Supporting information

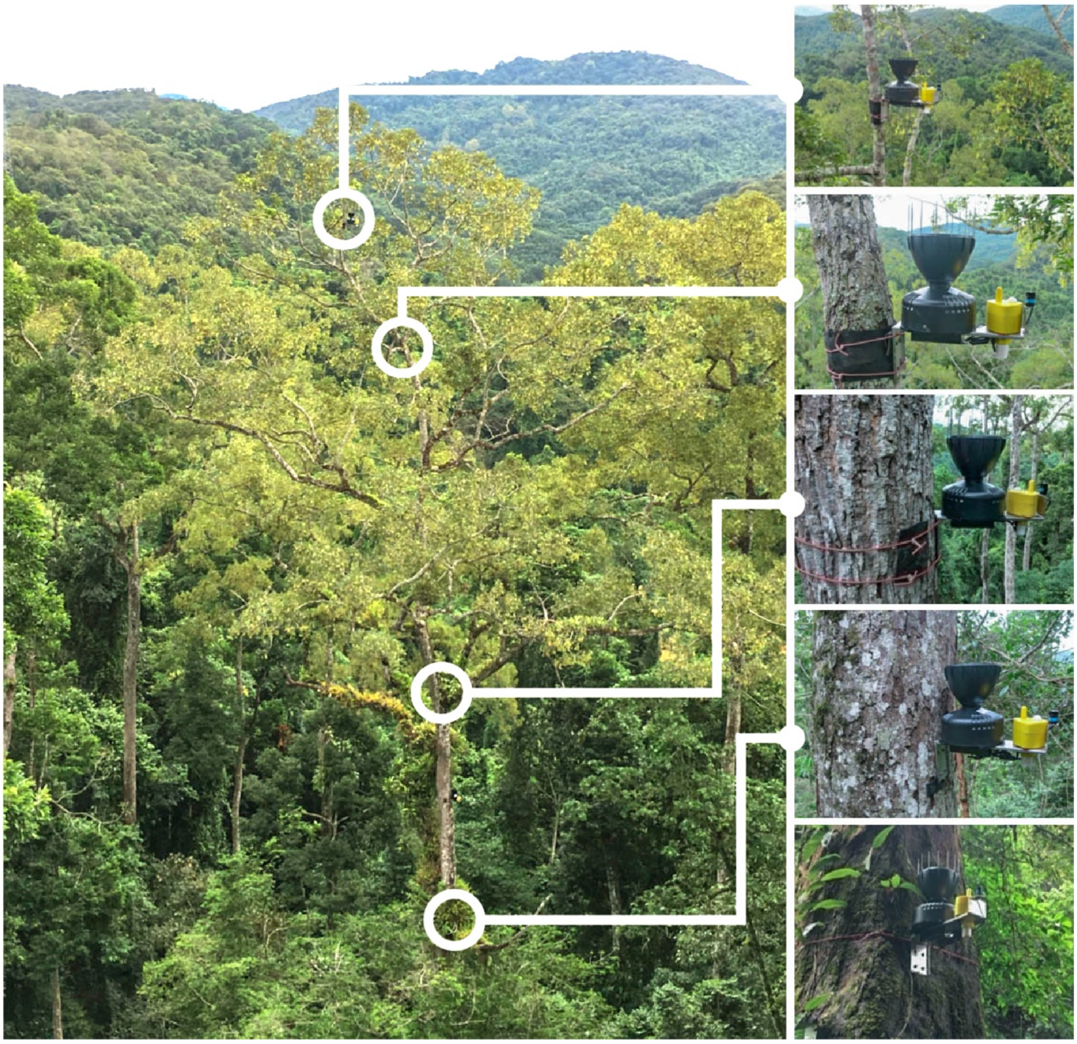

FIGURE S1 Data loggers used for recording light and microclimate conditions at the Xishuangbanna canopy crane facility, Yunnan, SW China. Temperature, relative humidity, photosynthetically active radiation and light intensity were recorded by 54 dataloggers on 12 individual trees at five height zones (1: tree base, 2: middle trunk, 3: inner canopy, 4: middle canopy, 5: outer canopy, modified from Johansson, 1974) every hour during 30 months between 2017 and 2019.

