Ecography

E6988
Wang, Z., Fang, J., Tang, Z. and Shi, L. 2012. Directional and geographical patterns in beta diversity of China's woody plants: niches versus dispersal limitations. – Ecography 35: xxx–xxx.

Supplementary material

Appendix 1 Relationships between the similarities (*S*) of species composition and spatial distances (*D*). Here, the similarities of species composition between grid cells were measured by Sørensen's similarity index. Our analysis and previous studies (Nekola and White 1999, Qian an Ricklefs 2007) showed that species similarities between grid cells decrease exponentially with the increase of spatial distance. In our analyses, beta diversity was defined as the decay rates of Sørensen's similarity index with spatial distance (i.e. the slopes of log(*S*) ~ *D*). For the regression results of these figures, see Table 1 in the text.

Figure A1 Relationships between log-transformed Sørensen's index and spatial distance between grid cells for all woody species in China. a, non-directional Sørensen's index; b, longitudinal Sørensen's index; b, latitudinal Sørensen's index.

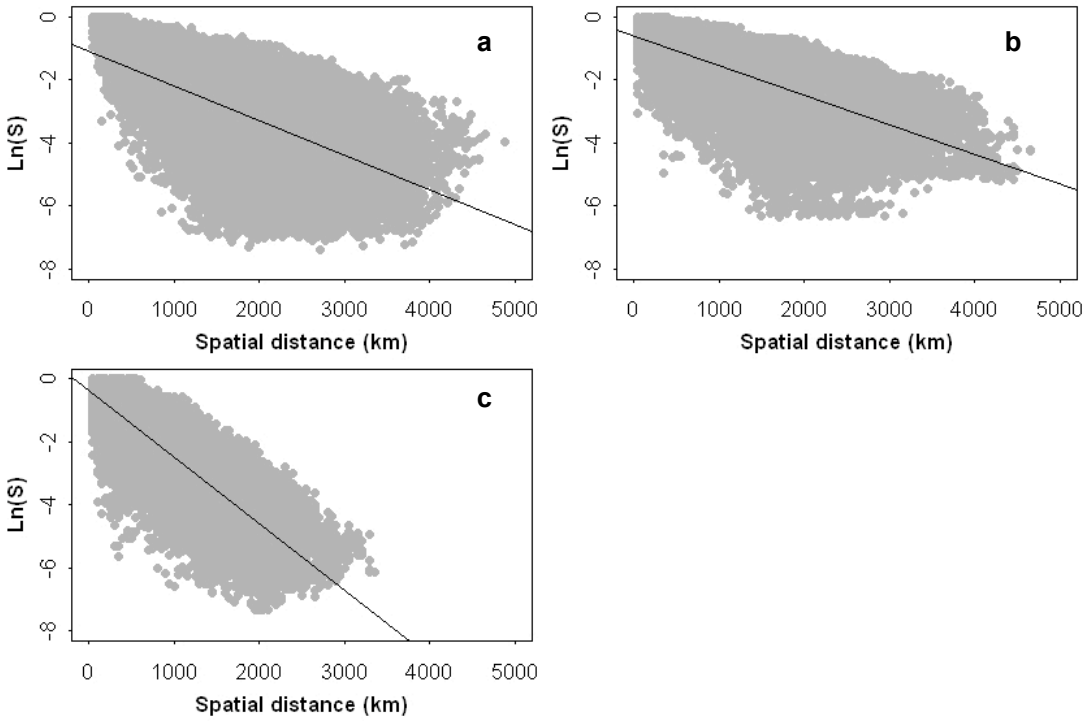
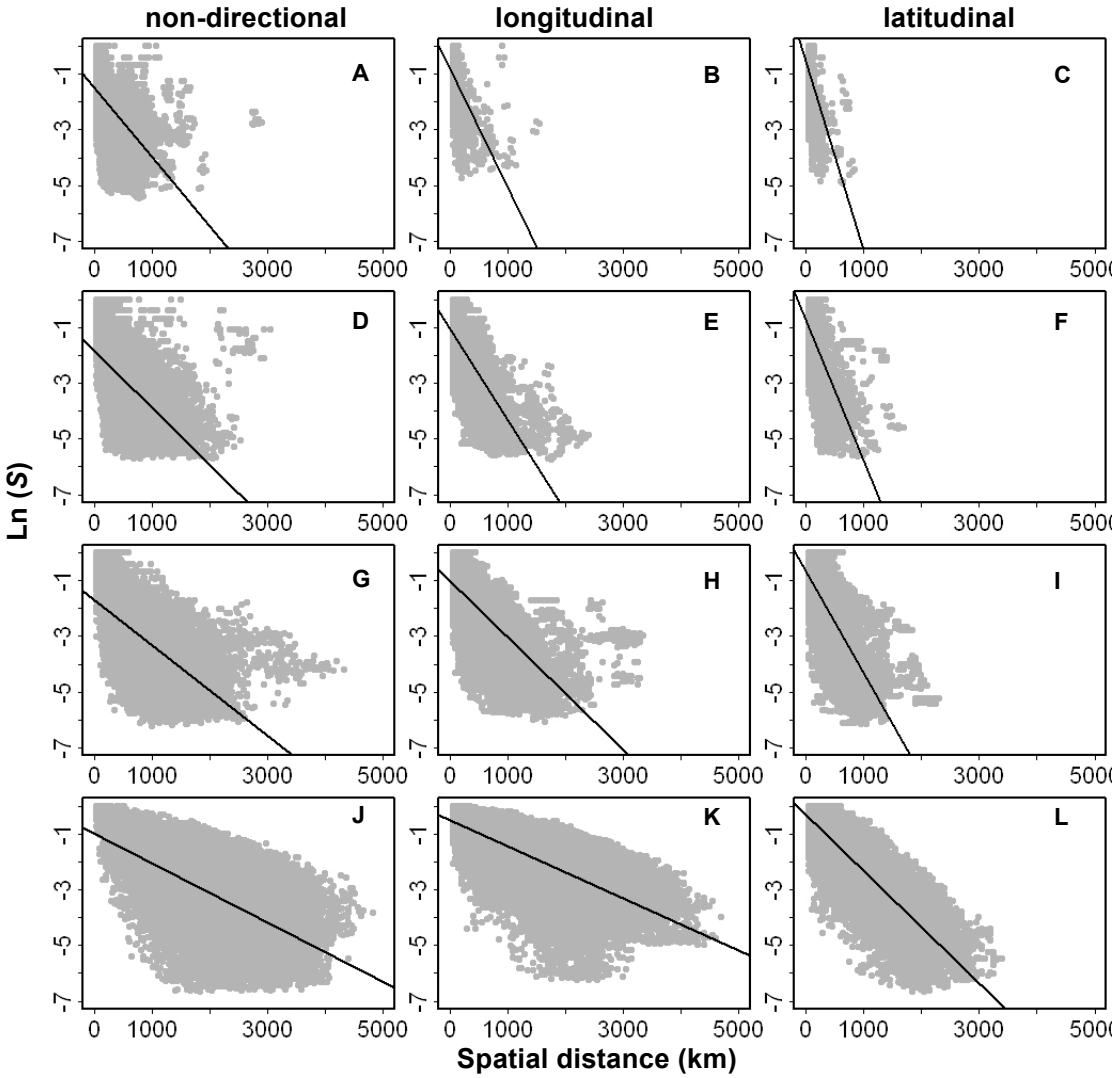


Figure A2 Relationships between log-transformed Sørensen's index and spatial distances for the species with small (Q1), medium (Q2), large (Q3) and very large (Q4) ranges. From top down, the four rows represented Q1, Q2, Q3, and Q4, respectively. From the left to the right, the three columns showed the relationships between non-directional, longitudinal and latitudinal Sørensen's index and spatial distances, respectively.



Supplementary literature cited

Nekola, J. C. and White, P. S. 1999. The distance decay of similarity in biogeography and ecology. — J. Biogeogr. 26: 867-878.

