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Supplementary material

Appendix S1. Results of linear mixed-models (LMMs) in comparison with that of general linear models (GLMs).

We first analyzed the data with linear mixed-models (LMMs), using study site as random effect (Appendix S4). Then we performed two analyses in general linear models (GLMs). In one analysis (GLMs1) we used the same variables obtained by LMMs, while in the other analysis we fitted site before these variables (GLMs2). We used changes in Akaike information criterion and R^2 as measures for explanatory power (since LMMs have no results on model R^2, we fitted observed richness to the predicted values of LMMs to estimate R^2).

The results showed that the explanatory power of the variables in LMMs (Appendix S4) were quite different from that of GLMs1 (Appendix S5), but were nearly the same as GLMs2 (Appendix S6). As indicated in Appendix S4 and S6, the explanatory powers of site in GLMs2 were the same as the LMMs with only an intercept term. It is particularly notable that no climatic variable entered the model for herb species in LMMs (see Discussion). These results suggested that the explanatory power of site had already been accounted before we examining the effects of other variables in LMMs. That is, using LMMs (with site as a random effect) was examining the within-site effects of the climatic and local factors, instead of their effects on the regional richness patterns (see Methods and Appendix S2 and S3).

Appendix S2. Summary of general linear models for the effects of climate and local factors on species richness at the regional scale. The explanatory terms were selected by a forward stepwise procedure (see Methods) from 10 variables in Table 2, and were listed in the order of entering the model. Abbreviations: +/–, positive/negative effect (for continuous variables); DF, degrees of freedom; MS, mean squares (type-I sums of squares); %SS, percentage of sum of squares explained; WI, warmth index; MTCM, mean temperature for the coldest month; AP, annual precipitation; POS, position on slope; Seasonality, canopy seasonality; Succession, successional stage. Adj. p: overall significance of the model corrected for spatial autocorrelation.

Term	DF	MS	F	p	%SS
Total richness (Adj. p < 0.001)					
WI (+)	1	97.1	457.9	0.000	65.5
MTCM (+)	1	10.6	50.1	0.000	7.2
POS	3	3.5	16.4	0.000	7.1
Aspect	8	0.8	3.6	0.001	4.2
Succession	2	1.0	4.5	0.014	1.3
Seasonality	3	0.6	2.7	0.048	1.2
Density (–)	1	1.5	7.1	0.009	1.0
Residuals	88	0.2			12.6
Tree species (Adj. p < 0.001)					
WI (+)	1	66.2	583.4	0.000	71.5
Density (+)	1	4.2	37.1	0.000	4.5
Seasonality	3	1.1	9.7	0.000	3.6
Succession	2	0.4	4.0	0.022	1.0
POS	3	1.1	9.8	0.000	3.6
AP (+)	1	3.7	32.5	0.000	4.0
Residuals	96	0.1			11.8
Shrub species (Adj. p < 0.001)					
WI (+)	1	22.4	109.5	0.000	34.0
Seasonality	3	5.2	25.5	0.000	23.7
Aspect	8	1.1	5.6	0.000	13.8
Residuals	92	0.2			28.5
Herb species (Adj. p < 0.001)					
MTCM (+)	1	43.4	97.8	0.000	33.8
Succession	2	5.8	13.1	0.000	9.1
Aspect	8	2.0	4.4	0.000	12.2
POS	3	2.8	6.3	0.001	6.5
Density (–)	1	5.1	11.5	0.001	4.0
Seasonality	3	1.6	3.6	0.017	3.7
Residuals	89	0.4			30.7

Appendix S3. General linear models for the effects of climate and local factors in explaining the within-site variation of species richness. The explanatory terms were listed in the order of entering the model. Abbreviations: +/–, positive/negative effect; DF, degrees of freedom; MS, mean squares (type-I sums of squares); %SS, percentage of sum of squares explained; WI, warmth index; MTCM, mean temperature for the coldest month; AP, annual precipitation, POS, position on slope; Seasonality, canopy seasonality; Succession, successional stage. Adj. p: the overall significance of the model corrected for spatial autocorrelation.

