Microbial metabolic limitation and soil multifunctionality changes across subtropical woodlands in southern China

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Supplementary information

Table S1 A description of C, N and P acquisition extracellular enzymes in this study.

Enzyme	Abbreviations	EC[a]	Function
β-D-cellobiosidase	CBH	3.2.1.91	Cellulose degradation: hydrolyses cellobiose dimers from non-reducing ends of cellulose molecules
β-1, 4-glucosidase	BG	3.2.1.21	Cellulose degradation: hydrolyses glucose from cellobiose
L-leucine aminopeptidase	LAP	3.4.11.1	Proteolysis: hydrolyses leucine and other hydrophobic amino acids from the N terminus of polypeptides
β-N-acetylglucosaminidase	NAG	3.2.1.14	Chitin and peptidoglycan degradation: hydrolyses glucosamine from chitobiose
Acid phosphatase	AP	3.1.3.2	Hydrolyses phosphate from phosphosaccharides and phospholipids

Table S2 Pearson correlations between averaging multifunctionality index (used in this study) and the number of functions at or above a threshold (25, 50 and 75%) of the maximum observed function (n = 64).

	25%	50%	75%
R	0.87	0.90	0.79
p	< 0.001	< 0.001	< 0.001

Table S3 Soil physicochemical properties in two subtropical woodlands. *P*-values are estimated using paired-samples T test.

Forests	pH**	SOC (g/kg) **	TN (g/kg)	Olsen-P (mg/kg)
P. massoniana	4.26±0.56	18.83±6.92	1.79±1.29	4.80±1.88
C. oleifera	4.43±0.39	18.06±8.03	1.56±0.55	4.67±2.38

Note: SOC, soil organic carbon; TN, soil total nitrogen. Values presented are mean values ± standard errors. *$p < 0.05$, and **$p < 0.01$.

Figure S1 Geographic location of the study areas and sampling sites across two subtropical woodlands in southern China.

