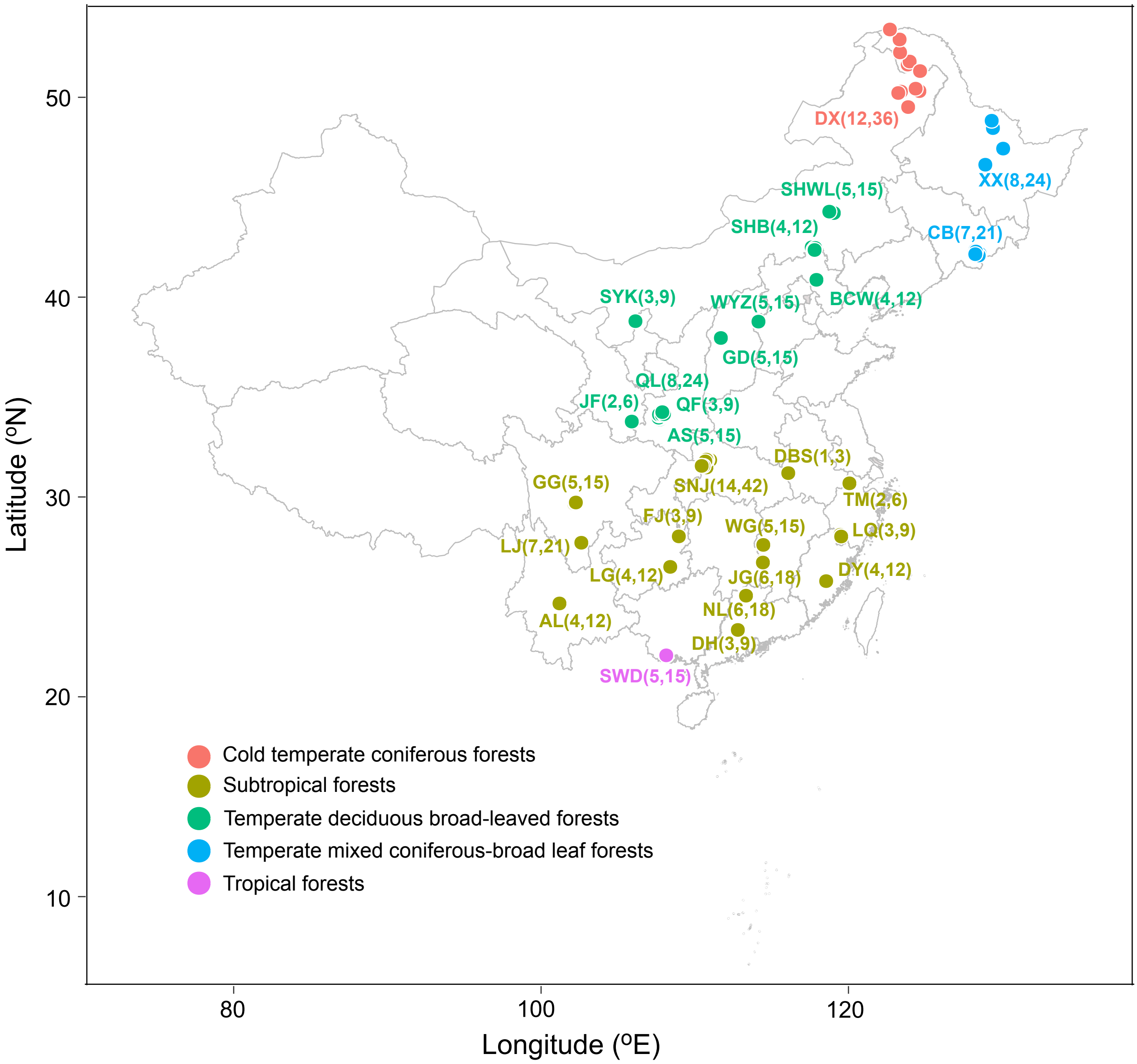

FIGURE S1 Spatial distribution of the forest reserves. In this study, a total of 429 soil samples were used to represent the soil bacterial communities and soil properties of 143 sites from 28 natural forest reserves across eastern China. The numbers in bracket denote the numbers of sites and samples we used in each natural forest reserve (#sites,#samples). The abbreviations for the names of the natural forest reserves are shown in TABLE S1.

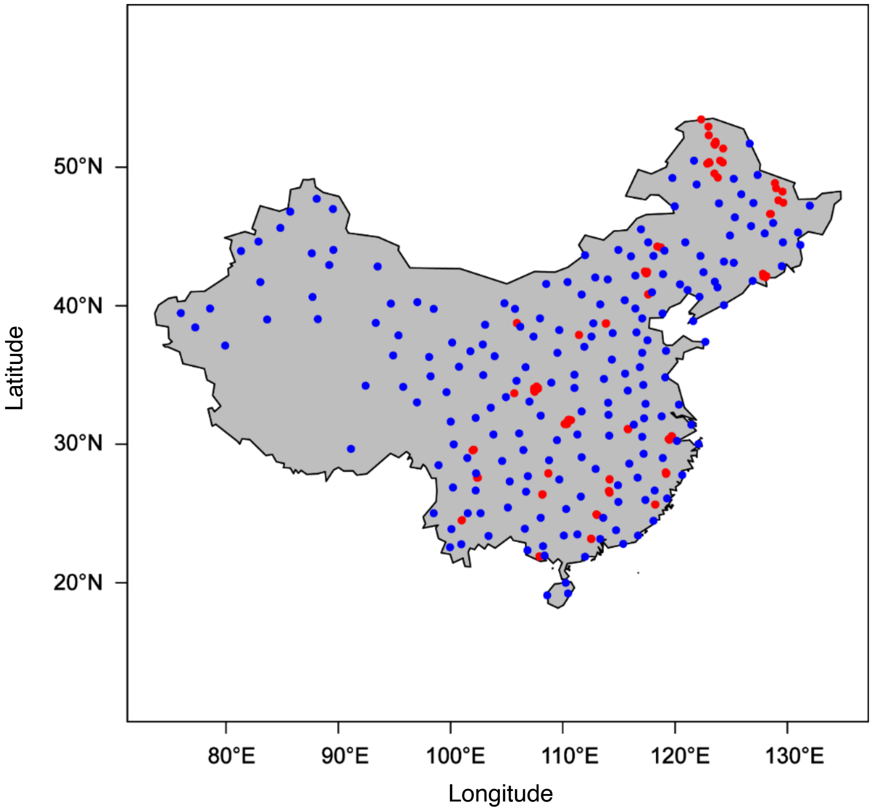

FIGURE S2 Spatial distributions of 194 weather stations (blue dots) across China and 143 forest sites (red dots) in this study.

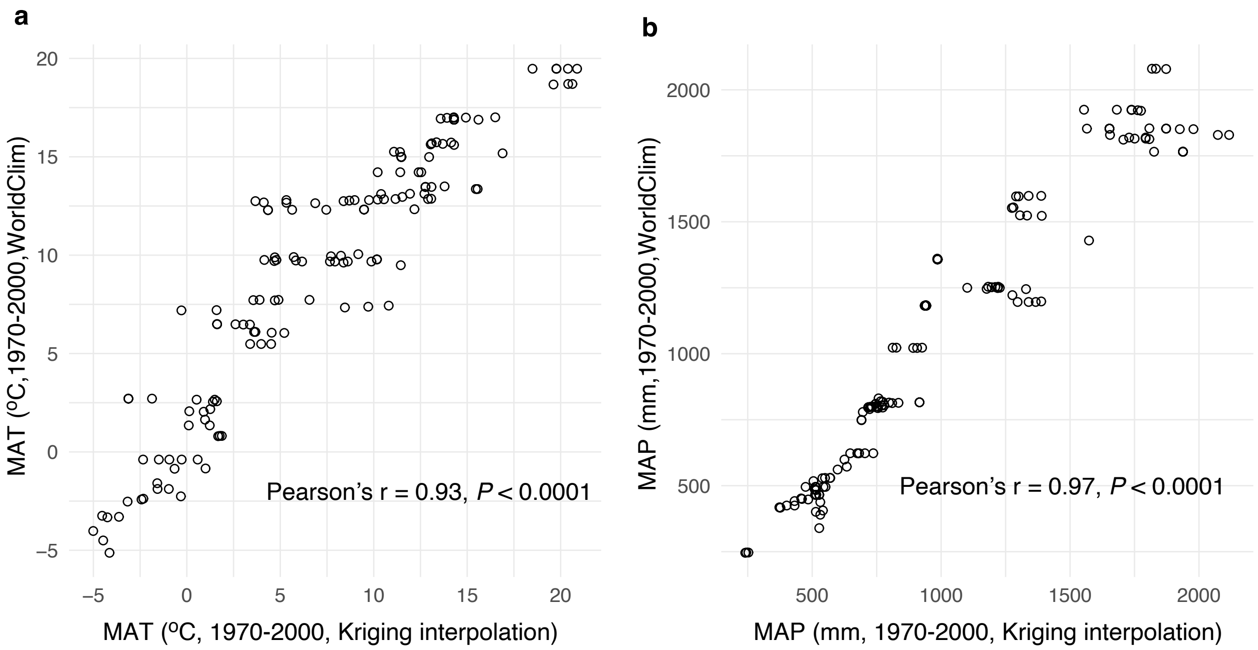

FIGURE S3 Comparison of mean annual temperature (MAT, **a**) and mean annual precipitation (MAP, **b**) between datasets for the 143 forest sites during the period from 1970 to 2000. Values of MAT and MAP calculated based on the kriging interpolation method in this study were compared against those from historical climate data in 'WorldClim' public climate database v2.1 (https://www.worldclim.org/data/index.html). The monthly climate data in 'WorldClim' for mean temperature and precipitation that were corrected by elevation were downloaded at high spatial resolution (30 seconds, ~1 km^2). Because the historical climate dataset in 'WorldClim' was compiled for 1970-2000, the comparison was focused on this period. Monthly values were extracted based on the site locations (TABLE S1). For each site, we calculated the AMT and AP of each year and then calculated the MAT and MAP during the period from 1970 to 2000. Accordingly, the MAT and MAP based on datasets using the kriging interpolation method were also calculated for 1970-2000.

