

Do increased CO₂ concentrations affect the availability of N in a mature temperate forest?

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The interaction between atmospheric carbon dioxide (CO₂) concentration and soil nitrogen (N) availability is critical in predicting the future effects of CO₂ on forests. A currently debated hypothesis is that CO₂-induced effects are limited due to the sequestration of N together with carbon (C), and hence to a progressive N limitation in the ecosystem (Johnson 2006).

In a mature mixed forest in northern Switzerland, trees are exposed increased CO₂ concentrations (+140 ppm) since five years (Pepin & Körner 2002). Nutrients in the soil solution were monitored with ceramic suction cups and resin bags installed along three transects through the experimental area. These transects run under both control and CO₂-treated trees: one transect under beech (*Fagus sylvatica*), one under oak (*Quercus petraea*, *Q. robur*) and one under hornbeam (*Carpinus betulus*) (Bucher-Wallin *et al.* 2003). Because the CO₂ used for the treatment is depleted in ¹³C, it was possible to obtain a measure of how much each sampling point is affected by this treatment by analysing inorganic ¹³C in the soil solution. In spite of a strong spatial and temporal variability, there was an indication that nitrogen availability (nitrate, ammonium) increases at locations with more ¹³C depletion compared to locations with less depletion, i.e. in treated areas compared to ambient conditions.

The mature trees of this experiment do not express a sustained growth enhancement when exposed to more CO₂, but they have reduced foliar N contents (Körner *et al.*, 2005). Their N demand is thus lower and this can explain why more N is left available in the soil. Alternatively, N mineralisation may be promoted by the microbial activity generated by an increased production of root exudates, as suggested by isotopic measurements of soil CO₂ (Steinmann *et al.* 2004).

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