

Table S1. Characteristics of sampling sites in *Larix* plantations.

Stand site	Sampling site basic conditions					
	Slope (°)	Mean height (m)	Mean DBH (cm)	SBD (g cm ⁻³)	MAP (mm)	MAT (°C)
Lar15-1	20	13.4	12.6	1.34	1820	15.8
Lar15-2	18	14.9	11.4	1.41		
Lar15-3	21	10	11.2	1.33		
Lar24-1	18	16.9	14.3	1.27	1850	16.2
Lar24-2	17	15.2	13.0	1.38		
Lar24-3	19	11.2	12.1	1.30		
Lar40-1	25	20	17.3	1.19	1880	16.3
Lar40-2	21	17.4	18.0	1.30		
Lar40-3	23	18.6	19.6	1.28		
Lar50-1	24	19.5	25.7	1.18	1930	16.6
Lar50-2	26	16.4	21.7	1.19		
Lar50-3	25	16.8	19.6	1.25		

Values: mean ± standard error. DBH: diameter at breast height; SBD: soil bulk density; MAP: mean annual precipitation; MAT: mean annual temperature; Lar15: young plantation; Lar24: middle-aged plantation; Lar40: near-mature plantation; Lar50: mature plantation.

Table S2. Species diversity of understory vegetation characteristics in *Larix* plantations.

Treatments	Herbaceous biodiversity			Shrub biodiversity		
	Shannon index	Richness index	Evenness index	Shannon index	Richness index	Evenness index
Lar15	2.79±0.28a	24.67±0.58a	0.89±0.01a	1.54±0.12a	5.00±2.00a	0.86±0.02a
Lar24	3.16±0.17a	25.33±1.15a	0.91±0.01a	1.59±0.05a	5.67±2.08a	0.88±0.01a
Lar40	3.19±0.09a	28.00±4.58a	0.94±0.02a	1.72±0.07a	6.33±1.53a	0.89±0.02a
Lar50	3.21±0.22a	29.67±3.79a	0.96±0.01a	1.78±0.28a	6.67±1.53a	0.93±0.02a

Values: mean ± standard error. Different lowercase letters indicate significant differences between treatments within a measured nutrient ($P < 0.05$). Lar15: young plantation; Lar24: middle-aged plantation; Lar40: near-mature plantation; Lar50: mature plantation.

Table S3. PLFAs biomarkers used to characterize microbial community structure.

Microbial community types	PLFAs	Reference
Gram - positive bacteria (G ⁺)	i13:0, i14:0, a14:0, a15:0, i15:0, i16:0, a17:0, i17:0, i18:0	Fichtner et al. (2014), Kourtev et al. (2002)
Gram – negative bacteria (G ⁻)	10:0 2OH, 15:1 w4c, 15:1 w6c, 16:0 2OH, 16:1 w6c, 16:1 w7c, 16:1 w9c, cy17:0, 17:1 w8c, 18:1 w5c, 18:1 w7c, cy19:0	Bossio et al. (2006), Fichtner et al. (2014), Gavazov et al. (2017)
Bacteria	G ⁺ , G ⁻ , 14:0, 15:0, 17:0, 18:0	Bossio et al. (2006), Fichtner et al. (2014), Gavazov et al. (2017), Kourtev et al. (2002), Myers et al. (2001)
Fungi	16:1 w5c, 18:1 w9c, 18:2 w6c, 18:2 w9c	Kourtev et al. (2002), Zhang et al. (2014)
Actinomycete	10 Me 16:0, 10 Me 17:0, 10 Me 18:0	Brockett et al. (2012)
Other PLFAs	14:0, 16:0, 16:1 2OH, 16:1ω9c, 17:1ω8c, 18:1ω9c and 18:3ω6c	Chen et al., (2016), Frostergård & Bååth, (1996)

Note: To categorize soil microbial groups, we utilized established content fatty acid methyl esters (i.e., 19:0) as an internal standard.

Reference

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Table S4. Repeated-measures ANOVA for soil physical and chemical properties in *Larix* plantations of different ages.

