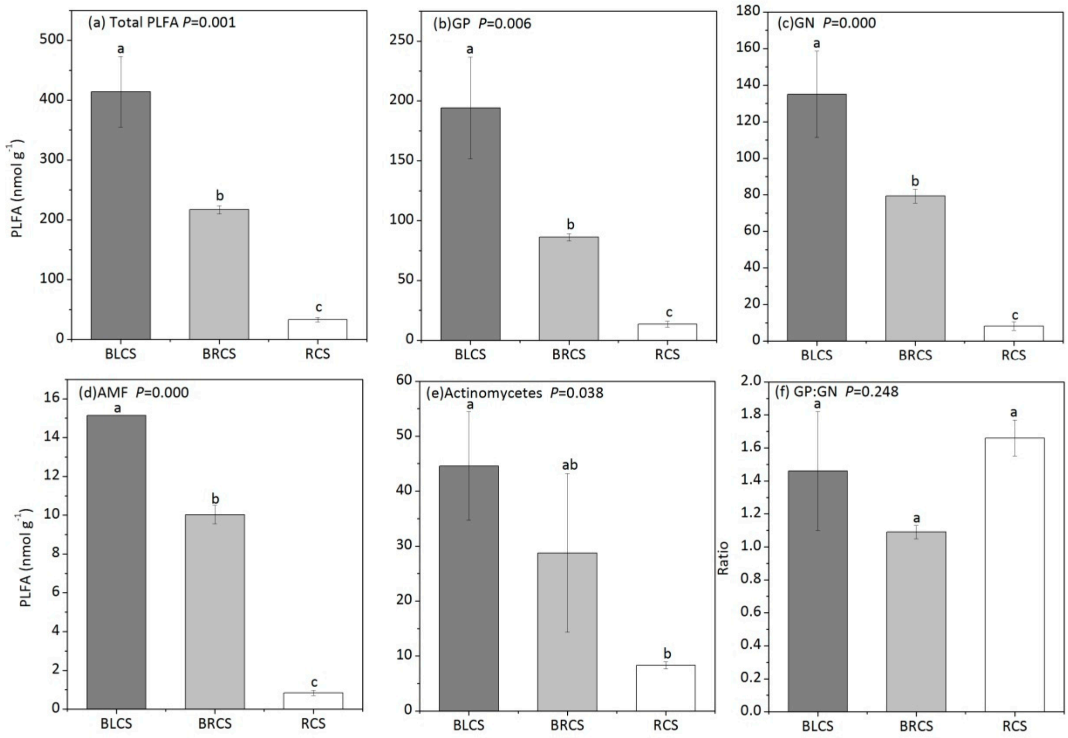

Figure S1. Effects of different calcareous soils on the abundance of soil microbial groups (indicated by PLFA) in the subtropical evergreen broadleaved forest of southwest of China. Values are means with standard error (SE), $n = 3$. PLFA, phospholipid fatty acids; GP, gram positive bacteria; GN, gram negative bacteria; AMF, arbuscular mycorrhizal fungi. Different lowercase letters denote significant difference at $p < 0.05$ level among different soil evolvement stages. BLCS, BRCS and RCS represent black calcareous soil, brown calcareous soil and red calcareous soil, respectively.

