

Effects of Tree Diversity, Functional Composition, and Large Trees on the Aboveground Biomass of an Old-Growth Subtropical Forest in Southern China

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Supplementary Figures

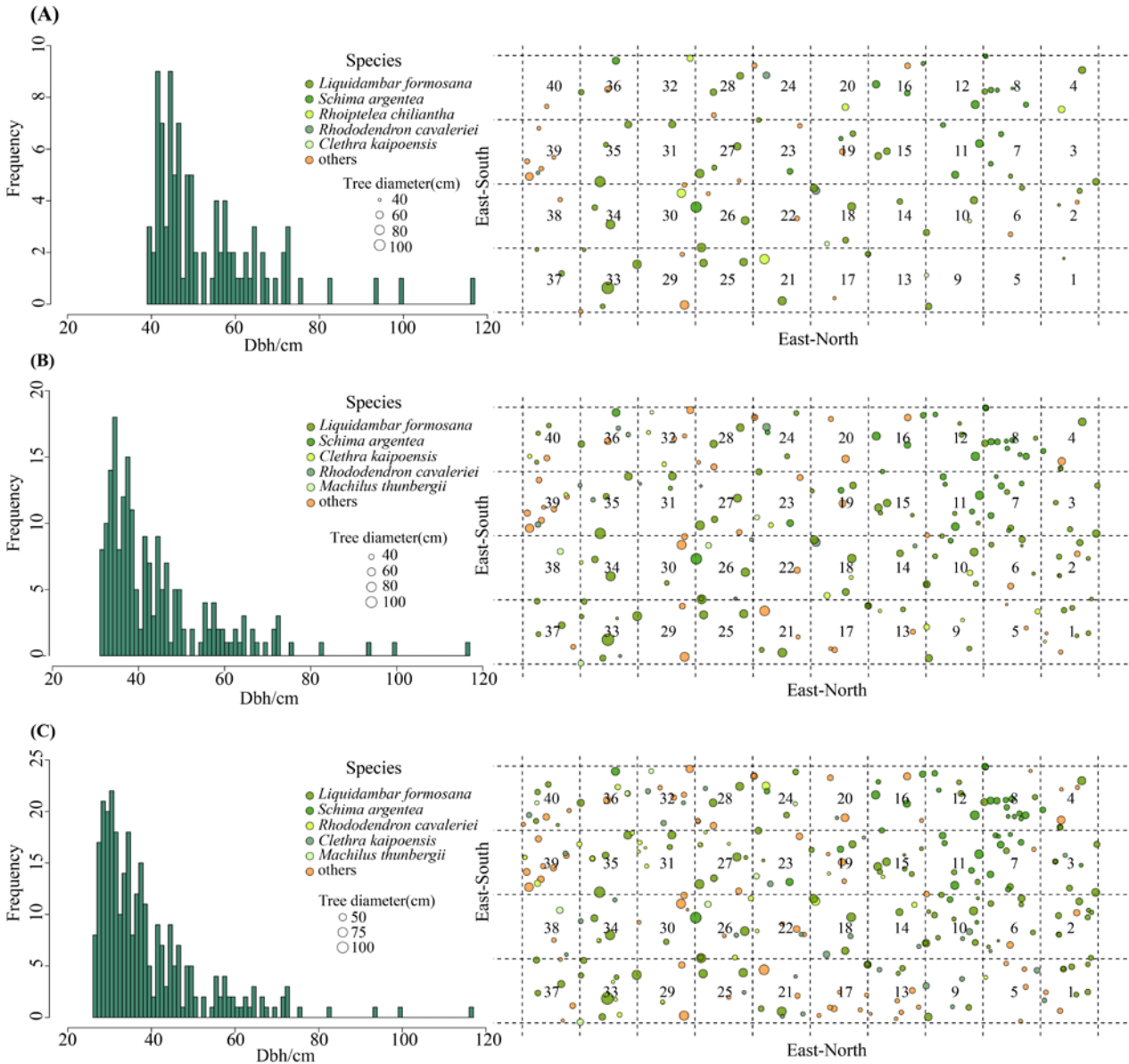


Figure S1. Diameter distribution and spatial distribution of large trees in the study plot. Subplot (20m × 20m) serial numbers are indicated by numbers 1-40. The green legend indicates the top 5 most abundant species of large trees, while the orange legend indicates other species. (A) Top 1% Large trees. (B) Top 2% Large trees. (C) Top 3% Large trees. (D) Top 3% Large trees.

