



# Mixing Downstream of Stream Confluences Alters Carbon and Nutrient Cycling in Freshwater Networks

Stephen Plont\*, Jacob Riney, Caitlin Miller,  
Erin Hotchkiss

Department of Biological Sciences, Virginia Tech

\*[plontste@vt.edu](mailto:plontste@vt.edu)

 [@stephenplont](https://twitter.com/stephenplont)

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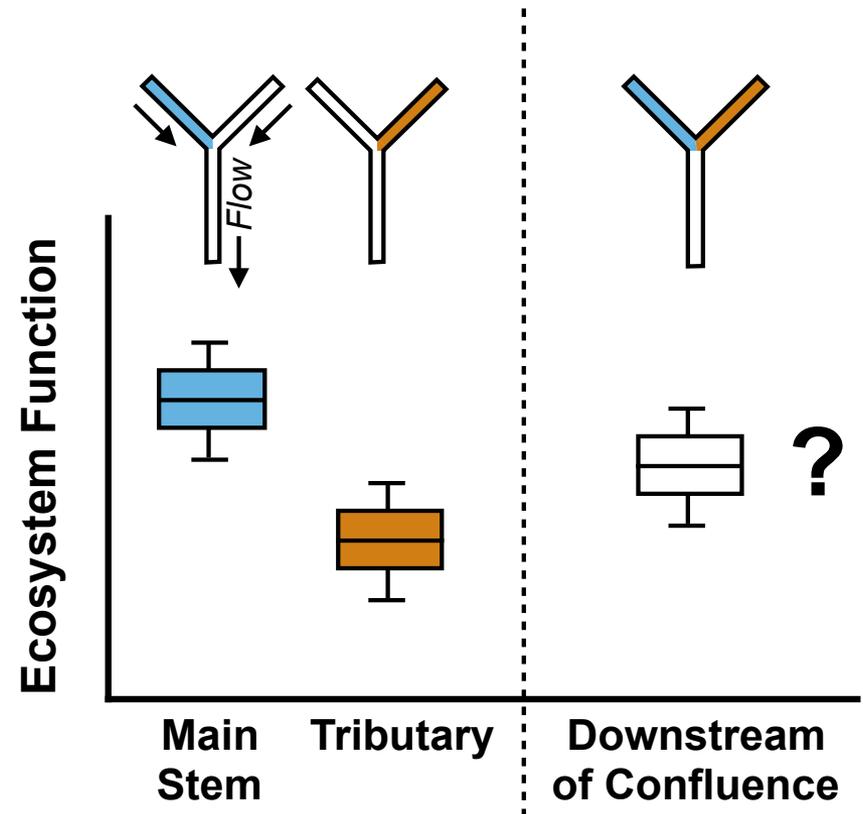
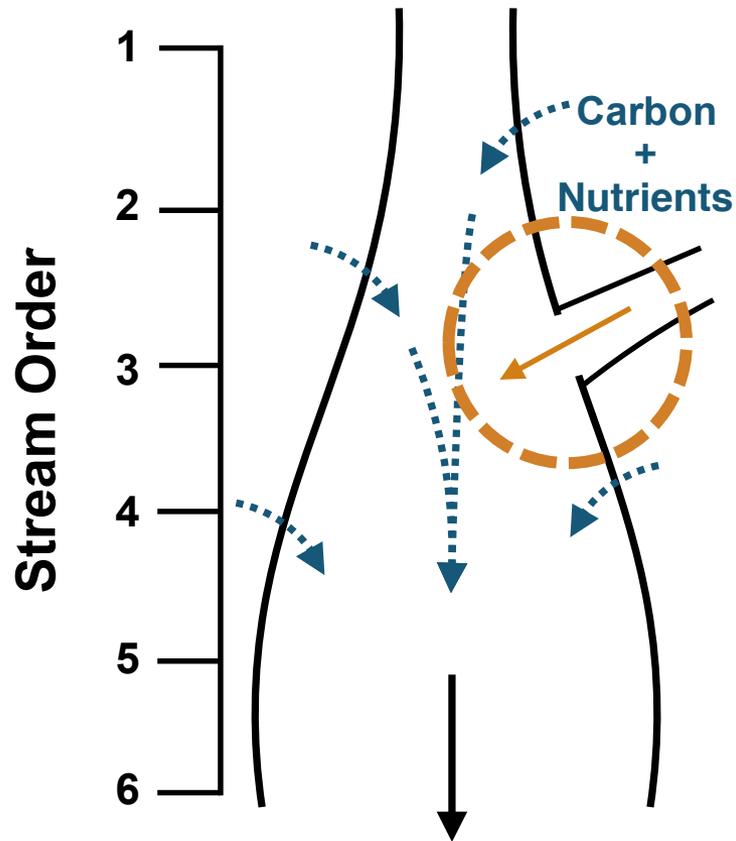
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- Bob Hall, Michelle Baker for method development

