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## Responses of soil microorganisms to land use in different soil types along the soil profiles

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### Electronic Supplementary Material (ESM)

The authors are fully responsible for both the content and the formal aspects of the electronic supplementary material. No editorial adjustments were made.

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Table S1. The changes in the soil physico-chemical characteristics along the soil profiles in the differently used soil types

<b>Soil water content (w/w)</b>									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	21.23	12.82	29.59	25.00	27.46	26.85	27.28	31.78	35.55
10-20	19.93	11.29	17.69	22.13	22.79	18.51	26.58	26.27	24.41
20-30	19.56	9.80	12.03	23.59	19.16	15.57	26.50	23.35	26.07
30-40	22.04	10.28	11.59	20.45	17.61	13.72	25.30	25.77	26.14
40-50	18.45	9.33	10.96	20.81	12.25	15.76	22.48	25.42	25.84
50-60	15.23	8.57	10.09	19.43	10.83	19.55	19.93	29.53	21.45
60-70	9.70	7.96	10.32	17.74	16.61	13.73	12.88	29.33	17.44
70-80	9.29	6.68	6.54	17.10	15.14	15.26	13.33	34.26	19.13
80-90	10.78	7.01	5.32	19.45	17.86	15.00	14.85	25.09	
90-100	9.22	7.13	5.06	16.21	19.09	13.85			

<b>C/N</b>									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	9.3	27.9	9.9	7.8	9.1	14.5	8.6	8.9	9.9
10-20	9.5	22.5	11.0	9.4	10.9	9.7	9.1	8.2	5.2
20-30	11.3	11.2	11.2	9.3	10.7	9.0	9.8	7.9	9.5
30-40	11.0	10.8	11.6	7.0	7.9	7.6	9.9	8.9	2.2
40-50	11.8	12.7	10.6	9.8	3.9	4.6	9.2	10.4	11.1
50-60	13.7	12.5	12.5	10.9	5.1	6.2	9.3	6.9	9.9
60-70	12.2	10.8	12.3	5.6	8.9	4.1	10.0	7.1	10.3
70-80	12.1	10.3	8.8	5.4	4.7	3.9	7.4	8.3	10.5
80-90	7.9	13.0	10.4	5.5	14.3	5.6	8.0	10.3	
90-100	7.9	10.5	14.0	6.7	2.6	3.5			

<b>TOC (mg/kg)</b>									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	25100	25100	61440	14340	25370	32630	16670	27460	38900
10-20	22810	20850	40550	13620	14370	9020	17000	13290	21050
20-30	20410	19990	21300	11810	6950	4580	14330	7500	12120
30-40	17660	17980	16230	5420	3100	4270	9790	7550	8140
40-50	14170	17870	12730	2350	1790	2340	6470	6730	7630
50-60	12290	11660	9960	4040	2150	2900	5040	4330	6410
60-70	11020	7740	8610	2450	3810	1530	4490	3990	6180
70-80	6030	5060	6190	2230	2170	1530	3420	4170	6750
80-90	3160	3500	5190	2150	5710	2820	3420	4430	
90-100	3160	4200	4210	2000	1160	1650			

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Table S1 to be continued

$C_L$ (mg/kg)									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	3252	2714	9322	1748	2895	3636	1431	2340	4556
10-20	3018	2368	5192	1152	1192	668	1383	1076	1761
20-30	2099	1886	1785	1198	491	290	1257	562	929
30-40	1991	1938	1501	490	222	314	936	474	672
40-50	1091	1592	1416	202	179	201	531	365	576
50-60	1205	1295	1120	246	133	135	393	291	477
60-70	481	288	340	112	357	134	324	234	525
70-80	206	224	181	112	151	156	311	225	536
80-90	66	90	165	214	495	260	263	244	
90-100	66	89	154	110	134	157			

$N_T$ (mg/kg)									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	2700	2200	6200	1840	2780	2250	1930	3100	3930
10-20	2400	1800	3700	1450	1320	930	1870	1630	4060
20-30	1800	1900	1900	1270	650	510	1460	950	1280
30-40	1600	1500	1400	770	390	560	990	850	3780
40-50	1200	1000	1200	240	460	510	700	650	690
50-60	900	800	800	370	420	470	540	630	650
60-70	900	800	700	440	430	370	450	560	600
70-80	500	600	700	410	460	390	460	500	640
80-90	400	400	500	390	400	500	430	430	
90-100	400	400	300	300	440	470			

