Influence of soil type on the canopy effect and leaf translocation in a forest ecosytem

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At equivalent climatic conditions and constant vegetation cover, the level of soil nutrients availability has a strong influence on water and element cycling between the different compartments of the forest ecosystem. The objective of this study is to evaluate the impact of contrasted soils on aboveground nutrient fluxes and particularly on the canopy effect.

The experimental site of Montiers corresponds to three plots of contrasted soil types (rendisol, calci-brunisol, alocrisol; AFES, 1998) developed on an equivalent beech stand (same age, same management). Each soil plot consists of 3 replicates equipped with 3 bulk precipitation collectors (above the canopy), 4 throughfall gutters and 6 stemflow collectors to collect the solutions on a monthly scale. Fallen leaves are collected in litter bags and the fresh leaves are sampled in the tree.

The comparison between over- and understorey fluxes (i.e. throughfall and stemflow) showed that most element fluxes are increased by canopy effect through foliar recretion. The enrichment dynamics of K, P, Mg and Si followed the same pattern throughout the three years, highlighting periods of strong foliar exchange activity. NO_3 and NH_4 were assimilated by the leaves whereas Cl and Na fluxes were not affected. The results showed limited soil influence on aboveground fluxes apart from manganese recretion fluxes, which increase with soil pH decrease.

The comparison of green leaves in August and fallen leaves in November showed that the difference of foliar composition before and after senescence cannot be explained solely by the process of recretion and that high translocation fluxes occur between the tree and the leaf in autumn. The results highlighted a decrease of Mg translocation and an increase of Mn translocation with soil pH decrease. With nutrient translocation being a key component in nutrient conservation strategies, this study gives a further insight into the link between biological cycle and plant activities.