

798      **Table S 1: Study stands characteristics.** Abbreviations: species – dominant tree species; WTL – mean water table level, cm; A – age,  
799      years; D – mean tree diameter, cm; H – mean tree height, m; BA – basal area, m<sup>2</sup> ha<sup>-1</sup>. Site types: Dr - Dryopterioso-caricosa; Ox - Oxalidosa  
800      turf. mel.; My - Myrtillosa turf.mel.

Site identifier	Latitude	Longitude	Species	Site type	WTL	Peat layer, cm	A	D	H	BA
Drained sites										
LTC106	54.79312	24.07451	Alder	Dr	−56	50	30	12	13	26
EEC108	58.25010	26.29040		Dr	−23	35	80	21	20	36
LVC108	57.32216	26.06411	Birch	Ox	−30	90	24	14	16	15
LVC115	56.69388	25.68767		Ox	−96	56	33	13	16	21
EEC106	58.43755	26.35558		Ox	−70	70	35	12	13	18
LTC105	54.79010	24.08022		Ox	−94	50	43	22	18	23
EEC109	58.34765	26.47599		Ox	−57	90	45	16	16	22
EEC105	58.42870	26.37470	Pine	My	−82	90	60	22	18	17
LVC110	56.62838	24.11370		Dr	−76	35	81	12	12	43
LVC107	56.78452	23.86247		Ox	−112	27	10	22	21	48
LVC116	57.26889	25.99285		My	−31	165	14	14	14	34
LVC313	57.26889	25.99285		My	−53	138	14	14	13	39
LVC104	56.99978	24.65896	Spruce	Ox	−80	50	40	22	20	33
LVC105	56.39288	25.65370		Ox	−31	86	55	22	19	22
LVC106	56.39495	25.65134		Ox	−42	95	55	24	21	21
EEC104	58.43861	26.35394		Ox	−66	80	60	20	17	18
LTC104	54.79426	24.08077		My	−63	50	70	20	17	27
LVC308	57.34717	25.92568		Ox	−50	212	14	25	23	36
LVC112	57.33731	26.02635		Ox	−31	68	16	10	10	21
Undrained sites										
LTC109	54.54109	23.61140	Alder	Dr	−10	150	44	16	16	30
LVC109	56.57378	24.82944		Dr	−11	100	74	28	28	36
LTC108	54.54396	23.56578	Birch	Dr	−7	150	44	21	20	22
LVC111	57.29058	25.99874		Dr	−14	230	61	8	9	23
LVC309	57.27915	25.85371	Spruce	Dr	−17	133	81	21	20	34
LVC311	57.27887	25.85441		Dr	−13	205	88	18	17	42
LVC312	57.31164	25.93609		Dr	−17	221	96	17	15	25

803 **Table S 2: Meteorological conditions during the study period** (Estonian Environment Agency. Climate normals, 2024; Latvian  
 804 Environment, Geology and Meteorology Centre. Climate normals, 2024; Lithuanian Hydrometeorological Service. Climate normals, 2024)  
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Parameter	Variable	Estonia		Latvia		Lithuania	
		1 <sup>st</sup> year	2 <sup>nd</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year	1 <sup>st</sup> year	2 <sup>nd</sup> year
Annual air temperature. °C	Mean	6.4	6.9	7.0	7.3	7.8	8.5
	Range	-22.4...27.2	-14.9...25.6	-31.0...33.7	-23.2...33.7	-12.0...27.2	-11.3...25.0
Annual precipitation. mm	Sum	597.0	472.9	676.3	685.8	639.8	533.6

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 807 **Table S 3: Laboratory standard methods used for sample analysis.**

Parameter	Unit	Method principle	Standard method
Analysis of soil and biomass samples			
Bulk density	kg m <sup>-3</sup>	Gravimetry	LVS ISO 11272:2017
pH	unit	Potentiometry	LVS ISO 10390:2021
Total C	g kg <sup>-1</sup>	Elementary analysis (dry combustion)	LVS ISO 10694:2006
Total N	g kg <sup>-1</sup>	Elementary analysis (dry combustion)	LVS ISO 13878:1998
Ash content	g kg <sup>-1</sup>	Gravimetry	LVS EN ISO 10693:2014
HNO <sub>3</sub> extractable potassium (K), calcium (Ca), magnesium (Mg) and phosphorus (P)	g kg <sup>-1</sup>	ICP-OES	LVS EN ISO 11885:2009
Analysis of water samples			
pH	unit	Potentiometry	LVS EN ISO 10523:2012
DOC	mg L <sup>-1</sup>	Catalytical combustion with infrared detection	LVS EN 1484:2000
Total N	mg L <sup>-1</sup>	Catalytical combustion with chemiluminescence detection	LVS EN 1484:2000
NO <sub>3</sub> <sup>-</sup> , PO <sub>4</sub> <sup>3-</sup>	mg L <sup>-1</sup>	Ion chromatography	LVS EN ISO 10304 – 1:2009
NH <sub>4</sub> <sup>+</sup>	mg L <sup>-1</sup>	Photometry	LVS ISO 7150-1:1984
K, Ca, Mg	mg L <sup>-1</sup>	Flame atomic absorption spectrometry	LVS EN ISO 7980:2000