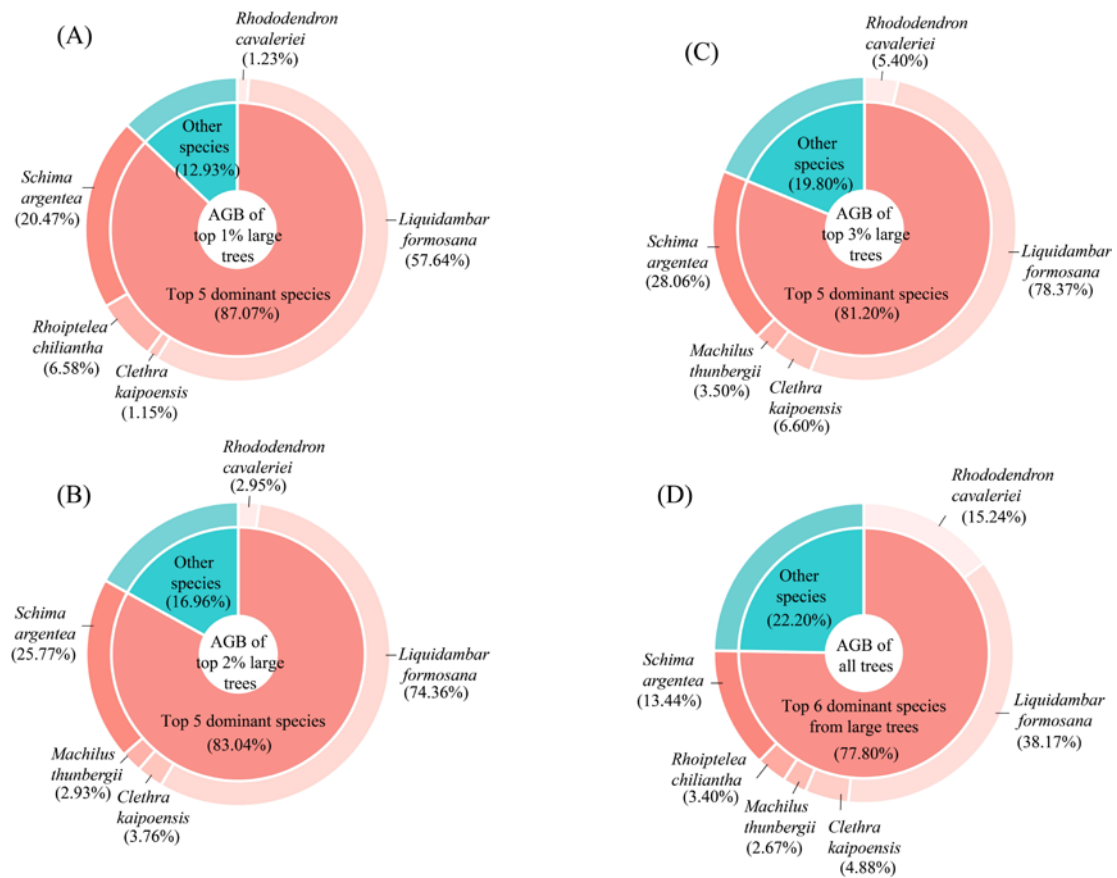


Figure S2. Proportions of AGB accounted for by dominant species. (A) Proportion of AGB accounted for by the top 5 dominant species among the top 1% large trees. (B) Proportion of AGB accounted for by the top 5 dominant species among the top 2% large trees. (C) Proportion of AGB accounted for by the top 5 dominant species among the top 3% large trees. (D) Proportion of AGB accounted for by the top 6 dominant species from the large trees among the entire community.

