



## **Interactive effects between N addition and disturbance on boreal forest ecosystem structure and function**

Annika Nordin, Joachim Strengbom, and Fredrik From  
Swedish University of Agricultural Sciences, Sweden (Annika.Nordin@slu.se)

In management of boreal forests, nitrogen (N) enrichment from atmospheric deposition or from forest fertilization can appear in combination with land-use related disturbances, i.e. tree harvesting by clear-felling. Long-term interactive effects between N enrichment and disturbance on boreal forest ecosystem structure and function are, however, poorly known. We investigated effects of N enrichment by forest fertilization done > 25 years ago on forest understory species composition in old-growth (undisturbed) forests, and in forests clear-felled 10 years ago (disturbed). In clear-felled forests we also investigated effects of the previous N addition on growth of tree saplings. The results show that the N enrichment effect on the understory species composition was strongly dependent on the disturbance caused by clear-felling. In undisturbed forests, there were small or no effects on understory species composition from N addition. In contrast, effects were large in forests first exposed to N addition and subsequently disturbed by clear-felling. Effects of N addition differed among functional groups of plants. Abundance of graminoids increased (+232%) and abundance of dwarf shrubs decreased (-44%) following disturbance in N fertilized forests. For vascular plants, the two perturbations had contrasting effects on  $\alpha$ - (within forests) and  $\beta$ -diversity (among forests): in disturbed forests, N addition reduced, or had no effect on  $\alpha$ -diversity, while  $\beta$ -diversity increased. For bryophytes, negative effects of disturbance on  $\alpha$ -diversity were smaller in N fertilized forests than in forests not fertilized, while neither N addition nor disturbance had any effects on  $\beta$ -diversity. Moreover, sapling growth in forests clear-felled 10 years ago was significantly higher in previously N fertilized forests than in forests not fertilized. Our study show that effects of N addition on plant communities may appear small, short-lived, or even absent until exposed to a disturbance. This highlights the importance of considering interactive effects with disturbance when evaluating long-term effects of N enrichment on boreal forest ecosystem structure and function.