

**Edaphic variables are better indicators of soil microbial functional structure
than plant-related ones in subtropical broad-leaved forests**

Jingmin Cheng^{a,b,c}, Zhongjie Han^d, Jing Cong^e, Jingjing Yu^a, Jizhong Zhou^{b, f, g}

Mengxin Zhao^{a,c,*}, and Yuguang Zhang^{a,**}

^aResearch Institute of Forest Ecology, Environment and Protection, and the Key Laboratory of Biological Conservation of National Forestry and Grassland Administration, Chinese Academy of Forestry, Beijing 100091, China

^bState Key Joint Laboratory of Environment Simulation and Pollution Control, School of Environment, Tsinghua University, Beijing 100084, China

^cState Key Laboratory for Biology of Plant Diseases and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing 100193, China

^dFaculty of Environmental and Life Sciences, Beijing University of Technology, Beijing 100124, China

^eCollege of Marine Science and biological engineering, Qingdao University of Science and Technology, Qingdao, 266042, China

^fInstitute for Environmental Genomics and Department of Microbiology and Plant Biology, University of Oklahoma, Norman, OK 73019, USA

^gEarth Sciences Division, Lawrence Berkeley National Laboratory, Berkeley, CA 94720, USA

Email addresses for all authors: Jingmin Cheng,

chengjm17@mails.tsinghua.edu.cn; Zhongjie Han, zhongjiehan@emails.bjut.edu.cn;

Jing Cong, yqdh77@163.com, Jingjing Yu, 15034576002@163.com; Mengxin Zhao,

zhaomengxin11@tsinghua.org.cn; Jizhong Zhou, jzhou@ou.edu; Yuguang Zhang,

yugzhang@sina.com.cn

Correspondence authors:

*State Key Laboratory for Biology of Plant Diseases and Insect Pests, Institute of Plant Protection, Chinese Academy of Agricultural Sciences, Beijing 100193, China

E-mail address: zhaomengxin11@tsinghua.org.cn (Mengxin Zhao)

**Research Institute of Forest Ecology, Environment and Protection, and the Key Laboratory of Biological Conservation of National Forestry and Grassland

Administration, Chinese Academy of Forestry, Beijing 100091, China

E-mail address: yugzhang@sina.com.cn (Yuguang Zhang)