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810 **Table S 4: Summary of soil characteristics in the study sites (mean±SD).** BD - bulk density, Corg – organic carbon, N – Nitrogen, CN –  
811 C:N ratio, P – phosphorous, K – potassium, Ca – calcium, Mg – magnesium.

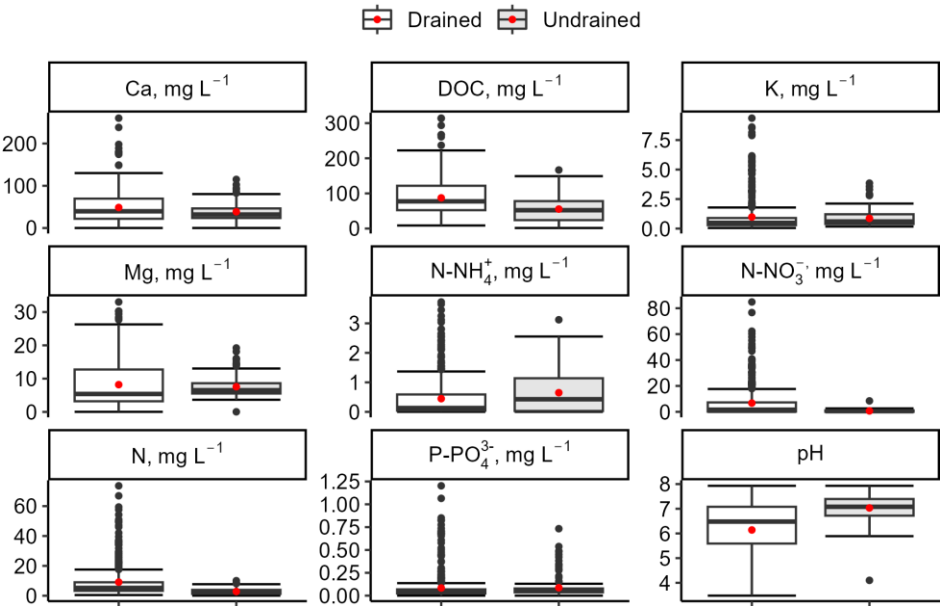
Parameter	Unit	Drained			Undrained		
		0-10	0-20	0-30	0-10	0-20	0-30
BD	kg m <sup>-3</sup>	221±86	270±135	314±214	173±38	174±32	168±32
pH	units	3.9±1.1	4.1±1.1	4.2±1.1	5.3±0.3	5.3±0.3	5.3±0.3
Corg	g kg <sup>-1</sup>	412±91	416±121	406±153	411±64	432±39	443±39
N	g kg <sup>-1</sup>	23±6	22±8	20±9	27±4	27±4	27±4
C:N	ratio	19±6	21±6	22±7	15±3	16±3	17±3
P	g kg <sup>-1</sup>	0.9±0.4	0.8±0.5	0.8±0.6	2±1.7	1.8±1.2	1.6±1.1
K	g kg <sup>-1</sup>	0.7±0.4	0.5±0.3	0.4±0.3	1.6±1.1	1.3±0.8	1.1±0.6
Ca	g kg <sup>-1</sup>	15±13	17±14	17±14	28±7	28±7	28±8
Mg	g kg <sup>-1</sup>	1.2±0.7	1.2±0.8	1.2±0.8	2.6±0.8	2.5±0.8	2.4±0.7

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813 **Table S 5: Summary of water table level characteristics in the study sites (mean±SD).**

Parameter	Unit	Drained			Undrained	
		EE	LT	LV	LT	LV
pH	unit	6.9±0.6	6.5±0.6	6.1±1.2	7±0.5	7±0.5
DOC	mg L <sup>-1</sup>	69.4±23.1	93.5±64.5	95.4±57.4	103.3±23.7	41.7±30
N	mg L <sup>-1</sup>	13.2±11.5	12.7±15.4	5.4±4.7	5.5±1.7	2.1±1.4
NH <sub>4</sub> <sup>+</sup>	mg L <sup>-1</sup>	0.6±0.9	0.5±0.7	0.4±0.4	0.7±0.9	0.6±0.7
NO <sub>3</sub> <sup>-</sup>	mg L <sup>-1</sup>	11.5±12.9	10.7±17.4	2.5±4.3	1.3±1.6	0.5±0.5
PO <sub>4</sub> <sup>3-</sup>	mg L <sup>-1</sup>	0.1±0.1	0.1±0.2	0.1±0.2	0.1±0.1	0.1±0.1
K	mg L <sup>-1</sup>	0.4±0.3	2.8±3.5	0.6±0.4	1.9±0.7	0.6±0.3
Ca	mg L <sup>-1</sup>	63.6±27.8	77.7±51	27.5±16.9	71.1±15.5	29±9.2
Mg	mg L <sup>-1</sup>	7.5±4.9	14.6±8.2	5.6±4.6	12.9±2.2	6±1.4