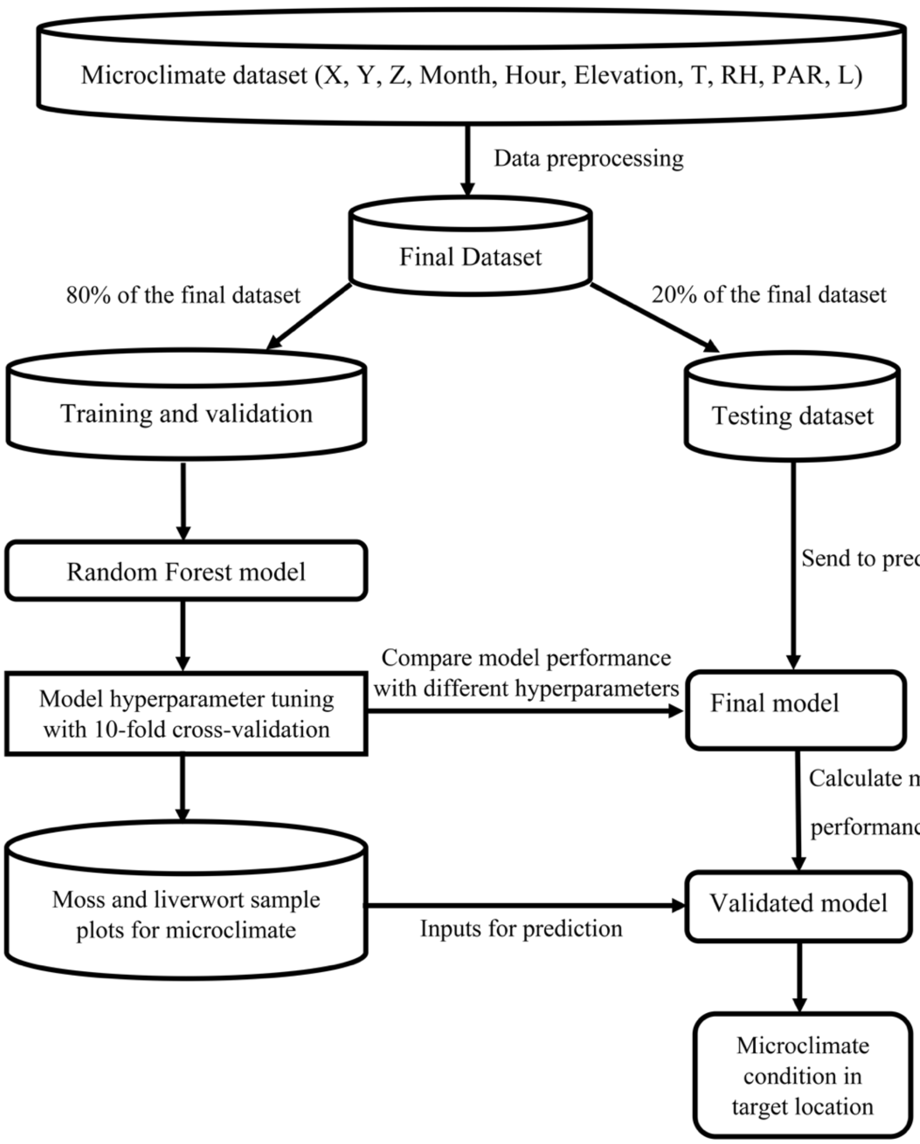

FIGURE S2 Flow chart of the protocol employed to model microclimatic variation using Random Forest.