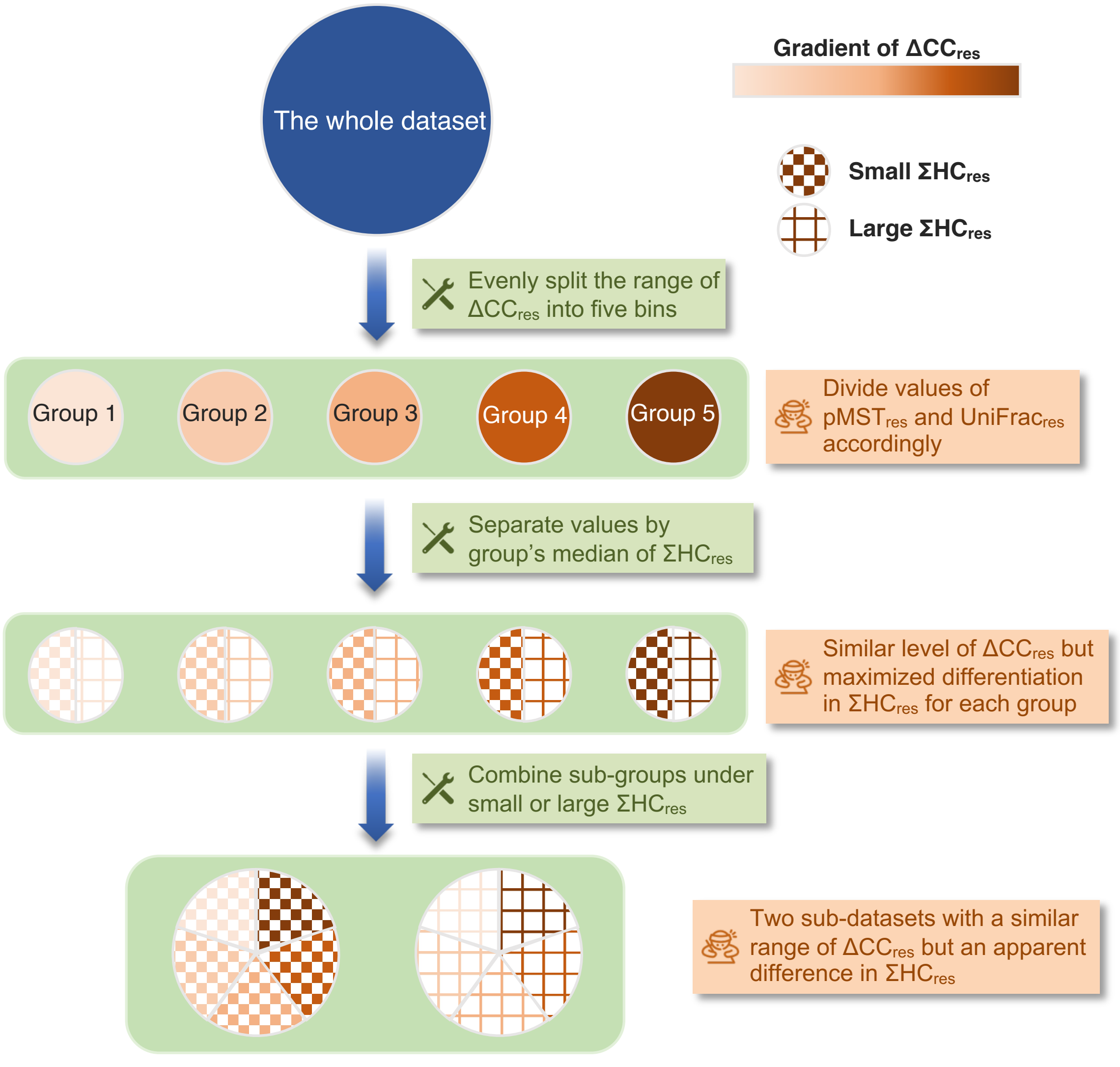

FIGURE S4 Clustering of two sub-datasets based on different levels of ΔCC_{res} and ΣHC_{res}. The residuals of ΔCC and ΣHC were calculated to represent the partial effects of ΔCC and ΣHC (see details in Methods). To better understand the effect of ΣHC_{res} along the whole gradient of ΔCC_{res}, we clustered the whole dataset into two sub-datasets based on different levels of ΔCC_{res} and ΣHC_{res} for subsequent analyses. Particularly, for each climate factor, we first evenly split the range of ΔCC_{res} into five bins and divided the values of $pMST_{res}$ and $UniFrac_{res}$ into five groups accordingly. We then separated each group's values into two sub-groups based on the group's median of ΣHC_{res}. By doing so, the level of ΔCC_{res} between the two sub-groups remained similar while the differentiation in ΣHC_{res} was maximized. We combined all the sub-groups under small or large ΣHC_{res} (i.e., low and high levels of ΣHC_{res} according to the group's median), respectively, to generate two sub-datasets with a similar range of ΔCC_{res} but an apparent difference in ΣHC_{res}. To test whether this arbitrary clustering may influence the results, we repeated this procedure to form different pairs of sub-datasets by evenly splitting the range of ΔCC_{res} into 10, 15, and 20 bins, respectively, and re-conducted the subsequent analyses. A total of 9750 data points were used in the analyses, and the numbers of data points in each bin were shown in TABLE S3 and TABLE S4. ΔCC_{res}: residuals of inter-site difference of current climate conditions. ΣHC_{res}: residuals of the sum of intra-site historical climate variability.

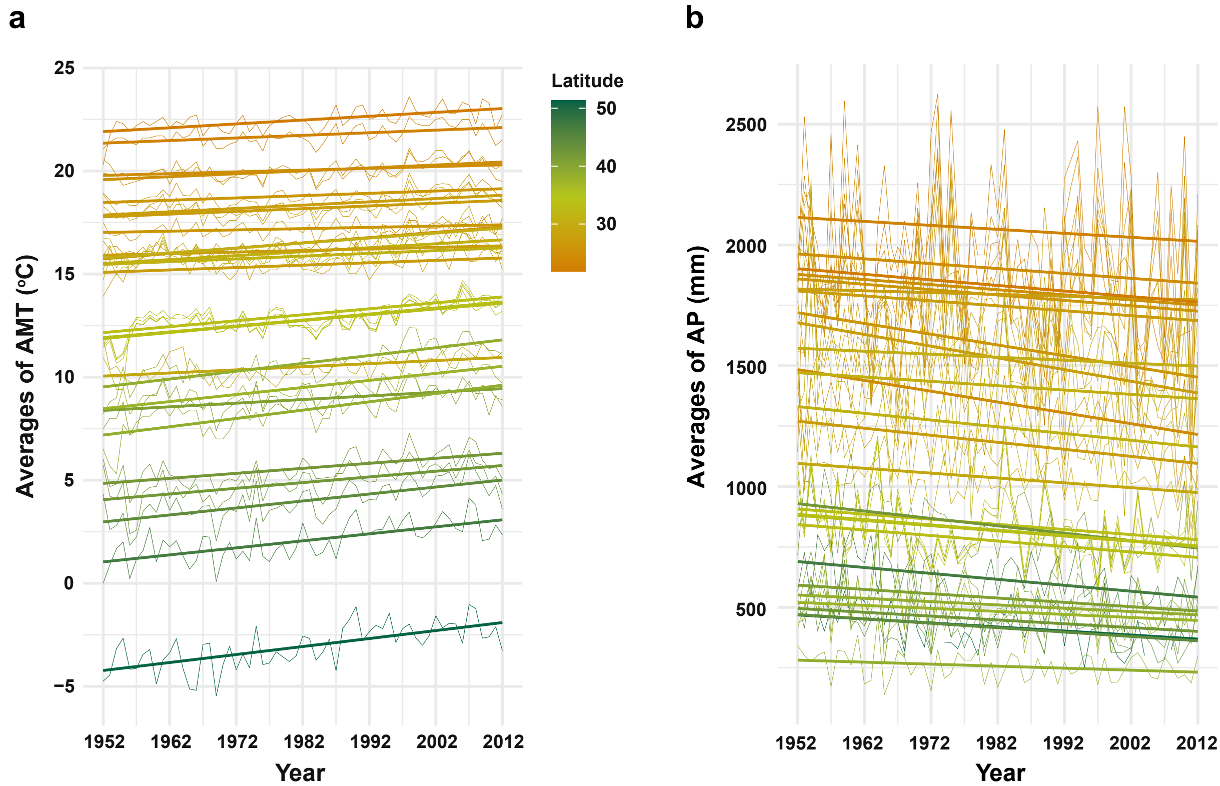

FIGURE S5 Temporal fluctuations of climate factors along the latitudinal gradient from 1952 to 2012. The yearly averages of annual mean temperature (AMT, **a**) and annual precipitation (AP, **b**) were calculated based on the sites within each forest reserve. Different lines repersent different forest reserves (28 forest reserves) and the colors show the latitudinal gradient. The regression lines are based on the linear model.

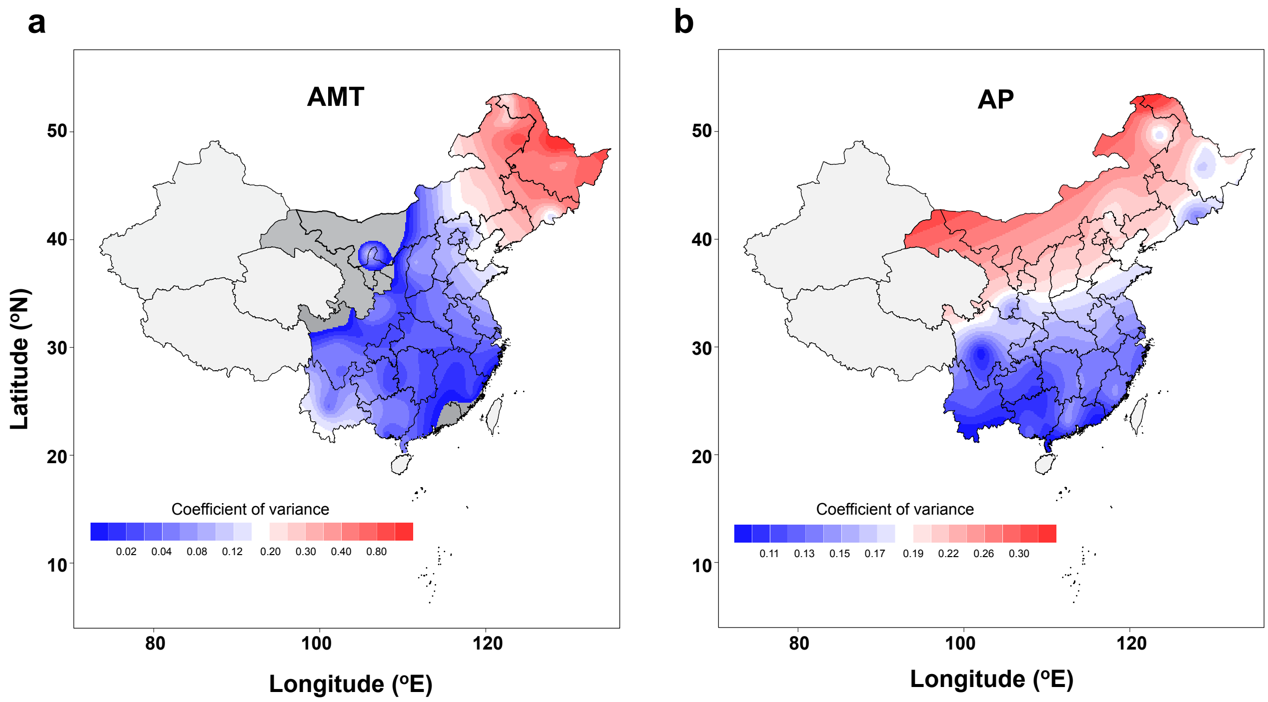

FIGURE S6 Spatial patterns of the coefficient of variation for the annual mean temperature and annual precipitation over a 60-year period from 1952 to 2012. Spatial interpolation of the coefficient of variation of annual mean temperature (AMT, **a**) and annual precipitation (AP, **b**) was performed by using kriging. Color key shows the gradient of values for the coefficient of variation. Grey areas in (**a**) suggest that the interpolated values were negative and not shown.

