Supplement to Soil organic matter and labile fractions depend on specific local parameter combinations

Malte Ortner[1], Michael Seidel[2], Sebastian Semella[2], Thomas Udelhoven[3], Michael Vohland[2], Sören Thiele-Bruhn[1]

[1]Soil Science Department, University of Trier, Trier, 54296, Germany
[2]Geoinformatics and Remote Sensing, Institute for Geography, Leipzig University, Leipzig, 04103, Germany
[3]Department of Remote Sensing & Geoinformatics, University of Trier, Trier, 54296, Germany

Correspondence: Malte Ortner (ortner@uni-trier.de), Sören Thiele-Bruhn (thiele@uni-trier.de)

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10 **Supporting information**

Table S1. Ranges (min to max) of analyzed parameters for the entire dataset and identified clusters.

	Dataset (n=199)	DCS (n= 50)	LBS (n=50)	DLS (n=50)	PSS (n=49)	Sandy soils (n=54)	Loamy soils (n=98)	Silty soils (n=42)	Arable (n=150)	Grassland (n=49)
SOC [%]	0.38-5.23	1.38-5.23	0.54-2.69	0.38-3.15	0.65-2.11	0.65-2.35	0.55-4.79	0.38-4.52	0.38-4.07	0.54-5.23
N [%]	0.06-0.55	0.14-0.55	0.06-0.24	0.09-0.30	0.07-0.26	0.07-0.20	0.06-0.52	0.06-0.49	0.06-0.47	0.06-0.55
H [%]	0.12-1.51	0.36-1.51	0.12-0.49	0.24-0.92	0.13-0.63	0.16-0.51	0.12-1.51	0.16-1.22	0.12-1.51	0.16-1.29
O [%]	0.91-14.60	4.59-9.72	1.39-4.56	0.91-14.60	1.61-4.37	1.39-4.40	1.87-8.41	0.91-14.60	0.91-14.60	1.38-9.72
HWEC [µg/g]	237-1889	438-1889	447-1146	386-1202	237-1711	263-1146	237-1889	386-1631	237-1304	317-1889
HWEN [µg/g]	6.08-237	53.9-221	18.5-146	35.5-220	6.08-237	13.5-144	6.08-237	35.5-220	6.08-237	26.0-221
MBC [µg/g]	52.4-810	126-798	52.4-242	177-810	59.8-599	52.4-344	83.1-810	135-629	52.4-558	114-810
MBN [µg/g]	3.60-139	10.4-117	3.60-43.3	18.2-139	12.6-87.1	3.60-54.5	7.98-139	20.02-99.7	3.60-99.7	16.26-139
