

# **SUPPLEMENTARY INFORMATION:**

## **Global forest thickening**

Marqués et al.

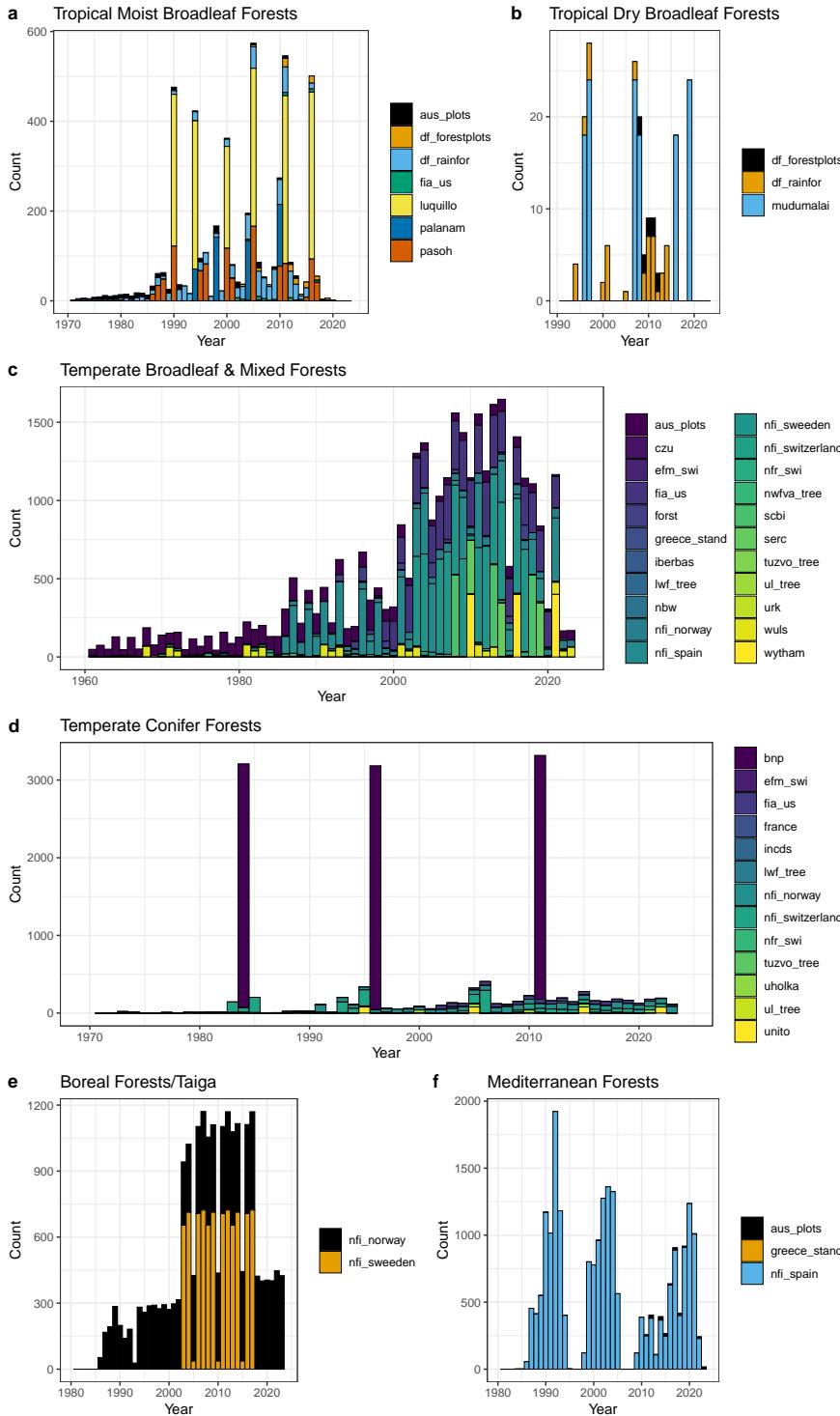
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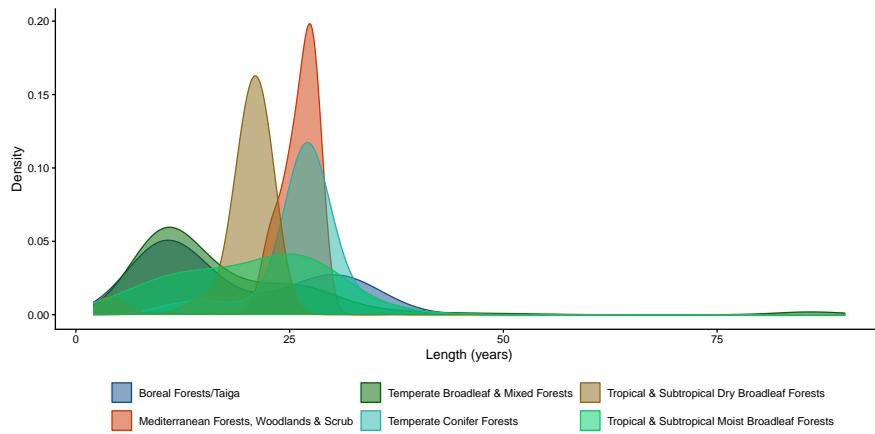
### S1 Data

