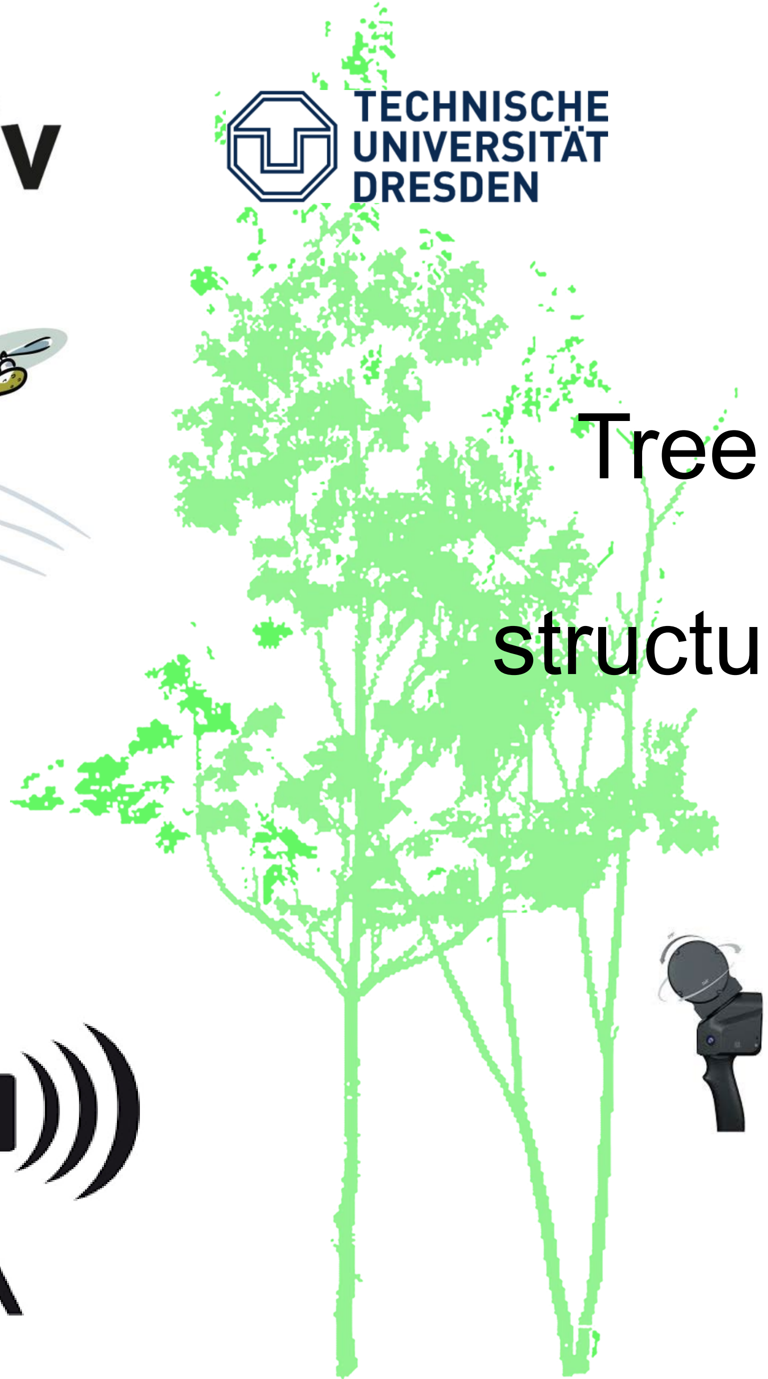
iDiv TECHNISCHE UNIVERSITÄT DRESDEN MARTIN-LUTHER UNIVERSITÄT HALLE-WITTENBERG LEUPHANA UNIVERSITÄT LÜNEBURG TreeDì



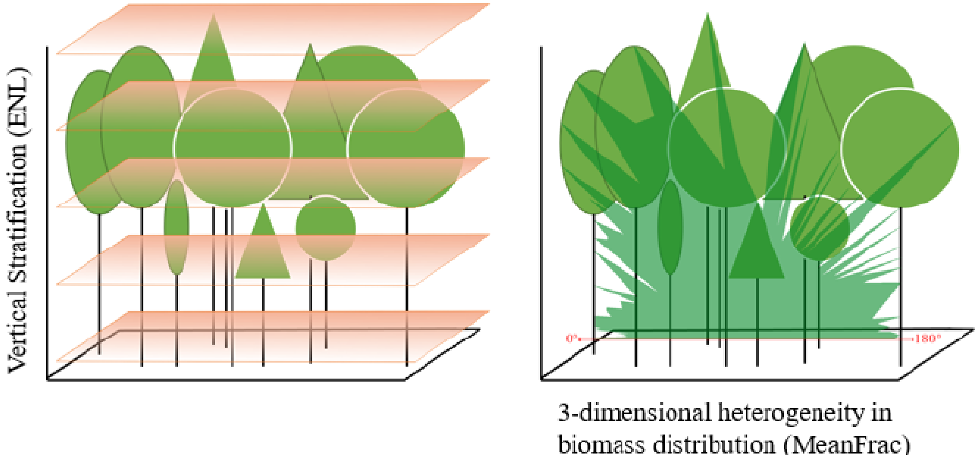
Tree diversity increases productivity through enhancing structural complexity across mycorrhizal types

