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Seasonal and longitudinal nutrient limitation patterns in a watershed influenced by irrigation delivery and return flow

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Abstract 190 words

Irrigation deliveries from mountain reservoirs that capture snowmelt support agriculture in the Yakima River Basin of Washington state. Yakima River water quality degrades as it moves downstream, as a result of increased nitrogen and phosphorus loads associated with irrigation return flow. Moreover, stream water N:P ratios are low during irrigation season as low-nutrient snowmelt is delivered, and N:P ratios increase shortly after irrigation season ends as shallow ground water discharges nitrate-rich water back to streams. We hypothesized that longitudinal water quality degradation would relieve nutrient limitation in downstream ecosystems and that the seasonal change in N:P ratios would change nutrient limitation patterns during and after irrigation season. After deploying NDS arrays with N, P, and Si, the most common nutrient limitation response was nitrogen limitation of respiration (8 of 12 assays) and silica limitation of production (5 of 12 assays). We did not see downstream nutrient limitation relief, likely because biofilm nutrient demand never saturated. However, nutrient demand was more likely to differ between summer and fall in the sites most affected by agricultural return flow indicating that water management can change seasonal and longitudinal patterns of biofilm nutrient demand.