$N_L$ (mg/kg)									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	143	157	270	123	126	109	80	153	119
10-20	140	166	217	142	84	68	111	119	117
20-30	141	152	142	130	96	22	96	70	57
30-40	142	184	96	62	46	35	78	64	65
40-50	119	148	107	11	19	26	54	53	29
50-60	97	130	86	53	34	29	88	56	52
60-70	75	99	84	15	18	45	53	47	44
70-80	62	58	66	17	25	16	48	36	56
80-90	20	18	54	35	47	50	22	26	
90-100	32	11	48	9	22	20			

Table S1 to be continued

<b>pH-H<sub>2</sub>O</b>									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	7.31	7.64	5.67	6.73	5.89	5.04	5.02	5.56	5.65
10-20	7.64	7.70	5.36	6.54	6.11	4.58	4.90	5.67	5.48
20-30	7.39	7.69	5.55	6.39	5.79	4.76	5.11	5.96	6.09
30-40	7.28	7.56	5.77	6.22	5.35	5.17	5.58	5.94	6.29
40-50	6.98	7.45	5.90	5.89	4.97	5.13	6.14	6.15	6.25
50-60	7.00	7.72	5.32	5.62	4.98	5.18	6.47	6.20	6.27
60-70	7.78	7.96	7.71	5.25	4.79	5.18	6.48	6.33	6.14
70-80	8.05	8.07	8.10	5.26	5.19	5.32	6.49	6.29	6.25
80-90	8.10	8.13	8.05	4.89	4.69	5.39	6.53	6.20	
90-100	8.12	8.14	8.04	5.10	4.59	5.37			

<b>pH-KCl</b>									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	7.15	7.39	5.48	5.67	5.16	4.19	4.54	4.54	5.09
10-20	7.47	7.43	5.04	5.62	5.28	3.85	4.49	4.49	4.79
20-30	7.05	7.37	5.13	5.66	4.76	3.97	4.54	4.54	5.30
30-40	6.77	7.11	5.20	5.39	4.43	4.31	4.94	4.94	5.30
40-50	6.35	7.00	5.52	4.89	4.13	3.86	5.30	5.30	5.30
50-60	6.56	7.33	4.84	4.43	3.99	3.93	5.41	5.41	5.23
60-70	7.50	7.71	7.60	4.04	3.76	4.03	5.40	5.40	5.17
70-80	7.90	7.88	7.76	4.06	4.11	4.07	5.41	5.41	5.39
80-90	8.01	7.92	7.79	3.82	3.76	4.11	5.37	5.37	
90-100	8.02	7.96	7.74	3.96	3.65	4.05			

<b>BC (mmol/kg)</b>									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	292	387	243	23	132	64	100	132	202
10-20	359	401	203	23	114	43	106	118	177
20-30	259	345	162	22	91	56	98	116	196
30-40	257	276	171	22	82	82	97	133	240
40-50	225	266	178	23	76	93	107	153	245
50-60	233	310	164	31	76	118	109	181	246
60-70	486	475	488	41	99	124	108	198	232
70-80	486	473	481	44	124	132	123	192	224
80-90	486	471	484	38	108	128	126	208	
90-100	486	475	484	39	113	118			

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Table S1 to be continued

CEC (mmol/kg)									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	297	393	300	120	171	133	150	183	261
10-20	362	405	261	84	141	105	160	149	226
20-30	264	349	205	88	119	112	145	143	222
30-40	265	281	207	64	115	119	129	160	264
40-50	236	272	201	79	117	139	127	176	268
50-60	241	314	190	106	124	158	125	202	267
60-70	491	477	495	116	176	160	124	217	254
70-80	488	475	483	122	162	161	138	213	241
80-90	489	473	487	103	190	159	142	231	
90-100	488	476	487	118	212	149			

BS (%)									
Depth (cm)	Chernozem			Stagnosol			Cambisol		
	cropland	grassland	forest	cropland	grassland	forest	cropland	grassland	forest
0-10	98.5	98.6	80.8	143.2	77.2	48.3	65.7	72.0	77.4
10-20	99.1	99.0	77.8	106.7	80.9	40.5	66.2	79.0	78.3
20-30	98.0	98.8	79.2	109.8	76.7	50.5	67.5	80.7	88.2
30-40	97.2	98.1	82.7	86.8	71.7	68.8	75.5	83.4	91.0
40-50	95.3	97.8	88.2	101.8	65.2	67.2	84.5	86.9	91.7
50-60	96.5	98.8	86.6	137.0	61.4	74.7	87.0	89.5	92.1
60-70	99.1	99.6	98.7	156.6	56.4	77.3	87.2	91.3	91.5
70-80	99.7	99.6	99.5	165.7	76.3	81.8	88.7	90.4	93.0
80-90	99.5	99.6	99.5	141.3	56.9	80.6	88.5	90.1	
90-100	99.7	99.7	99.5	156.4	53.3	79.0			