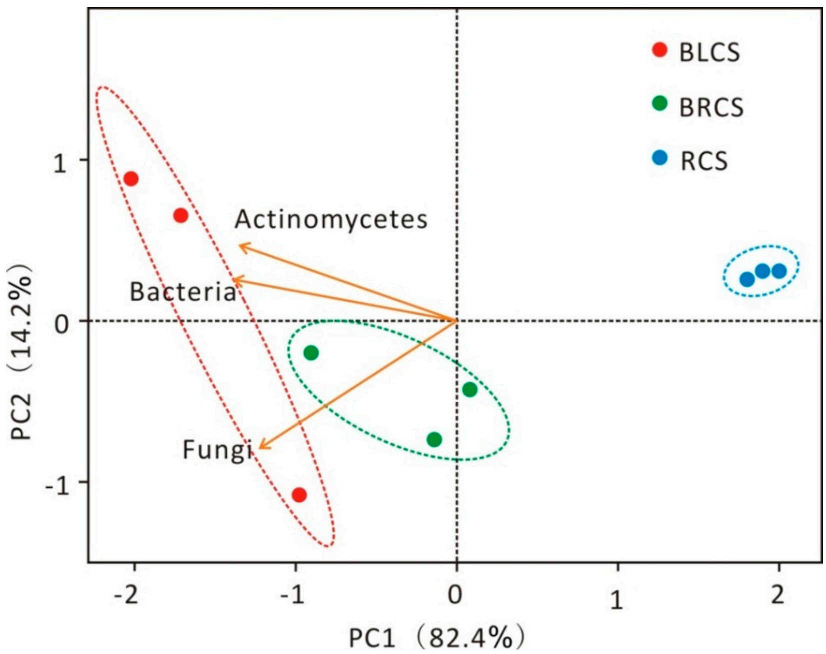

Figure S2. Principal component analysis (PCA) of microbial phospholipid fatty acids (PLFAs, vectors with different color lines). Percentages along the axes correspond to the amount of explained variability in PLFA. Each individual symbol represents an individual soil sample (*n* = 3) from one of the three treatments. BLCS, BRCS and RCS represent black calcareous soil, brown calcareous soil and red calcareous soil, respectively. P value represents PerMANOVA test of the differences in PLFA based on Bray-Curtis distance measurements.

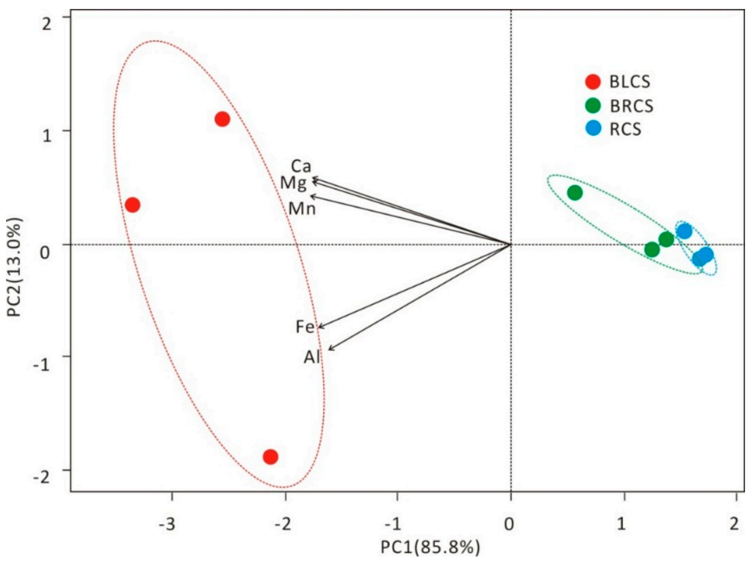

Figure S3. Principal component analysis (PCA) of extractable cations (vectors with different color lines). Percentages along the axes correspond to the amount of explained variability in extractable cations. Each individual symbol represents an individual soil sample (*n* = 3) from one of the three treatments. BLCS, BRCS and RCS represent black calcareous soil, brown calcareous soil and red calcareous soil, respectively.