Dataset	N	Description	Filter	Reference
nfi_spain	27642	Spanish National Forest Inventory	No management intervention observed during monitoring	
nfi_norway	25156	Norwegian National Forest Inventory	No management intervention observed during monitoring	
nfi_sweeden	15954	Swedish National Forest Inventory	No management intervention observed during monitoring	
bnp	9423	Berchtesgaden National Park	Forest reserves	
fia_us	7022	Forest Inventory and Analysis, US	Forest reserves	
aus_plots	6259	Sustainable Timber Tasmania, Forestry Corporation of NSW, Queensland, Victoria and Australia's Terrestrial Ecosystem Research Network	No management intervention observed during monitoring	
luquillo	1993	Luquillo	No management intervention observed during monitoring	
nfi_switzerland	1972	Swiss National Forest Inventory	No management intervention observed during the last 70 years	
scbi	1572	Smithsonian Conservation Biology Institute	No management intervention observed during monitoring	
wuls	1416	Bialowieża National Park	Forest reserves	
wytham	1200	Wytham Woods	No management intervention observed during monitoring	
serc	1026	Smithsonian Environmental Research Center	No management intervention observed during monitoring	
pasoh	1007	Pasoh	No management intervention observed during monitoring	
df_rainfor	988	Amazon Forest Inventory Network (RAINFOR)	No management intervention occurred	
nfr_swiforest	729	Swiss Natural Forest Reserves	Forest reserves	
	537	Forest Research Institute Baden-Württemberg	Forest reserves	
palanam	484	Palanam		
unito	311	University of Turin	Forest reserves	
uholka	200	Uholka-Shyrokyi Luh	Forest reserves	
df_forestplots	149	Forest Inventory Network	No management intervention occurred	
mudumalai	126	Mudumalai	No management intervention observed during monitoring	
lwf_tree	114	Bavarian Institute of Forestry	Forest reserves	
nwfva_tree	84	Northwest German Forest Research Institute (NW-FVA)	Forest reserves	
incds	75	National Institute for Research-Development in Forestry "Marin Drăcea" Department of Forest	Forest reserves	
tuzvo_tree	63	Technical University in Zvolen	Forest reserves	
iberbas	57	Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences	Forest reserves	
efm_swi	51	Experiential Forest Management plots	No management intervention observed during monitoring	
france	47	French plots	No management intervention observed during monitoring	
greece_stand	40	Greek plots	No management intervention observed during monitoring	
czu	24	Czech University of Life Sciences Prague	Forest reserves	
ul_tree	23	University of Ljubljana, Slovenia	Forest reserves	
urk	12	Roztocze National Park, Poland	Forest reserves	
nbw	7	NPV-BW	Forest reserves	

