Supplementary Information for *Scientific Reports*

Soil microbial quantification approaches coupling with relative abundances reflecting the changes of taxa in different locations

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Supplementary Table S1. Summary of soil characteristics of the two sampling sites in this study.

Location	Elevation (m)	Latitude	Soil pH[a]	Soil moisture (%)	Total carbon content (TOC, mg/g)
Beijing	810-1349	40°31'10"N 115°49'32"E	6.17±0.48	21.49±7.35	46.69±27.96
Tibet	5088-5116	29°36'21"N 85°45'09"E	6.53±0.22	1.50±0.35	26.28±5.27

[a] Average individual soil variables (pH, moisture, and TOC) over 10 samples.

Supplementary Table S2. Dissimilarity tests of microbial communities from two sampling sites[a].

Dissimilarity	MRPP[b]		ANOSIM[c]		ADONIS[d]	
Beijing vs. Tibet	δ	P	R	P	F	P
Total	0.715	**0.002**	0.288	**0.002**	0.14	**0.001**
Proteobacteria	0.708	**0.003**	0.269	**0.005**	0.139	**0.001**
Actinobacteria	0.693	**0.003**	0.233	**0.007**	0.122	**0.003**
Acidobacteria	0.713	**0.002**	0.256	**0.002**	0.139	**0.002**
Bacteroidetes	0.755	**<0.001**	0.347	**0.001**	0.146	**0.002**
Verrucomicrobia	0.698	**<0.001**	0.318	**0.003**	0.16	**0.003**
Planctomycetes	0.798	**0.002**	0.379	**0.001**	0.125	**0.001**
Chloroflexi	0.72	**0.005**	0.271	**0.004**	0.139	**0.007**
Gemmatimonadetes	0.715	**<0.001**	0.269	**0.003**	0.148	**0.001**
Crenarchaeota	0.699	**0.002**	0.223	**0.01**	0.142	**0.004**
Cyanobacteria	0.866	**0.003**	0.213	**0.015**	0.109	**0.004**

[a] Different statistical approaches were used with Bray-Curtis distances, and P values were of corresponding significance tests.

[b] MRPP, multiresponse permutation procedure.

[c] ANOSIM, analysis of similarity.

[d] ADONIS, permutational multivariate analysis of variance with the Adonis function.

Supplementary Table S3. Spearman and Kendall rank correlation (r values, n=20) between different measurements.

Spearman correlation	ATP	FCM	qPCR	PLFA	MBC
ATP	1	**0.839****	**0.793****	**0.496****	-0.179
FCM		1	**0.854****	**0.518****	-0.245
qPCR			1	**0.504****	-0.181
PLFA				1	-0.142
MBC					1

Kendall correlation	ATP	FCM	qPCR	PLFA	MBC
ATP	1	**0.642****	**0.586****	**0.311***	-0.132
FCM		1	**0.670****	**0.364***	-0.111
qPCR			1	**0.402****	-0.085
PLFA				1	-0.085
MBC					1

*: $P < 0.05$; **: $P < 0.01$

Supplementary Table S4. Correlation tests (r values, n=20) between different measurements and the environmental factors.

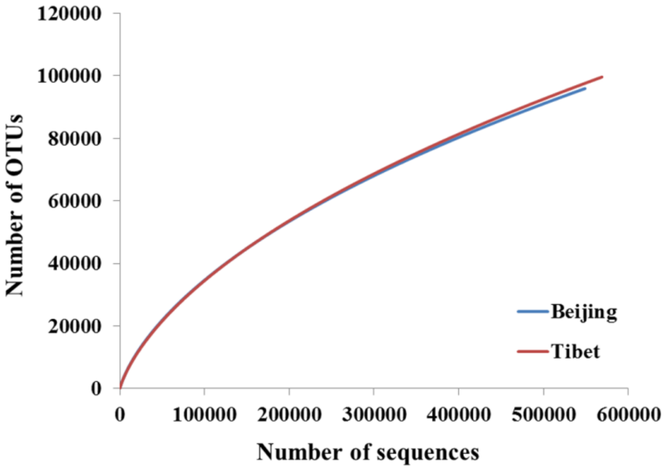
Pearson correlation	Moisture	TOC
ATP	**0.806*** **	**0.708*** **
FCM	**0.803*** **	**0.697** **
qPCR	**0.679*** **	**0.748*** **
PLFA	**0.650** **	**0.626** **
MBC	-0.245	0.041

**: $P < 0.01$; *** : $P < 0.001$

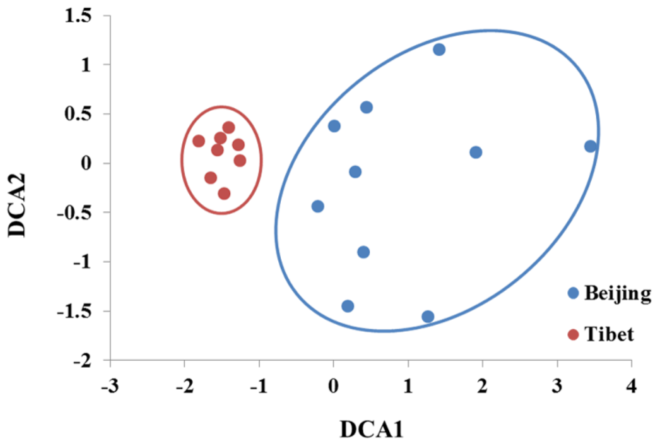
Supplementary Table S5. Correlation tests (r values, n=20) between the environmental factors and the EAA of the major phyla based on the ATP measurement.