Tama Ray

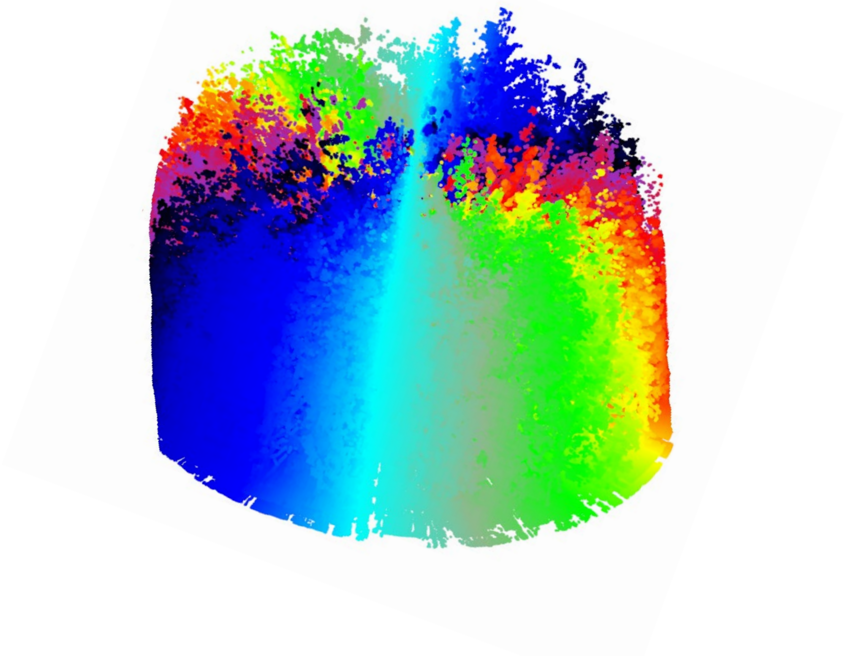
Supervisors: Prof. Goddert von Oheimb

PD. Dr. Andreas Fichtner

Background: Structural complexity

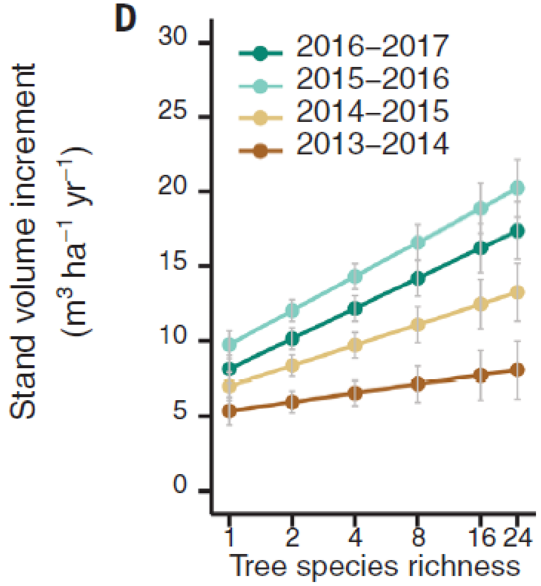


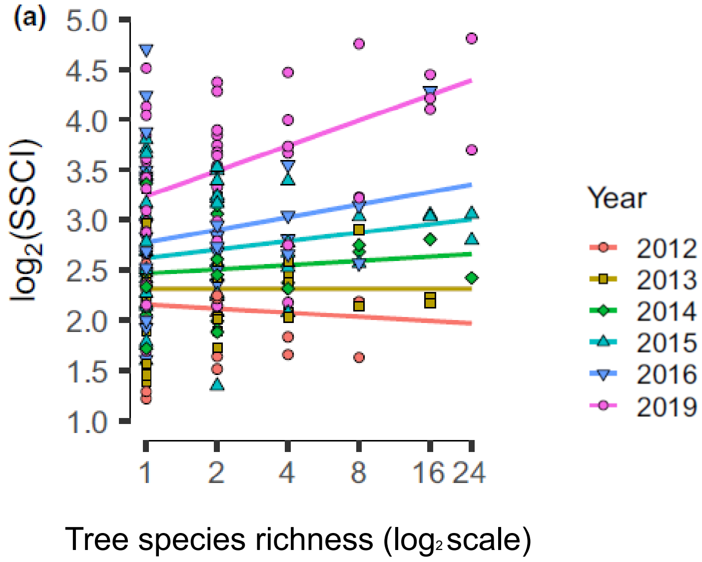
$$SSCI = MeanFrac^{ln(ENL)}$$



Ehbrecht et al. (2017), *Agricultural and Forest Meteorology*

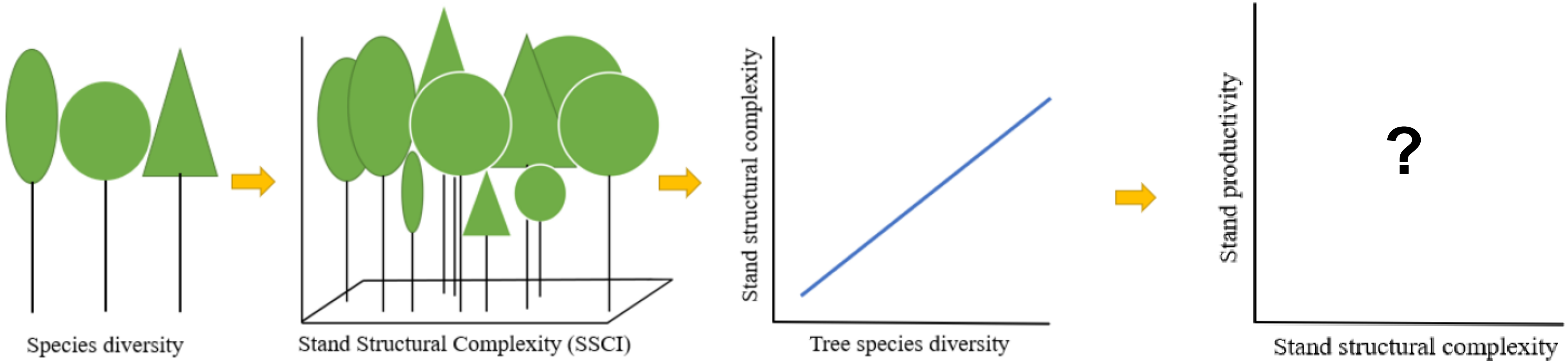
Biodiversity-productivity relationships – aboveground perspective