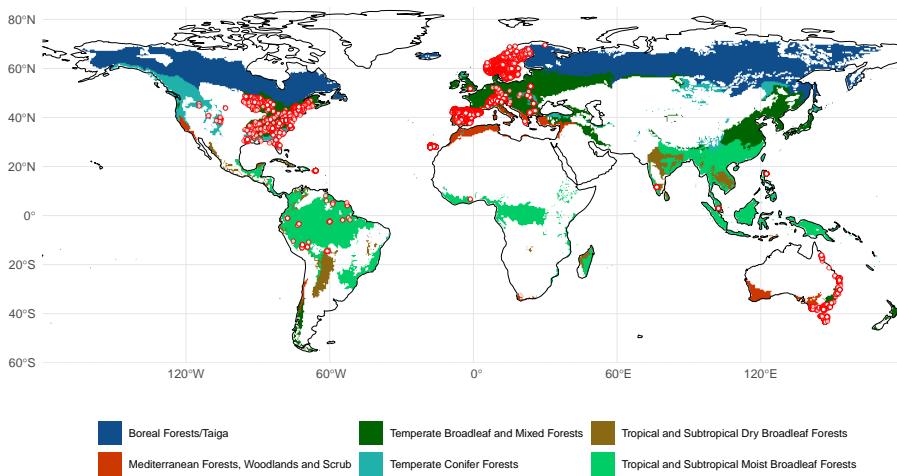
**Table S1:** Constituent forest dataset sizes and descriptions.



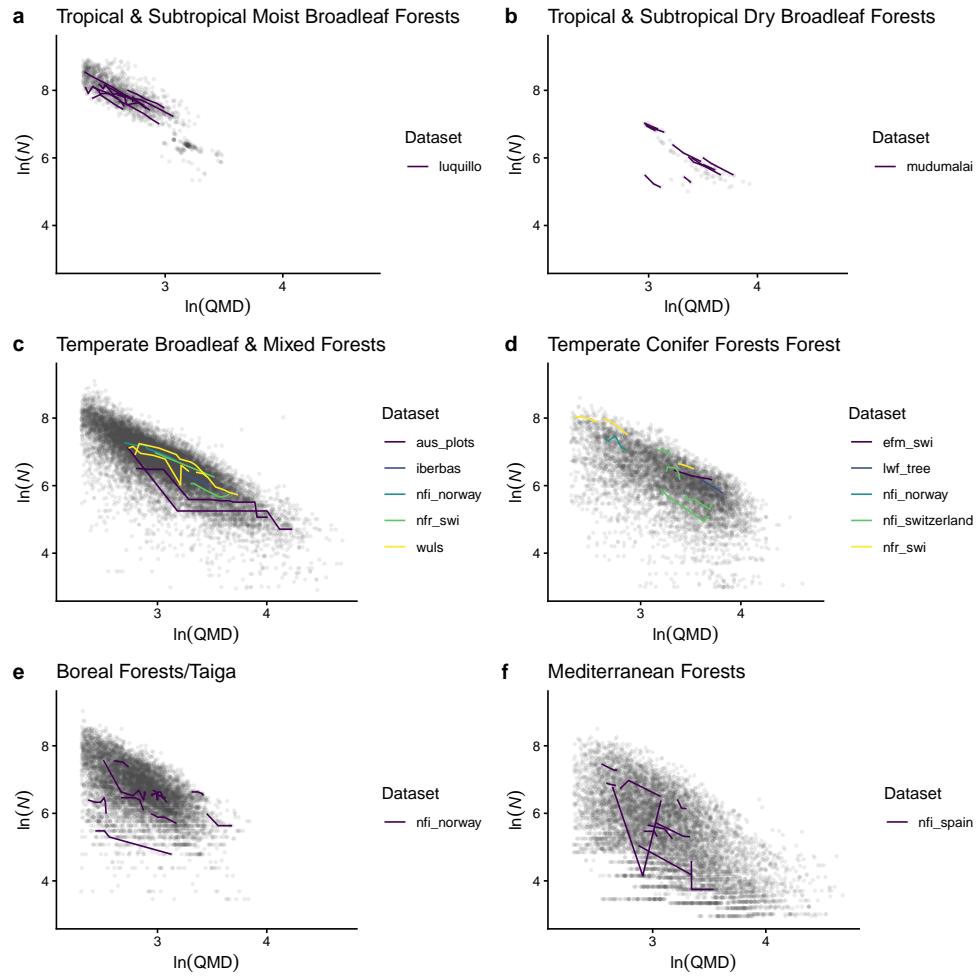
**Figure S1:** Distribution of forest census data over time, grouped by biome (a-f). Dataset names are explained in Tab. xxxx.