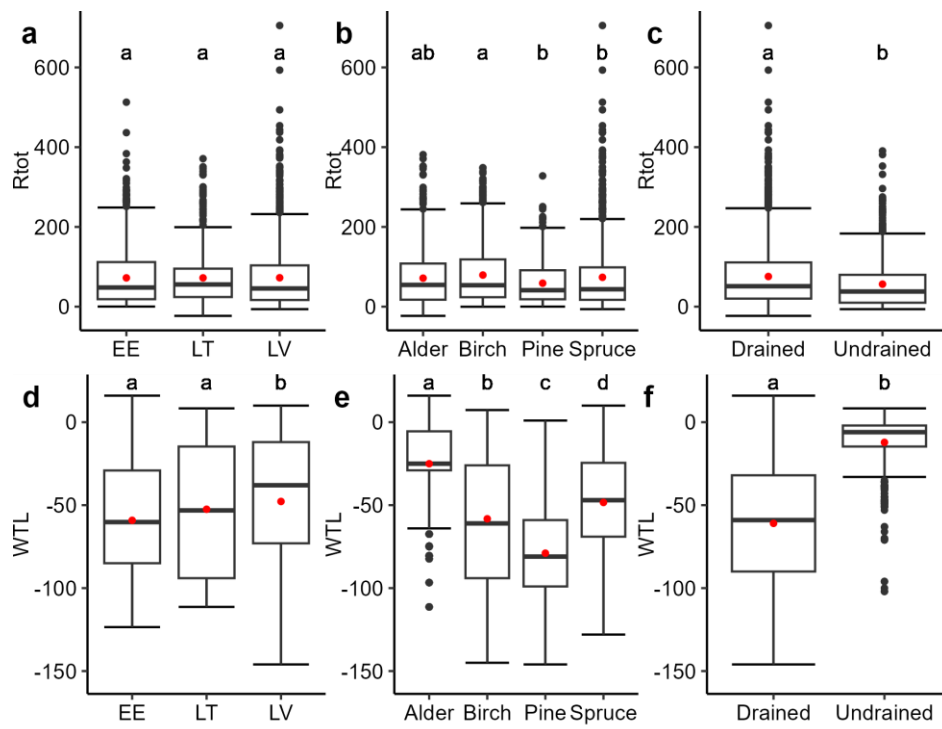
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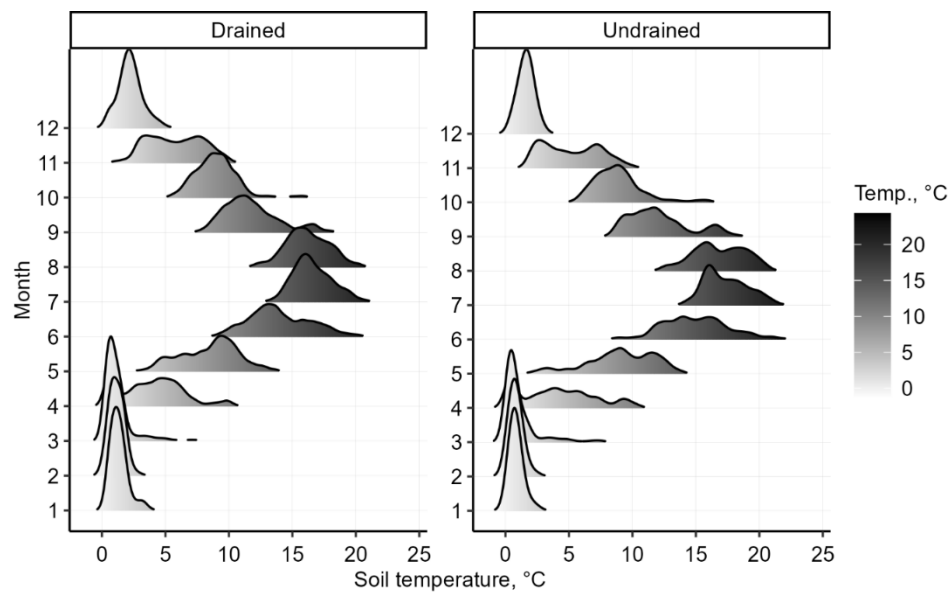
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817 **Figure S 1: Variation of groundwater chemical properties.**