Respiration [µg CO2 /g]	0.08-0.71	0.10-0.71	0.10-0.34	0.12-0.70	0.08-0.43	0.10-0.43	0.08-0.71	0.12-0.50	0.08-0.51	0.10-0.71
MBC/SOC	0.40-5.47	0.53-1.81	0.40-4.44	1.03-5.47	0.53-3.37	0.40-2.66	0.53-4.44	0.67-5.47	0.40-5.47	0.84-3.37
SOC/N	4.21-18.7	8.50-13.2	9.93-18.7	4.21-16.4	8.06-13.0	8.06-18.7	8.34-16.7	4.21-15.6	4.21-18.7	9.47-18.2
HWE-C/N	2.22-45.5	4.20-18.7	6.31-28.2	2.86-17.8	2.22-45.4	3.28-32.8	2.22-45.5	2.87-15.0	2.22-45.5	4.61-27.44
MB-C/N	2.86-23.3	4.12-19.2	3.22-23.3	4.98-13.5	2.86-10.1	2.86-23.3	2.98-19.2	4.41-13.5	2.86-23.3	4.49-13.5
IC [%]	0.00-6.80	-	-	0.00-6.80	-	-	0.00-4.09	0.00-6.80	0.00-6.80	0.00-4.50
pH	3.81-7.43	4.10-6.41	3.81 -6.71	5.03-7.43	4.78-7.09	3.81-6.68	4.10-7.41	4.92-7.43	3.81-7.43	4.22-7.41
ECEC [mmolc/kg]	14.0-147	28.8-110	14.0-86.4	46.9-147	34.9-108	14.0-61.4	24.9-135	27.9-147	14.0-147	20.2-142
Ca + MgECEC [mmolc/kg]	6.27-134	18.0-107	6.27-81.6	34.5-134	28.1-91.0	6.27- 57.8	18.0-127	22.41-134	6.27-134	12.21-132
Feo [g/kg]	0.54-6.43	2.34-6.43	0.54-2.29	1.37-5.22	0.80-4.54	0.54-2.01	0.88-5.29	1.37-5.22	0.54-5.29	0.84-6.43
Fed-Feo [g/kg]	0.15-11.7	2.02-11.7	1.40-7.63	1.12-8.70	0.15-8.45	0.55-6.26	0.15-11.24	1.12-11.7	0.15-11.7	0.55-9.70
Alo [g/kg]	0.11-5.23	1.25-5.23	0.21-1.98	0.11-1.53	0.23-1.10	0.23-1.98	0.11-5.23	0.13-3.71	0.13-5.01	0.11-5.23
Sand [%]	12.7-91.9	13.4-39.8	33.4-91.9	12.7-42.9	31.2-82.8	52.4-91.9	18.3-76.4	12.7-35.0	12.7-91.9	12.9-86.9
cSilt+ mSilt [%]	0.32-57.8	20.8-39.3	0.32-44.7	31.9-57.8	7.87-40.9	0.32-33.8	7.92-44.3	29.9-57.8	0.32-55.8	5.33-57.8
fSilt + clay [%]	6.27-53.3	33.4-53.3	6.27-23.0	16.7-44.8	8.51-40.6	6.27-20.9	13.7-53.3	16.7-47.1	6.27-53.3	7.78-51.0
Stones [%]	0.00-45.9	7.44-45.0	0.60-41.4	0.00-45.9	0.52-43.5	0.60-20.2	0.00-45.00	0.93-45.9	0.53-45.9	0.00-41.4

