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

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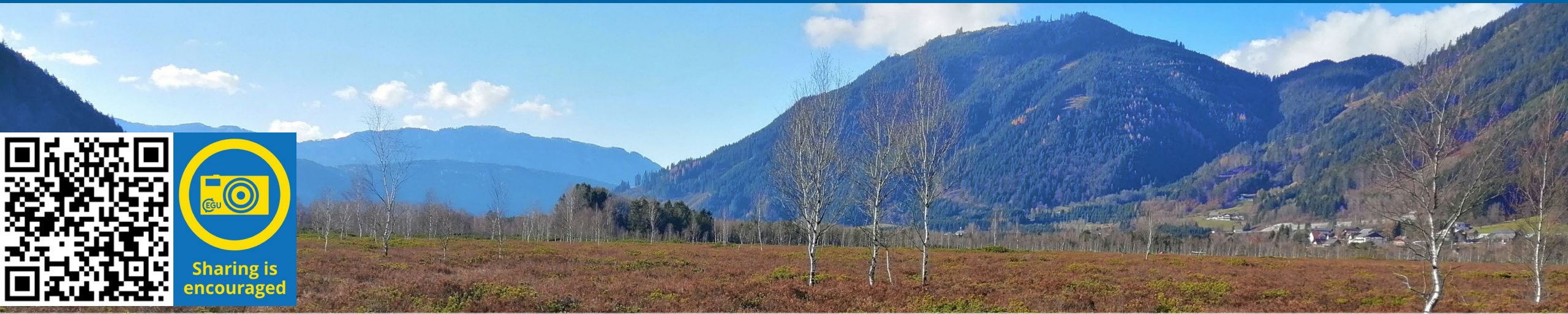
Introduction and research scope

Encroaching birch trees in Puergschachen bog © Raphael Müller

- Formation of peat is controlled by litter production and decomposition

- Litter quality is essential for peatland development

- Alteration of vegetational composition
  - Anthropogenic interference
  - Changing climatic conditions

- Changing litter quality in bogs may alter decomposition and formation of peat
  - Litter mixing effects

    → **How does litter mixing affect the development of decomposition patterns?**

Methods

- Laboratory incubation (dark, humid, 22 °C for 70 days)
  - *Sphagnum* **(S)**,
  - *Betula* leaves **(B)**,
  - *Calluna* twigs and leaves **(C)**
  - Mixtures **(SB, SC, BC)**
- Solid
  - Mass losses
  - TC, TN
  - C-, N-, P-degrading enzymatic activities

- Liquid
  - WEOC (DOC), TN-L
  - Quality of leachate using $SUVA_{280}$, pH
- Gaseous
  - CO_2-production
- Statistics
  - K-means clustering of cube-root transformed data
  - Linear discriminant analysis for evaluation of cluster assignment

