

## Atmospheric deposition onto forest ecosystems: use and abuse of the canopy budget model

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An accurate quantification of total atmospheric deposition of nitrogen, sulphur, and base cations onto forest ecosystems is prerequisite to relate external inputs to changes in biodiversity or nutrient cycling and to determine exceedances of critical and target loads. Therefore, throughfall and stemflow fluxes are measured in large-scale monitoring programmes. However, ion fluxes in the precipitation reaching the forest floor are only a measure of total deposition if ion exchange processes between aerial plant parts and rainfall are accounted for. One method to estimate canopy exchange is the canopy budget model, which has been used worldwide for varying forest types. After calculating dry deposition and canopy leaching of base cations using a tracer ion, the model estimates dry deposition and uptake of inorganic nitrogen by simulating canopy exchange of ammonium, protons, base cations and weak organic acids. However, varying approaches have been reported for all model steps. We reviewed variations with respect to the time step, type of open-field precipitation data, and tracer ion in the model, and discussed the strengths and weaknesses of possible ion exchange assumptions. To assess the effect of varying assumptions, nine approaches of the model were applied to data from two forest plots located in regions with contrasting atmospheric deposition (i.e., Belgium and Canada). For both plots, a semi-annual time step gave similar results as an annual time step. Na<sup>+</sup> was found to be the most suitable tracer ion. Using bulk instead of wet-only precipitation data underestimated the potentially acidifying deposition. Different equations for ammonium vs proton uptake had most effect on the results for the cation that was less important at a plot. Even though deposition estimates of the canopy budget model correspond with other methods, additional research on canopy interactions of nitrogen for varying tree species and environmental conditions would be valuable.

### Reference

Staelens J., Houle D., De Schrijver A., Neiryneck J. & Verheyen K. Calculating dry deposition and canopy exchange with the canopy budget model: review of assumptions and application to two deciduous forests. *Water, Air, and Soil Pollution*, in press (21 p.), DOI: 10.1007/s11270-008-9614-2.