Qian, H. and Ricklefs, R. E. 2007. A latitudinal gradient in large-scale beta diversity for vascular plants in North America. — Ecol. Lett. 10: 737-744.

Appendix 2 Variance inflation factors (VIF) of the models explaining non-directional, latitudinal and longitudinal Sørensen's similarity index in terms of environmental distances. Here, environmental distances between grid cells included the distance of environmental energy (D_{ene}), water availability (D_{wat}), climatic variability (D_{cv}), habitat heterogeneity (D_{hh}) and human activities (D_{ha}). VIF of all predictors in all models were smaller than 3, indicating insignificant multiple collinearity in the environmental models.

Models	VIF of different predictors				
	D_{ene}	D_{wat}	D_{cv}	D_{hh}	D_{ha}
Non-directional					
All species	1.35	1.49	1.58	1.03	1.04
Q1	1.49	1.91	1.66	1.52	1.14
Q2	1.53	1.81	1.48	1.45	1.05
Q3	1.51	1.57	1.46	1.26	1.03
Q4	1.35	1.48	1.57	1.03	1.04
Latitudinal					
All species	1.89	2.58	2.86	1.13	1.11
Q1	1.90	2.30	2.28	1.27	1.17
Q2	2.20	2.40	1.91	1.40	1.09
Q3	1.71	2.14	1.89	1.28	1.07
Q4	1.86	2.53	2.80	1.13	1.10
Longitudinal					
All species	1.59	1.53	1.80	1.19	1.25
Q1	1.77	1.81	1.75	1.54	1.20
Q2	1.88	1.84	1.62	1.69	1.07
Q3	1.91	1.76	2.00	1.50	1.07
Q4	1.58	1.51	1.78	1.18	1.25

Appendix 3 Geographical patterns of pure spatial and environmental effects, spatially structured environmental effects, and residual variance estimated by partial regression models explaining non-directional, longitudinal and latitudinal Sørensen's similarity index.

Figure A1 Patterns of pure spatial effects (column 1), spatially structured environmental effects (column 2), pure environmental effects (column 3), and residual variance (column 4) for the beta diversity of all woody species. From Top down, the three rows showed the patterns for non-directional (a, b, c, and d), latitudinal (e, f, g, and h) and longitudinal Sørensen's similarity index (i, j, k, and l), respectively.

