Whole-stream metabolism in two montane streams: Contribution of the hyporheic zone

Fellows, Christine S., H. Maurice Valett, Clifford N. Dahm

Limnol. Oceanogr., 46(3), 2001, 523-531 | DOI: 10.4319/lo.2001.46.3.0523

ABSTRACT: We used whole-stream and benthic chamber methods to measure rates of metabolism and determine the contribution of the hyporheic zone to ecosystem respiration (R) in two streams with differing surface-subsurface exchange characteristics, Rio Calaveras and Gallina Creek, New Mexico. We used the difference between whole-stream and benthic R to calculate the rate of hyporheic zone R and coupled this estimate to an independent measure of hyporheic sediment R to estimate the cross-sectional area of the hyporheic zone (A_H) for two reaches from each stream. Conservative tracer injections and solute transport modeling were used to characterize surface-subsurface hydrologic exchange by determining values of the cross-sectional area of the transient storage zone (A_s). The hyporheic zone contributed a substantial proportion of whole-stream R in all four study reaches, ranging from 40 to 93%. Whole-stream R, hyporheic R, and percent contribution of hyporheic R all increased as transient storage increased, with whole-stream and hyporheic R exhibiting significant relationships with A_s. All three measures of respiration and values of A_H were much greater for both reaches of the stream with greater surface-subsurface exchange. AH is valuable for cross-site comparisons because it accounts for differences in rates of both benthic and hyporheic sediment R and can be used to predict the importance of the hyporheic zone to other stream ecosystem processes.