

Relating leaf traits to seedling performance in a tropical forest: building a hierarchical functional framework

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Table S1. Pearson correlations between pairs of species-level leaf traits. LA – leaf area, SLA – specific leaf area, Thickness – leaf thickness. Values above the diagonal correspond to P-values, values below the diagonal correspond to r-values.

	log(LA)	log(SLA)	log(Thickness)
log(LA)		0.200	0.007
log(SLA)	-0.13		<0.001
log(Thickness)	0.27	-0.37	

Table S2. Pearson correlations between pair of individual-level biomass allocation traits. LMF – leaf mass fraction, LAR – leaf area ratio. Values above the diagonal correspond to P-values, values below the diagonal correspond to r-values.

	LMF	LAR
LMF		<0.001
LAR	0.7	

Table S3. Model comparison between models including the interaction term between biomass allocation traits and canopy openness and models no including the interaction term but instead including canopy openness as an additive effect. *elpd_diff* is the difference in *elpd* (expected log predictive density) for a pair hierarchical and interaction models, *se_diff* is the standard error of component-wide differences of *elpd* between a pair of models. If *elpd_diff* is small than 4, the difference between models is not significant. If the *elpd_diff* is larger than 4, then we compare the difference in standard error (*se_diff*).

Traits	Model type	elpd_diff	se_diff
LAR-LA	Hierarchical (additive light)	0	0
	Hierarchical (multiplicative light)	-6.3	3.4
LAR-SLA	Hierarchical (additive light)	0	0
	Hierarchical (multiplicative light)	-4.5	3.2
LAR-Thickness	Hierarchical (additive light)	0	0
	Hierarchical (multiplicative light)	-6.3	3.3
LMF-LA	Hierarchical (additive light)	0	0
	Hierarchical (multiplicative light)	-4.1	4
LMF-SLA	Hierarchical (additive light)	0	0
	Hierarchical (multiplicative light)	-6	3.8
LMF-Thickness	Hierarchical (additive light)	0	0
	Hierarchical (multiplicative light)	-4.9	3.9

Table S4. Species list and abundance of tree seedlings from Xishuangbanna, China.

Family	Species	No.	Family	Species	No.
Fabaceae	<i>Acacia pennata</i>	7	Annonaceae	<i>Fissistigma oldhamii</i>	5
Meliaceae	<i>Aglaia abbreviata</i>	4	Clusiaceae	<i>Garcinia cowa</i>	17
Meliaceae	<i>Aglaia perviridis</i>	3	Clusiaceae	<i>Garcinia lancilimba</i>	2
Annonaceae	<i>Alphonsea monogyna</i>	20	Burseraceae	<i>Garuga floribunda</i>	11
Lauraceae	<i>Alseodaphne andersonii</i>	10	Sapindaceae	<i>Harpullia cupanioides</i>	8
Lauraceae	<i>Alseodaphne petiolaris</i>	14	Araliaceae	<i>Heteropanax fragrans</i>	5
Meliaceae	<i>Amoora duodecimantha</i>	65	Myristicaceae	<i>Horsfieldia tetratepala</i>	1
Meliaceae	<i>Amoora yunnanensis</i>	36	Myristicaceae	<i>Knema furfuracea</i>	16
Primulaceae	<i>Ardisia virens</i>	1	Myristicaceae	<i>Knema globularia</i>	5
Phyllanthaceae	<i>Baccaurea ramiflora</i>	11	Rubiaceae	<i>Lasianthus attenuatus</i>	4
Lauraceae	<i>Beilschmiedia sp.</i>	31	Euphorbiaceae	<i>Lasiococca comberi</i>	3
Fabaceae	<i>Caesalpinia cucullata</i>	2	Rubiaceae	<i>Lasianthus hookeri</i>	8
Capparaceae	<i>Capparis fohaiensis</i>	31	Rubiaceae	<i>Lasianthus hooker</i>	2
Fagaceae	<i>Castanopsis indica</i>	5	Rubiaceae	<i>Lasianthus verticillatus</i>	39
Celastraceae	<i>Celastrus monospermus</i>	3	Lauraceae	<i>Lindera metcalfiana</i>	6
Rubiaceae	<i>Chassalia curviflora</i>	4	Lauraceae	<i>Litsea panamanja</i>	5
Meliaceae	<i>Chisocheton siamensis</i>	8	Lauraceae	<i>Litsea salicifolia</i>	7
Lauraceae	<i>Cinnamomum bejolghota</i>	2	Celastraceae	<i>Loeseneriella merrilliana</i>	4
Euphorbiaceae	<i>Cleidion brevipetiolatum</i>	2	Araliaceae	<i>Macropanax undulatus</i>	5
Malvaceae	<i>Colona thorelii</i>	2	Primulaceae	<i>Maesa indica</i>	3
Euphorbiaceae	<i>Croton argyratus</i>	4	Melastomataceae	<i>Memecylon cyanocarpum</i>	2
Euphorbiaceae	<i>Croton kongensis</i>	6	Malvaceae	<i>Microcos chungii</i>	2
Fabaceae	<i>Derris thyrsoiflora</i>	7	Annonaceae	<i>Miliusa chunii</i>	2
Dichapetalaceae	<i>Dichapetalum gelonioides</i>	38	Annonaceae	<i>Miliusa sinensis</i>	9
Ebenaceae	<i>Diospyros hasseltii</i>	29	Annonaceae	<i>Mitrephora thorelii</i>	2
Ebenaceae	<i>Diospyros xishuangbannaensis</i>	30	Rubiaceae	<i>Mycetia gracilis</i>	11
Euphorbiaceae	<i>Drypetes sp.</i>	8	Rubiaceae	<i>Mycetia hirta</i>	1
Putranjivaceae	<i>Drypetes hoaensis</i>	12	Myristicaceae	<i>Myristica yunnanensis</i>	2
Meliaceae	<i>Dysoxylum densiflorum</i>	7	Sapindaceae	<i>Nephelium chryseum</i>	5
Meliaceae	<i>Dysoxylum lenticellatum</i>	2	Icacinaceae	<i>Nothapodytes obtusifolia</i>	2
Elaeocarpaceae	<i>Elaeocarpus glabripetalus</i>	2	Euphorbiaceae	<i>Ostodes paniculata</i>	2
Convolvulaceae	<i>Erycibe obtusifolia</i>	1	Dipterocarpaceae	<i>Parashorea chinensis</i>	196
Moraceae	<i>Ficus fistulosa</i>	6	Rubiaceae	<i>Pavetta hongkongensis</i>	3
Moraceae	<i>Ficus langkokensis</i>	2	Lauraceae	<i>Phoebe lanceolata</i>	4
Moraceae	<i>Ficus ruyanensis</i>	2	Icacinaceae	<i>Pittosporopsis kerrii</i>	97
Moraceae	<i>Ficus subulata</i>	4	Icacinaceae	<i>Platea latifolia</i>	1