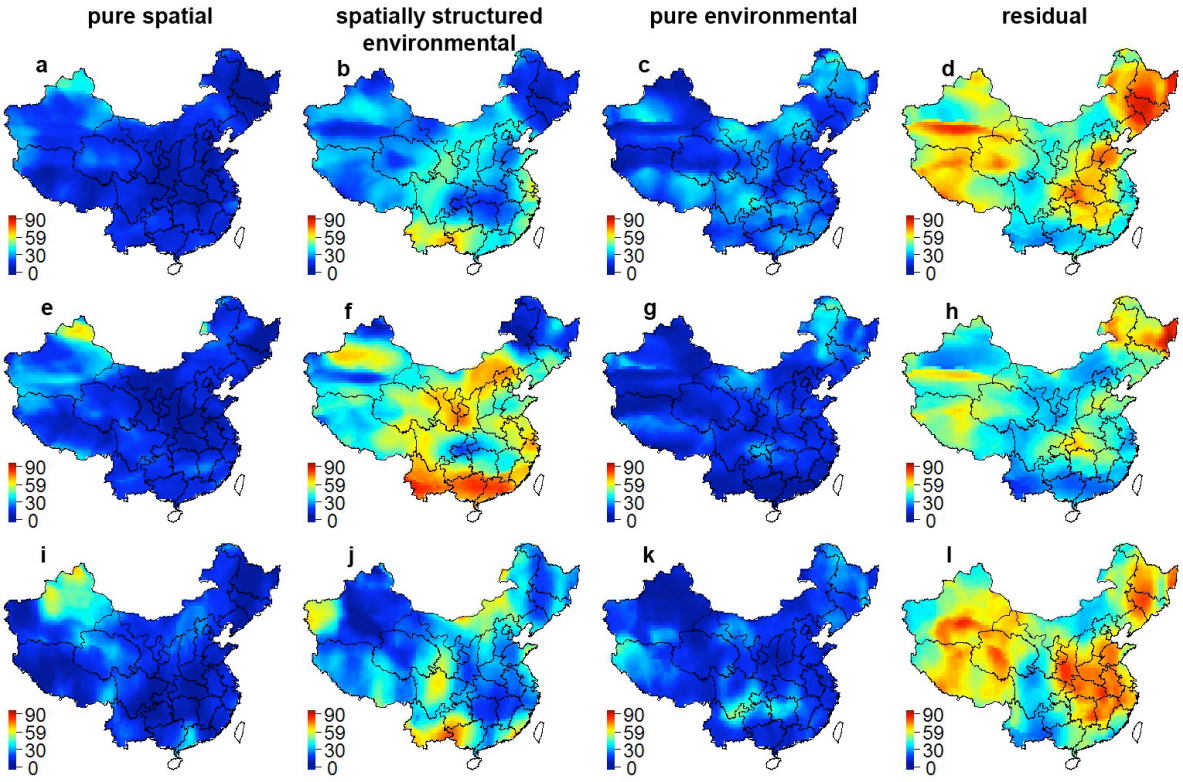


Figure A2 Patterns of pure spatial effects (column 1), spatially structured environmental effects (column 2), pure environmental effects (column 3), and residual variance (column 4) on the beta diversity of the species with small ranges (i.e. Q1 species). From Top down, the three rows showed the patterns for non-directional (a, b, c, and d), latitudinal (e, f, g, and h) and longitudinal Sørensen's similarity index (i, j, k, and l), respectively.

