Table S1. Variance analysis of soil carbon, nitrogen, and phosphorus stoichiometry between different forests and soil layers

Forest	Horizon	SOM (g/kg)	TN (g/kg)	TP (g/kg)	C:N	C:P	N:P
BP	A	128.63±3.71Aa	6.76±0.75Aa	0.77±0.07Aa	12.01±0.55Aa	106.11±15.72ABa	8.87±1.56Aa
	B	69.72±12.75Ab	3.44±0.74Ab	0.72±0.09Aa	12.69±0.85Aab	61.25±13.89ABb	4.85±1.20Ab
	C	26.33±8.92Ac	1.24±0.48Ac	0.48±0.10Ab	13.32±0.86Ab	33.80±10.67ABc	2.57±0.90Ac
L-B1	A	151.05±37.08Aa	7.03±0.73ABa	0.83±0.05ABa	12.95±0.93Aa	111.29±22.93ABa	8.55±1.34Aa
	B	74.52±7.73Ab	3.91±0.57ABb	0.79±0.07ABa	11.99±0.20Aa	59.68±6.27ABb	4.98±0.54Ab
	C	23.68±10.49Ac	1.16±0.52ABc	0.71±0.34ABa	13.19±4.30Aa	26.10±14.75ABc	1.87±0.93Ac
L-B2	A	128±5.86Aa	6.59±0.67Aa	0.79±0.08Aa	12.27±0.40Aa	102.48±2.72ABa	8.36±0.26Aa
	B	68.28±12.07Ab	3.47±0.71Ab	0.81±0.20Aa	12.12±0.40Aa	52.37±4.18ABb	4.32±0.25Ab
	C	19.2±10.35Ac	0.94±0.53Ac	0.39±0.14Ab	12.83±2.47Aa	28.98±6.64ABc	2.29±0.48Ac
L-B3	A	431.05±49.50Ba	17.68±1.36Ba	1.18±0.08Ba	14.59±1.50Aa	219.33±27.64Aa	15.01±0.43Aa
	B	64.13±9.79Bb	3.25±0.51Bb	0.73±0.12Bb	12.30±0.55Ab	55.97±5.51Ab	4.46±0.29Ab
	C	25.79±0.96Bb	1.17±0.04Bc	0.72±0.31Bb	13.96±0.93Aa	25.23±7.56Ac	1.83±0.62Ac
L-B4	A	104.95±21.83Aa	5.65±1.02Aa	0.88±0.04ABa	11.82±0.43Aa	75.51±11.33Ba	6.38±0.87Aa
	B	60.13±9.41Ab	3.16±0.45Ab	0.85±0.04ABa	11.96±0.28Aa	44.43±4.26Bb	3.70±0.40Ab
	C	20.63±10.95Ac	1.35±0.60Ac	0.51±0.14ABb	14.91±7.74Aa	36.36±17.59Bb	2.55±0.45Ac
LP	A	244.55±166.98ABa	9.98±6.24ABa	0.96±0.22ABa	13.90±1.40Aa	137.27±70.67ABa	9.56±4.52Aa
	B	50.87±13.86ABb	2.84±0.71ABb	0.55±0.30ABb	10.94±0.29Aa	75.82±41.86ABab	6.97±3.98Aab
	C	30.68±17.79ABb	1.85±0.95ABb	0.65±0.20ABab	18.81±19.42Aa	36.87±29.30ABb	2.68±0.85Ab

Different uppercase letters indicate significant differences between soil types within the same soil layer ($P < 0.05$), and different lowercase letters indicate significant differences among soil layers within the soil types ($P < 0.05$). SOM is the soil organic matter, TN is the soil total nitrogen, TP is the soil total phosphorus.

Table S2. Variance analysis of soil chemical and physical properties between different forests and soil layers

