nature portfolio

https://doi.org/10.1038/s41586-025-08692-x

Supplementary information

Widespread slow growth of acquisitive tree species

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Widespread slow growth of acquisitive tree species

Augusto *et al.*

Supplementary Information

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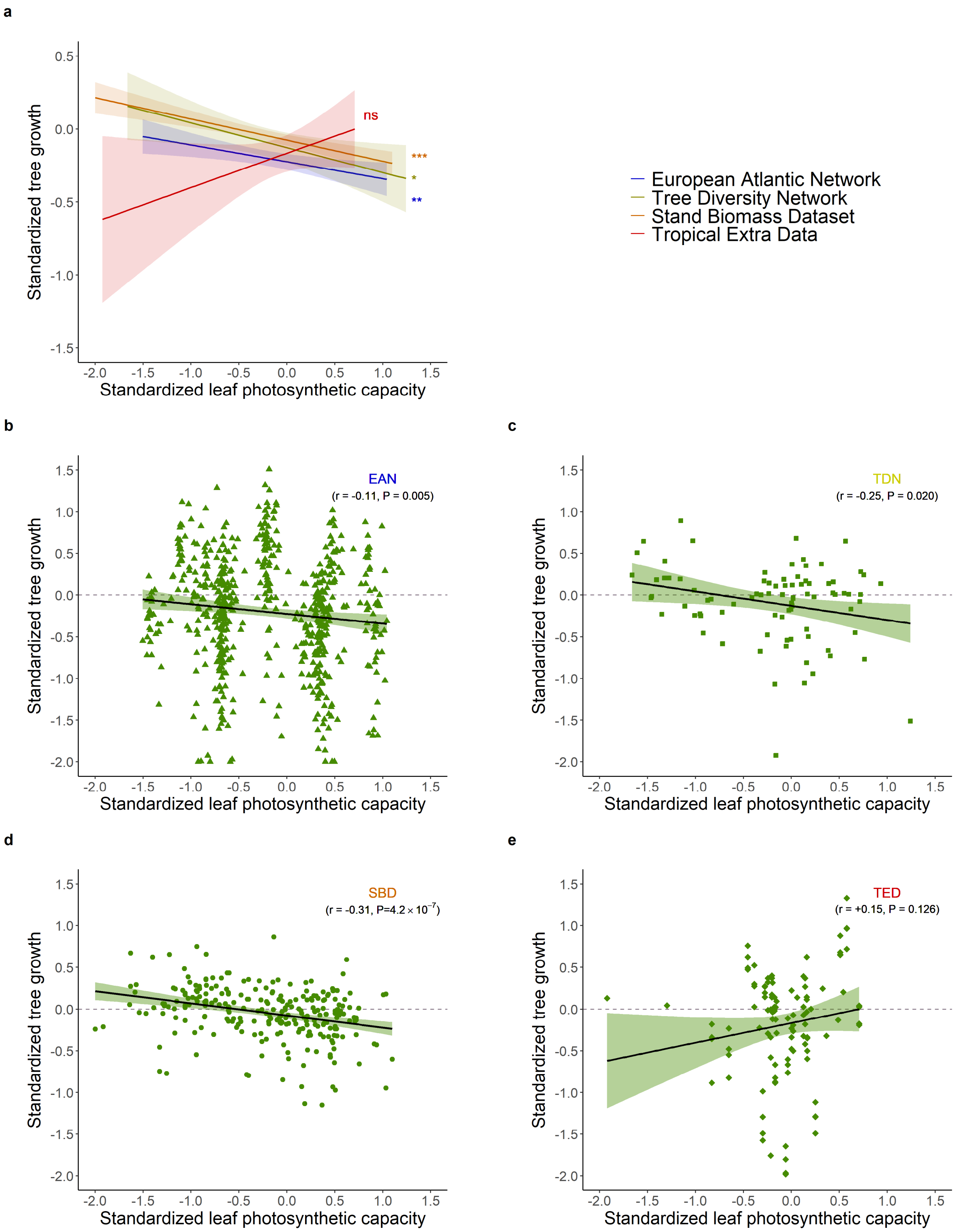
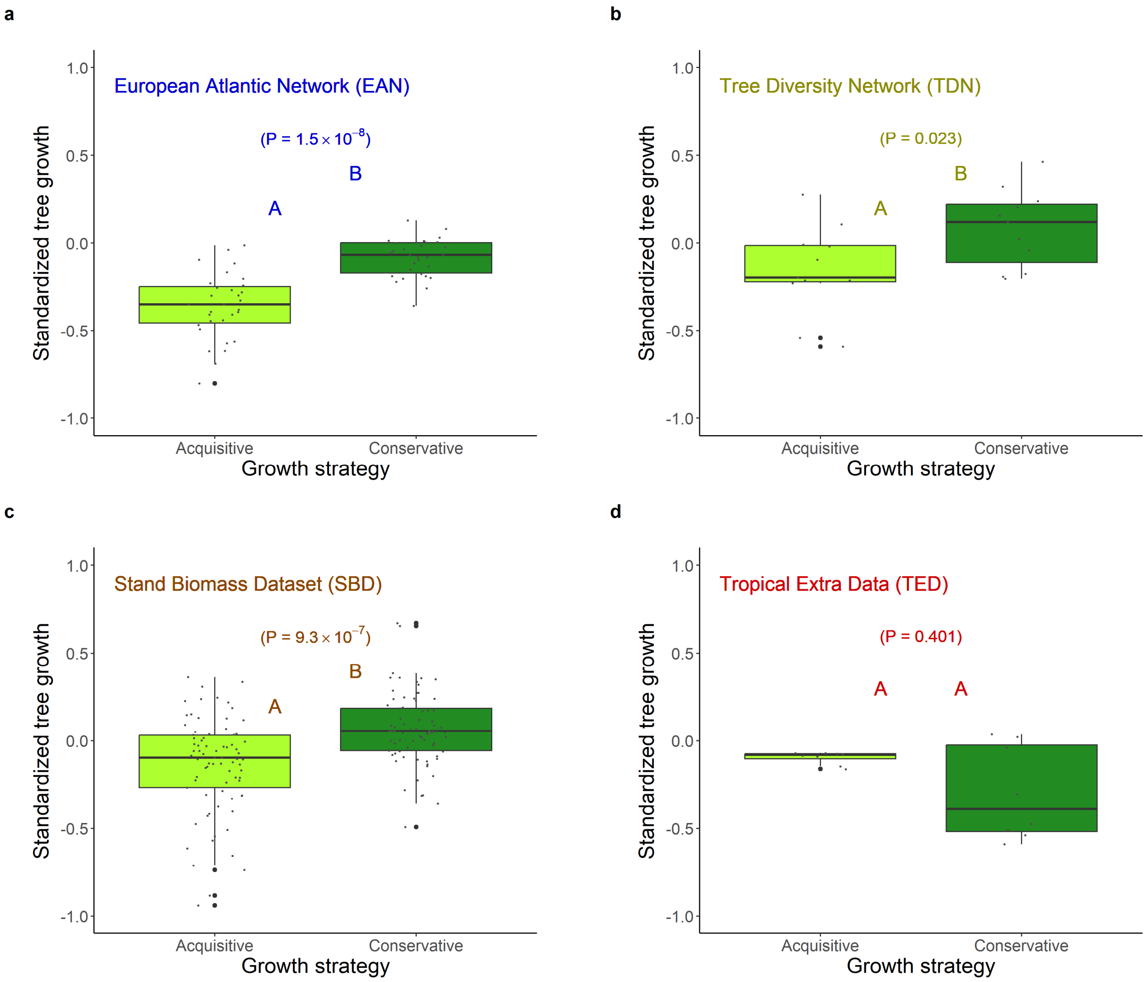
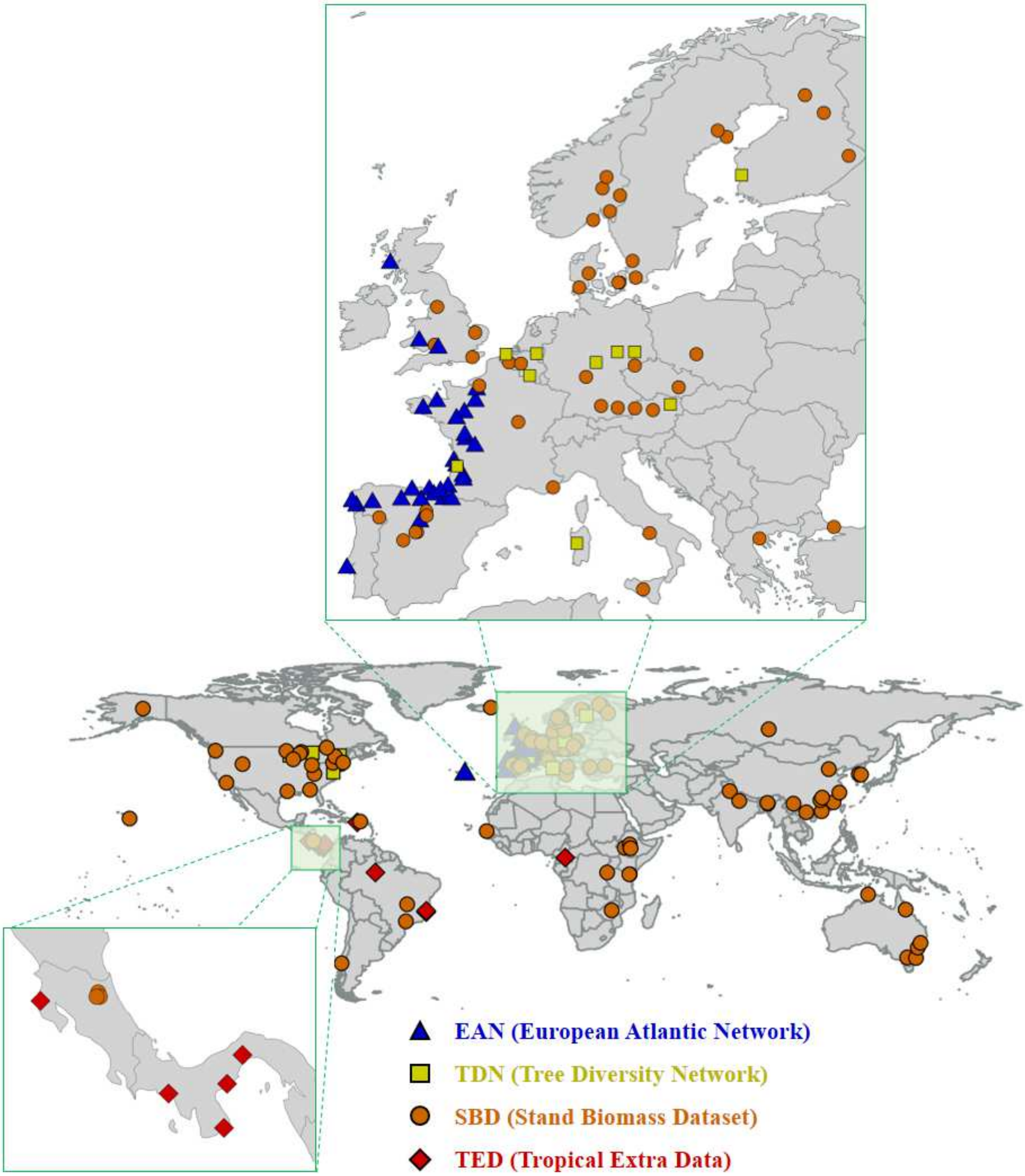


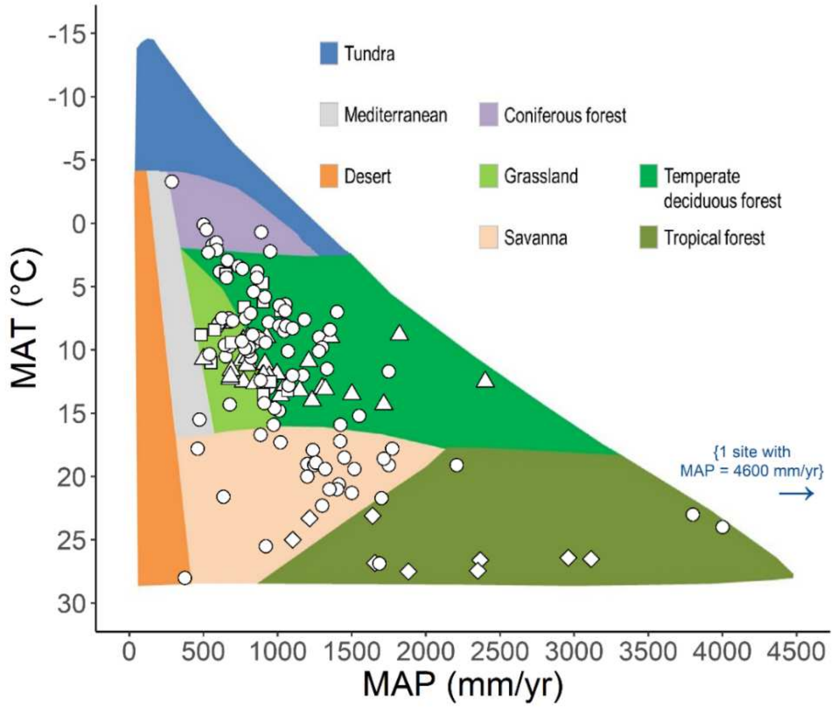
Supplementary Method 1 | Cross validation by dataset of data distribution about photosynthetic capacity (A_{max}). The data distribution presented in Figure 1 (see main text) are presented here by dataset to test results robustness. Relationships are presented altogether (**a**) and by dataset (**b-e**). Values were standardized to enable comparing sites (see Methods). Relationships were tested using the Pearson correlation method. *t*-values = -2.82, -2.37, -5.19 and +1.54 for the datasets EAN, TDN, SBD and TED, respectively. *df* = 617, 83, 259 and 107 for EAN, TDN, SBD and TED, respectively (n = 619, 85, 261 and 109).



