

Admixing other tree species to European beech forests: Effects on soil organic carbon and total nitrogen stocks. A meta-analysis.

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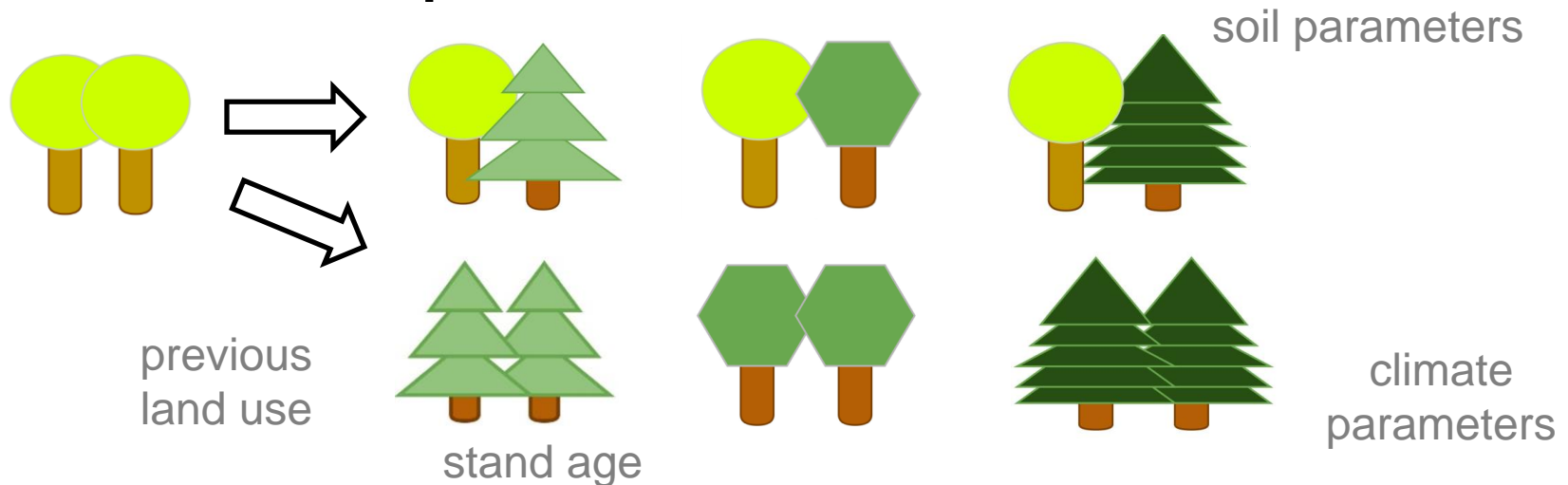
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Background

- Climate change → increase in „drying-wetting cycles“
- Beech forests are drought sensitive → plant physiological and nutrient limitations
- Current potential distribution of beech will shift to northern areas and higher altitudes

