

Impacts of management strategies on nutrient fluxes in a temperate *Picea abies* (L. Karst) plantation

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Plantation silviculture is currently no longer exclusively concerned with achieving the highest possible productivity, but also with the sustainability of yields over time. Environmental aspects of soil and water quality in relation to timber quality are now often integrated in questions of forest management. Before canopy closure, trees rely mainly on soil reserves for their nutrient requirements, whereas in later development stages efficient nutrient cycling provides much of the crop's nutrient supply. Through decomposition of organic matter and transformation of mineral compounds, soil microbial activities play a key role in biogeochemical cycling. Forest management practices such as liming, clearcut and harvesting residue treatment typically influence availability of nutrients through both their influence on soil microbial activities and on nutrient inputs and exports. Therefore, the long term productivity and sustainable development of plantation forests may only be achieved through a sound knowledge of nutrient cycling processes and input/output fluxes in these ecosystems.

In this paper, I summarise main results of studies performed in the Belgian Ardennes at the watershed (80 ha, mainly *Picea abies*) and plot scale. In this area, soils are naturally acidic and poor in magnesium, so that forest dieback symptoms reported from 1983 onwards were related to increased pollution exacerbating magnesium deficiency. Confrontation of long term nutrient input and output fluxes before and after clearcut with nutrient reserves on the soil exchange complex reveals the limited potential of the soil to support intensive silviculture on the long term. Therefore, the effects of afforestation with tree species adapted to soil conditions (according to 'Fichier écologique des essences' and 'Guide de boisement') are currently investigated in the watershed. In a litter decomposition experiment we measure the capacity of the different species to improve soil nutrient conditions. Results will be discussed in relation to liming measures and the return of nutrients to the soil in the mixed plots.