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# Litter mixing leads to the formation of a common decomposition pattern in a bog ecosystem

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Peat accumulation is the result of a small imbalance between the formation and decomposition of plant litter. Changing environmental conditions alter the vegetation cover in peatlands and therefore litter quality inputs. Litter mixing effects, describing variable interactions between different litter types and decomposition rates, have been studied, but observations and directions of non-additive effects are not consistent. To better understand litter mixture effects of an ombrotrophic bog, where the encroachment of vascular plants has been observed, we incubated pure litter (*Sphagnum* (S), *Betula* (B), *Calluna* (C)) and three resultant mixtures (SB, SC, BC) over 70 days.

We hypothesized that decomposition pattern of pure substrates differs from mixtures. Also, substrate specific decomposition patterns develop at the beginning of the experiment, which should harmonize with increasing time. Mixtures containing S litter have lower decomposition rates than their pure constituents, while mixtures without S (*i.e.* BC) show higher decomposition rates.

For our incubation study, we collected three litter types (*Calluna vulgaris* (L.) Hull., *Sphagnum capillifolium* (Ehrh.) Hedw., *Betula pubescens* Ehrh.) from an ombrotrophic bog (Pürgschachen Moor, Austria). Oven-dried (60 °C) and sieved (< 2 mm) litter was used for litter bags containing 1 g of pure litter (S, B, C) or mixtures (SB, SC, BC). Bags were inoculated with bog water for 24 h and incubated in 50 mL conical tubes containing 4.5 mL of saturated $K_2SO_4$ (glass marbles were used to avoid contact) to ensure constant relative humidity. For every sampling day (0, 2, 14, 28, 70) four replicates of each substrate were prepared. Three bags per day were used for measurements of $CO_2$ production rates, water extractable organic carbon (WEOC) and nitrogen (TN-L), mass loss and total carbon analysis. We measured the specific ultraviolet absorbance at 254 nm ($SUVA_{254}$) to monitor aromaticity of organic compounds in WEOC. In addition, one litter bag was used for the analysis of C-, N-, P-degrading enzymes using a fluorometric microplate assay. Cube root transformed data was used for k-means clustering to detect litter specific decomposition pattern over time.

As hypothesized, results show that S litter has a constant, low decomposition pattern over the

whole experimental time. Other substates share a similar (low decomposition) pattern on day 0 and day 2 (high decomposition). After 14 days, pure substrates develop a specific pattern, while all mixtures share a common pattern. S containing mixtures (SB, SC) behave similar over time but remarkably different than related pure components only on day 28. Our results indicate that, especially in the beginning, patterns of decomposition are mainly time depend, possibly covering litter specific decomposition patterns. In conclusion, whole decomposition patterns showed no clear litter mixing effects, although some measured variabales indicate shifts with increasing time.