SI-Tables

Table S1. Description of sampling transects and plots for *Pinus cembra* L. and *Larix decidua* Mill. in the South Swiss Alps

Table S2. LMM results for the effects of species (*Pinus cembra* L. and *Larix decidua* Mill.), altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: Oct) on NSCs, nutrients, and stable isotope over tissues. The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

Table S3. LMM results for the effects of species (*Pinus cembra* L.and *Larix decidua* Mill.), altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: Oct) on the stoichiometric ratios (C: N and N: P). The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

Table S4. LMM results for the effects of altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: October) and their interactions on NSCs, nutrients and stable isotope over tissues of *Pinus cembra* L. The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

Table S5. LMM results for the effects of altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: October) and their interactions on NSCs, nutrients and stable isotope over tissues of *Larix decidua* Mill. The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

Table S1. Description of sampling transects and plots for *Pinus cembra* L. and *Larix decidua* Mill. in the South Swiss Alps

Transect/site	Soil texture†	Soil type †	Plot	Location(E,N)		Elevation (m)	AMT‡	*Pinus cembra*		*Larix decidua*	
								Sapling	Adult	Sapling	Adult
Chandolin	Loamy sand	Leptosols	Treeline	46.2541° (46.2546°)	7.5981° (7.5910°)	2400 (2260)	-1.58 (-0.93)	H:0.5~0.7m D:2.0~3.5cm	H:5.0~6.0m D:9.8~14.1cm	H:0.8~1.1m D:2.5~3.4cm	H:5.0~7.0m D:11.2~33.0cm
			Timberline	46.2498° (46.2548°)	7.6183° (7.6057°)	2100 (2015)	-0.08 (0.30)	H:0.4~0.8m D:1.5~4.0cm	H: 8.0~12.0m D: 25.2~35.3cm	H: 0.7~1.0m D: 1.8~3.2cm	H:15.0~17.0m D:40.4~50.6cm
LaTzoumaz	Sandy loam	Leptosols	Treeline	46.1269°	7.2256°	2200	1.34	H:0.6~0.9m D:1.5~3.0cm	H:5.0~7.0m D:20.4~35.2cm	H:0.6~1.3m D:0.8~2.0cm	H:5.0~7.0m D:8.6~14.0cm
			Timberline	46.1312°	7.2372°	1940	2.64	H:0.7~0.9m D:1.5~2.0cm	H:7.0~10.0m D:12.6~30.0cm	H:0.6~0.7m D:1.4~1.7cm	H:8.0~12.0m D:22.3~32.2cm
Moosalp	Loamy sand	Podzols	Treeline	46.2471°	7.8230°	2224	0.74	H:0.5~0.9m D:1.7~3.2cm	H:4.5~6.0m D:13.5~17.1cm	H:0.7~1.4m D:2.0~4.0cm	H:5.0~7.0m D:14.7~16.5cm
			Timberline	46.2615°	7.8330°	1930	2.21	H:0.6~1.0m D:1.5~2.3cm	H:8.8~9.5m D:34.6~60.2cm	H:0.9~1.4m D:1.5~2.8cm	H:12.0~15.0m D:40.2~55.3cm
Sievz	Sandy loam	Leptosols	Treeline	46.1123°	7.3173°	2187	0.31	H:0.4~0.5m D:0.8~1.5cm	H:5.0~6.5m D:25.4~29.7cm	H:0.5~1.4cm D:1.9~3.5cm	H:8.0~11.0m D:30.1~45.2cm
			Timberline	46.1209°	7.3158°	1886	1.82	H:0.5~0.7m D:1.7~2.0cm	H:14.0~16.0m D:30.3~45.1cm	H:0.5~0.9cm D:1.2~1.7cm	H:15.0~18.0m D:40.8~60.3cm

Note: H, tree height (m); D: 10 cm aboveground diameter (cm) for saplings, and diameter (cm) at breast height (1.3m) for adults. †Soil features were extracted from Harmonized World Soil Database (version 1.2, HWSD, http://www.fao.org/soils-portal/soil-survey/soil-maps-and-databases/harmonized-world-soil-database-v12/en/) according to site geographical location; ‡ AMT: annual mean temperature (℃) was extracted from the Bioclim dataset (30 arc second, http://www.worldclim.org/bioclim) according to geographical location at timberline plot per site, and deduced the corresponding temperature of the treeline plot with altitudinal lapse rate of -0.5 °C per 100 m. Number in bracket denote value for *Larix decidua.*

Table S2. LMM results for the effects of species (*Pinus cembra* L. and *Larix decidua* Mill.), altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: Oct) on NSCs, nutrients, and stable isotope over tissues. The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