**Figure S2:** Distribution of the total length of the time series per forest plot, separated by biomes. The total length corresponds to the difference in the observation year of the first and last available forest inventory for each plot.

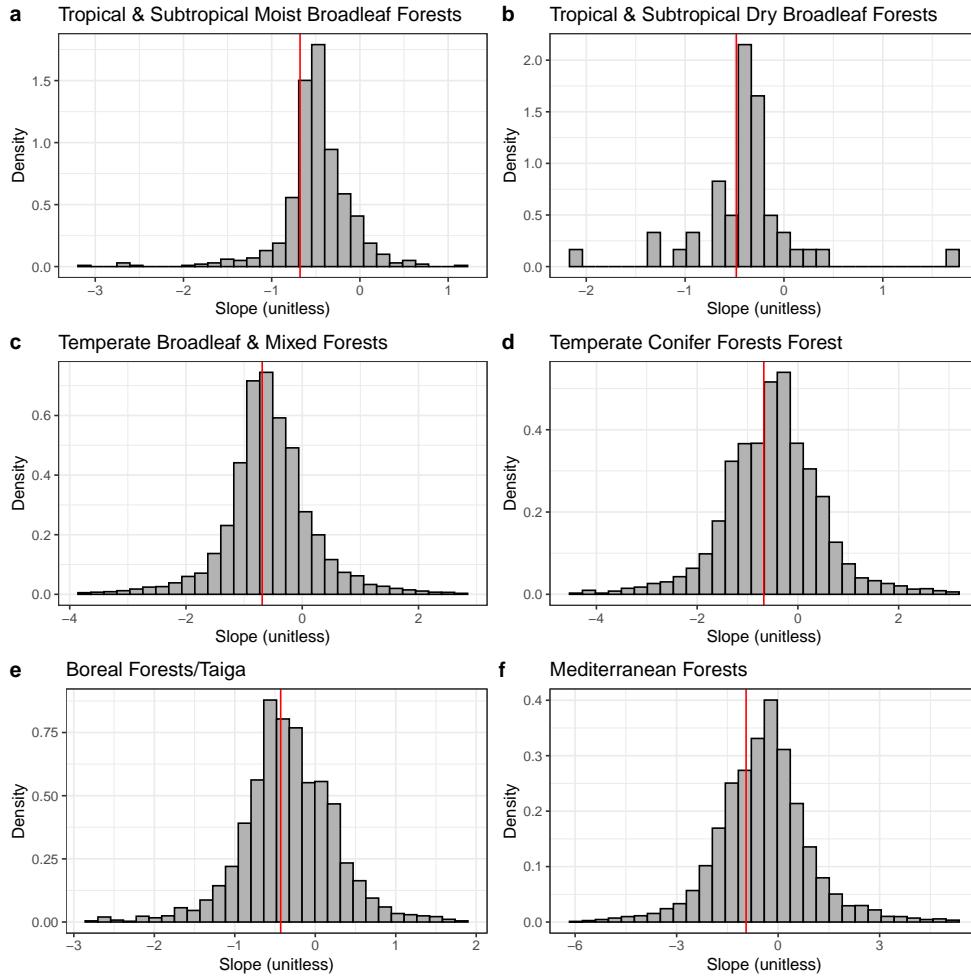


**Figure S3:** Distribution of forest plots (red circles) and forest biomes.



