SUPPORTING MATERIAL

Seeing the forest through the fractions – Comparing soil organic matter fractionation methods using molecular features after forest stand conversion

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Content:

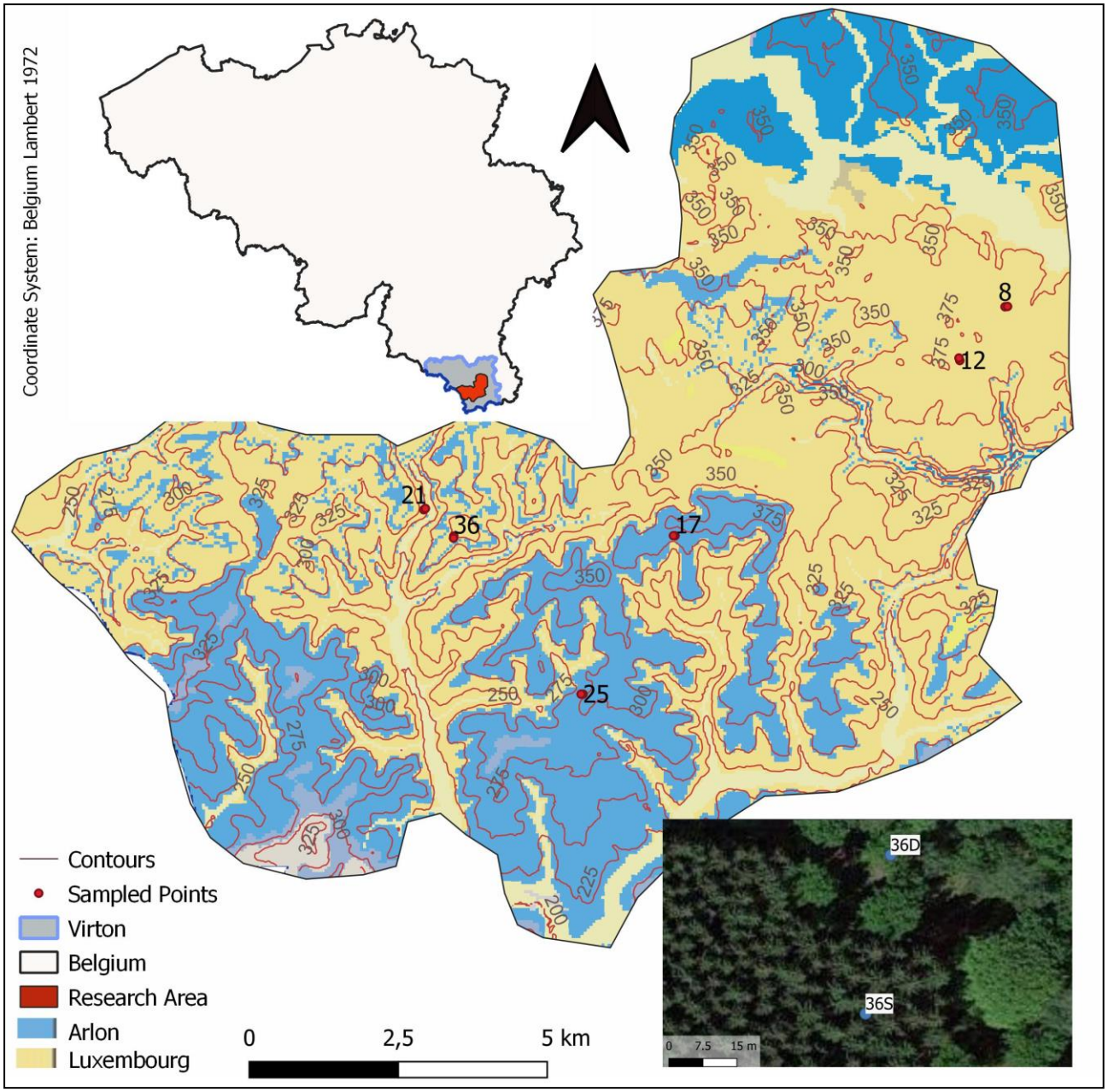

Figure S1. Study area. The upper left map shows the location of Virton and the research area in Belgium; the centre map the two geological formations (Arlon and Luxembourg) as well as the elevation (as contour lines) and the studies sites; the lower right picture is an example of a plot, here plot 36 showing the deciduous (D) and the spruce (S) stand. Source of the geological map: Service Géologique de Wallonie.

