

# AN INTERREGIONAL COMPARISON OF CHANNEL STRUCTURE, TRANSIENT STORAGE, AND NUTRIENT UPTAKE IN STREAMS DRAINING LATE AND EARLY SUCCESSIONAL WATERSHEDS

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## Abstract

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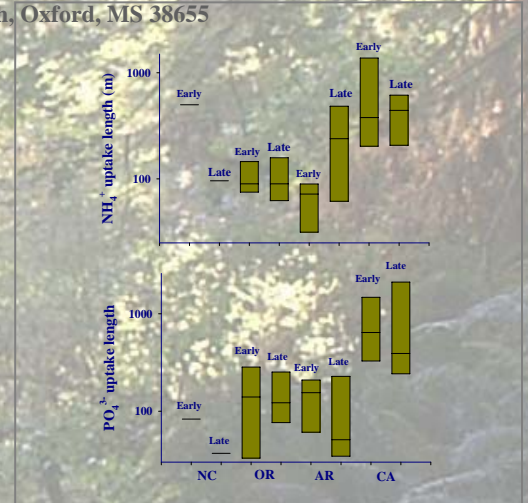
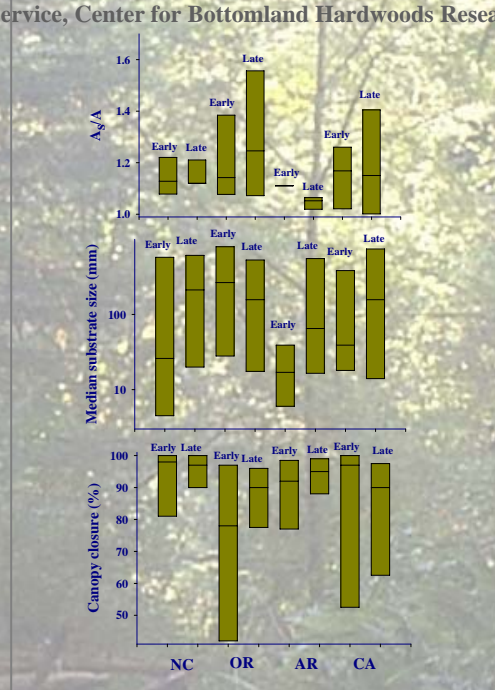
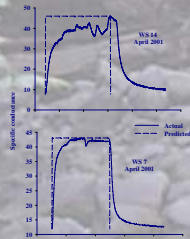
We compared stream channel structure and riparian canopy with transient storage and nutrient uptake in 32 streams draining early and late successional watersheds in the Appalachian Mountains (North Carolina), Ouachita Mountains (Arkansas), Cascade Range (Oregon) and coastal redwoods (California). Despite distinct differences among geographic regions, streams draining early watersheds overall had less riparian canopy and smaller median substrate sizes. Transient storage was calculated as the difference between actual and predicted chloride transport, and nutrient uptake lengths were estimated from the downstream depletion of added nutrients. Transient storage was greatest in the redwoods streams, followed by Cascade, Ouachita and Appalachian streams. In the western streams (California and Oregon), streams draining early successional watersheds had lower transient storage than streams draining late successional watersheds. The opposite was true in the southern streams (Arkansas and North Carolina). The ratio of transient storage ( $A_s/A$ ) to channel cross-sectional area ( $A$ ), a measure of the importance of transient storage, was similar among regions, except Arkansas streams which had lower  $A_s/A$ . Phosphate uptake length was shortest in the North Carolina streams, longest in the California streams, and significantly correlated with reach volume, riparian canopy closure and transient storage. Ammonium uptake length was shortest in the Oregon and Arkansas streams, longest in the California streams, and significantly correlated with reach volume and transient storage.

## Methods

Habitat characterization followed EMAP guidelines (Environmental Monitoring and Assessment Program-Surface Waters: Field Operations and Methods for Measuring the Ecological Condition of Wadeable Streams, J.M. Lazorchak, D.J. Klemm and D.V. Peck (eds). EPA/620/R-94/004F. U.S. Environmental Protection Agency, Washington, DC, 1998).



Solute releases followed procedures outlined by the Stream Solute Workshop (Journal of the North American Benthological Society 9:95-119, 1990)



Spearman correlations of  $\text{NH}_4^+$  and  $\text{PO}_4^{3-}$  uptake lengths, habitat measures and transient storage.

Uptake lengths Median substrate size Canopy closure Reach volume  $A_s$   $A_s/A$

|                    |       |        |       |       |        |
|--------------------|-------|--------|-------|-------|--------|
| $\text{NH}_4^+$    | 0.050 | -0.012 | 0.353 | 0.321 | -0.189 |
| $\text{PO}_4^{3-}$ | 0.032 | -0.280 | 0.531 | 0.524 | -0.106 |

## Conclusions

- Nutrient uptake lengths exhibit:
  - regional differences
  - watershed history differences
  - correlations with habitat features
- Median substrate size, while a good indicator of watershed disturbance, was not related to uptake lengths

ANOVA and Scheffe's multiple means test results comparing uptake lengths and watershed successional history.

Location History Uptake length Scheffe group

| Location | History | Uptake length      | Scheffe group |
|----------|---------|--------------------|---------------|
| NC       | Early   | $\text{NH}_4^+$    | A             |
|          | Late    | "                  | B             |
|          | Early   | $\text{PO}_4^{3-}$ | A             |
|          | Late    | "                  | B             |
| AR       | Early   | $\text{NH}_4^+$    | A             |
|          | Late    | "                  | B             |
|          | Early   | $\text{PO}_4^{3-}$ | A             |
|          | Late    | "                  | B             |
| CA       | Early   | $\text{NH}_4^+$    | A             |
|          | Late    | "                  | B             |
|          | Early   | $\text{PO}_4^{3-}$ | A             |
|          | Late    | "                  | B             |
| OR       | Early   | $\text{NH}_4^+$    | A             |
|          | Late    | "                  | A             |
|          | Early   | $\text{PO}_4^{3-}$ | A             |
|          | Late    | "                  | A             |