Supplementary Material

Revegetation Enriched Microbial Carbon-, Nitrogen- and Phosphorus-Cycling Genes in Pb-Zn Tailings, Promoted Their Coupling, and Was Regulated by Plant Type and Colonization Time

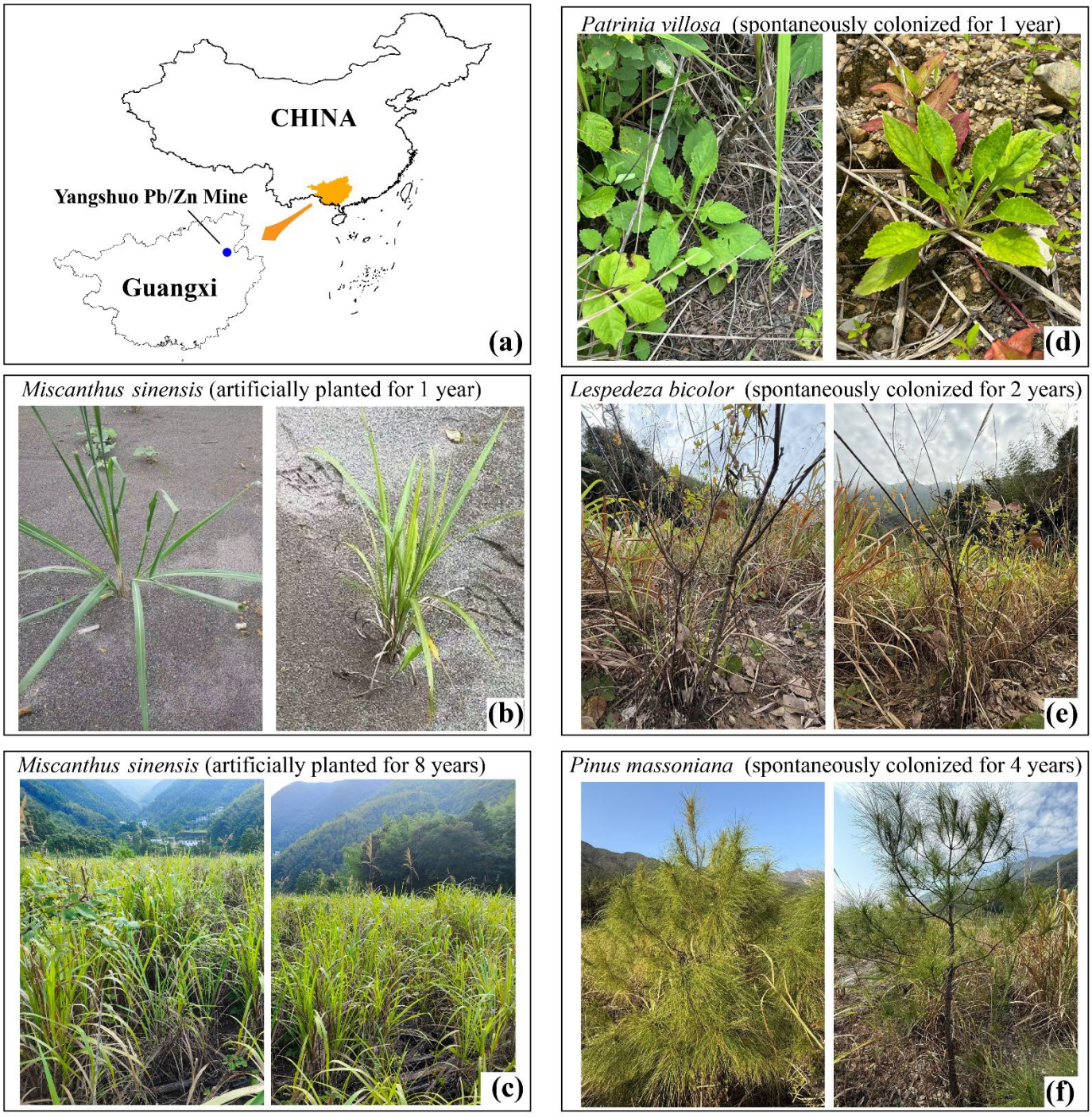


Fig. S1 The location of the test site in China (a) and photos of the plants on the site (b)-(f).