Reference

Géoportail de la Wallonie, 2012. Carte Géologique de Wallonie [WWW Document]. URL https://geoportail.wallonie.be/catalogue/c37917cc-8774-4777-b8b0-0936140fb802.html (accessed 9.20.21).

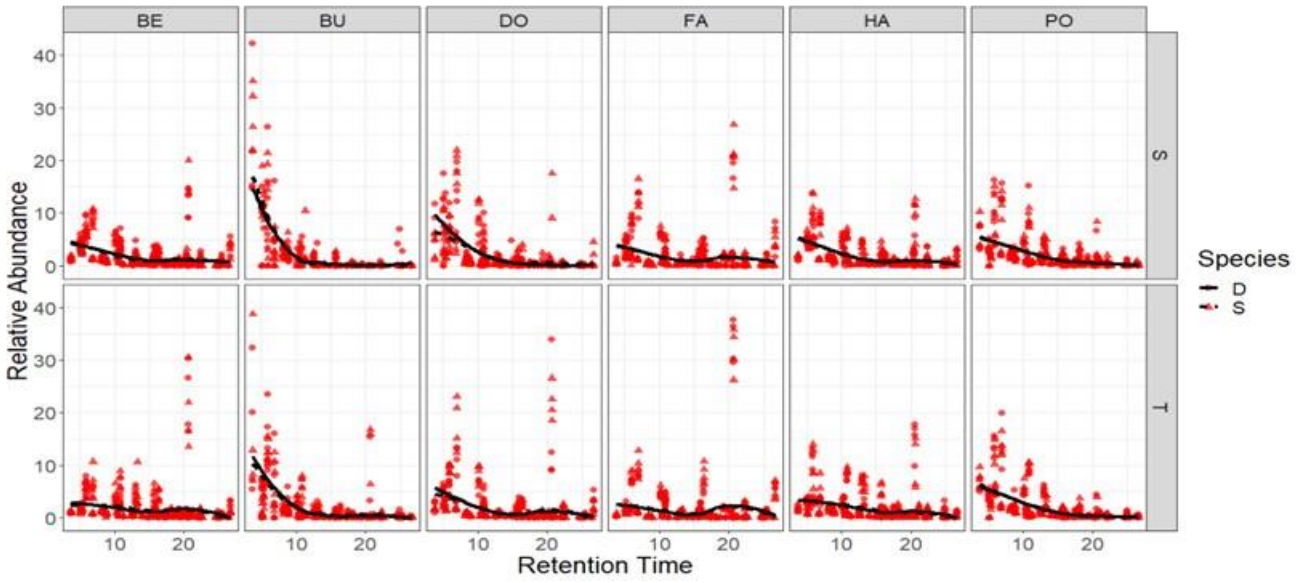

Figure S2. Relative abundance of pyrolysis products as a function of retention time. A separation according to fraction (Base extract, BE; Bulk mineral soil, BU; water extractable OM, DO; fulvic acid, FA; humic acid, HA; and particulate OM, POM) was done as well as according to subsoil (S) and topsoil (T). The lines and shapes indicate whether the sample belongs to the deciduous stands (D) or spruce stands (S).