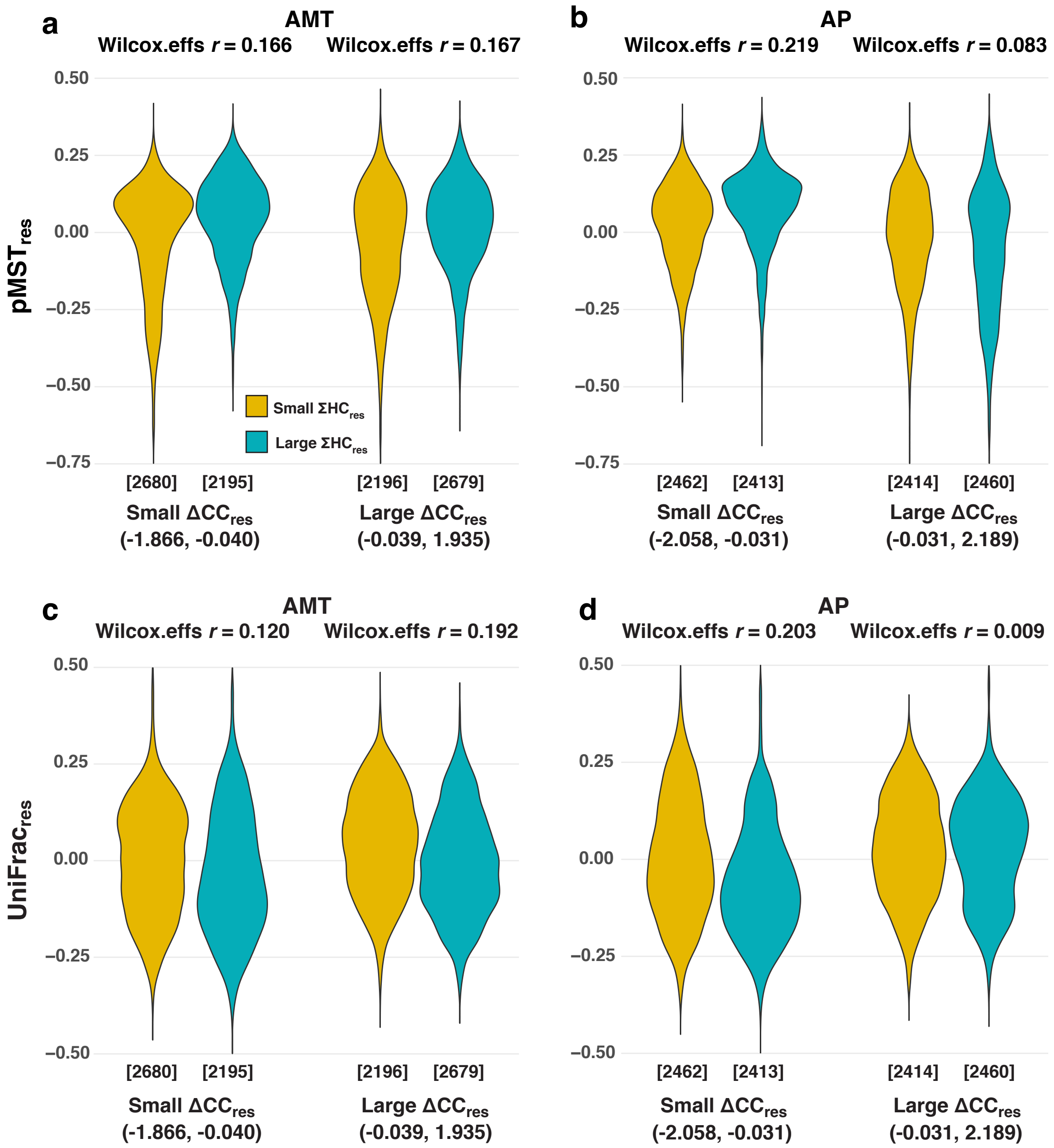

FIGURE S7 Disproportional influences of large ΣHC_{res} at different levels of ΔCC_{res}. The low and high levels of ΔCC_{res} were determined by evenly splitting the range of ΔCC_{res} for each climate factor and the range of each level was shown in brackets. Accordingly, the numbers of data points in low and high levels of ΣHC_{res} were shown in square brackets. At each level of ΔCC_{res}, the magnitude of differences in $pMST_{res}$ (**a**,**b**) and $UniFrac_{res}$ (**c**,**d**) between small and large ΣHC_{res} was evaluated by the effect size for Wilcoxon rank-sum test (Wilcox.effs *r*), including ‘negligible’ ($|r| < 0.1$), ‘small’ ($0.1 \leq |r| < 0.3$), ‘moderate’ ($0.3 \leq |r| < 0.5$), and ‘large’ ($|r| \geq 0.5$). $pMST_{res}$: residuals of the impact of stochasticity; $UniFrac_{res}$: residuals of the weighted UniFrac distance; ΔCC_{res}: residuals of the inter-site difference of current climate conditions; ΣHC_{res}: residuals of the sum of intra-site historical climate variability. See details of residual calculation in Methods.

TABLE S1 Spatial location, current climate conditions and historical climate variability for the 143 sites from the 28 natural forest reserves in this study. The latitude (Lat), longitude (Lon), and elevation (Ele) of each site were recorded by a portable GPS machine. We predicted the yearly annual mean temperature (AMT, °C) and annual precipitation (AP, mm) for each site by applying the kriging interpolation method. We used the interpolated climate data of 2012 (i.e., AMT.2012 and AP.2012) to represent the current climate conditions (CC) of each site, while we defined the intra-site historical climate variability (HC) of different climate factors as the coefficient of variation (i.e., ratio of standard deviation to mean, CV) using the interpolated values over the 60-year period (i.e., AMT.CV and AP.CV). The MAT and MAP over the 60-year period were also calculated for each site (i.e., MAT.60yrs and MAP.60yrs that were calculated as the means of 61 yearly AMT or AP). The AMT and AP of 2012 were found to be strongly and significantly correlated to their long-term averages (AMT.2012 vs. MAT.60yrs: $r = 0.99$, $P < 0.0001$; AP.2012 vs. MAP.60yrs: $r = 0.97$, $P < 0.0001$; Pearson correlation). Results of Mantel tests further suggested that the inter-site difference of current climate conditions (ΔCC) could reflect the inter-site differentiation in the long-term average effect of environmental stress on the microbial communities (AMT.2012 vs. MAT.60yrs: $r = 0.99$, $P < 0.001$; AP.2012 vs. MAP.60yrs: $r = 0.92$, $P < 0.001$; Mantel test). In this study, although we mainly focused on the potential effect from historical climate fluctuation on the assembly of soil bacterial communities, the influence of seasonal dynamics of climate conditions at the annual timescale could also alter the microbial communities. Thus, for each site, we calculated the CV of the monthly values of each year, and then calculated the mean of 61 CV values over the 60-year period to estimate the intra-site annual climate variation (TEM.CV and PRE.CV indicate the means of annual variations of temperature and precipitation, respectively).

Site	Forest reserve	Lon (°E)	Lat (°N)	Ele (m)	AMT. 2012	MAT. 60yrs	AMT. CV	TEM. CV	AP. 2012	MAP. 60yrs	AP. CV	PRE. CV
AL1	Ailao Mountain	101.033	24.533	2655	17.7	16.5	0.035	0.458	985	1349	0.123	1.102
AL2	Ailao Mountain	101.031	24.534	2570	17.7	16.5	0.035	0.458	985	1349	0.123	1.102
AL3	Ailao Mountain	101.029	24.536	2500	17.7	16.5	0.035	0.458	985	1349	0.123	1.102
AL4	Ailao Mountain	101.014	24.513	2407	17.7	16.5	0.035	0.458	989	1352	0.123	1.102
AS1	Aoshan Mountain	107.467	33.858	1720	13.9	13.0	0.055	0.591	731	842	0.169	0.997
AS2	Aoshan Mountain	107.500	33.788	1260	14.0	13.1	0.054	0.591	744	855	0.169	0.997
AS3	Aoshan Mountain	107.486	33.849	1530	13.9	13.0	0.054	0.591	733	844	0.169	0.997
AS4	Aoshan Mountain	107.443	33.876	2140	13.8	13.0	0.055	0.591	728	839	0.168	0.997
AS5	Aoshan Mountain	107.411	33.879	2470	13.8	13.0	0.055	0.591	728	837	0.168	0.997
BCW1	Baicaowa	117.606	40.815	1710	8.6	8.9	0.075	0.582	656	539	0.197	1.328
BCW2	Baicaowa	117.613	40.822	1580	8.6	8.9	0.075	0.582	655	539	0.197	1.328
BCW3	Baicaowa	117.610	40.828	1360	8.6	8.9	0.075	0.582	655	538	0.197	1.328
BCW5	Baicaowa	117.597	40.831	1121	8.5	8.9	0.075	0.582	654	538	0.197	1.328
CB2	Changbai Mountain	128.130	42.140	1250	5.1	5.6	0.124	0.542	941	837	0.138	1.141
CB3	Changbai Mountain	128.066	42.075	1700	5.1	5.6	0.123	0.542	948	843	0.138	1.141
CB4	Changbai Mountain	128.067	42.057	1995	5.1	5.6	0.123	0.542	950	845	0.138	1.141

