

Figure captions

Figure 1. EPR spectra of humic acids from Oa and A horizons of the soil under mountain mixed coniferous forest (MF-F)

Figure 2. FTIR spectra of humic acids from Oa and A horizons of the investigated soils under mixed coniferous forest in the lowland (LF) and mountain (MF); CC – forest after clear-cutting; F – forest without harvesting practice

Figure 3. ^1H NMR spectra of humic acids from Oa and A horizons of the investigated soils under mixed coniferous forest in the lowland (LF); CC – forest after clear-cutting; F – forest without harvesting practice

Figure 4 ^1H NMR spectra of humic acids from Oa and A horizons of the investigated soils under mountain mixed coniferous forest (MF); CC – forest after clear-cutting; F – forest without harvesting practice

Table titles

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Table 4. ^1H -NMR integrals of three major resonance regions of the spectra

Table 1. Basic properties of the investigated soils under mixed coniferous forest after clear-cutting and without harvesting practice

Object/soil horizon	pH 1 M KCl	TOC g x kg ⁻¹	Nt g x kg ⁻¹	CEC cmol(+) x kg ⁻¹	Humic acids (g x kg ⁻¹)	Fulvic acids (g x kg ⁻¹)	Total acidity of HA cmol(+) x kg ⁻¹
<i>LF CC Oa</i>	2.9	180.17	6.59	44.19	74.20	51.47	285.00
A	3.4	6.10	0.39	5.57	1.06	1.91	n.d.
B	4.0	2.09	0.14	4.26	0.54	0.55	n.d.
<i>LF F Oa</i>	3.1	243.00	9.38	48.90	89.60	56.17	328.00
A	3.2	7.79	0.44	6.04	1.54	2.49	n.d.
B	3.7	6.17	0.28	6.79	1.01	1.68	n.d.
<i>MF CC Oa</i>	2.7	203.98	10.30	86.49	54.40	52.28	351.50
A	2.9	37.99	1.62	18.90	6.60	9.99	n.d.
B	3.6	44.65	2.04	14.48	1.95	5.65	n.d.
<i>MF F Oa</i>	2.7	309.28	14.88	92.70	61.53	73.97	357.00
A	3.5	69.62	2.83	19.72	7.10	21.41	n.d.
B	4.0	48.50	1.81	15.52	5.50	9.95	n.d.

LF CC – lowland forest after clear-cutting; LF F – lowland forest without harvesting practice; MF CC – mountain forest after clear-cutting; MF F – mountain forest without harvesting practice; Oa, A – soil horizons

Table 2. Elemental composition and atomic ratio of humic (HA) and fluvic acids (FA) from mixed coniferous forest after clear-cutting and without harvesting practice – in atomic percentage of moisture and ash free sample

Sample	%C HA	%C FA	%H HA	%H FA	%N HA	%N FA	%O HA	%O FA	H/C HA	H/C FA	O/C HA	O/C FA	E ₄ /E ₆ HA
<i>Oa</i>													
LF CC	33.60a	33.27a	49.03a	37.49a	1.30a	0.62a	16.08a	28.62a	1.46	1.13	0.48	0.86	4.18a
LF F	32.87b	33.17a	49.92b	37.83a	1.28a	0.68a	15.94a	28.32a	1.52	1.14	0.48	0.85	6.16b
MF CC	31.80b c	33.68a	49.42c	35.78b	1.82b	0.70a	16.96b	29.83b	1.55	1.06	0.53	0.86	4.82c
MF F	31.33bc	33.43a	50.54d	35.89b	1.82b	0.78a	16.31ac	29.90b	1.61	1.07	0.52	0.89	6.32b
<i>A</i>													
LF CC	35.01a	38.96a	41.26a	23.70a	2.04ab	0.67a	21.69a	36.67a	1.18	0.61	0.62	0.94	3.80a
LF F	35.39b	34.01b	41.84b	23.78a	1.94ab	0.53a	20.83b	41.67b	1.18	0.70	0.59	1.23	4.33b
MF CC	32.22ab	33.91b	44.37ac	35.17b	2.31abc	0.61a	21.10b	30.67c	1.38	1.04	0.66	0.89	2.79c
MF F	30.54c	32.95c	44.37ac	36.04c	2.65cd	0.79a	22.43c	30.21c	1.45	1.09	0.73	0.92	4.89d

Means following the same letter are not significantly different according to t- test $p < 0.05$

LF CC – lowland forest after clear-cutting; LF F – lowland forest without harvesting practice; MF CC – mountain forest after clear-cutting; MF F – mountain forest without harvesting practice; Oa, A – soil horizons

