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Effects of experimental warming on plant root biomass and vertical distribution: A meta-analysis

Haibo Lu and Wenping Yuan
Sun Yat-sen University, School of Atmospheric Sciences, China (luhaibo@mail.sysu.edu.cn)

Root growth and turnover play an important role in terrestrial C cycling. Although the effects of warming on plant root biomass were extensively studied through manipulative experiments, hardly a consensus could be expected. Here, plant root biomass data of 80 papers from 41 experimental warming study sites were collected, and a meta-analysis was conducted to explore the responses of root biomass and vertical distribution to warming across a broad range of biomes. Our results showed experimental warming significantly increased root biomass by 7.04% (2.74% - 11.52%) across all ecosystems, and significantly increased forest root biomass by 16.30% (7.79% - 25.61%), but no significant warming effects were observed in grassland. Differential warming effects were found on root biomass in various soil depths. Experimental warming significantly decreased root biomass in top 0 – 10 cm depth soil by 14.91% (8.65% - 21.41%), but increased root biomass in 10 – 20 cm and 20 – 40 cm depth soil by 12.75% (0.50% - 27.76%) and 15.26% (4.50% - 27.00%), respectively. Our results indicate that warming could enhance plant carbon allocation to belowground and simulate root growth in deeper soil, and could further alter the profiles of soil water and carbon dynamics. Our study could benefit the development and improvement of related C models.