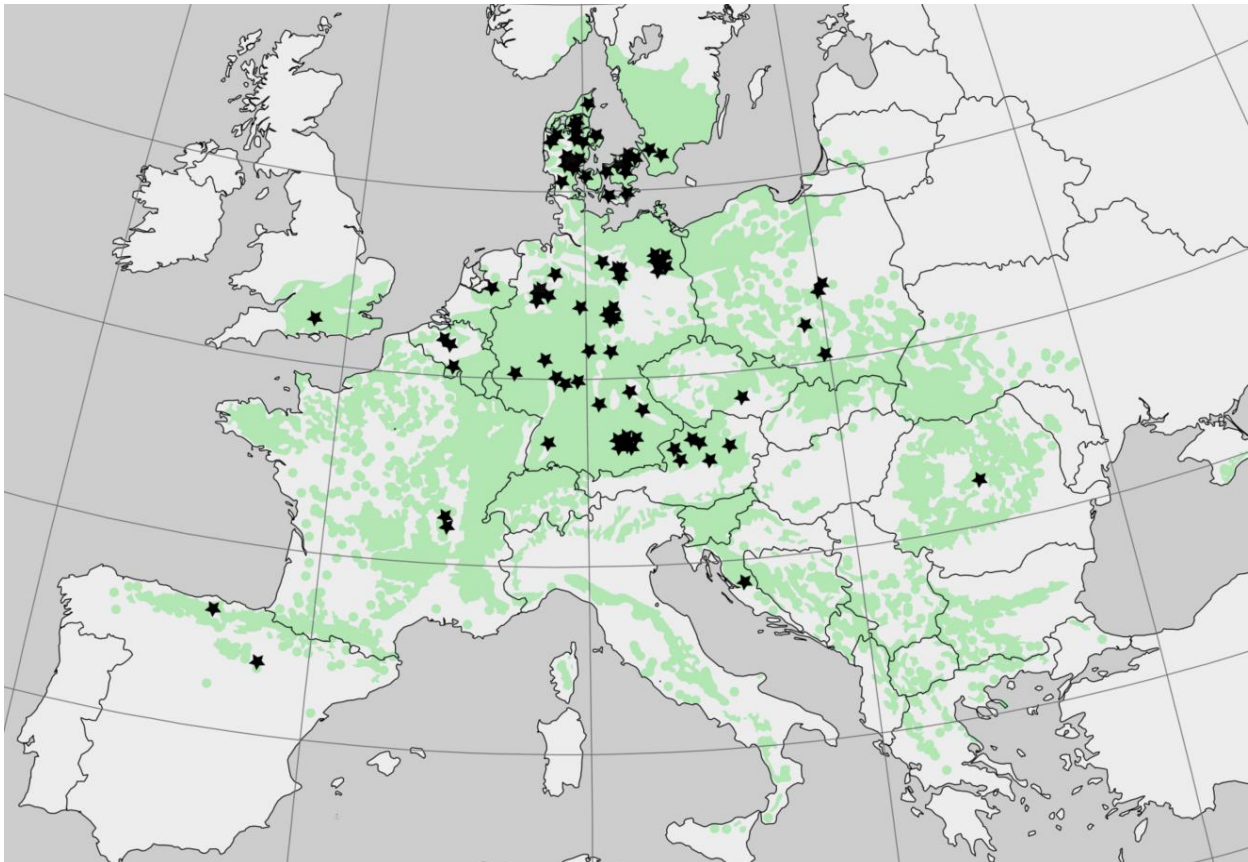
Research question

- ? Effect of admixing other tree species to beech stands on:
Soil organic carbon (SOC) and **total nitrogen (TN)** stocks
- ? Compare these soil parameters of pure beech stands
with those **other pure forests stands**



- ? Are there other **factors influencing** the difference in SOC/TN
due to different tree species

Meta analysis – Methods



Distribution of forest sites included in the meta-analysis (n = 102)

green color = natural distribution area of European beech, source: <http://www.euforgen.org/species/fagus-sylvatica/>