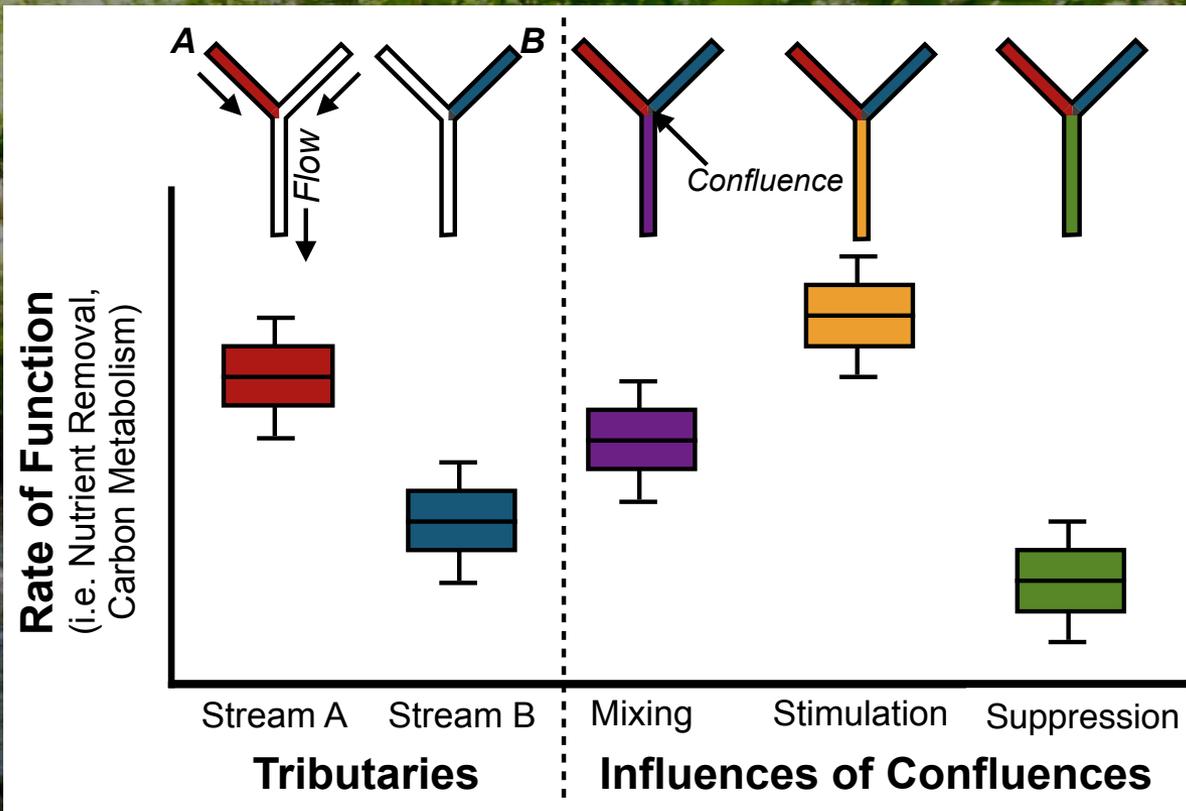


# What are the roles of confluences in ecosystem function?

## Stream Continuum + Confluence Effects

