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Effects of silvicultural management intensity on fluxes of dissolved and particulate organic matter in 27 forest sites of the Biodiversity Exploratories

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In forested ecosystems, throughfall and stemflow function as key components in the cycling of water and associated biogeochemistry. Analysing annual flux data collected from 27 intensively monitored forest sites of the Biodiversity Exploratories, we found throughfall fluxes of DOC (dissolved organic carbon) linearly related ($R2 = 0.40$, $p < 0.001$) to the silvicultural management intensity indicator (SMI) developed by Schall and Ammer (2013). The SMI combines tree species, stand age and aboveground living and dead woody biomass, thereby allowing the quantifying of silvicultural management intensities of stands differing in species composition, age, silvicultural system as they convert from one stand type into another. Throughfall fluxes of particulate organic C and N (POC and PN) and dissolved N were, however independent from those forest structural metrics as well as annual C and N stemflow fluxes, which varied greatly among management intensity classes. In this context, we suggest that canopy structure metrics are more important drivers of water and matter stemflow dynamics, than structural metrics on the level of forest stands. On the other hand, leaching losses of DOC and POC from the litter layer of forests increased significantly with increasing forest management intensity. The observed relationships revealed by intensive flux monitoring are important because they allow us to link organic matter fluxes to forest metrics of larger forested areas (e.g. derived from LiDAR imagery), and hence to model and up-scale water-bound OC dynamics to the landscape level.