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Metabolic "hot spots"and "hot moments" in nascent stream corridors

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Metabolic activity in stream corridors is regulated by a complex combination of factors that are difficult to disentangle in mature ecosystems. Chicken Creek in Germany, an artificial catchment in an early successional stage offers the opportunity to assess the spatio-temporal variation in metabolic activity in a highly simplified system. Water availability is usually assumed to be the main factor controlling soil and sediment metabolism during such early successional stages. We assessed microbial respiration in soils and sediments of Chicken Creek along the hydrological flow path from upland terrestrial to semi-aquatic to permanently aquatic sites of three stream corridors.

Dry soil and sediment was hydrated before respiration measurement to simulate the period during and after rainfall events. Soil and sediment respiration and organic matter content were generally low. Accretion of fragments of vascular plants in the incised stream channels increased respiration, pointing to the importance of organic matter quality and quantity in addition to water availability. Contrary to expectations, respiration rates of hydrated soil and sediments from dry stream channels were similar to rates measured with sediments collected in the permanently wet channel. This observation suggests that long-term water availability is not the main factor determining metabolic potential. Although aquatic sites showed carbon turnover rates 5 times higher than the semi-aquatic and terrestrial sites, the former contributed only marginally to the total carbon turnover in the catchment. Extrapolation of our data to an entire year indicated that more than 95% of the annual carbon turnover in the catchment was due to semi-aquatic and terrestrial sites, mainly during periods of high metabolic activity following rainfall. Thus, “hot moments” turned out to be much more important in determining overall metabolism of the Chicken Creek catchment than “hot spots.”