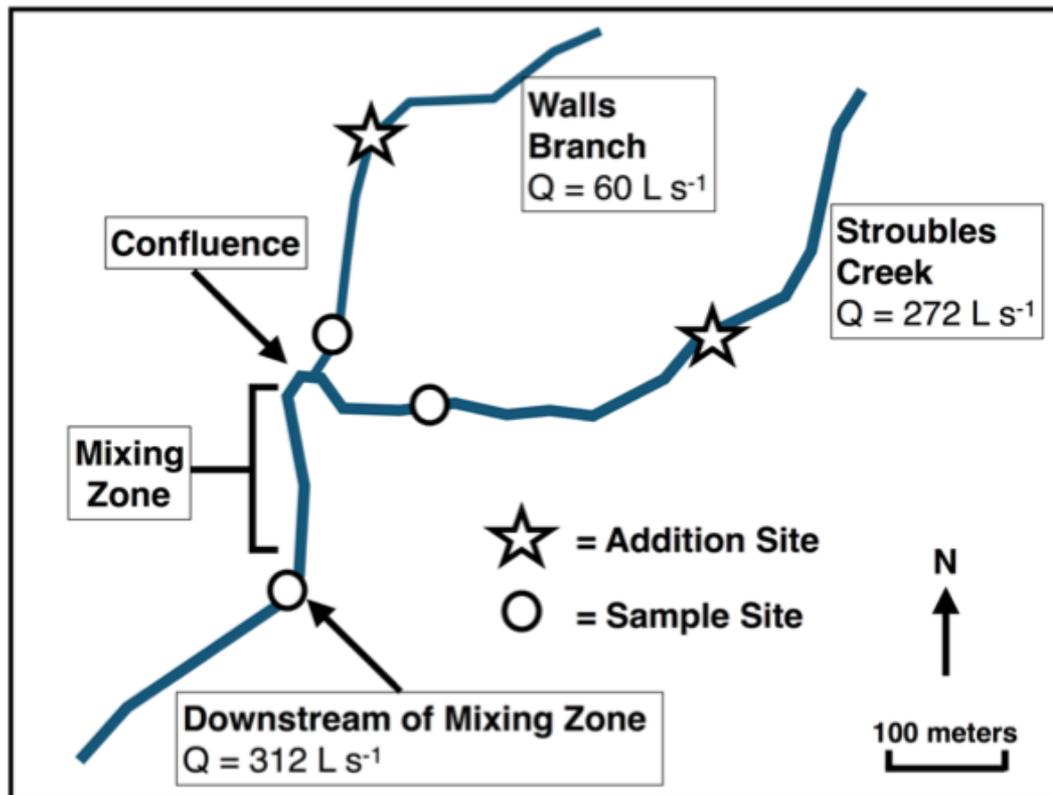


# How do stream confluences influence the fate of carbon and nutrients?

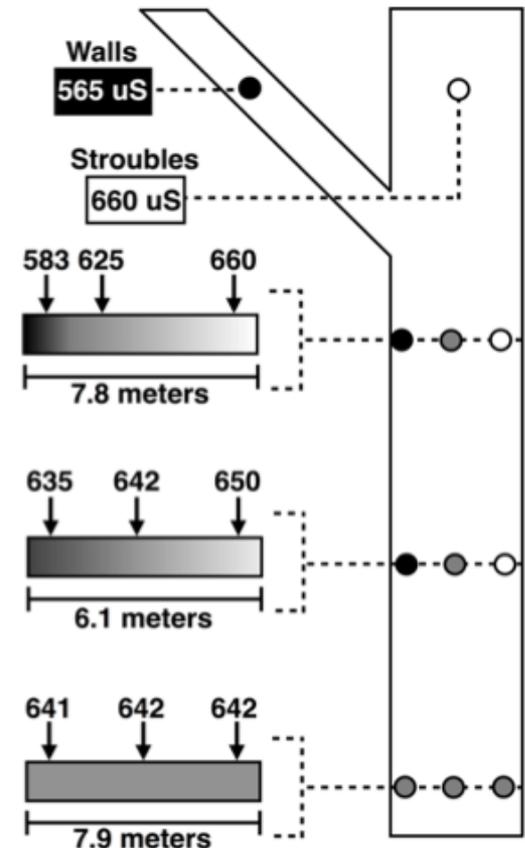


