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The impact of river morphology on phosphorous fluxes

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Channel sediments have a key function for understanding sediment associated nutrient transport in catchments. In two headwater catchments in the southern Black Forest (comparable geology, soil conditions and land use but different topography, river morphology and urbanisation) the influence of channel sediments on phosphorous (P) fluxes are analysed. The river morphology of the Rüttebach ($0.7\ km^2$) is highly anthropogenic influenced (channel straitening, artificial u-profile) in contrast to the naturally flowing Schneckenbach ($2.2\ km^2$) with meandering and anestomises sections.

The emphasis of investigation is (a) to estimate the contribution of riverine sediments to the suspended sediment (SS) and phosphorous yield, (b) to characterise the influence of morphology (brook regulation measurements) on sediment associated nutrient sources in the channel. Thereby the SS connectivity is playing a key role for understanding the P outlet behaviour. The analysis is based on studies to the dynamic of point and non-point phosphorus losses (see P. Schneider HS 21).

Morphology monitoring and intensive sediment sampling was conducted during low flow conditions since summer 2003. Grain size distribution, inorganic and organic carbon as well as plant available P (AL) and total P (KNO_3) contents were analysed. Since spring 2004 bank erosion was measured using the erosion pin method. To examine channel erosion and deposition 8 cross sections were sounded seasonally in 10 cm intervals. Discharge gauges and automated water samplers during runoff closing the gap to SS and P output of the brooks. Exchange processes between hyporheic and river water were also investigated with tracer experiments in summer 2004.

The comparison of the two study sites shows that river morphology is the governing factor for the SS and P dynamic. Thereby the conditions for immobilisation and remobilisation of fine channel and bank sediments determine the magnitude of flux and

transmission losses respectively. The natural channel system (Schneckenbach) is characterised by a buffered SS and P flux caused by numerous riffle/pool sequences and low, easily flooded banks. In contrast to the Schneckenbach, the regulated Rüttebach is modified in terms of a flush through of sediments and nutrients. The result is a rise of deposition in lentic reaches downstream. This SS and P fluxes are overlaid by an increase of P in the sediments through point and non point sources (under low flow conditions) which highlights the ecological function of river morphology.