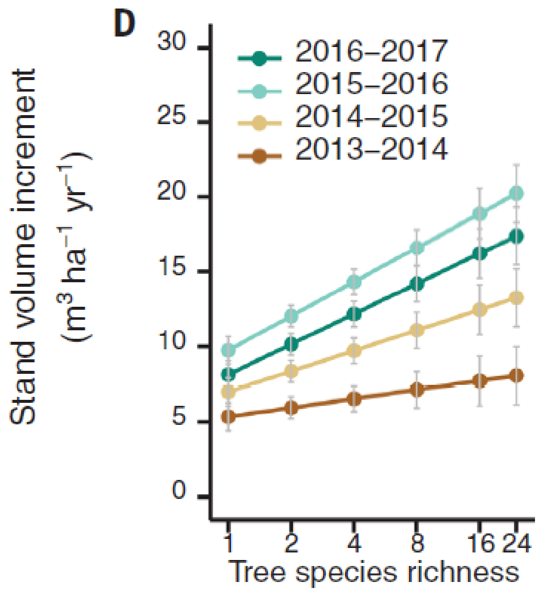


Huang et al. (2018), *Science*

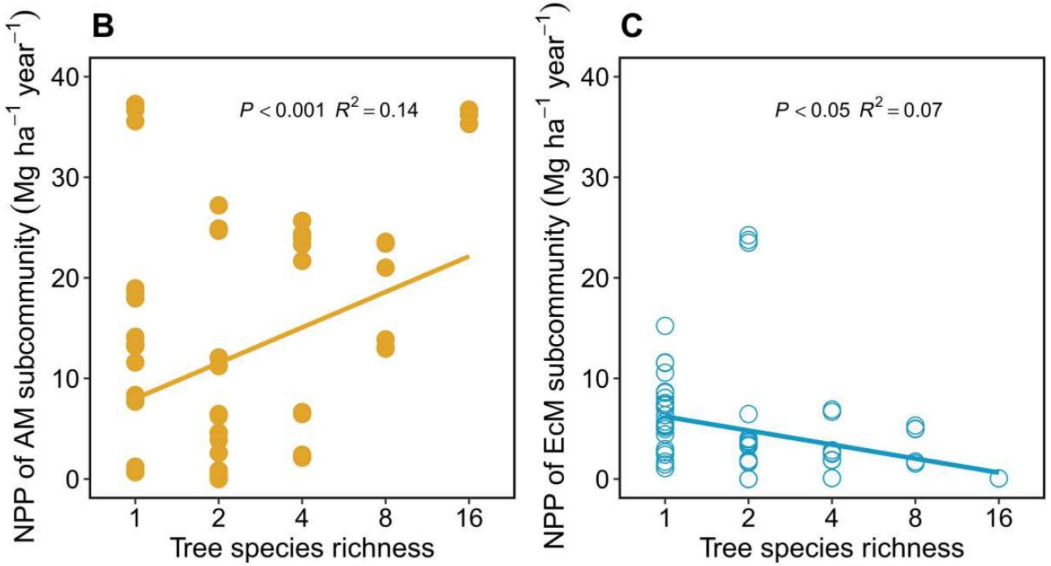
Perles-Garcia et al. (2021), *Journal of Applied Ecology*



Biodiversity-productivity relationships – belowground perspective



Huang et al. (2018), *Science*



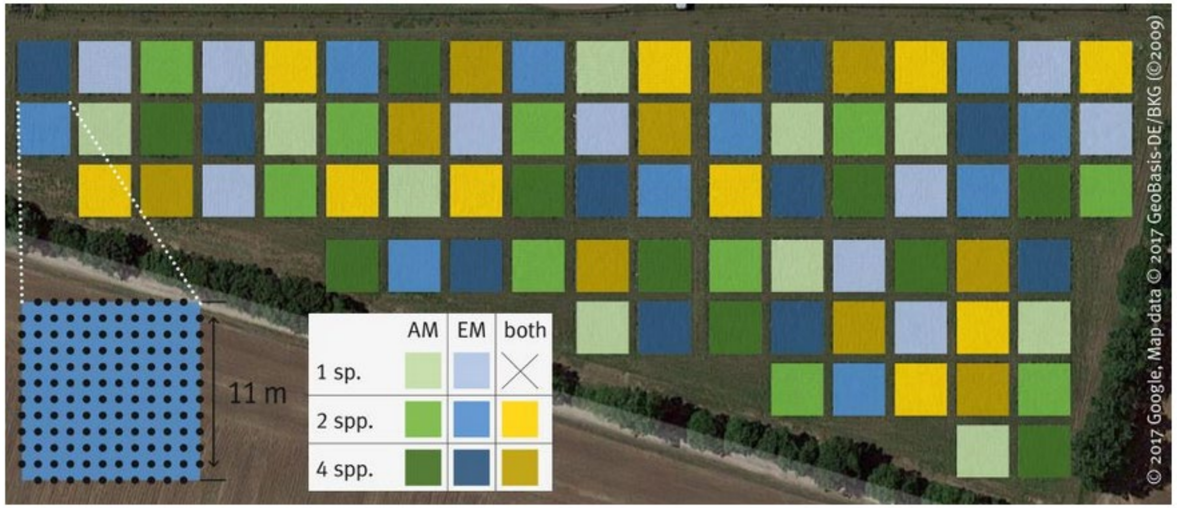
Deng et al. (2023), *Science Advances*

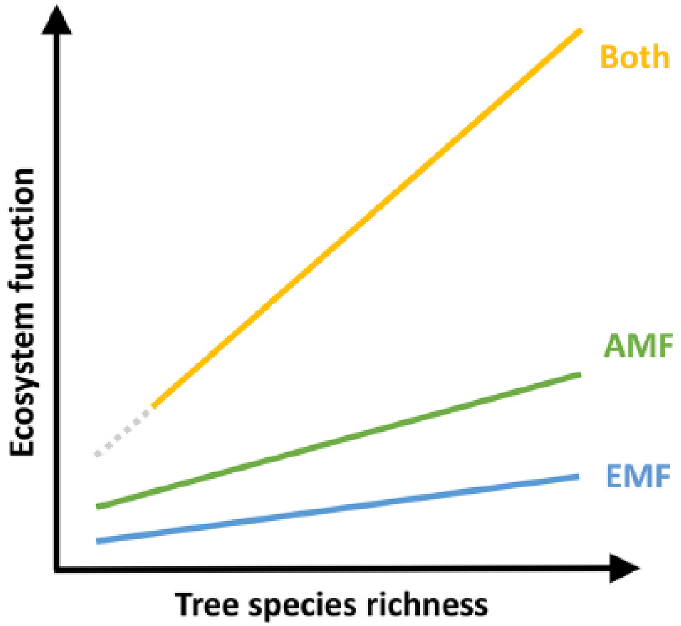
above

below

The relative importance of **above**- and **below**ground processes in shaping biodiversity-productivity relationships is still unclear