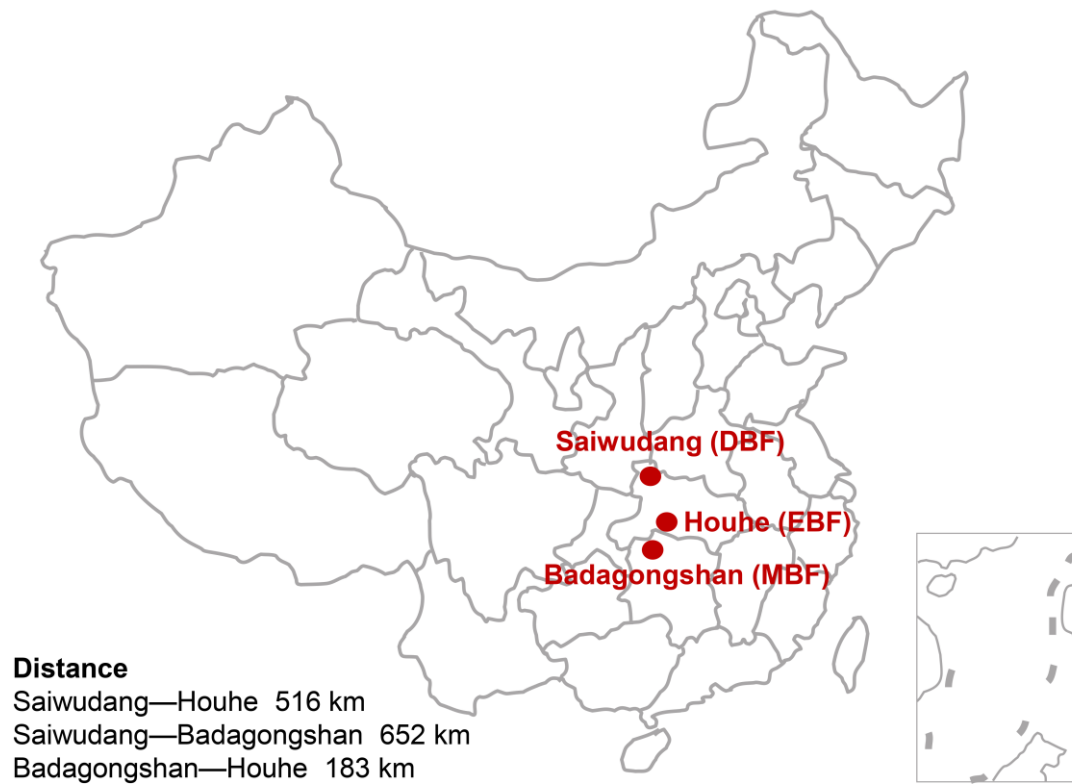


Figure S1. The geographical locations of forest sites. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest.