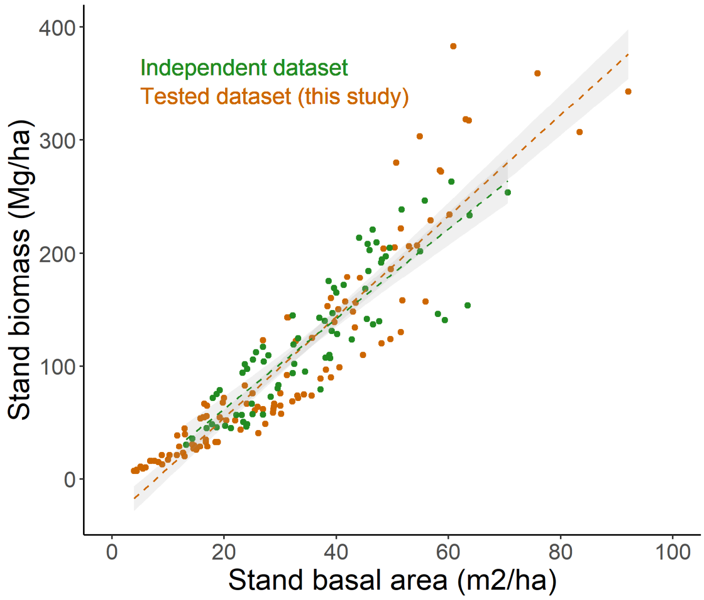
Supplementary Method 2 | Cross validation by dataset of data distribution about growth strategies. The data distribution presented in Figure 2 (see main text) are presented here by dataset to test results robustness. Growth strategies (*i.e.* acquisitive *versus* conservative) were defined a priori, based on theory and trait values (leaf A_{max}, SLA, and leaf N; see Methods). Growth values were standardized to enable comparing sites from all datasets (see Methods). Results are presented by independent dataset (see however structural limitation about TED in Methods). Sites that included only acquisitive species, or only conservative species, we not taken into account in data analyses. Because the number of species highly varied from site to site, values were averaged by site (*i.e.* one acquisitive average value + one conservative average value per site) to give the same statistical weight to all sites. N was 619, 77, 288 and 175 individual values, which were averaged into 64, 22, 154 and 16 final values for panels **a** to **d**. Boxplots represent the median, the first and third quartiles, and 1.5 × the inter-quartile range. Different letters indicate a significant difference between the two growth strategies. Differences were tested with the Kruskal & Wallis non-parametric test (two-sided). For panels **a** to **d**: χ^2 = 32.11, 5.13, 24.06, and 0.71; *df* = 1 in all cases. Results remained unchanged if individual values were used.



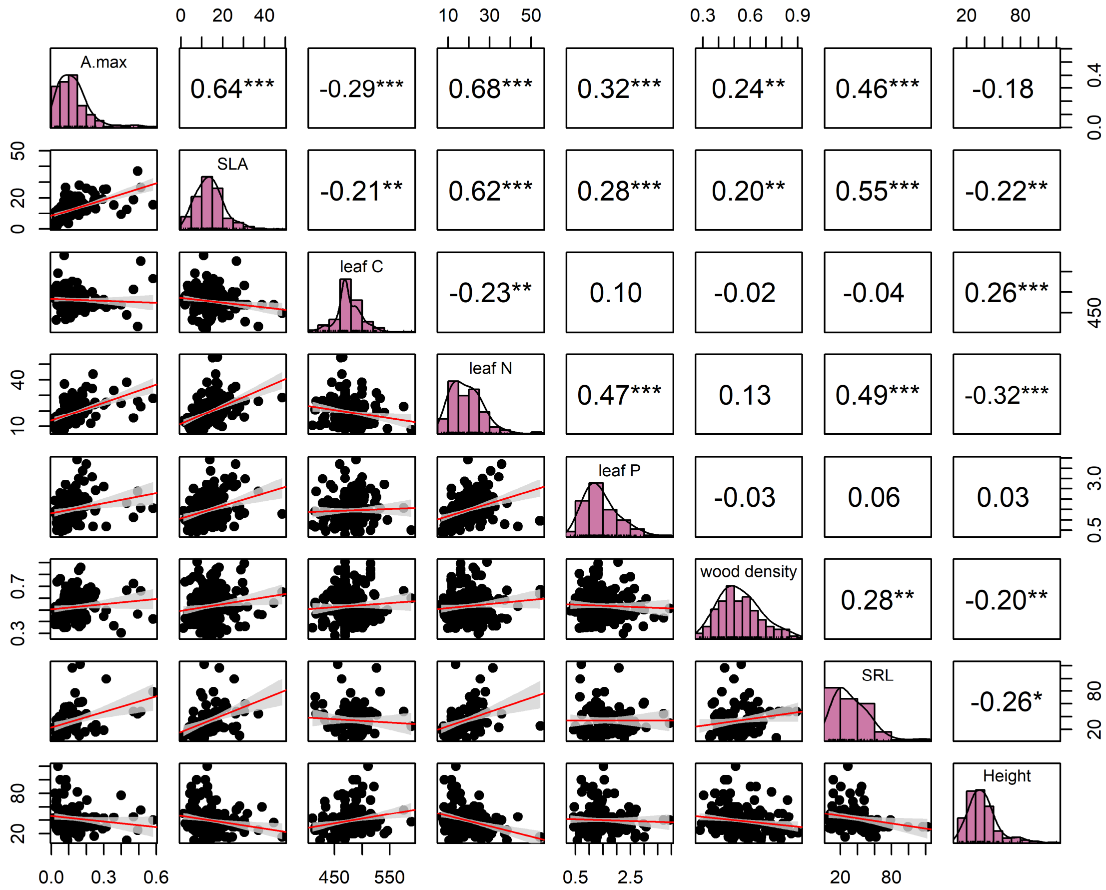
Supplementary Method 3 | Spatial distribution of sites. Triangle = European Atlantic Network (EAN); square = Tree Diversity Network (TDN); circle = Stand Biomass Dataset (SBD); diamond = Tropical Extra Data (TED). For the scope of readability, a zoom is proposed for Europe and another for Central America.



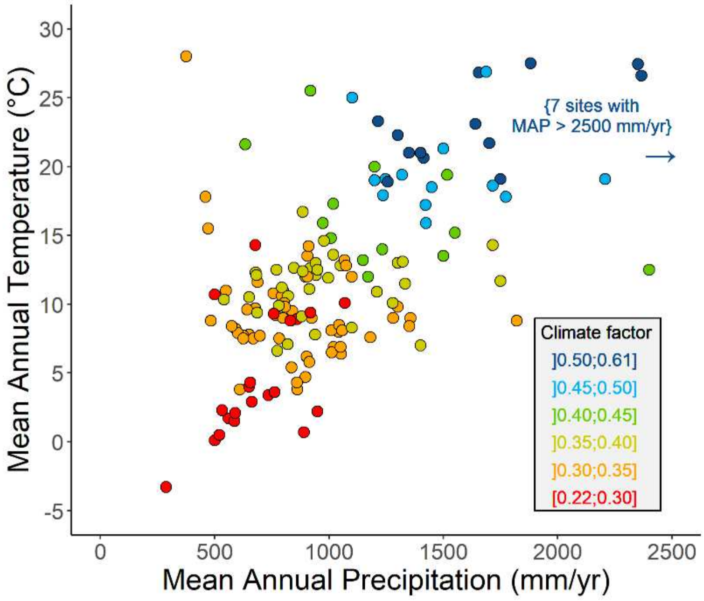
Supplementary Method 4 | Climatic distribution of sites. MAP and MAT = mean annual precipitation and temperature, respectively. Triangle = European Atlantic Network (EAN); square = Tree Diversity Network (TDN); circle = Stand Biomass Dataset (SBD); diamond = Tropical Extra Data (TED). Areas in solid colour represent the biomes in Whittaker biomes diagram (adapted from Forseth, I. (2010) Terrestrial Biomes. Nature Education Knowledge 3(10):11).



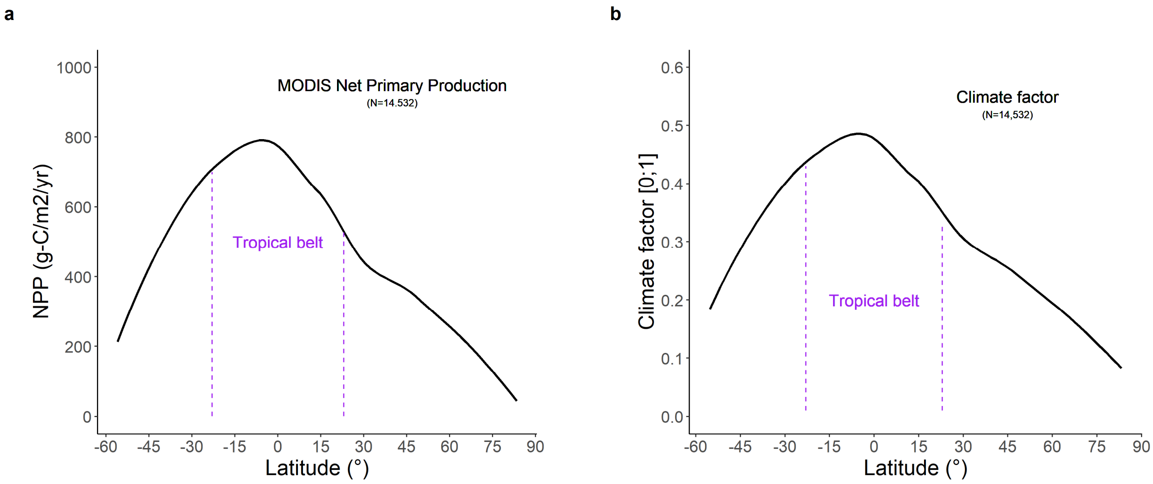
Supplementary Method 5 | Evaluation of the allometric relationships used to quantify stand aboveground biomass. In the Stand Biomass Dataset, some stand biomass values were estimated based on tree dimensions and stand density, using published allometric relationships (see Methods). The estimated values were evaluated by comparing with an independent dataset the relationship between stand biomass and stand basal area. Slope values were not significantly different (test based on covariance analysis: $P = 0.145$, $F = 2.14$, $df = 1$, n = 72 and 116 values [for the independent dataset and the tested dataset, respectively]).



