

Supplementary information

Effects of tourism development on ecological network and function of sediment microbial communities in the urban wetland park

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The following supplementary information (SI) appendix covers two sections:

- A. Supplementary figures
- B. Supplementary tables

A. SUPPLEMENTARY FIGURES

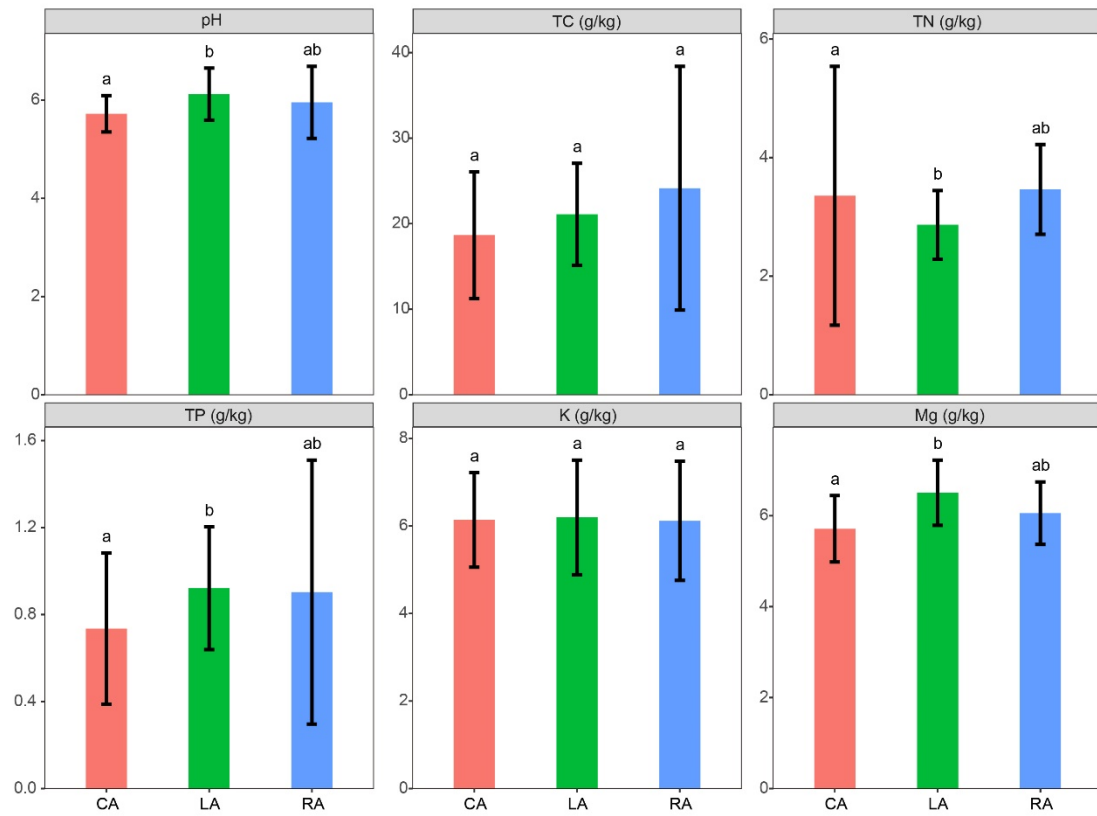


Fig. S1. The physicochemical parameters of sediment samples. Columns with different lowercase letters indicate significant difference ($P < 0.05$). Conservation areas, CA; landscaping areas, LA; recreation areas, RA.

