

Exceedance of critical loads for nitrogen, nutrient status and forest condition on Swiss Long-term Forest Ecosystem Research (LWF) plots

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On 14 Swiss ICP Forests Level II (LWF) plots, we estimated the atmospheric deposition of nitrogen using throughfall data and we determined the critical loads of nitrogen (N) with the steady state mass balance approach (Waldner et al., 2007). Exceedances of critical loads for nitrogen were related to the following indicators: 1) the nitrogen status in terms of mineral nutrition of the forest stand, based on foliar analyses; 2) the nitrogen status in the soil, including nitrate leaching below the rooting zone on selected plots where soil solution was analyzed; 3) crown defoliation.

Critical loads for nitrogen were exceeded on 8 plots. Foliar N concentrations were correlated with both, N deposition and the exceedances of the critical loads for N, especially for broadleaved species. In most of the coniferous stands, foliar N concentrations were in the deficiency range. Crown defoliation tended to be negatively correlated with N concentrations in the needles. In the majority of the broadleaved stands, foliar N concentrations were in the optimum nutritional range or, on one beech plot with high N deposition, above the optimum values. There was no correlation between crown defoliation assessed on broadleaved trees and foliar concentrations.

Nitrate leaching was observed on plots where critical loads were exceeded, but only if the C/N ratio of the forest soil was below 20. No or almost no nitrate leaching was recorded for C/N ratios above 20, even at sites with high N deposition, confirming the concept developed by Gundersen et al. (2006).

References:

- Gundersen, P., Schmidt, I. K., Raulund-Rasmussen, K., 2006. Leaching of nitrate from temperate forests - effects of air pollution and forest management. *Environmental Reviews* 14, 1-57.
- Waldner, P., Schaub, M., Graf Pannatier, E., Schmitt, M., Thimonier, A., Walthert, L., 2007. Atmospheric deposition and ozone levels in Swiss forests: Are critical values exceeded? *Environmental Monitoring and Assessment* 128, 5-17.