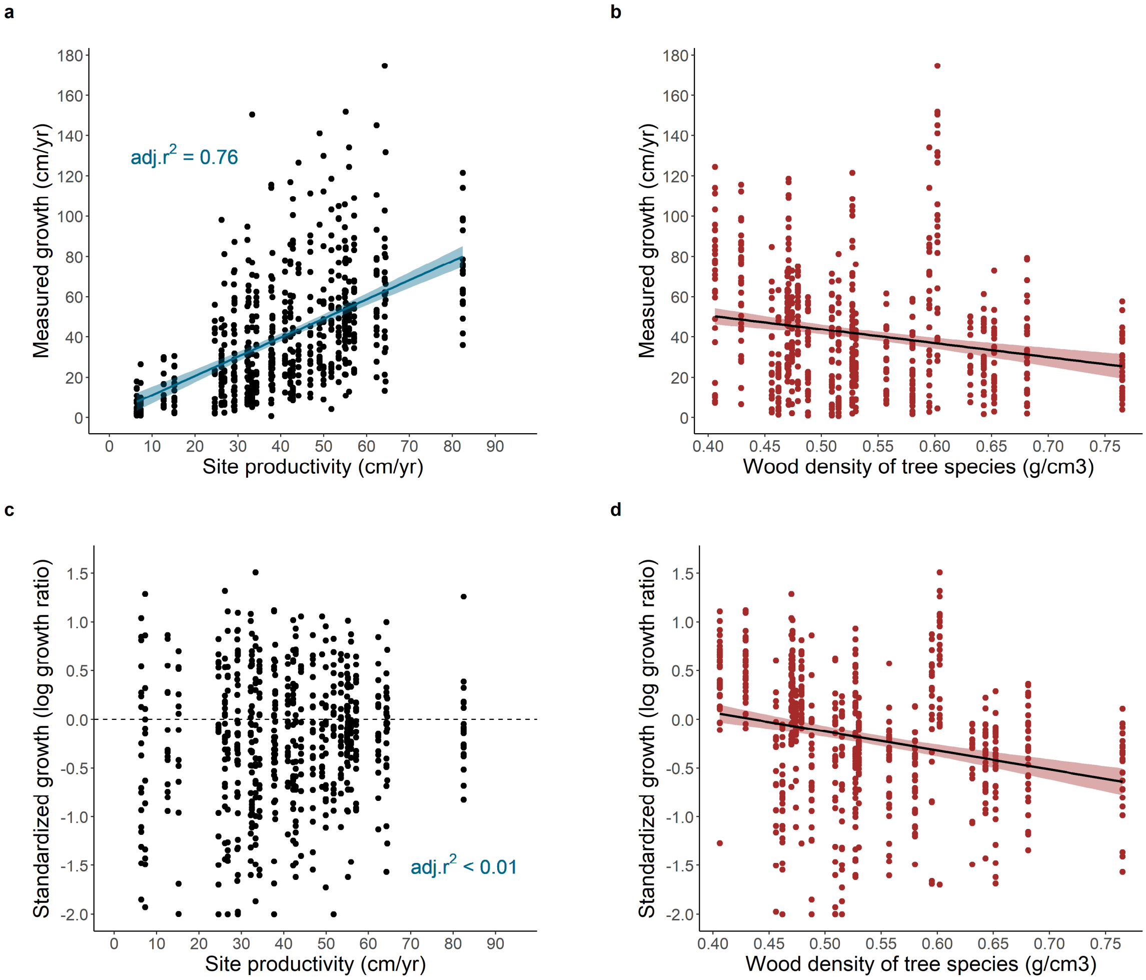
Supplementary Method 6 | Relationships among functional traits. To avoid pseudo-replications, we used only a subset of our data, containing one set of trait values per tree species (n = 223 species). The matrix shows the results of Spearman's rank correlation coefficients. The symbols *, **, and *** indicate correlations with *P* values respectively as follows: $P < 0.05$, $P < 0.01$, and $P < 0.001$. For the scope of readability, not all traits are presented, but the traits that are mainly studied. Units: leaf A_{max} (μmol g^{-1} s^{-1}), SLA (mm^2 mg^{-1}), leaf C (mg g^{-1}), leaf N (mg g^{-1}), leaf P (mg g^{-1}), wood density (g cm^{-3}), SRL (m g^{-1}), tree max height (m).



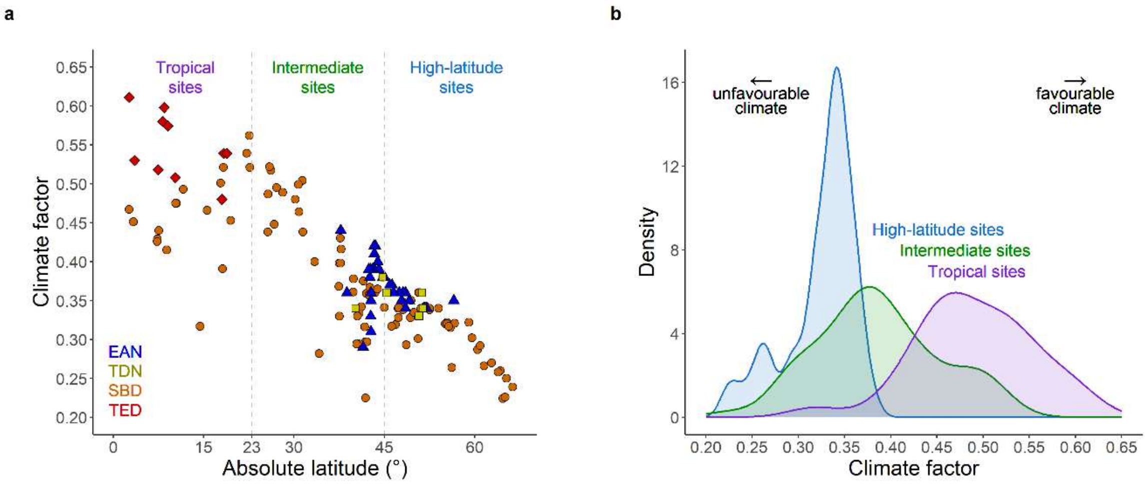
Supplementary Method 7 | Distribution of sites along gradients of temperature and precipitation. The different colours indicate classes of values of the "climate factor" ($f_{climate}$; see legend), which increases with concomitant increasing of water availability and temperature.



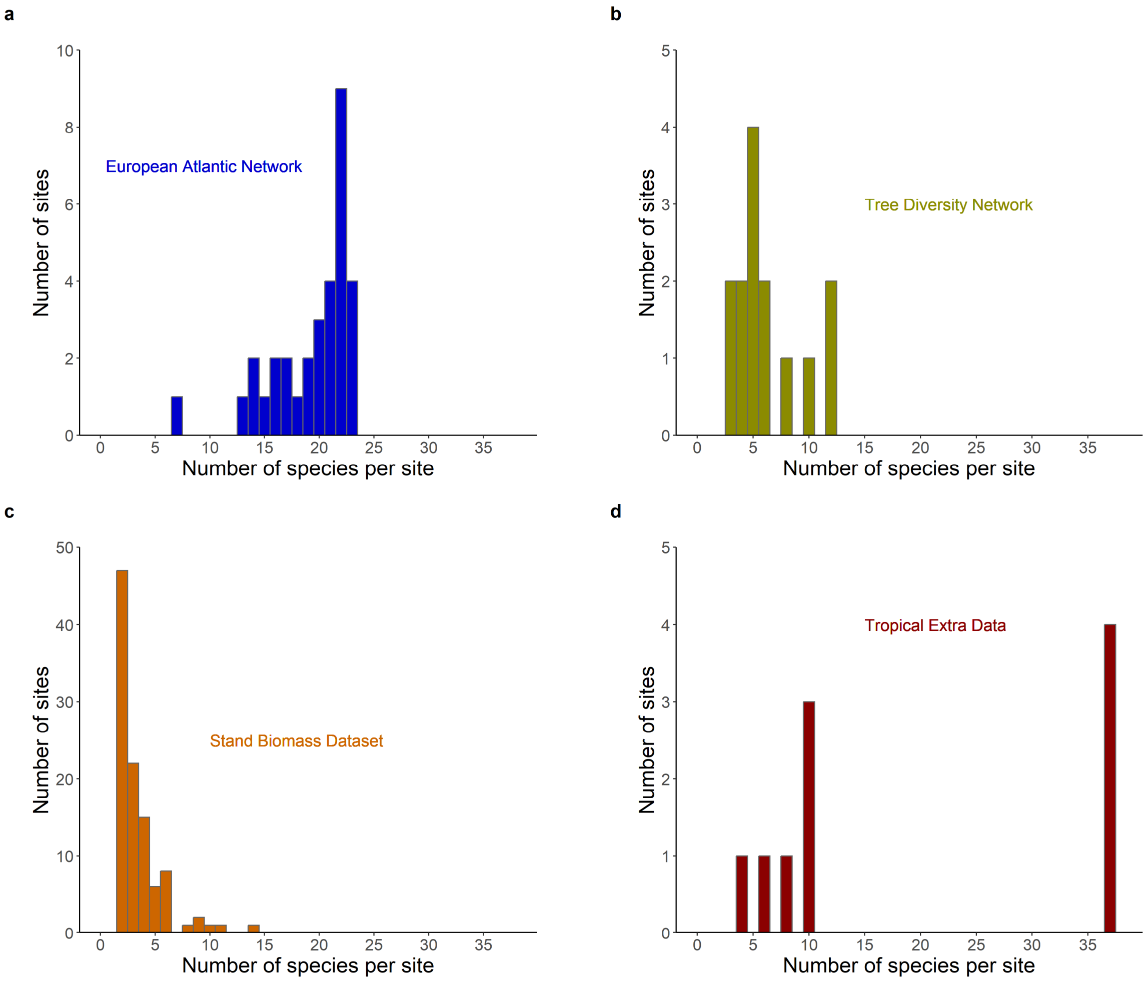
Supplementary Method 8 | Latitudinal distribution of ecosystem productivity and climatic conditions in forests. Data present the Net Primary Production (NPP; **a**) and the climatic conditions as summarised by the climate factor ($f_{climate}$, see Methods; **b**) along latitudes for forest ecosystems. NPP is the mean value of 10 years of the annual NPP of the 2010s decade (MODIS data; see Methods). Similarly, $f_{climate}$ values (which increase with concomitant increasing precipitation and temperature) were calculated based on global data (WorldClim). Both NPP and $f_{climate}$ were calculated for all terrestrial lands worldwide, but only the grid cells covered by at least 90% of forest were finally used to draw the graphs.



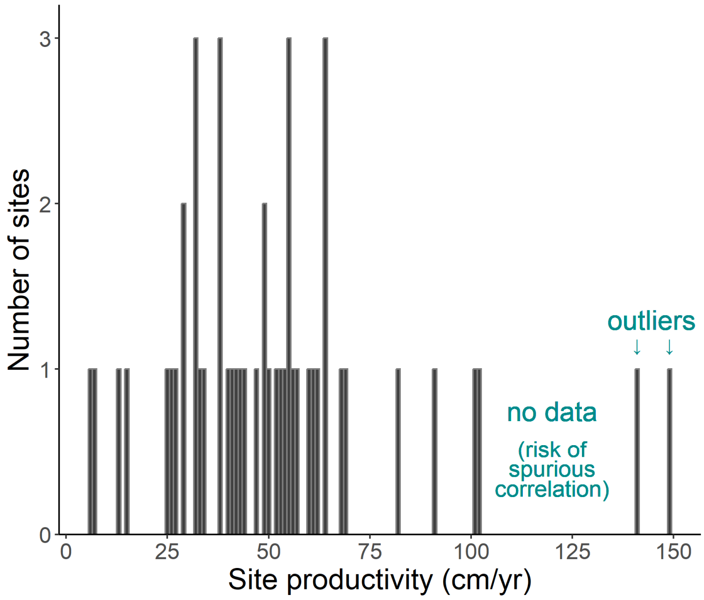
Supplementary Method 9 | Effect of standardization on data distribution. The panels show the consequence of standardization (see Methods) on data distribution, with wood density effect on growth in the EAN dataset as an example: relationship between tree species growth (in original values) with site productivity (**a**; $P = 2.2 \times 10^{-16}$), relationship between wood density and tree growth in original values (**b**), relationship between tree species growth (in standardized values; "*log growth ratio*") with site productivity (**c**; $P = 0.013$), and relationship between wood density and tree growth in standardized values (**d**). N = 619 in all panels.



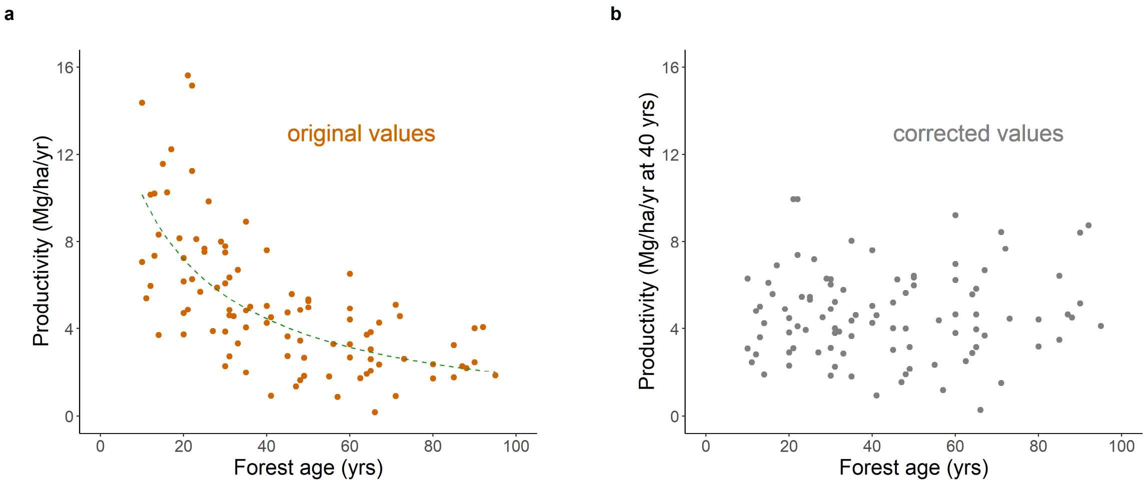
Supplementary Method 10 | Distribution of sites along latitudinal and climatic gradients. The four datasets are presented with different symbols and colours (see legend in panel **a**: EAN = European Atlantic Network; TDN = Tree Diversity Network; SBD = Stand Biomass Dataset; TED = Tropical Extra Data). Sites were grouped into three classes of latitude values, using absolute values (threshold values: 23° and 45°). The climate factor values (f_{climate}) were calculated based on local mean climate (see Methods). The distribution of the climate factor values is also presented by latitudinal class (**b**).



Supplementary Method 11 | Distribution of the number of tree species per site. The frequency y-axis represents the number of sites that include a given number of tree species (x-axis). For instance, in the Tree Diversity Network (**b**), two sites both include 12 different tree species.