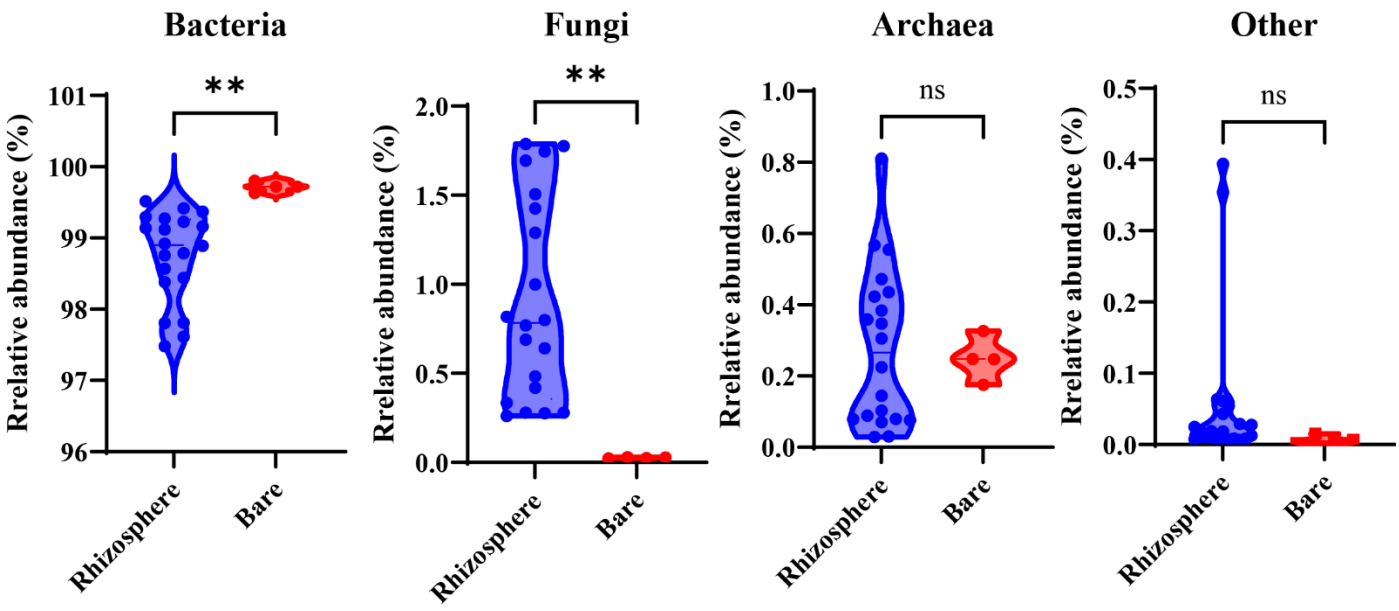


Fig. S2 The relative abundance of microorganisms in bare and rhizosphere tailings at the kingdom level.

Notes: ns, indicates no significant difference; **, indicates significant difference; student t-test.