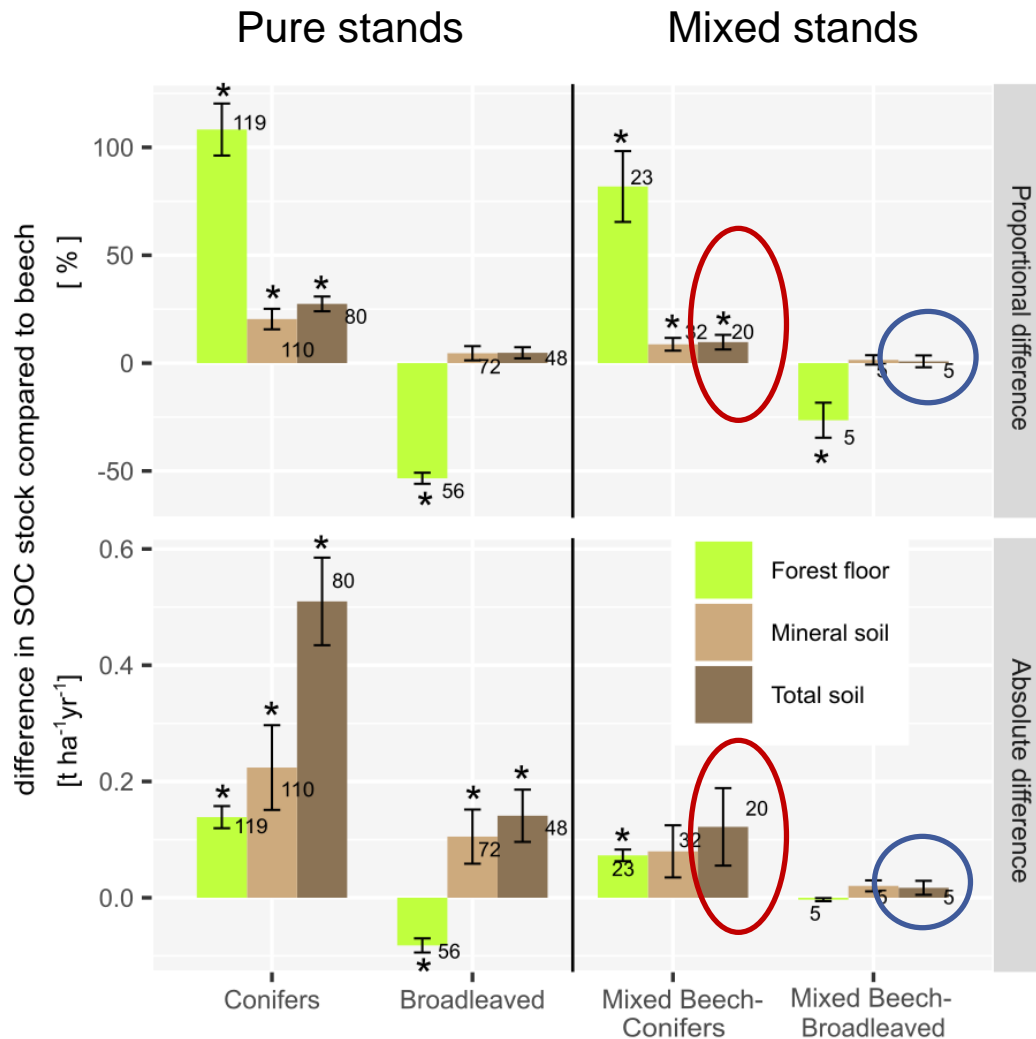
→ data set with 207, 230 and 164 observations for forest floor, mineral soil and the total soil profile

Most important criteria:

- replicated measurements
- paired stands/ designs (similar history, same soil type/ texture,...)