Supplementary Method 12 | Distribution of site productivity in young forests. The site productivity of sites used to assess the growth rate of young adult trees is presented (*i.e.* EAN sites + TDN sites + part of TED sites). Based on the distribution, two sites (noted in the graph as "*outliers*") were not included in the analyses implying interactions with site productivity (cf. Figure 3c and Table 1) to avoid spurious correlations because their productivity value was substantially higher than for the other sites (see Methods).

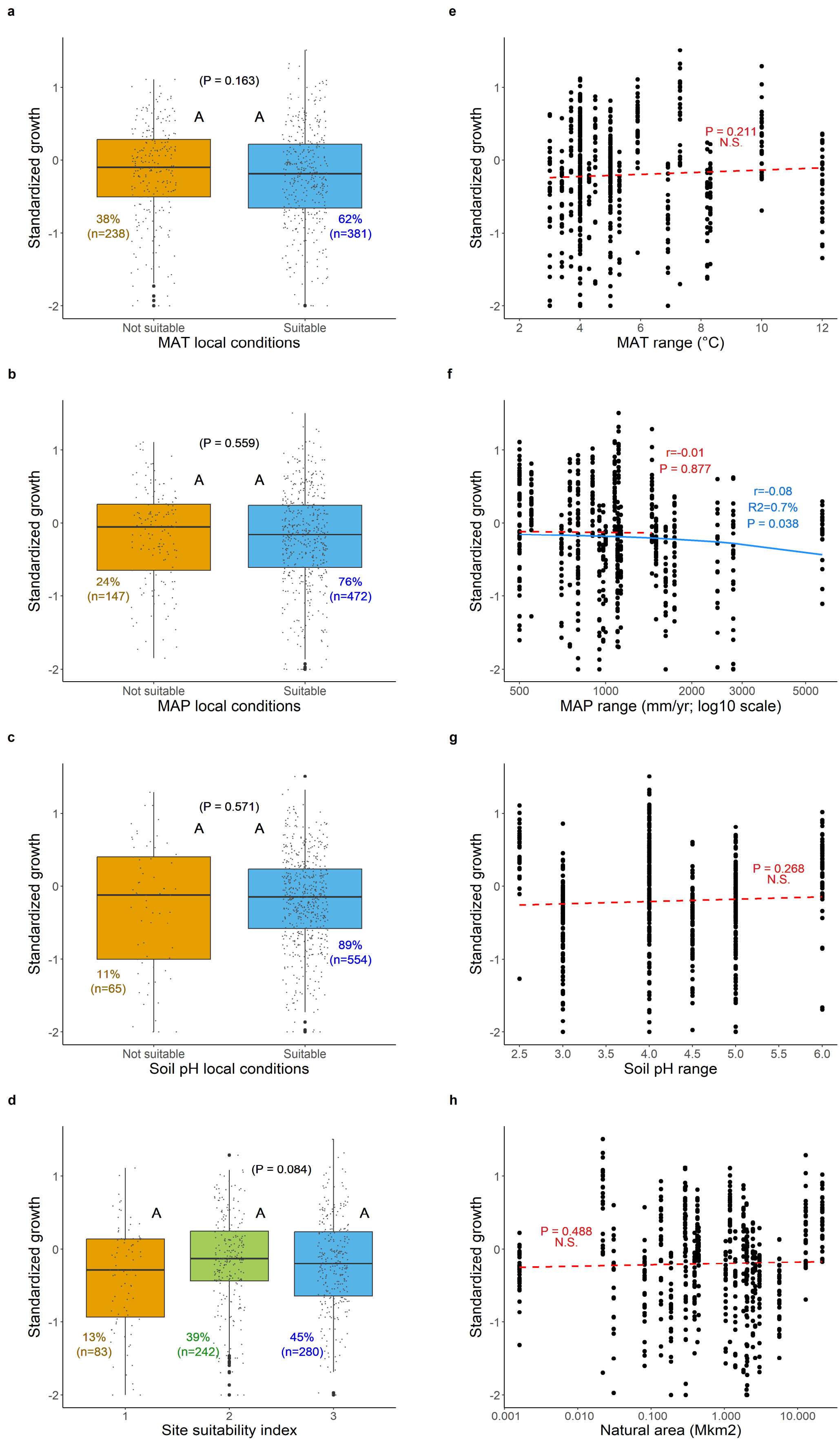


Supplementary Method 13 | Effect of forest age on site productivity. The relationship between forest age and site productivity in the Stand Biomass Dataset (SBD) is presented with original values (**a**). The fitted regression in panel **a** was:

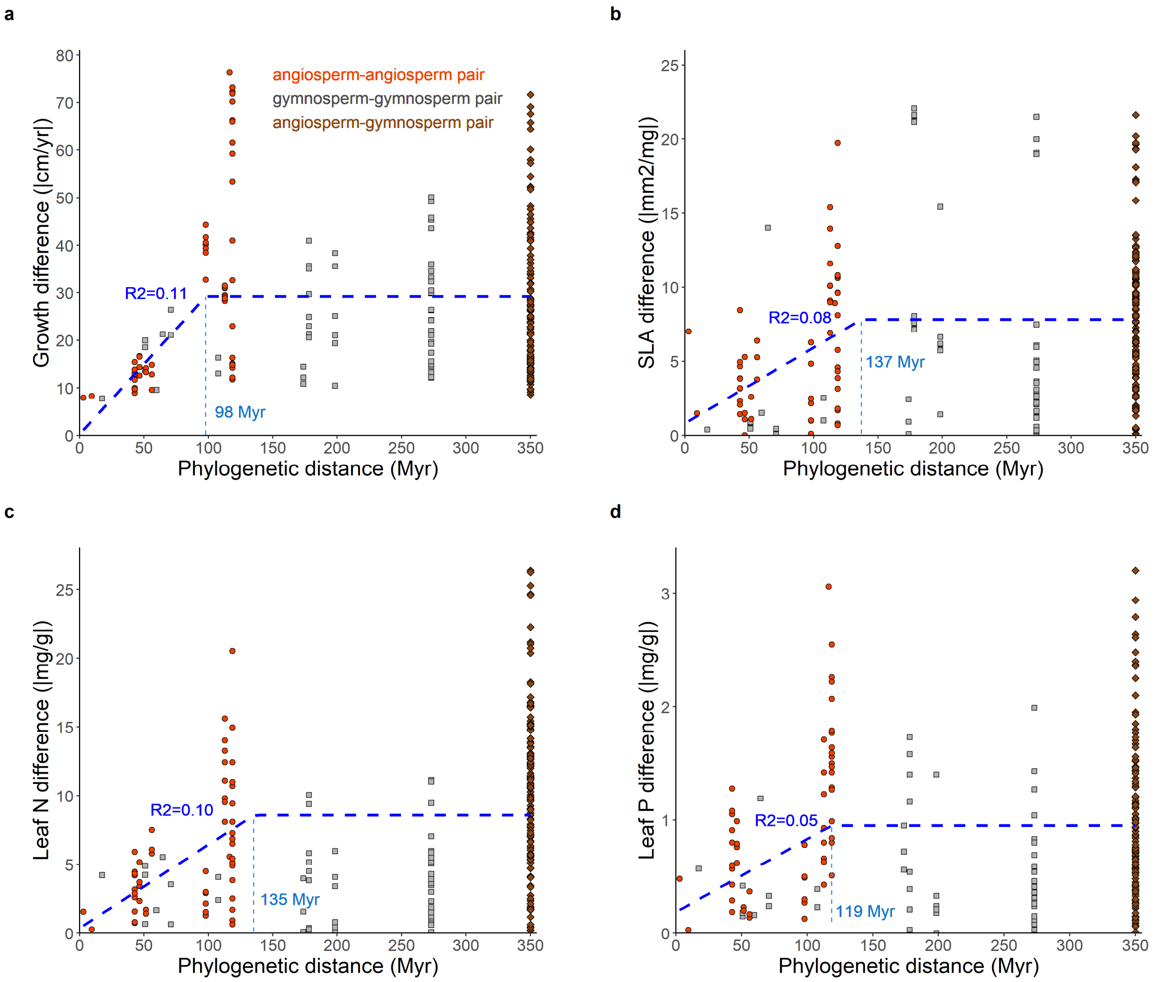
$$Prod. = \frac{((age \times \alpha) + \beta)}{(age + \gamma)} = \frac{((age \times (-0.4877)) + 268.2)}{(age + 15.9519)}$$

$P = 2.2 \times 10^{-16}$, $df = 340$, n = 342, achieved convergence tolerance = 3.75×10^{-6}

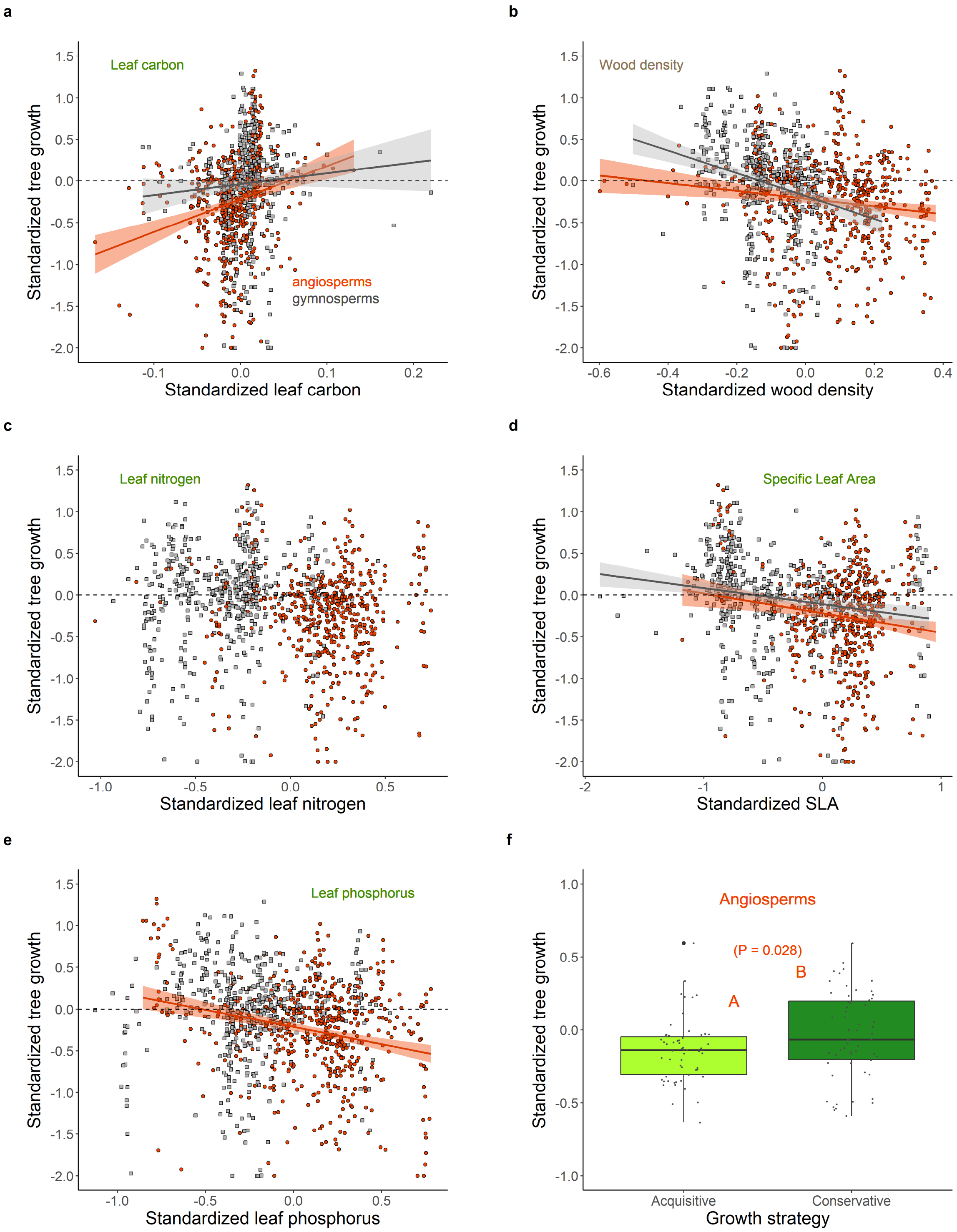
Assuming that the reliability of the original values of productivity increased with an increasing number of stands, the regression was fitted while weighing the productivity by the number of stands. Two forests (150 and 225 years-old) that were much older than the other sites (10-95 years-old) were not considered to avoid biasing the regression fitting. To avoid confounding effects, site productivity was corrected by estimating its value at 40 years-old (**b**; see Methods).