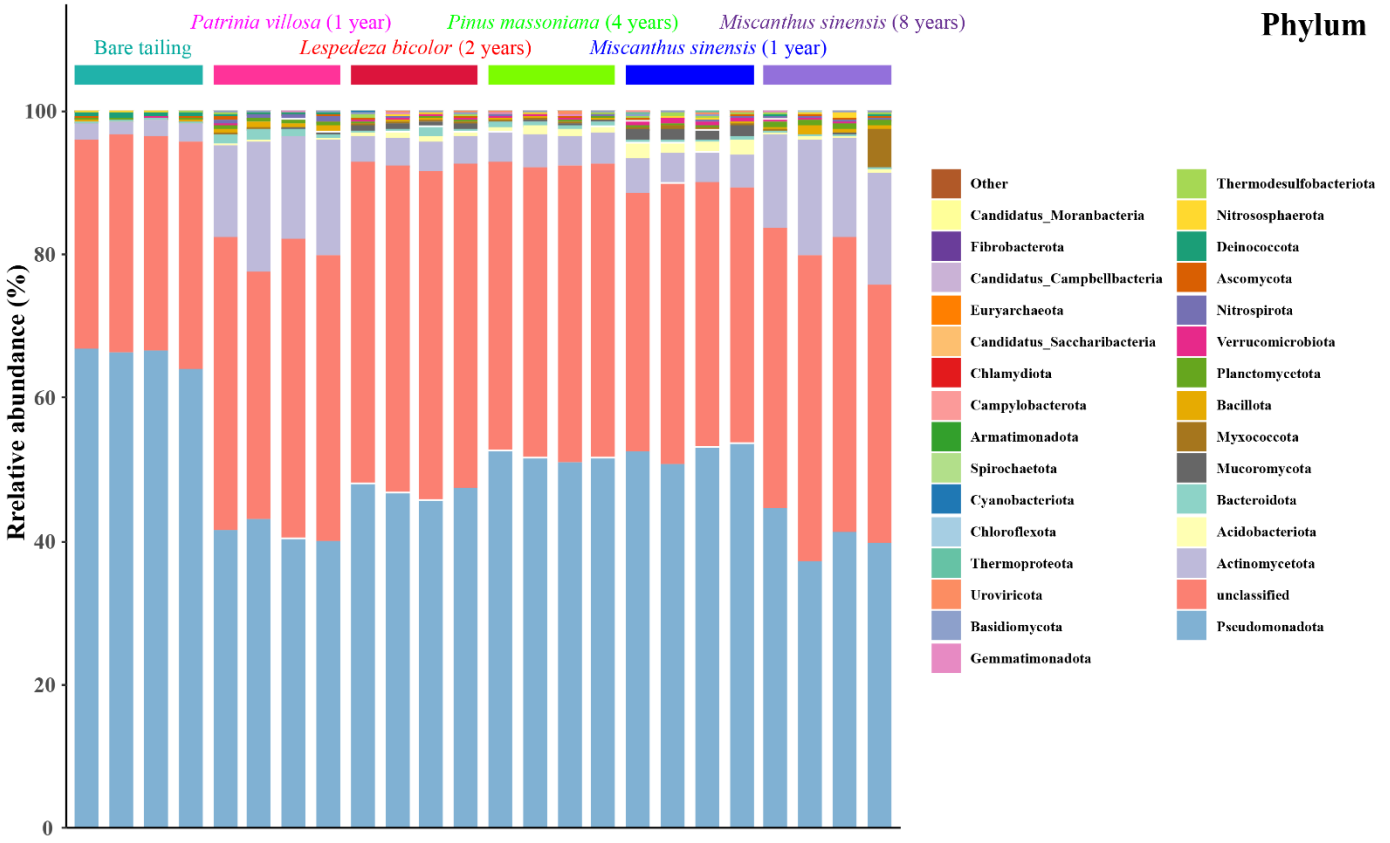


Fig. S3 The relative abundance of microorganisms in bare and rhizosphere tailings under different species of pioneer plants at the phylum level (Top 30).