# Stroubles-Walls Confluence

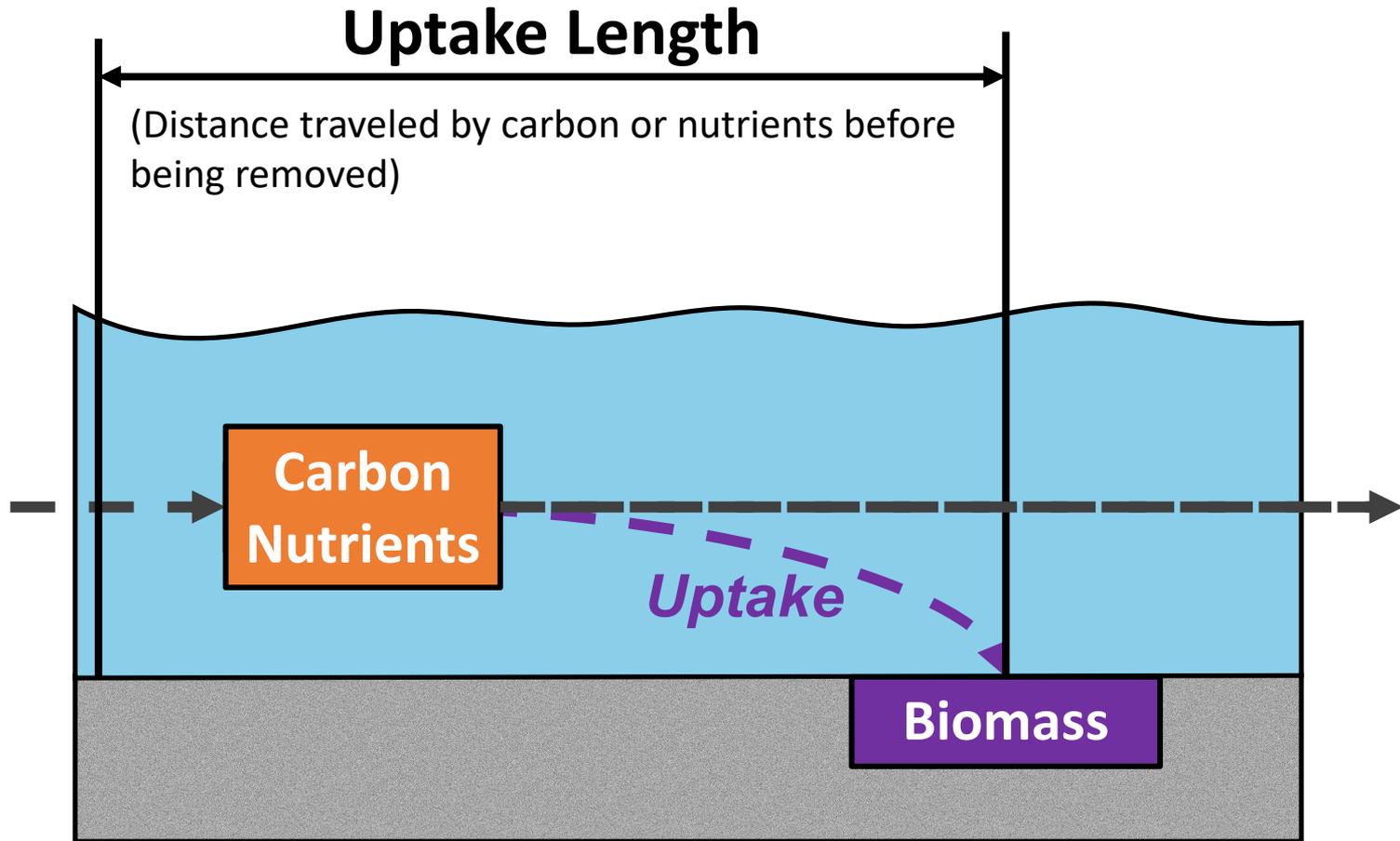
Urban/Agricultural catchment,  
High  $\text{NO}_3^-$  and conductivity