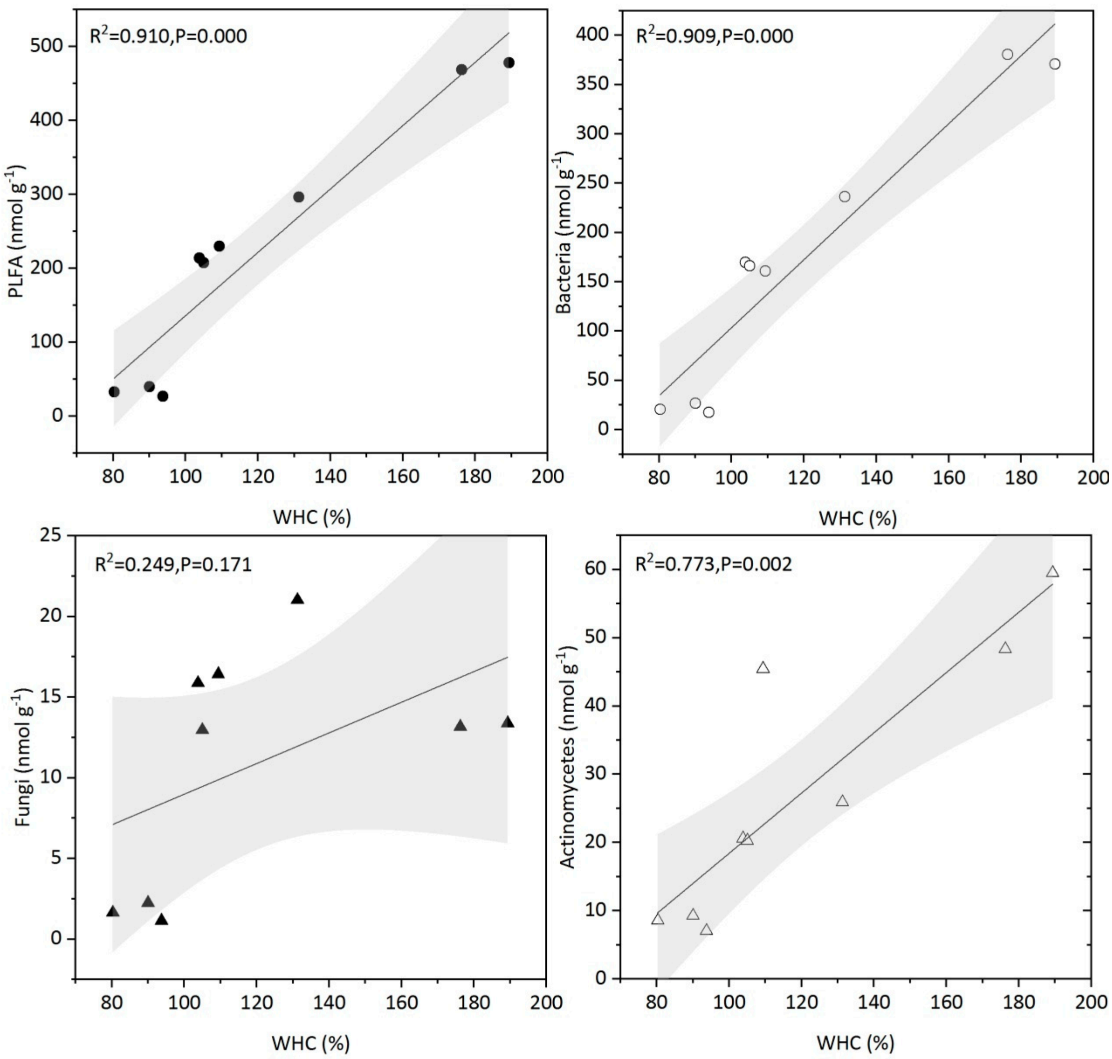

Figure S4. Correlation of microbial phospholipid fatty acids with water holding capacity in the subtropical karst area of southwest China. WHC represents water holding capacity.