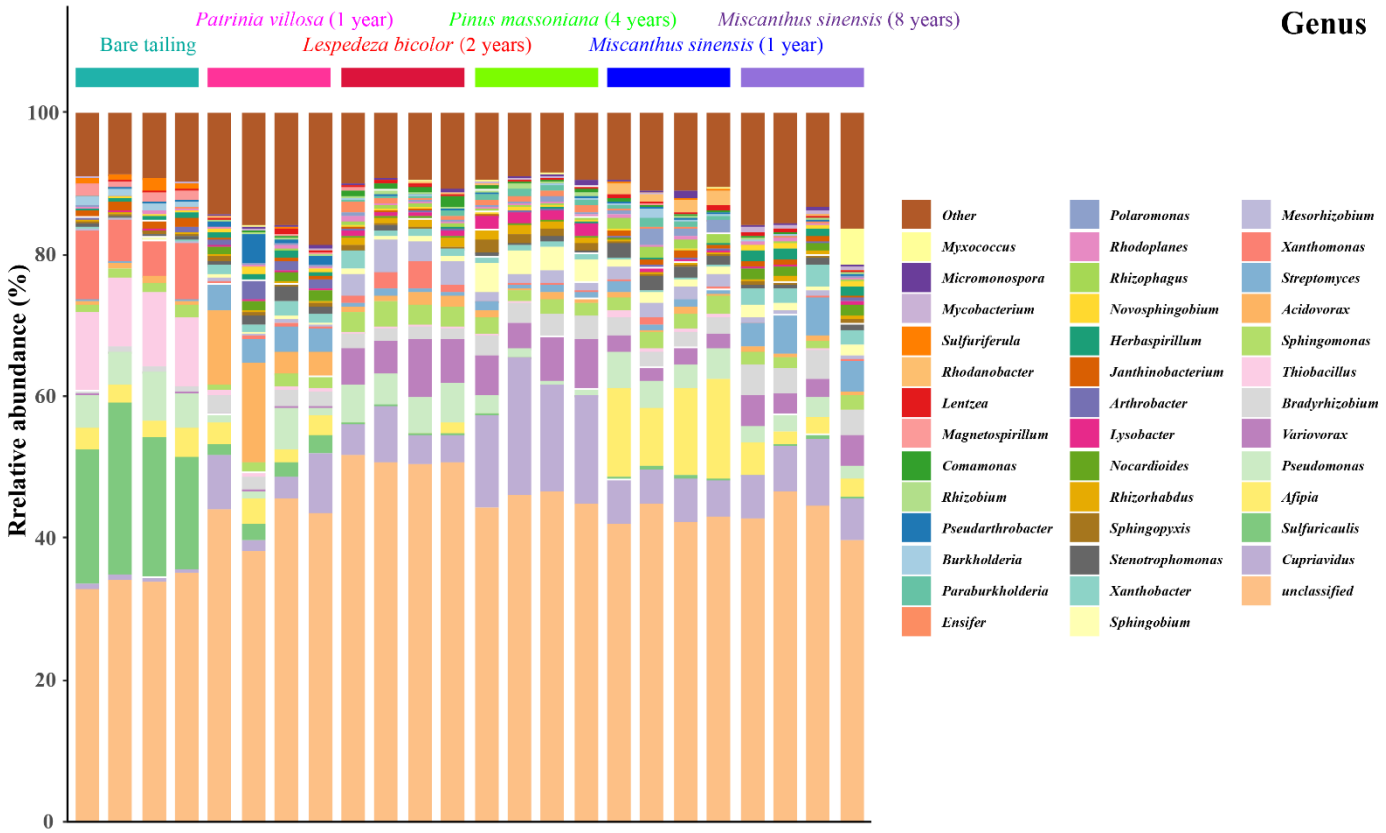


Fig. S4 The relative abundance of microorganisms in bare and rhizosphere tailings under different species of pioneer plants at the genus level (Top 40).

