Supporting Information

Ecological effects of heavy metal pollution on soil microbial community structure and diversity on both sides of a river around a mining area

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Supplementary materials

Supplementary materials Table S1 Mine soil physical and chemical properties and evaluation of heavy metal pollution.

Sample area	pH	Cu (mg/kg)	Zn (mg/kg)	Pb (mg/kg)	Cd (mg/kg)	Ni (mg/kg)	P_N	RI	MC (g/kg)	TOC (g/kg)	TN (mg/kg)	TP (mg/kg)	AK (mg/kg)
S1	6.28±	1274.5±	594.31±	616.94±	11.16±	46.06±	13.18±	609.24±	0.07±	3.69±	977.46±	801.61±	53.45±
	0.19a	59.74e	61.97c	74.42c	2.04c	12.45ab	1.01c	54.01d	0.02b	0.64a	69.1a	56.87d	14.19a
S2	7.79±	240.57±	314.34±	193.23±	6.7±	67.77±	6.99±	325.06±	0.04±	10.15±	1265.20±	458.25±	95.78±
	0.59b	81.72b	66.82b	12.89b	1.32ab	0.84c	0.58b	32.2c	0.01a	1.1bc	135.01b	16.05c	18.81ab
S3	6.33±	317.7±	132.59±	96.13±	5.79±	50.8±	6.20±	280.47±	0.15±	16.12±	1489.23±	358.95±	110.3±
	0.05a	28.73b	28.4a	8.45a	0.6ab	3.47b	0.64b	28.71	0.02cd	1.08d	109.43b	57.4ab	19.71bc
S4	6.11±	397.13±	276.31±	70.48±	5.02±	43.53±	5.51±	251.04±	0.15±	9.47±	2455.69±	485.17±	168.8±
	0.04a	13.11c	11.53b	5.99a	0.14ab	3.87b	0.38ab	14.87ab	0.02d	0.73b	110.09d	14.97c	14.71c
S5	7.02±	634.4±	145.18±	55.21±	4.33±	37.45±	6.17±	233±	0.09±	12.33±	1418.08±	428.52±	151.1±
	0.66a	36.15d	13.7a	6.04a	0.46ab	1.17ab	0.48b	15.56ab	0.01bc	0.26c	9.92b	54.82c	21.07c
S6	6.18±	128.95±	106.96±	38.59±	5.00±	44.45±	5.24±	229.9±	0.11±	8.90±	1190.94±	257.92±	138±
	0.07a	11.39a	6.33a	4.53a	0.16ab	1.73b	0.17ab	8.43ab	0.01bcd	0.63b	94.79b	18.33a	9.9bc
S7	6.24±	114.66±	107.06±	59.09±	3.11±	22.48±	3.35±	149.12±	0.10±	15.14±	1776.22±	400.03±	168.5±
	0.12a	8.23b	18.12a	6.12a	0.29a	6.22a	0.31a	16.1a	0.01bcd	0.73d	152.4c	41.61bc	25.85d

Note: The results are expressed as the mean ± standard error a;

a: Indicates significance difference among 7 samples in different areas;

Total organic carbon (TOC); Total nitrogen (TN); Total phosphorus (TP); Available potassium (AK); Moisture content (MC).

P_N: (Nemerow's pollution index).

The Grading Standards: $P_N \leq 0.7$, safety; $0.7 < P_N \leq 1$, warning limit; $1 < P_N \leq 2$, slight pollution; $2 < P_N \leq 3$, moderate pollution; $P_N > 3$, heavy pollution.

Potential ecological risk assessment (RI): RI <150, low potential ecological risk; 150 ≤ RI < 300, moderate ecological risk; 300 ≤ RI <600, considerable ecological risk; RI ≥ 600 very high ecological risk. Background values: (Cu:79.0 g/kg, Zn:139 g/kg, Pb:67 g/kg, Cd:0.71 g/kg, Ni:33 g/kg)