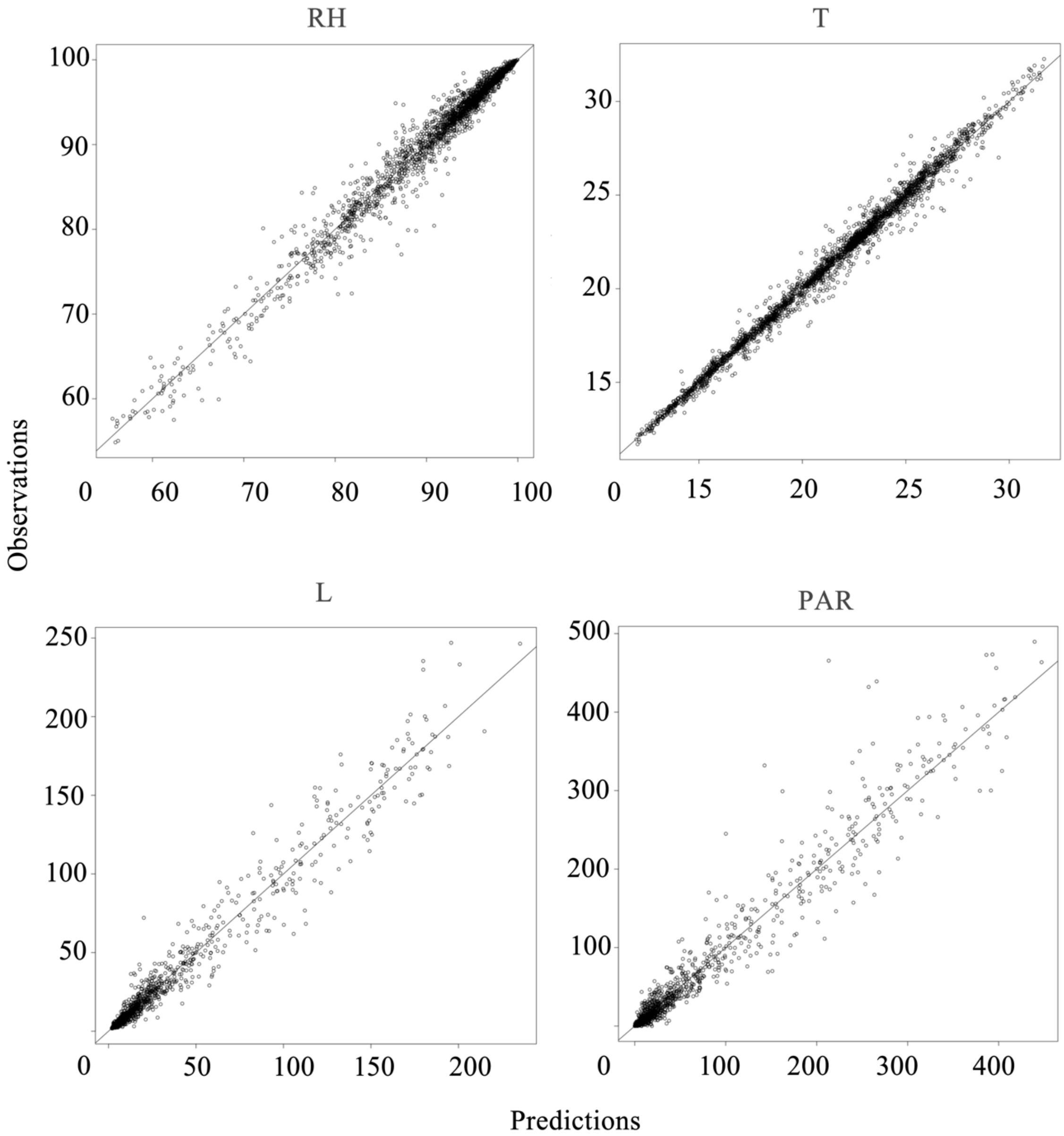

FIGURE S3 Observed vs predicted values of temperature (T), relative humidity (RH), photosynthetically active radiation (PAR), and light intensity (L) from Random Forest models in a 1.44 ha lowland dipterocarp forest at the Xishuangbanna canopy crane facility, Yunnan, SW China. Hourly variation in L, PAR, RH, and T, recorded by 54 dataloggers on 12 trees during 30 months between 2017 and 2019, was modelled by Random Forest using height on the tree, topography (X-Y coordinates and elevation), hour and month of the record as predictors.