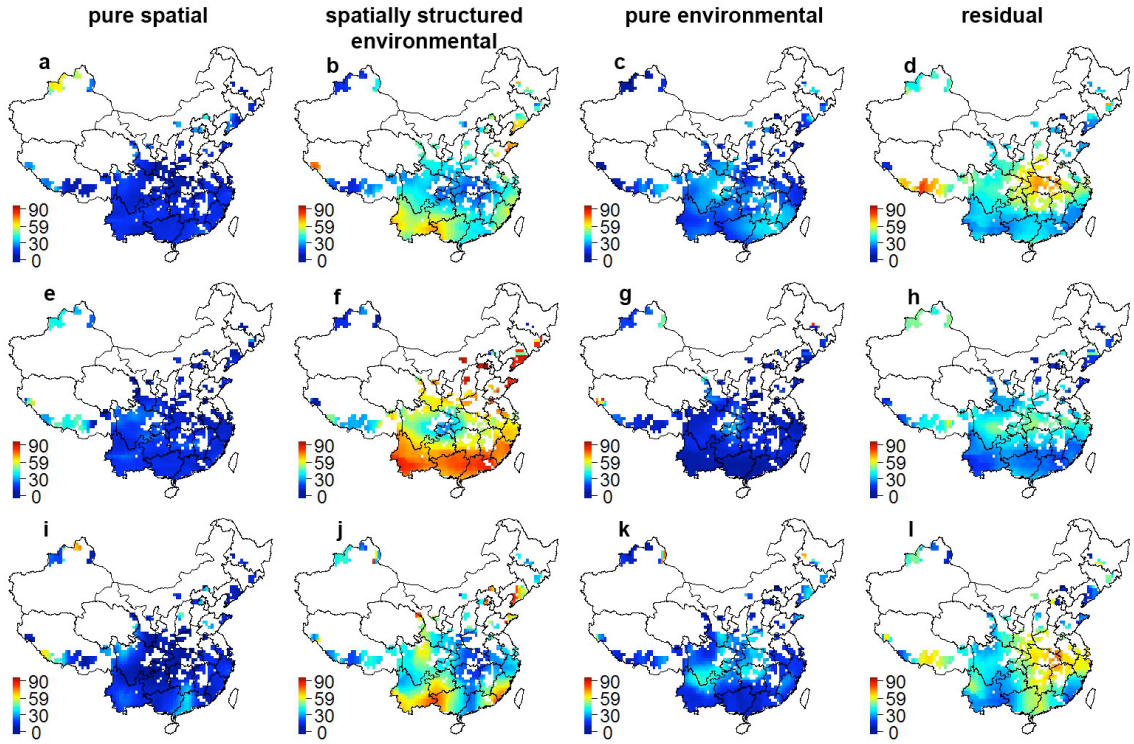


Figure A3 Patterns of pure spatial effects (column 1), spatially structured environmental effects (column 2), pure environmental effects (column 3), and residual variance (column 4) on the beta diversity of the species with medium ranges (i.e. Q2 species). From Top down, the three rows showed the patterns for non-directional (a, b, c, and d), latitudinal (e, f, g, and h) and longitudinal Sørensen's similarity index (i, j, k, and l), respectively.

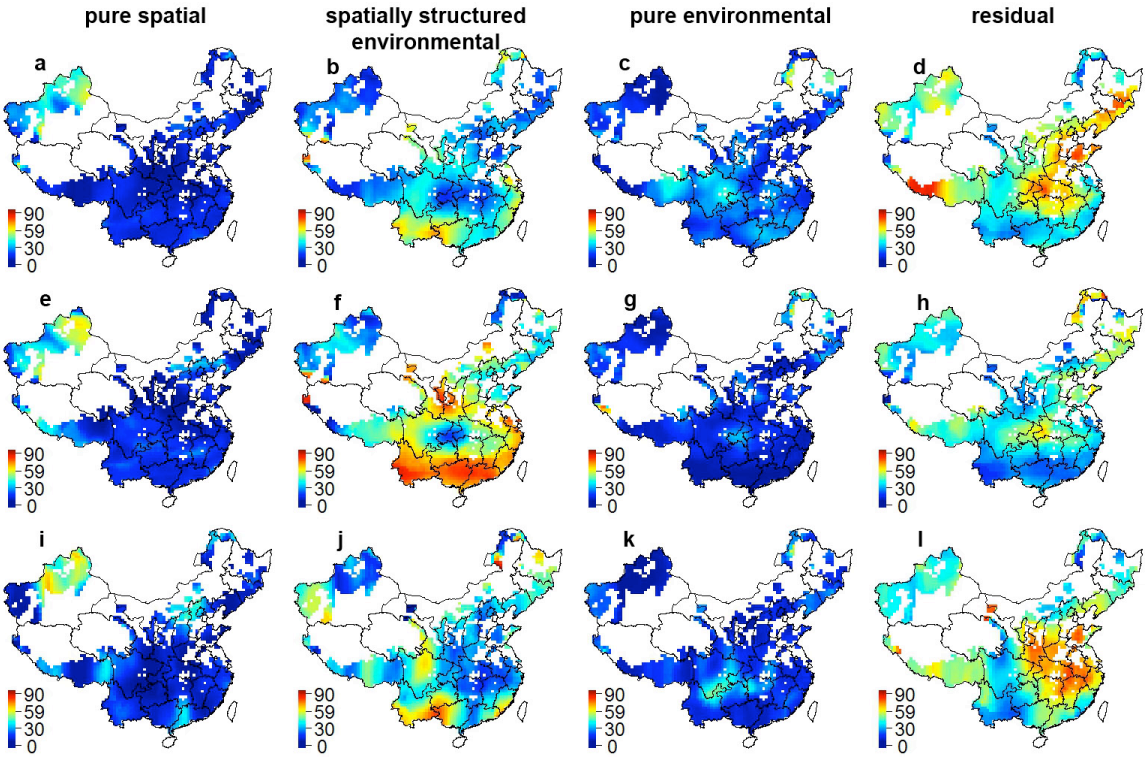


Figure A4 Patterns of pure spatial effects (column 1), spatially structured environmental effects (column 2), pure environmental effects (column 3), and residual variance (column 4) on the beta diversity of the species with large ranges (i.e. Q3 species). From Top down, the three rows showed the patterns for non-directional (a, b, c, and d), latitudinal (e, f, g, and h) and longitudinal Sørensen's similarity index (i, j, k, and l), respectively.