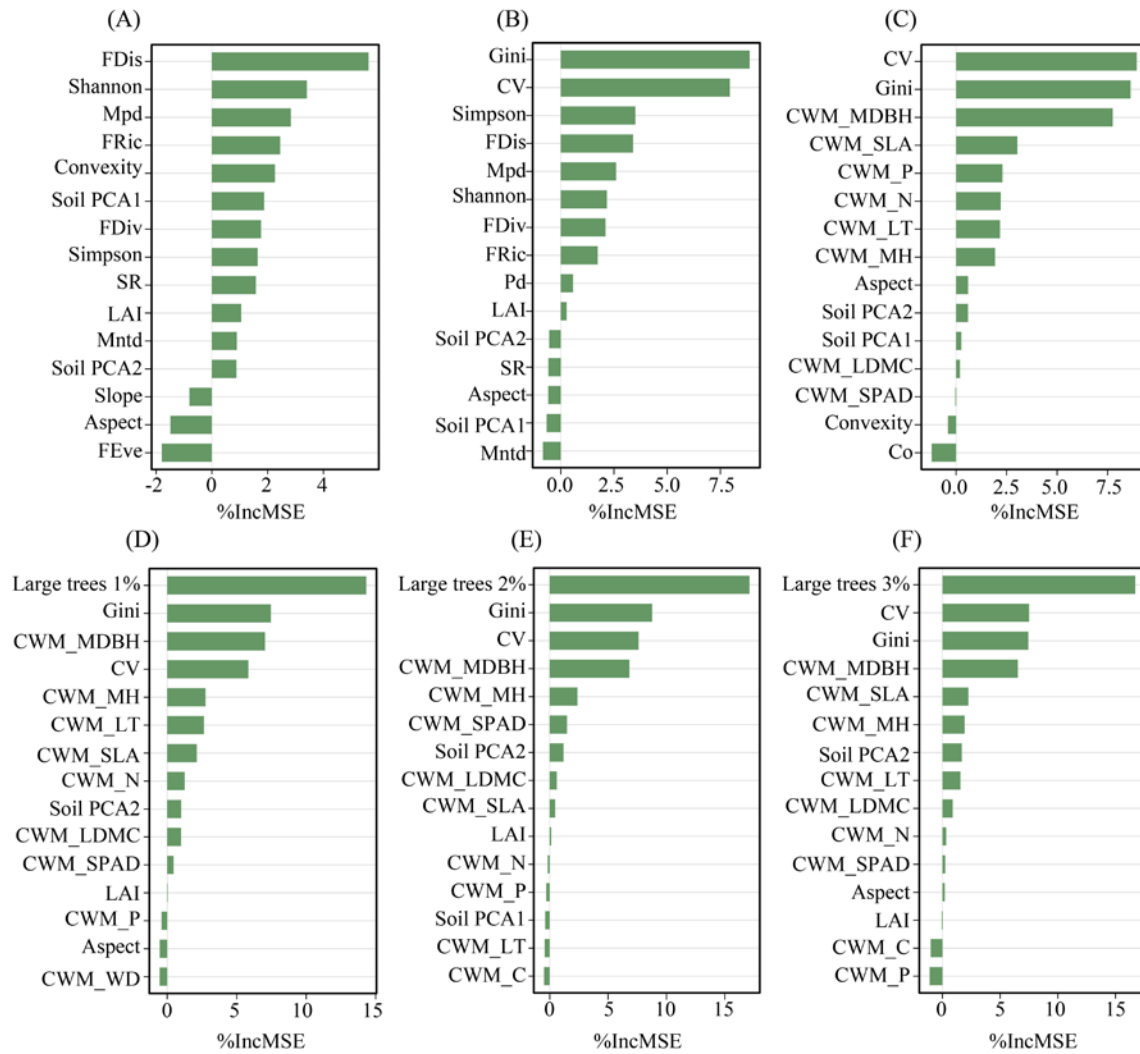


Figure S3. Random forest analysis of the relative importance of biotic and abiotic variables to AGB. The variable importance values are expressed as the percentage increase of mean square error (%IncMSE), and 15 top variables are shown. **(A)** Species, phylogenetic and functional diversity and environmental factors. **(B)** Tree diversity and environmental factors. **(C)** Trees diversity, functional composition and environmental factors. **(D)** Trees diversity, functional composition, top 1% large trees and environmental factors. **(E)** Trees diversity, functional composition, top 2% large trees and environmental factors. **(F)** Trees diversity, functional composition, top 3% large trees and environmental factors. Please refer to figure 3 notes for variable abbreviation interpretation.