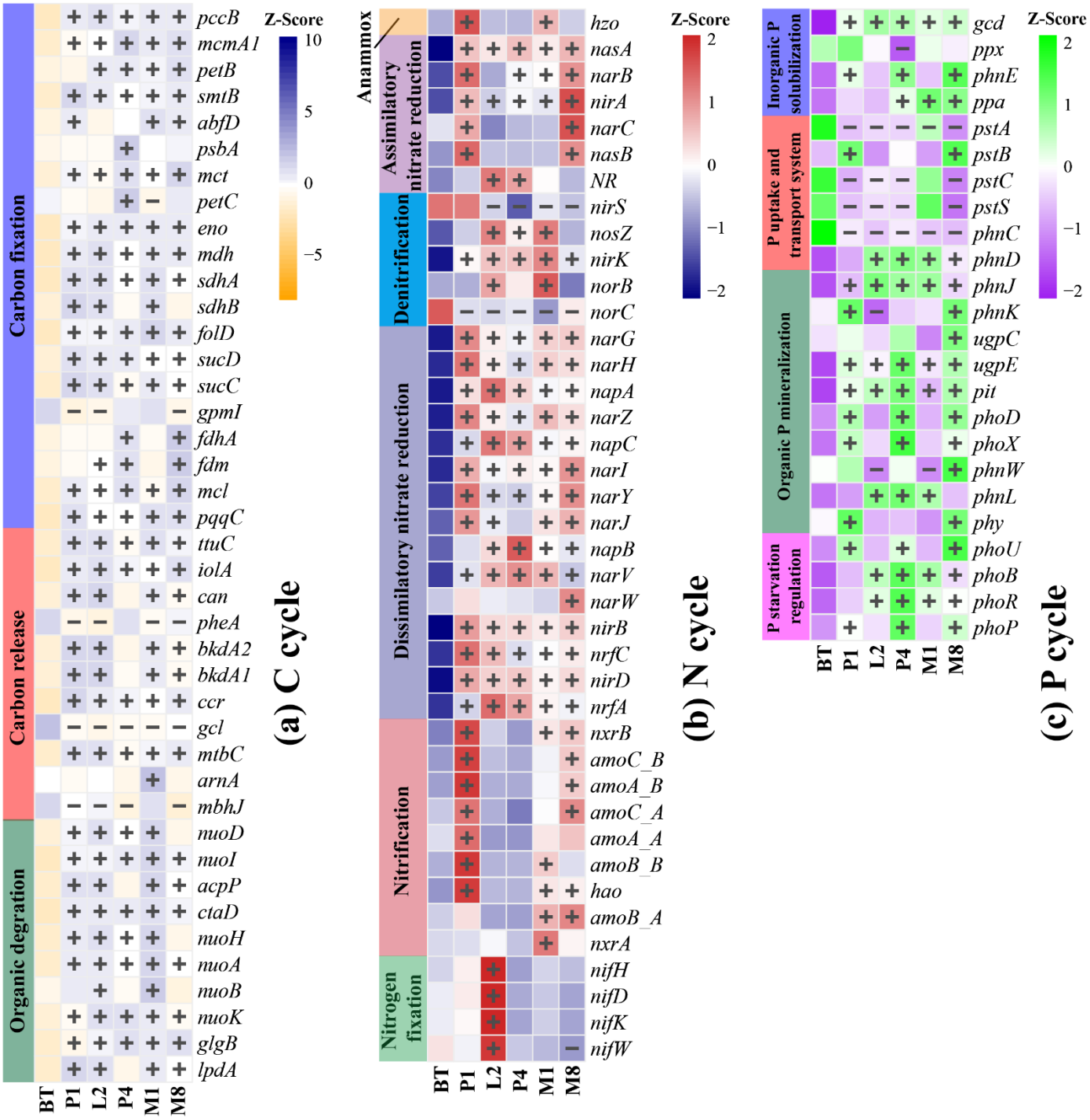


Fig. S5 Heat map of the abundance of functional genes involved in the carbon (a), nitrogen (b), and phosphorus (c) cycles in lead-zinc tailings. Microbial genes that were significantly changed compared to bare tailings were labelled using plus and minus signs (+, increased; -, decreased. $p < 0.05$, LSD).

Table S1 Basic physicochemical properties of Pb-Zn mine tailings.

