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The metabolic footprint of riverine dissolved organic carbon from different terrestrial sources

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ABSTRACT

A main driver of aquatic CO2 emissions is the respiration by bacteria (BR) that process terrestrially-derived dissolved organic carbon (DOC). We estimated BR on variable time scales (3 days - 365 days) in bioassays with nutrient-enriched (N+P) water from 12 Québec streams spanning broad gradients in DOC, catchment size and catchment composition. BR was strongly regulated by DOC concentrations and by incubation time. However, BR normalized to DOC was surprising similar across sites. The δ13C and Δ14C of the respired C (Keeling plot inferred) varied systematically across the landscape, with the highest values in bog streams characterized by high BR. The δ13C of respired C was also positively correlated to the amount of protein-like fluorescence lost during incubation. The results suggest that the peat-derived respired C was highly influenced by 'bomb carbon' (decades old material) and protein rich organic matter fractions. The forest-derived respired C was based on young energy rich DOC. This study describes how BR relates to DOC quality and age, and how DOC characteristics are influenced by the landscape in which DOC is produced, transported and cycled.