Article

Soil Microbial Biomass and Community Composition across a Chronosequence of Chinese Cedar Plantations

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Table S1. Selected basic climate data information of the study area in the last three years (2019-2021).

Climate data	2019	2020	2021
Annual precipitation (mm)	1812.6	1609.6	1458.1
Average annual precipitation (mm)		1627 ± 102	
Average annual temperature (°C)	16.8	17.1	17.2
Annual mean relative humidity (%)	81	79	81
Annual sunshine hours (hour)	893.5	2054.2	1486.4

Table S2. The basic information on *Cryptomeria japonica var. sinensis* plantations in different stand ages is from the survey conducted in August 2020.

Age group	Altitude (m)	Latitude (N)	Longitude (E)	Slope (°)	Canopy density (%)	Mean height of the trees (m)	Mean diameter at breast height (cm)
Young forest	1301	29°47′36″	103°10′04″	20	20	6.4±0.4e	8.04±0.48e
Middle-aged forest	1158	29°45′26″	103°11′25″	16	60	12.1±0.2d	16.20±0.61d
Near-mature forest	1239	29°47′44″	103°10′26″	25	70	17.0±0.6c	22.01±0.89c
Mature forest	1248	29°47′35″	103°10′31″	28	60	20.2±0.3b	30.30±0.84b
Over-mature forest	1160	29°44′08″	103°11′49″	20	90	25.2±0.6a	47.64±1.80a

Different lowercase letters indicate significant differences among different stand ages ($p < 0.05$).

Table S3. Soil physicochemical properties for each stand age in July 2021.

Stand age	Soil depth	GWC (kg kg⁻¹)	SBD g cm⁻³	pH	NH₄⁺-N (mg kg⁻¹)	NO₃⁻-N (mg kg⁻¹)	SOC (g kg⁻¹)	TN (g kg⁻¹)	TP (g kg⁻¹)	C/N	C/P	N/P
Young forest	0–15 cm	0.39±0.01c	1.12±0.07a*	4.65±0.01a*	2.79±0.17cd	2.42±0.22b	6.92±0.40d	0.78±0.06c	0.36±0.02c	7.80±0.07d	19.41±1.92d	2.24±0.00d
(7 years old)	15–30 cm	0.40±0.01c	1.10±0.14a	4.85±0.03a	2.39±0.33c	2.15±0.14b	7.09±0.11c	0.44±0.02c	0.32±0.03c	15.83±0.78b	22.19±1.58d	1.49±0.02c
Middle-aged forest	0–15 cm	0.81±0.01b*	0.92±0.00a*	4.30±0.04b*	1.27±0.06d*	23.74±1.24a*	55.72±2.75c*	1.59±0.11bc	0.55±0.03b	37.19±3.38ab*	101.51±3.11c*	2.85±0.34d
(13 years old)	15–30 cm	0.62±0.08b	1.02±0.04a	4.62±0.02b	4.14±0.60b	13.40±0.70a	29.47±0.56b	1.52±0.18b	0.58±0.01b	20.01±2.52b	50.85±1.47c	2.35±0.09bc
Near-mature forest	0–15 cm	1.27±0.00a*	0.45±0.08b*	4.05±0.05c*	13.22±0.56a*	27.27±2.46a*	91.24±0.20a*	3.84±0.62a*	0.58±0.03b	28.39±2.27bc*	158.43±9.22a*	7.47±0.18a*
(24 years old)	15–30 cm	0.81±0.07b	0.64±0.00b	4.39±0.04c	8.61±0.10a	14.66±1.08a	75.08±4.68a	1.58±0.28b	0.52±0.02b	43.13±1.55a	131.55±3.17a	2.47±0.16bc
Mature forest	0–15 cm	1.27±0.03a*	0.48±0.04b*	4.06±0.04c*	10.77±0.80b*	23.16±2.76a*	89.18±0.30a*	3.99±0.31a*	0.65±0.03a	22.64±1.71c	135.60±5.64b*	6.14±0.21b*
(33 years old)	15–30 cm	1.00±0.00a	0.56±0.02b	4.53±0.03bc	8.86±0.35a	12.54±1.19a	65.33±4.81a	2.72±0.22a	0.72±0.00a	24.09±1.02b	97.11±2.83b	4.12±0.04a
Over-mature forest	0–15 cm	0.76±0.07b*	0.96±0.06a*	4.19±0.07bc*	3.37±0.09c	28.17±3.11a*	70.70±1.01b*	2.06±0.48b	0.54±0.07b	40.68±9.07a*	150.74±6.21ab*	4.24±0.79c*
(53 years old)	15–30 cm	0.40±0.02c	1.06±0.01a	4.44±0.01c	4.10±0.03b	11.07±0.73a	33.82±1.54b	1.49±0.02b	0.49±0.03b	21.96±0.94b	69.60±3.43c	3.21±0.01ab
	Stand age (SA)	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p < 0.001$
	Soil depth (SD)	$p < 0.001$	$p < 0.05$	$p < 0.001$	$p < 0.05$	$p < 0.001$	$p < 0.001$	$p < 0.001$	$p = 0.643$	$p = 0.285$	$p < 0.001$	$p < 0.001$
	SA×SD	$p < 0.001$	$p = 0.599$	$p < 0.05$	$p < 0.001$	$p < 0.01$	$p < 0.001$	$p < 0.05$	$p = 0.247$	$p < 0.001$	$p < 0.001$	$p < 0.001$