Table 3. Radical concentration, g parameter, Mn and Fe ions concentration in HA from the mixed coniferous forest after clear-cutting and without harvesting practice

Soil horizon	Radical concent. x 10 ¹⁷ (Spin g ⁻¹)	g - Parametr	Mn (mg g ⁻¹)	Fe (mg g ⁻¹)
<i>LF CC</i>				
Oa	1.10	2.0037	0.000	0.718
A	1.13	2.0036	0.023	6.723
<i>LF F</i>				
Oa	1.90	2.0038	0.001	0.766
A	1.32	2.0037	0.023	6.682
<i>MF CC</i>				
Oa	0.49	2.0036	0.009	4.796
A	0.54	2.0036	0.006	5.356
<i>MF F</i>				
Oa	2.80	2.0037	0.004	1.562
A	1.83	2.0036	0.006	3.027

LF CC – lowland forest after clear-cutting; LF F – lowland forest without harvesting practice; MF CC – mountain forest after clear-cutting; MF F – mountain forest without harvesting practice; Oa, A – soil horizons

Table 4 ¹H-NMR integrals of three major resonance regions of the spectra

Assignment ¹ H ppm		% ¹ H NMR integral							
		Oa	A	Oa	A	Oa	A	Oa	A
		LF CC		LF F		MF CC		MF F	
0 – 2.33	RCH ₃ ; R _n CH	38.32	73.00	37.89	64.04	39.09	61.85	29.96	61.04
2.93 – 4.26	C _{ar} -CH _n R ₂ NCH _n RC(=O)CHR _n	34.69	20.00	53.52	26.08	46.70	30.96	58.49	31.56
5.82 – 8.22	C _{ar} -H; R _n C=CHOCO- CHR	26.97	7.00	8.58	9.87	14.20	7.18	11.55	7.40

LF CC – lowland forest after clear-cutting; LF F – lowland forest without harvesting practice; MF CC – mountain forest after clear-cutting; MF F – mountain forest without harvesting practice; Oa, A – soil horizons

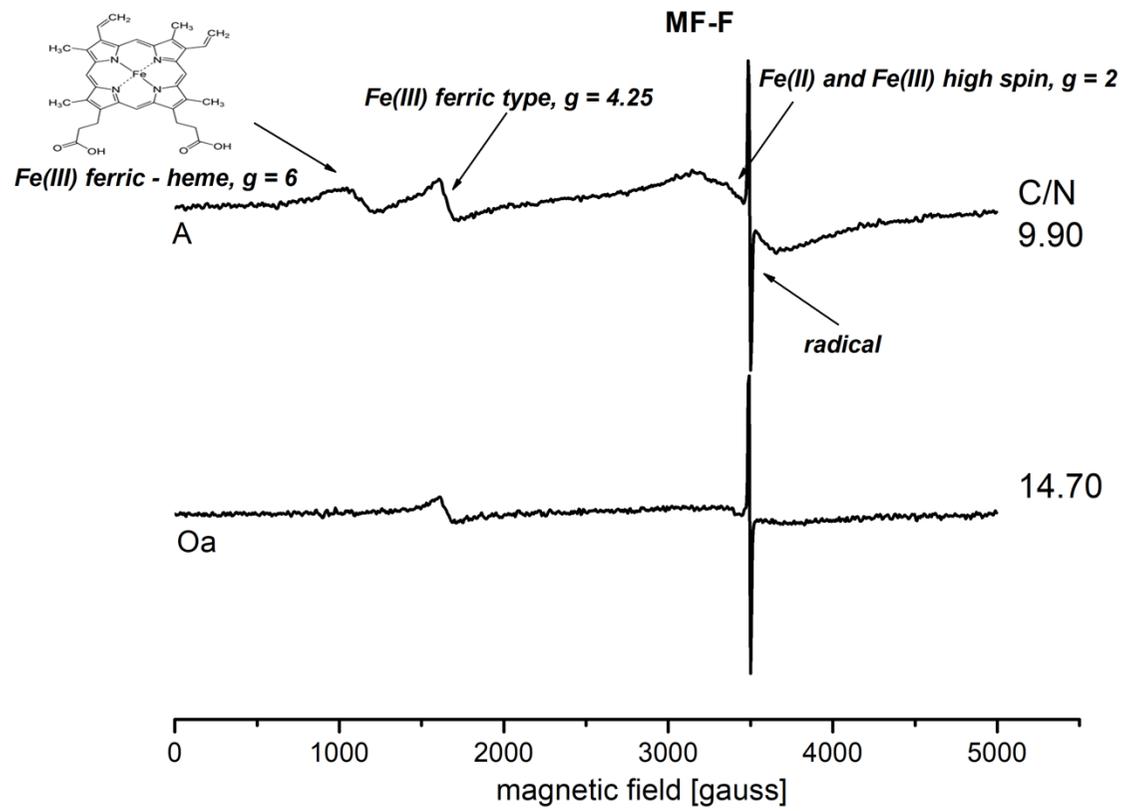


Figure 1. EPR spectra of humic acids from Oa and A horizons of the soil under mountain mixed coniferous forest (MF-F)