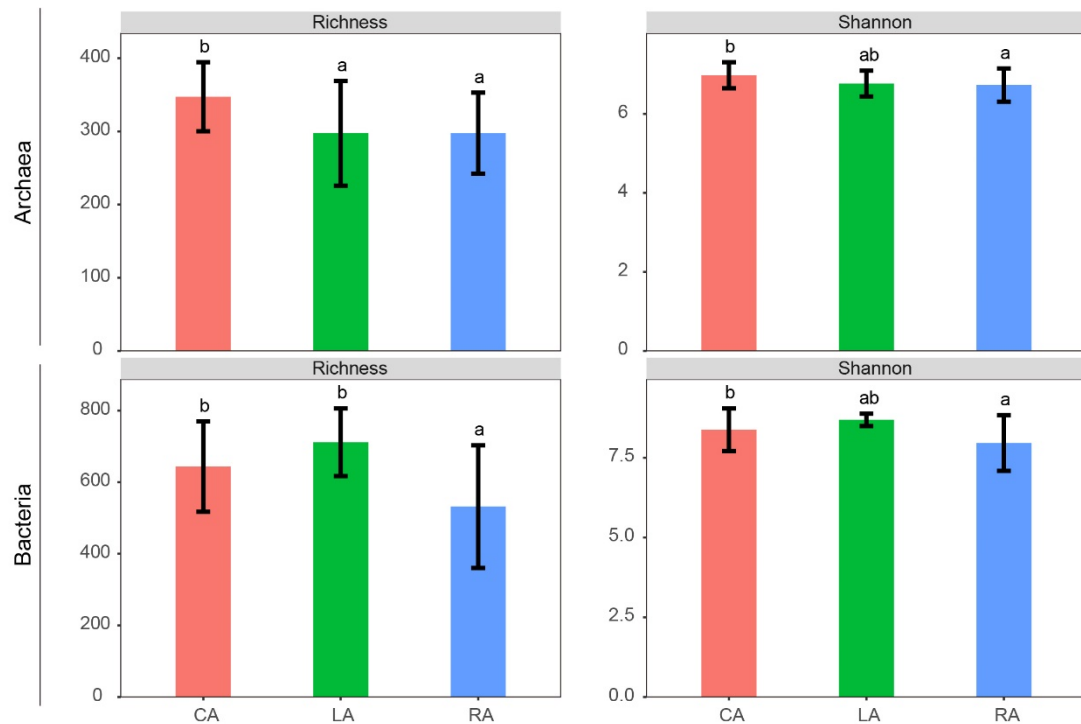


Fig. S2. Diversity of sediment archaeal and bacterial communities from conservation areas (CA); landscaping areas (LA) and recreation area (RA). (A) α -Diversity as determined by Richness and Shannon indices for archaea (top) and bacteria (bottom). Values are mean \pm SE ($n = 15, 18, 21$, respectively). Columns with different letters indicate significant difference ($P < 0.05$).

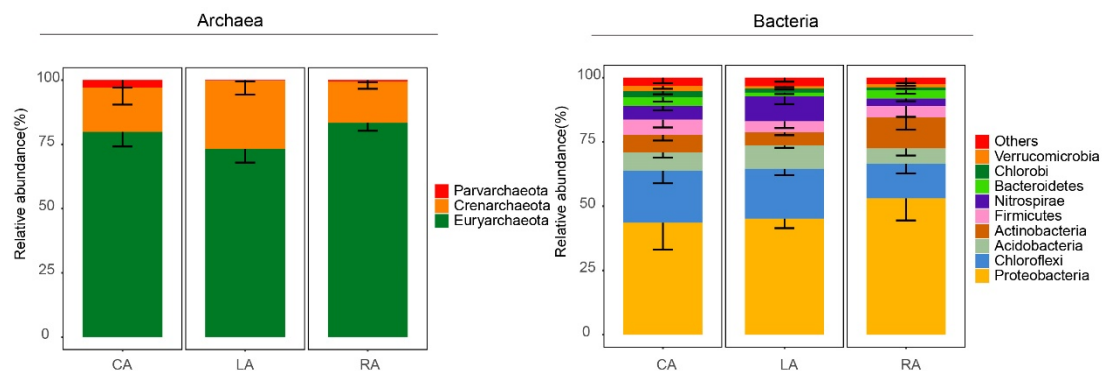


Fig. S3. Relative abundances of the dominant phyla for archaeal (left) and bacterial (right) communities.