Confluence mixing  
zone mapped using  
conductivity

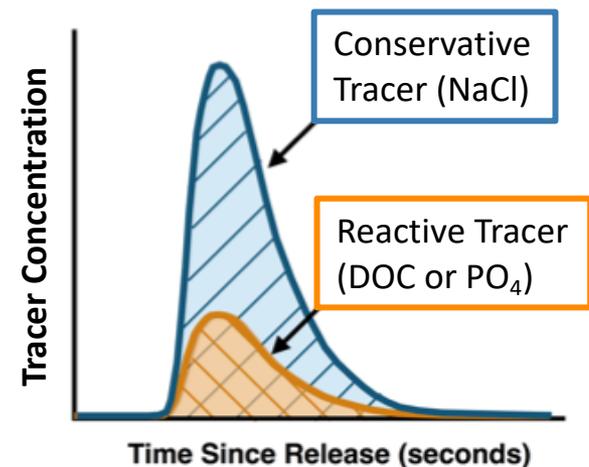


# Linking Process (Biology) and Transport (Hydrology)

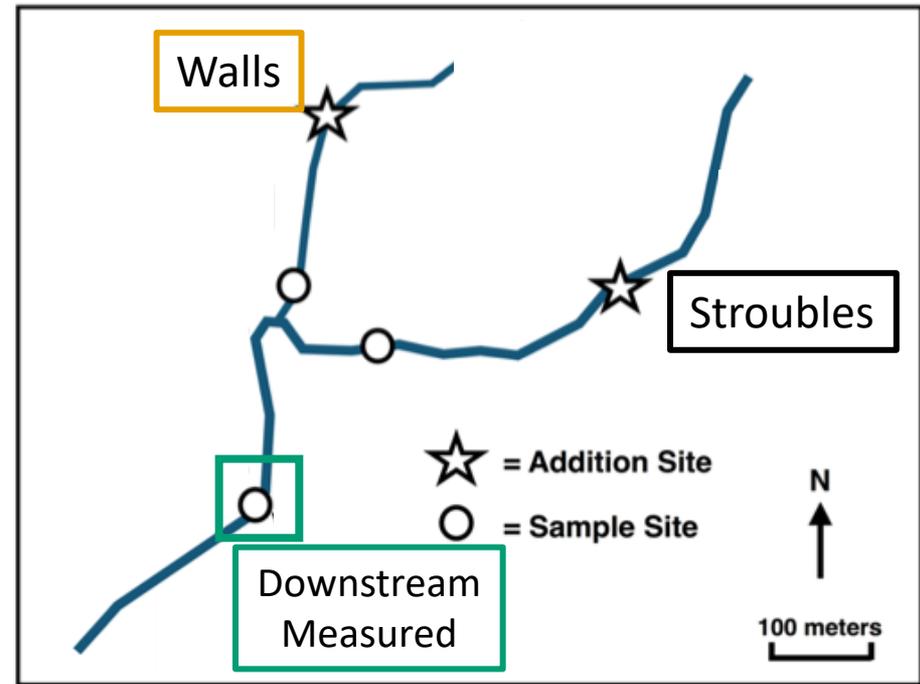
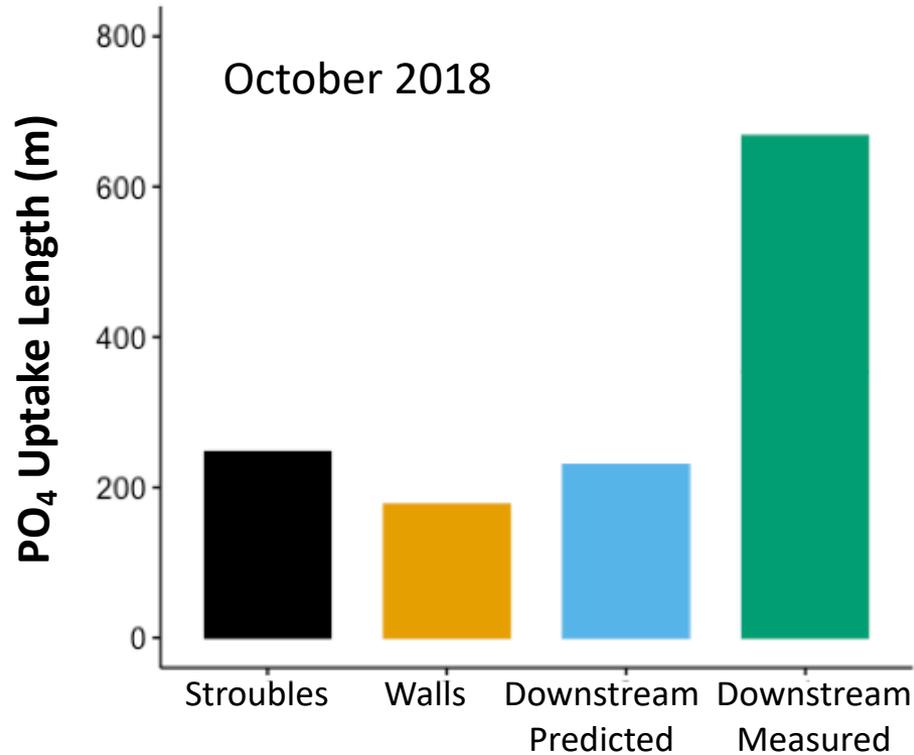


# Confluence DOC and PO<sub>4</sub> Uptake Experiments

- DOC, PO<sub>4</sub>, and NaCl pulsed in each tributary
- Measured changes in concentration in tributaries and downstream of confluence mixing zone
- Roasted Barley Leachate as a DOC source
  - Similar bioavailability to ambient stream DOC
- Calculated DOC and PO<sub>4</sub> uptake length
  - Breakthrough curve integration method (Tank et al., 2008 Ecology)