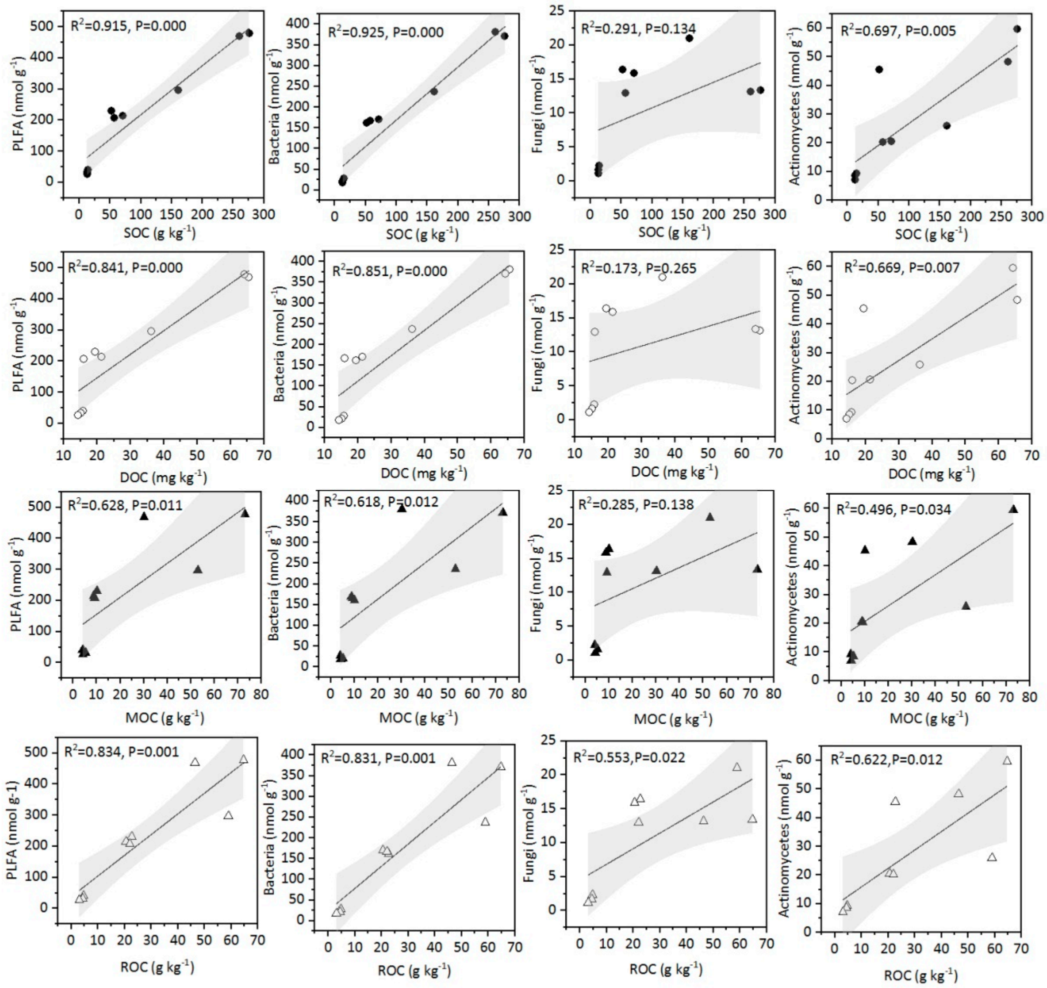

Figure S5. Correlation of SOC fractions with microbial phospholipid fatty acids in the subtropical karst area of southwest China.