Factor	df	Correlation index	Soil pH value	SWC	Soil temperature	STC	STN	STP	NO ₃ ⁻ -N	NH ₄ ⁺ -N	SAP
Plantation age	3	F value	1.15	8.64	8.79	11.26	11.68	11.49	11.34	11.51	11.42
		P value	0.38	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sampling time	3	F value	1.11	7.51	8.14	6.34	8.57	7.36	8.84	9.64	10.18
		P value	0.35	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01
Plantation age × Sampling time	9	F value	1.02	7.89	7.68	2.54	5.68	6.04	5.27	6.92	6.15
		P value	0.31	0.01	0.01	0.19	0.02	0.02	0.02	0.02	0.02

Table S5. Repeated-measures ANOVA for soil microbial biomass and the stoichiometric ratios in soil and microorganisms in *Larix* plantations of different ages.

Factor	df	Correlation index	STC:STN	STC:STP	STN:STP	MBC:MBN	MBC:MBP	MBN:MBP	Microbial biomass C	Microbial biomass N	Microbial biomass P
Plantation age	3	F value	7.98	6.34	8.12	8.76	9.26	9.13	12.48	13.50	13.96
		P value	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Sampling time	3	F value	1.06	3.14	0.49	2.45	1.57	1.35	4.48	6.79	2.91
		P value	0.46	0.04	0.27	0.42	0.38	0.41	0.04	0.03	0.09
Plantation age × Sampling time	9	F value	0.85	1.24	0.24	1.39	0.59	1.11	1.52	2.08	1.90
		P value	0.57	0.18	0.79	0.15	0.48	0.37	0.17	0.07	0.26

Table S6. Repeated-measures ANOVA for microbe group biomass in *Larix* plantations of different ages.

Factor	df	Correlation index	Total PLFAs	Gram - positive bacteria	Gram - negative bacteria	Bacteria	Fungi	Actinomycete
Plantation age	3	F value	5.29	5.81	6.04	6.76	5.93	6.11
		P value	0.04	0.03	0.02	0.01	0.03	0.02
Sampling time	3	F value	5.79	5.27	5.34	3.49	4.36	5.06
		P value	0.04	0.04	0.03	0.02	0.03	0.02
Plantation age × Sampling time	9	F value	2.11	1.96	1.27	1.54	1.98	2.04
		P value	0.16	0.25	0.28	0.19	0.12	0.09

Table S7. Linkage of C:N, C:P and N:P ratios and pH value, moisture, temperature and nutrient concentrations in topsoil across 4 different plantation ages.

	Soil pH value	SWC	Soil temperature	NO ₃ ⁻ -N	NH ₄ ⁺ -N	SAP
Soil C:N	0.485*	0.586**	-0.093	0.091	0.382	-0.629**
Soil C:P	0.680**	0.869**	0.188	0.352	0.693**	-0.671**
Soil N:P	0.624**	0.844**	0.374	0.455*	0.736**	-0.395

Soil C:N: total carbon : total nitrogen in soil; Soil C:P: total carbon : total phosphorus in soil; Soil N:P: total nitrogen : soil total phosphorus in soil. * represents P<0.05; ** represents P<0.01.

Table S8. Linkage of microbial C:N, C:P and N:P ratios and pH value, moisture, temperature and nutrient concentrations in topsoil under 4 different plantation ages.

	Soil pH value	SWC	Soil temperature	STC	STN	STP	NO ₃ ⁻ -N	NH ₄ ⁺ -N	SAP
Soil microbial C:N	0.444*	0.524**	0.534**	0.611**	0.597**	0.580**	0.378	0.570**	-0.233
Soil microbial C:P	0.533**	0.564**	0.624**	0.746**	0.736**	0.767**	0.598**	0.764**	-0.240
Soil microbial N:P	0.393	0.459*	0.531**	0.617**	0.615**	0.667**	0.576**	0.672**	-0.154

Soil microbial C:N: soil microbial biomass carbon : soil microbial biomass nitrogen; Soil microbial C:P: soil microbial biomass carbon : soil microbial biomass phosphorus; Soil microbial N:P: soil microbial biomass nitrogen : soil microbial biomass phosphorus. * represents P<0.05; ** represents P<0.01.