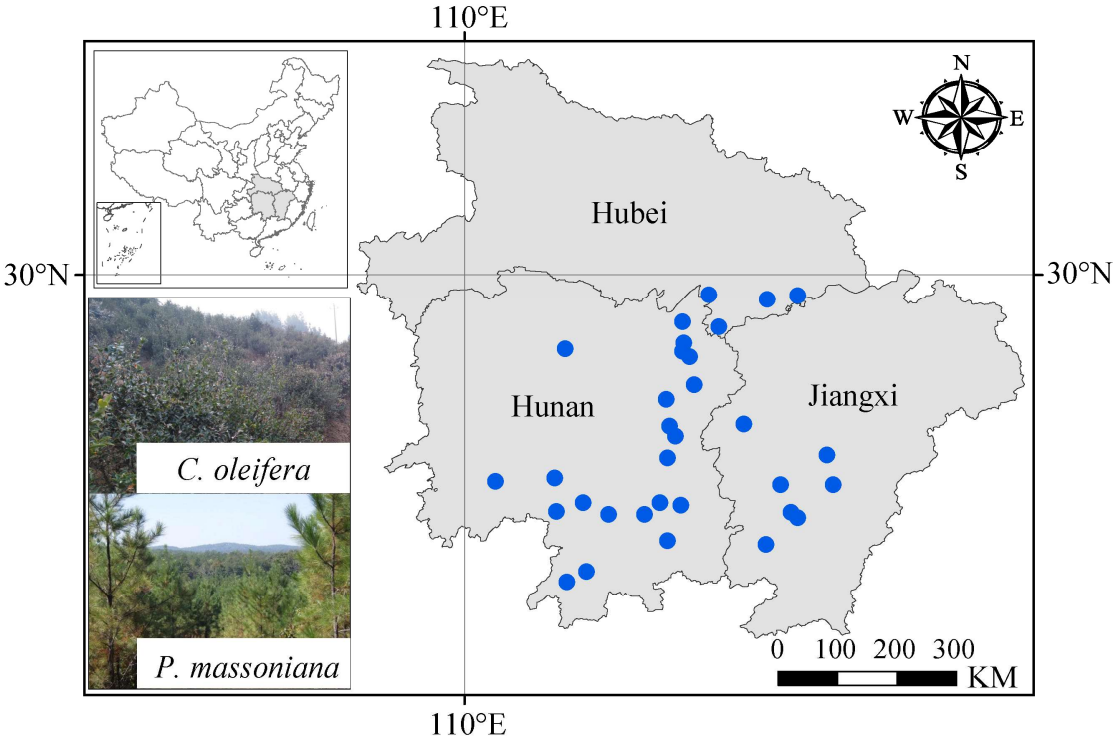


Figure S2 Relationships between microbial community parameter and multiple-threshold soil multifunctionality above a series of sequential thresholds (from 1 to 99% at 1% intervals) of the maximum observed soil function. (a) soil bacterial richness; (b) soil bacterial PCoA1; (c) soil fungal richness; (d) soil fungal PCoA1. Tmin is the line with the lowest threshold whose slope is different from 0. Tmde is the line with the steepest slope. Tmax is the line at the highest threshold where the slope is different from 0. All indices preceded by M indicate the number of functions for the corresponding curves.

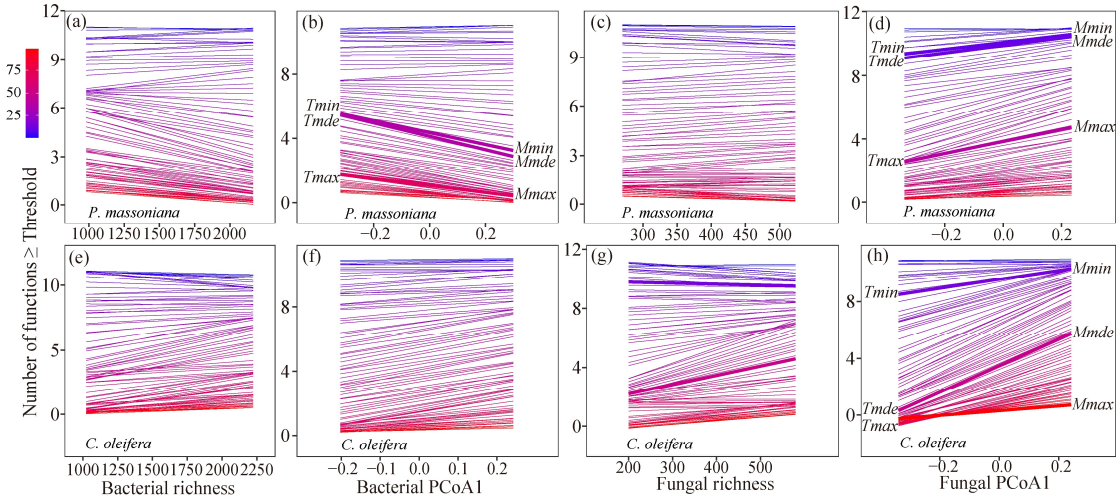


Figure S3 The slopes of the relationships between microbial community parameter and the number of functions at or above a threshold of some proportion of the maximum observed function, at different threshold values (x-axis). (a) soil bacterial richness; (b) soil bacterial PCoA1; (c) soil fungal richness; (d) soil fungal PCoA1. Points are the fitted values and shading indicates ± 1 CI.

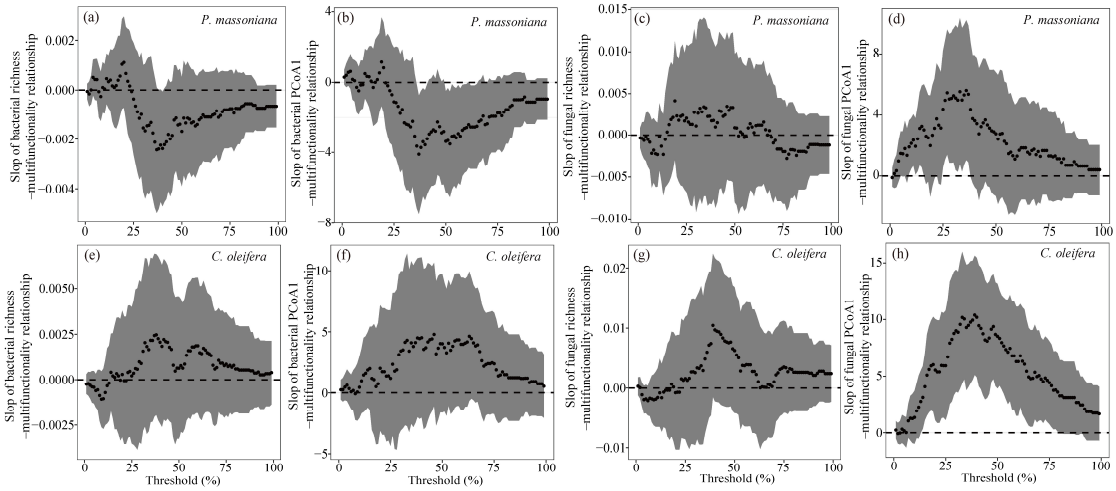


Figure S4 Pearson correlations between soil environmental factors with vector indices, soil multifunctionality and microbial richness in two subtropical woodlands. TN, soil total nitrogen; SOC, soil organic carbon; MBP, microbial biomass phosphorus; MBN, microbial biomass nitrogen; MBC, microbial biomass carbon. *$p < 0.05$, **$p < 0.01$ and ***$p < 0.001$