Table S2 Intercepts and regression coefficient of selected mixed effect models for the content SOC, HWEC and MBC as response variable for the complete dataset as well as for the cluster of DCS, sandy soils and arable soils (n according to Table 1).

Respon variable	Random factor	Intercept				Parameters and multipliers								
						Fe_o	**Fe_d-**	**Al_o**	**Sand**	**cSilt+mSi**	**fSilt+Clay**	$(Ca+Mg)_{ECEC}$	**pH**	**stones**
Dataset														
SOC	Parent material	A:2.41	B: 2.29	C: 2.37	D:		-0.07	0.51		-0.01	0.02	0.02	-0.25	-0.01
	Land use	E: 1.17		F: 1.30			-0.06	0.52	0.01		0.02	0.01	-0.26	
	Texture	G: 2.26	H:	I: 2.26	J: 2.26		-0.06	0.55		-0.01	0.02	0.02	-0.31	-0.01
HWEC	Parent material*	A:42.9	B: 42.2	C: 41.3	D: 39.8	0.96	-0.69	1.86				0.16	-4.23	-0.07
	Land use*	E: 35.1		F: 38.2		1.02	-0.54	1.92				0.12	-3.16	
	Texture*	G: 42.4	H:	I: 42.6	J: 42.6	0.80	-0.63	2.39				0.16	-4.59	-0.06
MBC	Parent material*	A: 20.4	B: 20.3	C: 20.4	D: 20.4		-0.53				0.20	0.11	-2.45	-0.05
	Land use*	E: 7.24		F: 11.5		0.55	-0.30			0.03	0.15	0.04		
	Texture*	G: 20.2	H:	I: 20.6	J:20.5		-0.53				0.20	0.11	-2.43	-0.05
Arable soils cluster														
SOC	Parent material	A: 0.77	B: 0.81	C: 0.84	D: 0.34			0.45	0.01		0.02	0.01	-0.19	-0.01
	Texture	G: 2.44	H: 2.44	I: 2.44	J: 2.44			0.50				0.02	-0.36	-0.01
HWEC	Parent material	A: 32.0	B: 32.4	C: 31.2	D: 28.9	0.94	-0.46	1.26				0.10	-2.17	
	Texture	G:1221	H: 1222	I: 1227	J: 1223		-19.6	114				6.56	-167	
MBC	Parent material	A: 17.2	B: 17.2	C: 17.2	D: 17.2				-0.07			0.06	-0.63	
	Texture	G: 17.1	H: 17.1	I: 17.2	J: 17.1				-0.07			0.06	-0.63	
DCS cluster														
SOC	Land use	E: 1.13		F: 1.90		0.32	-0.07	0.31						
	Texture	H: 4.03		I: 3.98	J: 4.45	0.30	-0.10	0.32				0.02	-0.72	
HWEC	Land use	E: 1568		F: 2094		141						8.30	-320	
	Texture	H: 2779		I: 2834	J: 3086	133	-59.4					14.2	-464	-9.2
MBC	Land use	E: 26.0		F: 315		56.8								
	Texture	H: 948		I: 959	J: 1115	52.2	-26.5					5.29	-156	-5.10
Sandy soils cluster														
SOC	Parent material	B: -0.43		D: -1.09		0.39		0.24	0.02			0.01		
	Land use	E: 1.22		F: 1.22				0.59		-0.02				
HWEC	Parent material	B; 1413		D: 1264		195		111			-22	11	-217	-9.95
	Land use	E; 1481		F: 1481				207			-18.2	10.6	-214	-10.4
MBC	Parent material	B: 28.9		D: 28.9				1.23	-0.14		-0.42	0.11	-1.31	
	Land use	E: 16.9		D: 19.9		2.68			-0.08		-0.32			

*Response variable was square root transformed; Intercepts of Random effect factors: a = DCS, b = LBS, c = DLS, d= PSS, e = arable, f = grassland, g= sand, h = silt, I = loam, j = clay.

Table S3. R^2 for implementation of the global dataset to local clusters for HWEC and MBC.

HWEC						
	Parent material		Land use		Texture	
Sample subgroups	Model	Global model to local cluster	Model	Global model to local cluster	Model	Global model to local cluster
Dataset	0.63		0.66		0.61	
DCS	-		0.78	0.66	0.60	0.48
LBS	-		0.34	0.21	0.29	0.15
DLS	-		0.35	0.37	0.35	0.36
PSS	-		0.55	0.54	0.55	0.52
Sandy soils	0.61	0.52	0.50	0.4	-	
Silty soils	0.75	0.57	0.64	0.54	-	
Loamy soils	0.59	0.57	0.64	0.62	-	
Arable	0.59	0.57			0.53	0.53
Grassland	0.75	0.73			0.75	0.71
MBC						
	Parent material		Land use		Texture	
Sample subgroups	Model	Global model to local cluster	Model	Global model to local cluster	Model	Global model to local cluster
Dataset	0.38		0.67		0.40	
DCS	-		0.79	0.73	0.56	0.37
LBS	-		0.48	0.43	0.30	0.24
DLS	-		0.32	0.35	0.25	0.25
PSS	-		0.71	0.71	0.61	0.53
Sandy soils	0.33	0.10	0.54	0.38	-	
Silty soils	0.48	0.46	0.48	0.43	-	
Loamy soils	0.40	0.36	0.60	0.59	-	
Arable	0.70	0.60			0.70	0.61
Grassland	0.75	0.61			0.75	0.60