**Figure S4:** Self-thinning relation across biomes with example long-term forest monitoring plots highlighted.

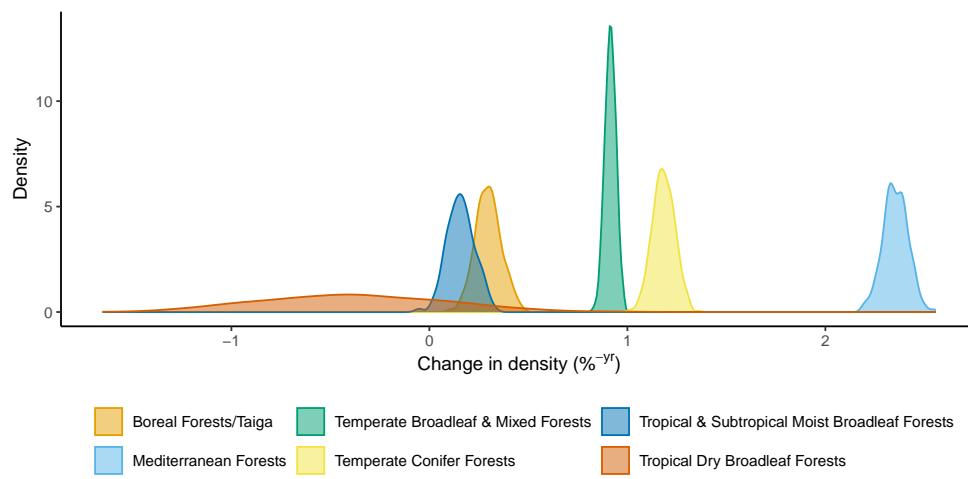
## S2 Self-thinning trends



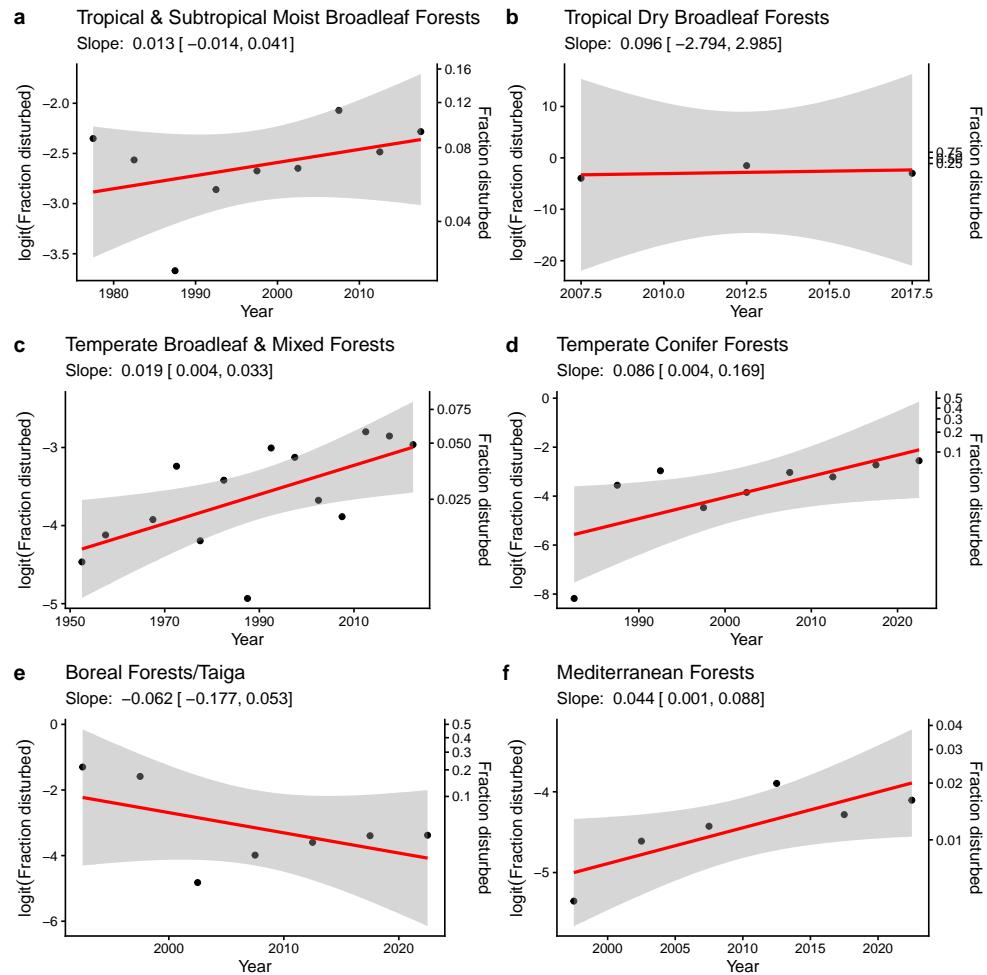
**Figure S5:** Self-thinning relation across biomes with example long-term forest monitoring plots highlighted.

