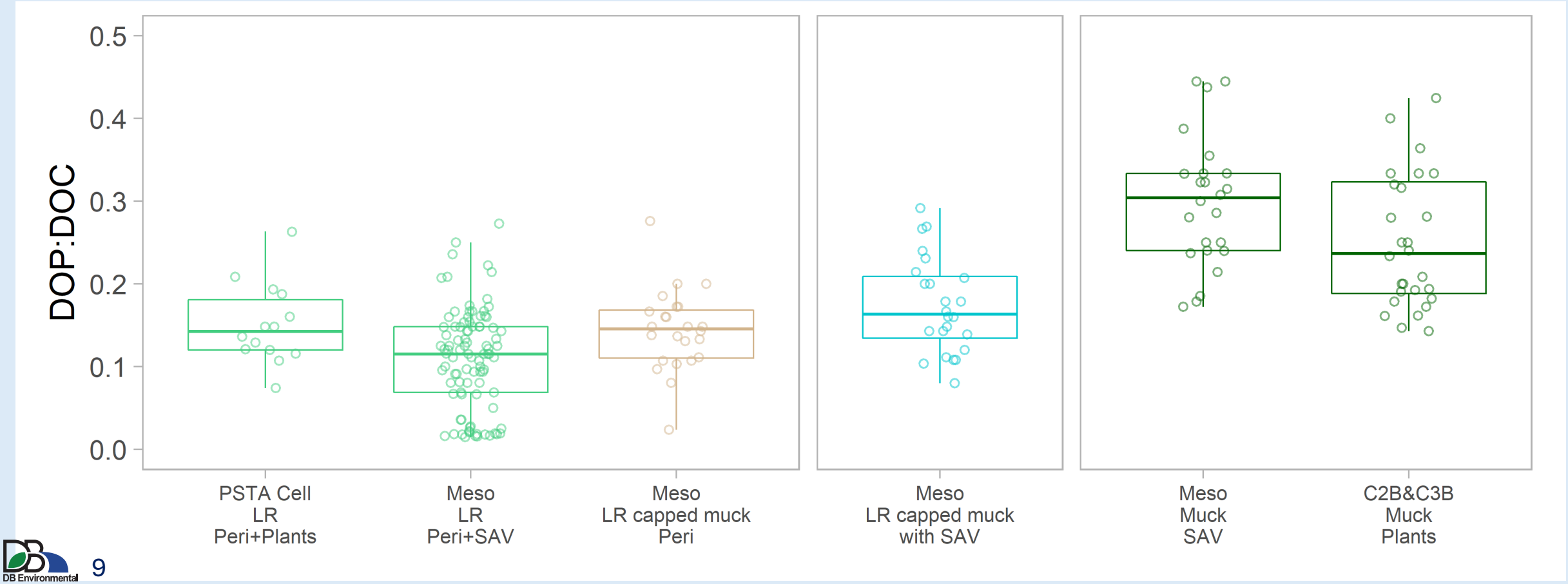
DOM Properties

- DOC similar among all systems
- **Muck+plants**
  Larger, more aromatic DOM
- **Limerock/periphyton-dominated**
  Smaller, more aliphatic DOM