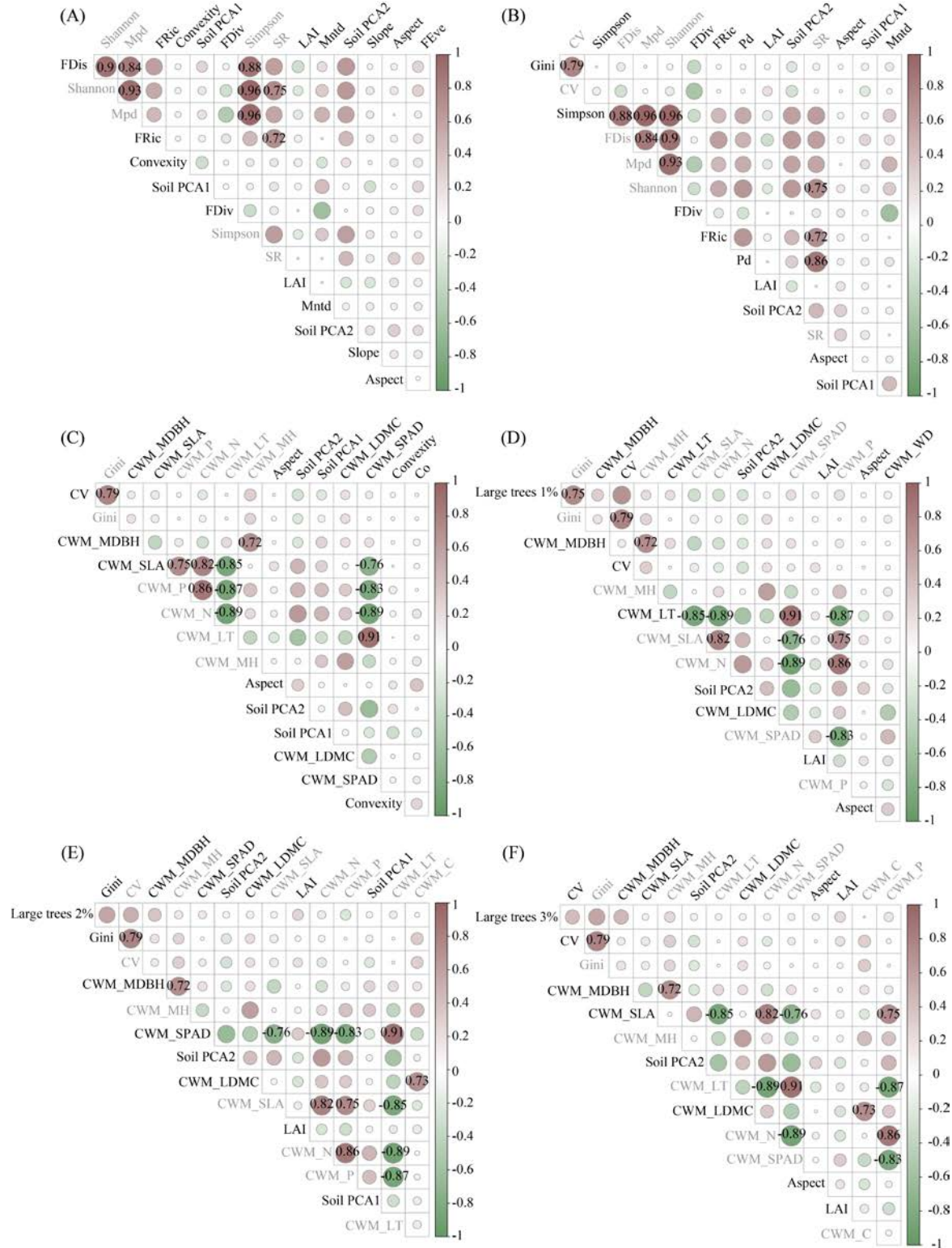


Figure S4. Correlation analysis of the most important 15 explanatory variables. Variables that were able to enter the structural equation models are represented in black fonts, while variables that were eliminated are represented in gray fonts. **(A)** Species, phylogenetic and functional diversity and environmental factors. **(B)** Tree diversity and environmental factors. **(C)** Trees diversity, functional composition and environmental factors. **(D)** Trees diversity, functional composition, top 1% large trees and environmental factors. **(E)** Trees diversity, functional composition, top 2% large trees and environmental factors. **(F)** Trees diversity, functional composition, top 3% large trees and environmental factors. The abbreviation interpretation of the variables can be found in the notes of figure 3.