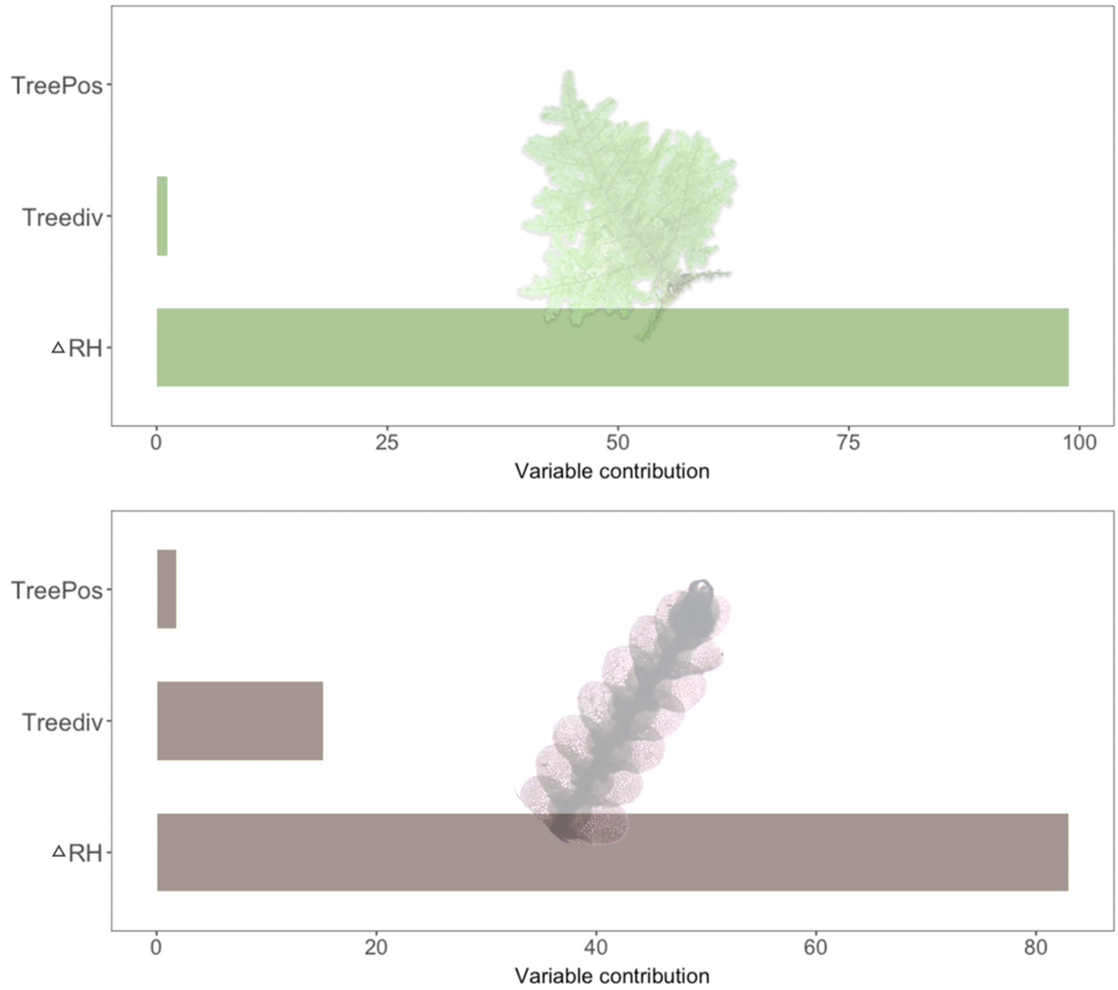

FIGURE S4 Importance (in % explained deviance) of the factors used to describe the vertical variation in species turnover among epiphytic moss (green) and liverwort (brown) communities by Generalized Dissimilarity Modelling. The percentage values illustrate the contribution of the variables remaining in the model after backward selection. ΔRH: difference in relative humidity among plots; TreePos: Position of each individual tree in the x-y space (distance to a reference point); Treediv: variable indicating whether two plots being compared are both located on the trunk or in the canopy, or in different parts of the tree.