Different lowercase letters donate statistically significant differences in the main effect between stand ages or significant differences between stand ages in the same soil depth ($p < 0.05$). The asterisk denotes significant differences between two soil depths of the same stand age or statistically significant differences in the main effect between the two soil depths. Results of two-way ANOVA for the main factors (stand age and soil depth) and their interactions (SA × SD) are shown in Table S2. Bonferroni was used for comparison of main effects or post-hoc tests of simple effects. Values are means ± standard errors (SE) for the sampling plots (n = 3). GWC, SBD, NH₄⁺-N, and NO₃⁻-N, SOC, TN, TP, C/N, C/P, and N/P refer to gravimetric water content, soil bulk density, ammonium nitrogen and nitrate nitrogen, soil organic carbon, total nitrogen, total phosphorus, the ratio of soil organic carbon to total nitrogen or total phosphorus, and the ratio of total nitrogen to total phosphorus, respectively.

Table S4. P value and F value based on a two-way ANOVA for the proportion of functional groups.

	Stand age (SA)[a]	Soil depth (SD)	SA × SD
GP/Total PLFAs	[b]24.13(0.00)***	87.40(0.00)***	3.66(0.02)*
GN/Total PLFAs	5.40(0.00)**	33.82(0.00)***	3.58(0.02)*
F/Total PLFAs	35.07(0.00)***	1.17(0.29)ns	4.23(0.01)*
AMF/Total PLFAs	11.89(0.00)***	7.24(0.01)*	0.83(0.53)ns
ACT/Total PLFAs	4.01(0.02)**	4.25(0.05)ns	1.47(0.25)ns
Other/Total PLFAs	15.00(0.00)***	46.99(0.00)***	2.00(0.13)ns

[a] Degrees of freedom: df = 1 for soil depth, df = 4 for stand age and SA × SD interaction.

[b] F-value and P-values (in parentheses) of two-way ANOVA were given. *, $p < 0.05$, **, $p < 0.01$, ***, $p < 0.001$, and ns, not significant.