Table S4. (continuation).

Family	Species	No.	Family	Species	No.
Sapindaceae	<i>Pometia tomentosa</i>	30	Anacardiaceae	<i>Semecarpus reticulata</i>	8
Annonaceae	<i>Pseuduvaria indochinensis</i>	377	Elaeocarpaceae	<i>Sloanea tomentosa</i>	1
Rubiaceae	<i>Psychotria calocarpa</i>	1	Malvaceae	<i>Sterculia brevissima</i>	1
Rubiaceae	<i>Psychotria yunnanensis</i>	3	Capparaceae	<i>Stixis suaveolens</i>	1
Malvaceae	<i>Pterospermum menglunense</i>	32	Symplocaceae	<i>Symplocos cochinchinensis</i>	2
Gesneriaceae	<i>Rhynchotechum obovatum</i>	2	Myrtaceae	<i>Syzygium latilimbum</i>	12
Connaraceae	<i>Rourea microphylla</i>	2	Myrtaceae	<i>Syzygium oblatum</i>	7
Celastraceae	<i>Salacia aurantia</i>	6	Araliaceae	<i>Trevesia palmata</i>	2
Celastraceae	<i>Salacia cochinchinensis</i>	5	Euphorbiaceae	<i>Trigonostemon thyrsoideum</i>	4
Rubiaceae	<i>Saprosma ternata</i>	58	Meliaceae	<i>Walsura robusta</i>	5
Sapotaceae	<i>Sarcosperma kachinense</i>	4	Meliaceae	<i>Walsura yunnanensis</i>	79
Sapotaceae	<i>Sarcosperma kachinense</i>	6	Rhamnaceae	<i>Ziziphus rugosa</i>	6
Theaceae	<i>Schima wallichii</i>	2			

Table S5. Posterior means, 95% credible interval, and R_{hat} from hierarchical Bayesian models of the intercept and the slopes of organ-level traits and biomass allocation traits. The explanation of the parameters can be found in the main text (explanation for equations 1 and 2). LAR – leaf area ratio, LMF – leaf mass fraction, LA – leaf area, SLA – specific leaf area, Thickness –leaf thickness.