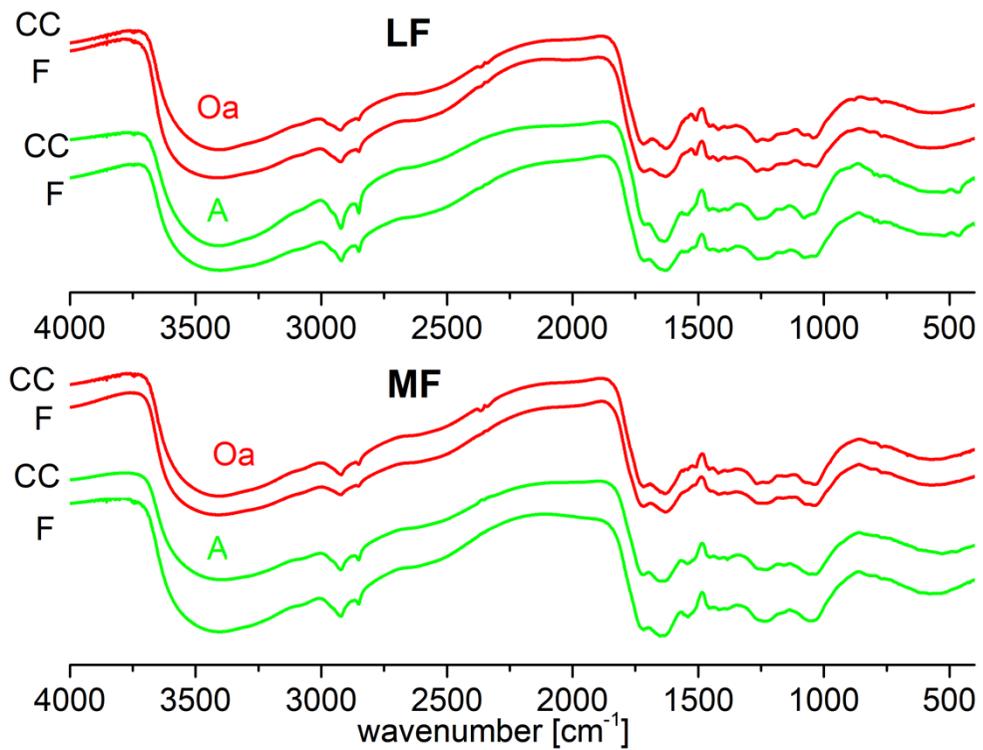


Figure 2 FTIR spectra of humic acids from Oa and A horizons of the investigated soils under mixed coniferous forest in the lowland (LF) and mountain (MF); CC – forest after clear-cutting; F – forest without harvesting practice