Supplementary Method 14 | Effect of ecological niches of tree species on tree growth. Each species-site combination (EAN data) was evaluated in terms of site suitability by checking if the site conditions (MAT, MAP, soil pH) were within or outside the range of values reported for the species in natural conditions (**a**, **b**, **c**). A site suitability index (**d**) was calculated as the sum of the MAT+MAP+pH criteria that were met (*i.e.* from 0 for no criterion met, to 3 for all criteria met; not enough data for index = 0). Tree growth was also presented as a function of the ecological range of the tree species (as defined as {MAT_{max} - MAT_{min}}, and so on for MAP, soil pH; **e**, **f**, **g**), and as a function of the surface area of the natural niche of the species (**h**). To enable the comparison of growth data among common gardens, growth values were standardized (see Methods). Data were statistically tested with the Kruskal & Wallis test (two-sided; different letters indicate a significant difference between classes; **a**–**d**) and linear models (**e**–**h**). N = 619 in all panels.



Supplementary Method 15 | Effect of the phylogenetic distance among species on tree growth and functional traits. In each EAN site, for all possible pairs of tree species (n = 484 pairs, averaged over all sites), we calculated the growth absolute difference (**a**; *P* values for the model parameters: slope = 0.025, break = 6.1×10^{-5}, plateau = 0.965) and the trait value absolute difference for Specific Leaf Area (SLA; **b**; *P* values for the model parameters: slope = 8.3×10^{-5}, break = 8.7×10^{-15}, plateau = 0.485), leaf nitrogen (**c**; *P* values for the model parameters: slope = 1.4×10^{-5}, break = 1.0×10^{-16}, plateau = 0.758) and leaf phosphorus (**d**; *P* values for the model parameters: slope = 0.003, break = 6.5×10^{-9}, plateau = 0.245). Other functional traits (*e.g.* leaf A_{max}, wood density, SRL) showed no phylogenetic effect. These absolute difference values were plotted as a function of the phylogenetic distance (in Myr; see Methods) between the two species composing the pair. Regressions were fitted using a linear-plateau function.



Supplementary Method 16 | Growth-trait relationships in angiosperm tree species and gymnosperm tree species. Tree growth was plotted as a function of trait values: leaf carbon (**a**; n = 1052; *P* values: Angiosperms (A) = 5.1×10^{-8}, Gymnosperms (G) = 0.026, under unfavourable climate), wood density (**b**; n = 1054; *P* values: A = 0.002, G = 3.5×10^{-9}), leaf nitrogen (**c**; n = 1039), Specific Leaf Area (SLA; **d**; n = 1037; *P* values: A = 7.8×10^{-4}, G = 1.0×10^{-4}), and leaf phosphorus (**e**; n = 1032; *P* values: A = 1.0×10^{-8}, G = 5.2×10^{-5}). Significant growth-trait relationships were shown with the fitted linear regressions (red = angiosperms; grey = gymnosperms). Tree growth was quantified by growth strategy (**f**; not enough data for gymnosperms). Growth strategy (*i.e.* acquisitive or conservative) was defined a priori, based on theory and trait values (see Methods). Sites that included only acquisitive species, or only conservative species, were not taken into account. To enable the comparison of growth data among common gardens with different tree species and site productivity, growth values were standardized (see Methods). Boxplots represent the median, the first and third quartiles, and 1.5 × the inter-quartile range. Different letters indicate a significant difference between acquisitive species and conservative species. To avoid pseudo-replication within a given site (panel **f**), values were averaged by site (*i.e.* one acquisitive average value + one conservative average value per site) to give the same statistical weight to all sites (256 individual values averaged into 118 final values). Differences were tested with the Kruskal & Wallis test (two-sided): $\chi^2 = 4.83$, *df* = 1. Results remained unchanged if individual values were used.

Supplementary Table 1 | Description of the four datasets of common gardens. For convenience, common gardens are named "*sites*". Latitude values are described as absolute values, implying that negative values (for the Southern hemisphere) were transformed to positive values. Spatial distribution of the sites is presented in Supplementary Method 3. The $f_{climate}$ index is a standardized value [0;1] that increases with concomitant climate wetness and warmth, indicating favourable climatic conditions for biological activity (see Methods). Values are sum values (for sites, tree species, stands), mean values ± 1 standard error (for tree species per site), or mean values with range in square brackets (other site descriptors). The symbol "¤" indicates that three common gardens (which were close to each other) were considered as non-independent and were consequently merged as a single site. Similarly, the symbols "#" and "§" indicate that a site was split into respectively three and two sites because of their study design. The presented numbers of sites are the final values (*i.e.* after the merge or the splits described above).

Descriptors	European Atlantic Network (EAN)	TreeDivNet (TDN)	Stand Biomass Dataset (SBD)	Tropical Extra Dataset (TED)
Sites (n)	32¤	14	104#	10§
Tree species (n)	23	41	161	71
Tree species (n/site)	19.3 ± 0.7	6.3 ± 0.8	3.5 ± 0.2	19.6 ± 4.8
Stands (n)	619	88	359	196
Tree age (years)	6 [3–10]	13 [8–24]	46 [10–225]	7 [2–22]
Latitude (°)	44.9 [37.7–56.5]	48.4 [38.5–61.7]	38.9 [2.6–66.3]	10.5 [2.6–18.8]
Elevation (m)	308 [30–1195]	218 [15–640]	556 [10–2642]	132 [34–575]
MAT (°C)	11.7 [8.8–14.3]	8.7 [4.0–13.5]	12.0 [-3.3–28.0]	25.6 [23.1–27.5]
MAP (mm yr^{-1})	1089 [500–2400]	780 [484–1068]	1149 [287–4600]	1949 [1102–3114]
$f_{climate}$ index [0;1]	0.37 [0.29–0.44]	0.34 [0.28–0.38]	0.37 [0.22–0.56]	0.54 [0.48–0.61]
Soil clay (mg g^{-1})	197 [0–583]	125 [20–400]	196 [1–805]	425 [n.a.]
Soil sand (mg g^{-1})	457 [93–1000]	628 [50–937]	528 [40–966]	300 [n.a.]
Soil pH value	5.1 [3.7–7.9]	5.7 [4.0–8.5]	5.1 [3.0–8.3]	5.4 [n.a.]
Soil $C_{organic}$ (mg g^{-1})	27.9 [9.4–117]	36.2 [1.9–129]	39.6 [0.7–147]	21.4 [11–30]
Soil C:N ratio	14.4 [7.1–30.0]	16.8 [9.4–29.1]	18.1 [6.6–36.5]	12.9 [11–15]

Supplementary Table 2 | Distribution of trait values in the four datasets of common gardens. Leaf A_{max}: leaf photosynthetic maximum capacity; leaf C, N, P, and Ca: leaf content of carbon, nitrogen, phosphorus and calcium; SLA and SRL: specific leaf area and specific root length; Values are mean values, with range between first quartile and third quartile in square brackets. Seed mass values were log-transformed to avoid data skewness. Data with insufficient values were not presented (n.p.).

Traits	European Atlantic Network (EAN)	TreeDivNet (TDN)	Stand Biomass Dataset (SBD)	Tropical Extra Dataset (TED)
Leaf A_{max} (μmol g^{-1} s^{-1})	0.098 [0.050–0.142] (n = 619)	0.133 [0.051–0.162] (n = 85)	0.113 [0.043–0.146] (n = 285)	0.183 [0.138–0.207] (n = 110)
SLA (mm^2 mg^{-1})	11.6 [5.4–14.6] (n = 619)	14.9 [9.9–19.4] (n = 88)	12.3 [7.0–16.2] (n = 342)	15.8 [12.1–18.6] (n = 177)
Leaf C (mg g^{-1})	493 [486–500] (n = 619)	481 [469–495] (n = 87)	486 [469–499] (n = 333)	461 [456–473] (n = 30)
Leaf N (mg g^{-1})	17.1 [12.2–22.0] (n = 619)	20.2 [15.4–24.6] (n = 88)	17.8 [12.7–22.9] (n = 344)	20.5 [15.2–24.5] (n = 118)
Leaf P (mg g^{-1})	1.86 [1.31–2.42] (n = 619)	1.94 [1.40–2.45] (n = 88)	1.52 [1.13–1.74] (n = 336)	1.38 [0.89–1.73] (n = 102)
Leaf Ca (mg g^{-1})	7.5 [6.1–9.2] (n = 619)	8.8 [6.3–10.0] (n = 86)	8.1 [5.9–9.6] (n = 313)	9.2 [6.6–9.9] (n = 34)
Wood density (mg cm^{-3})	540 [471–595] (n = 619)	527 [463–597] (n = 88)	533 [458–627] (n = 359)	508 [416–595] (n = 184)
SRL (m g^{-1})	21.8 [12.4–30.8] (n = 619)	28.7 [17.4–35.9] (n = 79)	30.3 [18.9–40.1] (n = 264)	n.p. (n = 11)
Tree max height (m)	52 [40–56] (n = 619)	46 [34–50] (n = 88)	48 [35–54] (n = 349)	34 [28–40] (n = 115)
Seed mass (log{mg})	4.0 [2.0–5.5] (n = 619)	4.0 [2.1–5.5] (n = 88)	3.2 [1.9–4.4] (n = 346)	4.6 [2.9–6.3] (n = 152)

Supplementary Table 3 | Example of data standardization. One site of the SBD dataset is presented to illustrate how data were standardized (see eq. 2 in Methods). In Table 3a, original values of stand growth, specific leaf area (SLA) and leaf maximum photosynthetic capacity (A_{max}) are presented for the four tree species of the site. In Table 3b, the standardized values (named "standardized") for exploring the {growth-wood density} relationship are presented based on site mean values (named "mean") and original values. In Table 3c, the same standardization was applied for the evaluation of the {growth-A_{max}} relationship. It should be noted that, because of one non-available value (NA) for leaf A_{max}, only three tree species were taken into account for the latter case, resulting in different standardized growth values between the standardization dedicated to wood density (Table 3b) and the case dedicated to leaf A_{max} (Table 3c). Units: growth (t ha^{-1} yr^{-1}); wood density (g cm^{-3}); leaf A_{max} (µmol g^{-1} s^{-1}).

Table 3a | Original values. (see Table 2 for units).

Dataset	Site id.	Tree species	Growth	Wood density	A_{max}
SBD	28	*Cinnamomum camphora*	5.98	0.487	0.057
SBD	28	*Liquidambar acalycina*	6.43	0.624	NA
SBD	28	*Pinus elliottii*	3.34	0.600	0.074
SBD	28	*Pinus massoniana*	7.01	0.428	0.048

Table 3b | Standardized values for exploring the relationship between wood density and tree growth. Site mean values are calculated based on the four tree species.

Dataset	Site id.	Tree species	Growth (mean)	Growth (standardized)	Wood density (mean)	Wood density (standardized)
SBD	28	*Cinnamomum camphora*	5.69	+0.050	0.535	-0.094
SBD	28	*Liquidambar acalycina*	5.69	+0.122	0.535	+0.154
SBD	28	*Pinus elliottii*	5.69	-0.533	0.535	+0.115
SBD	28	*Pinus massoniana*	5.69	+0.209	0.535	-0.223

Table 3c | Standardized values for exploring the relationship between A_{max} and tree growth. Site mean values are calculated based on the three tree species that have no missing value for growth and A_{max}.

Dataset	Site id.	Tree species	Growth (mean)	Growth (standardized)	A_{max} (mean)	A_{max} (standardized)
SBD	28	*Cinnamomum camphora*	5.44	+0.095	0.060	-0.051
SBD	28	*Liquidambar acalycina*	NA	NA	NA	NA
SBD	28	*Pinus elliottii*	5.44	-0.488	0.060	+0.210
SBD	28	*Pinus massoniana*	5.44	+0.254	0.060	-0.223

Supplementary Table 4 | Sensitivity analyses of the threshold values defining the species growth strategy. Rows with bold type present results of data analyses with the threshold values retained in the study. Other rows present results with modified threshold values (± 1.0 MCR [max change range], which is calculated based on the statistical distribution of the predictor; cf. Methods). To avoid pseudo-replication within a given site, values were averaged by site (i.e. one acquisitive average value + one conservative average value per site) to give the same statistical weight to all sites. The n values refer to the number of sites but the number of stands (before averaging by site) is indicated between brackets. The statistics results are presented using the average values, but results remained fairly unchanged if stand values were used.

Table 4a | Sensitivity to variation of trait values (A_{max}, SLA and leaf N).
Statistical analysis of the linear regressions and slope difference (cf. Figure 3c).

Threshold values	Acquisitive species (trait value ≥ threshold value) n	r	slope	*P*	*t*	Slope difference *P*	*F*	Conservative species (trait value < threshold value) n	r	slope	*P*	*t*
-1.0 MCR	44 (632)	+0.58	+0.005	<0.001	4.61	<0.001	14.1	44 (144)	-0.31	-0.005	0.084	-2.12
-0.5 MCR	46 (383)	+0.60	+0.007	<0.001	5.02	<0.001	16.8	46 (393)	-0.10	-0.001	0.520	-0.65
Initial	**46 (373)**	**+0.62**	**+0.007**	**<0.001**	**5.22**	**<0.001**	**16.2**	**46 (403)**	**-0.03**	**-0.000**	**0.830**	**-0.22**
+0.5 MCR	46 (326)	+0.54	+0.006	<0.001	4.24	0.093	2.8	46 (450)	+0.19	+0.001	0.216	+1.25
+1.0 MCR	46 (262)	+0.44	+0.002	0.003	3.20	0.200	1.7	46 (514)	+0.38	+0.003	0.009	+2.74

Table 4b | Sensitivity to variation of trait values (A_{max}, SLA and leaf N).
Statistical analysis testing difference of growth rate between species classes (cf. Figure 4a).

