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Simulated nitrogen deposition in a boreal forest increased soil carbon stocks by increasing above and below ground carbon inputs and decreasing autotrophic and heterotrophic respiration

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Nitrogen (N) deposition in boreal forests can potentially change soil carbon (C) stocks by alleviating stoichiometric constraints on net primary production and microbial activity. We studied the effect of different levels of simulated N deposition on the C balance of a *Pinus sylvestris* forest soil in the middle boreal region, where a gradient of N addition rates (0, 3, 6, 12, 50 kg N ha^{-1} yr^{-1}; n=6) simulating anthropogenic N deposition had been applied for 12 years. Nitrogen had positive effects on soil C stocks with 17.2 kg C accumulating per N added annually averaged across all levels of N input. At the highest N addition rate, this effect occurred due to increased inputs of aboveground litter (+46 %) and decreased C outputs by free-living saprotrophic (-21 %) and tree root zone (-28 %) respiration. Nitrogen had no effect on the total mass of C allocated below ground, indicating that the reduction in tree root zone respiration was mainly caused by shifts in the partitioning of metabolic C between root functions within the root zone, and not by a reduction in the relative allocation of C below ground. Lower levels of N addition, simulating current rates of N deposition in the boreal region, had no effect on above ground tree litter inputs but increased soil C stores by at least the same amount per unit of N as at the highest level of N addition. These results show that N deposition in N poor boreal forests have positive effects on soil C accumulation that is mediated through increased net primary production at high levels of N input, but also by decreased root zone respiration potentially acting also at lower levels of N input.