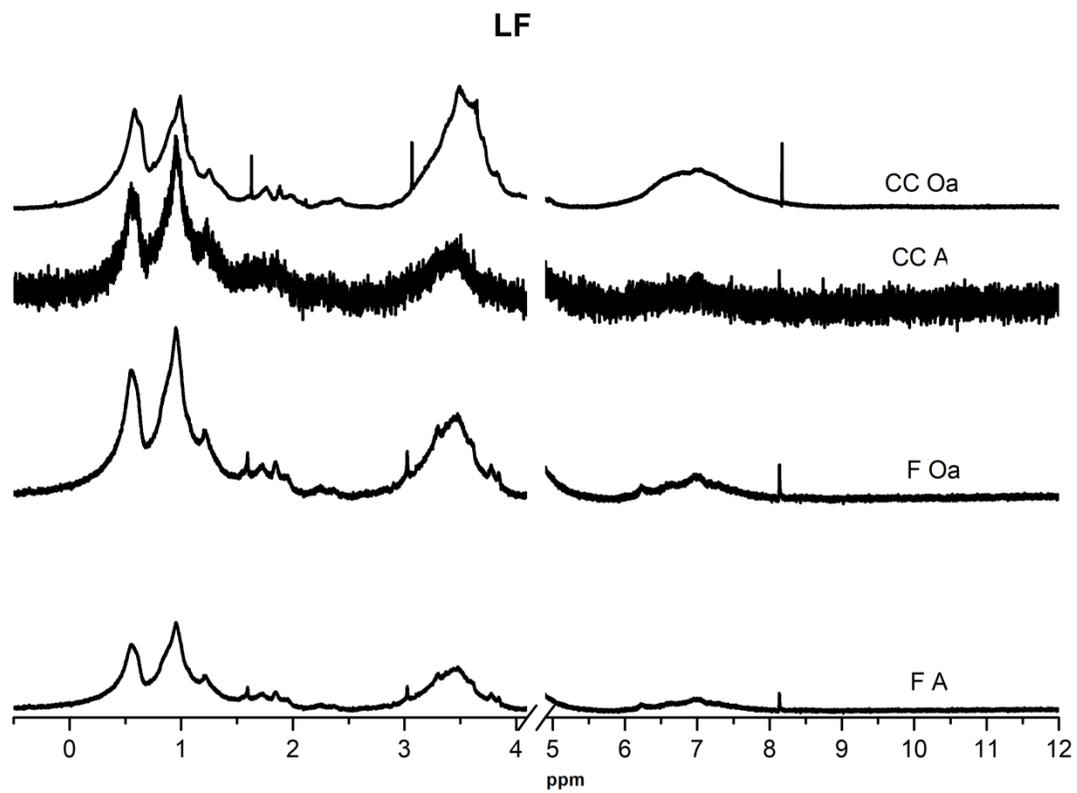


Figure 3 ¹H NMR spectra of humic acids from Oa and A horizons of the investigated soils under mixed coniferous forest in the lowland (LF); CC – forest after clear-cutting; F – forest without harvesting practice

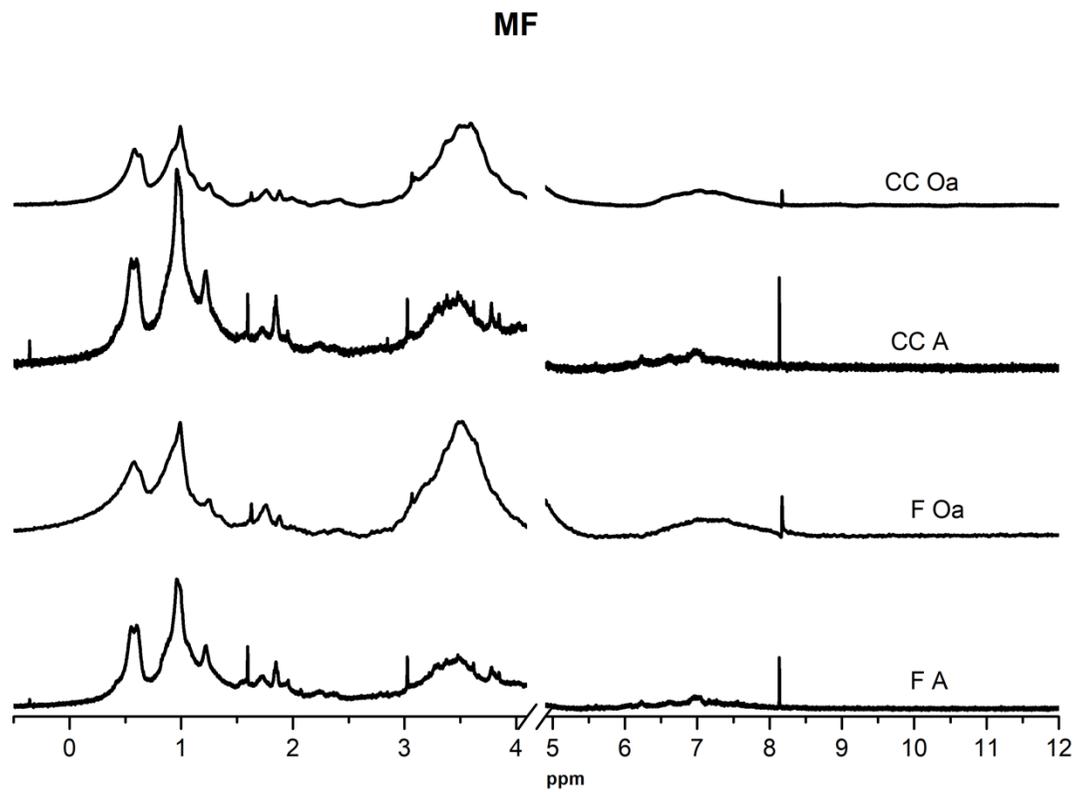


Figure 4 ^1H NMR spectra of humic acids from Oa and A horizons of the investigated soils under mountain mixed coniferous forest (MF); CC – forest after clear-cutting; F – forest without harvesting practice