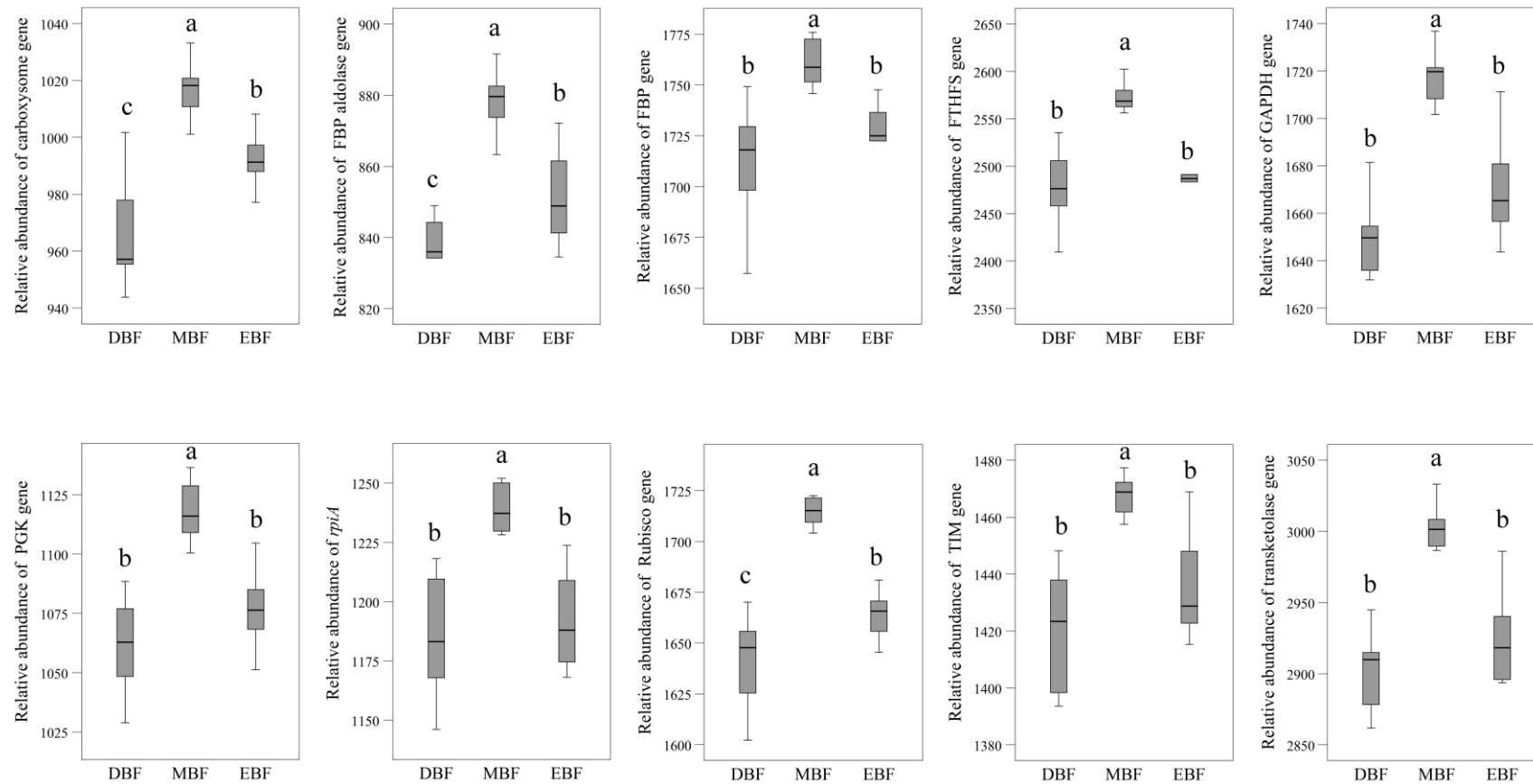


Figure S2. Comparison of microbial functional genes for C fixation among forests. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest. Letters including “a” “b” and “c” above bars indicate significant difference ($P < 0.05$, one-way ANOVA with Tukey HSD) among forests.

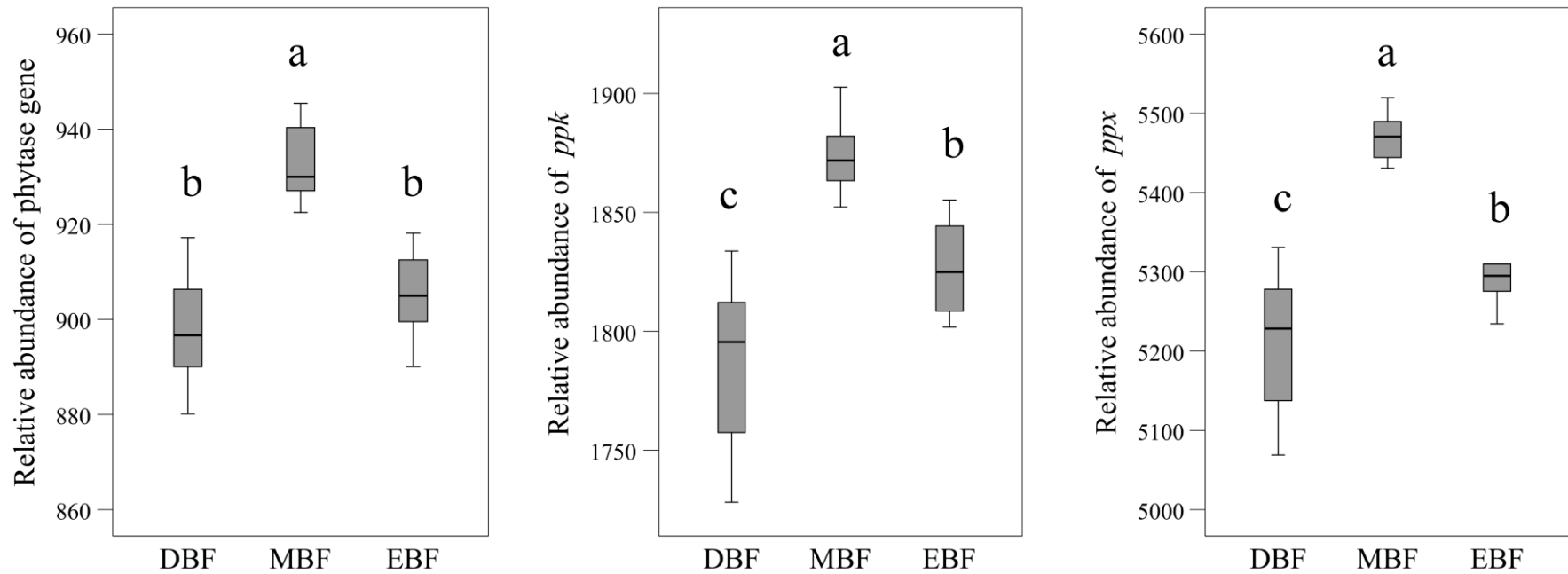


Figure S3. Comparison of microbial functional genes for P cycling among forests. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest. Letters including “a” “b” and “c” above bars indicate significant difference ($P < 0.05$, one-way ANOVA with Tukey HSD) among forests.