Forest	Horizon	$pH_{(H_2O)}$	Bulk density (g/cm^3)	Soil porosity (%)	AHN (mg/kg)	AP (mg/kg)
BP	A	5.54±0.34Aba	0.54±0.07Aa	61.65±7.63Aa	692.66±224.83Aa	25.30±11.20BCa
	B	6.51±0.09ABb	0.79±0.07Ab	61.93±4.91Aa	248.50±50.86Ab	6.90±2.40BCb
	C	6.60±0.12ABb	1.07±0.13Ac	55.32±5.47Aa	114.27±29.31Ab	3.80±2.40BCb
L-B1	A	5.89±0.28Aba	0.70±0.08Aa	53.34±3.80Aa	552.50±83.62Aa	5.91±7.12Ca
	B	6.36±0.04ABb	0.91±0.04Ab	60.16±0.98Aa	277.33±20.60Ab	3.45±0.89Ca
	C	6.67±0.13ABc	1.14±0.23Ac	52.53±9.63Aa	87.07±33.00Ac	2.37±0.61Ca
L-B2	A	5.85±0.61Ba	0.41±0.30Aa	31.41±11.99Aa	776.00±83.56Aa	35.05±7.76ABCa
	B	6.18±0.47Bab	0.94±0.04Ab	50.45±2.07Aa	345.00±58.36Ab	4.12±0.86ABCb
	C	6.36±0.11Bb	1.01±0.13Ac	50.59±4.97Aa	116.63±33.25Ac	2.02±0.76ABCb
L-B3	A	6.33±0.18Aba	0.60±0.08Aa	60.50±9.45Ba	1257.50±170.75Aa	66.58±10.05Aba
	B	6.18±0.96Aba	0.88±0.03Ab	54.62±8.68Ba	241.67±56.13Ab	3.26±0.58ABb
	C	6.56±0.85ABb	1.14±0.18Ac	49.40±9.04Ba	88.57±4.22Ac	3.83±1.00ABb
L-B4	A	6.15±0.57Aba	0.55±0.08Aa	56.39±1.37Aa	518.00±70.24Aa	17.26±10.25BCa
	B	6.49±0.88ABb	0.84±0.06Ab	51.83±1.33Aab	287.33±41.30Ab	4.28±2.17BCb
	C	6.33±0.35ABb	1.12±0.14Ac	51.41±8.20Ab	134.95±40.90Ac	2.95±0.63BCb
LP	A	5.79±0.52Aa	0.21±0.02Aa	61.81±17.12Aba	1183.50±176.98Aa	89.33±18.13Aa
	B	6.39±0.11Ab	0.87±0.08Ab	55.12±1.34Aba	223.67±32.34Ab	7.13±1.19Ab
	C	6.96±0.86Ab	1.08±0.08Ab	53.99±5.05ABa	136.15±61.80Ab	4.68±2.07Ab

Different uppercase letters indicate significant differences between soil types within the same soil layer ($P < 0.05$), and different lowercase letters indicate significant differences among soil layers within the soil types ($P < 0.05$). AHN is alkali-hydrolyzable nitrogen, AP is available phosphorus.

Table S3. The interactive effects and proposed interpretation of vegetation and soil physicochemical properties on soil nutrient stoichiometry [].

Effect	Proposed interpretation	References
Mixed tree species proportions → Soil physicochemical properties	Trees species can create a soil environment that enhances their ability to compete and thus increases their fitness. Mixing tree species can result in a more effectively used soil space, and temporal or spatial niche partitioning in the soil can increase root biomass. The nutrient content of tree species determined leaf-fall decomposition, nutrient return, and nutrient release into the soil in forests, affecting soil fertility.	[63]; [22]; [64].
Soil physical properties → Soil nutrient stoichiometry	Soil physical properties have a close relationship with soil moisture, vegetation community, soil texture, organic matter. Increases in bulk weight lead to poorer air permeability and less oxygen in the soil, which limited the activity of soil microorganisms and results in lower SOM and TP concentrations.	[50]; [51].
pH → Soil nutrient stoichiometry	Litter decomposition is a major source of soil nutrients and pH influences litter decomposition through microbial activity.	[31].
Soil available nutrients → Soil nutrient stoichiometry	The degree of control of soil nutrient availability by geochemical and biological processes is inconsistent during ecosystem succession. Decomposition and mineralization by microorganisms through depletion of soil available nutrients.	[15]; [44].

Table S4. Characteristics of the study plots.

Site	*Larix principis-rupprechtii* proportion(%)	No. of trees	Mean tree DBH (cm)	Mean tree height (m)
BP	0	693	17.12±8.25a	9.84±2.97a
L-B1	8.58	3334	13.35±3.61d	8.02±1.33d
L-B2	10.44	2203	16.97±7.62b	10.09±2.93a
L-B3	18.62	910	12.15±4.41b	10.00±2.06b
L-B4	38.23	2137	11.91±4.34c	7.26±1.50c
LP	100	1138	10.48±3.01b	7.77±1.83b