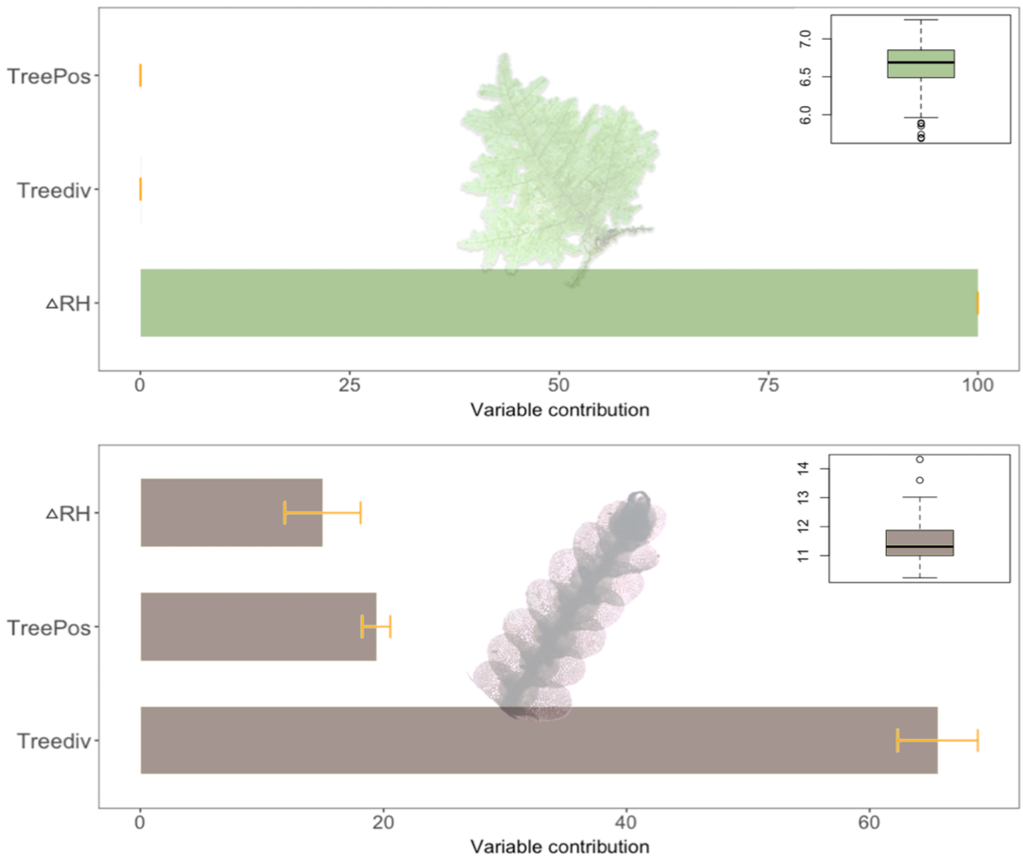

FIGURE S5 Importance (in % explained deviance) of the factors used to describe the vertical variation in phylogenetic turnover among epiphytic moss (green) and liverwort (brown) communities by Generalized Dissimilarity Modelling. The main panel illustrates the contribution (in %) of the variables remaining in the model after backward selection. The upper right panels summarize how the percentage deviance explained by the GDM varies across 100 trees with randomly resolved relationships among congeneric species using box-plots (showing the 1st and 3rd quartiles (upper and lower bounds), 2nd quartile (center), average (red dots), 1.5* interquartile range (whiskers) and minima-maxima beyond the whiskers). ΔRH: difference in relative humidity among plots; TreePos: Position of each individual tree in the x-y space (distance to a reference point); Treediv: variable indicating whether two plots being compared are both located on the trunk or in the canopy, or in different parts of the tree.

Tables

Table S1 Distribution of the dataloggers used to model microclimatic. 54 dataloggers were installed on 12 trees, for which the ID number, species identity, elevation, and coordinates (X-Y) are provided. Z: height of a datalogger on the tree.

ID	Host tree	Elevation	X	Y	Z
TD43-002	*Garcinia cowa*	658.65	64.9	48	2 6.1 8.66 11.5 15
TD43-078	*Garcinia cowa*	660.28	77.8	52.8	2 5.8 10.47 12.7 16
TD23-025	*Garcinia cowa*	651.27	22.2	47	2 5.7 9 10.9 13.4
TD32-021	*Parashorea chinensis*	672.51	44	22.5	2 30.55 40.4 54.3 58.7
TD53-111	*Parashorea chinensis*	666.21	89.7	54.6	2 30.6 41.3 49.88

					57.8
TD46-023	*Parashorea chinensis*	693.95	68	105.7	2 37.2 50.05 56.16 61.34
TD43-066	*Pometia pinnata*	655.69	79	59.6	2
TD36-013	*Pometia pinnata*	682.75	43.5	103.2	2 12.65 19.66 23.58 27.54
TD65-029	*Pometia pinnata*	675.5	100.5	88	2 9.8 16.48 20.73 24.3
TD44-036	*Sloanea tomentosa*	668.41	61.5	77.6	2 15.4 28.83 31.83
TD53-034	*Sloanea tomentosa*	660.28	84	45.3	2 15.86 23.4 29.35
TD52-035	*Sloanea tomentosa*	683.46	86.8	28.7	2 20.56 32.57 38.9

41.5

Table S2 Moss genera not included in the phylogeny of Laenen et al. (2014) and re-assigned to their closest genus based on phylogenetic evidence.