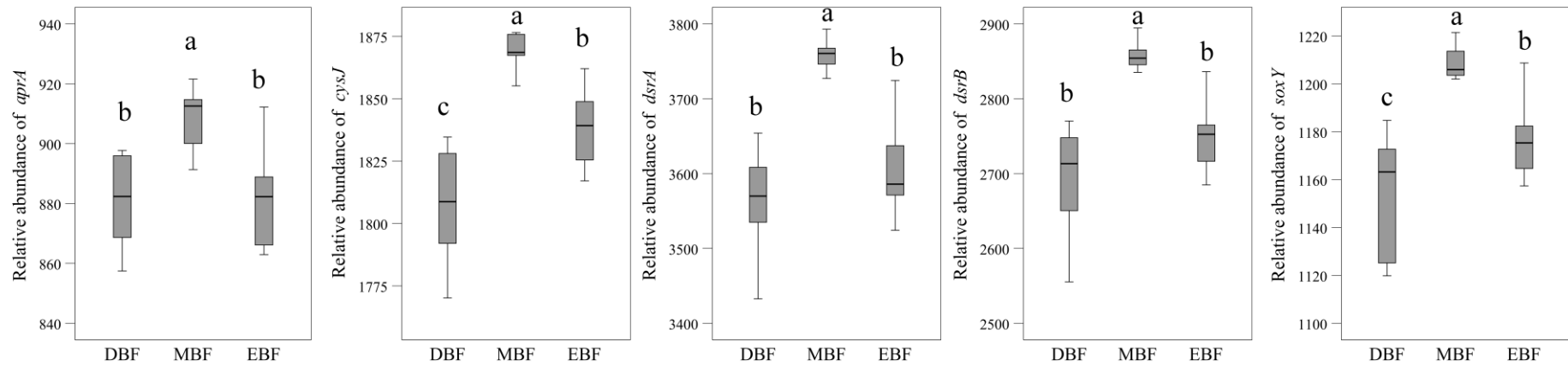


Figure S4. Comparison of microbial functional genes for S cycling among forests. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest. Letters including “a” “b” and “c” above bars indicate significant difference ($P < 0.05$, one-way ANOVA with Tukey HSD) among forests.