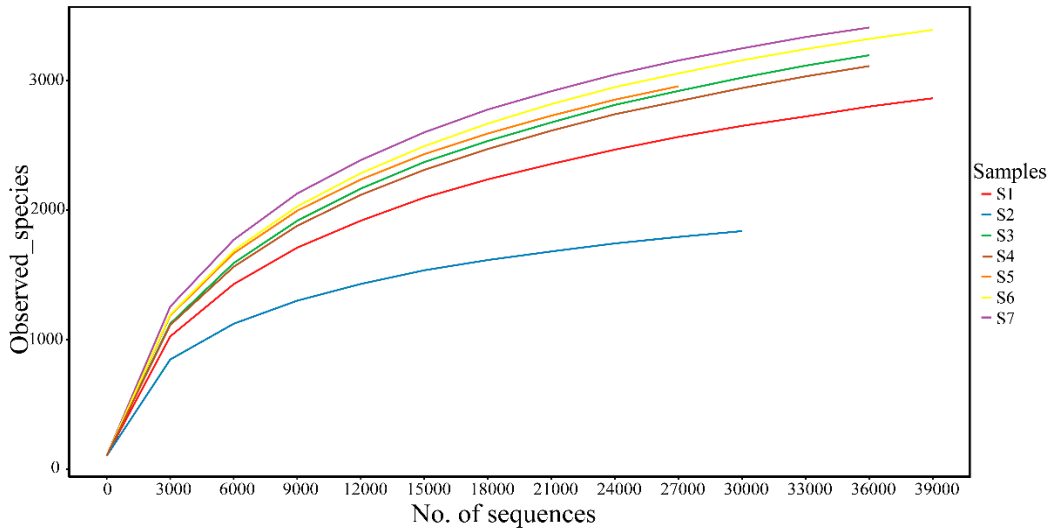
Supplementary materials Table S2 Microbial community diversity index (97% sequence similarity).

Sample area	No. of seqs		No. of OTUs		Chao1		Dominance		Observed species		Shannon		Simpson	
	Bacteria	Archaea	Bacteria	Archaea	Bacteria	Archaea	Bacteria	Archaea	Bacteria	Archaea	Bacteria	Archaea	Bacteria	Archaea
S1	39535	379	2852	26	3434.454	30.25173	0.006206	0.22032	2588	20	9.155878	1.624835	0.993794	0.779679
S2	30549	3933	1794	22	2109.61	23.69167	0.011783	0.250279	1770	16	8.488059	2.352446	0.988217	0.749721
S3	38080	1387	3236	106	3904.8	124.6617	0.005608	0.083883	2969	104	9.501584	4.644679	0.994392	0.916117
S4	36238	1592	3102	115	3824.674	135.7744	0.011628	0.069934	2885	107	9.277772	4.776795	0.988372	0.930066
S5	28925	5349	3001	53	3865.062	48.24848	0.003756	0.74109	3001	30	9.742548	1.07126	0.996244	0.25891
S6	39485	1281	3395	88	3941.841	102.8824	0.003816	0.133983	3105	88	9.805996	4.101433	0.996184	0.866017
S7	36483	1432	3414	101	3991.138	134.7559	0.003589	0.120121	3203	97	9.939062	4.162279	0.996411	0.879879

Supplementary materials Table S3 Pearson correlation analysis between heavy metals and environmental factors.

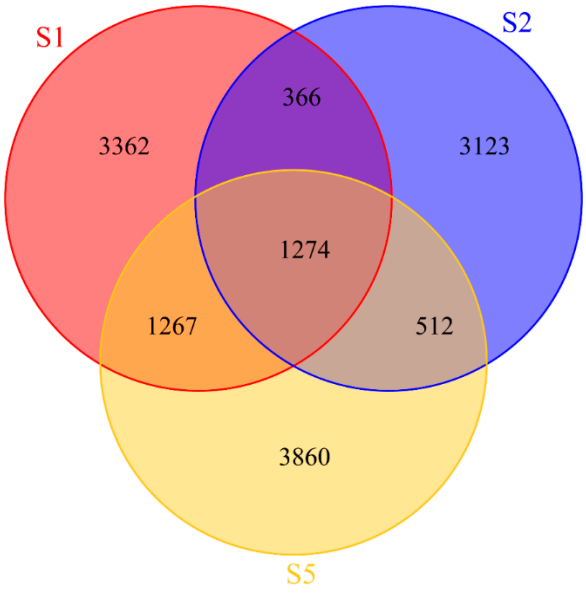
	pH	Cu	Zn	Pb	Cd	Ni	MC	TOC	TN	TP	AK	P_N	RI
pH	1												
Cu	-0.079	1											
Zn	0.076	0.829*	1										
Pb	-0.002	0.863*	0.942**	1									
Cd	0.046	0.818*	0.925**	0.955**	1								
Ni	0.610	0.052	0.356	0.243	0.470	1							
MC	-0.722	-0.269	-0.445	-0.471	-0.398	-0.337	1						
TOC	0.039	-0.675	-0.819*	-0.739	-0.769*	-0.284	0.412	1					
TN	-0.320	-0.370	-0.299	-0.518	-0.548	-0.321	0.637	0.343	1				
TP	-0.007	0.900**	0.945**	0.920**	0.828*	0.100	-0.381	-0.683	-0.210	1			
AK	-0.248	-0.647	-0.760*	-0.858*	-0.926**	-0.595	0.508	0.556	0.742	-0.643	1		
P_N	0.050	0.915**	0.918**	0.957**	0.977**	0.365	-0.409	-0.769*	-0.556	0.872**	-0.882**	1	
RI	0.027	0.874*	0.939**	0.971**	0.994**	0.396	-0.399	-0.772*	-0.529	0.874*	-0.900**	0.992**	1