# PO<sub>4</sub> Uptake Suppressed Downstream



Downstream Predicted Uptake\*

=

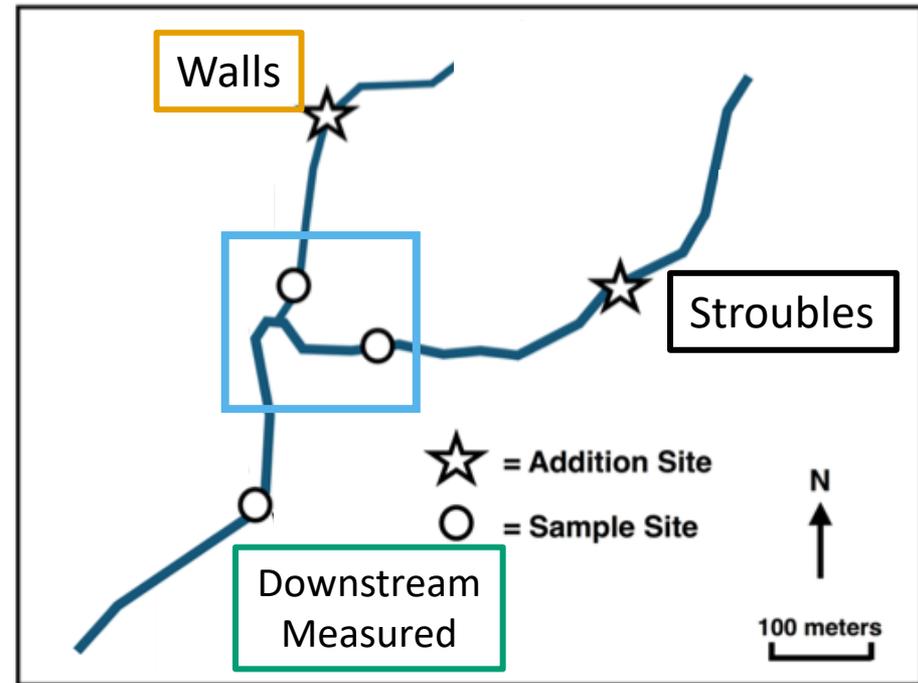
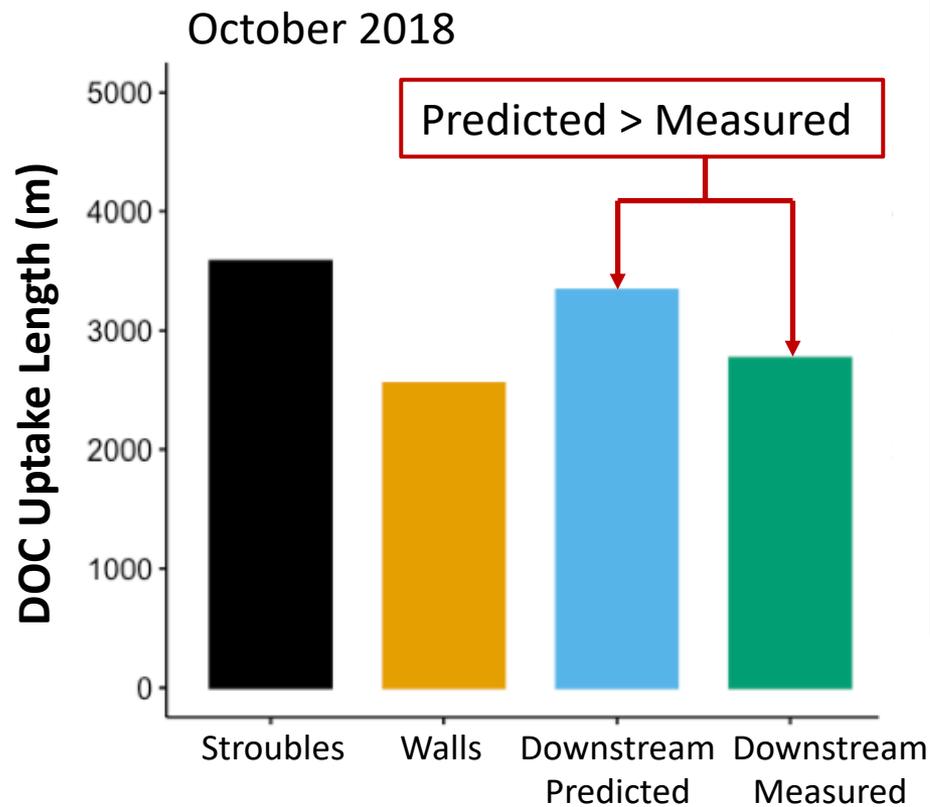
Stroubles Uptake\*