Study Site





<u>MyDiv key hypothesis</u>

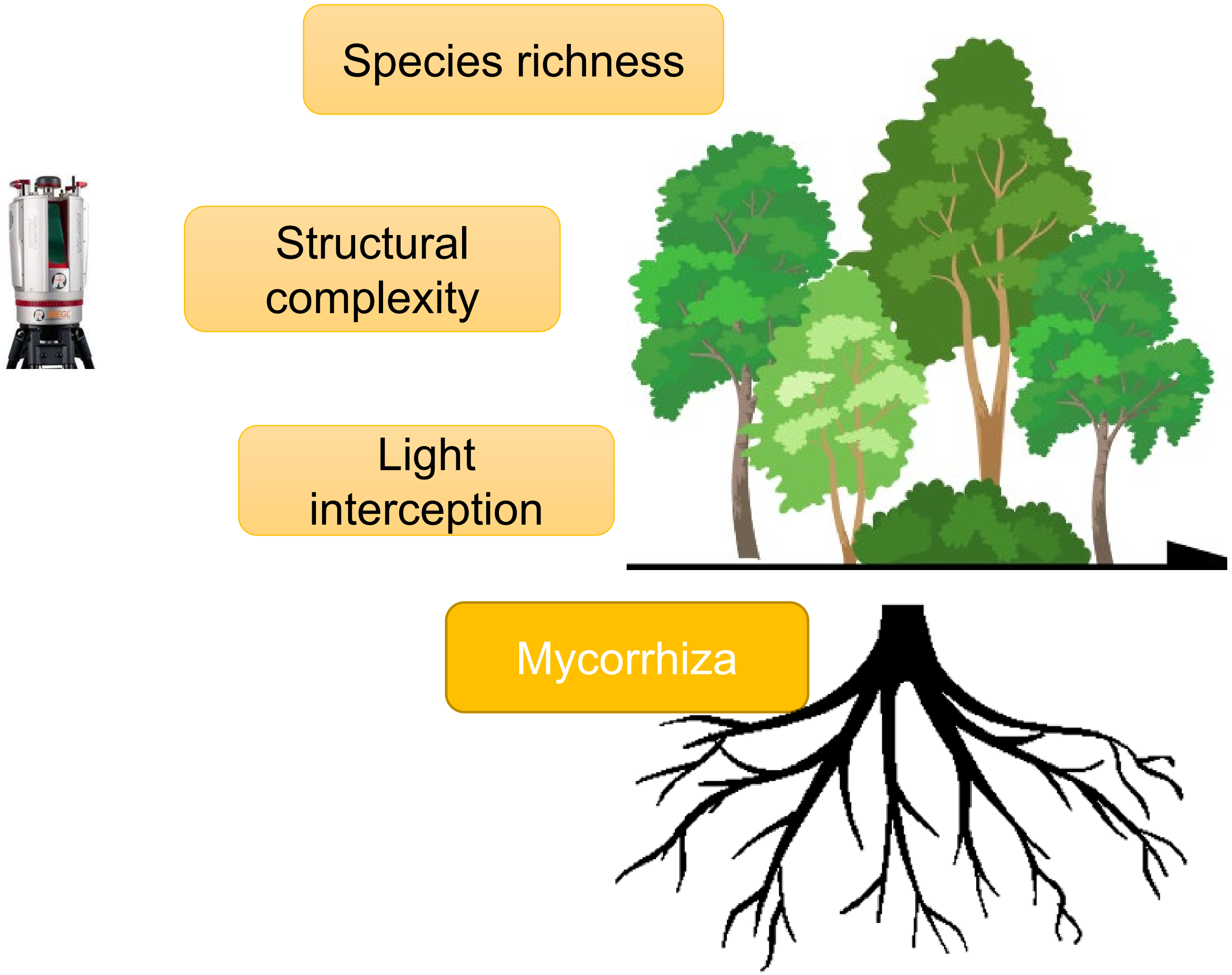
Stands with a high species richness of trees and the presence of functionally dissimilar mycorrhizal types show the highest levels of ecosystem functioning.

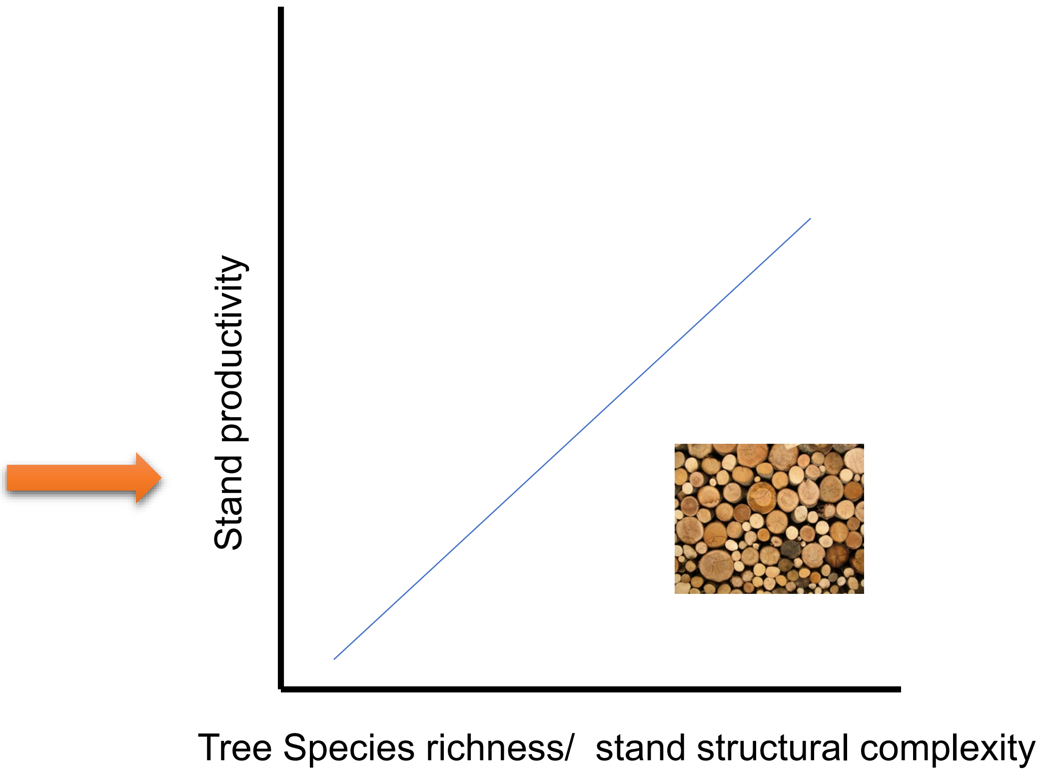
Methods

SCIENCE ADVANCES | RESEARCH ARTICLE

ECOLOGY

Tree diversity increases productivity through enhancing structural complexity across mycorrhizal types





