

Assessing stream metabolism in two spruce catchments of contrasting lithology previously impacted by acid rain

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Increasing pH and dissolved organic carbon (DOC) in drainage waters recovering from anthropogenic acidification may alter freshwater ecosystem function. However, the extent to which changes in pH and DOC may influence stream metabolism is not well documented. We evaluated stream metabolism (gross primary production and ecosystem respiration: GPP and ER) and its relationship with pH and DOC in two catchments of contrasting acidic versus ultrabasic lithology. Both are recovering from decades of high acidic inputs. Catchments studied were the Lysina (LYS-granite) and Pluhův Bor (PLB-serpentinite) catchments in the Slavkov Forest, Czechia, Central Europe. We deployed high-frequency dissolved oxygen (DO) and temperature sensors for ~9 months at each catchment and collected surface water samples on a weekly to monthly basis. Water samples were analyzed for DOC, pH, and major ions. Mean DOC was higher and more variable at PLB than LYS (mean $\pm$ SD: 23.5 ± 13.6 and 15.5 ± 8.0 mg L⁻¹, respectively). Acidic conditions are prevalent at LYS (mean pH: 4.68 ± 0.49) compared to PLB which is circumneutral (mean pH: 7.75 ± 0.28). Flow at both catchments alter water chemistry by enriching DOC during high flows (R^2 : 0.8, $p < 2.2e-16$) and diluting base cations while increasing acidity at LYS (R^2 : 0.22, $p < 0.002$) and at PLB (R^2 : 0.87, $p < 2.2e-16$). Differences in buffering capacity are supported by decreases in alkalinity with increases in flow at both catchments, but responses at LYS lead to negative alkalinity. Flow, DOC, and pH, will likely influence metabolic rates at both catchments, where GPP will be low relative to ER, and we predict that ER will increase due to DOC inputs from soil organic horizons during high flows. Ongoing work is modeling GPP and ER to explore differences among sites, with changes in flow, and as a function of environmental drivers to examine which best predict metabolism at each catchment.