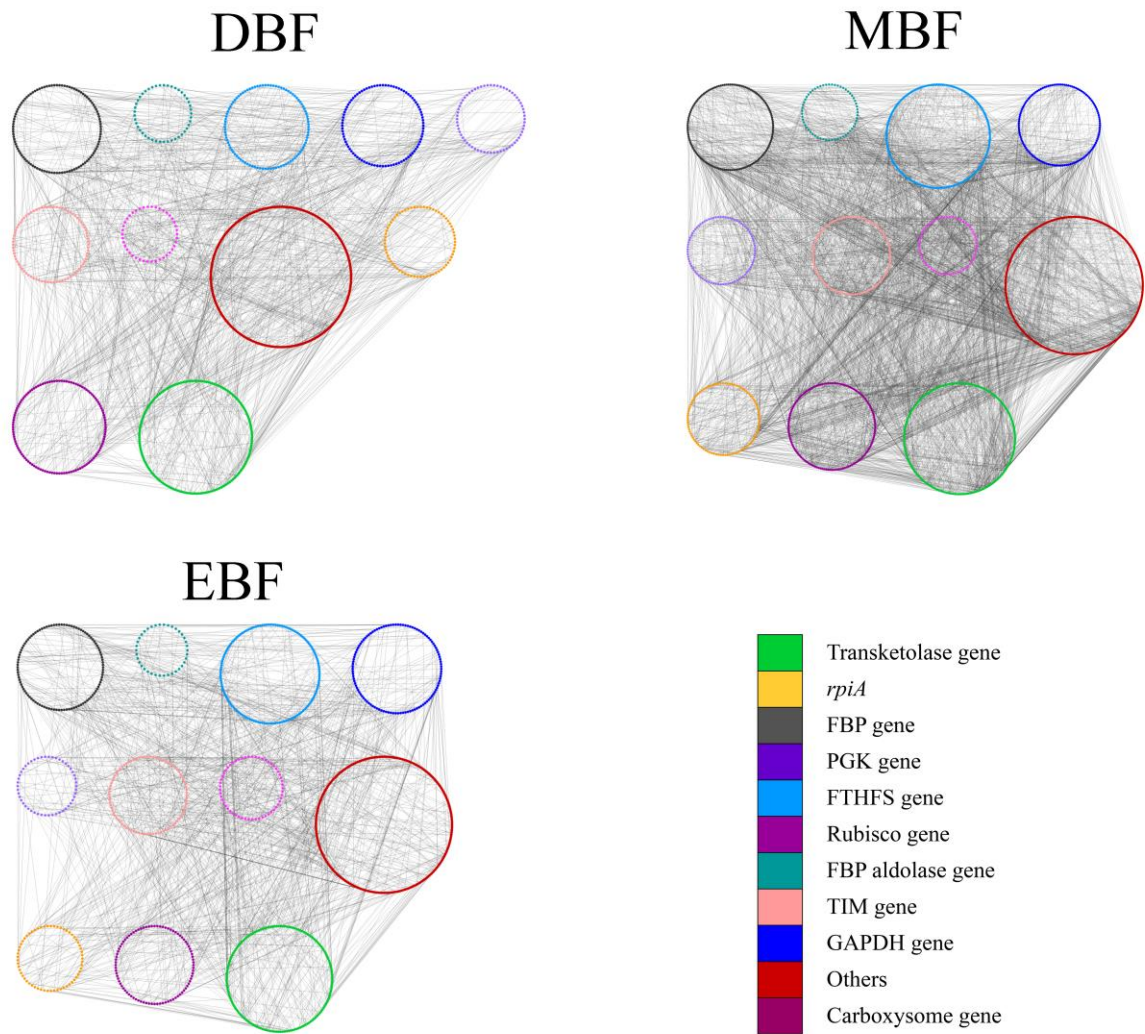


Figure S5. Topology of forest-specific networks based on microbial functional genes for C fixation. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest. Each dot indicates a node and each line indicates an edge. Nodes are separated by genes, which are indicated by different colors.