Genus missing in Laenen et al. 2014	Re-assigned genus	References
Circulifolium	*Himantocladium*	Olsson et al., 2016
Caduciella	*Himantocladium*	Olsson et al., 2016
Haplohymenium	*Herpetineuron*	Zhang et al., 2003
Leucophanes	*Syrrhopodon*	Pereira et al., 2019
Macromitrium	*Schlotheimia*	Li et al., 2013
Nerkeropsis	*Himantocladium*	Olsson et al., 2016
Cyrto-hypnum	*Thuidium*	Huttunen et al., 2012
Entondontopsis	*Pilosium*	Buck et al., 2000
Pelekium	*Thuidium*	Huttunen et al., 2012
Calymperes	*Syrrhopodon*	Pereira et al., 2019
Aerobryidium	*Meteoriopsis*	Huttunen et al., 2004
Racopilum	*Braithwaitea*	Liu et al., 2019

Table S3 Setting and performance of microclimatic models in a 1.44 ha lowland dipterocarp forest at the Xishuangbanna canopy crane facility, Yunnan, SW China. Variation in temperature (T), relative humidity (RH), photosynthetically active radiation (PAR), and light intensity (L) was predicted from Random Forest models calibrated from hourly records between 2017 and 2019 of those variables by dataloggers installed on 12 trees. RMSE: Root Mean Square Error; mtry: number of variables available for splitting at each tree node; ntree: number of trees to grow.

Microclimatic variables	R^2	RMSE	Mtry	Ntree
T	0.99	0.41	4	600
RH	0.97	1.43	6	100
L	0.97	6.06	5	1000
PAR	0.96	14.83	6	100

Table S4 Mosses and liverworts recorded on 42 *Parashorea chinensis* in a 1.44 ha lowland dipterocarp forest at the Xishuangbanna canopy crane facility, Yunnan, SW China.

Mosses (50)	Liverworts (52)
Aerobryidium aureo-nitens (Schwaegr.) Broth.	*Acrolejeunea recurvata* Gradst.
Aerobryopsis cochlearifolia Dixon	*Caudalejeunea reniloba* (Gottsche) Steph.
Brotherella nictans (Mitt.) Broth.	*Cheilolejeunea eximia* P.C.Chen & P.C.Wu
Caduciella mariei (Besch) Enroth	*Cheilolejeunea intertexta* (Lindenb.) Steph.
Calymperes erosum Müll. Hal.	*Cheilolejeunea obtusilobula* (S.Hatt.) S.Hatt.
Calyptothecium phyllogonoides Nog. & X.J.Li	*Cheilolejeunea ventricosa* (Schiffn. ex P.Syd.) X.L.He
Calyptothecium wightii (Mitt.) Fleisch.	*Cheilolejeunea vittata* (Steph. ex G. Hoffm.) R.M.Schust. & Kachroo
Circulifolium microdendron (Mont.) M.Fleisch.	*Cheilolejeunea xanthocarpa* (Lehm. & Lindenb.) Malombe
Claopodium prionophyllum (Müll. Hal.) Broth.	*Cololejeunea appressa* (A.Evans) Benedix
Cryphaea obovatocarpa S.Okamura	*Cololejeunea descicens* Steph.
Cyrto-hypnum gratum (P.Beauv.) W.R.Buck & H.Crum	*Cololejeunea dinghuiana* R.L.Zhu & Y.F.Wang
Entondontopsis wightii (Mitt.) W.R.Buck & R.R.Ireland	*Cololejeunea indocinica* Tixier
Erythrodontium julaceum (Hook. ex Schwägr.) Paris	*Cololejeunea inflata* Steph.
Fissidens hollianus Dozy & Molk.	*Cololejeunea lanciloba* Steph.
Fissidens linearis var. *obscurirete* (Broth. & Par.) Stone	*Cololejeunea latilobula* (Herzog) Tixier
Floribundaria pseudofloribunda M.Fleisch.	*Cololejeunea peraffinis* (Schiffn.) Schiffn.
Gollania tereticaulis (Besch.) Broth.	*Cololejeunea planissima* (Mitt.) Abeyw.
Groutiella tomentosa (Hornsch.) Wijk & Margad	*Cololejeunea platyneura* (Spruce) A.Evans
Haplohymenium triste (Ces.) Kindb.	*Cololejeunea raduliloba* Steph.
Homaliadelphus targionianus (Mitt.) Dixon & P. de la Varde	*Cololejeunea subfloccosa* Mizut.
Hypopterygium sp.	*Cololejeunea tenella* Benedix
Leucobryum chlorophyllosum Müll. Hal.	*Cololejeunea trichomanis* Gottsche ex Steph.
Leucophanes octoblepharioides Brid.	*Frullania ericoides* (Nees ex Mart.) Mont.
Mesonodon flavescens (Hook.) W.R.Buck.	*Frullania monocera* (Taylor) Gottsche, Lindenb. & Nees
Meteoriopsis reclinata (Müll. Hal.) M.Fleisch.	*Frullania orientalis* S.Lac.
Meteoriopsis sp.	*Frullania polyptera* Taylor