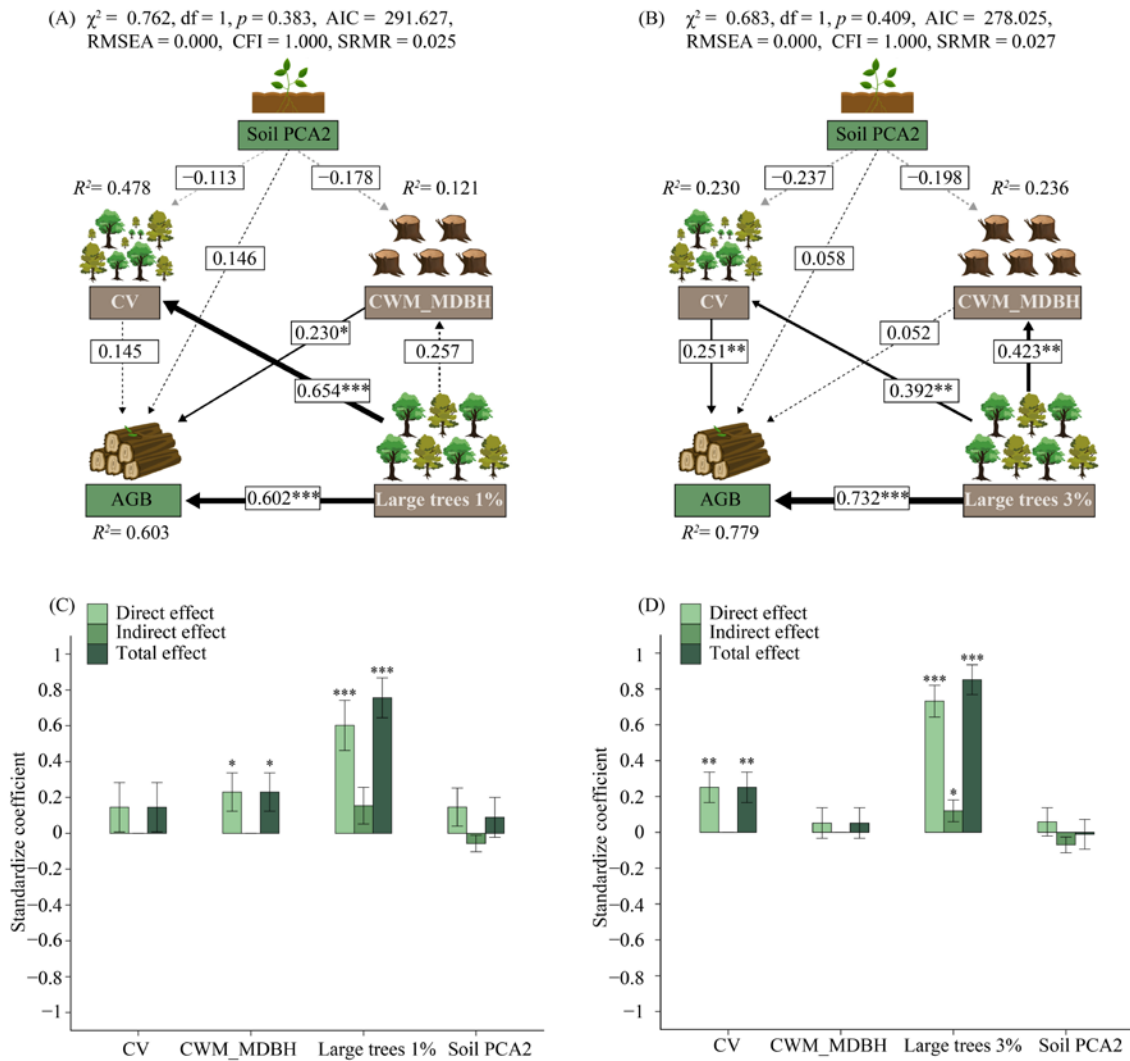


Figure S5. Optimal structural equation models (SEMs) results for different thresholds of large trees and the standardized coefficients derived from SEMs. **(A)** Effects of tree size inequality, functional composition and top 1% large trees on AGB. **(B)** Effects of tree size inequality, functional composition and top 3% large trees on AGB. **(C)** Comparison of direct (light green bar) indirect (green bar) and total effects (dark green bar) derived from SEM (Figure S5. A). **(D)** Comparison of direct (light green bar) indirect (green bar) and total effects (dark green bar) derived from SEM (Figure S5. B). The width of the arrow represents the strength of the relationship, with the solid black line and the solid gray line indicating significant positive and negative effects, respectively. The values near solid arrows indicate normalized coefficients with different levels of significance (* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). and the dotted arrows indicate non-significant effects. R^2 , the percentage explained by dependent variables; χ^2 , Chi-square value; df , Degrees of freedom; p , the p -value of chi-square test; AIC, Akaike information criterion; RMSEA, Root mean square error of approximation; CFI, Comparative fit index; SRMR, Standardized root mean square residual. Data shows standardized coefficient \pm standard error. See figure 3 notes for variable abbreviation interpretations.

Supplementary Tables

Table S1. Summary statistics of environmental factors.

Environment Factors	Abbreviations	Mean	Standard Deviation	Max	Min	Median	Coefficient of Variation (%)
Soil pH	PH	3.93	0.13	4.31	3.76	3.92	3.18
Soil total nitrogen (g/kg)	TN	3.57	0.90	6.57	2.39	3.40	25.29
Soil organic carbon (g/kg)	OC	67.31	17.93	130.31	43.33	64.63	26.64
Soil total phosphorus (g/kg)	TP	0.66	0.10	0.95	0.48	0.65	15.60
Soil total potassium (g/kg)	TK	12.32	1.84	17.62	10.42	11.70	14.90
