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Regional comparison of the canopy effect on the accumulation of nitrogen in mosses and studies on the relationship of nitrogen contents and understory vegetation

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Background. Atmospheric nitrogen (N) deposition into terrestrial ecosystems is frequently considered as a threat to phyto-diversity. Especially in forest ecosystems, the total N deposition is systematically higher due to their large surface, their height and their roughness. The dose-response relationship in forests is very complex on the basis of multi-factorial relationships between the N input and the ecological reactions. In Germany, N concentrations in mosses were recorded in 2004 as part of a regional investigation at 54 locations in the North-West (Schröder et al. 2007) and in 2005 at 726 locations across the whole territory. Following the methodology presented by Schröder et al. (2013), differences of correlations between N concentrations in atmospheric deposition and in mosses between landscapes across Europe could be corroborated (Schröder et al. 2014). These investigations (Schröder et al. 2007, 2013, 2014) were accomplished by studies focusing on spatial differences of N concentrations in mosses at the site level. ***Methods***. To this end, N concentrations were determined in mosses sampled at sites with and without canopy drip effects in several European states, amongst them Germany. The presentation deals with two studies conducted in 2012 and 2013 comparing N concentrations in mosses sampled within 30 forest stands and in 26 adjacent open fields in North-western Germany (Kluge et al. 2013). The N concentrations were converted to N atmospheric deposition values by use of a regression model derived from Schröder et al. (2014). These deposition estimations enabled to calculate N critical loads exceedances. In addition, the two studies include examinations of the relationship of nitrogen contents and understory vegetation in terms of nitrogen indicators based on the Ellenberg system. ***Results.*** Compared to the average N concentration in mosses sampled in open fields 2012 (7.4 kg / ha*a) and in 2013 (11.1 kg / ha*a), the average N concentrations in mosses within adjacent forests were almost four times higher (26.6 kg / ha*a in 2012, 31.9 kg / ha*a in 2013), and the maximum within the stands accounted for $\sim$ 56 kg / ha*a in 2012 and 43 kg / ha*a in 2013. The atmospheric N deposition as estimated from the N concentration in mosses ranged between the minimum and maximum N critical load at 71% (year 2012) and 80% (year 2013) of the 56 sites investigated. In 2012, at 11% of the sites the N deposition the maximum N critical load value even was exceeded, in 2013 at 20%. ***Discussion.*** A long-term high atmospheric N input can lead to various damages in forest ecosystems. The presented findings illustrate that the total N deposition in forests is significantly higher than in open fields. ***Conclusions.*** The presented findings should be accounted for both modelling and mapping atmospheric N deposition into terrestrial ecosystems on the one hand and related estimations of N critical load exceedances on the other hand. ***References***.Kluge M. et al. 2013.Accounting for canopy drip effects of spatiotemporal trends of the concentrations of N in mosses, atmospheric N depositions and critical load exceedances: a case study from North-Western Germany. Environ Sci Europe 2013, 25:26 (13 pp + 4 suppl files) ? Schröder W. et al. 2007. Nitrogen and metals in two regions in Central Europe: Significant differences in accumulation in mosses due to land use? *Environ Monit Assess* 133:495-505 ? Schröder W. et al. 2013. Correlation between atmospheric deposition of Cd, Hg and Pb and their concentrations in mosses specified for ecological land classes covering Europe. *AtmosPollut Res* 4:267-274 ? Schröder W. et al. 2014. Mapping correlations between nitrogen concentrations in atmospheric deposition and mosses for natural landscapes in Europe. *Ecol Ind* 36:563-571.