**Figure S 2: Summary of water table level (WTL, cm) depth and total respiration ( $R_{tot}$ ,  $\text{mg CO}_2 \text{ C m}^{-2} \text{ h}^{-1}$ ) measurement results.**



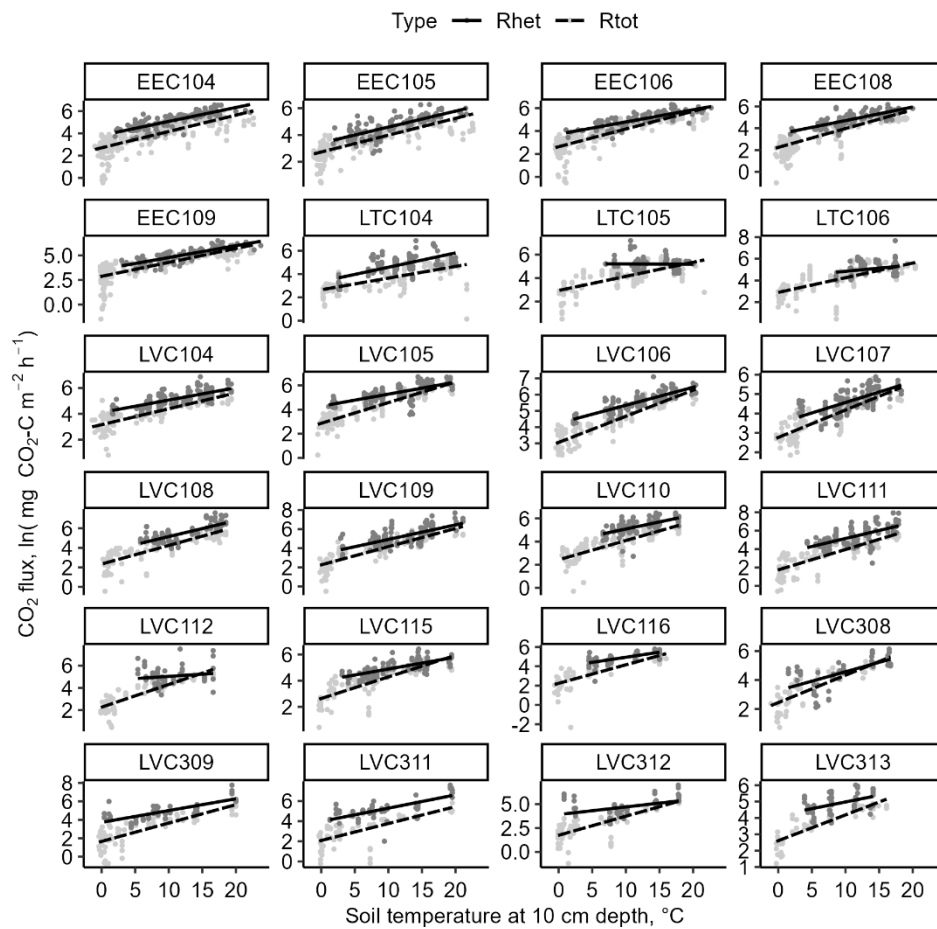
**Figure S 3: Density plots of soil temperature measurement results at 10 cm depth.**

824 **Table S 6: Characteristics of total soil respiration (R<sub>tot</sub>) prediction models used for interpolation of hourly emissions.** Abbreviations:  
825 R10 - R<sub>tot</sub> when soil temperature is 10 °C at 10 cm depth, RMSE – root mean square error of the model prediction. RMSE improvement  
826 and R10 increase are relative differences of corresponding model characteristics compared to linear models fitted using log10 transformed  
827 data. Model describes:  $\frac{R_{tot}^{\lambda-1}}{\lambda} = a * T + b$ . where:  
828 R<sub>tot</sub> – soil instantaneous total respiration (mg CO<sub>2</sub>-C m<sup>-2</sup> h<sup>-1</sup>), lambda – lambda value used for R<sub>tot</sub> data transformation, a – coefficient a of  
829 linear model, b – coefficient b of a linear model, T – soil temperature at 10 cm depth (°C).