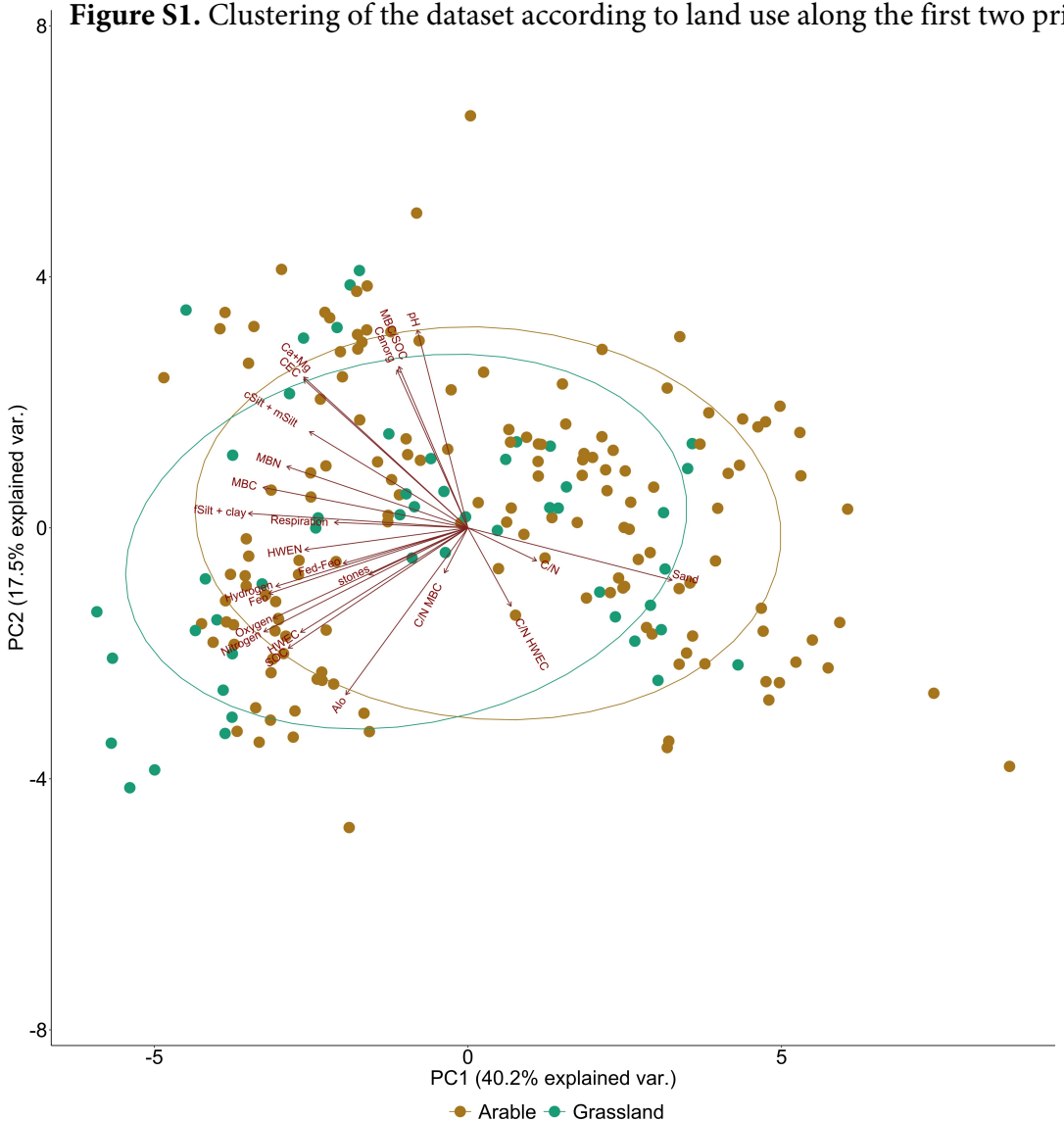

Figure S1. Clustering of the dataset according to land use along the first two principal components.