Meteorium polytrichum Dozy & Molk.	*Frullania riojaneirensis* (Raddi) Spruce
Meteorium subpolytrichum (Besch.) Broth.	*Heteroscyphus argutus* (Schiffn.) Schiffn.
Nerkeropsis crinita (Griff.) M.Fleisch.	*Lejeunea anisophylla* Mont.
Pelekium bifarium (Bosch et Lac.) Fleisch.	*Lejeunea cocoes* Mitt.
Pinnatella ambigua (Bosch. & Lac.) Fleisch.	*Lejeunea flava* (Sw.) Ness
Pylaisiadelpha yokohamae (Broth.)	*Lejeunea pallidevirens* S.Hatt.
Racopilum orthocarpum Wilson ex Mitt.	*Lejeunea sordida* (Nees) Nees
Rhynchostegiella japonica Dixon & Thér.	*Lejeunea tuberculosa* Steph.
Rhynchostegium fauriei Card.	*Leptolejeunea dapitana* Steph.
Rhynchostegium sp.1	*Leptolejeunea subacuta* Steph. ex A.Evans
Rhynchostegium sp.2	*Lopholejeunea subfusca* (Nees) Schiffn.
Sematophyllum phoeniceum (Müll. Hal.) M.Fleisch.	*Lopholejeunea sikkimensis* Steph.
Sematophyllum subhumile (Müll. Hal.) M.Fleisch.	*Metzgeria conjugata* Lindb.
Sematophyllum subpinnatum (Brid.) E.Britton	*Plagiochila fordiana* Steph.
Symphyodon perrottetii Mont.	*Plagiochila furcifolia* Mitt.
Syrrhopodon parasiticus (Brid.) Besch.	*Plagiochila gracilis* Lindenb. & Gottsche
Taxiphyllum cuspidifolium (Cardot) Z.Iwats.	*Plagiochila parviramifera* Inoue
Taxithelium oblongifolium (Sull. & Lesq.) Z.Iwats.	*Plagiochila trabeculata* Steph.
Sp.1	*Plagiochila wightii* Nees ex Lindenb.
Sp.2	*Porella* sp.
Sp.3	*Ptychanthus striatus* (Lehm. & Lindenb.) Nees
Sp.4	*Radula retroflexa* Taylor
Sp.5	*Spruceanthus planiusculus* (Mitt.) X.Q.Shi, R.L.Zhu & Gradst.
Sp.6	*Mastigolejeunea humilis* (Gott.) Schiffn.
	Thysananthus repletus (Taylor) Sukkharak & Gradst.
	Tuzibeanthus chinensis (Steph.) Mizut.

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Table S5 Generalized Dissimilarity Modeling of the horizontal variation (among trees within the same height zone) in turnover (βsim), nestedness (βsne) and phylogenetic turnover (πst) among epiphytic moss and liverwort communities. The table indicates, for each of the six height zones (Z1–Z6), the percent deviance explained by the models and the the relative contribution (in %) of the variables remaining in the models after backward selection. GeoDist: geographic distance among trees; ΔDBH: difference in DBH among trees; ΔElev: difference in elevation among trees; ΔT, ΔRH, ΔL, ΔPAR: differences in temperature, relative humidity, light intensity and PAR among plots. For phylogenetic turnover, the percent values indicate that different models were selected across the 100 phylogenetic trees and indicate the proportion of trees supporting a given model. At height zone 4, model selection varied among the 100 randomly resolved phylogenetic trees: in 14% of the trees, selected models included GeoDist, ΔDBH and ΔT; 35% of the models included GeoDist and ΔT; and the remaining models were not significant. '-' indicates that no significant model was obtained for the considered height zone. Results for moss βsne and liverwort πst are not displayed, because no significant model for moss βsne was found at any height zone, and liverwort πst is phylogenetic overdispersion (πst < 0).

