

Supplemental Materials

Table S1. Major topological properties of the empirical and random MENs of nifH genes in four forests.

Habitat Communities	Empirical Networks					Random Networks ^a					
	Similarity Threshold	Network Size (n)	Modularity and (the number of modules)	Average degree (avgK)	Average Clustering Coefficient (avgCC)	Average Path (GD)	Connectedness	Modularity	Average Clustering Coefficient (avgCC)	Average Path (GD)	Connectedness
HS	0.91	330	0.74* ^b (63)	2.67*	0.16*	5.56*	0.35*	0.67 ± 0.01	0.01 ± 0.01	4.97 ± 0.10	0.78 ± 0.05
MES	0.94	244	0.78* (34)	2.75*	0.20*	5.79*	0.50*	0.65 ± 0.01	0.01 ± 0.01	4.79 ± 0.09	0.83 ± 0.04
HP	0.88	344	0.81* (49)	2.64*	0.18*	6.84*	0.41*	0.68 ± 0.01	0.01 ± 0.01	5.12 ± 0.12	0.81 ± 0.04
JFL	0.91	214	0.52* (31)	5.25*	0.29*	4.89*	0.55*	0.38 ± 0.01	0.07 ± 0.01	3.30 ± 0.06	0.92 ± 0.04

^a Random networks were generated by rewiring all of the links of a network with identical numbers of nodes and links to the corresponding empirical network. ^b Significant difference ($P < 0.001$) between any two sites.

Table S2. Plant and environmental variables in subtropical and tropical forest soils. Values are shown as mean \pm standard deviation (SD).

	Plant Richness	Elevation	Soil T	T	P	pH	Moisture (g/100g)	TN (g/100g)	TK (g/100g)	TP (g/100g)	SOC (g/100g)	AN (mg/kg)	AP (mg/kg)
HS	39.2 \pm 4.85	1054.5 \pm 17.47	15.11 \pm 0.14	14.5 \pm 0	1485 \pm 0	4.04 \pm 0.1	0.47 \pm 0.05	0.43 \pm 0.05	0.12 \pm 0.03	0.06 \pm 0.01	5.36 \pm 0.57	449.07 \pm 51.58	6.28 \pm 1.06
MES	30.5 \pm 4.67	1248 \pm 5.66	12.27 \pm 0.7	12.56 \pm 0.51	1637 \pm 12.65	3.74 \pm 0.11	0.48 \pm 0.05	0.53 \pm 0.06	0.1 \pm 0.03	0.06 \pm 0.01	7.04 \pm 0.97	543.19 \pm 44.68	7.02 \pm 0.43
HP	35.8 \pm 4.39	1211.4 \pm 21.46	12.97 \pm 0.29	13 \pm 0	1646 \pm 0	3.74 \pm 0.07	0.47 \pm 0.02	0.77 \pm 0.09	0.14 \pm 0.03	0.07 \pm 0.01	10.4 \pm 1.73	700.59 \pm 44.8	8.09 \pm 0.91
JFL	77.4 \pm 14.3	880.4 \pm 11.06	16.85 \pm 0.2	19.97 \pm 0.53	1690.67 \pm 46.51	4.42 \pm 0.13	34.03 \pm 4.24	0.21 \pm 0.04	1.69 \pm 0.02	0.01 \pm 0	5.36 \pm 1.06	179.27 \pm 42.08	2.94 \pm 0.92

Abbreviations: soil T—soil temperature, T—Annual Mean Temperature, P—Annual Precipitation, TN—total nitrogen, TK—total potassium, TP—total phosphorus, SOC—soil organic carbon, AN—available nitrogen, AP—available phosphorus. .