Table S2. The minimal and maximal values of the soil properties in the different soil types

Soil variable		Chernozem		Cambisol		Stagnosol	
		min	max	min	max	min	max
TOC	w/w	0.32	6.14	0.34	3.89	0.12	3.26
C <sub>L</sub>	w/w	0.01	0.93	0.02	0.46	0.01	0.36
N <sub>T</sub>	w/w	0.03	0.62	0.04	0.41	0.02	0.28
N <sub>L</sub>	w/w	0.001	0.027	0.002	0.015	0.001	0.014
C/N		7.9	17.9	2.2	11.1	2.6	14.5
pH-H <sub>2</sub> O		5.32	8.14	4.9	6.53	4.58	6.73
pH-KCl		4.84	8.02	4.49	5.41	3.65	5.67
BC	mmol/kg	1662	488	97.2	246.2	21.6	131.7
CEC	mmol/kg	189	495	124	268	64	212
BS	%	77.8	99.7	65.6	93	19.5	81.8
SWC	w/w	5.06	29.6	12.8	35.6	10.8	27.5

Table S3. The analysis of covariance of the soil characteristics: degrees of freedom, *F*-tests and the associated probabilities

Soil variable	Soil type			Land use			Depth			Depth × Soil type			Depth × Land use			Error	
	2		<i>F</i>	2		<i>P</i>	1		<i>F</i>	2		<i>F</i>	2		<i>F</i>		<i>P</i>
	<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>			
TOC	17.07	<.0001	7.98	0.0007	140.05	<.0001	5.48	0.0060	5.72	0.0048							
<i>C<sub>L</sub></i>	17.88	<.0001	7.66	0.0009	88.59	<.0001	8.70	0.0004	5.42	0.0063							
<i>N<sub>T</sub></i>	11.82	<.0001	8.33	0.0005	115.59	<.0001	6.07	0.0036	5.05	0.0087							
<i>N<sub>L</sub></i>	29.48	<.0001	0.30	0.7390	157.16	<.0001	7.64	0.0009	0.17	0.8403							
<i>C/N</i>	3.16	0.0480	0.07	0.9360	4.11	0.0461	4.80	0.0108	0.00	0.9971							
pH-H <sub>2</sub> O	7.33	0.0012	15.53	<.0001	13.45	0.0005	21.77	<.0001	8.27	0.0006							
pH-KCl	9.51	0.0002	14.26	<.0001	4.02	0.0486	26.16	<.0001	6.28	0.0030							
BC	8.39	0.0005	2.04	0.1370	25.96	<.0001	9.89	0.0002	1.20	0.3062							
CEC	6.62	0.0022	0.75	0.4747	19.76	<.0001	9.72	0.0002	0.09	0.9135							
BS	23.62	<.0001	9.21	0.0003	15.38	0.0002	1.59	0.2109	6.17	0.0033							
SWC	10.25	0.0001	3.20	0.0461	53.66	<.0001	1.40	0.2518	3.97	0.0229							

Significant results are bold-faced

Table S4. The analysis of covariance of the microbial characteristics: degrees of freedom, *F*-tests and the associated probabilities

Microbial indicator	Soil type			Land use			Depth			Depth × Soil type			Depth × Land use			Error	
	2		<i>F</i>	2		<i>P</i>	1		<i>F</i>	2		<i>F</i>	2		<i>F</i>		<i>P</i>
	<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>		<i>F</i>	<i>P</i>			
Microbial carbon	52.79	<.0001	10.57	<.0001	288.03	<.0001	24.07	<.0001	4.80	0.0109							
N-mineralization	10.35	0.0001	6.33	0.0029	29.04	<.0001	6.03	0.0037	4.36	0.0161							
Catalase activity	0.19	0.8269	5.93	0.0040	16.20	0.0001	6.44	0.0026	2.34	0.1029							
Richness*	5.45	0.0061	0.60	0.5490	0.17	0.6816	0.89	0.4141	1.38	0.2566							
Diversity*	2.51	0.0879	0.13	0.8796	0.03	0.8708	3.41	0.0381	0.11	0.8919							
DF	2		2		1		2		2							58	
Basal respiration	21.25	<.0001	10.27	0.0002	23.58	<.0001	5.69	0.0055	4.55	0.0146							

\*Richness and diversity of microbial functional groups metabolizing BIOLOG substrates; significant results are bold-faced