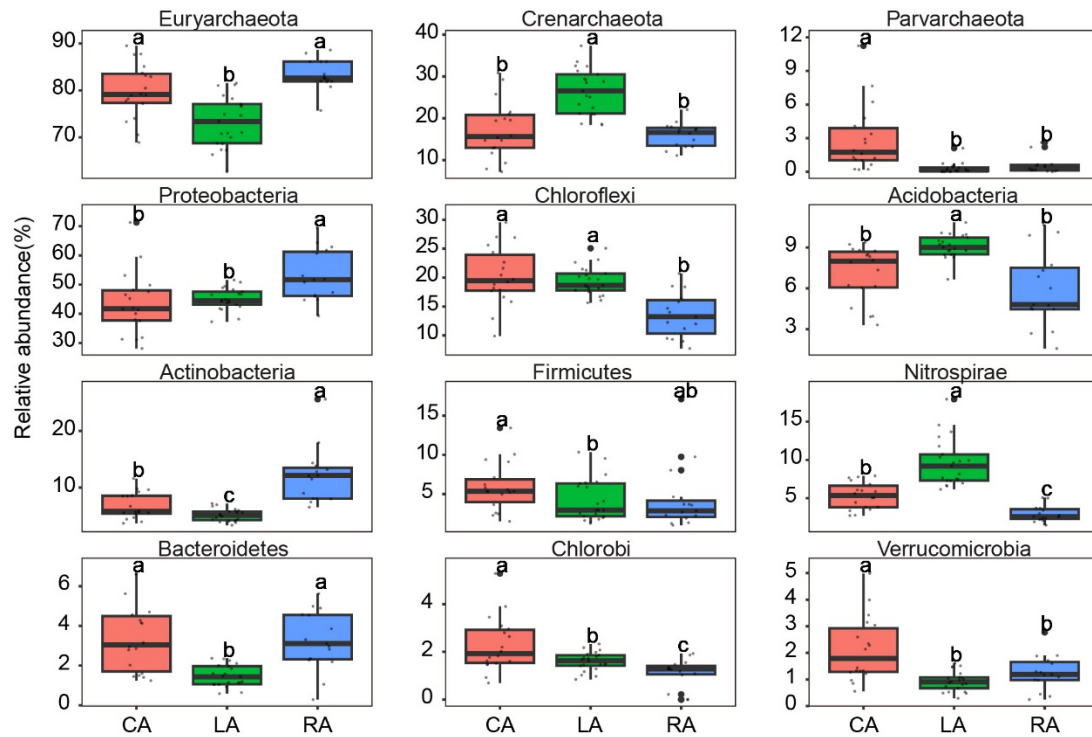


Fig. S4. Analysis of differences in relative abundance of archaeal and bacterial taxa at phylum level. Columns with different letters indicate significant difference ($P < 0.05$).

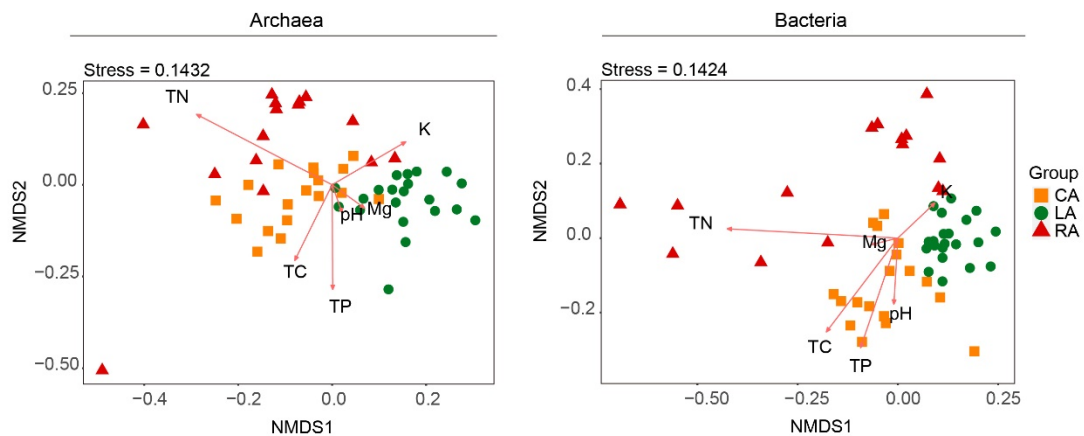


Fig. S5. NMDS ordination showing relationships between archaeal and bacterial communities and sediment physicochemical characteristics. The symbols are colored with their group. A second matrix of environmental variables was incorporated into the NMDS using the envfit function in R.