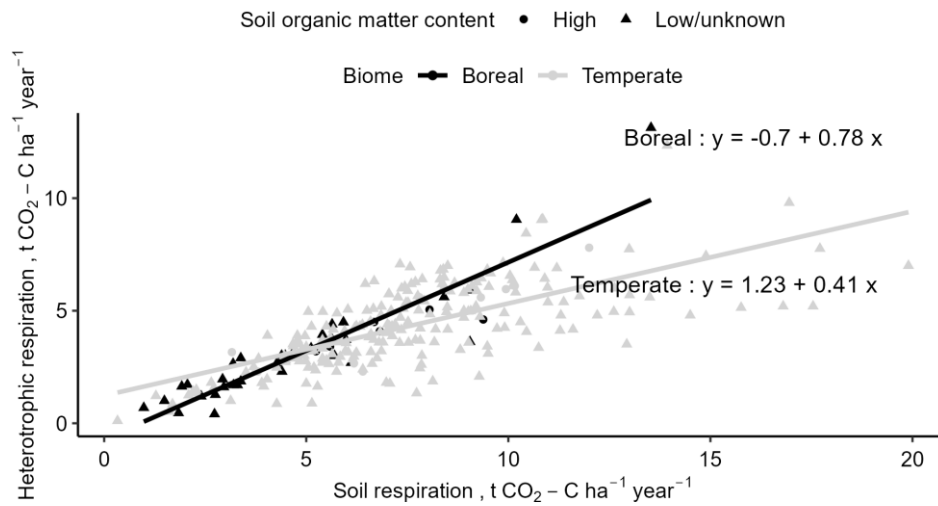
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Site identifier	Coefficient a	Coefficient b	R <sup>2</sup>	R10	RMSE	RMSE improvement	R10 increase
LVC104	0.4903	5.6964	0.71	89	35	7%	10%
LVC105	0.74315	4.44323	0.84	116	59	8%	19%
LVC106	0.7318	5.0111	0.85	127	59	14%	20%
LVC107	0.53295	4.32402	0.70	72	36	6%	10%
LVC108	0.70835	3.45753	0.78	88	45	20%	26%
LVC109	0.68144	3.27991	0.80	80	43	34%	24%
LVC110	0.60544	3.41507	0.72	69	31	11%	15%
LVC111	0.70313	2.31005	0.78	67	31	7%	28%
LVC112	0.6929	3.341	0.84	83	24	43%	12%
LVC115	0.61712	4.19065	0.75	85	38	25%	17%
LVC116	0.6038	3.5911	0.77	72	21	31%	12%
LVC308	0.65977	3.86443	0.82	87	23	38%	14%
LVC309	0.5781	2.4058	0.74	50	24	40%	30%
LVC311	0.5456	3.1613	0.63	56	31	6%	29%
LVC312	0.6539	2.1481	0.73	57	33	-11%	35%
LVC313	0.52151	4.277	0.80	69	17	25%	6%
EEC108	0.59162	3.17106	0.82	63	25	27%	19%
EEC106	0.5715	4.2928	0.82	78	37	32%	20%
EEC105	0.44359	4.60199	0.75	62	32	20%	15%
EEC104	0.55427	4.47956	0.72	78	53	14%	20%
EEC109	0.499	5.732	0.63	92	52	6%	26%
LTC104	0.35744	4.25538	0.46	46	38	5%	17%
LTC105	0.4589	5.07975	0.52	72	54	6%	15%
LTC106	0.5431	4.8996	0.54	84	68	7%	22%
LTC108	0.28306	4.04885	0.39	35	26	3%	28%
LTC109	0.36444	4.24811	0.43	46	44	-4%	36%

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**Figure S 4: Relationship between soil temperature, soil heterotrophic (Rhet) and total (Rtot) respiration.**



**Figure S 5: Relationship between total soil respiration and soil heterotrophic respiration in forests according to previous studies (Jian, J. et al., 2021).**

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Table S 7: Biomass (t dm. ha<sup>-1</sup>) measurement results (mean±SD) stratified by drainage status and country. NE – not estimated.  
 \*Data used for soil C balance estimation.