Threshold values	Acquisitive species n	Growth rate difference *P*	χ^2	Conservative species n (stands)
-1.0 MCR	112 (909)	<0.001	33.0	112 (250)
-0.5 MCR	126 (618)	<0.001	37.0	126 (541)
Initial	**128** (584)	**<0.001**	**39.0**	**128** (575)
+0.5 MCR	119 (500)	0.006	8.0	119 (659)
+1.0 MCR	117 (412)	<0.001	22.0	117 (747)

Supplementary Note 1 | List of species used to characterize seedling growth under optimal conditions

Data sources (reference numbers are used in Extended Data Fig. 1):

ref.0 Cornelissen, J. H. C., Diez, P. C., & Hunt, R. (1996). Seedling growth, allocation and leaf attributes in a wide range of woody plant species and types. Journal of Ecology 84(5), 755-765.

ref.1 Kramer-Walter, K. R., Bellingham, P. J., Millar, T. R., Smissen, R. D., Richardson, S. J., & Laughlin, D. C. (2016). Root traits are multidimensional: specific root length is independent from root tissue density and the plant economic spectrum. Journal of Ecology 104(5), 1299-1310.

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ref.4 Poorter, H., & Remkes, C. (1990). Leaf area ratio and net assimilation rate of 24 wild species differing in relative growth rate. Oecologia 83(4), 553-559.

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ref.6 Reich, P. B., Tjoelker, M. G., Walters, M. B., Vanderklein, D. W., & Buschena, C. (1998). Close association of RGR, leaf and root morphology, seed mass and shade tolerance in seedlings of nine boreal tree species grown in high and low light. Functional Ecology 12(3), 327-338.

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	Species	Plant type	Biome
1	*Acacia binervata*	Shrub	Temperate
2	*Acacia burkitii*	Tree	Mediterranean-Dry
3	*Acacia cognata*	Tree	Temperate
4	*Acacia jonesii*	Shrub	Temperate
5	*Acer platanoides*	Tree	Temperate
6	*Acer pseudoplatanus*	Tree	Temperate
7	*Ackama rosifolia*	Tree	Temperate
8	*Aesculus hippocastanum*	Tree	Temperate
9	*Afzelia bipindensis*	Tree	Tropical
10	*Agathis australis*	Tree	Temperate
11	*Albizia niopoides*	Tree	Tropical
12	*Alectryon excelsus*	Tree	Temperate
13	*Alnus glutinosa*	Tree	Temperate
14	*Anadenanthera colubrina*	Tree	Tropical
15	*Angophora floribunda*	Tree	Temperate
16	*Anthriscus sylvestris*	Non-woody	Temperate
17	*Antrocaryon klaineanum*	Tree	Tropical
18	*Aristotelia serrata*	Tree	Temperate
19	*Autranella congolensis*	Tree	Tropical
20	*Baillonella toxisperma*	Tree	Tropical
21	*Banksia ericifolia*	Shrub	Temperate
22	*Banksia oblongifolia*	Shrub	Temperate
23	*Beilschmiedia tarairi*	Tree	Temperate
24	*Beilschmiedia tawa*	Tree	Temperate
25	*Berberis vulgaris*	Shrub	Temperate
26	*Betula alleghenienisis*	Tree	Boreal
27	*Betula papyrifera*	Tree	Boreal
28	*Betula pendula*	Tree	Temperate
29	*Bischofia javanica*	Tree	Tropical
30	*Bossiaea walkeri*	Shrub	Mediterranean-Dry
31	*Brachypodium pinnatum*	Non-woody	Temperate
32	*Briza media*	Non-woody	Temperate
33	*Buddleja davidii*	Shrub	Temperate
34	*Buxus sempervirens*	Tree	Temperate
35	*Callistemon brachyandrus*	Shrub	Temperate
36	*Calluna vulgaris*	Shrub	Temperate
37	*Cariniana ianerensis*	Tree	Tropical
38	*Carpodetus serratus*	Tree	Temperate
39	*Castanea sativa*	Tree	Temperate
40	*Cedrela fissilis*	Tree	Tropical
41	*Chorisia speciosa*	Tree	Tropical
42	*Coprosma linariifolia*	Tree	Temperate
43	*Cornus sanguinea*	Tree	Temperate
44	*Corynephorus canescens*	Non-woody	Mediterranean-Dry
45	*Corynocarpus laevigatus*	Tree	Temperate
46	*Crataegus monogyna*	Tree	Temperate
47	*Cyathea dealbata*	Tree	Temperate
48	*Cyathea medullaris*	Tree	Temperate
49	*Cyathea smithii*	Tree	Temperate
50	*Cynosurus cristatus*	Non-woody	Temperate
51	*Cytisus scoparius*	Shrub	Temperate
52	*Dacrycarpus dacrydioides*	Tree	Temperate
53	*Dacrydium cupressinum*	Tree	Temperate

54	*Dactylis glomerata*	Non-woody	Temperate
55	*Desbordesia glaucescens*	Tree	Tropical
56	*Deschampsia flexuosa*	Non-woody	Temperate
57	*Dicksonia squarrosa*	Tree	Temperate
58	*Diospyros crassiflora*	Tree	Tropical
59	*Dodonaea peduncularis*	Shrub	Mediterranean-Dry
60	*Dracophyllum longifolium*	Tree	Temperate
61	*Dysoxylum spectabile*	Tree	Temperate
62	*Elaeocarpus dentatus*	Tree	Temperate
63	*Elaeocarpus hookerianus*	Tree	Temperate
64	*Elaeocarpus photiniaefolius*	Tree	Tropical
65	*Entandrophragma candollei*	Tree	Tropical
66	*Entandrophragma cylindricum*	Tree	Tropical
67	*Entandrophragma utile*	Tree	Tropical
68	*Enterolobium contortisiliquum*	Tree	Tropical
69	*Erica cinera*	Shrub	Temperate
70	*Erythrina crista-galli*	Tree	Tropical
71	*Erythrophleum suaveolens*	Tree	Tropical
72	*Eucalyptus amplifolia*	Tree	Temperate
73	*Eucalyptus apiculata*	Tree	Temperate
74	*Eucalyptus burgessiana*	Tree	Temperate
75	*Eucalyptus grandis*	Tree	Temperate
76	*Eucalyptus largiflorens*	Tree	Mediterranean-Dry
77	*Eucalyptus saligna*	Tree	Temperate
78	*Eucalyptus sieberi*	Tree	Temperate
79	*Fagus sylvatica*	Tree	Temperate
80	*Festuca ovina*	Non-woody	Temperate
81	*Frangula alnus*	Shrub	Mediterranean-Dry
82	*Fraxinus excelsior*	Tree	Temperate
83	*Fraxinus ornus*	Tree	Mediterranean-Dry
84	*Fuchsia excorticata*	Tree	Temperate
85	*Fuscospora cliffortioides*	Tree	Temperate
86	*Fuscospora fusca*	Tree	Temperate
87	*Fuscospora solandri*	Tree	Temperate
88	*Fuscospora truncata*	Tree	Temperate
89	*Galinsoga parviflora*	Non-woody	Temperate
90	*Geum urbanum*	Non-woody	Temperate
91	*Gompholobium latifolium*	Shrub	Temperate
92	*Grevillea striata*	Tree	Mediterranean-Dry
93	*Griselinia littoralis*	Tree	Temperate
94	*Hakea dactyloides*	Shrub	Temperate
95	*Hakea gibbosa*	Shrub	Temperate
96	*Halocarpus biformis*	Tree	Temperate
97	*Halocarpus kirkii*	Tree	Temperate
98	*Hedycarya arborea*	Tree	Temperate
99	*Hoheria lyallii*	Tree	Temperate
100	*Hoheria sexstylosa*	Tree	Temperate
101	*Holcus lanatus*	Non-woody	Temperate
102	*Hovea acutifolia*	Shrub	Temperate
103	*Hymenaea courbaril*	Tree	Tropical
104	*Hypericum perforatum*	Non-woody	Temperate
105	*Ilex aquifolium*	Tree	Temperate
106	*Knightia excelsa*	Tree	Temperate
107	*Kunzea ericoides*	Tree	Temperate
108	*Laburnum anagyroides*	Tree	Temperate
109	*Larix decidua*	Tree	Temperate
110	*Larix laricina*	Tree	Boreal
111	*Laurelia novae-zelandiae*	Tree	Temperate
112	*Leptospermum laevigatum*	Shrub	Temperate
113	*Leptospermum scoparium*	Tree	Temperate
114	*Litsea calicaris*	Tree	Temperate
115	*Lolium perenne*	Non-woody	Temperate
116	*Lonicera xylosteum*	Shrub	Mediterranean-Dry
117	*Lophostemon confertus*	Tree	Temperate
118	*Lophozonia menziesii*	Tree	Temperate
119	*Lysimachia vulgaris*	Non-woody	Temperate
120	*Machaerium villosum*	Tree	Tropical
121	*Malus sylvestris*	Tree	Temperate
122	*Melaleuca linariifolia*	Tree	Temperate
123	*Melicytus ramiflorus*	Tree	Temperate
124	*Metrosideros excelsa*	Tree	Temperate
125	*Metrosideros robusta*	Tree	Temperate
126	*Metrosideros umbellata*	Tree	Temperate
127	*Milicia excelsa*	Tree	Tropical
128	*Myrsine australis*	Tree	Temperate
129	*Myrsine divaricata*	Shrub	Temperate
130	*Myrsine salicina*	Tree	Temperate
131	*Nestegis lanceolata*	Tree	Temperate
132	*Olearia rani*	Tree	Temperate
133	*Origanum vulgare*	Non-woody	Mediterranean-Dry
134	*Ormosia nobilis*	Tree	Tropical
135	*Pennantia corymbosa*	Tree	Temperate
136	*Phleum pratense*	Non-woody	Temperate
137	*Phyllocladus alpinus*	Tree	Temperate
138	*Phyllocladus trichomanoides*	Tree	Temperate
139	*Phyllyrea angustifolia*	Shrub	Mediterranean-Dry

140	*Picea glauca*	Tree	Boreal
141	*Picea mariana*	Tree	Boreal
142	*Picea sitchensis*	Tree	Boreal
143	*Pimpinella saxifraga*	Non-woody	Temperate
144	*Pinus banksiana*	Tree	Boreal
145	*Pinus strobus*	Tree	Boreal
146	*Pinus sylvestris*	Tree	Boreal
147	*Pittosporum eugenioides*	Tree	Temperate
148	*Pittosporum tenuifolium*	Tree	Temperate
149	*Pittosporum undulatum*	Tree	Temperate
150	*Plagianthus regius*	Tree	Temperate
151	*Plantago major*	Non-woody	Temperate
152	*Poa annua*	Non-woody	Temperate
153	*Podocarpus cunninghamii*	Tree	Temperate
154	*Podocarpus hallii*	Tree	Temperate
155	*Podocarpus totara*	Tree	Temperate
156	*Populus tremuloides*	Tree	Boreal
157	*Pouteria altissima*	Tree	Tropical
158	*Prumnopitys ferruginea*	Tree	Temperate
159	*Prumnopitys taxifolia*	Tree	Temperate
160	*Prunus dulcis*	Tree	Mediterranean-Dry
161	*Prunus laurocerasus*	Tree	Temperate
162	*Prunus lusitanica*	Tree	Mediterranean-Dry
163	*Prunus spinosa*	Tree	Temperate
164	*Pseudopanax arboreus*	Tree	Temperate
165	*Pseudopanax crassifolius*	Tree	Temperate
166	*Pseudowintera colorata*	Tree	Temperate
167	*Pterocarpus soyauxii*	Tree	Tropical
168	*Pultenaea daphnoides*	Shrub	Temperate
169	*Quercus cerris*	Tree	Mediterranean-Dry
170	*Quercus faginea*	Tree	Mediterranean-Dry
171	*Quercus ilex*	Tree	Mediterranean-Dry
172	*Quercus petraea*	Tree	Temperate
173	*Quercus robur*	Tree	Temperate
174	*Quintinia serrata*	Tree	Temperate
175	*Rhamnus alaternus*	Shrub	Mediterranean-Dry
176	*Rhamnus cathartica*	Tree	Temperate
177	*Rhododendron ponticum*	Shrub	Mediterranean-Dry
178	*Rhopalostylis sapida*	Tree	Temperate
179	*Ribes uva-crispa*	Shrub	Temperate
180	*Rosa arvensis*	Shrub	Temperate
181	*Rubus fruticosus*	Shrub	Temperate
182	*Rumex erispus*	Non-woody	Temperate
183	*Salix caprea*	Tree	Temperate
184	*Samanea tubulosa*	Tree	Tropical
185	*Sambucus nigra*	Tree	Temperate
186	*Sapindus saponaria*	Tree	Tropical
187	*Schefflera digitata*	Tree	Temperate
188	*Schima mertensiana*	Tree	Tropical
189	*Scrophularia nodosa*	Non-woody	Temperate
190	*Senna artemisioides*	Shrub	Mediterranean-Dry
191	*Senna barclayana*	Shrub	Temperate
192	*Sophora microphylla*	Tree	Temperate
193	*Sorbus aucuparia*	Tree	Temperate
194	*Stenocarpus sinuatus*	Tree	Temperate
195	*Swietenia macrophylla*	Tree	Tropical
196	*Syzygium maire*	Tree	Temperate
197	*Taraxaeum offieinale*	Non-woody	Temperate
198	*Taxus baccata*	Tree	Temperate
199	*Terminalia superba*	Tree	Tropical
200	*Thuja occidentalis*	Tree	Boreal
201	*Trema orientalis*	Tree	Tropical
202	*Trifolium repens*	Non-woody	Temperate
203	*Triplochiton scleroxylon*	Tree	Tropical
204	*Ulex europaeus*	Shrub	Temperate
205	*Ulmus glabra*	Tree	Temperate
206	*Urtica dioica*	Non-woody	Temperate
207	*Vaccinium myrtillus*	Shrub	Boreal
208	*Vaccinium vitis-idaea*	Shrub	Boreal
209	*Viburnum opulus*	Shrub	Temperate
210	*Vitex lucens*	Tree	Temperate
211	*Weinmannia racemosa*	Tree	Temperate
212	*Weinmannia silvicola*	Tree	Temperate