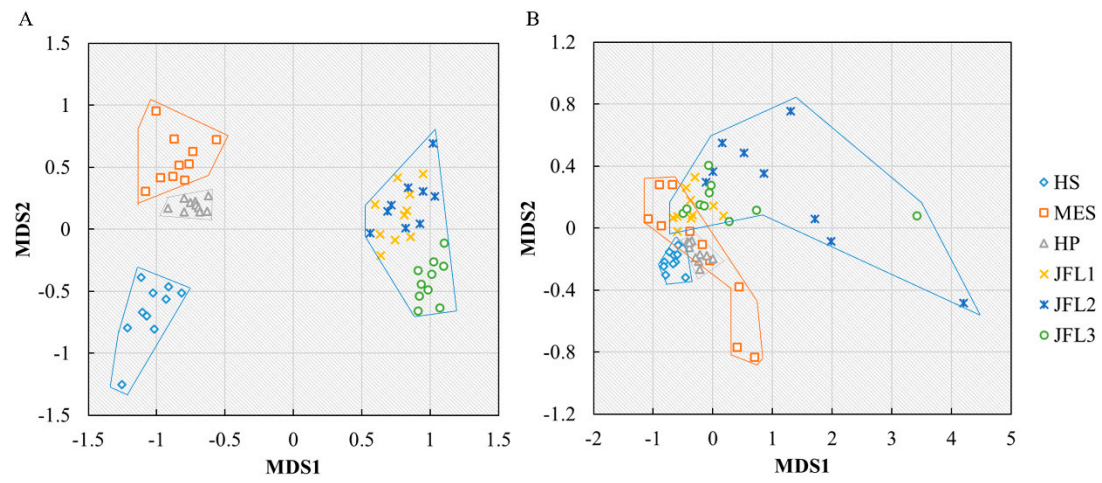


Figure S1. Nonmetric multidimensional scaling of soil microbial taxonomic compositions (**A**) and functional structures (**B**) to examine microbial distribution patterns. The analysis is performed on the Bray-Curtis dissimilarity.

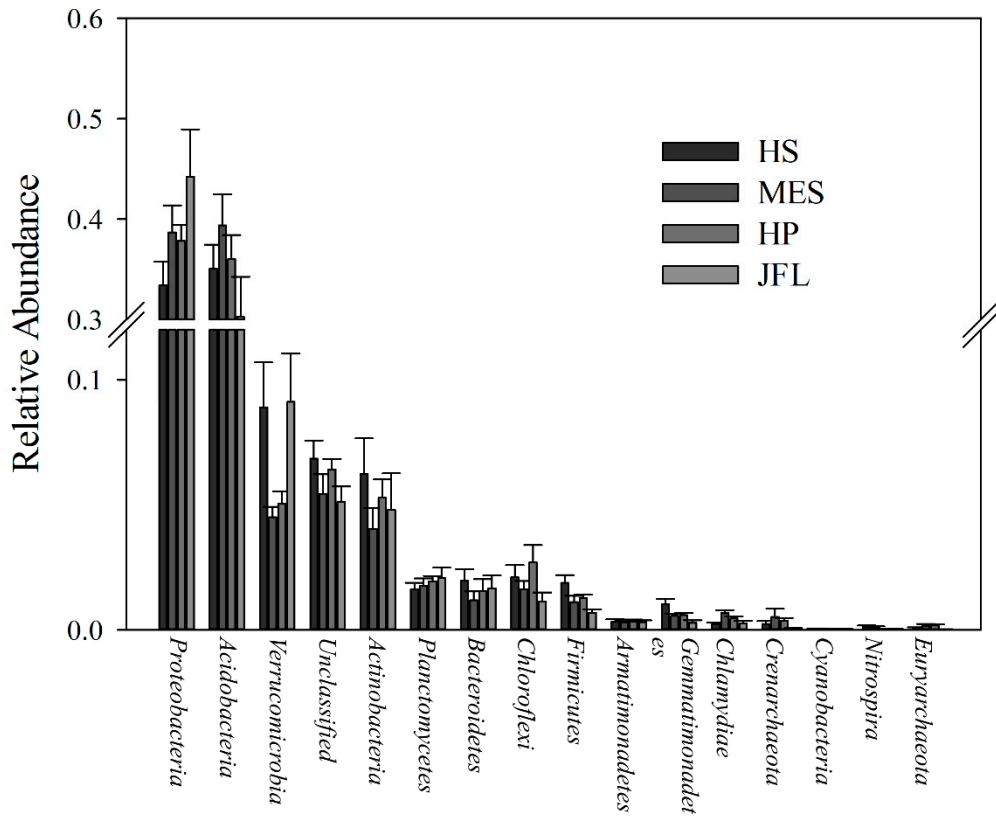
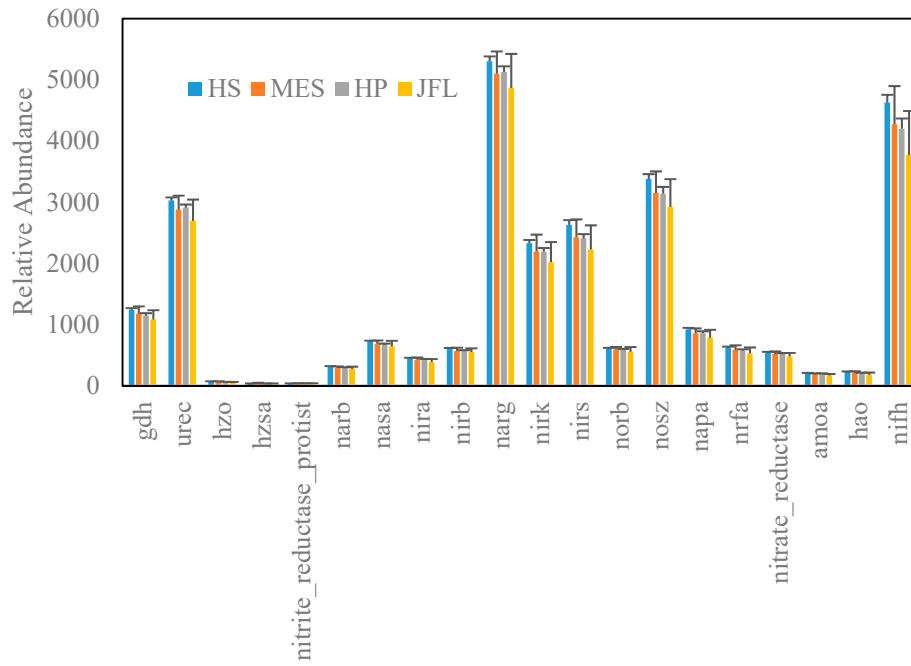