CB5	Changbai Mountain	128.067	42.057	2000	5.1	5.6	0.123	0.542	950	845	0.138	1.141
CB6	Changbai Mountain	127.832	42.302	1025	5.0	5.5	0.131	0.542	924	824	0.140	1.141
CB7	Changbai Mountain	127.887	42.257	1030	5.0	5.5	0.129	0.542	929	828	0.140	1.141
CB8	Changbai Mountain	127.847	42.123	1050	5.1	5.6	0.126	0.542	944	840	0.140	1.141
DBS3	Dabie Mountain	115.777	31.085	1050	16.1	16.1	0.037	0.541	1420	1417	0.157	0.790
DH1	Dinghu Mountain	112.539	23.168	210	21.5	21.7	0.020	0.454	2073	2065	0.146	0.908
DH2	Dinghu Mountain	112.531	23.172	320	21.5	21.7	0.020	0.454	2073	2065	0.146	0.908
DH3	Dinghu Mountain	112.524	23.177	586	21.5	21.7	0.020	0.454	2073	2064	0.146	0.908
DX12	Daxing'anling	123.524	51.634	940	-3.5	-3.4	0.314	0.544	371	393	0.248	1.354
DX13	Daxing'anling	123.488	51.682	630	-3.6	-3.4	0.309	0.544	364	388	0.251	1.354
DX14	Daxing'anling	123.610	51.837	860	-3.6	-3.5	0.310	0.544	348	377	0.262	1.354
DX15	Daxing'anling	122.992	52.297	950	-4.3	-4.2	0.260	0.544	272	324	0.315	1.354
DX16	Daxing'anling	122.962	52.949	590	-4.9	-4.7	0.240	0.544	183	287	0.380	1.354
DX17	Daxing'anling	122.337	53.453	360	-5.7	-5.3	0.215	0.544	100	226	0.445	1.354
DX2	Daxing'anling	123.514	49.541	446	-1.3	-1.0	0.970	0.544	549	513	0.171	1.354
DX3	Daxing'anling	124.242	50.344	500	-1.8	-1.7	0.597	0.544	513	490	0.188	1.354
DX4	Daxing'anling	123.050	50.321	605	-2.8	-2.5	0.381	0.544	493	475	0.190	1.354
DX5	Daxing'anling	122.878	50.251	645	-2.9	-2.5	0.373	0.544	495	475	0.189	1.354
DX7	Daxing'anling	123.999	50.470	520	-2.1	-2.0	0.504	0.544	499	480	0.192	1.354
DX8	Daxing'anling	124.282	51.356	655	-2.7	-2.7	0.409	0.544	421	428	0.228	1.354
DY1	Daiyun Mountain	118.222	25.643	1180	20.3	20.0	0.023	0.457	2010	1815	0.144	0.795
DY2	Daiyun Mountain	118.221	25.648	1335	20.3	20.0	0.023	0.457	2011	1815	0.144	0.795
DY3	Daiyun Mountain	118.224	25.649	1510	20.3	20.0	0.023	0.457	2012	1815	0.144	0.795
DY6	Daiyun Mountain	118.224	25.639	1100	20.3	20.0	0.023	0.457	2010	1815	0.144	0.795
FJ2	Fanjing Mountain	108.702	27.907	2095	15.2	16.1	0.024	0.527	1500	1532	0.115	0.773
FJ3	Fanjing Mountain	108.708	27.899	1803	15.2	16.1	0.024	0.527	1501	1532	0.115	0.773
FJ4	Fanjing Mountain	108.715	27.896	1482	15.2	16.1	0.024	0.527	1501	1533	0.115	0.773
GD1	Guandi Mountain	111.444	37.888	2346	9.7	9.5	0.082	0.542	469	483	0.206	1.279
GD2	Guandi Mountain	111.442	37.888	1310	9.7	9.5	0.082	0.542	469	483	0.206	1.279
GD3	Guandi Mountain	111.427	37.885	2200	9.7	9.5	0.082	0.542	469	483	0.206	1.279
GD4	Guandi Mountain	111.437	37.893	2065	9.7	9.5	0.082	0.542	469	483	0.206	1.279
GD5	Guandi Mountain	111.429	37.898	1870	9.7	9.5	0.083	0.542	469	482	0.206	1.279

GG1	Gongga Mountain	101.958	29.544	4167	11.1	10.4	0.057	0.528	1049	1035	0.092	1.029
GG2	Gongga Mountain	101.961	29.546	3966	11.1	10.4	0.057	0.528	1049	1035	0.092	1.029
GG3	Gongga Mountain	102.025	29.586	2760	11.2	10.5	0.057	0.528	1049	1035	0.091	1.029
GG4	Gongga Mountain	102.044	29.596	2369	11.3	10.6	0.057	0.528	1049	1035	0.091	1.029
GG5	Gongga Mountain	102.071	29.603	2060	11.4	10.6	0.057	0.528	1050	1036	0.091	1.029
JF1	Jifeng Mountain	105.682	33.687	1900	13.2	12.7	0.069	0.554	728	774	0.146	1.006
JF2	Jifeng Mountain	105.680	33.684	1785	13.2	12.8	0.070	0.554	728	775	0.146	1.006
JG1	Jinggang Mountain	114.163	26.500	1321	18.7	18.9	0.022	0.516	2084	1796	0.144	0.762
JG2	Jinggang Mountain	114.168	26.505	1310	18.7	18.9	0.022	0.516	2084	1796	0.144	0.762
JG3	Jinggang Mountain	114.126	26.604	1350	18.6	18.8	0.022	0.516	2080	1790	0.143	0.762
JG4	Jinggang Mountain	114.124	26.550	925	18.6	18.8	0.022	0.516	2081	1793	0.143	0.762
JG5	Jinggang Mountain	114.106	26.632	1055	18.6	18.7	0.022	0.516	2079	1789	0.143	0.762
JG6	Jinggang Mountain	114.142	26.577	1000	18.6	18.8	0.022	0.516	2081	1792	0.143	0.762
LG1	Leigong Mountain	108.207	26.384	2155	16.3	17.2	0.021	0.420	1559	1587	0.110	0.896
LG3	Leigong Mountain	108.199	26.376	1715	16.3	17.2	0.021	0.420	1558	1587	0.110	0.896
LG4	Leigong Mountain	108.181	26.371	1535	16.3	17.2	0.021	0.420	1556	1585	0.110	0.896
LG5	Leigong Mountain	108.162	26.357	1223	16.3	17.2	0.021	0.420	1555	1585	0.110	0.896
LJ1	Luoji Mountain	102.380	27.578	3580	16.3	15.4	0.032	0.473	1118	1183	0.112	1.114
LJ2	Luoji Mountain	102.384	27.582	3390	16.3	15.4	0.032	0.473	1119	1183	0.112	1.114
LJ3	Luoji Mountain	102.393	27.583	3080	16.3	15.4	0.032	0.473	1119	1183	0.112	1.114
LJ4	Luoji Mountain	102.399	27.579	2670	16.3	15.4	0.032	0.473	1119	1183	0.112	1.114
LJ5	Luoji Mountain	102.367	27.572	3830	16.3	15.4	0.032	0.473	1117	1183	0.112	1.114
LJ6	Luoji Mountain	102.374	27.572	3700	16.3	15.4	0.032	0.473	1117	1183	0.112	1.114
LJ7	Luoji Mountain	102.424	27.574	2200	16.3	15.5	0.032	0.473	1119	1184	0.112	1.114
LQ1	Longquan Mountain	119.142	27.975	380	18.4	18.3	0.027	0.524	2214	1795	0.140	0.766
LQ4	Longquan Mountain	119.196	27.904	1240	18.5	18.4	0.027	0.524	2209	1795	0.139	0.766
LQ7	Longquan Mountain	119.193	27.888	1929	18.5	18.4	0.027	0.524	2209	1796	0.139	0.766
NL1	Nanling	113.015	24.914	1432	19.5	20.0	0.019	0.488	2082	1902	0.142	0.809
NL2	Nanling	113.017	24.910	1160	19.5	20.0	0.019	0.488	2082	1903	0.142	0.809
NL3	Nanling	112.993	24.948	1375	19.4	20.0	0.019	0.488	2080	1899	0.141	0.809
NL4	Nanling	113.014	24.917	1545	19.5	20.0	0.019	0.488	2082	1902	0.142	0.809
NL5	Nanling	113.025	24.895	1520	19.5	20.1	0.019	0.488	2082	1904	0.142	0.809