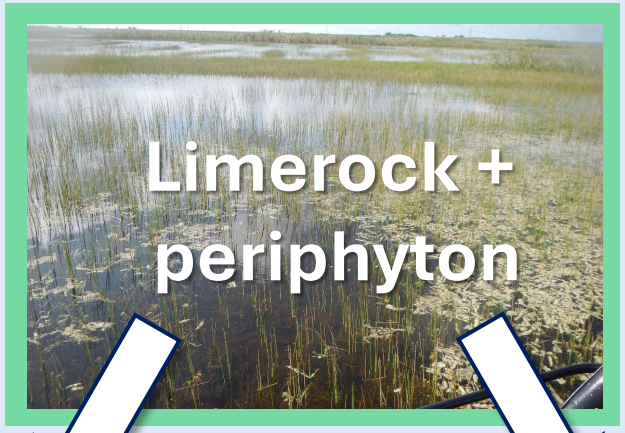


Depletion of P from DOM

- DOM is more P-depleted in limerock+periphyton-dominated systems



Take-aways

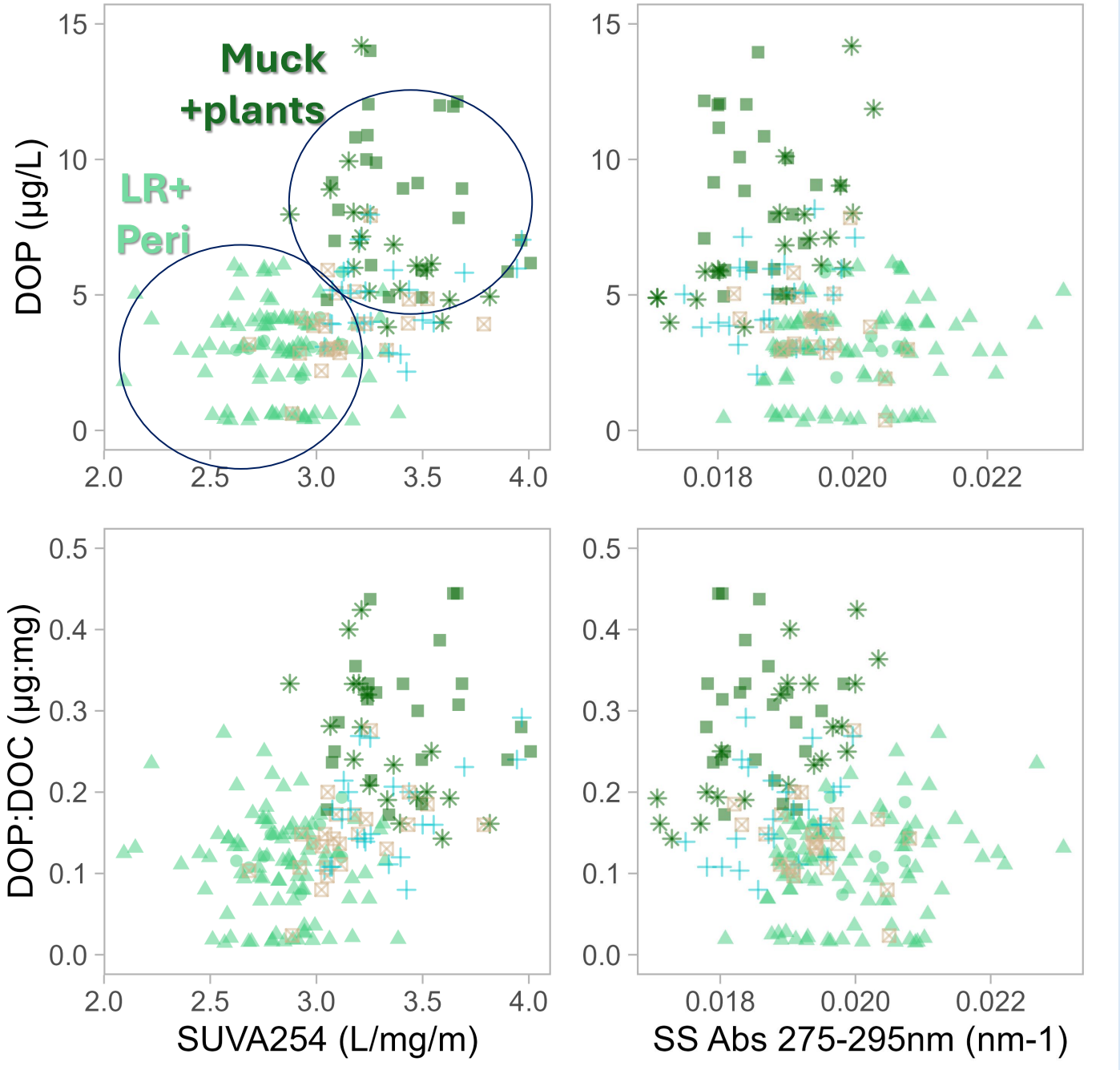


Smaller, more aliphatic DOM

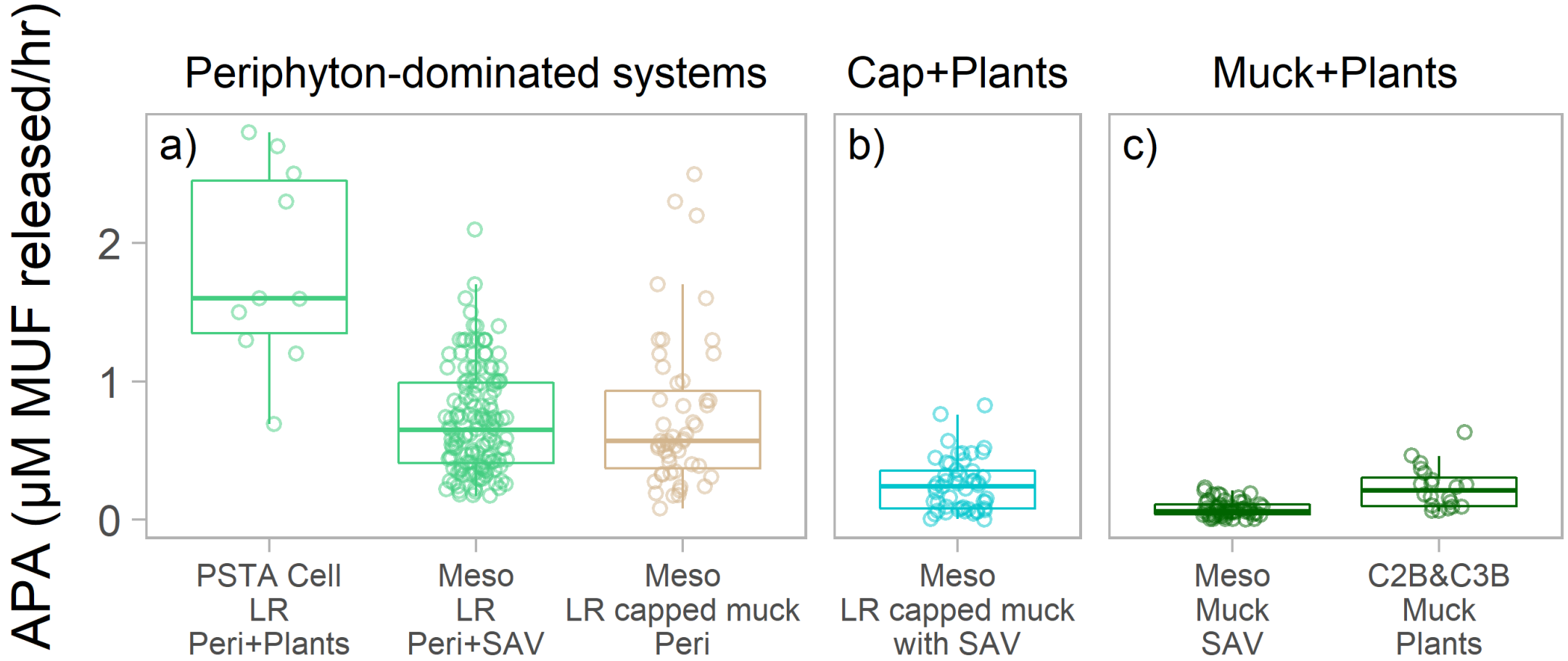
?