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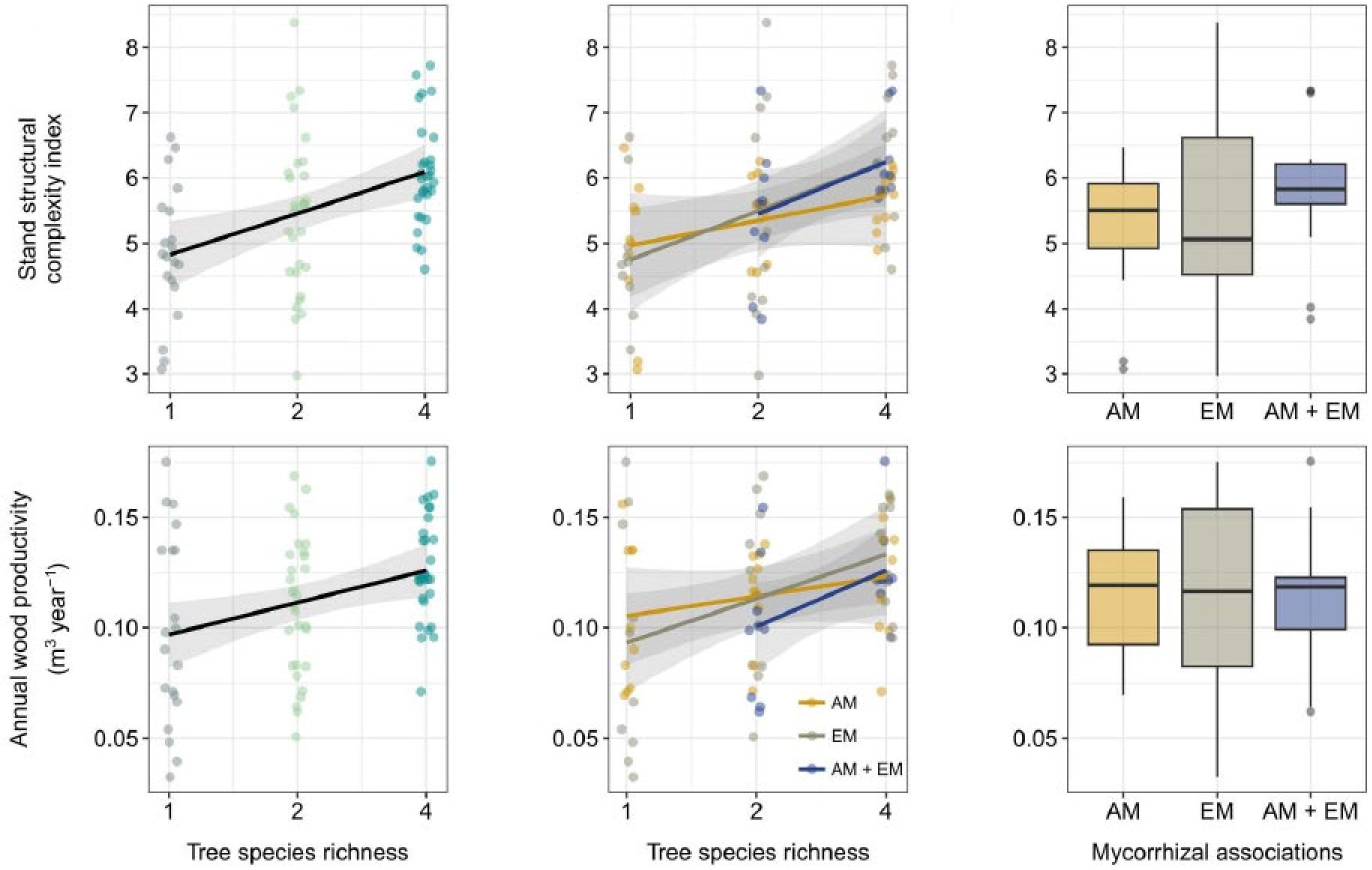
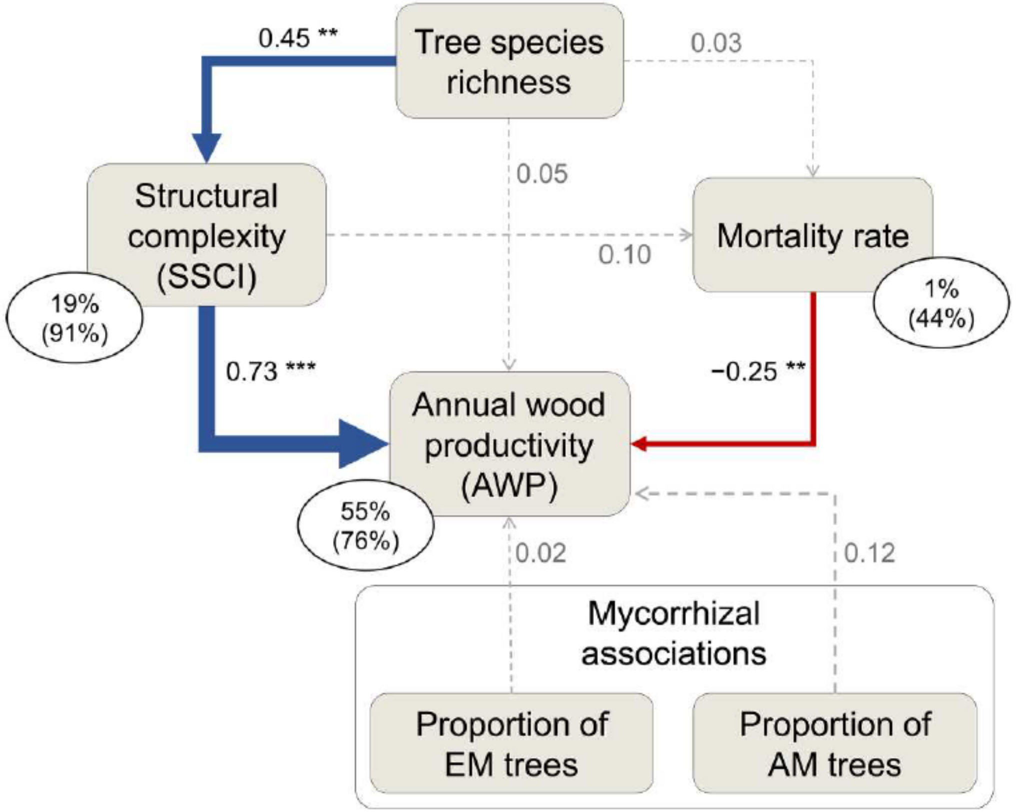
Hypothesis: Structural complexity and wood productivity increase with tree species richness, and mixtures composed of AM and EM tree species are most productive and structurally more complex.