Biome	Mean	SE
Boreal Forests/Taiga	0.30	0.06
Mediterranean Forests	2.35	0.06
Temperate Broadleaf & Mixed Forests	0.91	0.03
Temperate Conifer Forests	1.18	0.06
Tropical & Subtropical Moist Broadleaf Forests	0.16	0.07
Tropical Dry Broadleaf Forests	-0.38	0.46

**Table S2:** Mean estimate and standard error (SE) of percentage change (%/yr) of forest stand density (number of trees per ha) by biome, determined from quantile regressions on bootstrapped data samples.



**Figure S6:** Distribution of percentage change (%/yr) in stand density (number of trees per ha) by biome.

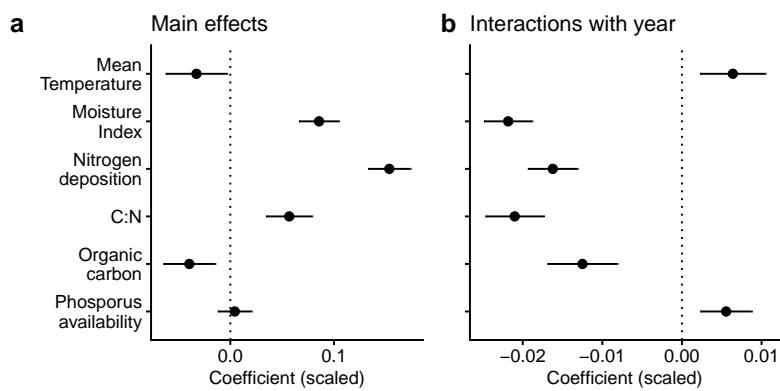


**Figure S7:** Trends in the fraction of disturbed forest plots, by biome. Fraction values are logit-transformed. The corresponding un-transformed values are indicated by the right y-axis in each plot. No regression fit is shown for tropical dry broadleaf forests (b) as only two points are available with non-zero values for the disturbed fraction.