Pearson correlation	Moisture	TOC
Proteobacteria	__0.784**__	__0.585**__
Acidobacteria	__0.698**__	__0.511*__
Actinobacteria	__0.741**__	__0.608**__
Bacteroidetes	__0.575**__	__0.528*__
Verrucomicrobia	__0.595**__	__0.508*__
Chloroflexi	__0.665**__	__0.512*__
Gemmatimonadetes	__0.651**__	0.433
Planctomycetes	__0.706**__	__0.577**__
Cyanobacteria	__-0.596**__	-0.227

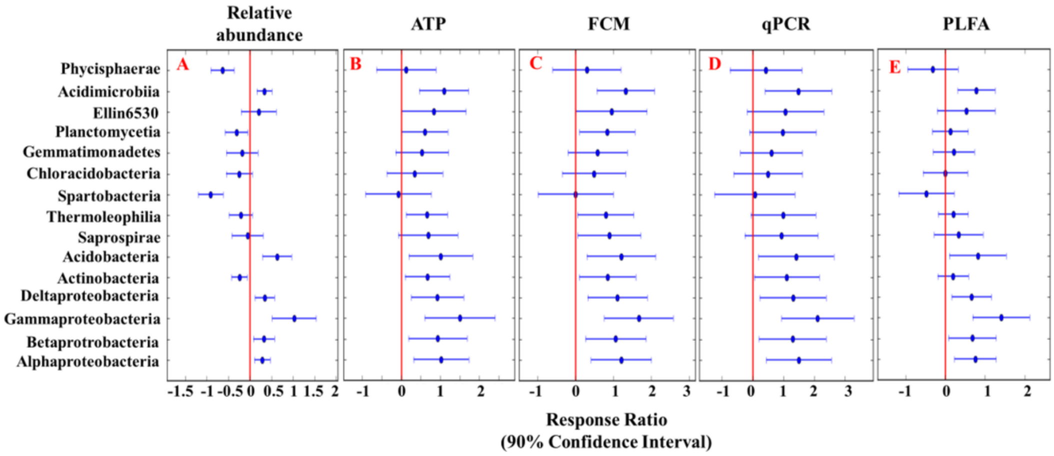
*: $P < 0.05$; **: $P < 0.01$



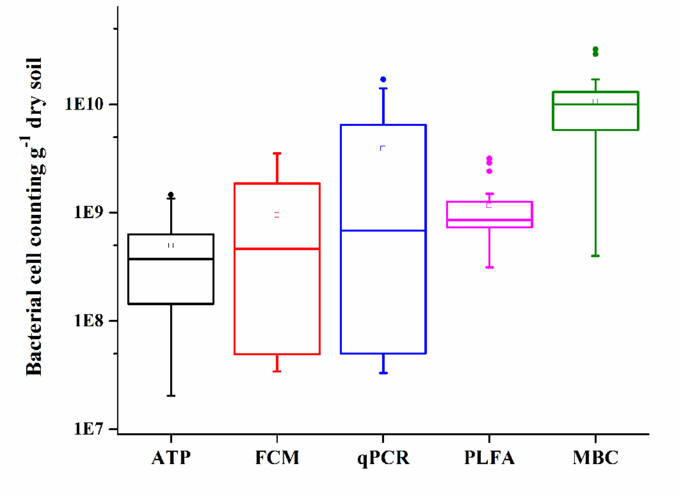
Supplementary Figure S1. Rarefaction curves based on 16S rRNA gene amplicon sequencing of soil microbial communities.



Supplementary Figure S2. Detrended correspondence analysis (DCA) of microbial community composition in Beijing and Tibet sampling sites based on 16S rRNA gene sequencing.



Supplementary Figure S3. Response ratio for the differences between the relative abundances and absolute abundances of the major class in the two sampling sites. Significance was determined using the response ratio analysis at a 95% confidence level. The 95% CI of a response variable without overlapping with zero represent a significant result, otherwise, with non-significance. The vertical solid line was drawn when the variables of Beijing samples equaled with those of Tibet samples.



Supplementary Figure S4. Bacterial cell numbers assessed by five different methods in Beijing and Tibet sites. Horizontal lines show median values, □ indicate mean values, boxes denote values comprised within the lower and upper quartile of the data, the vertical lines represent ranges, and • indicate outliers.