+

Walls Uptake\*

\*corrected for changes in discharge

# DOC Uptake Stimulated Downstream

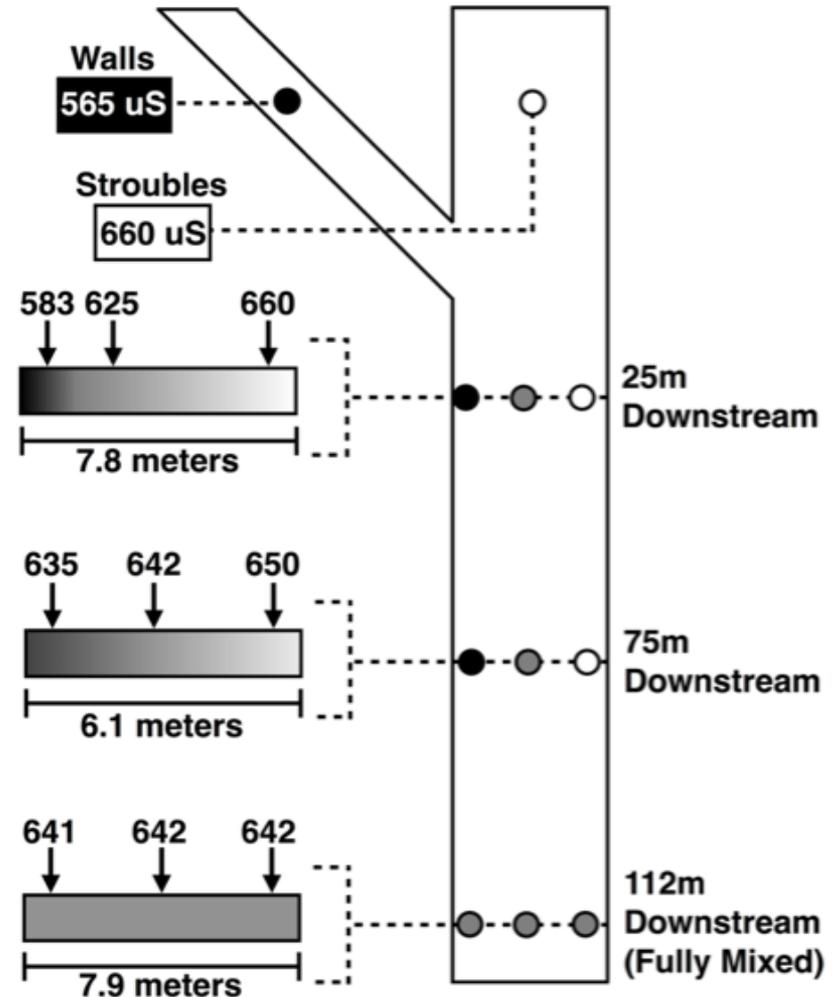


$$\text{Downstream Predicted Uptake*} = \text{Stroubles Uptake*} + \text{Walls Uptake*}$$