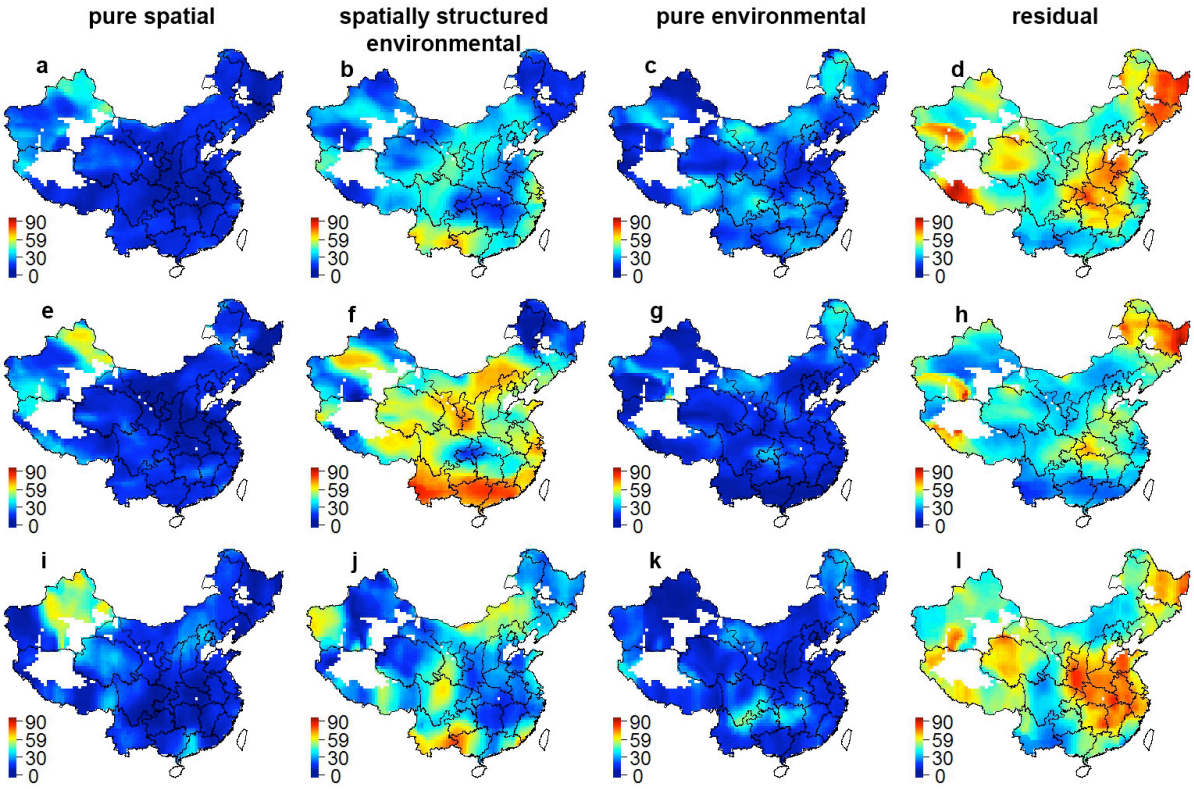
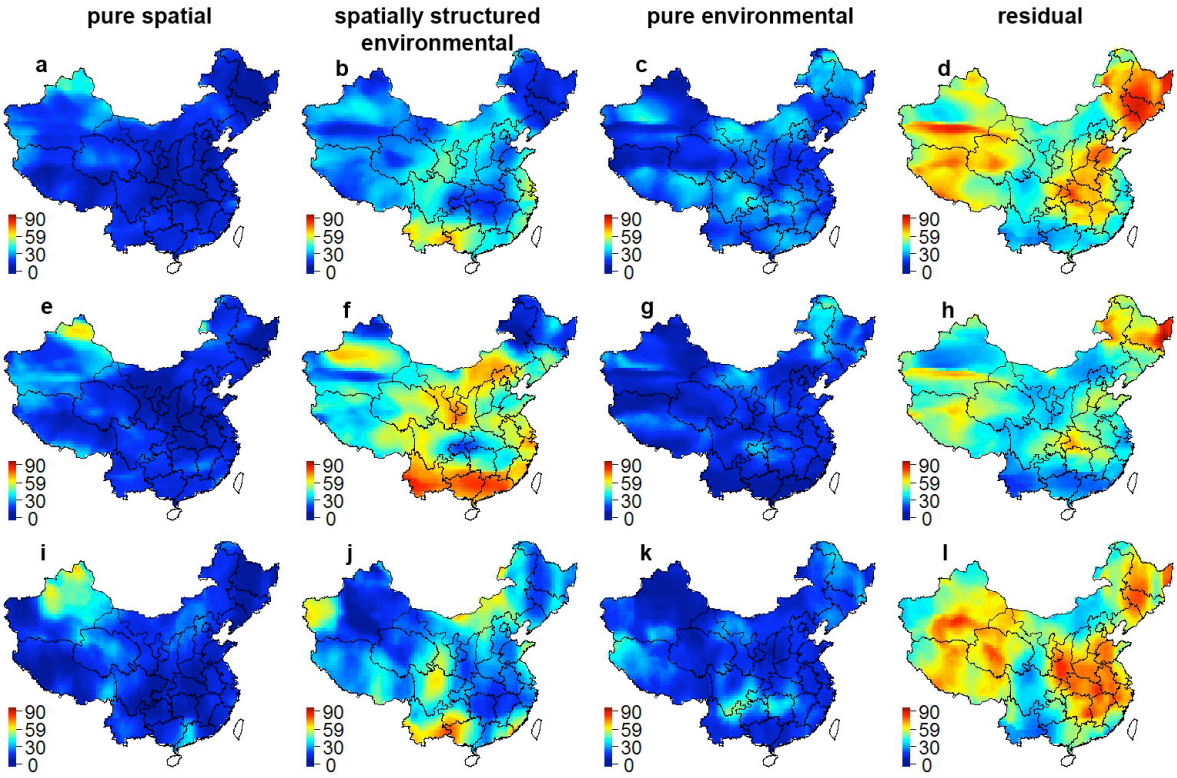