Note: ** indicates an extremely significant correlation ($p < 0.01$), and * indicates a significant correlation ($p < 0.05$).

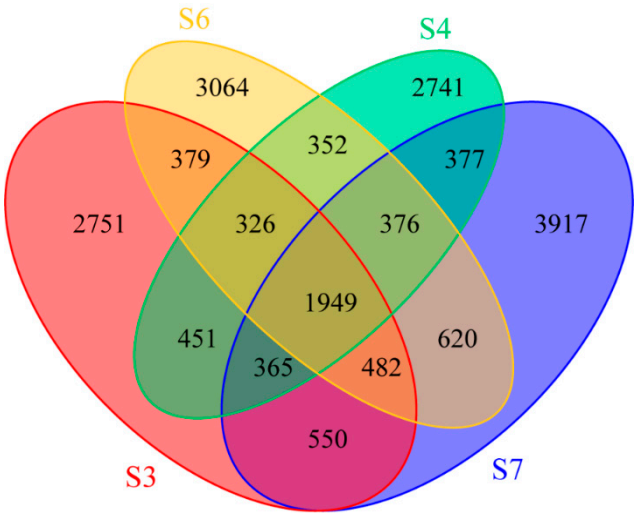


Supplementary materials Fig. S1 Microbial community dilution curve.

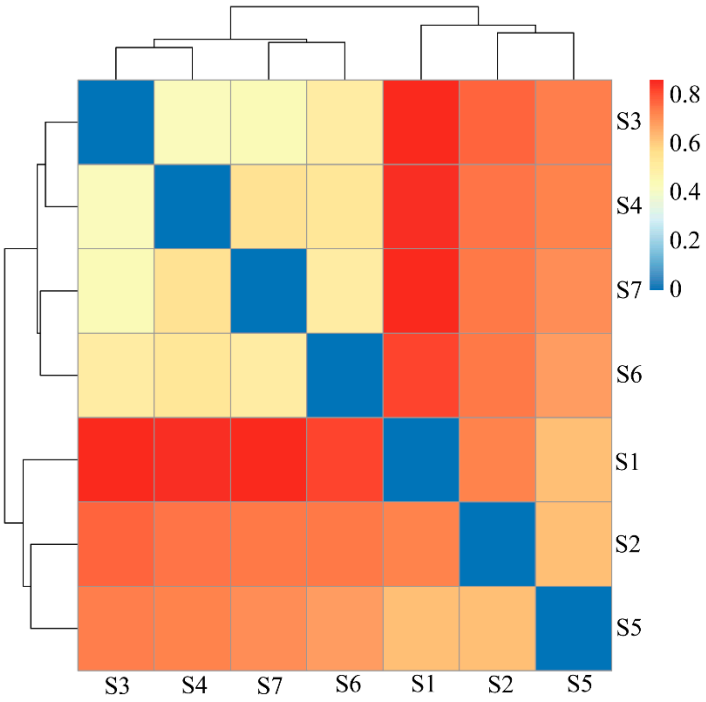
Note: Abandoned land (S1); Vegetable filed (S2, S5); Paddy field (S3, S4, S6, and S7).