		Sugar		Starch		NSC		Nitrogen		Phosphorus		$\delta^{13}C$		$\delta^{15}N$	
Source of variation	*Df*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
Leaf															
Species	1	99.23	**<0.001**	11.78	**<0.001**	46.13	**<0.001**	0.32	0.577	1.37	0.249	226.5	**<0.001**	70.37	**<0.001**
Altitude	1	0.75	0.391	0.64	0.430	1.16	0.287	22.25	**<0.001**	2.55	0.117	8.85	**0.005**	51.67	**<0.001**
Age	1	4.08	**0.049**	1.97	0.168	1.13	0.294	0.92	0.344	0.12	0.733	16.67	**<0.001**	0.03	0.865
Season	1	25.65	**<0.001**	97.53	**<0.001**	0.03	0.871	1.89	0.176	37.78	**<0.001**	35.03	**<0.001**	0.13	0.720
Species×Altitude	1	0.09	0.771	0.27	0.606	0.00	0.989	0.50	0.484	2.99	0.091	1.86	0.179	13.31	**<0.001**
Species×Age	1	4.19	**0.047**	4.45	**0.041**	7.00	**0.011**	3.70	0.061	1.75	0.193	10.72	**0.002**	0.53	0.469
Altitude×Age	1	0.61	0.441	0.01	0.920	0.37	0.548	1.42	0.239	0.16	0.689	0.00	0.948	5.01	**0.030**
Species×Season	1	5.90	**0.019**	8.81	**0.005**	11.22	**0.002**	8.38	**0.006**	0.06	0.809	0.68	0.414	1.31	0.258
Altitude×Season	1	10.04	**0.003**	1.78	0.189	4.21	**0.046**	1.34	0.253	0.03	0.855	3.73	0.059	0.37	0.544
Shoot															
Species	1	9.47	**0.004**	0.04	0.836	7.38	**0.009**	7.50	**0.009**	0.34	0.565				
Altitude	1	8.39	**0.006**	2.07	0.158	8.53	**0.005**	0.00	0.972	0.71	0.403				
Age	1	2.47	0.123	10.62	**0.002**	5.35	**0.025**	1.13	0.292	0.00	0.989				
Season	1	60.83	**<0.001**	34.91	**<0.001**	24.97	**<0.001**	15.34	**<0.001**	2.88	0.097				
Altitude×Season	1	8.61	**0.005**	0.12	0.730	5.90	**0.019**	0.74	0.393	2.24	0.141				
Root															
Species	1	9.23	**0.004**	45.86	**<0.001**	35.61	**<0.001**	0.10	0.750	0.12	0.730				
Altitude	1	21.37	**<0.001**	0.23	0.633	11.20	**0.002**	0.40	0.531	1.05	0.310				
Age	1	0.05	0.822	0.35	0.559	0.24	0.627	0.11	0.737	0.43	0.514				
Season	1	6.67	**0.013**	34.32	**<0.001**	26.29	**<0.001**	16.78	**<0.001**	11.68	**<0.001**				

Species×Age	1	3.30	0.076	3.88	0.055	6.06	**0.018**	2.17	0.147	0.13	0.719
Species×Season	1	2.42	0.127	3.88	0.055	5.11	**0.029**	0.01	0.936	1.85	0.181
Altitude×Season	1	0.48	0.492	10.45	**0.002**	5.10	**0.029**	0.07	0.794	2.85	0.098

Table S3. LMM results for the effects of species (*Pinus cembra* L.and *Larix decidua* Mill.), altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: Oct) on the stoichiometric ratios (C: N and N: P). The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

		C:N		N:P	
Source of variation	*df*	*F*	*P*	*F*	*P*
Leaf					
Species	1	31.109	**<.0001**	1.355	0.251
Altitude	1	3.802	0.057	2.329	0.134
Age	1	1.090	0.302	0.626	0.433
Season	1	0.231	0.633	40.153	**<.0001**
Species×Age	1	9.011	**0.004**	5.078	**0.029**
Species×Season	1	18.053	**0.000**	1.266	0.267
Altitude×Season	1	4.599	**0.037**	0.569	0.454
Age×Season	1	0.003	0.956	4.127	**0.048**
Shoot					
Species	1	15.819	**0.000**	0.028	0.867
Altitude	1	3.729	0.060	0.949	0.335
Age	1	0.727	0.399	0.031	0.861
Season	1	47.117	**<.0001**	2.538	0.118

Altitude×Season	1	5.665	**0.022**	3.286	0.077
Root					
Species	1	16.710	**0.000**	0.455	0.504
Altitude	1	2.072	0.157	0.800	0.376
Age	1	0.060	0.808	0.924	0.342
Season	1	0.175	0.678	28.938	**<.0001**
Species×Altitude	1	6.208	**0.017**	2.961	0.092
Species×Age	1	9.951	**0.003**	0.549	0.463

