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Dynamic Transfer of Dissolved Organic Carbon and Bacteria from Soils to Small Streams – Dynamic Inoculation of River Networks?

Jakob Schelker (1,2), Florian Caillon (2), Astrid Harjung (1,2), Peter Peduzzi (1), and Katharina Besemer (2)

(1) University of Vienna, Dept. of Limnology & Bio-Oceanography, Vienna, Austria (jakob.schelker@univie.ac.at), (2) WasserCluster Lunz Biological Station GmbH, Lunz, Austria

Small headwater streams interlink catchment soils with the river network. Recent studies have identified small streams as 'critical reservoirs' of microbial diversity, but the origin of this diversity is not well understood. Here we present first results from the HYDRO-DIVERSITY project which aims to investigate the dynamic transfer of dissolved organic matter (DOM) and microbial life from catchment soils into streams. We hypothesize that increased soil saturation enhances the lateral inflow of microbial life and DOM into streams and that these lateral inflows shape stream biofilm community composition and diversity. To address these hypotheses, we sampled six first-order streams and three soil transects with two depth located within the pre-alpine Oberer Seebach (OSB) catchment in Austria over a duration of 18 month. We found a strong variation in dissolved organic carbon (DOC) concentrations (range: 0.4 to 4.7 mg L-1) and bacterial counts (range: <500 to 3862 counts μL-1) measured by flow-cytometry. The highest values of DOC and counts occurred during high flow events. Also, DOC concentration and bacterial abundance were strongly correlated across all streams and seasons. In soils, ranges were higher and a similar correlation between DOC and bacterial abundance was found, but DOC concentrations were $\sim$10 times higher per bacterial count than in streams. To further investigate the role of newly transferred soil microbes on stream microbial communities we also performed a large scale flume experiment, in which the relative importance of biofilm successional age (5 to 35 days) for soil microbial inoculation was investigated. Overall our results show that soils provide a dynamic and relevant influx of microbes to first order streams and that streams are able to maintain higher bacterial abundances as soils. We propose that the dynamic and repeatedly occurring inoculation of small streams by soils is relevant for microbial community dynamics of downstream fluvial networks.