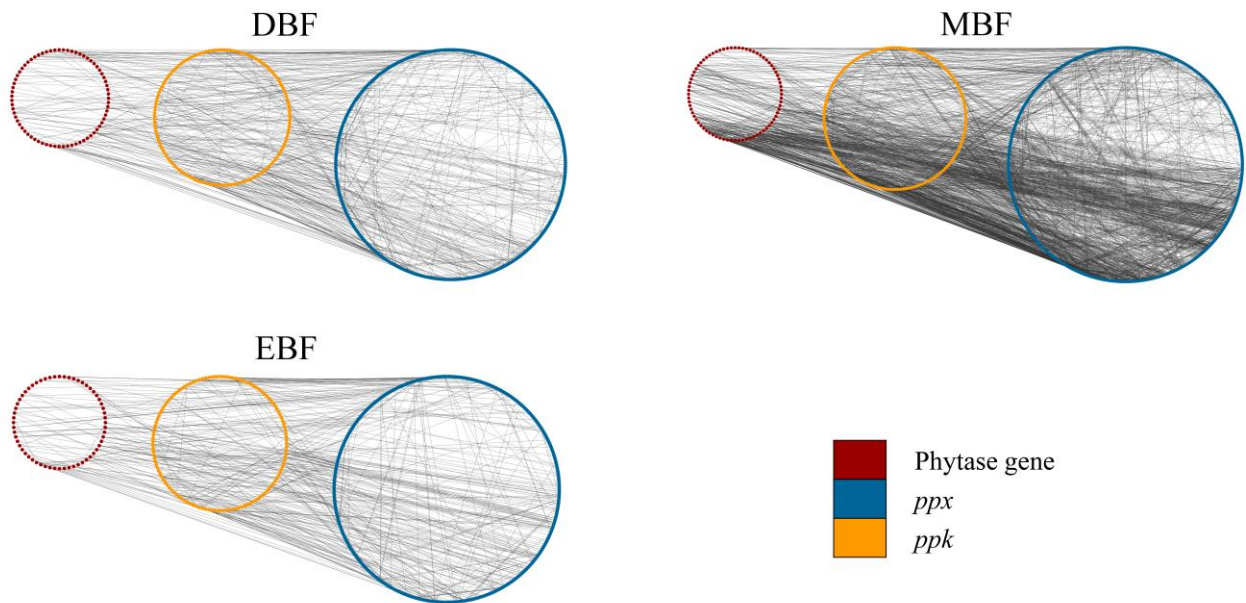


Figure S6. Topology of forest-specific networks based on microbial functional genes for P cycling. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest. Each dot indicates a node and each line indicates an edge. Nodes are separated by genes, which are indicated by different colors.