NL6	Nanling	113.052	24.905	800	19.5	20.1	0.019	0.488	2083	1903	0.142	0.809
QF1	Qingfeng Mountain	107.442	34.001	2100	13.6	12.8	0.055	0.591	706	819	0.168	0.997
QF2	Qingfeng Mountain	107.437	34.008	1805	13.6	12.8	0.055	0.591	704	817	0.168	0.997
QF3	Qingfeng Mountain	107.439	34.037	1530	13.5	12.7	0.056	0.591	699	813	0.168	0.997
QL1	Qinling	107.800	34.017	2350	13.7	12.8	0.055	0.566	696	827	0.170	1.056
QL10	Qinling	107.614	34.039	1030	13.6	12.8	0.055	0.566	696	818	0.169	1.056
QL2	Qinling	107.793	34.023	2145	13.7	12.8	0.055	0.566	695	826	0.170	1.056
QL3	Qinling	107.793	34.037	1865	13.7	12.8	0.055	0.566	692	824	0.170	1.056
QL4	Qinling	107.785	34.059	1545	13.6	12.8	0.055	0.566	689	820	0.170	1.056
QL6	Qinling	107.758	34.058	1450	13.6	12.8	0.055	0.566	690	820	0.170	1.056
QL7	Qinling	107.757	34.059	1335	13.6	12.8	0.055	0.566	690	819	0.170	1.056
QL9	Qinling	107.651	34.159	870	13.4	12.6	0.056	0.566	674	801	0.169	1.056
SHB1	Saihanba	117.292	42.468	1560	4.0	4.6	0.185	0.533	530	441	0.187	1.340
SHB2	Saihanba	117.512	42.440	1870	4.4	5.0	0.163	0.533	537	448	0.187	1.340
SHB3	Saihanba	117.412	42.346	1690	4.4	4.9	0.165	0.533	539	450	0.186	1.340
SHB4	Saihanba	117.478	42.335	1610	4.5	5.1	0.159	0.533	541	452	0.186	1.340
SHWL1	Saihanwula	118.707	44.191	1400	4.0	4.3	0.205	0.571	509	420	0.205	1.585
SHWL2	Saihanwula	118.718	44.197	1240	4.0	4.3	0.205	0.571	509	421	0.205	1.585
SHWL4	Saihanwula	118.414	44.269	1140	3.3	3.8	0.235	0.571	502	412	0.205	1.585
SHWL5	Saihanwula	118.417	44.268	1120	3.3	3.8	0.234	0.571	502	413	0.205	1.585
SHWL6	Saihanwula	118.427	44.269	1100	3.4	3.8	0.233	0.571	503	413	0.205	1.585
SNJ1	Shennong Jia	110.737	31.739	1110	16.0	16.0	0.030	0.546	1097	1264	0.154	0.881
SNJ11	Shennong Jia	110.308	31.489	1850	15.9	15.7	0.031	0.546	1030	1211	0.155	0.881
SNJ12	Shennong Jia	110.284	31.460	2110	16.0	15.9	0.030	0.546	1095	1259	0.154	0.881
SNJ13	Shennong Jia	110.371	31.484	2480	16.0	15.9	0.029	0.546	1102	1265	0.153	0.881
SNJ14	Shennong Jia	110.402	31.452	2825	16.0	15.9	0.029	0.546	1105	1267	0.153	0.881
SNJ15	Shennong Jia	110.499	31.370	3090	16.0	15.9	0.029	0.546	1105	1268	0.153	0.881
SNJ2	Shennong Jia	110.548	31.758	1510	16.0	15.9	0.030	0.546	1093	1259	0.154	0.881
SNJ3	Shennong Jia	110.536	31.758	1873	15.9	15.9	0.029	0.546	1111	1267	0.153	0.881
SNJ4	Shennong Jia	110.488	31.764	2230	15.9	15.9	0.029	0.546	1107	1264	0.153	0.881
SNJ5	Shennong Jia	110.424	31.673	2610	16.0	15.9	0.029	0.546	1110	1268	0.153	0.881
SNJ6	Shennong Jia	110.307	31.441	670	16.0	15.8	0.032	0.546	1021	1211	0.156	0.881

SNJ7	Shennong Jia	110.298	31.442	1210	15.9	15.8	0.031	0.546	1027	1211	0.155	0.881
SNJ8	Shennong Jia	110.149	31.455	1415	15.9	15.8	0.030	0.546	1064	1237	0.154	0.881
SNJ9	Shennong Jia	110.193	31.448	1540	15.9	15.8	0.031	0.546	1028	1211	0.155	0.881
SWD1	Shiwanda Mountain	107.914	21.884	531	22.8	22.5	0.025	0.434	1822	1833	0.128	1.012
SWD2	Shiwanda Mountain	107.918	21.880	708	22.8	22.5	0.025	0.434	1824	1834	0.128	1.012
SWD3	Shiwanda Mountain	107.912	21.890	400	22.7	22.5	0.025	0.434	1821	1832	0.128	1.012
SWD4	Shiwanda Mountain	107.906	21.900	393	22.7	22.5	0.025	0.434	1819	1831	0.128	1.012
SWD5	Shiwanda Mountain	107.905	21.896	521	22.7	22.5	0.025	0.434	1819	1831	0.128	1.012
SYK2	Suyukou	105.911	38.736	2310	8.9	8.4	0.114	0.487	299	257	0.238	1.386
SYK3	Suyukou	105.912	38.742	2210	8.9	8.4	0.115	0.487	299	256	0.238	1.386
SYK4	Suyukou	105.917	38.746	2030	8.9	8.4	0.115	0.487	298	256	0.238	1.386
TM1	Tianmu Mountain	119.707	30.583	1460	16.9	16.5	0.039	0.535	1692	1534	0.135	0.701
TM2	Tianmu Mountain	119.726	30.571	1080	16.9	16.5	0.039	0.535	1696	1536	0.135	0.701
WG1	Wugong Mountain	114.163	27.465	778	18.2	18.2	0.026	0.516	2067	1748	0.141	0.762
WG2	Wugong Mountain	114.171	27.463	1030	18.2	18.2	0.026	0.516	2068	1748	0.141	0.762
WG3	Wugong Mountain	114.174	27.462	1175	18.2	18.2	0.026	0.516	2068	1748	0.141	0.762
WG4	Wugong Mountain	114.172	27.462	1115	18.2	18.2	0.026	0.516	2068	1748	0.141	0.762
WG5	Wugong Mountain	114.167	27.465	910	18.2	18.2	0.026	0.516	2068	1748	0.141	0.762
WYZ1	Wuyuezhai	113.838	38.720	1880	11.1	10.7	0.082	0.545	525	510	0.214	1.365
WYZ2	Wuyuezhai	113.839	38.716	1770	11.1	10.7	0.082	0.545	525	510	0.214	1.365
WYZ3	Wuyuezhai	113.843	38.720	1660	11.1	10.7	0.082	0.545	525	510	0.214	1.365
WYZ4	Wuyuezhai	113.848	38.733	1430	11.1	10.7	0.082	0.545	525	510	0.214	1.365
WYZ5	Wuyuezhai	113.856	38.724	1210	11.1	10.7	0.082	0.545	526	510	0.214	1.365
XX1	Xiaoxing'anling	129.645	47.447	340	2.3	2.0	0.439	0.524	665	610	0.173	1.330
XX10	Xiaoxing'anling	128.466	46.633	1420	2.8	2.6	0.340	0.524	693	632	0.164	1.330
XX4	Xiaoxing'anling	128.987	48.481	650	1.4	1.0	1.015	0.524	635	582	0.178	1.330
XX5	Xiaoxing'anling	128.906	48.853	420	1.1	0.6	1.735	0.524	619	571	0.183	1.330
XX6	Xiaoxing'anling	128.538	46.630	565	2.8	2.6	0.339	0.524	692	633	0.164	1.330
XX7	Xiaoxing'anling	128.521	46.630	810	2.8	2.6	0.339	0.524	692	633	0.164	1.330
XX8	Xiaoxing'anling	128.511	46.636	1040	2.8	2.6	0.340	0.524	692	632	0.164	1.330
XX9	Xiaoxing'anling	128.494	46.635	1220	2.8	2.6	0.340	0.524	692	632	0.164	1.330

TABLE S2 Soil properties and plant species richness for the 143 sites from the 28 natural forest reserves in this study. Soil properties, including moisture, pH, electrical conductivity (EC), total organic carbon (TOC), total nitrogen (TN), total phosphorus (TP), total potassium (TK), as well as available phosphorus (AP), available potassium (AK), available aluminum (AAl), available calcium (ACa), and available magnesium (AMg), were measured for each soil sample (replicate). The mean values of the three replicates were calculated for each site. All values are in mg kg^{-1}, except Moisture (in %), pH (in standard units), and EC (in μS cm^{-1}). Plant species richness was obtained based on the spatial location of the sites and the woody plant distribution map from a previously compiled database (Fang et al., 2011; Wang et al., 2011; 2012).

Site	Forest reserve	Moisture	pH	EC	TOC	TN	TP	TK	AP	AK	AAl	ACa	AMg	Plant richness
AL1	Ailao Mountain	30.0	4.5	19	144650	9491	669	9.6	7500	279	223	17	6	1866
AL2	Ailao Mountain	33.8	4.7	32	134033	12832	851	7.0	8754	149	219	69	24	1866
AL3	Ailao Mountain	37.4	5.4	84	143367	9376	1249	18.8	8689	289	105	241	56	1866
AL4	Ailao Mountain	25.8	5.1	34	99147	6777	1080	7.0	14516	218	204	141	30	1866
AS1	Aoshan Mountain	57.5	6.1	268	132700	7423	1033	17.8	9596	357	93	714	104	1311
AS2	Aoshan Mountain	39.9	6.1	206	75553	5174	709	12.2	14033	263	76	488	106	1311
AS3	Aoshan Mountain	31.5	6.5	188	88787	3217	1145	20.6	14341	244	74	672	57	1311
AS4	Aoshan Mountain	56.5	6.2	126	196733	6609	1069	50.4	8231	223	64	679	58	1311
AS5	Aoshan Mountain	59.8	5.5	113	131417	3886	901	6.7	11182	263	147	390	59	1311
BCW1	Baicaowa	27.3	5.7	82	97327	9049	1293	12.7	10257	140	140	707	101	664
BCW2	Baicaowa	20.3	5.7	137	100810	7792	1172	13.2	11092	256	110	959	128	664
BCW3	Baicaowa	26.4	5.9	178	102060	7590	1119	11.4	10462	259	100	1035	138	664
BCW5	Baicaowa	20.9	6.0	124	62973	4912	1695	11.1	14783	258	133	596	67	664
CB2	Changbai Mountain	51.4	6.2	55	41857	2404	514	5.5	25000	81	166	152	23	679
CB3	Changbai Mountain	57.2	6.1	54	80757	8023	872	6.4	13878	184	194	295	40	679
CB4	Changbai Mountain	55.4	6.2	44	75610	4312	748	4.6	21520	218	173	161	27	679
CB5	Changbai Mountain	51.1	5.8	68	75777	4009	747	1.5	22095	194	171	277	41	679
CB6	Changbai Mountain	60.3	5.7	34	123737	9907	1473	14.3	12459	244	117	1354	145	679
CB7	Changbai Mountain	46.3	5.1	248	90847	8227	1291	23.7	13469	374	140	677	81	679
CB8	Changbai Mountain	56.4	5.4	81	76147	8368	1268	9.8	19194	253	196	294	52	679
DBS3	Dabie Mountain	26.6	4.6	124	67670	4199	2119	44.9	11707	211	253	109	13	1306
DH1	Dinghu Mountain	23.9	4.6	24	15380	1269	414	3.1	11665	38	164	16	2	1198
DH2	Dinghu Mountain	18.7	4.3	41	40540	2402	148	3.9	18006	115	186	26	5	1198
DH3	Dinghu Mountain	22.0	4.1	51	41450	2346	181	3.0	16150	95	188	20	3	1198
DX12	Daxing'anling	54.3	4.8	73	97940	1963	307	2.7	10088	183	126	42	15	302