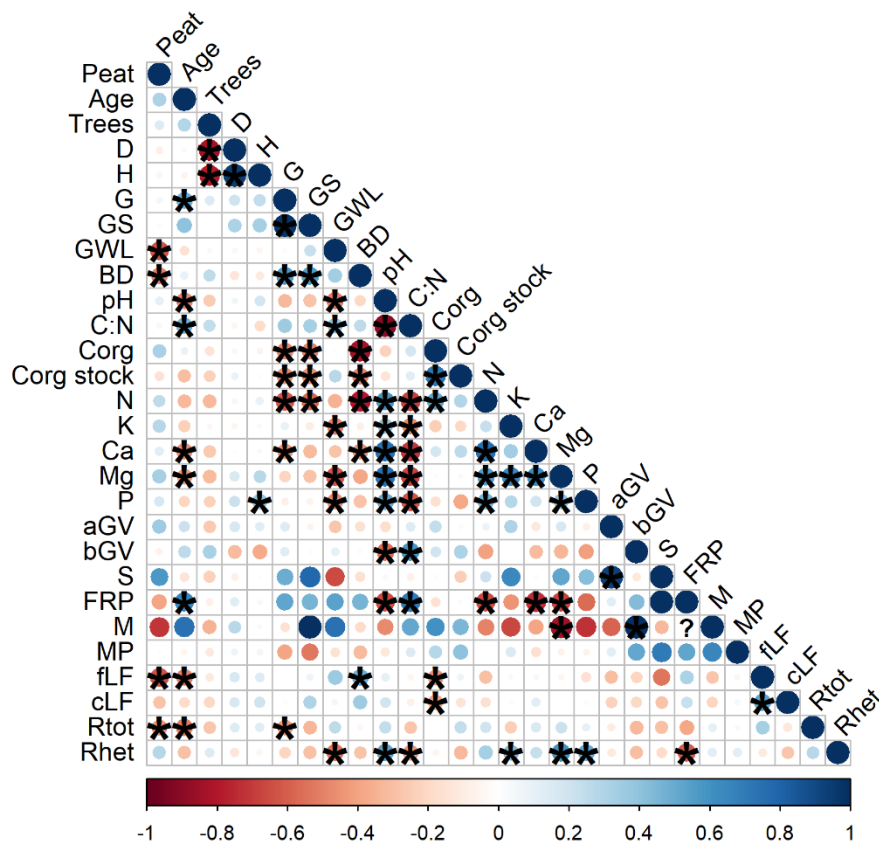
Category	Drained			Undrained	
	EE	LT	LV	LT	LV
aGV*	0.79±0.33	1.34±2.98	2.38±0.63	4.64±14.53	1.44±0.63
bGV*	NE	4.24±2.01	2.52±0.96	2.3±7.74	2.47±1.26
S	0.36±0.36	2.04±2.42	NE	4.27±24.24	NE
FR	NE	NE	NE	NE	NE
FRP*	NE	2.51±5.35	2.54±1.02	NE	1.08±0.76
M	4.8±2.49	NE	NE	NE	NE
MP	0.92±0.48	NE	0.87±0.32	NE	1.01±0.31
fLF*	3.66±0.64	3.7±1.2	2.9±0.69	3.28±13.77	2.23±1.23
cLF	1.39±0.65	0.33±0.62	0.54±0.26	1.35±6.61	0.55±0.68

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**Table S 8: Mean estimated annual cumulative total respiration (t C ha<sup>-1</sup> year<sup>-1</sup>) and biomass (t dm. ha<sup>-1</sup>) in the study sites.** Abbreviations: aGV and bGV – aboveground and belowground biomass of herbaceous ground vegetation, respectively; NE – not estimated, NA – biomass not present or in negligible amounts. \*Used as soil C input values for soil C balance estimation.

