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Effect of river restoration on organic carbon (OC) dynamics in a riparian groundwater system

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The effect of river revitalization measures on OC dynamics was investigated in a restored and a channelized section of a riverine floodplain. Revitalization measures established high environmental heterogeneity reflected in different types of functional process zones (FPZ). High spatial variability is thought to enhance subsurface OC transformations by directing transport and transformation processes of relevant organic reactants. In 2008/09 water samples were collected along riparian hyporheic connectivity in the test site of the CCES Project RECORD (Restored corridor dynamics) at the prealpine River Thur, Switzerland. The distribution of total and dissolved organic carbon (TOC, DOC) and oxygen was monitored in the different FPZs. The OC was chemically characterized by measuring its stable C isotopic ratio, polydispersity, fluorescence properties, and the yield and composition of hydrolyzable amino acids (THAA). These data were related to cell abundance, extracellular enzymatic activity, and respiration. The results showed that river and groundwater OC was predominantly terrestrial derived. In the restored section, high hydrological connectivity transported river-borne OC into groundwater, and particularly flood disturbances facilitated vertical input of soil-derived OC. Re-dissolution enriched the flow with bioavailable substrates, which increased the potential for co-metabolic transformation hotspots, fuelling the turnover of highly refractory OC. While in the restored part groundwater OC became most diagenetically altered through microbial action, in the non-restored part transport prevailed relative to turnover processes. This study documented that OC dynamics are enhanced through high system heterogeneity, which allowed the formation of OC transformations loops along groundwater flow.