Soil alkaline hydrolysis nitrogen (g/kg)	AHN	155.31	21.14	206.82	123.03	153.95	13.61
Soil available phosphorus (g/kg)	AP	1.00	0.43	2.35	0.45	0.90	43.40
Soil available potassium (g/kg)	AK	81.75	11.17	107.67	63.67	80.17	13.67
Soil moisture content	SMC	0.86	0.14	1.20	0.53	0.85	16.50
Slope	Slope	26.75	2.86	33.12	22.30	26.81	10.70
Aspect	Aspect	171.95	26.48	239.58	104.19	171.86	15.40
Convexity	Convexity	−0.14	0.62	1.30	−1.24	−0.27	117.47
Elevation	Elevation	1753.90	11.00	1772.14	1730.00	1754.90	0.63
Canopy openness	Co	0.16	0.04	0.27	0.10	0.16	25.26

Table S2. The top 20 species ranked by important value in the forest plot.

Species	Abundance	DBH Range (cm)	Average DBH (cm)	Important Value (%)
<i>Rhododendron cavaleriei</i>	1223	[1.0, 64.1]	12.7	13.66
<i>Liquidambar formosana</i>	194	[1.0, 117.0]	30.4	9.92
<i>Eurya impressinervis</i>	1111	[1.0, 73.0]	7.9	8.31
<i>Eurya nitida</i>	1958	[1.0, 20.0]	2.0	8.18
<i>Ilex ficoidea</i>	1301	[1.0, 46.2]	2.4	6.36
<i>Schima argentea</i>	102	[1.0, 99.5]	21.6	4.05
<i>Litsea elongata</i>	614	[1.0, 21.6]	3.3	3.66
<i>Clethra kaipoensis</i>	98	[1.0, 44.9]	23.3	3.30
<i>Schefflera metcalfiana</i>	432	[1.0, 4.2]	1.9	2.67
<i>Manglietia fordiana</i>	240	[1.0, 42.0]	5.1	2.58
<i>Neolitsea chuii</i>	309	[1.0, 41.4]	3.1	2.35
<i>Photinia beauverdiana</i>	124	[1.0, 35.5]	8.5	1.99
<i>Ficus erecta</i>	251	[1.0, 5.9]	1.9	1.86
<i>Dendropanax dentiger</i>	192	[1.0, 22.0]	3.2	1.82
<i>Machilus thunbergii</i>	56	[14.0, 43.2]	18.1	1.78
<i>Symplocos botryantha</i>	190	[1.0, 3.8]	1.6	1.57
<i>Neolitsea aurata</i>	129	[1.0, 22.9]	3.0	1.55
<i>Styrax japonicus</i>	87	[1.0, 41.2]	3.8	1.23
<i>Laurocerasus spinulosa</i>	74	[1.0, 45.2]	3.8	1.22
<i>Rhoiptelea chiliantha</i>	13	[3.9, 83.0]	37.2	1.19

Table S3. Summary of the selected generalized least-squares (GLS) models for the relationships between AGB and its affecting factors, including both biotic and abiotic factors.