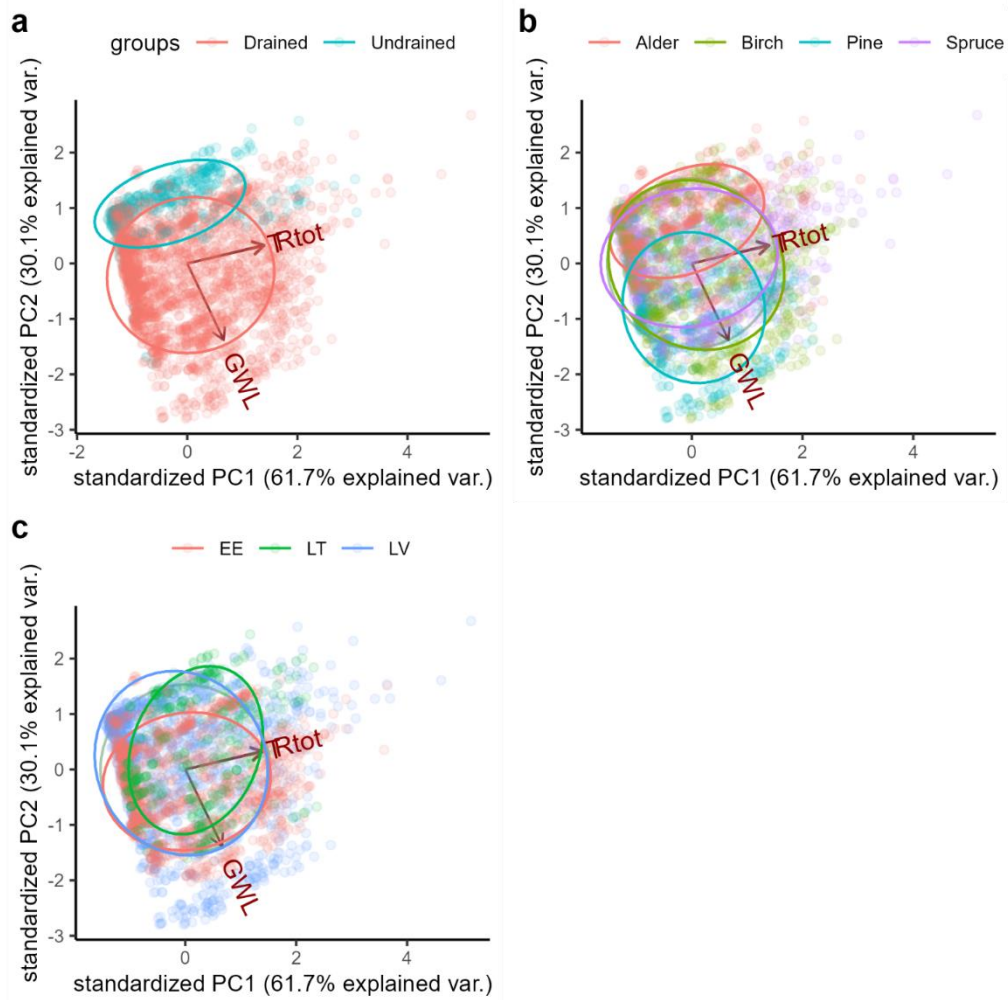
Study site	Rtot	Rhet	aGV*	bGV*	Shrubs	Fine root production*	Moss	Moss production	Fine litterfall*	Coarse litterfall
EEC104	6.04	7.62	0.93	NE	0.08	NE	7.20	1.24	3.80	1.30
EEC105	4.76	9.48	1.10	NE	0.07	NE	5.63	1.08	3.31	1.72
EEC106	6.07	7.95	0.38	NE	0.43	NE	3.61	1.11	3.63	1.51
EEC108	5.08	12.77	0.83	NE	0.73	NE	NE	0.92	4.44	1.88
EEC109	7.61	10.36	0.70	NE	0.51	NE	2.75	0.26	3.12	0.53
LTC104	3.92	-	NA	5.11	2.72	5.00	5.93	2.08	3.77	0.62
LTC105	6.45	-	2.19	4.10	NA	1.29	NA	NA	3.19	0.13
LTC106	7.59	-	0.50	3.52	1.35	1.25	NA	NA	4.15	0.25
LTC108	2.98	-	3.49	1.69	2.37	NE	0.96	NE	4.37	1.87
LTC109	4.04	-	5.78	2.91	6.18	NE	NA	NA	2.20	0.83
LVC104	6.59	12.45	2.60	0.72	NE	2.10	NE	0.35	4.09	0.03
LVC105	9.01	15.78	2.47	1.43	NE	1.40	NE	0.74	4.03	0.45
LVC106	10.50	18.03	3.23	1.83	NE	2.96	NE	1.68	2.76	0.44
LVC107	5.36	7.57	1.49	3.02	NE	5.57	NE	NA	3.98	1.08
LVC108	7.25	17.25	1.82	2.19	NE	0.94	NE	1.20	2.67	0.35
LVC109	6.89	13.72	1.12	1.36	NE	0.64	NE	NA	3.33	1.52
LVC110	5.43	13.92	1.12	2.43	NE	2.89	NE	0.32	4.00	1.33
LVC111	5.51	17.42	0.82	2.38	NE	1.51	NE	1.18	3.11	0.47
LVC112	6.60	12.50	1.67	3.11	NE	NE	NE	NA	1.52	0.27
LVC115	6.61	10.76	1.44	2.48	NE	1.92	NE	NA	2.57	0.86
LVC116	5.65	11.66	3.22	6.12	NE	NE	NE	1.06	1.42	0.34
LVC308	6.27	7.72	3.15	1.36	NE	NE	NE	0.75	1.85	0.33
LVC309	3.98	12.90	1.61	3.29	NE	NE	NE	NA	2.09	0.33
LVC311	4.57	18.30	1.51	3.69	NE	NE	NE	NA	1.68	0.24
LVC312	5.27	9.49	2.14	1.62	NE	NE	NE	0.83	0.94	0.21
LVC313	4.96	11.11	3.98	3.08	NE	NE	NE	NA	2.96	0.45





**Figure S 6: Correlation matrix of annual data (soil parameters at 0-30 cm depth).** Abbreviations: Peat – peat layer width; Age – stand age; Trees – tree density; D – mean tree diameter; H – mean tree height; G – basal area; GS – growing stock; GWL – water table level; BD – bulk density; pH – soil pH value; C:N – ratio between organic carbon and nitrogen in soil; Corg stock – soil organic carbon stock; K, Ca, Mg, P, and Corg represent the content of potassium, calcium, magnesium, phosphorus, and organic carbon in the soil, respectively; aGV, bGV, S, FRP, M, MP, fLF, cLF – biomass of aboveground herbaceous vegetation, belowground herbaceous vegetation, shrubs, tree fine root production, moss, moss production, fine foliar litterfall, coarse woody litterfall, respectively; Rtot – annual total forest floor respiration ; Rhet – annual soil heterotrophic respiration.