Figure A5 Patterns of pure spatial effects (column 1), spatially structured environmental effects (column 2), pure environmental effects (column 3), and residual variance (column 4) on the beta diversity of the species with very large ranges (i.e. Q4 species). From Top down, the three rows showed the patterns for non-directional (a, b, c, and d), latitudinal (e, f, g, and h) and longitudinal Sørensen's similarity index (i, j, k, and l), respectively.



Appendix 4 The numbers and proportions of the grid cells where environmental or spatial distances are the better predictor of non-directional, longitudinal, and latitudinal species similarity. Q1 – Q4, the species with small, medium, large and very large ranges, respectively.

	Total number of grid cells	Environmental distance		Spatial distance	
		Grid cell number	Proportion (%)	Grid cell number	Proportion (%)
Non-directional beta diversity					
Q1	1318	500	37.9	818	62.1
Q2	2207	482	21.8	1725	78.2
Q3	3310	1066	32.2	2244	67.8
Q4	3794	2807	74.0	987	26.0
All species	3794	2874	75.8	920	24.2
Longitudinal beta diversity					
Q1	1318	407	30.9	911	69.1
Q2	2207	657	29.8	1550	70.2
Q3	3310	1153	34.8	2157	65.2
Q4	3794	2248	59.3	1546	40.7
All species	3794	2174	57.3	1620	42.7
Latitudinal beta diversity					
Q1	1318	508	38.6	809	61.4
Q2	2207	791	35.8	1416	64.2
Q3	3310	1205	36.4	2105	63.6
Q4	3794	1853	48.8	1941	51.2
All species	3794	1847	48.7	1947	51.3