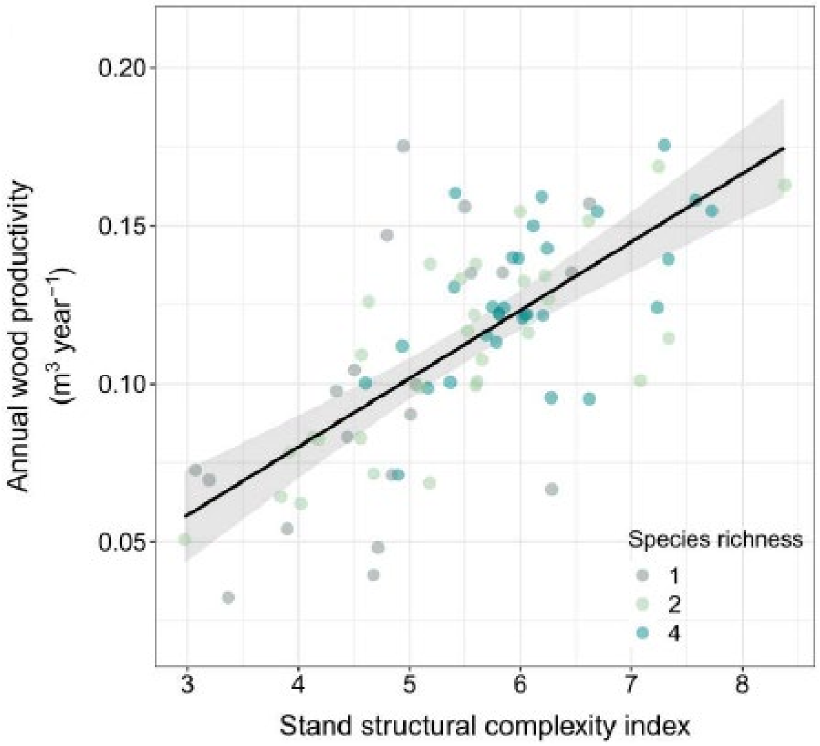


	df	ddf	*F* value	*P* value
SSCI				
Species richness (SR)	1	52.7	8.41	**0.005**
Mycorrhizal association (MA)	2	52.8	0.10	0.903
SR x MA	2	52.0	0.40	0.671
AWP				
Species richness (SR)	1	54.7	8.11	**0.006**
Mycorrhizal association (MA)	2	53.1	0.80	0.453
SR x MA	2	50.6	0.63	0.535

Tree species richness has a positive effect on stand structural complexity and productivity across mycorrhizal types

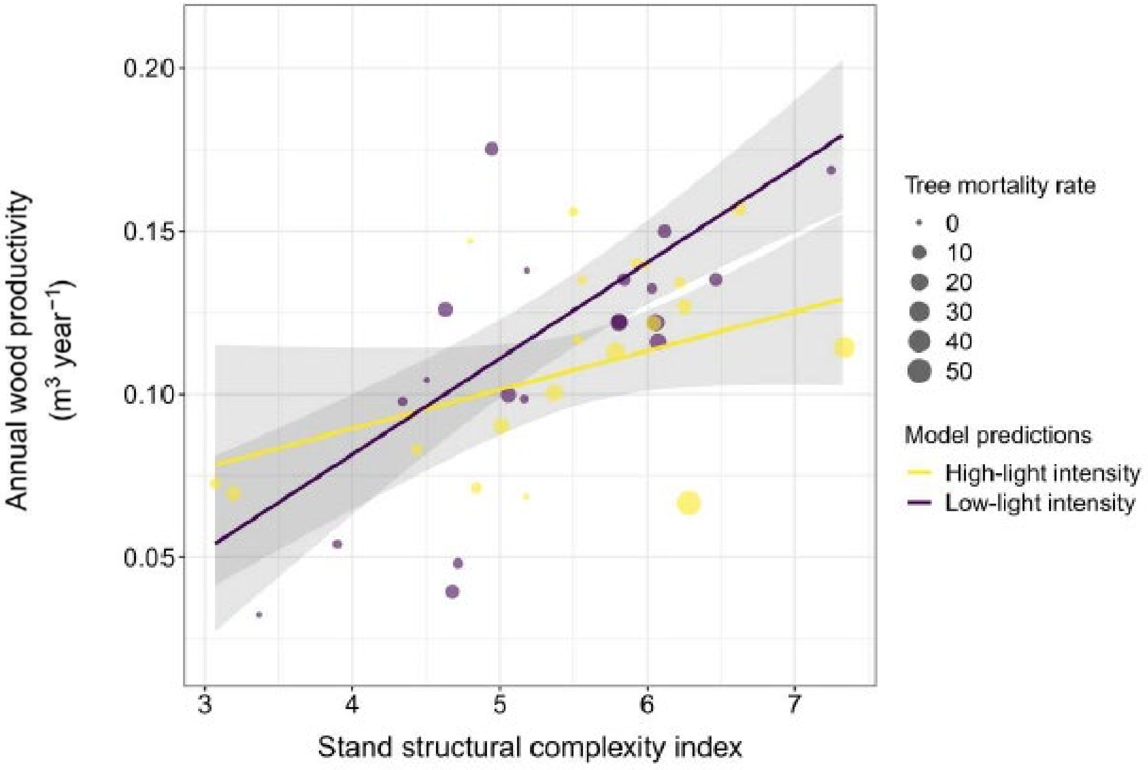
Above- and belowground processes on community productivity

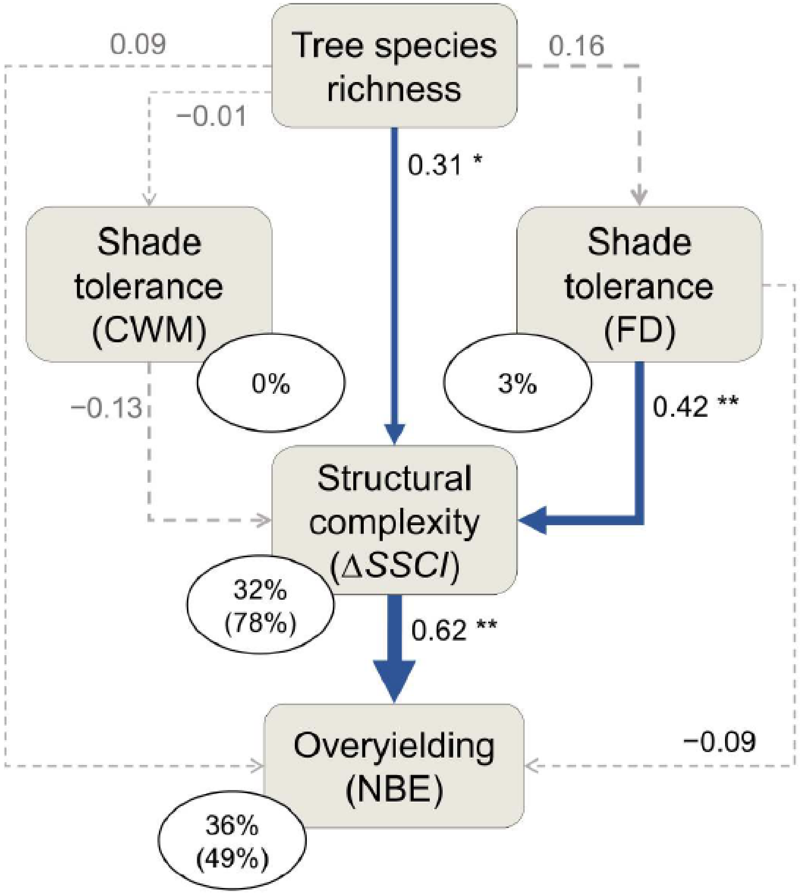




Community productivity is largely driven by stand structural complexity,
but not by mycorrhizal associations