Term	DF	MS	F	p	%SS
Total richness (Adj. p < 0.001)					
Site	5	11.2	60.7	0.000	37.8
WI (+)	1	52.4	284.3	0.000	35.4
Succession	2	5.4	29.3	0.000	7.3
POS	3	1.6	8.8	0.000	3.3
Aspect	8	0.7	3.8	0.001	3.8
Seasonality	3	0.6	3.3	0.024	1.2
Density (–)	1	1.1	6.1	0.015	0.8
Residuals	84	0.2			10.4
Tree species (Adj. p < 0.001)					
Site	5	7.3	66.4	0.000	39.7
WI (+)	1	40.6	367.0	0.000	43.9
Seasonality	3	0.8	7.0	0.000	2.5
Density (+)	1	1.3	11.8	0.001	1.4
Succession	2	0.5	4.6	0.012	1.1
Residuals	95	0.1			11.4
Shrub species (Adj. p < 0.001)					
Site	5	5.8	32.9	0.000	43.8
WI (+)	1	11.4	64.9	0.000	17.3
Seasonality	3	1.7	9.5	0.000	7.6
Aspect	8	0.7	3.8	0.001	8.1
Residuals	87	0.2			23.2
Herb species (Adj. p < 0.001)					
Site	5	8.5	23.1	0.000	33.2
Succession	2	16.5	44.8	0.000	25.8
POS	3	1.6	4.4	0.007	3.8
Seasonality	3	1.3	3.5	0.019	3.0
Density (–)	1	3.3	9.1	0.003	2.6
Aspect	8	1.0	2.6	0.014	6.0
Residuals	85	0.4			25.6

Appendix S4. Summary of linear mixed-models for the effects of climate and local factors on species richness. Study site is the random effect in the models. The models R^2 were estimated by fitting observed richness to the predicted values of the models. Abbreviations: numDF, degrees of freedom for numerator; denDF, degrees of freedom for denominator; △AIC: Akaike information criterion (AIC) change; △AIC%, percentage of changes in AIC; $\triangle R^2$, R^2 change.

	numDF	denDF	F	p	△AIC	△AIC%	$\triangle R^2$
	Total richness (overall R^2 = 0.89)						
(Intercept)	1	83	1723.7	0.000	–28.1	15.3	0.38
WI	1	83	315.0	0.000	–95.7	52.3	0.35
Succession	2	83	23.6	0.000	–22.8	12.4	0.08
POS	3	83	9.4	0.000	–14.0	7.6	0.03
Aspect	8	83	3.2	0.003	–9.1	5.0	0.04
Seasonality	3	83	4.0	0.011	–5.3	2.9	0.01
Density	1	83	5.6	0.020	–5.1	2.8	0.01
MTCM	1	83	8.1	0.006	–3.1	1.7	0.00
	Tree species (overall R^2 = 0.89)						
(Intercept)	1	91	1131.3	0.000	–30.2	14.8	0.40
WI	1	91	465.9	0.000	–140.5	68.5	0.44
Seasonality	3	91	7.8	0.000	–11.0	5.3	0.02
Density	1	91	14.1	0.000	–9.1	4.5	0.01
Succession	2	91	3.4	0.036	–4.0	2.0	0.01
MTCM	1	91	16.0	0.000	–6.9	3.4	0.00
POS	3	91	2.9	0.041	–3.2	1.6	0.01
	Shrub species (overall R^2 = 0.76)						
(Intercept)	1	87	491.9	0.000	–35.0	32.2	0.44
WI	1	87	75.2	0.000	–36.8	33.9	0.17
Seasonality	3	87	13.3	0.000	–19.7	18.2	0.07
Aspect	8	87	4.3	0.000	–17.0	15.7	0.08
	Herb species (overall R^2 = 0.76)						
(Intercept)	1	84	118.2	0.000	–22.0	24.8	0.33
Succession	2	84	43.5	0.000	–43.4	49.1	0.26
POS	3	84	4.5	0.005	–4.3	4.9	0.04
Seasonality	3	84	4.0	0.010	–4.5	5.1	0.03
Density	1	84	9.6	0.003	–6.9	7.8	0.03
Aspect	8	84	2.4	0.020	–3.8	4.3	0.06
Biomass	1	84	4.7	0.032	–3.6	4.0	0.01

Note: 1. Totally 10 explanatory terms (Table 2) were used in these analyses. The final model was selected from a number of models with different combinations of climatic, topographical, forest structural and forest type variables. The model with the lowest AIC and the least parameters was selected. The sequence of the variables entering the model was determined by their ability in reducing AIC.
2. Abbreviations for variables: WI, warmth index; MTCM, mean temperature for the coldest month; Density: tree density for each plot; POS, position on slope; Succession, successional stage, Seasonality, canopy seasonality (For details, see Table 2).

Appendix S5. Results of general linear models using the same variables obtained from linear mixed-models (Appendix S4). DF, degrees of freedom; MS, mean squares (type-I sums of squares); for other abbreviations, see Appendix S4.

