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AN INTERREGIONAL COMPARISON OF CHANNEL STRUCTURE, TRANSIENT STORAGE AND RIPARIAN CANOPY WITH METABOLISM IN STREAMS DRAINING WATERSHEDS IN DIFFERENT SUCCESSIONAL STAGES

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Summary

We related channel structure, transient storage and riparian canopy with net daily metabolism (NDM) in 32 first- through fourth-order streams in the southeastern and northwestern United States. Management histories of the watershed ranged from clear-cut timber harvests to old-growth forests. Channel structure and riparian canopy estimates were collected at 10 points along each 40-100m study reach. Transient storage (A/A_s) was calculated as differences in areas under the curves for predicted and actual Cl- transport through the study reaches. NDM was estimated from in situ, single-station, diel oxygen changes using the surface renewal model. All of the study streams were heterotrophic (mean NDM ranged -94 to -2412 mg O_2 m^{-2} d^{-1}) and correlated with management history (Fig. 1). Canonical correlation analyses identified a single environmental gradient in both the northwestern and southeastern streams. The environmental gradient in northwestern streams was correlated with channel slope (r=0.914) ,woody debris (r=0.62) and transient storage (r=0.35) (Table 1, Figs. 2 & 3). NDM in the northwestern streams was significantly correlated (r=0.73) with this canonical gradient (Fig. 4). The environmental gradient in the southeastern streams was correlated with riparian canopy (r=0.80), stream width (r=0.47), stream depth (r=0.41), woody debris (-0.40) and transient storage (r=-0.36) (Table 1, Fig. 3). NDM in the southeastern streams was significantly correlated (r=0.63) with this canonical gradient (Fig. 4).

Table 1. Correlation of channel structure, A/A_s, canopy cover and NDM in Northwestern and Southeastern streams with the 1st canonical environmental gradient.

Variable	NW	SE
% Fine sediment	-0.23	0.29
% Canopy cover	-030	**0.80**
Stream depth	0.03	**0.41**
Stream width	0.01	**0.47**
Woody degris	0.62	**-0.40**
Channel slope	**0.91**	-0.20
Transient storage (A_s/A)	**0.35**	**-0.36**

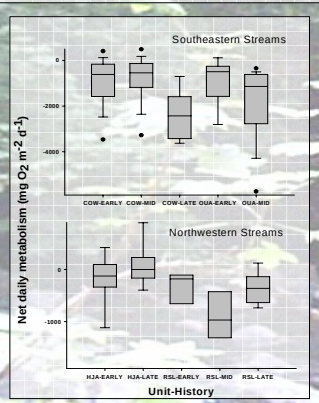

Figure 1. Comparison of NDM in streams draining watershed in different successional stages.

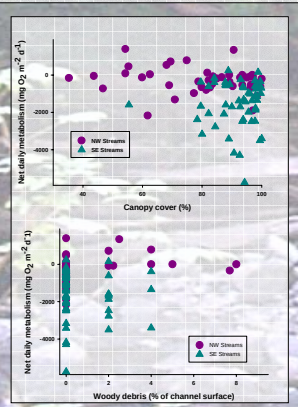

Figure 2. Comparison of NDM with riparian canopy and woody debris.

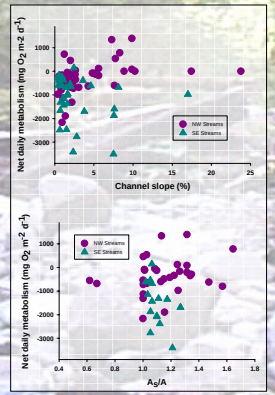

Figure 3. Comparison of NDM with channel slope and A_s/S.

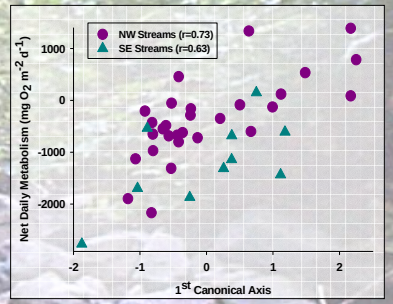

Figure 4. Correlation of NDM in with the 1st canonical environmental gradient.

Conclusions

- **There is a significant successional stage effect on NDM**
- NDM is significantly greater in low gradient streams
- A_s/A was a better predictor of NDM in SE streams, primarily due to the wider range of this variable in these streams
- The canonical gradient constructed from channel structure, canopy cover and A_s/A was a better predictor of NDM than any single environmental variable