Table S4. LMM results for the effects of altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: October) and their interactions on NSCs, nutrients and stable isotope over tissues of *Pinus cembra* L. The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

Tissue	Source of variation		Sugar		Starch		NSC		Nitrogen		Phosphorus		$\delta^{13}C$		$\delta^{15}N$	
		df	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
Leaf	Age	1	15.45	**<0.001**	0.22	0.647	8.21	**0.009**	5.52	**0.028**	0.50	0.485	0.29	0.596	0.17	0.685
	Altitude	1	0.31	0.586	0.75	0.396	0.67	0.421	10.69	**0.004**	0.01	0.925	8.33	**0.009**	6.75	**0.017**
	Season	1	6.49	**0.019**	71.51	**<0.001**	7.37	**0.013**	1.54	0.228	21.43	**<0.001**	20.12	**<0.001**	0.33	0.571
	Age:Altitude	1	4.59	**0.044**	0.35	0.562	3.02	0.097	1.56	0.225	0.35	0.562	0.85	0.367	2.48	0.130
	Age:Season	1	0.21	0.654	0.27	0.608	0.33	0.571	1.89	0.184	4.34	**0.049**	0.17	0.683	0.01	0.934
Shoot	Age	1	0.07	0.798	2.46	0.131	0.42	0.522	0.22	0.645	0.07	0.797				
	Altitude	1	2.01	0.171	2.26	0.148	2.86	0.106	0.06	0.810	0.12	0.737				
	Season	1	18.87	**<0.001**	27.21	**<0.001**	6.71	**0.017**	8.62	**0.008**	2.48	0.130				
	Altitude:Season	1	1.01	0.325	0.14	0.710	0.67	0.421	4.69	**0.042**	0.24	0.627				
Root	Age	1	2.13	0.160	3.72	0.067	3.96	0.060	1.41	0.248	0.03	0.868				
	Altitude	1	6.83	**0.016**	0.15	0.702	3.02	0.097	9.90	**0.005**	1.57	0.224				

	Season	1	0.54	0.471	8.60	**0.008**	3.74	0.067	17.58	**<0.001**	7.40	**0.013**
	Altitude:Season	1	0.35	0.562	7.13	**0.014**	2.90	0.104	2.11	0.161	5.02	**0.036**

Table S5. LMM results for the effects of altitude (timberline and treeline), tree age (sapling and adult tree), sampled season (mid-growing season: Aug; and late-season: October) and their interactions on NSCs, nutrients and stable isotope over tissues of *Larix decidua* Mill. The interactions were retained in the models only when significant. *df*: degrees of freedom. Significant p-values are in bold face.

Tissue	Source of variation		Sugar		Starch		NSC		Nitrogen		Phosphorus		$\delta^{13}C$		$\delta^{15}N$	
		df	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*	*F*	*P*
Leaf	Age	1	0.00	0.988	6.47	**0.019**	1.14	0.299	0.46	0.503	1.19	0.288	39.66	**<0.001**	0.40	0.535
	Altitude	1	0.47	0.500	0.04	0.842	0.54	0.471	14.57	**0.001**	4.73	**0.041**	1.90	0.183	57.69	**<0.001**
	Season	1	19.71	**<0.001**	25.02	**<0.001**	4.60	**0.044**	9.04	**0.007**	14.91	**0.001**	19.02	**<0.001**	1.11	0.303
	Age:Altitude	1	5.00	**0.036**	0.25	0.622	5.42	**0.030**	0.36	0.555	0.00	0.996	1.15	0.295	2.66	0.118
	Age:Season	1	0.28	0.602	5.39	**0.030**	0.21	0.652	0.67	0.423	1.77	0.197	0.00	0.977	0.02	0.902
	Altitude:Season	1	8.21	**0.009**	0.65	0.428	5.69	**0.027**	0.01	0.933	0.03	0.873	2.30	0.144	0.00	0.982
Shoot	Age	1	3.71	0.068	8.62	**0.008**	6.35	**0.020**	1.17	0.293	0.03	0.874				
	Altitude	1	6.94	**0.015**	0.47	0.501	5.82	**0.025**	0.04	0.839	0.58	0.456				
	Season	1	43.41	**<0.001**	12.53	**0.002**	19.32	**<0.001**	7.20	**0.014**	1.07	0.313				
	Altitude:Season	1	9.53	**0.006**	0.02	0.879	6.39	**0.020**	1.04	0.320	1.99	0.173				
Root	Age	1	1.15	0.296	0.76	0.392	2.19	0.154	1.28	0.271	1.04	0.319				
	Altitude	1	14.16	**0.001**	0.08	0.780	9.52	**0.006**	7.12	**0.014**	0.02	0.887				
	Season	1	7.77	**0.011**	24.57	**<0.001**	30.66	**<0.001**	6.80	**0.016**	4.23	0.052				