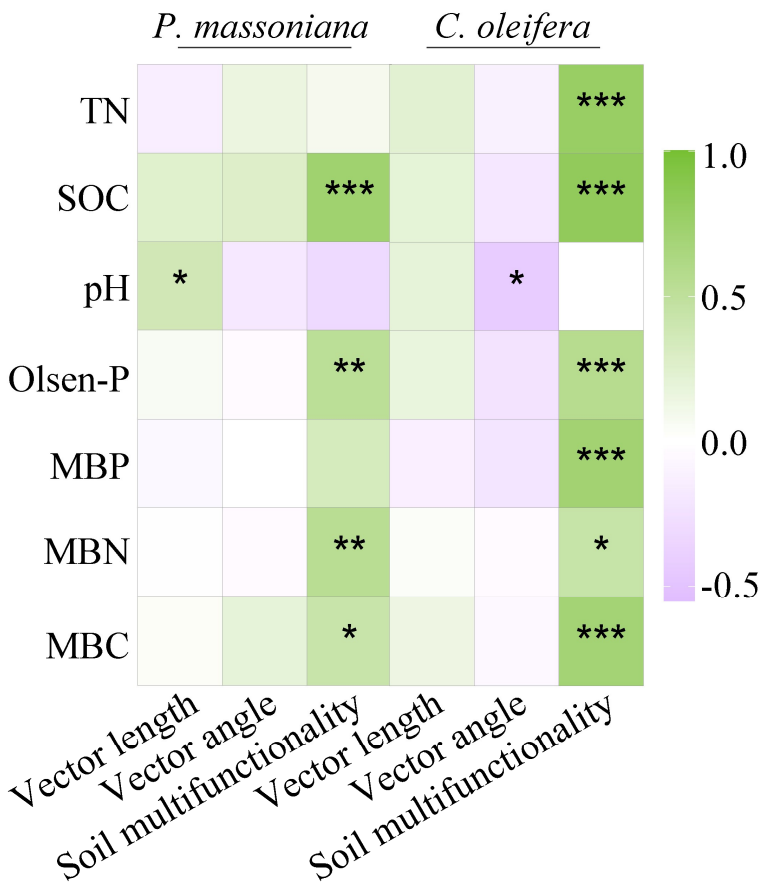


Figure S5 Richness and Shannon diversity for (a) bacterial and (b) fungal communities in two subtropical woodlands. Significance levels are determined at $p \leq 0.05$ (two-sided). ns: non-significant difference, *$p < 0.05$, **$p < 0.01$ and ***$p < 0.001$.

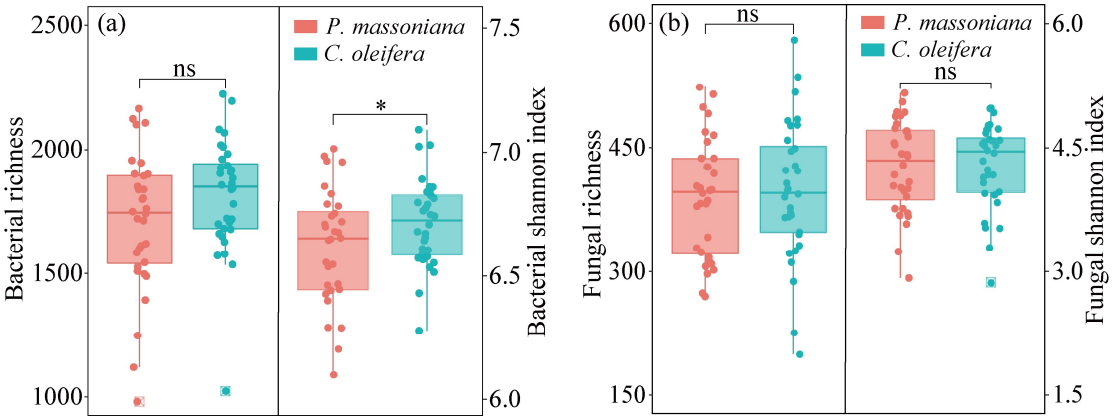


Figure S6 Relative abundance of soil (a) bacterial and (b) fungal classes in two subtropical woodlands.