GLS Model	Model	Coefficient	t-Value	P-Value	AIC
AGB ~ SR	Non-spatial	-0.053	-0.33	0.740	122.071
	Spatial	-0.053	-0.33	0.740	126.071
AGB ~ Simpson	Non-spatial	-0.188	-1.18	0.245	120.81
	Spatial	-0.188	-1.18	0.245	124.81
AGB ~ Shannon	Non-spatial	0.182	-1.142	0.261	120.90
	Spatial	0.182	-1.142	0.261	124.90
AGB ~ Pd	Non-spatial	-0.081	-0.50	0.620	121.93
	Spatial	-0.081	-0.50	0.620	125.93
AGB ~ Mpd	Non-spatial	-0.141	-0.876	0.387	121.42
	Spatial	-0.141	-0.876	0.387	125.42
AGB ~ Mntd	Non-spatial	-0.071	-0.436	0.665	121.99
	Spatial	-0.071	-0.436	0.665	125.99
AGB ~ FDis	Non-spatial	-0.22	-1.415	0.165	120.23
	Spatial	-0.22	-1.415	0.165	124.23
AGB ~ FRic	Non-spatial	-0.085	-0.526	0.602	121.903
	Spatial	-0.085	-0.526	0.602	125.903
AGB ~ FEve	Non-spatial	-0.140	-0.869	0.391	121.43
	Spatial	-0.140	-0.869	0.391	125.43
AGB ~ FDiv	Non-spatial	0.109	-0.676	0.503	121.72
	Spatial	0.109	-0.676	0.503	125.72
AGB ~ CWM_LT	Non-spatial	0.161	1.004	0.321	121.18
	Spatial	0.161	1.004	0.321	125.18
AGB ~ CWM_WD	Non-spatial	0.097	0.602	0.551	121.82
	Spatial	0.097	0.602	0.551	125.82
AGB ~ CWM_SPAD	Non-spatial	0.177	1.106	0.276	120.975
	Spatial	0.177	1.106	0.276	124.975
AGB ~ CWM_SLA	Non-spatial	-0.157	-0.981	0.330	121.23
	Spatial	-0.157	-0.981	0.330	121.23
AGB ~ CWM_LDMC	Non-spatial	-0.082	-0.509	0.614	121.92
	Spatial	-0.082	-0.509	0.614	125.92
AGB ~ CWM_C	Non-spatial	0.054	0.336	0.74	122.07
	Spatial	0.054	0.336	0.74	126.07
AGB ~ CWM_N	Non-spatial	-0.22	-1.371	0.178	120.343
	Spatial	-0.22	-1.371	0.178	124.343
AGB ~ CWM_P	Non-spatial	-0.223	-1.413	0.166	120.232
	Spatial	-0.223	-1.413	0.166	124.232
AGB ~ CWM_MDBH	Non-spatial	0.396	2.661	0.011	115.6839
	Spatial	0.396	2.661	0.011	119.6839
AGB ~ CWM_MH	Non-spatial	0.165	1.03	0.310	121.1328
	Spatial	0.165	1.03	0.310	125.1328
AGB ~ Gini	Non-spatial	0.626	4.95	0.000	103.294