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Table S5. The analysis of covariance of the abundance of the microbial group metabolising the BILOG substrates: degrees of freedom, F-tests and the associated probabilities

Substrate	Soil type						Land use						Depth						Depth × Soil type						Depth × Land use						Error	
	2		2		2		2		2		2		1		1		2		2		2		2		2		2		76			
	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P	F	P		
s2	0.91	0.4084	0.80	0.4542	0.00	0.9862	0.56	0.5742	0.05	0.9518																						
s3	3.10	0.0510	2.78	0.0682	0.65	0.4211	2.59	0.0814	1.43	0.2445																						
s4	5.12	<b>0.0082</b>	0.33	0.7197	1.25	0.2664	1.87	0.1618	0.14	0.8662																						
s5	6.87	<b>0.0018</b>	0.06	0.9428	0.01	0.9420	3.48	<b>0.0359</b>	0.14	0.8664																						
s6	1.01	0.3695	1.11	0.3350	0.78	0.3797	1.78	0.1750	2.04	0.1371																						
s7	3.07	0.0523	1.82	0.1686	2.40	0.1254	1.41	0.2498	0.54	0.5845																						
s8	6.11	<b>0.0035</b>	0.46	0.6350	0.14	0.7121	2.99	0.0564	0.06	0.9408																						
s9	2.42	0.0959	1.45	0.2416	0.34	0.5588	0.30	0.7393	3.09	0.0515																						
s10	0.92	0.4033	0.97	0.3842	0.27	0.6016	1.46	0.2385	1.31	0.2767																						
s11	0.01	0.9859	0.11	0.8955	0.08	0.7791	0.23	0.7941	0.03	0.9714																						
s12	4.91	<b>0.0099</b>	2.70	0.0734	0.01	0.9142	4.34	<b>0.0164</b>	0.72	0.4895																						
s13	4.68	<b>0.0121</b>	1.30	0.2777	9.19	<b>0.0033</b>	0.20	0.8185	0.24	0.7882																						
s14	4.39	<b>0.0157</b>	2.94	0.0592	0.46	0.5019	1.69	0.1907	2.16	0.1228																						
s15	10.06	<b>0.0001</b>	6.36	<b>0.0028</b>	1.53	0.2198	2.06	0.1341	5.01	<b>0.0090</b>																						
s16	0.31	0.7340	0.08	0.9201	0.52	0.4751	0.82	0.4427	0.21	0.8103																						
s17	3.80	<b>0.0266</b>	0.94	0.3969	1.67	0.2001	0.63	0.5374	0.01	0.9880																						
s18	2.70	0.0738	0.68	0.5095	0.16	0.6913	2.25	0.1128	0.67	0.5154																						
s19	1.29	0.2811	1.87	0.1613	0.75	0.3908	0.34	0.7146	0.72	0.4913																						
s20	4.17	<b>0.0192</b>	3.38	<b>0.0392</b>	1.23	0.2718	3.34	<b>0.0407</b>	2.64	0.0781																						
s21	10.17	<b>0.0001</b>	4.09	<b>0.0206</b>	1.21	0.2758	2.30	0.1075	2.45	0.0932																						
s22	3.00	0.0559	2.26	0.1115	0.95	0.3320	0.42	0.6611	1.90	0.1572																						
s23	2.60	0.0806	2.40	0.0980	1.09	0.2999	1.50	0.2306	1.57	0.2152																						
s24	1.53	0.2236	0.17	0.8452	0.15	0.7040	0.85	0.4327	0.35	0.7032																						
s25	4.31	0.0168	2.50	0.0891	0.88	0.3525	1.47	0.2353	0.96	0.3882																						
s26	2.42	0.0961	0.81	0.4473	2.88	0.0940	1.85	0.1642	0.91	0.4077																						
s27	0.14	0.8662	0.56	0.5762	0.35	0.5576	0.62	0.5407	0.18	0.8355																						
s28	0.74	0.4792	0.72	0.4919	0.00	0.9541	0.78	0.4640	0.48	0.6225																						
s29	10.45	<b>&lt;.0001</b>	0.23	0.7976	0.22	0.6398	2.43	0.0952	0.15	0.8645																						
s30	3.06	0.0529	2.94	0.0587	0.01	0.9309	2.05	0.1353	3.37	<b>0.0395</b>																						
s31	4.60	<b>0.0130</b>	1.11	0.3345	2.65	0.1076	3.51	<b>0.0347</b>	1.28	0.2834																						
s32	1.01	0.3696	1.62	0.2056	0.80	0.3746	0.36	0.7020	0.84	0.4358																						