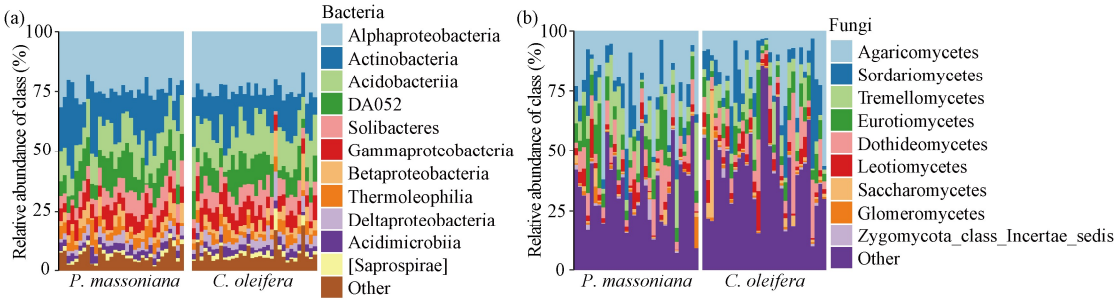


Figure S7 Liner correlation between vector length and soil microbial parameter in two subtropical woodlands. (a) bacterial richness; (b) bacterial PCoA1; (e) fungal richness; (f) fungal PCoA1. Liner correlation between vector angle and soil microbial parameter in two subtropical woodlands. (c) bacterial richness; (d) bacterial PCoA1; (g) fungal richness; (h) fungal PCoA1. Solid and dashed lines denote statistically significant (two-sided $p \leq 0.05$) and nonsignificant (two-sided $p > 0.05$) relationships, respectively.

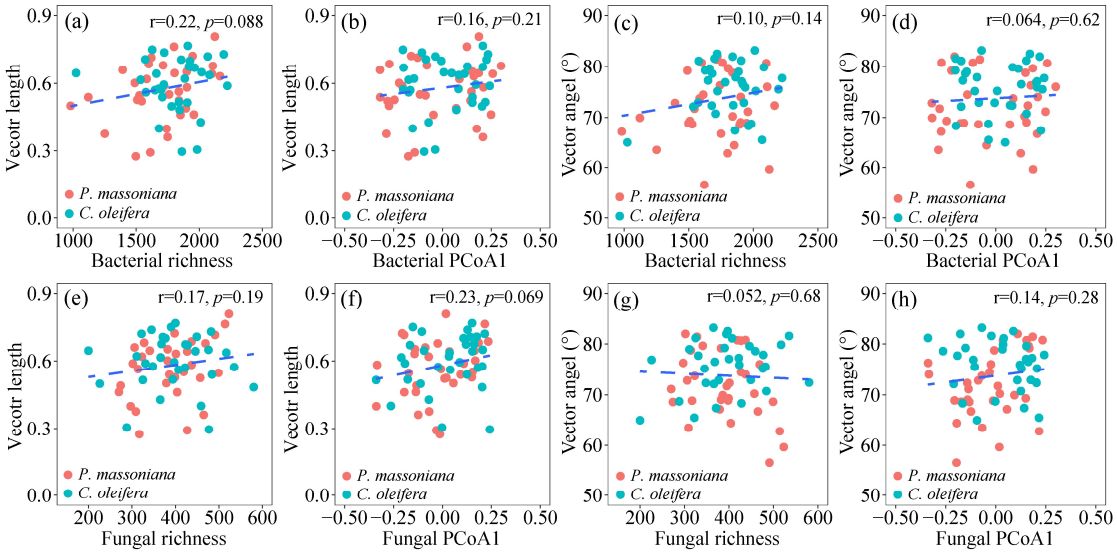


Figure S8 Liner correlation between soil multifunctionality and microbial parameter in two subtropical woodlands. (a) soil bacterial richness; (b) soil bacterial PCoA1; (c) soil fungal richness; (d) soil fungal PCoA1. Solid and dashed lines denote statistically significant (two-sided $p \leq 0.05$) and nonsignificant (two-sided $p > 0.05$) relationships, respectively.