Abbreviations: sum of 16:0 and 18:0 (Other), actinomycetes (ACT), Arbuscular mycorrhizal fungi (AMF), Gram-negative bacteria (GN), and Gram-positive bacteria (GP).
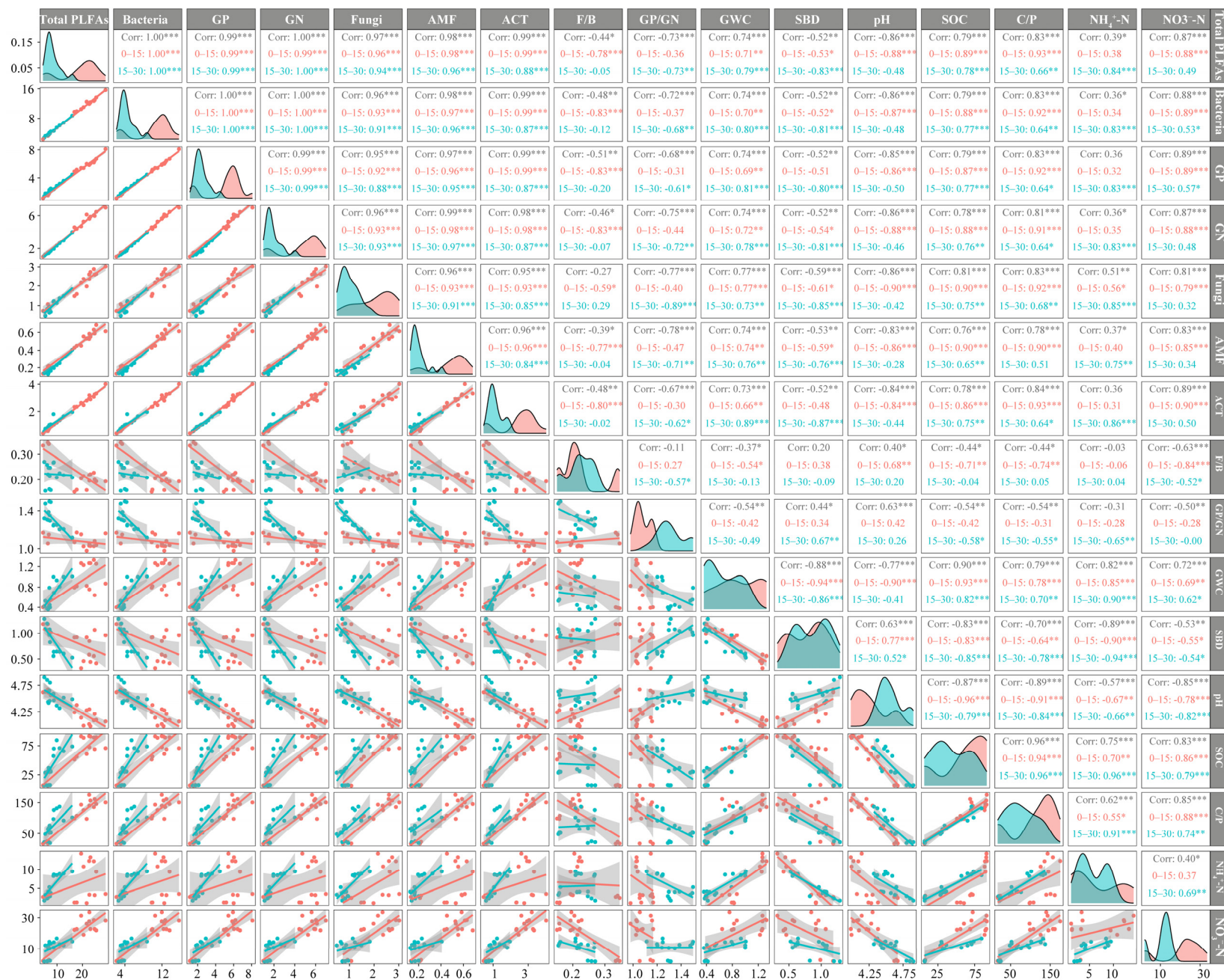
Figure S1. Correlation analysis of the soil microbial biomass and composition with selected soil physicochemical properties. The upper right part is Pearson's correlation coefficient between PLFAs and soil physicochemical properties ("corr" indicates regardless of soil depth, red and cyan represent 0−15 cm soil depth and 15−30 cm soil depth, respectively, and * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$). The diagonal position shows the intensity distribution of each indicator at 0–15 cm soil depth (red) and 15–30 cm soil depth (cyan). The lower left part is the scatter plot among indicators of different soil depths (solid straight red and solid straight cyan trend lines represent linear regression of 0−15 cm soil depth and 15−30 cm soil depth, respectively). Abbreviations: Gram-positive bacteria (GP), Gram-negative bacteria (GN), arbuscular mycorrhizal fungi (AMF), actinomycetes (ACT), gravimetric water content (GWC), soil bulk density (SBD), soil organic carbon (SOC), ammonium nitrogen (NH_4^+-N), nitrate nitrogen (NO_3^--N). GP/GN, F/B, and C/P represent the ratios of Gram-positive bacteria to Gram-negative bacteria, fungi to bacteria, and organic carbon to total phosphorus, respectively.