**Figure S 8: PCA of total forest floor respiration (Rtot), soil temperature and WTL data.** In figures a, b, c data are grouped by drainage status, dominant tree species and country, respectively.

20 **Table S 9: Characteristics of linear mixed-effects models predicting total forest floor respiration (Rtot) incorporating a random effect for study site.**

Fixed effects	SE	t-value	p	AIC
T	1%	76.0	<0.001	7083
T+Drainage	-20%	-5.0	<0.001	7067
T+Country	-210%	-0.8	0.49	7085
T+Species	295%	0.3	0.73	7089
T+WTL category	14%	7.2	<0.001	7035
T+WTL	14%	7.1	<0.001	7037

**Table S 10: Summary of soil C balance (mean $\pm$ CI, t C ha $^{-1}$  year $^{-1}$ ) estimation results. As soil carbon inputs only ground vegetation, fine roots of trees and foliar fine litter is considered.**

Drainage status	Country	Tree specie	Soil C input	R <sub>tot</sub>	R <sub>het</sub>	C balance	
						Forest floor	Soil
Drained	EE	Mean	5.33 $\pm$ 3.03	5.91 $\pm$ 1.38	3.91 $\pm$ 1.08	-0.58 $\pm$ 3.30	1.42 $\pm$ 3.22
	LT		6.06 $\pm$ 3.33	5.99 $\pm$ 4.66	3.97 $\pm$ 3.63	0.07 $\pm$ 5.72	2.09 $\pm$ 4.93
	LV		5.28 $\pm$ 0.86	6.75 $\pm$ 1.12	4.56 $\pm$ 0.87	-1.47 $\pm$ 1.41	0.72 $\pm$ 1.22
	Mean		5.56 $\pm$ 3.35	6.22 $\pm$ 4.9	4.15 $\pm$ 0.89	-0.66 $\pm$ 1.92	1.41 $\pm$ 1.70
	Mean	Alder	5.01 $\pm$ 2.06	6.34 $\pm$ 2.45	4.24 $\pm$ 1.91	-1.32 $\pm$ 3.20	0.77 $\pm$ 2.81
		Birch	4.44 $\pm$ 0.9	6.8 $\pm$ 0.77	4.60 $\pm$ 0.60	-2.36 $\pm$ 1.18	-0.16 $\pm$ 1.08
		Pine	6.75 $\pm$ 1.92	5.23 $\pm$ 0.45	3.38 $\pm$ 0.35	1.52 $\pm$ 1.97	3.37 $\pm$ 1.95
		Spruce	5.41 $\pm$ 1.57	6.99 $\pm$ 1.98	4.75 $\pm$ 1.54	-1.58 $\pm$ 3.10	0.66 $\pm$ 2.20
		Mean	5.4 $\pm$ 0.82	6.34 $\pm$ 1.81	4.24 $\pm$ 0.98	-0.94 $\pm$ 1.99	1.16 $\pm$ 2.44
Undrained	LT	Mean	5.73 $\pm$ 1.73	3.51 $\pm$ 1.04	2.04 $\pm$ 0.81	2.22 $\pm$ -2.02	3.69 $\pm$ 1.91
	LV		3.69 $\pm$ 1.04	5.24 $\pm$ 1.37	3.39 $\pm$ 1.07	-1.56 $\pm$ 1.72	0.30 $\pm$ 1.49
	Mean		4.71 $\pm$ 0.68	4.38 $\pm$ 0.33	2.72 $\pm$ 1.32	0.33 $\pm$ 0.76	2.00 $\pm$ 3.32
	Mean	Alder	4.57 $\pm$ 1.25	5.47 $\pm$ 2.80	3.56 $\pm$ 2.18	-0.9 $\pm$ 2.34	1.01 $\pm$ 2.51
		Birch	4.84 $\pm$ 2.49	4.25 $\pm$ 2.48	2.61 $\pm$ 1.93	0.59 $\pm$ 3.75	2.23 $\pm$ 3.15
		Spruce	3.7 $\pm$ 1.22	4.6 $\pm$ 1.60	2.89 $\pm$ 0.57	-0.90 $\pm$ 1.46	0.81 $\pm$ 1.35
		Mean	4.37 $\pm$ 1.81	4.77 $\pm$ 2.49	3.02 $\pm$ 1.21	-0.40 $\pm$ 2.14	1.35 $\pm$ 1.91