Mineral SOC stock data -> converted to 100 cm depth

Results: Differences in SOC stock compared to beech



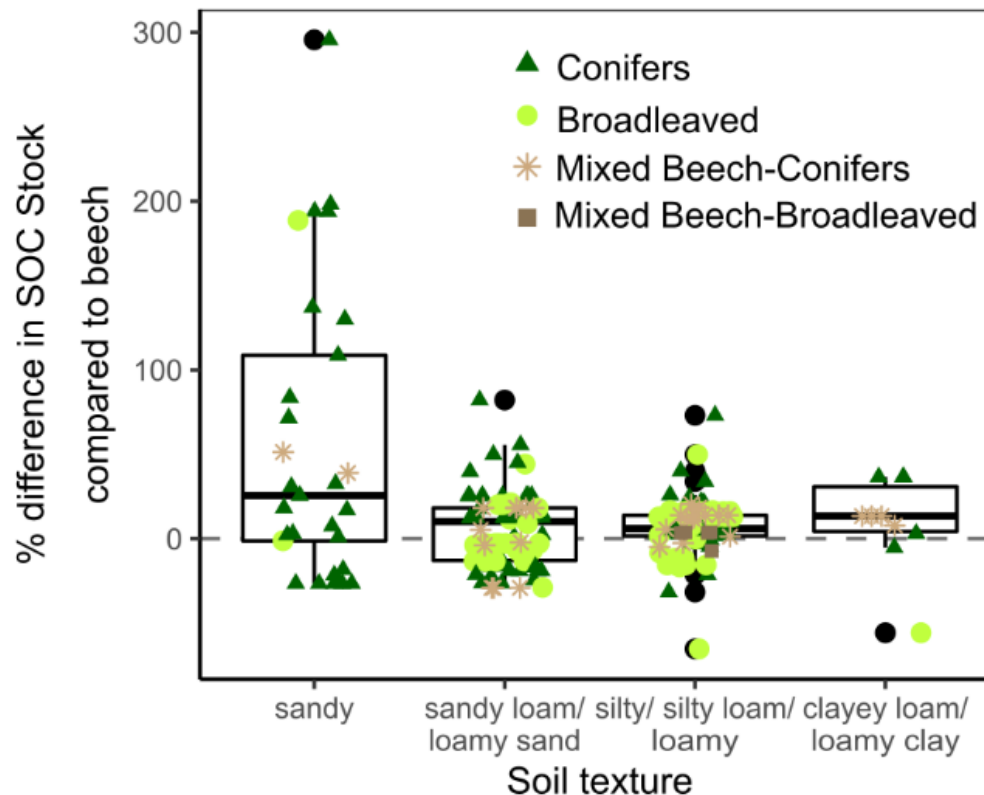
- SOC stocks of mixed stands are intermediate between those of the pure stands

In comparison to pure beech:

- mixed beech-conifers: higher total SOC stock of **~10 %**, which equals to a plus of **>0.1 t C ha⁻¹ yr⁻¹**
- mixed beech-broadleaved stands → less influence on total SOC stock