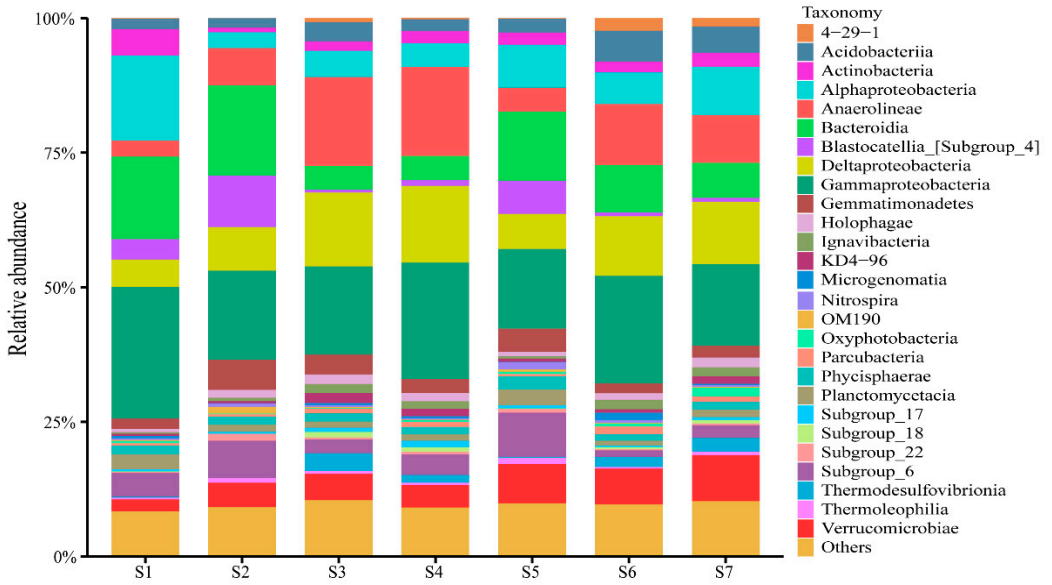
Supplementary materials Fig. S2 Venn diagram of sampling points S1, S2, S5.



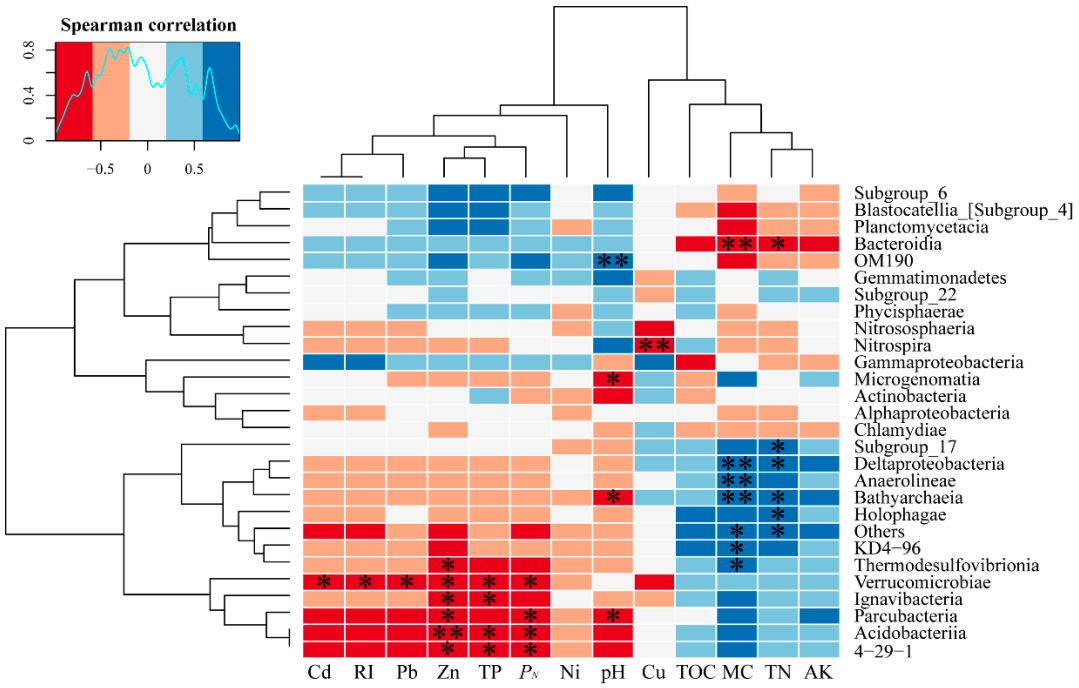
Supplementary materials Fig. S3 Venn diagram of sampling points S3, S4, S6, and S7.



Supplementary materials Fig. S4 Similarity metric heat map based on the Bray-Curtis distance.



Supplementary materials Fig. S5 Relative abundance (%) of dominant bacteria at the class level.



Supplementary materials Fig. S6 Correlation between soil physical and chemical properties and heavy metals and microbial community abundance.