Sphagnum biomass in a beaker © Raphael Müller
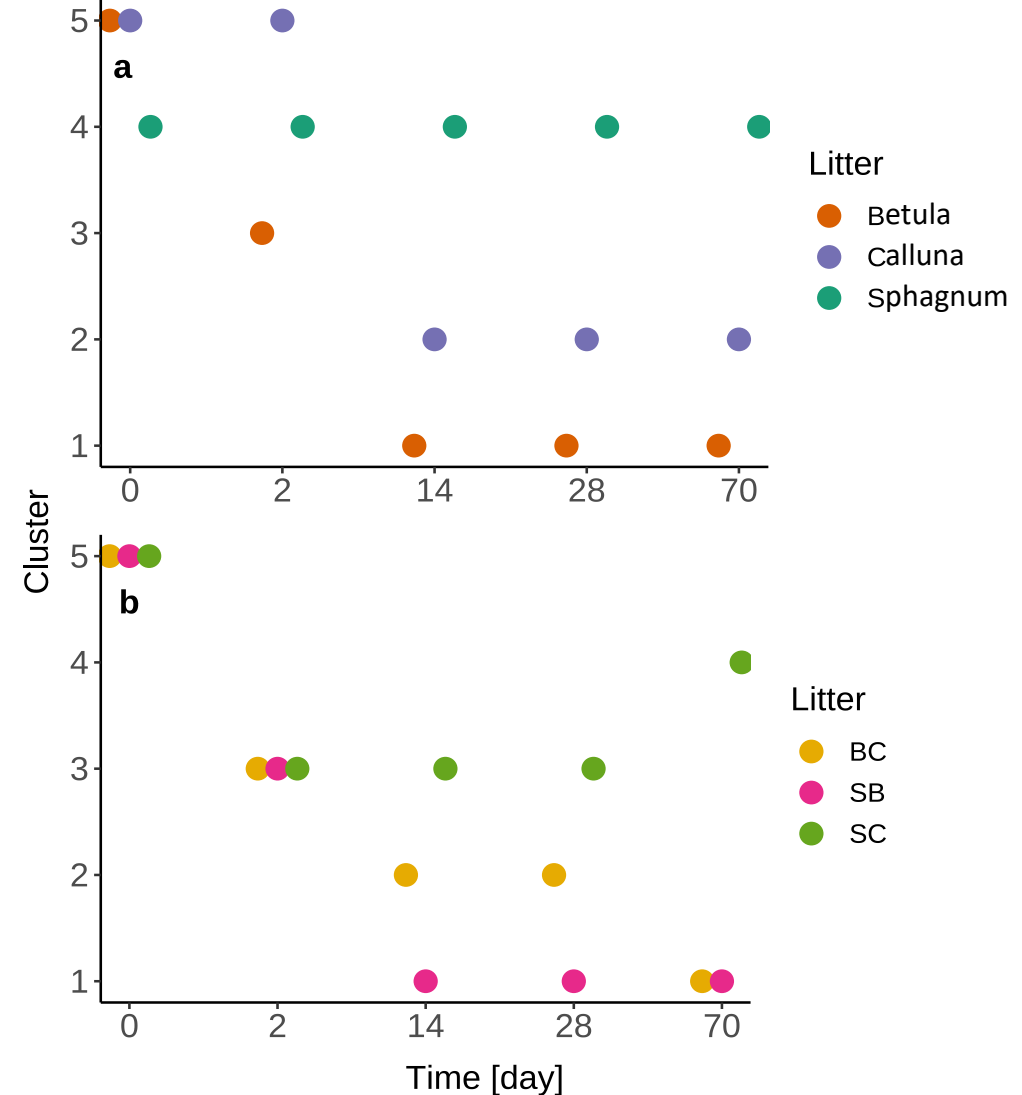
Decomposition during lab incubation

