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Understanding responses of nitrogen dynamics in plants and soils to elevated CO_2 concentrations through multi-level meta-analytical insights

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Elevated atmospheric CO_2 concentration triggers a well-known CO_2 fertilization effect for plants (involving improved photosynthetic capacity and reduced stomatal conductance). Besides, it also distorts soil and plants' C/N balances and nitrogen dynamics (including increased nitrogen use efficiency and reduced plant nitrogen concentration). The altered balances and dynamics may cause feedbacks that prevent plants to benefit from potential CO_2 fertilization and decrease nutritional quality. We construct a database of experimental FACE data and conduct a meta-analysis on CO_2 responses of physiological processes and variables related to C-N metabolisms. The analysis aims at linking insights from different ecosystem types and hierarchical levels (from individual plant to ecosystem) and quantifying influences from environmental conditions (water, temperature,...). Nitrogen dynamics responses are smaller than photosynthetic or stomatal responses, but similar in magnitude to canopy transpiration responses and assumed relevant. Insights could be used to improve mechanistic models with essential feedbacks between carbon and nitrogen dynamics.