DX13	Daxing'anling	49.1	4.9	89	175043	4581	857	1.7	8584	245	146	109	29	302
DX14	Daxing'anling	35.9	5.0	102	170000	5576	946	2.7	7591	475	82	166	34	302
DX15	Daxing'anling	68.1	4.2	70	147300	4189	473	3.5	9667	229	89	39	16	302
DX16	Daxing'anling	38.5	4.6	73	134833	3341	875	2.6	8047	269	245	241	64	302
DX17	Daxing'anling	25.0	4.8	78	255367	5442	883	4.5	7578	340	236	424	49	302
DX2	Daxing'anling	35.0	6.6	142	170933	11651	2053	3.0	8407	493	133	313	66	302
DX3	Daxing'anling	34.6	6.6	162	147567	11464	1739	3.2	12760	428	68	449	44	302
DX4	Daxing'anling	32.2	6.5	177	82597	4119	1353	3.8	17771	313	126	256	47	302
DX5	Daxing'anling	19.1	6.5	136	94470	7348	2013	2.5	15519	208	133	263	37	302
DX7	Daxing'anling	20.6	6.3	137	189267	11966	1964	1.7	10936	610	69	442	68	302
DX8	Daxing'anling	44.0	6.1	103	213900	10915	1565	2.8	10255	505	76	334	69	302
DY1	Daiyun Mountain	41.3	4.6	68	119343	5852	773	7.2	12634	243	364	409	75	1350
DY2	Daiyun Mountain	45.3	4.7	35	110307	10797	752	6.5	12309	123	318	786	92	1350
DY3	Daiyun Mountain	45.1	4.7	28	137917	6508	597	3.3	10309	74	493	266	53	1350
DY6	Daiyun Mountain	35.3	5.3	63	50737	4115	616	5.9	11844	84	205	225	37	1350
FJ2	Fanjing Mountain	66.3	4.2	145	126900	8785	1609	12.5	12405	273	179	67	16	1344
FJ3	Fanjing Mountain	59.6	3.8	130	165867	10535	755	8.8	7670	244	215	28	8	1344
FJ4	Fanjing Mountain	39.9	3.9	129	198600	17658	871	16.5	3852	251	219	66	16	1344
GD1	Guandi Mountain	37.9	6.3	145	66853	5092	914	20.1	13000	189	11	1638	123	846
GD2	Guandi Mountain	43.5	6.1	201	79780	4127	1011	25.5	10728	243	15	1751	113	846
GD3	Guandi Mountain	56.0	6.3	119	63067	5326	961	24.5	11694	211	14	1411	101	846
GD4	Guandi Mountain	43.0	6.7	96	56417	5073	967	33.7	9459	241	14	1939	137	846
GD5	Guandi Mountain	43.9	6.6	148	69983	5617	961	29.5	10460	224	10	1909	147	846
GG1	Gongga Mountain	32.9	6.7	27	25270	490	1320	19.8	19380	111	287	189	31	1669
GG2	Gongga Mountain	26.7	5.6	40	76120	1294	1561	6.8	14604	218	239	358	72	1669
GG3	Gongga Mountain	25.4	4.1	173	57120	756	726	3.7	18841	53	650	38	22	1669
GG4	Gongga Mountain	22.8	3.8	111	80100	1393	1118	12.8	13376	199	14	2922	369	1669
GG5	Gongga Mountain	18.7	3.7	105	102100	852	1010	5.0	13233	65	9	6345	108	1669
JF1	Jifeng Mountain	56.7	5.1	116	77360	4699	384	7.5	9505	138	257	486	72	1268
JF2	Jifeng Mountain	50.4	5.0	90	86347	3674	474	9.7	8431	194	249	419	74	1268
JG1	Jinggang Mountain	67.5	4.2	114	118323	6407	792	10.4	15096	140	158	18	12	1725
JG2	Jinggang Mountain	65.7	4.0	70	214533	4803	940	12.7	5711	135	239	32	12	1725

JG3	Jinggang Mountain	48.4	4.8	46	92730	3870	900	8.3	11028	94	260	40	11	1725
JG4	Jinggang Mountain	49.7	4.9	59	48323	3768	367	1.3	23179	146	186	51	10	1725
JG5	Jinggang Mountain	33.9	4.7	105	42747	3130	398	1.3	30898	125	189	25	5	1725
JG6	Jinggang Mountain	34.8	4.1	114	82103	11640	266	2.5	8867	185	242	110	17	1725
LG1	Leigong Mountain	41.3	4.5	67	79993	1664	579	12.8	16258	259	294	405	58	1517
LG3	Leigong Mountain	25.5	4.4	46	85423	790	315	18.8	16442	160	323	65	21	1517
LG4	Leigong Mountain	32.1	4.5	51	102750	947	470	7.6	11978	125	347	295	49	1517
LG5	Leigong Mountain	15.8	4.6	72	110567	985	933	13.3	13144	208	273	105	32	1517
LJ1	Luoji Mountain	52.9	4.3	156	318467	15186	634	39.2	5094	293	100	63	25	1648
LJ2	Luoji Mountain	55.2	5.0	151	356167	13382	958	59.8	3859	295	75	160	40	1648
LJ3	Luoji Mountain	39.4	5.1	70	152100	8179	1059	14.4	11788	295	199	102	23	1648
LJ4	Luoji Mountain	16.3	4.7	65	80600	6587	1229	9.2	22188	189	181	145	28	1648
LJ5	Luoji Mountain	56.8	4.2	198	380567	12260	828	56.3	5471	295	112	100	35	1648
LJ6	Luoji Mountain	43.4	5.7	108	199433	11728	1038	64.1	10407	295	100	198	43	1648
LJ7	Luoji Mountain	22.1	4.4	114	68837	1227	1109	27.1	16171	261	120	306	95	1648
LQ1	Longquan Mountain	15.9	6.2	73	40180	842	595	22.4	24463	174	167	70	17	1522
LQ4	Longquan Mountain	23.8	5.3	21	107897	1879	474	3.9	27105	134	278	88	11	1522
LQ7	Longquan Mountain	23.8	5.5	26	39207	551	293	3.6	21794	118	267	13	4	1522
NL1	Nanling	30.9	5.3	32	91990	3027	501	2.3	25695	113	218	13	3	1582
NL2	Nanling	34.1	5.0	75	101980	2451	602	3.6	25656	203	192	147	12	1582
NL3	Nanling	52.2	4.7	48	110630	3319	490	14.0	16826	183	208	38	9	1582
NL4	Nanling	30.3	5.1	29	85030	1017	369	4.9	30595	96	217	20	3	1582
NL5	Nanling	36.9	5.2	18	110880	790	294	0.9	20581	75	240	39	4	1582
NL6	Nanling	29.0	5.0	18	58633	445	514	1.3	25371	131	245	33	5	1582
QF1	Qingfeng Mountain	51.9	6.4	221	135367	9726	1361	12.2	12615	239	86	687	81	1286
QF2	Qingfeng Mountain	40.8	6.3	237	105790	5803	1390	17.8	14008	225	63	758	81	1286
QF3	Qingfeng Mountain	41.7	6.4	144	142863	4775	1021	22.9	16202	159	34	402	48	1286
QL1	Qinling	45.0	5.2	150	75847	12028	1205	20.4	10261	511	58	536	72	1282
QL10	Qinling	32.8	6.6	168	94897	4914	1452	25.5	13009	381	55	547	61	1282
QL2	Qinling	50.1	5.6	137	103237	9947	939	18.5	10393	308	77	736	112	1282
QL3	Qinling	47.8	5.3	107	123500	7157	1744	29.4	10853	246	41	713	80	1282
QL4	Qinling	38.6	5.8	130	150533	19151	1922	64.5	10856	293	57	1022	104	1282

QL6	Qinling	45.4	5.8	173	150667	9945	1467	34.2	9562	228	16	936	81	1282
QL7	Qinling	38.9	6.0	179	122100	7575	2023	134.8	10510	225	21	587	65	1282
QL9	Qinling	26.7	6.6	187	74087	3074	1044	1.6	12231	178	16	1390	58	1282
SHB1	Saihanba	12.1	5.7	114	52340	3471	710	14.0	19244	211	116	635	120	669
SHB2	Saihanba	25.7	5.7	162	95197	6159	991	12.5	14750	304	141	780	147	669
SHB3	Saihanba	25.9	5.8	108	114913	6706	962	12.5	11683	336	136	877	135	669
SHB4	Saihanba	33.5	6.0	71	71800	5896	708	11.5	12729	353	132	806	120	669
SHWL1	Saihanwula	20.0	6.1	78	91840	6163	1656	16.4	14845	196	74	929	158	606
SHWL2	Saihanwula	15.5	5.5	91	48263	5331	1488	21.0	18912	249	81	724	151	606
SHWL4	Saihanwula	17.7	5.7	88	58320	4097	1286	16.6	17105	238	79	494	102	601
SHWL5	Saihanwula	21.3	6.3	72	37933	3222	537	22.6	22059	314	65	542	113	601
SHWL6	Saihanwula	19.7	6.3	83	32693	3121	315	17.4	21124	286	76	626	110	601
SNJ1	Shennong Jia	44.5	5.8	77	197367	11022	1188	26.6	9996	300	142	296	70	1734
SNJ11	Shennong Jia	39.6	6.0	103	113200	6240	724	34.9	12711	293	199	208	35	1691
SNJ12	Shennong Jia	44.7	5.7	251	99830	7164	1455	47.5	18034	296	158	460	109	1734
SNJ13	Shennong Jia	43.3	4.9	67	167500	14873	1689	29.8	10923	311	158	526	96	1734
SNJ14	Shennong Jia	43.1	5.0	76	84210	5682	1240	36.5	12249	214	219	88	16	1734
SNJ15	Shennong Jia	57.7	5.2	59	146400	11526	823	17.4	4138	184	170	182	39	1734
SNJ2	Shennong Jia	57.2	5.6	372	42640	3145	796	21.9	19199	248	123	264	62	1734
SNJ3	Shennong Jia	54.2	6.0	67	181050	8491	1265	20.3	11157	294	96	883	232	1734
SNJ4	Shennong Jia	49.1	5.8	87	101987	6272	939	5.0	13376	294	210	223	53	1734
SNJ5	Shennong Jia	48.1	5.8	135	78340	10670	1258	9.4	13459	296	203	210	34	1734
SNJ6	Shennong Jia	35.7	5.8	151	60007	7103	1555	5.2	14082	291	51	896	81	1734
SNJ7	Shennong Jia	25.1	5.8	202	176850	10873	784	1.5	12299	300	67	588	161	1691
SNJ8	Shennong Jia	26.2	5.9	147	114100	7045	2242	68.4	15119	296	59	699	95	1691
SNJ9	Shennong Jia	26.6	5.8	149	46380	4315	599	33.9	18265	293	135	390	78	1691
SWD1	Shiwanda Mountain	38.2	4.1	74	72530	2906	470	5.9	12290	114	19	33	6	1696
SWD2	Shiwanda Mountain	46.1	4.5	30	69560	1373	195	6.9	6669	126	19	32	6	1696
SWD3	Shiwanda Mountain	22.6	4.8	25	68970	1048	236	1.3	8281	108	18	32	6	1696
SWD4	Shiwanda Mountain	15.5	4.5	28	56570	1930	90	4.3	1428	155	19	32	6	1696
SWD5	Shiwanda Mountain	34.8	4.1	39	45610	2057	255	1.0	12357	100	19	32	5	1696
SYK2	Suyukou	5.7	6.5	65	21660	1682	782	54.2	10953	228	56	676	52	747