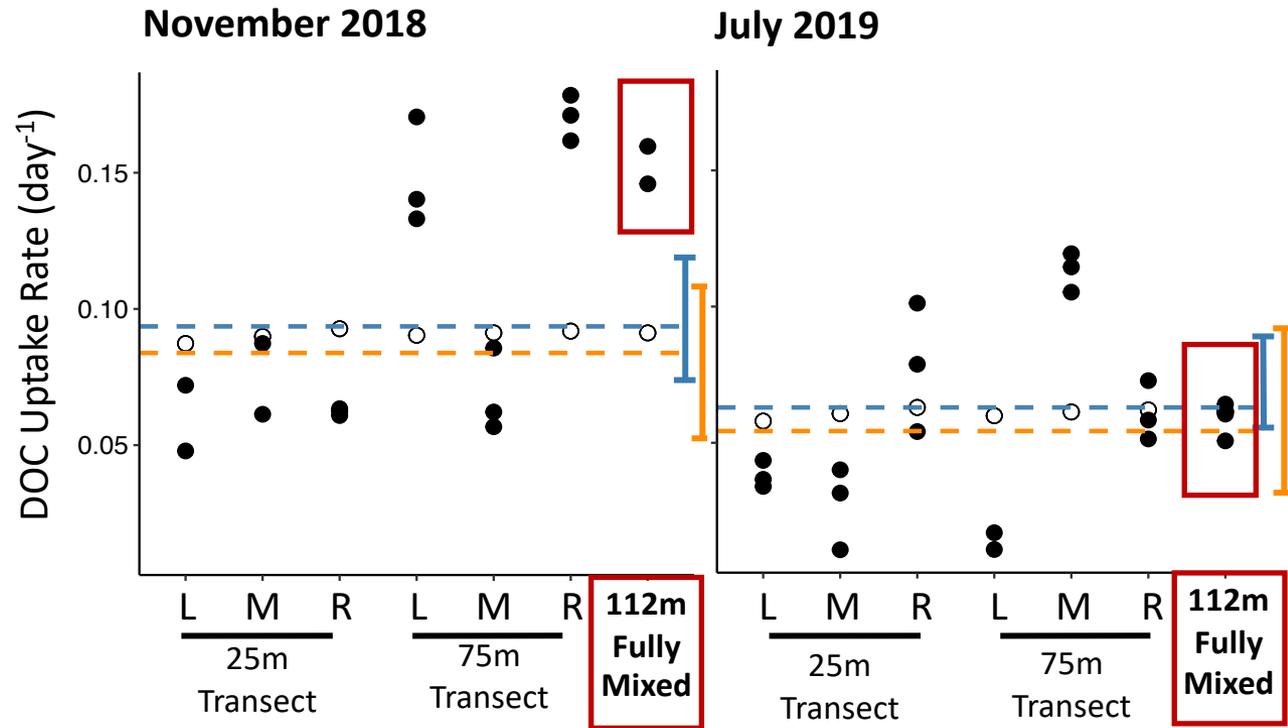
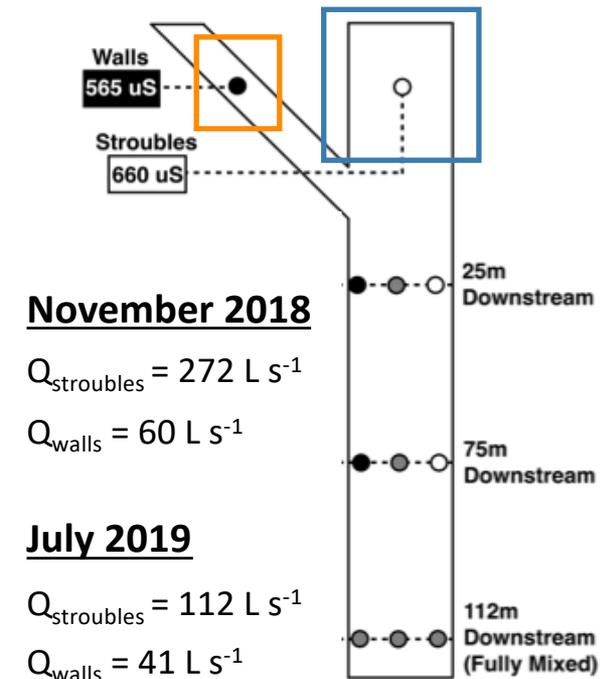
\*corrected for changes in discharge

# Removal within Confluence Mixing Zone

- Mixing of tributaries assessed using conductivity
- Water collected from transects in confluence mixing zone
- Bioassays to measure water column DOC uptake
- Enriched with roasted barley leachate ( $2 \text{ mg DOC L}^{-1}$ )
- Mixing model of tributaries for **predicted DOC uptake**



# DOC Uptake Spatially and Temporally Variable in Mixing Zone



- = Measured DOC Uptake Rate
- = Predicted DOC Uptake Rate
- (blue) = Stroubles Creek DOC Uptake Rate Range
- (orange) = Walls Branch DOC Uptake Rate Range

# Concluding Remarks

- $\text{PO}_4$  uptake length was longer downstream of confluence than predicted  $\rightarrow$  suppression?
- DOC uptake length was shorter downstream of confluence than predicted  $\rightarrow$  stimulation?
- Bioassay DOC uptake was spatially and temporally dynamic and more variable in mixing zone than tributaries