Figure S2 Relative abundance of main phyla in four forests.

A



B

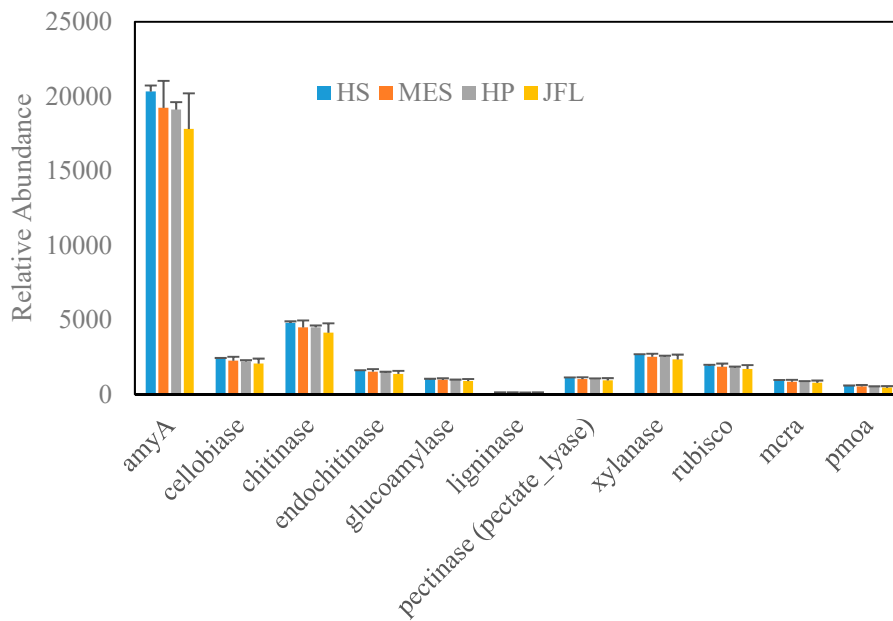


Figure S3. Relative abundance (total signal intensities of functional genes) of (A) nitrogen cycling genes and (B) part of carbon cycling genes in GeoChip data.