

Impacts of changes in climate, nitrogen deposition, ozone and CO₂ exposure on forest carbon sequestration: a meta-analysis

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Carbon sequestration in forests and forest soils is influenced by various drivers including changes in climate (temperature and water availability), nutrient (nitrogen, base cations, phosphorous) availability, carbon dioxide (CO₂) exposure and ozone (O₃) exposure. The combined effects of these drivers in forests and forest soils can either be synergistic (amplifying), antagonistic (dampening) or neutral (no interaction). To quantify the forests and forest soils response to single or interacting drivers, we conducted a meta-analysis of published manipulative field studies that reported above-ground C responses (above-ground net primary productivity-ANPP, leaf litterfall) and below-ground C responses (below-ground NPP, below-ground root litter, soil respiration) as well as total forests ecosystem CO₂ exchanges (NPP, net ecosystem productivity-NEP, net ecosystem exchange-NEE). We limited our study to boreal, temperate and Mediterranean regions particularly those in Europe, US and Canada. Data collection was limited to field experiments of at least one year, excluding data based on laboratory incubation or growth chambers. In total, results of 101 studies were compiled in a database and analysed. We used the site data on longitude, latitude, altitude and year to derive additional information on missing or unknown drivers, using the CRU climate database to assess mean annual temperature and annual precipitation and results of atmospheric deposition models to assess N deposition and an ozone measure such as AOT40 or phytotoxic ozone dose (POD). The quantitative synthesis of the data was done by a number of different effect size metrics including, the difference between treatment and control divided by the difference in conditions of the drivers between treatment and control. This metric is relevant to quantify responses to treatments, normalizing absolute responses to the magnitude of the treatment imposed. Results of the meta-analysis will be presented during the conference.