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How warming and CO2 enrichment alter soil carbon cycling in terrestrial ecosystems

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The rising atmospheric CO2 concentrations and the concomitant temperature increases have a profound impact on terrestrial ecosystems. Elevated CO2 is generally believed to enhance terrestrial C uptake via increased plant productivity, whereas warming would induce a positive climate feedback via acceleration of decomposition. Via meta-analysis, we summarized results of 198 manipulation experiments examining single and multifactor effects of elevated CO2 and temperature on various ecosystem C pools and fluxes. Elevated CO2 stimulated soil C inputs via increased plant production, but also accelerated decomposition rates, leaving soil C stocks unaffected. Warming also increased plant biomass, but mainly in peaty and woody systems. Overall, decomposition rates were unaffected by elevated temperatures. We found supporting information for the general assumption that substrate availability plays a key role regarding thermal downregulation of microbial activity. Last, despite the scarcity of multifactor studies, we found a significant positive effect of a simultaneous increase of CO2 and temperature on soil respiration, suggesting limited potential for additional soil C sequestration in a warmer, high CO2 world.