Mechanisms underlying the positive relationship between tree species richness, structural complexity and wood productivity

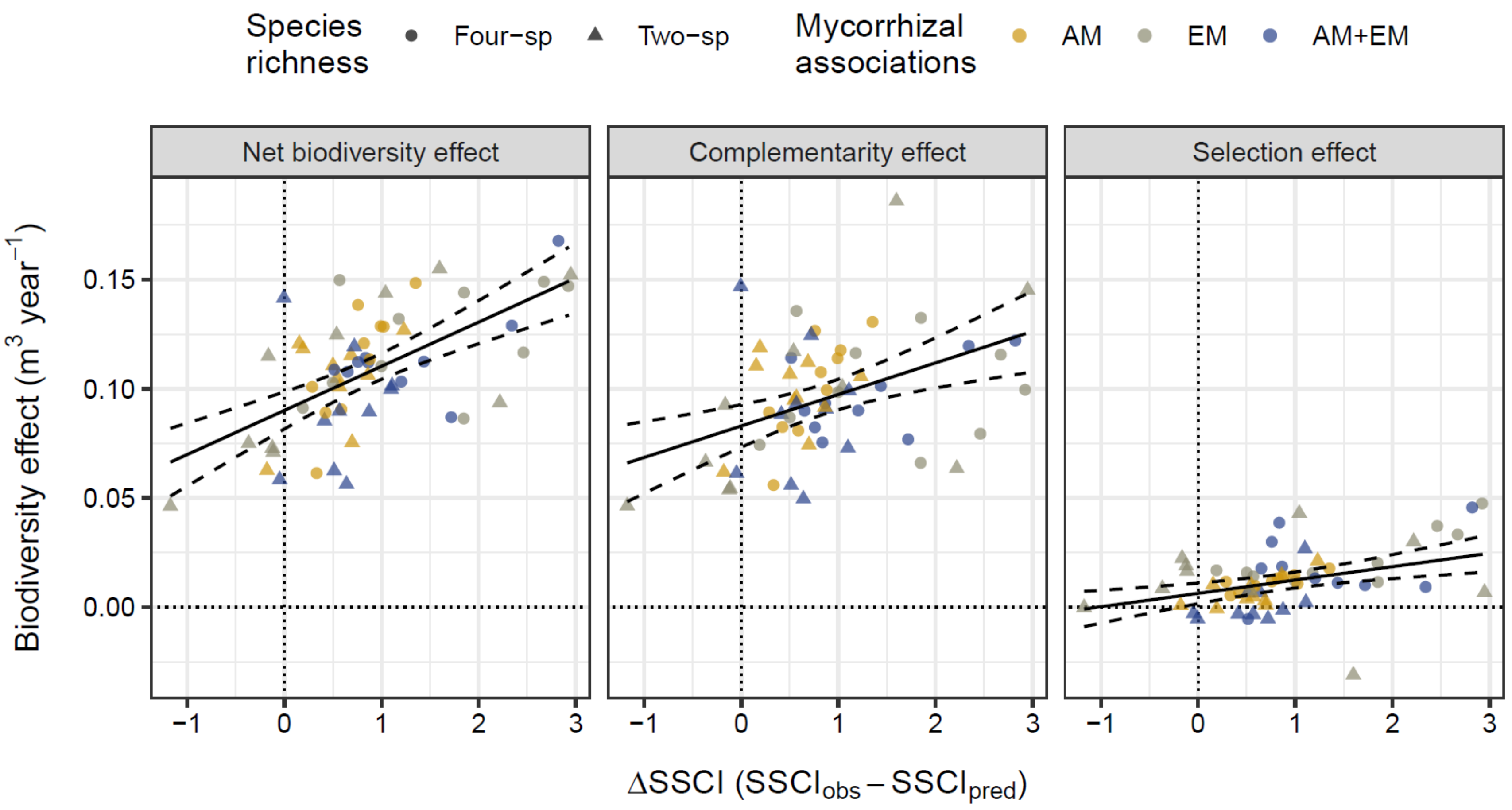




Net biodiversity effects on structural complexity (ΔSSCI) are strongly associated with functional variation in shade tolerance and to a lesser extent to taxonomic diversity

Mechanisms underlying the positive relationship between tree species richness, structural complexity and wood productivity

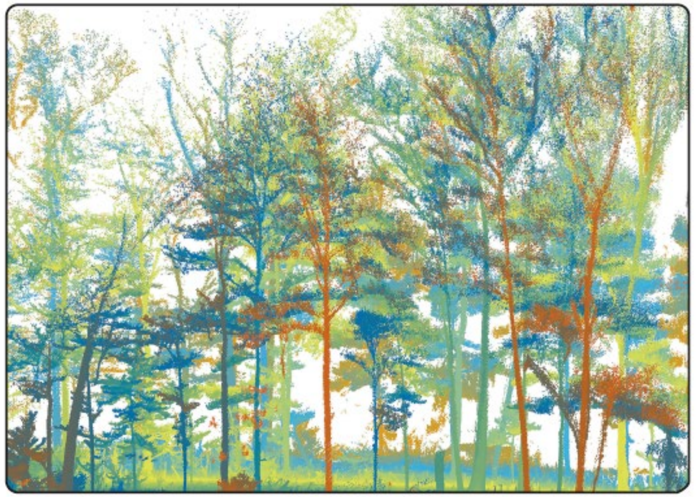
Net effect of tree species richness on
(1) wood productivity > overyielding = net biodiversity effect and
(2) stand structural complexity = ΔSSCI