Supplementary Note 2 | List of tree species selected in the European Atlantic Network (EAN)

Tree species	Selection	Rationale for not selecting
Acer pseudoplatanus	selected	-
Betula pendula	selected	-
Calocedrus decurrens	selected	-
Castanea sativa	selected	-
Cedrus atlantica	selected	-
Cedrus libani	not selected	low availability of functional trait values
Ceratonia siliqua	not selected	low survival rate
Cunninghamia lanceolata	not selected	low survival rate
Cupressus sempervirens	selected	-
Eucalyptus globulus	not selected	low survival rate
Eucalyptus gundal	not selected	hybrid
Eucalyptus nitens	selected	-
Fagus orientalis	selected	-
Fagus sylvatica	selected	-
Larix decidua	selected	-
Larix hybrid (Europe-Japan)	not selected	hybrid
Liquidambar styraciflua	selected	-
Pinus brutia	not selected	low availability of functional trait values
Pinus caribea	not selected	low survival rate
Pinus elliottii	not selected	redundant with other species of the same genus
Pinus nigra	selected	-
Pinus peuce	not selected	low survival rate
Pinus pinaster	selected	-
Pinus pinea	not selected	redundant with other species of the same genus
Pinus ponderosa	not selected	redundant with other species of the same genus
Pinus sylvestris	selected	-
Pinus taeda	selected	-
Pseudotsuga menziesii	selected	-
Quercus ilex	selected	-
Quercus petraea	selected	-
Quercus robur	selected	-
Quercus rubra	selected	-
Quercus shumardii	not selected	low availability of functional trait values
Quercus suber	not selected	low availability of functional trait values
Robinia pseudoacacia	selected	-
Sequoia sempervirens	selected	-
Thuja plicata	selected	-

Supplementary Note 3 | List of species provenances selected in the European Atlantic Network (EAN)

Tree species	Provenance	Rationale for selecting the provenance
Acer pseudoplatanus	northern Cantabrica (Spain)	within the EAN area; present in almost all sites
Betula pendula	northern France	within the EAN area; present in almost all sites
Calocedrus decurrens	northern California (USA)	similar climate as regions of the EAN; present in almost all sites
Castanea sativa	southern France	similar climate as regions of the EAN; present in almost all sites
Cedrus atlantica	Ménerbes (France)	similar climate as regions of the EAN; present in almost all sites
Cupressus sempervirens	southern France	similar climate as regions of the EAN; present in almost all sites
Eucalyptus nitens	Victoria (Australia)	similar climate as regions of the EAN; present in almost all sites
Fagus orientalis	backward Black Sea (Turkey)	similar climate as regions of the EAN; present in all sites
Fagus sylvatica	northern France	within the EAN area; present in almost all sites
Larix decidua	Le Theil (France)	within the EAN area; present in all sites
Liquidambar styraciflua	Arkansas (USA)	present in almost all sites
Pinus nigra	south-western France	within the EAN area; present in all sites
Pinus pinaster	south-western France	within the EAN area; present in all sites
Pinus sylvestris	Severozapadna (Slovakia)	present in all sites
Pinus taeda	southern California	similar climate as regions of the EAN; present in all sites
Pseudotsuga menziesii	Washington Cascade (USA)	similar climate as regions of the EAN; present in all sites
Quercus ilex	Spain	within the EAN area; present in all sites
Quercus petraea	south-western France	within the EAN area; present in all sites
Quercus robur	south-western France	within the EAN area; present in all sites
Quercus rubra	south-western France	within the EAN area; present in almost all sites
Robinia pseudoacacia	Carei (Romania)	similar climate as regions of the EAN; present in almost all sites
Sequoia sempervirens	California coast (USA)	similar climate as regions of the EAN; present in almost all sites
Thuja plicata	Washington coast (USA)	similar climate as regions of the EAN; present in all sites

Supplementary Note 4 | List of references used to collect extra data for the stand biomass dataset (SBD) or for tropical sites (TED)

Data sources (SBD):

Bristow, M., Vanclay, J. K., Brooks, L., & Hunt, M. (2006). Growth and species interactions of Eucalyptus pellita in a mixed and monoculture plantation in the humid tropics of north Queensland. Forest Ecology and Management 233(2-3), 285-294.

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van Breugel, M., Hall, J. S., Craven, D. J., Gregoire, T. G., Park, A., Dent, D. H., ... & Ashton, M. S. (2011). Early growth and survival of 49 tropical tree species across sites differing in soil fertility and rainfall in Panama. Forest Ecology and Management 261(10), 1580-1589.

Supplementary Note 5 | List of references used to complement the functional trait database

<u>Data sources</u>:

Adams, T. S., McCormack, M. L. & Eissenstat, D. M. (2013). Foraging strategies in trees of different root morphology: the role of root lifespan. Tree Physiology 33, 940-948.
Alvarez-Uria, P. & Körner, C. (2011). Fine root traits in adult trees of evergreen and deciduous taxa from low and high elevation in the Alps. Alpine Botany 121, 107-112.
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Supplementary Note 6 | Mathematical demonstration showing the constancy of the z-score value for a two individuals population

The z-score of an individual “a” nested in a population is:

$$Z_a = \frac{(a-m)}{SD}$$

With **m** as the mean value of the population, **SD** the standard deviation of the population.

The stand deviation (**SD**) of a sampled population is:

$$SD = \sqrt{\frac{\sum_1^n (x-m)^2}{(n-1)}}$$

With **m** as the mean value and **n** as the population size.

In a population of 2 values (**a**,**b**), then n=2 and (n-1)=1
In this population of 2 values, the standard deviation is:

$$SD = \sqrt{\sum_1^2 (x-m)^2}$$

⇔ $$SD = \sqrt{(a-m)^2 + (b-m)^2}$$

⇔ $$SD = \sqrt{\left(a - \left(\frac{a+b}{2}\right)\right)^2 + \left(b - \left(\frac{a+b}{2}\right)\right)^2}$$

⇔ $$SD = \sqrt{\left(\frac{2a}{2} - \left(\frac{a+b}{2}\right)\right)^2 + \left(\frac{2b}{2} - \left(\frac{a+b}{2}\right)\right)^2}$$

⇔ $$SD = \sqrt{\left(\frac{a-b}{2}\right)^2 + \left(\frac{b-a}{2}\right)^2}$$

The absolute difference between **a** and **b**:is defined as **d**:

$$d = |a-b| = |b-a|$$

Then:

⇔ $$SD = \sqrt{\left(\frac{d}{2}\right)^2 + \left(\frac{d}{2}\right)^2}$$

⇔ $$SD = \sqrt{\frac{d^2}{4} + \frac{d^2}{4}}$$

⇔ $$SD = \sqrt{\frac{2d^2}{4}}$$

⇔ $$SD = \sqrt{\frac{d^2}{2}}$$

⇔ $$SD = \frac{d}{\sqrt{2}}$$

Considering the SD value of a population of two individuals, the **z-score** of the **a value** is:

$$Z_a = \frac{(a-m)}{SD}$$

⇔ $$Z_a = \frac{\left(a - \left(\frac{a+b}{2}\right)\right)}{SD}$$

⇔ $$Z_a = \frac{\left(\frac{2a}{2} - \left(\frac{a+b}{2}\right)\right)}{SD}$$

⇔ $$Z_a = \frac{\left(\frac{a-b}{2}\right)}{SD}$$

⇔ $$Z_a = \frac{\left(\frac{a-b}{2}\right)}{\left(\frac{d}{\sqrt{2}}\right)}$$

⇔ $$Z_a = \left(\frac{a-b}{2}\right) \times \left(\frac{\sqrt{2}}{d}\right)$$

⇔ $$Z_a = \left(\frac{|d|}{2}\right) \times \left(\frac{\sqrt{2}}{d}\right)$$

⇔ $$|Z_a| = \frac{\sqrt{2}}{2}$$

⇔ $$|Z_a| = constant = 0.707$$

Supplementary Note 7 | A priori classification of tree species based on their trait values

The acquisitive-conservative status of the studied tree species is presented in the sake of scientific transparency. Nevertheless, although a dichotomous classification was useful for data analyses, the authors stress that tree species are distributed along ecological and functional gradients, with many species having intermediate positions (ref.[24]). As such, the acquisitive-conservative status of many species is less informative than their trait values and, more generally, information about their ecological niche. Consequently, the authors strongly recommend not using –directly or alone– this acquisitive-conservative classification for management decisions.

	Tree species	Family	Strategy
1	*Abies alba*	*Pinaceae*	conservative
2	*Abies cephalonica*	*Pinaceae*	conservative
3	*Abies grandis*	*Pinaceae*	conservative
4	*Abies holophylla*	*Pinaceae*	conservative
5	*Abies lasiocarpa*	*Pinaceae*	conservative
6	*Abies nordmanniana*	*Pinaceae*	conservative
7	*Acacia auriculiformis*	*Fabaceae*	acquisitive
8	*Acacia catechu*	*Fabaceae*	acquisitive
9	*Acacia dealbata*	*Fabaceae*	conservative
10	*Acacia implexa*	*Fabaceae*	acquisitive
11	*Acacia mangium*	*Fabaceae*	acquisitive
12	*Acacia mearnsii*	*Fabaceae*	acquisitive
13	*Acacia melanoxylon*	*Fabaceae*	acquisitive
14	*Acacia nilotica*	*Fabaceae*	acquisitive
15	*Acer negundo*	*Sapindaceae*	acquisitive
16	*Acer platanoides*	*Sapindaceae*	acquisitive
17	*Acer pseudoplatanus*	*Sapindaceae*	acquisitive
18	*Acer rubrum*	*Sapindaceae*	acquisitive
19	*Acer saccharum*	*Sapindaceae*	acquisitive
20	*Adenostoma fasciculatum*	*Rosaceae*	conservative
21	*Aesculus hippocastanum*	*Sapindaceae*	conservative
22	*Afzelia bipindensis*	*Fabaceae*	acquisitive
23	*Albizia adinocephala*	*Fabaceae*	acquisitive
24	*Albizia falcataria*	*Fabaceae*	n.d. (not determined)
25	*Albizia kalkora*	*Fabaceae*	acquisitive
26	*Albizia procera*	*Fabaceae*	acquisitive
27	*Alnus glutinosa*	*Betulaceae*	conservative
28	*Alnus incana*	*Betulaceae*	acquisitive
29	*Alnus nepalensis*	*Betulaceae*	acquisitive
30	*Alnus nitida*	*Betulaceae*	acquisitive
31	*Alnus rubra*	*Betulaceae*	acquisitive
32	*Amburana cearensis*	*Fabaceae*	acquisitive
33	*Anadenanthera peregrina* [a]	*Fabaceae*	acquisitive
34	*Anthocephalus chinensis*	*Rubiaceae*	acquisitive
35	*Araucaria cunninghamii*	*Araucariaceae*	conservative
36	*Astronium graveolens*	*Anacardiaceae*	acquisitive
37	*Austrocedrus chilensis*	*Cupressaceae*	conservative
38	*Autranella congolensis*	*Sapotaceae*	acquisitive
39	*Azadirachta indica*	*Meliaceae*	acquisitive
40	*Baillonella toxisperma*	*Sapotaceae*	acquisitive
41	*Betula fruticosa*	*Betulaceae*	acquisitive
42	*Betula papyrifera*	*Betulaceae*	acquisitive
43	*Betula pendula*	*Betulaceae*	acquisitive
44	*Betula platyphylla*	*Betulaceae*	acquisitive
45	*Betula pubescens*	*Betulaceae*	acquisitive
46	*Brosimum alicastrum*	*Moraceae*	acquisitive
47	*Callitris columellaris*	*Cupressaceae*	conservative
48	*Calocedrus decurrens*	*Cupressaceae*	conservative
49	*Calophyllum brasiliense*	*Calophyllaceae*	conservative
50	*Calycophyllum candidissimum*	*Rubiaceae*	n.d.
51	*Camellia oleifera*	*Theaceae*	conservative
52	*Carpinus betulus*	*Betulaceae*	acquisitive
53	*Castanea sativa*	*Fagaceae*	acquisitive
54	*Castanopsis hystrix*	*Fagaceae*	conservative
55	*Castanopsis kawakamii*	*Fagaceae*	acquisitive
56	*Casuarina equisetifolia*	*Casuarinaceae*	acquisitive
57	*Ceanothus crassifolius*	*Rhamnaceae*	conservative
58	*Cedrela odorata*	*Meliaceae*	acquisitive
59	*Cedrela serrata*	*Meliaceae*	conservative
60	*Cedrus atlantica*	*Pinaceae*	conservative
61	*Ceiba pentandra*	*Malvaceae*	acquisitive
62	*Celtis australis*	*Cannabaceae*	conservative
63	*Chamaecyparis lawsoniana*	*Cupressaceae*	conservative
64	*Cinnamomum camphora*	*Lauraceae*	conservative
65	*Cinnamomum triplinerve*	*Lauraceae*	acquisitive
66	*Colubrina glandulosa*	*Rhamnaceae*	acquisitive
67	*Copaifera aromatica*	*Fabaceae*	acquisitive
68	*Cordia alliodora*	*Boraginaceae*	acquisitive
69	*Cunninghamia lanceolata*	*Cupressaceae*	conservative
70	*Cupressus arizonica*	*Cupressaceae*	conservative
71	*Cupressus lusitanica*	*Cupressaceae*	conservative
72	*Cupressus sempervirens*	*Cupressaceae*	conservative
73	*Dalbergia retusa*	*Fabaceae*	acquisitive
74	*Diphysa americana*	*Fabaceae*	acquisitive
75	*Dipteryx oleifera* [b]	*Fabaceae*	conservative