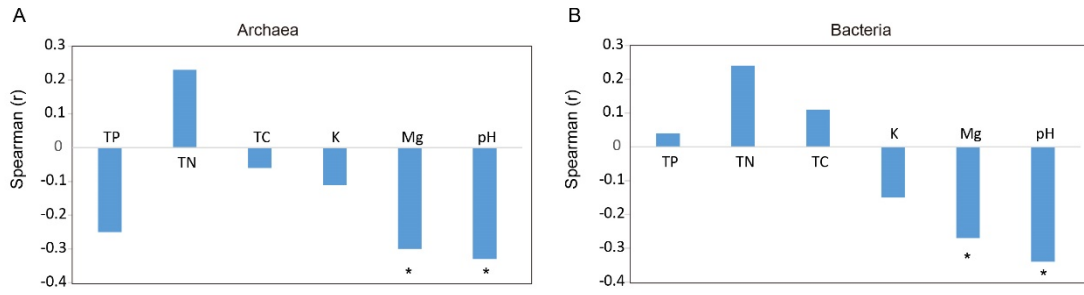


Fig. S6. Relationships between sediment physico-chemical parameters and microbial network complexity. The correlation coefficient (r) is determined by Spearman. Significance: * < 0.05 , ** < 0.01 .

B. SUPPLEMENTARY TABLES

Table S1 Correlations between environmental variables and the NMDS1, NMDS2 axes of ordinations.

Relationship	Archaeal communities			Bacterial communities		
	NMDS1	NMDS2	R ²	NMDS1	NMDS2	R ²
TP	0.004	-0.999	0.08	-0.301	-0.953	0.10
TN	-0.832	0.554	0.12*	-0.998	0.058	0.18**
TC	-0.359	-0.933	0.05	-0.578	-0.816	0.10
pH	0.269	-0.963	0.01	-0.056	-0.998	0.03
K	0.800	0.599	0.04	0.699	0.714	0.02
Mg	0.736	-0.677	0.01	-0.965	-0.261	0.01

Significance: * < 0.05, ** < 0.01; number of permutations: 999

Table S2 Network topological structure properties for the archaea-bacteria networks.

	Explanation	CA	LA	RA
Connectance	Ratio of observed links to the potential links.	0.066	0.029	0.098
Web asymmetry	Ratio of bacteria to archaea species (negative values indicate more methanogens in the ecological network).	-0.09	-0.29	0.089
Links per species	Average links for each species	4.41	1.87	4.64
Number of compartments	Subsets of bipartite matrix	1	10	2
Cluster coefficient	Average cluster coefficient of all species	0.05	0.02	0.069
Nestedness	Nested structure. Range from 0 of high nestedness to 100 of chaotic structure	10.7	5.43	16.3
Specialisation asymmetry	Specialization ratio of archaeal species to bacterial species	0.13	0.09	-0.04
Linkage density	Average number of links per species	14.4	7.5	15.2

Groups are as follows: conservation areas, CA; landscaping areas, LA; recreation areas, RA.

Table S3 Topological properties of the observed networks in comparison to the random networks for interdomain ecological networks.

	Observed networks				Random networks ^a			
	Nestedness	Specialisation asymmetry	Checkerboard Score (archaea)	Checkerboard Score (bacteria)	Nestedness	Specialisation asymmetry	Checkerboard Score (archaea)	Checkerboard Score (bacteria)
CA	10.7	0.13	0.849	0.856	10.2 ±0.307*	0.13 ±0.001*	0.808 ±0.004*	0.829 ±0.002*
LA	5.43	0.09	0.943	0.933	4.8 ±0.285*	0.09 ±0.001*	0.929 ±0.002*	0.915 ±0.002*
RA	16.3	-0.04	0.791	0.792	13.6 ±0.564*	-0.04 ±0.001*	0.736 ±0.006*	0.734 ±0.006*

^a The parameters presented here are the mean values and standard derivations generated from 100 permutations of randomly rewired networks. * One-sample Student's t value (P <0.05). Groups are as follows: conservation areas, CA; landscaping areas, LA; recreation areas, RA.