SYK3	Suyukou	25.9	6.3	213	56513	2957	798	16.4	9450	220	38	1181	130	747
SYK4	Suyukou	31.3	6.4	197	51943	3216	750	11.2	12063	196	41	1180	127	747
TM1	Tianmu Mountain	20.2	4.6	52	75763	872	1291	3.7	20916	310	252	55	9	1158
TM2	Tianmu Mountain	32.9	4.4	48	47723	4348	645	5.5	14097	161	256	17	3	1158
WG1	Wugong Mountain	37.3	6.1	37	33283	699	278	5.2	11718	111	570	77	31	1671
WG2	Wugong Mountain	45.6	5.3	20	129833	1074	660	22.1	16995	176	404	245	42	1671
WG3	Wugong Mountain	54.3	5.1	84	122313	1155	1262	15.9	14773	260	421	50	20	1671
WG4	Wugong Mountain	41.2	5.5	68	49560	690	558	6.2	16450	76	321	66	27	1671
WG5	Wugong Mountain	34.8	5.6	32	56120	330	639	10.1	23674	128	328	87	28	1671
WYZ1	Wuyuezhai	31.3	5.6	88	37977	2638	501	11.5	9665	103	202	343	45	766
WYZ2	Wuyuezhai	31.3	5.6	90	43447	3572	785	16.9	10724	135	193	296	35	766
WYZ3	Wuyuezhai	52.5	5.7	90	51453	4243	759	20.0	10071	173	164	366	44	766
WYZ4	Wuyuezhai	24.6	6.0	83	42433	3662	977	21.3	12348	163	193	296	37	766
WYZ5	Wuyuezhai	34.2	5.6	72	33880	1767	635	20.5	13020	93	188	159	19	766
XX1	Xiaoxing'anling	37.6	7.0	142	110733	10034	426	1.6	14054	345	137	611	79	574
XX10	Xiaoxing'anling	36.1	4.7	73	77933	6571	1160	11.2	13647	140	177	214	39	574
XX4	Xiaoxing'anling	37.3	6.5	111	129300	9084	1275	32.5	12952	428	188	325	67	574
XX5	Xiaoxing'anling	23.6	6.0	112	110727	5949	1602	41.5	10904	459	197	354	77	574
XX6	Xiaoxing'anling	24.5	6.0	106	119383	8521	613	18.5	14446	239	118	328	57	574
XX7	Xiaoxing'anling	33.3	6.0	120	192067	9605	1217	39.9	11797	348	120	525	96	574
XX8	Xiaoxing'anling	30.6	5.5	45	61750	5282	1273	10.3	16280	161	200	195	29	574
XX9	Xiaoxing'anling	35.0	4.9	64	104800	7540	1022	9.8	12512	225	209	234	47	574

TABLE S3 Comparison of $pMST_{res}$ (or $UniFrac_{res}$) between low and high levels of ΣHC_{res} along a similar range of ΔCC_{res}. The whole dataset was clustered into two sub-datasets based on different levels of ΔCC_{res} and ΣHC_{res}. For each climate factor, the range of ΔCC_{res} was evenly split into different bins (i.e., 5, 10, 15, and 20 bins) and the values of $pMST_{res}$ and $UniFrac_{res}$ were then divided into different groups accordingly. The values of each group were separated into two sub-groups based on the group's median of ΣHC_{res}. All the sub-groups under small or large ΣHC_{res} were finally combined, respectively, to generate two sub-datasets with a similar range of ΔCC_{res} but an apparent difference in ΣHC_{res}. The significance (*P*-value) of difference of $pMST_{res}$ (or $UniFrac_{res}$) between small and large ΣHC_{res} was estimated by the Wilcoxon rank-sum test. The magnitude of difference was also evaluated by the effect size for the Wilcoxon rand-sum test (Wilcox.effs *r*), including 'negligible' ($|r| < 0.1$), 'small' ($0.1 \le |r| < 0.3$), 'moderate' ($0.3 \le |r| < 0.5$), and 'large' ($|r| \ge 0.5$). The numbers in bracket denote the numbers of data points in each bin, and a total of 9750 data points were used in the analyses.

Climate factors	Bins	ΣHC levels	Stochasticity ($pMST_{res}$) Mean ± s.d.	Stochasticity ($pMST_{res}$) *P*-value	Stochasticity ($pMST_{res}$) Wilcox.effs *r*	Community dissimilarity ($UniFrac_{res}$) Mean ± s.d.	Community dissimilarity ($UniFrac_{res}$) *P*-value	Community dissimilarity ($UniFrac_{res}$) Wilcox.effs *r*
AMT	5	low	-0.029 ± 0.178	< 0.001	0.147	0.021 ± 0.141	< 0.001	0.142
		high	0.029 ± 0.141			-0.021 ± 0.146		
	(5 Bins: 211, 2152, 5558, 1603, 226)							
	10	low	-0.033 ± 0.181	< 0.001	0.163	0.023 ± 0.164	< 0.001	0.163
		high	0.033 ± 0.136			-0.022 ± 0.145		
	(10 Bins: 53, 158, 446, 1706, 2977, 2581, 1052, 551, 180, 46)							
	15	low	-0.030 ± 0.180	< 0.001	0.150	0.024 ± 0.141	< 0.001	0.169
		high	0.030 ± 0.139			-0.023 ± 0.144		
	(15 Bins: 45, 39, 127, 183, 629, 1340, 2160, 1709, 1689, 846, 479, 278, 142, 67, 17)							
	20	low	-0.029 ± 0.178	< 0.001	0.150	0.023 ± 0.141	< 0.001	0.160
		high	0.029 ± 0.141			-0.022 ± 0.144		
	(20 Bins: 34, 19, 40, 118, 156, 290, 658, 1048, 1391, 1586, 1297, 1284, 713, 339, 363, 188, 124, 56, 36, 10)							
AP	5	low	-0.003 ± 0.148	< 0.001	0.062	0.016 ± 0.144	< 0.001	0.098
		high	0.003 ± 0.180			-0.016 ± 0.144		
	(5 Bins: 625, 2764, 3711, 2051, 599)							
	10	low	-0.007 ± 0.152	< 0.001	0.079	0.017 ± 0.144	< 0.001	0.106
		high	0.007 ± 0.176			-0.017 ± 0.143		
	(10 Bins: 94, 531, 1255, 1509, 1890, 1821, 1146, 905, 504, 95)							
	15	low	-0.006 ± 0.153	< 0.001	0.068	0.015 ± 0.144	< 0.001	0.096
		high	0.006 ± 0.175			-0.015 ± 0.144		
	(15 Bins: 45, 144, 436, 778, 887, 1099, 1263, 1225, 1223, 771, 814, 466, 423, 153, 23)							
	20	low	-0.007 ± 0.153	< 0.001	0.076	0.016 ± 0.143	< 0.001	0.102
		high	0.007 ± 0.175			-0.016 ± 0.145		
	(20 Bins: 26, 68, 161, 370, 555, 700, 620, 889, 921, 969, 906, 915, 563, 583, 599, 306, 358, 146, 84, 11)							

TABLE S4 Comparison of coefficient (i.e., slope) of the relationship between $pMST_{res}$ (or $UniFrac_{res}$) and ΔCC_{res} under low and high levels of ΣHC_{res}. The significance (*P*-value) of $coef_{obs}$ as well as the difference of coefobs ($\Delta coef = coef_{small.\Sigma HCres} - coef_{large.\Sigma HCres}$) between sub-datasets was estimated by the randomization test (1000 times). For each null dataset, the range of ΔCC_{res} was evenly split into different bins (i.e., 5, 10, 15, and 20 bins) and the values of $pMST_{res}$ and $UniFrac_{res}$ were then divided into different groups accordingly. The values of each group were separated into two sub-groups based on the group's median of ΣHC_{res}. All the sub-groups under small or large ΣHC_{res} were finally combined, respectively, to generate two null sub-datasets with a similar range of ΔCC_{res} but an apparent difference in ΣHC_{res}. The standardized effect size (SES) of Δcoef was calculated as: $SES.\Delta coef = (\Delta coef_{obs} - \Delta coef_{null}) / SD_{null}$, where $\Delta coef_{obs}$ is the observed difference of coefobs, $\Delta coef_{null}$ is the mean of the simulated values and SD_{null} is the standard deviation of the simulated values. The numbers in bracket denote the numbers of data points in each bin, and a total of 9750 data points were used in the analyses.