Index	Unit	Bare tailings	*P. villosa* (1 year)	*L. bicolor* (2 years)	*P. massoniana* (4 years)	*M. sinensis* (1 year)	*M. sinensis* (8 years)
pH	-	7.96±0.06	8.05±0.05	7.11±0.07	7.09±0.05	7.82±0.15	7.52±0.04
EC	$\mu S \cdot cm^{-1}$	40.5±3.04	31.0±1.71	55.5±3.99	67.4±3.89	42.9±1.72	51.4±3.85
Pb	$g \cdot kg^{-1}$	3.41±0.17	2.87±0.07	1.24±0.07	1.08±0.12	2.91±0.05	2.56±0.07
Zn	$g \cdot kg^{-1}$	5.77±0.12	4.82±0.08	2.10±0.06	2.18±0.24	4.46±0.09	3.32±0.05
Cd	$mg \cdot kg^{-1}$	33.2±1.18	30.7±0.50	14.9±2.49	16.8±3.81	26.3±0.99	23.5±2.81
AK	$mg \cdot kg^{-1}$	5.49±0.35	10.6±0.30	25.1±3.02	29.6±2.57	6.78±0.66	12.2±0.52
NH_4-N	$mg \cdot kg^{-1}$	0.23±0.05	1.66±0.22	5.40±0.61	5.05±0.29	5.46±0.53	7.02±0.22
NO_3-N	$mg \cdot kg^{-1}$	0.60±0.09	0.86±0.04	3.72±0.37	8.19±0.50	1.33±0.25	4.17±0.30
AN	$mg \cdot kg^{-1}$	0.83±0.12	2.52±0.24	9.12±0.79	13.2±0.68	6.79±0.45	11.2±0.43
AP	$mg \cdot kg^{-1}$	0.24±0.03	0.39±0.03	3.98±0.72	7.84±0.56	0.61±0.14	1.47±0.02
CEC	$cmol^{+} \cdot kg^{-1}$	0.15±0.00	0.38±0.09	0.37±0.01	0.42±0.00	0.34±0.01	0.63±0.03
Bulk density	$g \cdot cm^{-3}$	1.40±0.11	1.85±0.02	1.55±0.05	1.86±0.02	1.85±0.02	1.87±0.03

Notes: Available potassium, AK; Ammonium nitrogen, NH_4-N; Nitrate nitrogen, NO_3-N; Available nitrogen, AN; Available phosphorus, AP; Cation exchange capacity, CEC (n = 4).

Table S2 Sampling design and grouping structure of the experimental samples.

Sample	Tailings type	Plant species	Vegetation type	Colonization time	Sample number
BT	Bare	—	—	—	4
P1	Rhizosphere	*Patrinia villosa*	Spontaneous	1 year	4
L2	Rhizosphere	*Lespedeza bicolor*	Spontaneous	2 years	4
P4	Rhizosphere	*Pinus massoniana*	Spontaneous	4 years	4
M1	Rhizosphere	*Miscanthus sinensis*	Artificial	1 year	4
M8	Rhizosphere	*Miscanthus sinensis*	Artificial	8 years	4

Table S3 Quality control for DNA extraction of tailings samples.

Sample	Sample ID	DNA concentration (ng/ul)	Volume (ul)	Mass (ug)	Loading quantity of agarose gel electrophoresis (ul)
BT	BT_1	0.87	60.00	0.05214	2.00
	BT_2	0.73	60.00	0.04356	2.00
	BT_3	0.88	60.00	0.05280	2.00
	BT_4	0.58	60.00	0.03456	2.00
P1	P1_1	2.64	60.00	0.15828	2.00
	P1_2	3.57	60.00	0.21402	2.00
	P1_3	2.26	60.00	0.13536	2.00
	P1_4	1.50	60.00	0.09012	2.00
L2	L2_1	4.25	60.00	0.25500	2.00
	L2_2	6.80	60.00	0.40782	2.00
	L2_3	8.26	60.00	0.49536	2.00
	L2_4	2.66	60.00	0.15942	2.00
P4	P4_1	1.15	60.00	0.06918	2.00

	P4_2	1.12	60.00	0.06690	2.00
	P4_3	1.89	60.00	0.11310	2.00
	P4_4	1.24	60.00	0.07464	2.00
M1	M1_1	11.75	60.00	0.70494	2.00
	M1_2	5.16	60.00	0.30960	2.00
	M1_3	7.46	60.00	0.44778	2.00
	M1_4	5.43	60.00	0.32580	2.00
M8	M8_1	5.09	60.00	0.30534	2.00
	M8_2	3.48	60.00	0.20892	2.00
	M8_3	5.61	60.00	0.33630	2.00
	M8_4	9.82	60.00	0.58908	2.00