- Mass losses for all litter types
  - *Betula*: 27%, *Calluna* 21%, *Sphagnum* 8%
  - Mixtures: 15-20%
- Development of temporal pattern for most litter types and variables but different amplitudes
- CO_2-production: nearly no activity on day 0, *explosion* on day 2 and constant low rates until day 70
- Enzymatic activities: peak shifts towards day 14, lowest values for S, SB and SC
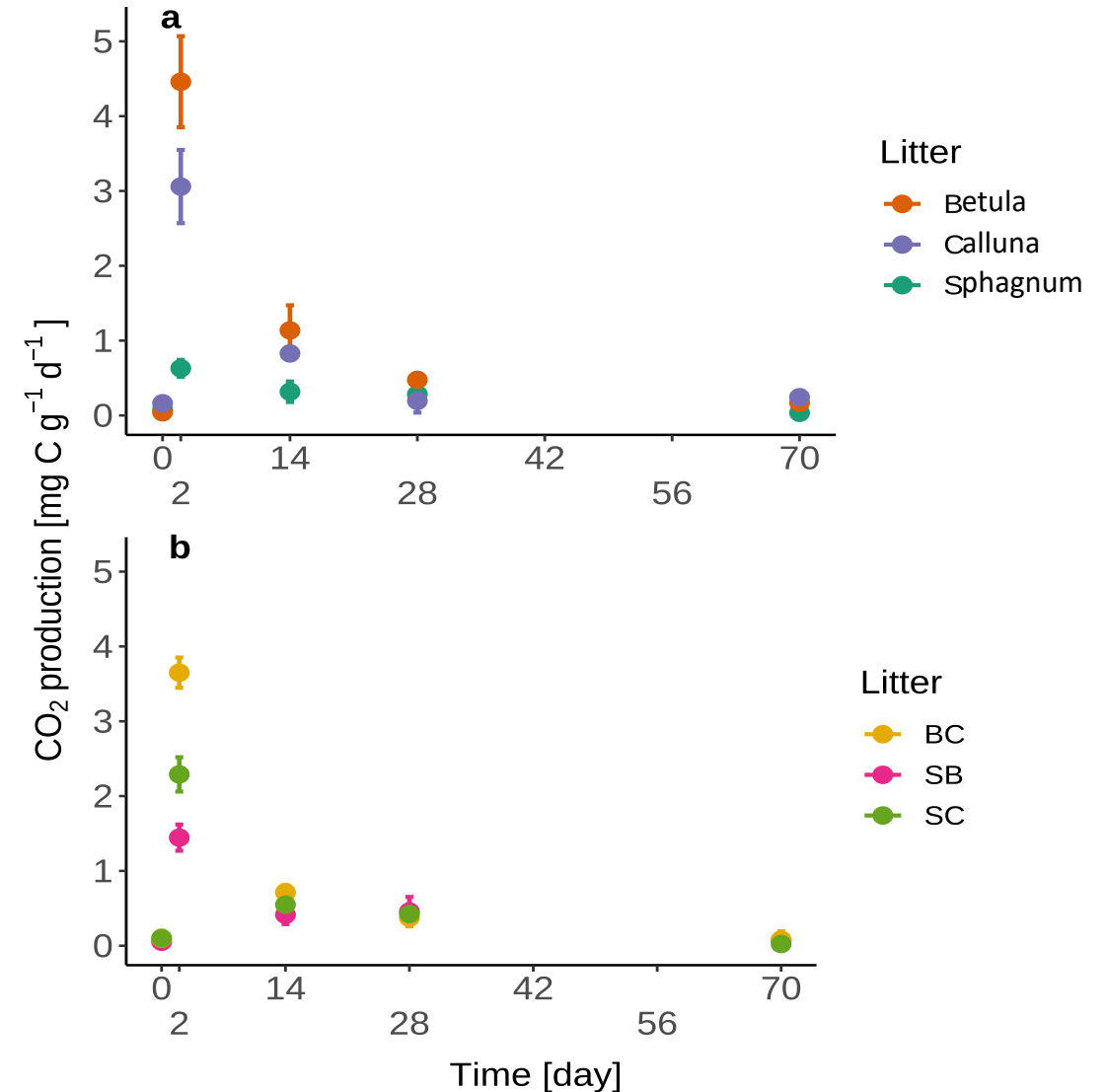
Mean CO_2-production rates of pure litter **(a)** and mixtures **(b)**, Increased rates were observed especially on day 2, immediately after inoculation with bog water, error bars indicate SD, Müller et al. 2023 (unpublished)

Decomposition patterns by k-means clustering

- Describes the overall decomposition *pattern* of litter types – includes all measured variables

- ***Resting phase*** on day 0 (cluster 5)

- ***Initial decomposition* phase** on day 2 (cluster 3)

- After day 14: litter type specific pattern

- Reassignments only after day 70

Cluster assignment of litter types **(a)** (B=*Betula*, S=*Sphagnum*, C=*Calluna*) and mixtures **(b)** for each sampling day, Müller et al. 2023 (unpublished)

Conclusion

- Presence of S litter suppresses enzymatic activities, mass loss and leaching of TN-L → prevention from synergistic litter mixing effects

- Cluster analysis seems to be a useful tool to detect decomposition patterns of mixtures – short term changes

    → **We need to promote or maintain conditions favoring the occurrence of *Sphagnum* in bogs**

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