Climate factors	Bins	ΣHC levels	Stochasticity ($pMST_{res}$)					Community dissimilarity ($UniFrac_{res}$)				
			$coef_{obs}$	*P* ($coef_{obs}$)	Δcoef	*P* (Δcoef)	SES.Δcoef	$coef_{obs}$	P ($coef_{obs}$)	Δcoef	*P* (Δcoef)	SES.Δcoef
AMT	5	low	-0.011	0.239	-0.009	0.311	-0.487	0.022	< 0.001	-0.007	0.193	-0.880
		high	-0.002	0.430				0.028	< 0.001			
	(5 Bins: 211, 2152, 5558, 1603, 226)											
	10	low	-0.009	0.259	-0.010	0.261	-0.631	0.022	0.001	-0.003	0.395	-0.284
		high	0.001	0.481				0.024	< 0.001			
	(10 Bins: 53, 158, 446, 1706, 2977, 2581, 1052, 551, 180, 46)											
	15	low	-0.013	0.175	-0.019	0.124	-1.207	0.022	< 0.001	-0.001	0.447	-0.164
		high	0.006	0.331				0.023	< 0.001			
	(15 Bins: 45, 39, 127, 183, 629, 1340, 2160, 1709, 1689, 846, 479, 278, 142, 67, 17)											
	20	low	-0.009	0.176	-0.011	0.217	-0.716	0.026	< 0.001	0.007	0.165	0.967
		high	0.002	0.353				0.019	0.001			
	(20 Bins: 34, 19, 40, 118, 156, 290, 658, 1048, 1391, 1586, 1297, 1284, 713, 339, 363, 188, 124, 56, 36, 10)											
AP	5	low	-0.064	< 0.001	0.026	< 0.001	3.094	0.037	< 0.001	-0.018	< 0.001	-3.796
		high	-0.090	< 0.001				0.055	< 0.001			
	(5 Bins: 625, 2764, 3711, 2051, 599)											
	10	low	-0.064	< 0.001	0.017	0.040	1.750	0.040	< 0.001	-0.010	0.006	-2.414
		high	-0.081	< 0.001				0.051	< 0.001			
	(10 Bins: 94, 531, 1255, 1509, 1890, 1821, 1146, 905, 504, 95)											
	15	low	-0.065	< 0.001	0.023	0.003	2.695	0.040	< 0.001	-0.011	0.011	-2.415
		high	-0.088	< 0.001				0.051	< 0.001			
	(15 Bins: 45, 144, 436, 778, 887, 1099, 1263, 1225, 1223, 771, 814, 466, 423, 153, 23)											
	20	low	-0.062	< 0.001	0.029	< 0.001	3.567	0.039	< 0.001	-0.013	0.004	-2.710
		high	-0.091	< 0.001				0.052	< 0.001			
	(20 Bins: 26, 68, 161, 370, 555, 700, 620, 889, 921, 969, 906, 915, 563, 583, 599, 306, 358, 146, 84, 11)											

TABLE S5 Summary of statistics of multiple linear regression for the sub-communities of rare species. All the calculations were followed the detailed methods in TABLE 1, except that we used the results of $pMST_{res}$ and $UniFrac_{res}$ for the sub-communities of rare species. We calculated the relative abundance of each OTU for each composited sample (i.e., based on a total of 29,205 reads in each sampling site). We defined rare species as those OTUs with <0.1% relative abundances across all the 143 sampling sites. See detailed legend in TABLE 1.

Climate factors	Variables	Stochasticity ($pMST_{res}$)			Community dissimilarity ($UniFrac_{res}$)		
		$coef_{obs}$	*P*-value	SES.coef	$coef_{obs}$	*P*-value	SES.coef
AMT	ΔCC_{res}	-0.010	0.246	-0.685	0.032	< 0.001	3.685
	ΣHC_{res}	0.040	0.005	2.817	-0.030	< 0.001	-3.882
AP	ΔCC_{res}	-0.068	< 0.001	-8.900	0.070	< 0.001	15.895
	ΣHC_{res}	-0.021	0.063	-1.431	0.010	0.122	1.197

TABLE S6 Mantel and partial Mantel tests for the correlations linking the residuals of stochasticity (or community dissimilarity) to ΔCC_{res} and ΣHC_{res} for the sub-communities of rare species. All the calculations were followed the detailed methods in TABLE 2, except that we used the results of pMSTres and UniFracres for the sub-communities of rare species. We calculated the relative abundance of each OTU for each composited sample (i.e., based on a total of 29,205 reads in each sampling site). We defined rare species as those OTUs with <0.1% relative abundances across all the 143 sampling sites. Tests were conducted using Pearson's r for different climate factors. The significances were tested based on 999 permutations. ***$P < 0.001$; **$P < 0.01$; *$P < 0.05$.

Effects of	Controlling for	Stochasticity ($pMST_{res}$)		Community dissimilarity ($UniFrac_{res}$)	
		AMT	AP	AMT	AP
ΔCC_{res}		0.035	-0.277***	0.132***	0.463***
ΣHC_{res}		0.167**	-0.167**	-0.134***	0.192***
ΔCC_{res}	ΣHC_{res}	-0.007	-0.238***	0.173***	0.431***
ΣHC_{res}	ΔCC_{res}	0.163**	-0.083	-0.174***	0.046

TABLE S7 Comparison of $pMST_{res}$ (or $UniFrac_{res}$) between low and high levels of ΣHC_{res} along a similar range of ΔCC_{res} for the sub-communities of rare species. All the calculations were followed the detailed methods in TABLE S3, except that we used the results of pMSTres and UniFracres for the sub-communities of rare species. We calculated the relative abundance of each OTU for each composited sample (i.e., based on a total of 29,205 reads in each sampling site). We defined rare species as those OTUs with <0.1% relative abundances across all the 143 sampling sites. See detailed legend in TABLE S3.

Climate factors	Bins	ΣHC levels	Stochasticity ($pMST_{res}$)			Community dissimilarity ($UniFrac_{res}$)		
			Mean ± s.d.	*P*-value	Wilcox.effs *r*	Mean ± s.d.	*P*-value	Wilcox.effs *r*
AMT	5	low	-0.044 ± 0.213	< 0.001	0.208	0.036 ± 0.135	< 0.001	0.264
		high	0.044 ± 0.181			-0.036 ± 0.122		
	(5 Bins: 211, 2152, 5558, 1603, 226)							
	10	low	-0.043 ± 0.213	< 0.001	0.201	0.034 ± 0.134	< 0.001	0.249
		high	0.043 ± 0.182			-0.034 ± 0.124		
	(10 Bins: 53, 158, 446, 1706, 2977, 2581, 1052, 551, 180, 46)							
	15	low	-0.039 ± 0.213	< 0.001	0.182	0.030 ± 0.134	< 0.001	0.226
		high	0.039 ± 0.183			-0.030 ± 0.126		
	(15 Bins: 45, 39, 127, 183, 629, 1340, 2160, 1709, 1689, 846, 479, 278, 142, 67, 17)							
	20	low	-0.041 ± 0.211	< 0.001	0.192	0.027 ± 0.136	< 0.001	0.195
		high	0.041 ± 0.184			-0.027 ± 0.126		
	(20 Bins: 34, 19, 40, 118, 156, 290, 658, 1048, 1391, 1586, 1297, 1284, 713, 339, 363, 188, 124, 56, 36, 10)							
AP	5	low	-0.026 ± 0.200	< 0.001	0.138	0.008 ± 0.132	< 0.001	0.055
		high	0.026 ± 0.201			-0.008 ± 0.134		
	(5 Bins: 625, 2764, 3711, 2051, 599)							
	10	low	-0.023 ± 0.200	< 0.001	0.121	0.006 ± 0.134	< 0.001	0.045
		high	0.023 ± 0.202			-0.006 ± 0.133		
	(10 Bins: 94, 531, 1255, 1509, 1890, 1821, 1146, 905, 504, 95)							
	15	low	-0.025 ± 0.200	< 0.001	0.129	0.007 ± 0.133	< 0.001	0.054
		high	0.025 ± 0.202			-0.007 ± 0.134		
	(15 Bins: 45, 144, 436, 778, 887, 1099, 1263, 1225, 1223, 771, 814, 466, 423, 153, 23)							
	20	low	-0.022 ± 0.201	< 0.001	0.117	0.005 ± 0.134	< 0.001	0.034
		high	0.022 ± 0.201			-0.005 ± 0.133		
	(20 Bins: 26, 68, 161, 370, 555, 700, 620, 889, 921, 969, 906, 915, 563, 583, 599, 306, 358, 146, 84, 11)							

TABLE S8 Comparison of coefficient (i.e., slope) of the relationship between $pMST_{res}$ (or $UniFrac_{res}$) and ΔCC_{res} under low and high levels of ΣHC_{res} for the sub-communities of rare species. All the calculations were followed the detailed methods in TABLE S4, except that we used the results of pMSTres and UniFracres for the sub-communities of rare species. We calculated the relative abundance of each OTU for each composited sample (i.e., based on a total of 29,205 reads in each sampling site). We defined rare species as those OTUs with <0.1% relative abundances across all the 143 sampling sites. See detailed legend in TABLE S4.

Climate factors	Bins	ΣHC levels	Stochasticity ($pMST_{res}$)					Community dissimilarity ($UniFrac_{res}$)				
			$coef_{obs}$	*P* ($coef_{obs}$)	Δcoef	*P* (Δcoef)	SES.Δcoef	$coef_{obs}$	P ($coef_{obs}$)	Δcoef	*P* (Δcoef)	SES.Δcoef
AMT	5	low	-0.008	0.360	-0.019	0.211	-0.778	0.019	0.052	-0.012	0.165	-0.977
		high	0.011	0.265				0.031	0.002			
	(5 Bins: 211, 2152, 5558, 1603, 226)											
	10	low	-0.004	0.420	-0.016	0.218	-0.764	0.017	0.070	-0.009	0.213	-0.761
		high	0.012	0.229				0.026	0.002			
	(10 Bins: 53, 158, 446, 1706, 2977, 2581, 1052, 551, 180, 46)											
	15	low	-0.010	0.275	-0.028	0.079	-1.317	0.025	0.010	0.007	0.262	0.640
		high	0.018	0.142				0.018	0.029			
	(15 Bins: 45, 39, 127, 183, 629, 1340, 2160, 1709, 1689, 846, 479, 278, 142, 67, 17)											
	20	low	-0.007	0.357	-0.023	0.148	-1.081	0.020	0.030	-0.002	0.444	-0.108
		high	0.016	0.164				0.022	0.008			
	(20 Bins: 34, 19, 40, 118, 156, 290, 658, 1048, 1391, 1586, 1297, 1284, 713, 339, 363, 188, 124, 56, 36, 10)											
AP	5	low	-0.077	< 0.001	-0.008	0.281	-0.580	0.071	< 0.001	-0.006	0.219	-0.716
		high	-0.069	< 0.001				0.076	< 0.001			
	(5 Bins: 625, 2764, 3711, 2051, 599)											
	10	low	-0.078	< 0.001	-0.009	0.236	-0.718	0.074	< 0.001	0.0004	0.491	0.028
		high	-0.069	< 0.001				0.073	< 0.001			
	(10 Bins: 94, 531, 1255, 1509, 1890, 1821, 1146, 905, 504, 95)											
	15	low	-0.076	< 0.001	-0.004	0.347	-0.383	0.072	< 0.001	-0.003	0.331	-0.435
		high	-0.072	< 0.001				0.075	< 0.001			
	(15 Bins: 45, 144, 436, 778, 887, 1099, 1263, 1225, 1223, 771, 814, 466, 423, 153, 23)											
	20	low	-0.079	< 0.001	-0.009	0.225	-0.704	0.073	< 0.001	-0.001	0.445	-0.142
		high	-0.069	< 0.001				0.074	< 0.001			
	(20 Bins: 26, 68, 161, 370, 555, 700, 620, 889, 921, 969, 906, 915, 563, 583, 599, 306, 358, 146, 84, 11)											