Appendix 5 Correlation analyses between the species turnover of all species and those of the species with different range size (Q1 - Q4). Panel a, correlation coefficients for the richness of shared species between grid cells; panel b, correlation coefficients for the Sørensen's similarity index between grid cells. The richness of species shared by two grid cells is calculated as the number of species that occur in both grid cells. Q1 – Q4, the species with small, medium, large and very large ranges, respectively. P values in the table were estimated using Mantel test.

	non-directional		*longitudinal*		*latitudinal*	
	r	*p*	*r*	*p*	*r*	*p*
Panel a: Shared species richness						
Q1	0.382	<0.001	0.441	<0.001	0.445	<0.001
Q2	0.407	<0.001	0.506	<0.001	0.520	<0.001
Q3	0.633	<0.001	0.730	<0.001	0.764	<0.001
Q4	0.994	<0.001	0.986	<0.001	0.984	<0.001
Panel b: Sørensen index						
Q1	0.181	<0.001	0.390	<0.001	0.423	<0.001
Q2	0.313	<0.001	0.520	<0.001	0.563	<0.001
Q3	0.544	<0.001	0.687	<0.001	0.766	<0.001
Q4	0.994	<0.001	0.994	<0.001	0.996	<0.001

Appendix 6 Analysis constrained within the grid cells where the species with small (Q1), medium (Q2), large (Q3) and very large (Q4) ranges overlapped with each other. The analysis showed consistent results with those calculated using all grid cells of each species group.

Table A1 Beta diversity estimated within the grid cells where the distributions of the four species quartiles (i.e. Q1-Q4) overlapped. Q1-Q4, the four quartiles of species with small, medium, large and very large ranges. In total, 1318 grid cells were overlapped between the four quartiles. The results were consistent with those calculated within all grid cells of each species quartile.

	β (1000 km^{-1})	SE	p
Non-directional			
All species	-1.447	1.488e-03	<0.001
Q1	-2.519	7.640E-03	<0.001
Q2	-1.903	7.415E-03	<0.001
Q3	-2.055	3.462E-03	<0.001
Q4	-1.400	1.471E-03	<0.001
Longitudinal			
All species	-1.244	7.554e-03	<0.001
Q1	-4.510	3.208E-02	<0.001
Q2	-2.680	2.922E-02	<0.001
Q3	-2.383	1.436E-02	<0.001
Q4	-1.171	7.662E-03	<0.001
Latitudinal			
All species	-1.990	1.153e-02	<0.001
Q1	-7.141	4.938E-02	<0.001
Q2	-5.462	6.342E-02	<0.001
Q3	-4.215	2.580E-02	<0.001
Q4	-1.823	1.069E-02	<0.001

Table A2 Correlation coefficients of the beta diversity patterns of all species with those of the species with small (Q1), medium (Q2), large (Q3) and very large (Q4) ranges. The effective degrees of freedom (df), and F and p values were estimated by modified t test (Dutilleul, P. et al. 1993).

	Non-directional				Latitudinal				Longitudinal			
	r	df	F	p	r	df	F	p	r	df	F	p
Q1	0.62	18.61	11.83	0.003	0.29	26.86	2.48	0.127	0.24	37.46	2.29	0.138
Q2	0.46	14.16	3.71	0.074	0.58	11.06	5.57	0.038	0.52	31.77	11.51	0.002
Q3	0.25	12.28	0.85	0.373	0.57	15.73	7.62	0.014	0.72	49.72	52.91	<0.001
Q4	0.98	8.80	216.06	<0.001	0.98	8.26	221.11	<0.001	0.98	18.98	366.67	<0.001

Supplementary literature cited

Dutilleul, P. et al. 1993. Modifying the t test for assessing the correlation between two spatial processes. — Biometrics 49: 305-314.