Model	Parameter	Mean	2.50%	97.50%	Rhat
LAR & LA	$\mu\beta_0$	-0.93	-1.24	-0.63	1.0
LAR & LA	$\gamma_1 (\beta_0)$	-0.06	-0.12	0.01	1.0
LAR & LA	$\mu\beta_1$	0.17	0.12	0.22	1.0
LAR & LA	$\gamma_1 (\beta_1)$	0.04	0.01	0.09	1.0
LAR & SLA	$\mu\beta_0$	-0.85	-1.14	-0.55	1.0
LAR & SLA	$\gamma_1 (\beta_0)$	0.12	0.05	0.18	1.0
LAR & SLA	$\mu\beta_1$	0.14	0.08	0.19	1.0
LAR & SLA	$\gamma_1 (\beta_1)$	0.01	-0.05	0.06	1.0
LAR & Thickness	$\mu\beta_0$	-0.89	-1.18	-0.58	1.0
LAR & Thickness	$\gamma_1 (\beta_0)$	-0.02	-0.08	0.04	1.0
LAR & Thickness	$\mu\beta_1$	0.16	0.11	0.21	1.0
LAR & Thickness	$\gamma_1 (\beta_1)$	0.00	-0.05	0.05	1.0
LMF & LA	$\mu\beta_0$	-0.76	-1.05	-0.45	1.0
LMF & LA	$\gamma_1 (\beta_0)$	-0.08	-0.15	0.00	1.0
LMF & LA	$\mu\beta_1$	0.11	0.06	0.16	1.0
LMF & LA	$\gamma_1 (\beta_1)$	0.03	-0.02	0.09	1.0
LMF & SLA	$\mu\beta_0$	-0.71	-1.00	-0.43	1.0
LMF & SLA	$\gamma_1 (\beta_0)$	0.19	0.12	0.25	1.0
LMF & SLA	$\mu\beta_1$	0.12	0.08	0.17	1.0
LMF & SLA	$\gamma_1 (\beta_1)$	0.03	-0.02	0.08	1.0
LMF & Thickness	$\mu\beta_0$	-0.71	-1.00	-0.43	1.0
LMF & Thickness	$\gamma_1 (\beta_0)$	-0.05	-0.12	0.01	1.0
LMF & Thickness	$\mu\beta_1$	0.11	0.06	0.15	1.0
LMF & Thickness	$\gamma_1 (\beta_1)$	-0.03	-0.07	0.02	1.0