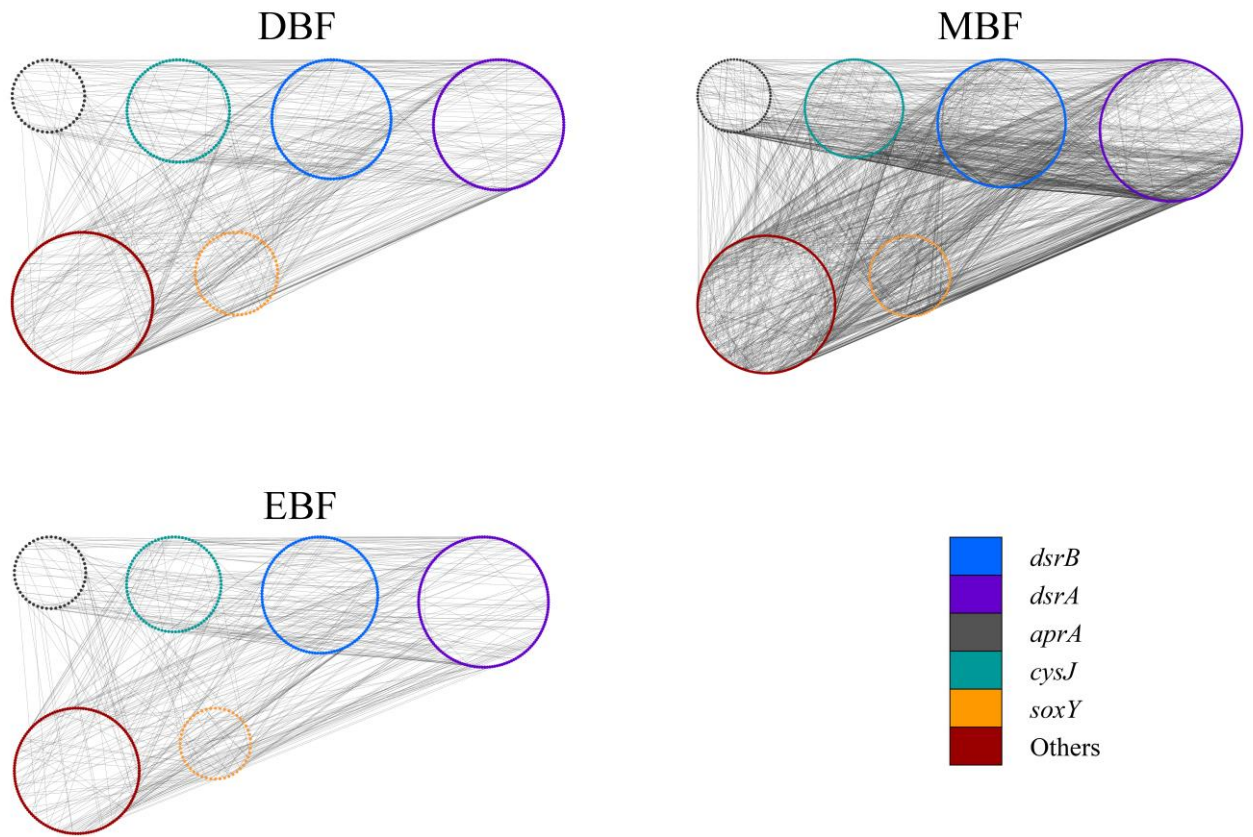


Figure S7. Topology of forest-specific networks based on microbial functional genes for S cycling. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest. Each dot indicates a node and each line indicates an edge. Nodes are separated by genes, which are indicated by different colors.

Table S1. Comparison of environmental variables (including plant-related and edaphic variables) among forests. DBF: the deciduous broad-leaved forest. MBF: the mixed deciduous-evergreen broad-leaved forest. EBF: the evergreen broad-leaved forest. Letters including “a” “b” and “c” next to values (mean \pm standard deviation, n = 9) indicate significant difference ($P < 0.05$, one-way ANOVA with Tukey HSD) among forests.

	DBF	MBF	EBF
<i>Plant-related variables</i>			
dIVI	0.99 \pm 0.03 a	0.52 \pm 0.10 b	0.19 \pm 0.07 c
Shannon-Wiener index	3.11 \pm 0.40 a	3.23 \pm 0.32 a	2.61 \pm 0.13 b
Richness	49 \pm 12 a	56 \pm 5 a	21 \pm 3 b
Pielou’s evenness	0.80 \pm 0.06	0.81 \pm 0.08	0.86 \pm 0.06
<i>Edaphic variables</i>			
Soil pH	4.48 \pm 0.48 b	4.12 \pm 0.18 b	6.72 \pm 0.72 a
Organic carbon (C) (g kg ⁻¹)	42.32 \pm 10.94 b	64.91 \pm 20.71 a	53.58 \pm 19.44 ab
Total nitrogen (N) (g kg ⁻¹)	3.19 \pm 0.87 b	5.07 \pm 1.38 a	4.72 \pm 1.36 a
Total potassium (K) (g kg ⁻¹)	0.70 \pm 0.36 b	1.13 \pm 0.16 b	1.86 \pm 0.57 a
Total phosphorus (P) (g kg ⁻¹)	0.25 \pm 0.08 b	0.59 \pm 0.07 a	0.65 \pm 0.26 a
Total sulfur (S) (g kg ⁻¹)	0.41 \pm 0.12 b	1.06 \pm 0.12 a	0.89 \pm 0.30 a
NH ₄ ⁺ -N (mg kg ⁻¹)	41.59 \pm 7.16 b	83.83 \pm 27.71 a	17.11 \pm 10.16 c
NO ₃ ⁻ -N (mg kg ⁻¹)	5.14 \pm 5.97 b	43.48 \pm 20.05 a	36.40 \pm 10.15 a
Alkali-hydrolysable N (mg kg ⁻¹)	291.33 \pm 70.55 b	510.19 \pm 106.37 a	417.03 \pm 89.99 a
Plant available P (mg kg ⁻¹)	8.95 \pm 3.47 a	6.74 \pm 1.62 ab	5.34 \pm 2.12 b
Fe ³⁺ (g kg ⁻¹)	13.78 \pm 1.94 b	34.24 \pm 2.45 a	34.05 \pm 9.10 a