Table S1. Basic information of the study area and sampling sites

Type	Soil	Vegetation
BLCS	The BLCS were sporadically distributed in stone joints and crevices with poor drainage, which were dark black and sticky in texture, and their layers were about 15 cm deep. The distribution area of BLCS has better preserved natural vegetation and leaf litter. The leaching of calcium carbonate in the soil is weak. The BLCS is dark in color, heavy in texture, and well developed in aggregate and kernel structure.	The site occupied by shrub community dominated by *vitex negundo*, *Loropetalum chinense*, *Rhus chinensis Mill.*, *Phragmites*, *miscanthus floridulus (Labill.) warb*, and *Cyclobalanopsisglauc*.
BRCS	The BRCS were continuously distributed, which were brown to dark brown and sticky in texture, and their average depth of layers were about 30 cm and their soil profile stratifications were not obvious. In these areas, the drainage was good, the leaching of calcium carbonate in soil was obvious, the exchangeable cations were reduced, and the base saturation was decreased.	The dominant species in the shrub were *Loropetalum chinense*, *Alchornea trewioides*, *Vitexnegundo* and *Bauhinia championii*.
RCS	The RCS were continuously distributed, which were brownish red to dark red and sticky in texture, and their average depth of layers were about 150 cm and their soil profile stratifications were also not obvious. The RCS had a long history of formation, mostly developed	The dominant species in the shrub were *Rhodomyrtus tomentosa*, *Loropetalum chinense*, and *Paeonia delavayi* .

in the hot and rainy climate conditions. The soil was strongly leached, and a large number of salts were leached or even exhausted, which was unsaturated soil.

***Cite**: Zhang M.L.; Deng Z.Q. The soil and soil-forming processes in karst area of South China. Journal of Guizhou Institute of Technology,1994,23(1): 67-75 (in Chinese)*

Table S2. The phospholipid fatty acids detected in this study (Chen et al., 2020).

Category	Fatty acid
Bacteria	11:0 anteiso, 11:0 iso,12:0 anteiso, 12:0 iso, 13:0 anteiso, 13:0 iso, 14:0 anteiso, 14:0 iso, 14:1 iso w7c, 15:0 anteiso, 15:0 iso, 15:1 anteiso w9c, 15:1 iso w6c, 15:1 iso w9c, 16:0 anteiso, 16:0 iso, 17:0 anteiso, 17:0 iso, 17:1 iso w9c, 18:0 iso, 19:0 anteiso, 19:0 iso, 20:0 iso, 22:0 iso, 10:0 2OH, 10:0 3OH, 12:0 2OH, 12:1 w5c, 12:1 w8c, 13:1 w3c, 13:1 w4c, 13:1 w5c, 14:0 2OH, 14:1 w5c, 14:1 w7c, 14:1 w8c, 14:1 w9c, 15:1 w5c, 15:1 w6c, 15:1 w7c, 15:1 w8c, 15:1 w9c, 16:0 2OH, 16:1 w3c, 16:1 w4c, 16:1 w6c, 16:1 w7c, 16:1 w9c, 17:0 cyclo w7c, 17:1 w3c, 17:1 w4c, 17:1 w5c, 17:1 w6c, 17:1 w7c, 17:1 w8c, 17:1 w9c, 18:1 w3c, 18:1 w5c, 18:1 w6c, 18:1 w7c, 18:1 w8c, 19:0 cyclo w6c, 19:0 cyclo w7c, 19:0 cyclo w9c, 19:1 w6c, 19:1 w7c, 19:1 w8c, 19:1 w9c, 20:0 cyclo w6c, 20:1 w4c, 20:1 w6c, 20:1 w8c, 20:1 w9c, 21:1 w3c, 21:1 w4c, 21:1 w5c, 21:1 w6c, 21:1 w8c, 21:1 w9c, 22:0 cyclo w6c, 22:1 w3c, 22:1 w5c, 22:1 w6c, 22:1 w8c, 22:1 w9c, 24:1 w7c, 24:1 w9c
Gram Positive	11:0 anteiso, 11:0 iso,12:0 anteiso, 12:0 iso, 13:0 anteiso, 13:0 iso, 14:0 anteiso, 14:0 iso, 14:1 iso w7c, 15:0 anteiso, 15:0 iso, 15:1 anteiso w9c, 15:1 iso w6c, 15:1 iso w9c, 16:0 anteiso, 16:0 iso, 17:0 anteiso, 17:0 iso, 17:1 iso w9c, 18:0 iso, 19:0 anteiso, 19:0 iso, 20:0 iso, 22:0 iso
Gram Negative	10:0 2OH, 10:0 3OH, 12:0 2OH, 12:1 w5c, 12:1 w8c, 13:1 w3c, 13:1 w4c, 13:1 w5c, 14:0 2OH, 14:1 w5c, 14:1 w7c, 14:1 w8c, 14:1 w9c, 15:1 w5c, 15:1 w6c, 15:1 w7c, 15:1 w8c, 15:1 w9c, 16:0 2OH, 16:1 w3c, 16:1 w4c, 16:1 w6c, 16:1 w7c, 16:1 w9c, 17:0 cyclo w7c, 17:1