			Z1		Z2		Z3		Z4		Z5		Z6	
Groups	Beta diversity	Variables	Percent Deviance Explained	Variable contribution	Percent Deviance Explained	Variable Contribution	Percent Deviance Explained	Variable contribution	Percent Deviance Explained	Variable Contribution	Percent Deviance Explained	Variable contribution	Percent Deviance Explained	Variable contribution
		GeoDist		1.8		_		0.3		_		_		1
Mosses	βsim	ΔDBH	5.90%	68.8	_	_	7.50%	98.7	_	_	_	_	44.50%	99
		ΔElev		_		_		_		_		_		_

		ΔT		_		_		_		_		_		_
		ΔRH		29.2		_		1		_		_		_
		ΔL		0.2		_		_		_		_		_
		ΔPAR		_		_		_		_		_		_
		GeoDist		_		_		_		(1) < 0.1; (2) 0.9 ± 0.02		_		< 0.1
		ΔDBH		_		_		_		(1) 30.8 ± 0.02; (2) _		_		_
		ΔElev		_		_		_		_		_		_
	πst	ΔT	_	_	_	_	_	_	(1) 14% :18.6 ± 0.02 %; (2) 35%: 14.2 ± 0.02 %; (3) 51%: NS	(1) 69.2 ± 0.02; 99.1 ± 0.02	_	_	2.2 ± 0.16 %	_
		ΔRH		_		_		_		_		_		_
		ΔL		_		_		_		_		_		99.9
		ΔPAR		_		_		_		_		_		_
		GeoDist		0.2		8		0.2		3.4		_		_
		ΔDBH		98.8		92		99.8		64.7		_		_
		ΔElev		_		_		_		_		_		_
	βsim	ΔT	13.30%	_	8.10%	_	13.10%	_	9.80%	_	_	_	_	_
		ΔRH		_		_		_		31.5		_		_
Liverworts		ΔL		_		_		_		_		_		_
		ΔPAR		_		_		_		0.4		_		_
		GeoDist		_		< 1		_		_		_		_
		ΔDBH		_		59.7		_		_		_		_
	βsne	ΔElev	_	_	6.90%	40.2	_	_	_	_	_	_	_	_
		ΔT		_		_		_		_		_		_

ΔRH	–	–	–	–	–	–
ΔL	–	–	–	–	–	–
ΔPAR	–	–	–	–	–	–

Table S6 P-values of community-level average πst in epiphytic moss and liverwort communities in a lowland dipterocarp forest (Xishuangbanna, Yunnan, SW China) per DBH class (small, medium, large) and height zone (Z1 – Z6). Significant values are highlighted in bold. P-values of the significance test are given in parentheses, with ‘<’ and ‘>’ indicating whether the observed value is lower or higher than expected by chance.

DBH class	Height zone	Mosses πst (p-value)	Liverworts πst (p-value)
Small	1	0.16 (> 0.000)	-0.05 (< 0.22)
	2	**-0.07** (< 0.03)	**-0.07** (< 0.04)
	3	0.05 (0.84)	-0.01 (> 0.43)
	4	-	0.01 (0.57)
	5	-	0.01(0.77)
	6	-	-0.05 (0.19)
Medium	1	0.10 (1)	0.12 (0.92)
	2	**0.23** (> 0.03)	0.00 (0.44)
	3	-0.02 (0.31)	0.03 (0.76)
	4	0.04 (0.77)	-0.04 (0.2)
	5	0.00 (0.74)	0.02 (0.76)
	6	-	0.03 (0.77)
Large	1	0.04 (0.97)	-0.46 (< 0.07)
	2	0.01 (0.74)	-0.16 (< 0.07)
	3	-0.01 (0.29)	-0.02 (0.33)
	4	-0.05 (0.15)	-0.07 (0.38)
	5	-0.11 (< 0.12)	0.16 (0.91)
	6	**-0.12** (< 0.03)	-0.02 (0.33)

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