	DF	MS	F	p	△AIC	△AIC%	△R^2
	Total richness (overall R^2 = 0.87)						
WI	1	97.12	457.9	0.000	–113.1	60.9	0.66
Succession	2	2.39	11.3	0.000	–6.6	3.6	0.03
POS	3	1.93	9.1	0.000	–8.4	4.5	0.04
Aspect	8	0.74	3.5	0.002	–1.0	0.5	0.04
Seasonality	3	1.89	8.9	0.000	–13.3	7.2	0.04
Density	1	0.32	1.5	0.225	0.8	–0.4	0.00
MTCM	1	9.98	47.0	0.000	–44.2	23.8	0.07
Residuals	88	0.21					
	Tree species (overall R^2 = 0.88)						
WI	1	66.17	567.1	0.000	–133.8	64.9	0.72
Seasonality	3	1.41	12.1	0.000	–13.0	6.3	0.05
Density	1	3.26	28.0	0.000	–15.3	7.4	0.04
Succession	2	0.45	3.9	0.025	–1.3	0.6	0.01
MTCM	1	5.54	47.4	0.000	–38.0	18.4	0.06
POS	3	0.39	3.3	0.023	–4.7	2.3	0.01
Residuals	96	0.12					
	Shrub species (overall R^2 = 0.71)						
WI	1	22.4	109.5	0.000	–41.6	38.6	0.34
Seasonality	3	5.22	25.5	0.000	–40.7	37.8	0.24
Aspect	8	1.14	5.6	0.000	–25.4	23.5	0.14
Residuals	92	0.20					
	Herb species (overall R^2 = 0.60)						
Succession	2	12.61	21.9	0.000	–19.6	30.9	0.20
POS	3	2.96	5.1	0.003	–3.7	5.8	0.07
Seasonality	3	8.98	15.6	0.000	–30.3	47.8	0.21
Density	1	4.59	8.0	0.006	–5.6	8.9	0.04
Aspect	8	0.74	1.3	0.260	5.3	–8.4	0.05
Biomass	1	5.72	9.9	0.002	–9.4	14.9	0.04
Residuals	89	0.58					

Appendix S6. Results of general linear models using the same variables obtained from linear mixed-models (Appendix S4), except that site entered the models the first. For abbreviations, see Appendix S4 and S5.

	DF	MS	F	p	△AIC	△AIC%	△R^2
	Total richness (overall R^2 = 0.90)						
Site	5	11.20	60.1	0.000	–41.3	20.8	0.38
WI	1	52.42	281.4	0.000	–88.8	44.9	0.35
Succession	2	5.40	29.0	0.000	–30.2	15.3	0.07
POS	3	1.63	8.7	0.000	–13.9	7.0	0.03
Aspect	8	0.71	3.8	0.001	–12.8	6.5	0.04
Seasonality	3	0.61	3.3	0.025	–5.3	2.7	0.01
Density	1	1.13	6.1	0.016	–5.6	2.8	0.01
MTCM	1	0.03	0.1	0.709	1.8	–0.9	0.00
Residuals	83	0.19					
	Tree species (overall R^2 = 0.90)						
Site	5	7.3	70.6	0.000	–44.7	20.9	0.40
WI	1	40.60	390.1	0.000	–138.8	64.8	0.44
Seasonality	3	0.77	7.4	0.000	–11.9	5.6	0.03
Density	1	1.30	12.5	0.001	–9.5	4.5	0.01
Succession	2	0.51	4.9	0.010	–6.0	2.8	0.01
MTCM	1	0.28	2.7	0.104	–0.9	0.4	0.00
POS	3	0.25	2.4	0.071	–2.3	1.1	0.01
Residuals	91	0.10					
	Shrub species (overall R^2 = 0.77)						
Site	5	5.8	32.9	0.000	–50.5	42.3	0.44
WI	1	11.44	64.9	0.000	–36.7	30.7	0.17
Seasonality	3	1.67	9.5	0.000	–16.8	14.1	0.08
Aspect	8	0.67	3.8	0.001	–15.3	12.8	0.08
Residuals	87	0.18					
	Herb species (overall R^2 = 0.76)						
Site	5	8.54	23.1	0.000	–33.7	31.4	0.33
Succession	2	16.55	44.8	0.000	–48.7	45.4	0.26
POS	3	1.61	4.4	0.007	–4.4	4.1	0.04
Seasonality	3	1.30	3.5	0.019	–3.2	3.0	0.03
Density	1	3.35	9.1	0.003	–6.6	6.1	0.03
Aspect	8	0.96	2.6	0.014	–6.7	6.2	0.06
Biomass	1	1.82	4.9	0.029	–4.1	3.9	0.01
Residuals	84	0.37					