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An in-situ DOM leachate addition experiment demonstrating the retention capacity of small headwater systems

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Dissolved organic matter (DOM) is the most important carbon (C) source in aquatic ecosystems and the basis for microbial metabolism. Therefore, it is important for water quality and inorganic nutrient dynamics. Many studies have shown that DOM quality has an impact on the ecological state of streams, but the underlying processes are complex and not fully understood. Since climate change and intensified agriculture can have severe influence on the delivery, quantity and quality of DOM, from both allochthonous and autochthonous sources, understanding these processes is important for future management and mitigation strategies.
We performed plateau additions with 5 different leachates (2 replicates per leachate) in an agriculturally influenced small stream in Lower Austria to analyse the effects of DOM quality on DOM retention and benthic biofilm activities. The different DOM sources were leaves, cow droppings, pig droppings, corn plants and nettles. While the background dissolved organic carbon (DOC) concentration was between 1200 and 1700 μg/L, highest concentrations during plateau conditions were up to 3800 μg/L. NaCl was added to the leachate as conservative tracer to correct for potential dilution through groundwater input. Before the addition and during the plateau, we took water samples at 11 sites along the 220 m long stream reach. After water sampling, we measured CO_2 outgassing and took sediment samples at each site. Water and sediment samples were analysed for dissolved organic carbon (DOC), DOM characteristics (absorbance and fluorescence including a PARAFAC analysis), nutrients (P, N), extra-cellular enzymes, bacterial abundance. The PARAFAC analysis was done with the recently published staRdom package for R.
Preliminary results show a decrease of DOC of 80 - 900 μg/L (5 - 30 % of total DOC) within the first 220 m when leachates were added. Different DOM fractions showed diverting uptake rates. The tyrosine-like peak decreased by up to 0.38 Fmax (maximal fluorescence of peak, 10 – 60 % from Fmax at the first sampling point) , while the coumarine-like peak was again at the background level after 220 m. DOC and also fluorescence peaks increased from up- to downstream when no leachate was added and in some cases when leachate was added as well. SRP, NH4 and NO_2 added by the leachates were taken up almost completely, while no general trend can be seen in the NO_3 and dissolved organic nitrogen (DON) concentrations.