Soil texture influences difference in SOC stocks due to tree species

■ Mineral soil

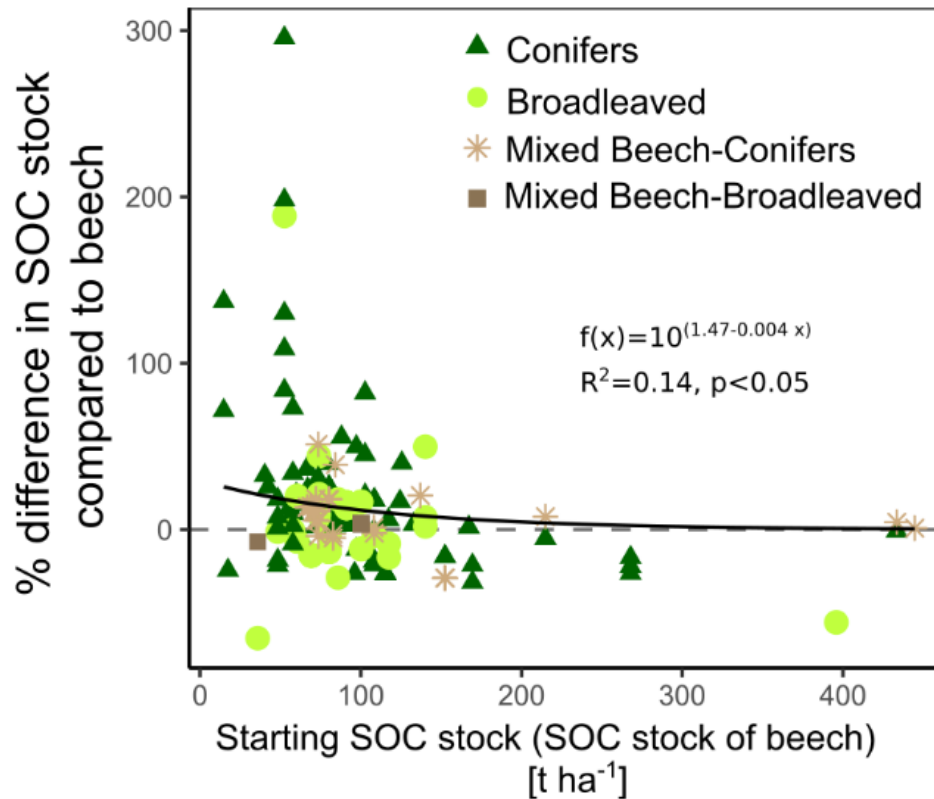


- With decrease in grain size → decrease in differences of SOC stocks
- Clayey and loamy soils buffer tree species effects better than sandy soils

Decrease in grain size

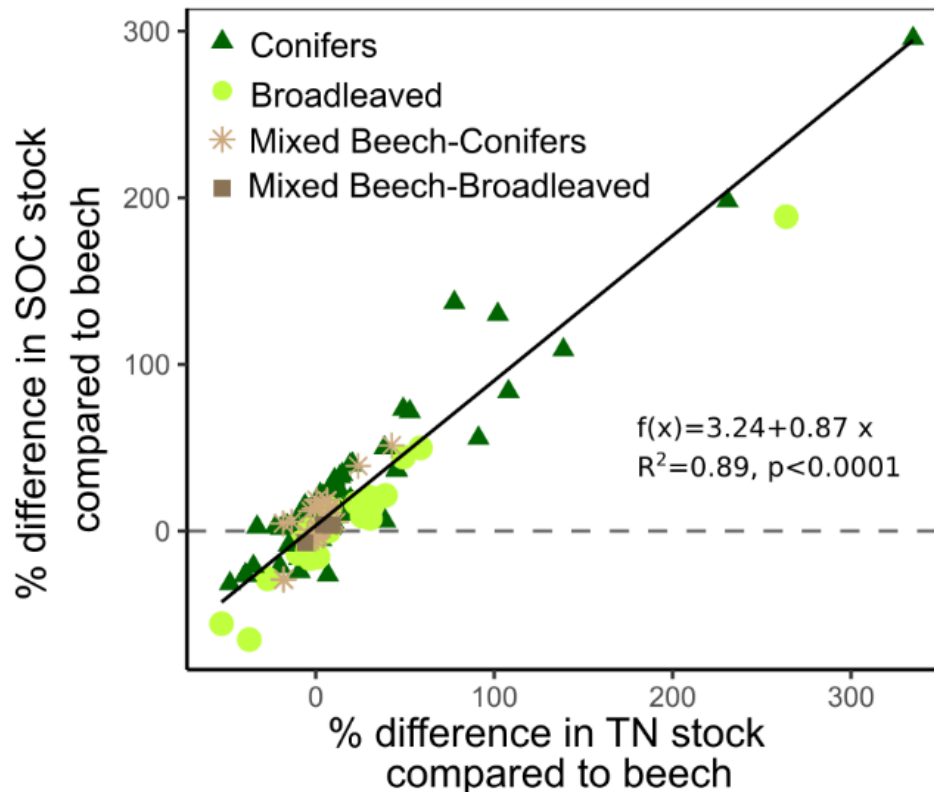
Largest tree species effect on soils with low SOC and TN stocks

■ Mineral soil



Strong correlations btw. rates of SOC and TN stock changes

■ Mineral soil



■ SOC stock dynamics are closely coupled with total nitrogen stock dynamics

Conclusion & Outlook

- This study provides a decision-making tool for forest management and policy by providing evidence for mixed beech stands with the largest potential towards increasing SOC stocks
- Mixed beech-conifers: highest C sequestration → most suitable for silvicultural measures when considering SOC stocks
- Mixture effects are not consistent across sites and soil layers → other factors influence SOC storage
- Especially on sandy soils and on soils with low SOC stocks greatest effects can be expected due to a change in tree species
- More research is needed in mixed forest stands

Thank you for your attention!