GLS Model	Model	Coefficient	t-Value	P-Value	AIC
AGB ~ CV	Spatial	0.626	4.95	0.000	107.294
	Non-spatial	0.548	4.036	0.000	108.6239
	Spatial	0.548	4.036	0.000	112.6239
AGB ~ Large trees 1%	Non-spatial	0.74	6.70	0.000	92.541
	Spatial	0.74	6.70	0.000	96.541
AGB ~ Large trees 2%	Non-spatial	0.85	9.94	0.000	78.42
	Spatial	0.85	9.94	0.000	85.70
AGB ~ Large trees 3%	Non-spatial	0.85	10.14	0.000	72.38
	Spatial	0.85	10.14	0.000	76.38
AGB ~ Soil PCA1	Non-spatial	-0.123	-0.762	0.451	121.6024
	Spatial	-0.123	-0.762	0.451	125.6024
AGB ~ Soil PCA2	Non-spatial	-0.104	-0.642	0.525	121.7683
	Spatial	-0.104	-0.642	0.525	125.7683
AGB ~ Slope	Non-spatial	-0.037	-0.226	0.822	122.1276
	Spatial	-0.037	-0.226	0.822	126.1276
AGB ~ Aspect	Non-spatial	0.054	0.331	0.742	122.0693
	Spatial	0.054	0.331	0.742	126.0693
AGB ~ Elevation	Non-spatial	0.158	0.988	0.329	121.2148
	Spatial	0.158	0.988	0.329	125.2148
AGB ~ Convexity	Non-spatial	0.096	0.596	0.555	121.8252
	Spatial	0.096	0.596	0.555	125.8252
AGB ~ Co	Non-spatial	0.006	0.039	0.969	122.1773
	Spatial	0.006	0.039	0.969	126.1773
AGB ~ LAI	Non-spatial	0.161	1.006	0.321	121.1792
	Spatial	0.161	1.006	0.321	125.1792

Notes: The variables abbreviation interpretation see figure 3 notes.

Table S4. Comparison of results from multiple linear regression models predicting AGB based on biotic and abiotic factors.

Variables	Models	df	logLik	AICc	Delta	R ²
Species, phylogenetic and functional diversity	~ FDis	3	-55.22	117.11	0.29	0.05
	~ LAI	3	-55.73	118.12	1.29	0.03
	~ FEve	3	-55.86	118.38	1.56	0.02
	~ Soil PCA1	3	-55.95	118.56	1.74	0.02
	~ FDiv	3	-56.01	118.69	1.86	0.01
	~ Soil PCA2	3	-56.04	118.74	1.91	0.01
	~ Convexity	3	-56.07	118.80	1.97	0.01
Tree diversity	~ Gini + LAI	4	-44.91	98.97	0.00	0.43
	~ Gini + LAI + Soil PCA2 + Simpson	6	-42.33	99.21	0.23	0.50
	~ Gini	3	-46.31	99.29	0.32	0.39
	~ Gini + Simpson	4	-45.22	99.58	0.61	0.42
	~ Gini + LAI + Mntd	5	-43.91	99.59	0.62	0.46
	~ Gini + Soil PCA2 + Simpson	5	-44.01	99.79	0.82	0.46
	~ Gini + Mntd	4	-45.39	99.92	0.95	0.42
	~ Gini + LAI + Simpson	5	-44.19	100.14	1.17	0.45
	~ FDiv + Gini + LAI	5	-44.25	100.26	1.29	0.45
	~ FDiv + Gini	4	-45.73	100.60	1.63	0.41
Functional composition and tree size inequality	~ CV + CWM_LDMC + CWM_MDBH + Soil PCA2	6	-39.65	93.84	0.00	0.56
	~ Aspect + CV + CWM_LDMC + CWM_MDBH + Soil PCA2	7	-39.08	95.66	1.82	0.58
Functional composition, tree size inequality and Large trees	~ CV + CWM_LDMC + CWM_MDBH + Large trees 1% + Soil PCA2	7	-31.14	79.78	0.00	0.72
	~ Large trees 2% + Gini	4	-28.19	65.52	0.00	0.75
	~ CWM_MDBH + Large trees 2% + Gini	5	-27.46	66.68	1.16	0.76
	~ CWM_SPAD + Large trees 2% + Gini	5	-27.79	67.34	1.81	0.76
	~ Large trees 3% + CV	4	-26.48	62.10	0.00	0.77
	~ Large trees 3% + CV + LAI	5	-26.12	64.00	1.90	0.78

Notes: Only models with delta < 2 are presented. **AICc** denotes Akaike information criterion for small samples; **Delta** represents the difference between the AICc of a given model and the best model; **df**, Degrees of freedom; **R²**, the percentage explained by variables in models; logLik, Log-likelihoods. For the interpretation of variable abbreviations, please refer to figure 3 notes.