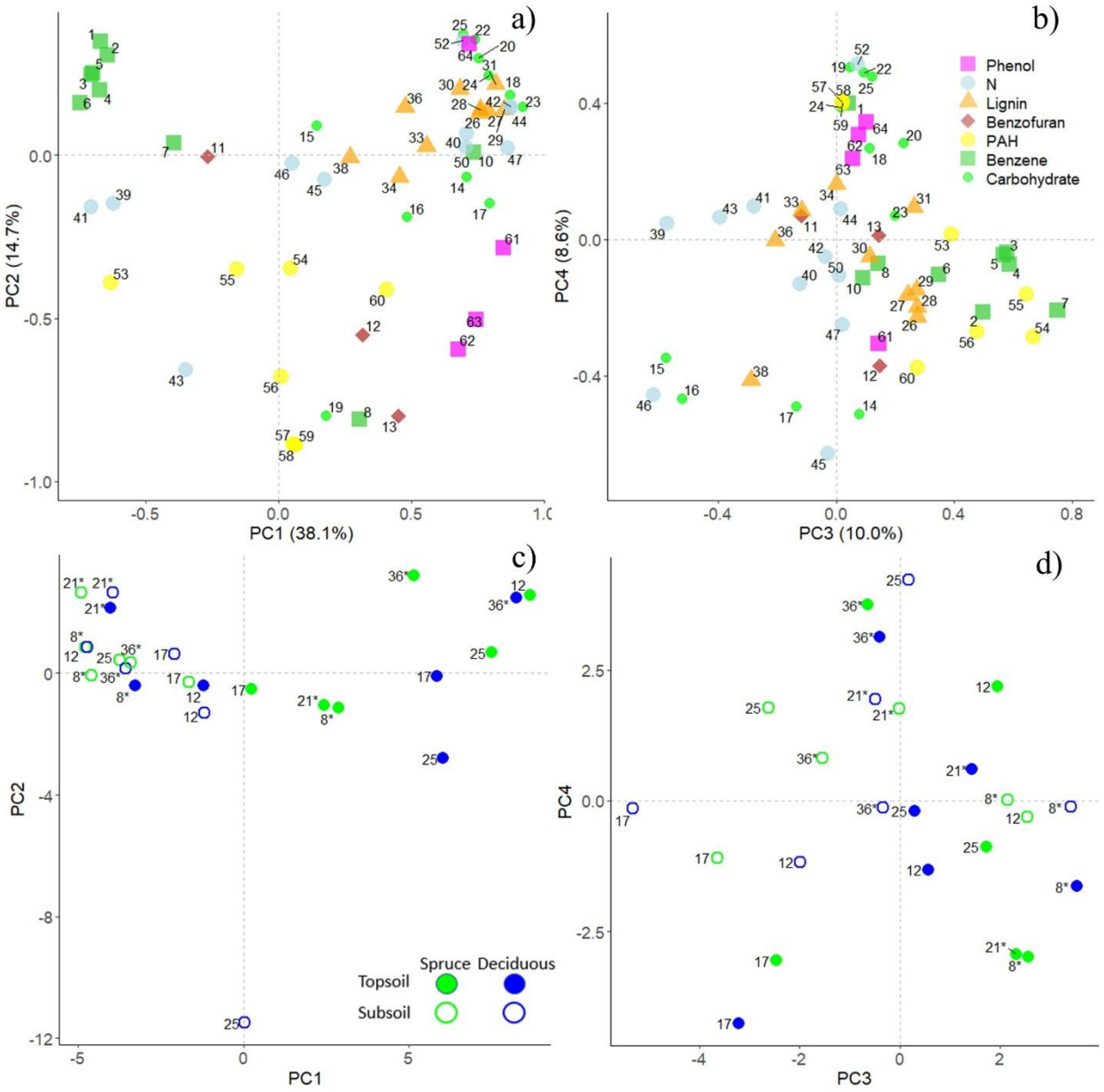

Figure S3. Loadings (a,b) and scores (c,d) of the PC1–PC2 and PC3–PC4 projections from PCA applied to pyrolysates of the Bulk mineral soil samples. Pyrolysis products that correspond to the codes in the loadings are given in the Appendix.