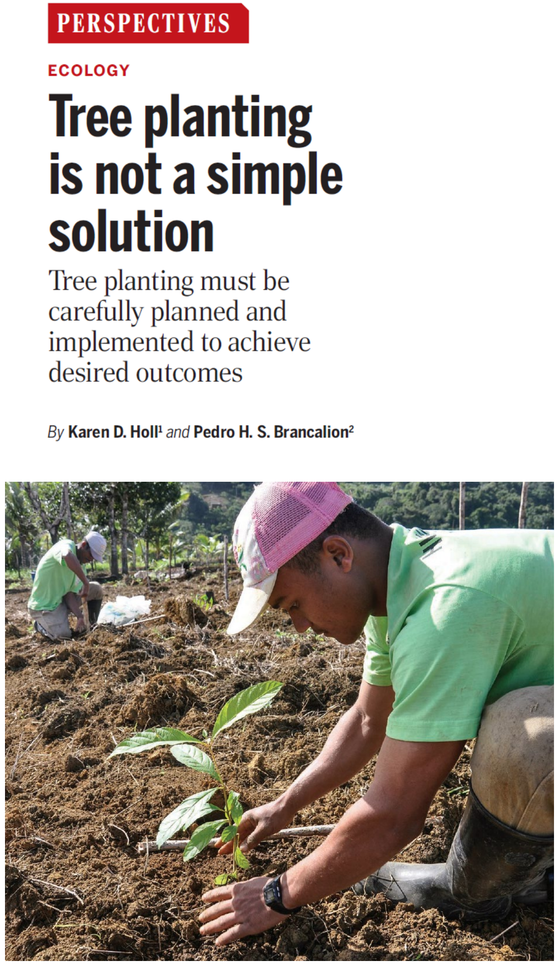


- Biodiversity effects on structural complexity (ΔSSCI) explain overyielding in species mixtures
- The positive relationship between overyielding and ΔSSCI is mainly driven by greater complementarity effects in structurally more complex tree communities

UNITED NATIONS DECADE ON ECOSYSTEM RESTORATION 2021-2030

Conclusion





PERSPECTIVES

ECOLOGY

Tree planting is not a simple solution

Tree planting must be carefully planned and implemented to achieve desired outcomes

By Karen D. Holl[1] and Pedro H. S. Brancalion[2]

Consideration of stand structural complexity appears to be a crucial element in predicting carbon sequestration in the early successional stages of mixed-species forests

We can relate this to MASSIVE data (potentials) from remote-sensing work to come up with global relationships for Earth System Models.

References

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I am thankful to ……

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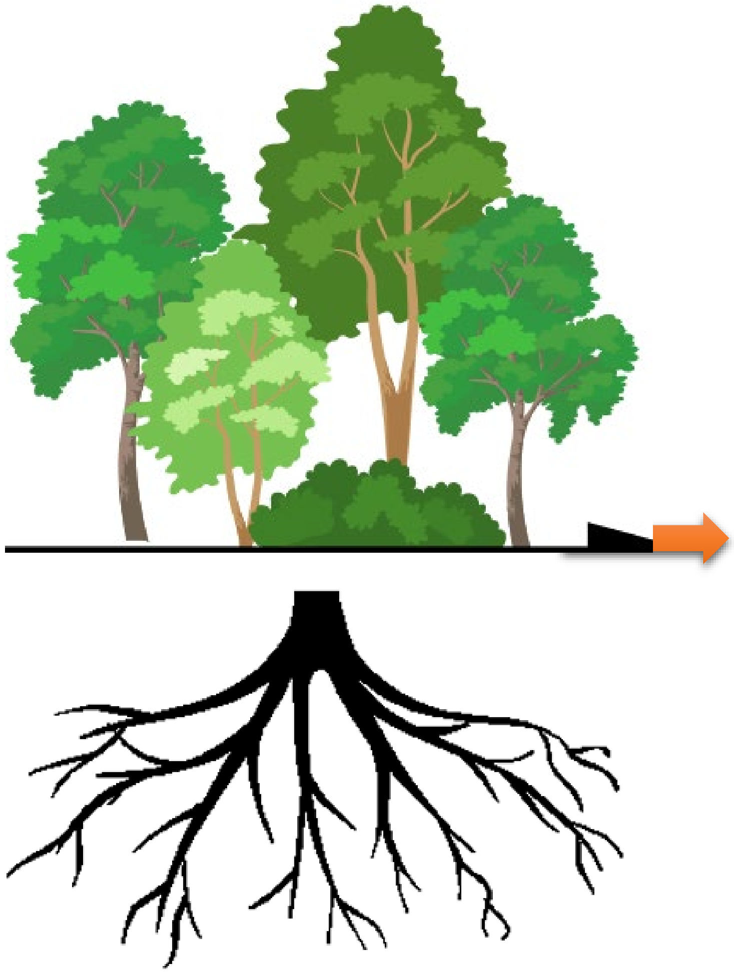
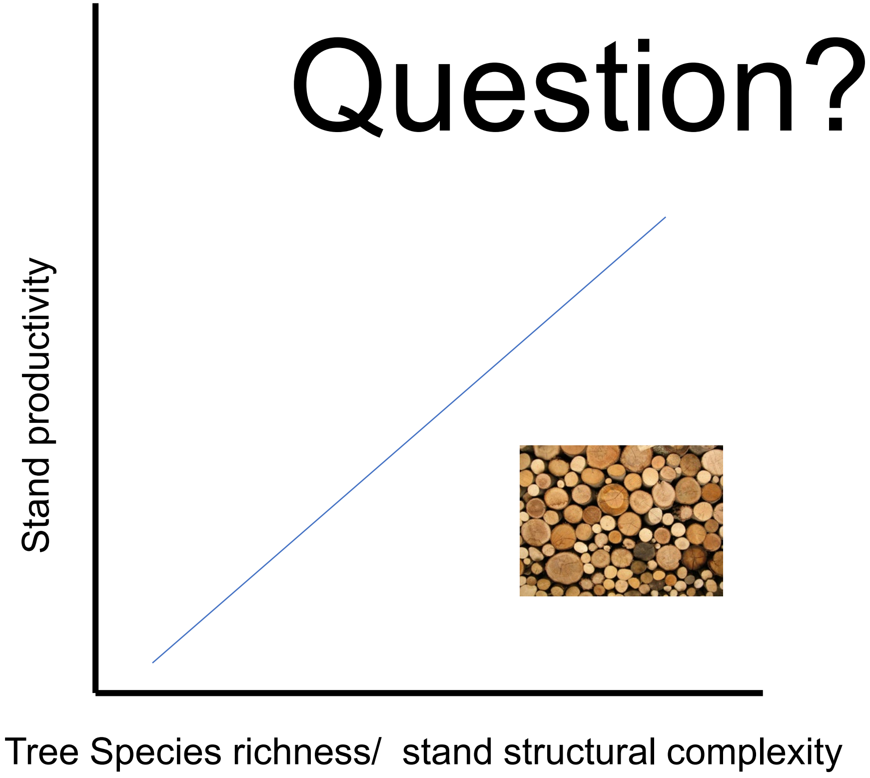


Question?



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Full paper: