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Litter fall control of soil respiration observed by litter exclusion study and laboratory incubation

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Although litter decomposition is assumed to be one of the major drivers of carbon dioxide (CO_2) efflux in forests, little information on its contribution to total CO_2 efflux is available. The influence of the litter fall on soil respiration was determined by a litter exclusion experiment in an unmanaged beech dominated forest in Central Germany along with measurement of the amount and species of litter and the content of hot water-extractable carbon. Additionally, a laboratory incubation experiment was carried out to investigate the carbon mineralization of the two dominant species, beech (*Fagus sylvatica)* and ash (*Fraxinus excelsior)*. During the 70 day incubation emission of CO_2 and release of dissolved organic (DOC) and inorganic carbon (DIC) together with total dissolved nitrogen (TDN) were monitored as well as the change of hot water-extractable carbon and the isotopic signature of both litter species.

Litter exclusion led to a reduction of CO_2 efflux between 37.5 and 42.7 %. Furthermore plots with a higher proportion of ash litter emitted significantly more CO_2 than plots with a high proportion of beech litter. This observation was confirmed by the laboratory incubation, where ash litter emitted more than the double amount of CO_2-C than ash litter, accompanied by a significant higher DOC release. The decrease of hot water-extractable carbon and the change in isotopic signature also reflect this difference in carbon mineralization intensity between both species, as this intensity changed more in the ash litter than in beech litter. This can be explained by the higher amount of nitrogen and lower content in lignin in ash litter.

The results from both experiments show a clear influence of litter fall on soil respiration. This influence depends on the composition of the litter, which varies between the species and causes different decomposition intensities in particular in the initial phase of the litter decomposition.