	w3c, 17:1 w4c, 17:1 w5c, 17:1 w6c, 17:1 w7c, 17:1 w8c, 17:1 w9c, 18:1 w3c, 18:1 w5c, 18:1 w6c, 18:1 w7c, 18:1 w8c, 19:0 cyclo w6c, 19:0 cyclo w7c, 19:0 cyclo w9c, 19:1 w6c, 19:1 w7c, 19:1 w8c, 19:1 w9c, 20:0 cyclo w6c, 20:1 w4c, 20:1 w6c, 20:1 w8c, 20:1 w9c, 21:1 w3c, 21:1 w4c, 21:1 w5c, 21:1 w6c, 21:1 w8c, 21:1 w9c, 22:0 cyclo w6c, 22:1 w3c, 22:1 w5c, 22:1 w6c, 22:1 w8c, 22:1 w9c, 24:1 w7c, 24:1 w9c
Fungi	18:2 w6c, 16:1 w5c
AMF	16:1 w5c
Others	16:0 10-methyl, 17:0 10-methyl, 17:1 w7c 10-methyl, 18:0 10-methyl, 18:1 w7c 10-methyl, 19:1 w7c 10-methyl, 20:0 10-methyl

Chen J, Xiao W, Zheng C, Zhu B. Nitrogen addition has contrasting effects on particulate and mineral-associated soil organic carbon in a subtropical forest [J]. Soil Biology and Biochemistry, 2020, 142:107708

Table S3. Total organic C (OC), nitrogen (N), and C/N ratios of OM fractions

Soil	Untreated			NaOCl-resistant									
				Total			Released by HF (MOC)				Not released by HF (ROC)		
	OC (g kg^{-1})	N (g kg^{-1})	C/N	OC (g kg^{-1})	N (g kg^{-1})	C/N	OC (g kg^{-1})	N (g kg^{-1})	C/N	% of total	OC (g kg^{-1})	N (g kg^{-1})	C/N
	161.2	14.4	13.1	112.0	8.7	15.0	53.0	3.3	18.5	47.3	59.0	5.4	12.8
BLCS	260.9	22.1	13. 8	76.6	6.1	14.7	30.2	1.7	20.5	39.4	46.4	4.4	12.4
	276.5	23.2	13.9	137.8	10.1	15.9	73.0	4.1	20.9	53.0	64.7	6.0	12.6
BRCS	52.5	4.9	12.5	32. 8	2.7	14.0	10.1	0.7	16.3	30.7	22.7	2.0	13.2

	71.2	6.2	13.3	29.4	2. 7	12.8	8.8	0.8	12.5	29.9	20.6	1.9	12.9
	57.4	5.1	13.1	31.2	2.6	14.3	9.2	0.7	14.9	29.4	22.1	1.8	14.2
	14.6	1.7	10.3	8. 8	0.7	11.9	4.1	0.5	9.7	46.6	4.7	0.4	14.8
RCS	13.1	1.7	9.0	9.6	0.7	15.8	5.2	0.3	20.9	54.1	4.4	0.4	12.6
	13.3	1.7	9.0	7.2	0.8	11.3	4.2	0.4	11.8	57.5	3.1	0.3	10.6