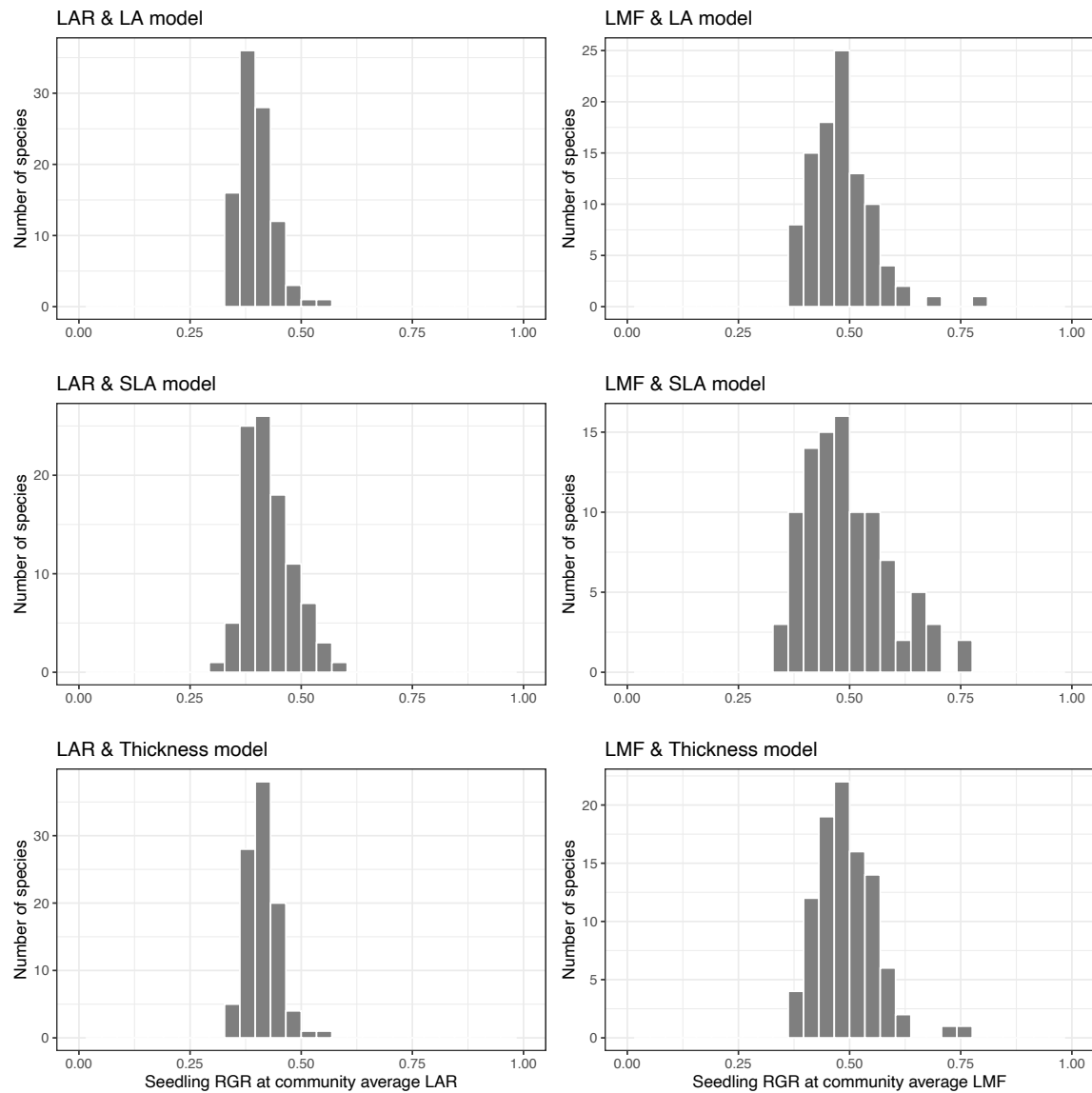


Figure S1. Histograms of species-level posterior means of intercept (β_0) of models predicting seedling relative growth rate (RGR, $\text{cm}\cdot\text{cm}^{-1}\cdot\text{year}^{-1}$). The title in each plot corresponds to the biomass allocation trait used in the first level of the model and to the species-level organ-level trait used in the second level. LAR– leaf area ratio, LMF– leaf mass fraction, LA– leaf area, SLA– specific leaf area, Thickness– leaf thickness. All traits were standardized (std.) at the community level (mean=0, standard deviation=1).

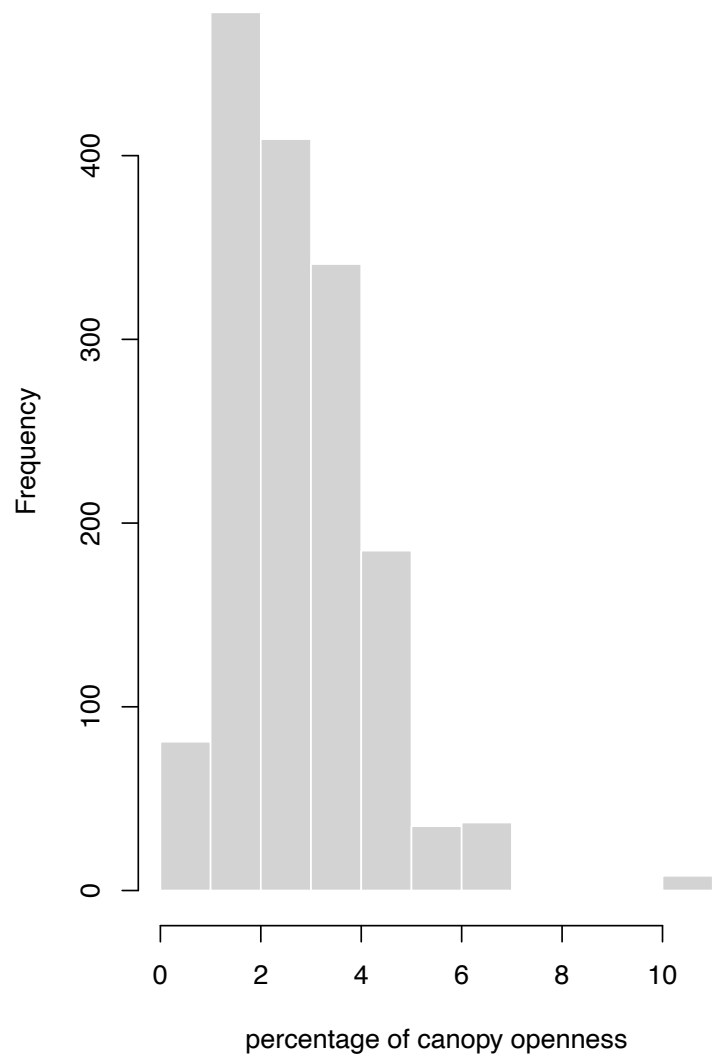


Figure S2. Histogram of canopy openness across 218 seedling plots in China.