### S3 Environmental drivers

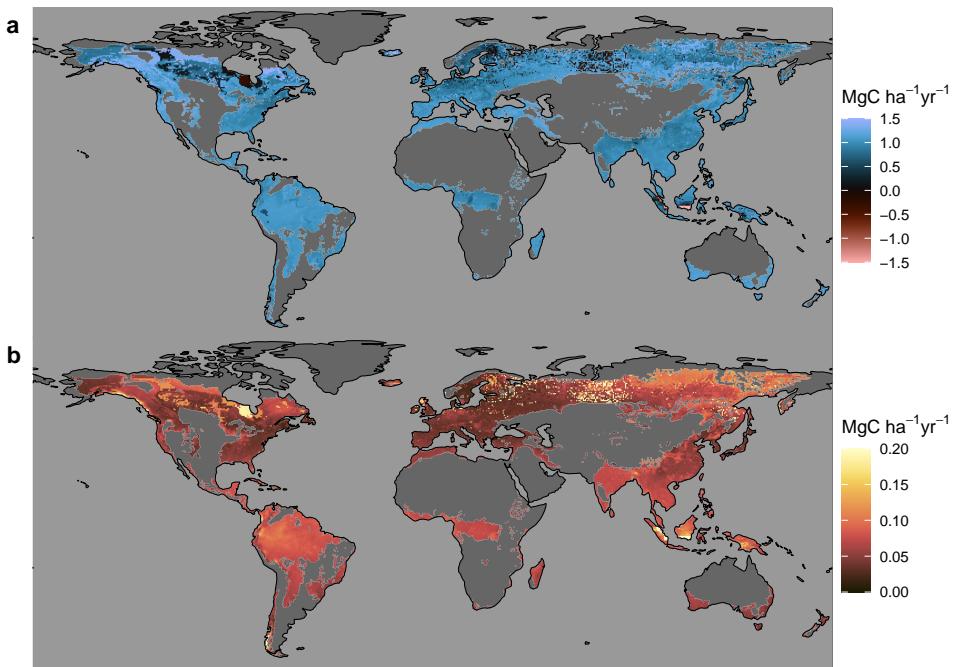
Table S3: Regression Results

	Complete	No PBR	No PBR, ORGC	No PBR, C:N
scale(logQMD)	-0.861*** (0.002)	-0.862*** (0.002)	-0.862*** (0.002)	-0.864*** (0.002)
scale(year)	0.129*** (0.001)	0.130*** (0.001)	0.130*** (0.001)	0.132*** (0.001)
scale(tavg)	-0.033* (0.015)	-0.026+ (0.015)	-0.007 (0.014)	-0.018 (0.015)
scale(ai)	0.086*** (0.010)	0.095*** (0.009)	0.097*** (0.009)	0.087*** (0.009)
scale(ndep)	0.153*** (0.010)	0.140*** (0.010)	0.146*** (0.010)	0.131*** (0.010)
scale(ORG C)	-0.039** (0.013)	-0.048*** (0.012)		-0.001 (0.009)
scale(PBR)	0.004 (0.008)			
scale(CNrt)	0.057*** (0.011)	0.060*** (0.011)	0.031*** (0.008)	
scale(year) × scale(tavg)	0.006** (0.002)	0.009*** (0.002)	0.013*** (0.002)	0.006** (0.002)
scale(year) × scale(ai)	-0.022*** (0.002)	-0.018*** (0.001)	-0.018*** (0.001)	-0.017*** (0.001)
scale(year) × scale(ndep)	-0.016*** (0.002)	-0.015*** (0.002)	-0.015*** (0.002)	-0.011*** (0.001)
scale(year) × scale(ORG C)	-0.012*** (0.002)	-0.011*** (0.002)		-0.028*** (0.002)
scale(year) × scale(PBR)	0.006*** (0.002)			
scale(year) × scale(CNrt)	-0.021*** (0.002)	-0.023*** (0.002)	-0.028*** (0.001)	
SD (Observations)	0.176	0.178	0.178	0.178
Num.Obs.	36133	37652	37652	37652
R2 Marg.	0.521	0.530	0.531	0.527
R2 Cond.	0.980	0.980	0.980	0.980
AIC	17693.1	19142.8	19162.9	19315.9
BIC	17846.0	19279.3	19282.4	19435.4
ICC	1.0	1.0	1.0	1.0
RMSE	0.15	0.15	0.15	0.15



**Figure S8:** Coefficients of fixed effects of environmental factors on the self-thinning relationship. Data was filtered to retain observations from plots subject to dominant self-thinning dynamics based on slopes.

## S4 Global C sink



**Figure S9:** (a) C sink in aboveground biomass due to temporal changes in the self-thinning relationship. (b) Standard deviation of estimates across bootstraps. Values are expressed per unit forest area ( $\text{gC m}^{-2} \text{yr}^{-1}$ ).

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