76	*Duabanga grandiflora*	*Lythraceae*	conservative
77	*Entandrophragma cylindricum*	*Meliaceae*	acquisitive
78	*Entandrophragma excelsum*	*Meliaceae*	n.d.
79	*Entandrophragma utile*	*Meliaceae*	acquisitive
80	*Enterolobium cyclocarpum*	*Fabaceae*	acquisitive
81	*Erythrina fusca*	*Fabaceae*	conservative
82	*Erythrophleum suaveolens*	*Fabaceae*	acquisitive
83	*Eucalyptus camaldulensis*	*Myrtaceae*	acquisitive
84	*Eucalyptus citriodora*	*Myrtaceae*	acquisitive
85	*Eucalyptus globulus*	*Myrtaceae*	conservative
86	*Eucalyptus grandis*	*Myrtaceae*	acquisitive
87	*Eucalyptus maculate*	*Myrtaceae*	acquisitive
88	*Eucalyptus microcorys*	*Myrtaceae*	acquisitive
89	*Eucalyptus nitens*	*Myrtaceae*	conservative
90	*Eucalyptus occidentalis*	*Myrtaceae*	n.d.
91	*Eucalyptus pellita*	*Myrtaceae*	conservative
92	*Eucalyptus polyanthemos*	*Myrtaceae*	acquisitive
93	*Eucalyptus robusta*	*Myrtaceae*	conservative
94	*Eucalyptus saligna*	*Myrtaceae*	acquisitive
95	*Eucalyptus tereticornis*	*Myrtaceae*	conservative
96	*Eucalyptus viminalis*	*Myrtaceae*	acquisitive
97	*Fagus grandifolia*	*Fagaceae*	acquisitive
98	*Fagus orientalis*	*Fagaceae*	acquisitive
99	*Fagus sylvatica*	*Fagaceae*	acquisitive
100	*Fokienia hodginsii*	*Cupressaceae*	conservative
101	*Fraxinus americana*	*Oleaceae*	conservative
102	*Fraxinus excelsior*	*Oleaceae*	acquisitive
103	*Fraxinus pennsylvanica*	*Oleaceae*	acquisitive
104	*Gliricidia sepium*	*Fabaceae*	acquisitive
105	*Guazuma ulmifolia*	*Malvaceae*	acquisitive
106	*Gustavia superba*	*Lecythidaceae*	acquisitive
107	*Hernandia sonora*	*Hernandiaceae*	n.d.
108	*Hibiscus elatus*	*Malvaceae*	conservative
109	*Hura crepitans*	*Euphorbiaceae*	acquisitive
110	*Hydrochorea elegans* [c]	*Fabaceae*	acquisitive
111	*Hyeronima alchorneoides*	*Phyllanthaceae*	acquisitive
112	*Hymenaea courbaril*	*Fabaceae*	acquisitive
113	*Inga punctata*	*Fabaceae*	acquisitive
114	*Jacaranda copaia*	*Bignoniaceae*	conservative
115	*Juniperus procera*	*Cupressaceae*	n.d.
116	*Juniperus virginiana*	*Cupressaceae*	conservative
117	*Khaya nyasica*	*Meliaceae*	conservative
118	*Larix decidua*	*Pinaceae*	conservative
119	*Larix eurolepis*	*Pinaceae*	conservative
120	*Larix gmelinii*	*Pinaceae*	conservative
121	*Larix kaempferi*	*Pinaceae*	conservative
122	*Larix larcinia*	*Pinaceae*	conservative
123	*Larix sibirica*	*Pinaceae*	acquisitive
124	*Leucaena leucocephala*	*Fabaceae*	acquisitive
125	*Liquidambar acalycina*	*Altingiaceae*	n.d.
126	*Liquidambar styraciflua*	*Altingiaceae*	acquisitive
127	*Liriodendron tulipifera*	*Magnoliaceae*	acquisitive
128	*Luehea seemannii*	*Malvaceae*	acquisitive
129	*Margaritaria nobilis*	*Phyllanthaceae*	acquisitive
130	*Michelia macclurei*	*Magnoliaceae*	conservative
131	*Michelia oblonga*	*Magnoliaceae*	n.d.
132	*Milicia excelsa*	*Moraceae*	acquisitive
133	*Mytilaria laosensis*	*Hamamelidaceae*	acquisitive
134	*Neltuma juliflora* [d]	*Fabaceae*	acquisitive
135	*Nothofagus dombeyi*	*Nothofagaceae*	conservative
136	*Nothofagus obliqua*	*Nothofagaceae*	acquisitive
137	*Ochroma pyramidale*	*Malvaceae*	acquisitive
138	*Ormosia macrocalyx*	*Fabaceae*	conservative
139	*Ormosia xylocarpa*	*Fabaceae*	n.d.
140	*Pachira quinata*	*Malvaceae*	acquisitive
141	*Parkia roxburghii*	*Fabaceae*	n.d.
142	*Picea abies*	*Pinaceae*	conservative
143	*Picea glauca*	*Pinaceae*	conservative
144	*Picea mariana*	*Pinaceae*	conservative
145	*Picea omorika*	*Pinaceae*	conservative
146	*Picea orientalis*	*Pinaceae*	conservative
147	*Pinus banksiana*	*Pinaceae*	conservative
148	*Pinus caribaea*	*Pinaceae*	conservative
149	*Pinus contorta*	*Pinaceae*	conservative
150	*Pinus coulteri*	*Pinaceae*	conservative
151	*Pinus densiflora*	*Pinaceae*	conservative
152	*Pinus elliottii*	*Pinaceae*	conservative
153	*Pinus halepensis*	*Pinaceae*	conservative
154	*Pinus kesiya*	*Pinaceae*	conservative
155	*Pinus massoniana*	*Pinaceae*	conservative
156	*Pinus nigra*	*Pinaceae*	conservative
157	*Pinus patula*	*Pinaceae*	conservative
158	*Pinus pinaster*	*Pinaceae*	conservative
159	*Pinus radiata*	*Pinaceae*	acquisitive
160	*Pinus resinosa*	*Pinaceae*	conservative
161	*Pinus rigida*	*Pinaceae*	conservative

162	*Pinus roxburghii*	*Pinaceae*	conservative
163	*Pinus sibirica*	*Pinaceae*	conservative
164	*Pinus strobus*	*Pinaceae*	conservative
165	*Pinus sylvestris*	*Pinaceae*	conservative
166	*Pinus tabuliformis*	*Pinaceae*	conservative
167	*Pinus taeda*	*Pinaceae*	conservative
168	*Pinus tecunumanii*	*Pinaceae*	conservative
169	*Populus balsamifera*	*Salicaceae*	acquisitive
170	*Populus tremula*	*Salicaceae*	acquisitive
171	*Populus tremuloides*	*Salicaceae*	acquisitive
172	*Posoqueria latifolia*	*Rubiaceae*	acquisitive
173	*Prosopis cineraria*	*Fabaceae*	conservative
174	*Protium tenuifolium*	*Burseraceae*	acquisitive
175	*Prunus avium*	*Rosaceae*	acquisitive
176	*Pseudosamanea guachapele*	*Fabaceae*	acquisitive
177	*Pseudotsuga menziesii*	*Pinaceae*	conservative
178	*Pterocarpus soyauxii*	*Fabaceae*	acquisitive
179	*Quercus alba*	*Fagaceae*	acquisitive
180	*Quercus dumosa*	*Fagaceae*	acquisitive
181	*Quercus ellipsoidalis*	*Fagaceae*	acquisitive
182	*Quercus ilex*	*Fagaceae*	conservative
183	*Quercus leucotrichophora*	*Fagaceae*	acquisitive
184	*Quercus macrocarpa*	*Fagaceae*	acquisitive
185	*Quercus mongolica*	*Fagaceae*	conservative
186	*Quercus petraea*	*Fagaceae*	acquisitive
187	*Quercus prinus*	*Fagaceae*	acquisitive
188	*Quercus pubescens*	*Fagaceae*	conservative
189	*Quercus pyrenaica*	*Fagaceae*	acquisitive
190	*Quercus robur*	*Fagaceae*	acquisitive
191	*Quercus rubra*	*Fagaceae*	acquisitive
192	*Robinia pseudoacacia*	*Fabaceae*	acquisitive
193	*Samanea saman*	*Fabaceae*	conservative
194	*Sapindus saponaria*	*Sapindaceae*	conservative
195	*Sapium glandulosum*	*Euphorbiaceae*	acquisitive
196	*Schima superba*	*Theaceae*	acquisitive
197	*Schizolobium parahyba*	*Fabaceae*	conservative
198	*Sclerolobium paniculatum*	*Fabaceae*	conservative
199	*Sequoia sempervirens*	*Cupressaceae*	conservative
200	*Shorea robusta*	*Dipterocarpaceae*	acquisitive
201	*Sorbus aria*	*Rosaceae*	conservative
202	*Sorbus aucuparia*	*Rosaceae*	acquisitive
203	*Spondias mombin*	*Anacardiaceae*	acquisitive
204	*Swietenia macrophylla*	*Meliaceae*	acquisitive
205	*Tabebuia impetiginosa*	*Bignoniaceae*	acquisitive
206	*Tabebuia ochracea*	*Bignoniaceae*	conservative
207	*Tabebuia rosea*	*Bignoniaceae*	acquisitive
208	*Tectona grandis*	*Lamiaceae*	acquisitive
209	*Terminalia amazonia*	*Combretaceae*	acquisitive
210	*Terminalia ivorensis*	*Combretaceae*	acquisitive
211	*Terminalia superba*	*Combretaceae*	acquisitive
212	*Thuja plicata*	*Cupressaceae*	conservative
213	*Tilia americana*	*Malvaceae*	acquisitive
214	*Tilia cordata*	*Malvaceae*	acquisitive
215	*Tilia platyphyllos*	*Malvaceae*	acquisitive
216	*Triplochiton scleroxylon*	*Malvaceae*	acquisitive
217	*Tsuga canadensis*	*Pinaceae*	conservative
218	*Tsuga heterophylla*	*Pinaceae*	conservative
219	*Ulmus villosa*	*Ulmaceae*	n.d.
220	*Vachellia tortilis* [(e)]	*Fabaceae*	conservative
221	*Virola koschnyi*	*Myristicaceae*	conservative
222	*Vochysia ferruginea*	*Vochysiaceae*	acquisitive
223	*Vochysia guatemalensis*	*Vochysiaceae*	conservative

Former names:
(a) *Acacia peregrina*
(b) *Dipteryx panamensis*
(c) *Balizia elegans*
(d) *Prosopis juliflora*
(e) *Acacia tortilis* or *Acacia raddiana*

Supplementary Note 8 | List of references used to define the ecological niche of tree species

(only for tree species of the European Atlantic Network; EAN)

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https://forest.jrc.ec.europa.eu/en/european-atlas
https://www.fs.usda.gov (ecology of tree species)
https://www.fs.usda.gov/nrs/atlas/tree/tree_atlas.html# (spatial area of tree species)
https://www.fs.usda.gov/research/programs/nfi (used to define climatic niche of tree species)
https://pfaf.org