Greater DOP depletion

Why?

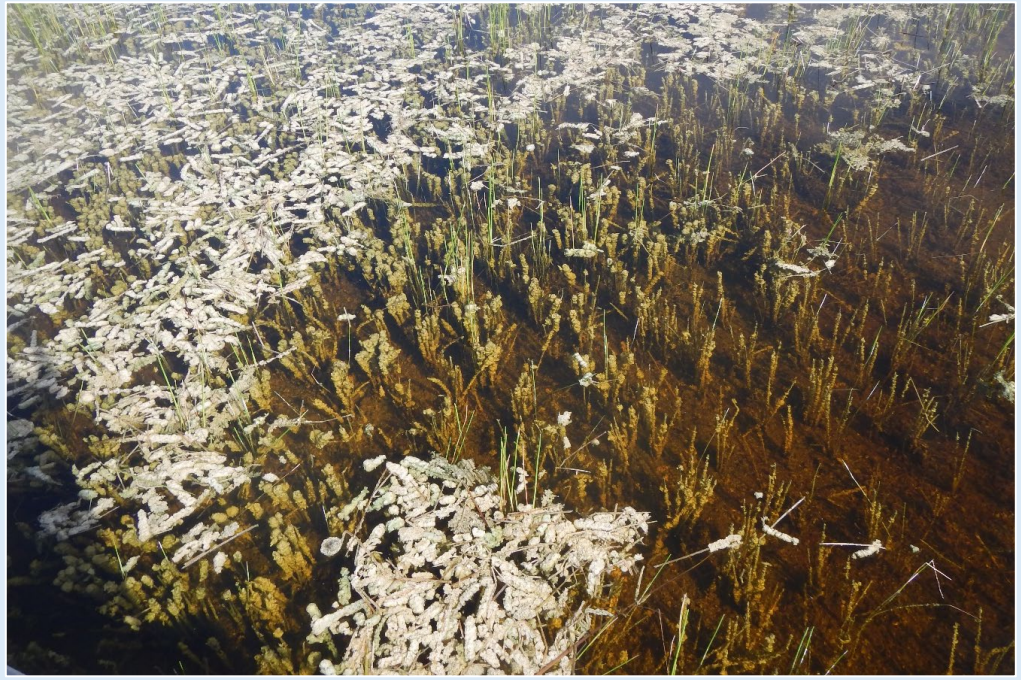


Enzyme activity



Why?

1. Limerock/periphyton-generated DOM is product of enzyme hydrolysis?
2. Limerock/periphyton-generated DOM susceptible to P-acquiring enzymes?
3. Muck/macrophyte-generated DOM deactivates P-acquiring enzymes?
4. Plant community physical structure of periphyton-dominated systems favors UV photolysis?



Further reading

Amaral, J.H.F., J.R. Gaddy, T.S. Bianchi, T.Z. Osborne, S. Newman, J. Dombrowski, E.S. Morrison, 2023. Controls on the composition of dissolved organic matter in treatment wetland source waters of South Florida, USA. EE 194, 107047. https://doi.org/10.1016/j.ecoleng.2023.107047

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Jørgensen, C., K.S. Inglett, H.S. Jensen, K. Reitzel, K.R. Reddy, 2015. Characterization of biogenic phosphorus in outflow water from constructed wetlands. Geoderma 257–258, 58–66. https://doi.org/10.1016/j.geoderma.2015.01.019

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