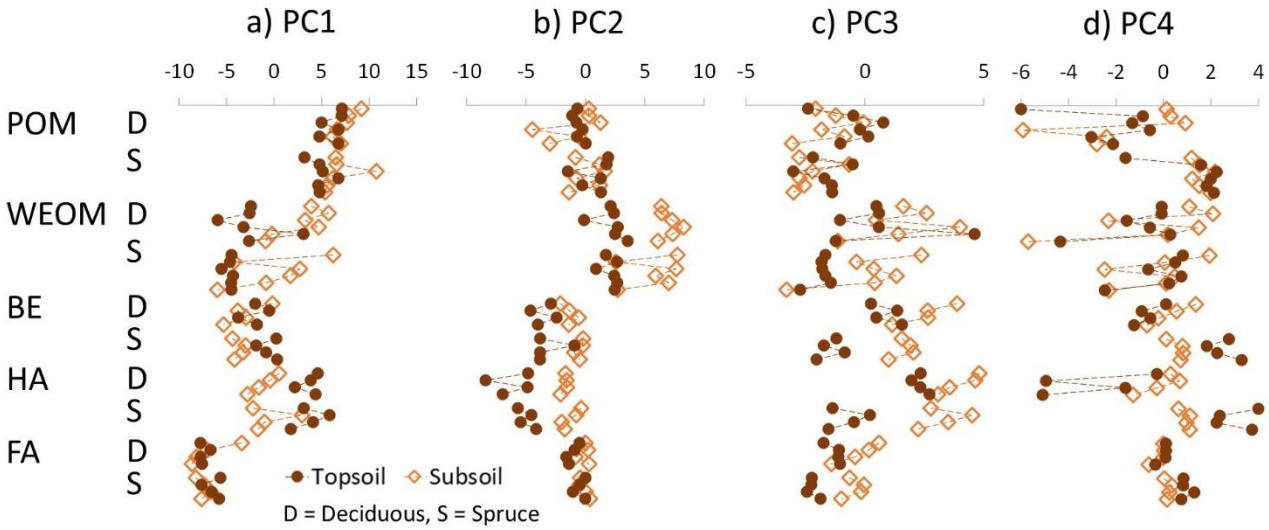

Figure S4: PCA scores presented individually for PC1–PC4 to visualise depth differences within and between SOM fractions. The corresponding loadings are given in Figure 3ab. PC1 and PC2 mainly separated the samples according to fractions and soil depth; PC2, PC3 and PC4 reflected aqueous solubility, SOM degradation state and PC4 input material, respectively. Samples were connected with dotted lines to better visualise trends.

Table S1. Site characteristic, adapted from Desie et al. (2019). The soil process domain refers to the conditions before forest stand conversion, after conversion to spruce all soils shifted to the Aluminium Domain.

Plot	Soil process domain	Formation	Forest stand	Dominant species	Age (year)
8	Aluminium	Luxembourg	Deciduous	Common oak (*Quercus robur*)	>200
			Spruce	Norway Spruce (*Picea abies*)	41
12	Exchange	Luxembourg	Deciduous	Common hornbeam (*Carpinus betulus*), Sycamore maple (*Acer pseudoplatanus*)	>200
			Spruce	Norway Spruce (*Picea abies*)	41
17	Exchange	Arlon	Deciduous	Common beech (*Fagus sylvatica*), Cherry tree (*Prunus avium*)	>200
			Spruce	Norway Spruce (*Picea abies*)	40
21	Aluminium	Luxembourg	Deciduous	Common oak (*Quercus robur*), Common beech (*Fagus sylvatica*)	>200
			Spruce	Norway Spruce (*Picea abies*)	50
25	Exchange	Arlon	Deciduous	Common oak (*Quercus robur*), Sycamore maple (*Acer pseudoplatanus*)	>200
			Spruce	Norway Spruce (*Picea abies*)	49
36	Aluminium	Luxembourg	Deciduous	Common hornbeam (*Carpinus betulus*), Common oak (*Quercus robur*)	>200
			Spruce	Norway Spruce (*Picea abies*)	unknown

References

Desie, E., Vancampenhout, K., Heyens, K., Hlava, J., Verheyen, K., Muys, B., 2019. Forest conversion to conifers induces a regime shift in soil process domain affecting carbon stability. Soil Biol. Biochem. 136. https://doi.org/10.1016/j.soilbio.2019.107540

de Ferraris, J., 1777. The Ferraris map [WWW Document]. URL https://www.kbr.be/en/the-ferraris-map/

Table S2: Comparison of our methodology with that of previous studies that worked on the soil C cycle in the study area.

