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Increased nitrate availability in the soil of a mixed mature temperate forest subjected to elevated CO_2 concentration (canopy FACE)

Patrick Schleppi (1), Bucher-Wallin Inga (1), Hagedorn Frank (1), and Körner Christian (2)

(1) Swiss Federal Institute for Forest, Snow and Landscape Research (WSL), Zürcherstr. 111, CH-8903 Birmensdorf, Switzerland (schleppi@wsl.ch), (2) Institute of Botany, University of Basel, Schönbeinstr. 6, CH-4056 Basel, Switzerland

In a mature temperate forest in Hofstetten, Switzerland, deciduous tree canopies were subjected to a free-air CO_2 enrichment (FACE) for a period of eight years. The effect of this treatment on the availability of nitrogen (N) in the soil was assessed along three transects across the experimental area, one under *Fagus sylvatica*, one under *Quercus robur* and *Q. petraea* and one under *Carpinus betulus*. Nitrate, ammonium and dissolved organic N (DON) were analysed in soil solution obtained with suction cups. Nitrate and ammonium were also captured in buried ion-exchange resin bags. These parameters were related to the local intensity of the FACE treatment as measured from the ^{13}C depletion of dissolved inorganic carbon in the soil solution, because the CO_2 used for the treatment was depleted in ^{13}C (Schleppi et al., 2012).

Over the eight years of the experiment, the CO_2 enrichment reduced DON concentrations, did not affect ammonium, but induced higher nitrate concentrations, both in soil solution and in resin bags. In the nitrate captured in the resin bags, the natural abundance of the isotope ^{15}N strongly increased. This indicates that the CO_2 enrichment accelerated net nitrification, probably as an effect of the higher soil moisture resulting from the reduced transpiration of the CO_2-enriched trees. It is also possible that N mineralisation was enhanced by root exudates (priming effect) or that the uptake of inorganic N by these trees decreased slightly as the result of a reduced N demand for fine root growth. In this mature deciduous forest we did not observe any progressive N limitation due to elevated atmospheric CO_2 concentrations; on the contrary, we observed an enhanced N availability over the eight years of our measurements. This may, together with the global warming projected, exacerbate problems related to N saturation and nitrate leaching, although it is uncertain how long the observed trends will last in the future.

Following the experiment with deciduous trees, a similar FACE experiment was initiated on *Picea abies* trees. First results from this new experiment will be presented.

REFERENCE

Schleppi, P., Bucher-Wallin, I., Hagedorn, F. & Körner C. 2012: Increased nitrate availability in the soil of a mixed mature temperate forest subjected to elevated CO_2 concentration (canopy FACE). Global Change Biology, 18, 757-768.