Significant results are bold-faced



Chernozem	cropland	48°12.637	17°58.983
	grassland	48°14.554	17°55.232
	forest	48°12.960	17°57.854
Cambisol	cropland	48°36.660	19°01.503
	grassland	48°36.683	19°01.494
	forest	48°36.712	19°01.462
Stagnosol	cropland	49°00.727	21°30.344
	grassland	49°00.658	21°30.058
	forest	49°00.339	21°31.248

Figure S1. The coordinates of the sampling sites, photos of the soil profiles



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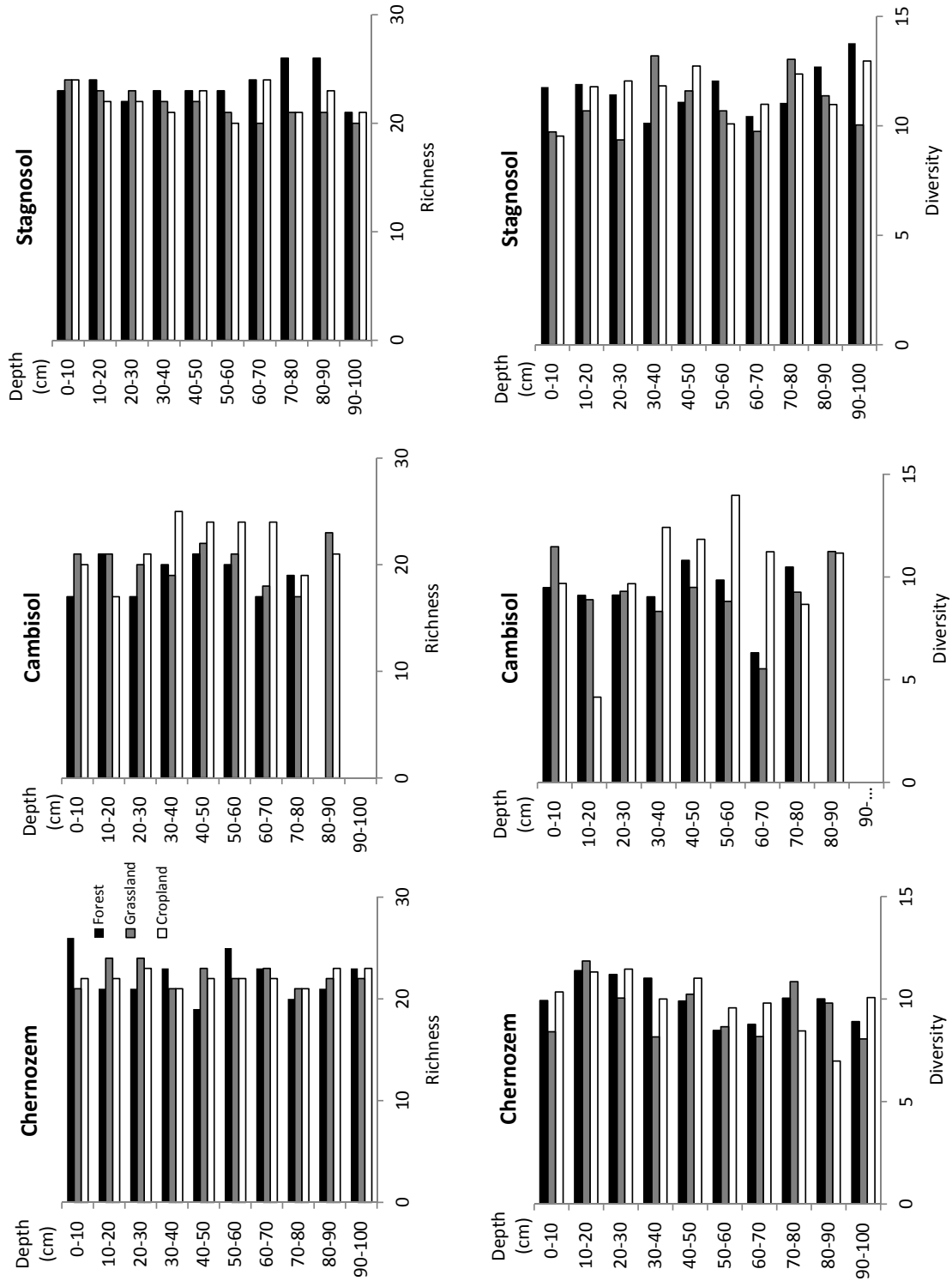


Figure S2. Changes in the richness and diversity of the soil microbial functional groups along the soil profiles in the three soil types (Chernozem, Cambisol, Stagnosol) in the areas with the different land use (forest, grassland, cropland)