	Brock et al. (2019)	Desie et al. (2019)	This study (Nikolaus et al.)
Sampling year	2013.	2015.	Samples from Desie et al. (2019).
Plots	2, 8, 12, 25, 26, 36.	2, 8, 11, 12, 17, 21, 25, 26, 27, 36.	8, 12, 17, 21, 25, 36.
Depths (cm)	0-5; 5-10; 10-15; 15-20.	0-5; 10-20; 25-30.	0-5; 25-30.
Fractions	Bulk soil.	Bulk soil; POM; WEOM; MAOM; (according to Zimmermann et al., 2007).	Bulk soil; POM; WEOM; NaOH extracts; HA; FA.
Analysed SOM properties	THM-TMAH (lignin, cutin/suberin).	C% (distribution of C among the fractions).	C% (distribution of C among the fractions); C/N; Pyrolysis-GC/MS (overall SOM composition: lignin, phenols, benzenes, PAHs, carbohydrates, N-containing compounds).

References

Brock, O., Kooijman, A., Nierop, K.G.J., Muys, B., Vancampenhout, K., Jansen, B., 2019. Organic Geochemistry Disentangling the effects of parent material and litter input chemistry on molecular soil organic matter composition in converted forests in Western Europe. Org. Geochem. 134, 66–76. https://doi.org/10.1016/j.orggeochem.2019.05.006

Desie, E., Vancampenhout, K., Heyens, K., Hlava, J., Verheyen, K., Muys, B., 2019. Forest conversion to conifers induces a regime shift in soil process domain affecting carbon stability. Soil Biol. Biochem. 136. https://doi.org/10.1016/j.soilbio.2019.107540

Table S3. Medians of sample characteristics for different sample classes separated for topsoil (A) and subsoil (B). The bold numbers indicate significant differences between the classes. Significance was tested by means of the Kruskal-Wallis test.

A. Topsoil		C_{bulk} (%)	C_{POM} (% of C)	C_{BE} (% of C)	C_{WEOM} (mg/l)	$\delta^{13}C_{WEOM}$ (‰)	C/N_{bulk}
Forest stand	Deciduous	2.4	22.9	43.2	**77.3**	-26.3	**15.2**
	Spruce	4.0	25.2	48.9	**142.4**	-26.1	**22.8**
Soil process domain[a]	Aluminium	3.1	26.4	43.3	96.1	-26.3	21.7
	Exchange	4.2	23.2	48.9	124.7	-26.0	17.9
Geological Formation	Arlon	4.7	23.5	60.5	117.7	-26.2	16.1
	Luxembourg	3.1	24.2	41.8	104.7	-26.2	21.5

B. Subsoil		C_{bulk} (%)	C_{POM} (% of C)	C_{BE} (% of C)	C_{WEOM} (mg/l)	$\delta^{13}C_{WEOM}$ (‰)	C/N_{bulk}
Forest stand	Deciduous	0.7	20.7	50.3	21.2	-24.4	11.6
	Spruce	0.7	23.5	54.2	20.8	-24.2	11.2
Soil process domain[a]	Aluminium	0.6	20.8	53.4	19.8	**-25.0**	12.2
	Exchange	0.9	23.5	50.1	22.6	**-24.0**	11.2
Geological Formation	Arlon	0.9	23.6	49.1	23.7	**-23.8**	11.8
	Luxembourg	0.6	20.8	53.4	20.6	**-24.6**	11.1

[a] The soil process domain refers to the conditions before forest conversion, after conversion to spruce all soils shifted to the Aluminium Domain.