Supplementary information

Uncoupling of microbial community structure and function in decomposing litter across beech forest ecosystems in Central Europe

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Table S1. Statistical values from 2-way ANOVA of all parameters used in this study. Data on oxidative enzyme activities are derived from Purahong et al.[1].

Parameter	2 way ANOVA		
	FMPs	DAI	FMPs $_x$ DAI
Fungal : Bacteria ratio	***F* = 28.47, *P* < 0.001**	***F* = 77.83, *P* < 0.001**	***F* = 16.87, *P* < 0.001**
Total microbial biomass	***F* = 8.791, *P* = 0.001**	***F* = 25.46, *P* < 0.001**	***F* = 4.21, *P* = 0.005**
i15:0, Gram-positive bacteria biomass	***F* = 37.04, *P* < 0.001**	***F* = 68.10, *P* < 0.001**	***F* = 19.43, *P* < 0.001**
16:1ω7c, Gram negative bacteria biomass	***F* = 21.50, *P* < 0.001**	***F* = 44.49, *P* < 0.001**	***F* = 8.63, *P* < 0.001**
10Me16:0, actinobacteria biomass	***F* = 51.13, *P* < 0.001**	***F* = 120.10, *P* < 0.001**	***F* = 40.69, *P* < 0.001**
17:0 cyclo and 19:0 cyclo, anaerobic bacteria biomass	***F* = 23.70, *P* < 0.001**	***F* = 37.05, *P* < 0.001**	***F* = 11.50, *P* < 0.001**
18:2ω6,9c, general fungal biomass	***F* = 19.99, *P* < 0.001**	***F* = 48.38, *P* < 0.001**	***F* = 10.91, *P* < 0.001**
Cellobiohydrolase	*F* = 0.75, *P* = 0.483	***F* = 11.33, *P* < 0.001**	***F* = 2.84, *P* = 0.031**
Xylosidase	***F* = 6.65, *P* = 0.005**	***F* = 6.87, *P* = 0.002**	*F* = 1.12, *P* = 0.379
β-glucosidase	*F* = 1.92, *P* = 0.169	***F* = 9.75, *P* < 0.001**	***F* = 3.35, *P* = 0.015**
N-acetylglucosaminidase	***F* = 4.61, *P* = 0.020**	*F* = 1.76, *P* = 0.183	***F* = 7.11, *P* < 0.001**
Acid phosphatase	***F* = 5.01, *P* = 0.015**	*F* = 1.31, *P* = 0.295	***F* = 7.82, *P* < 0.001**
Laccase	***F* = 16.82, *P* < 0.001**	***F* = 3.40, *P* = 0.034**	*F* = 1.29, *P* = 0.301
Peroxidase	*F* = 1.19, *P* = 0.320	***F* = 5.39, *P* = 0.006**	*F* = 0.80, *P* = 0.582
Manganese peroxidase	***F* = 5.90, *P* = 0.008**	*F* = 1.58, *P* = 0.220	*F* = 0.78, *P* = 0.593

Table S2. Correlations among total PLFA, PLFA indicators and enzyme activities (significant values ($P < 0.05$), are given in bold).

	total_bior	Actinomy	anaerobic	Gram+	Gram-	fungi	MNP	Per	L	P	X	B	N
total_biomass													
Actinomycetes													
anaerobic_bacteria		**0.954**											
Gram+		**0.956**	**0.967**										
Gram-		**0.861**	**0.908**	**0.930**									
fungi		**0.768**	**0.823**	**0.841**	**0.960**								
MNP	0.154	0.170	0.159	0.179	0.158	0.105							
Per	-0.085	-0.243	-0.225	-0.245	-0.158	0.011	0.095						
L	-0.216	**-0.336**	**-0.362**	*-0.279*	*-0.281*	-0.145	-0.119	**0.480**					
P	0.121	0.112	0.217	0.204	0.138	0.073	-0.009	-0.024	-0.022				
X	0.116	-0.093	-0.045	0.028	0.089	0.135	*0.297*	0.146	0.102	0.086			
B	*0.316*	0.115	0.247	0.262	**0.329**	*0.309*	0.086	0.209	0.109	**0.791**	**0.369**		
N	-0.046	-0.241	-0.099	-0.121	-0.036	-0.045	0.037	-0.026	0.025	**0.429**	**0.600**	**0.497**	
C	-0.068	-0.266	-0.168	-0.172	-0.089	-0.013	*0.289*	**0.443**	0.221	0.220	**0.688**	**0.533**	**0.530**

Abbreviations: MNP = Mn-peroxidase, Per = general peroxidase, L = laccase, P = acid phosphatase, X = Xylosidase, B = β-glucosidase, N = N-acetylglucosaminidase

Table S3. Information on the litter composition for individual forest sites[1].

Forest management practice	Litter composition (%)		
	Fagus sylvatica	*Acer* sp.	*Fraxinus* sp.
Beech age-class forest (BA)	85	10	5
Beech selection cutting forest (BS)	90	10	0
Beech unmanaged forest (BU)	100	0	0

Table S4. Initial chemical composition of dried leaf litter under different forest management practices (Mean±SD, n = 3) [1].

Nutrient	Age-class beech forest (BA)	Selection cutting beech forest (BS)	Unmanaged beech forest (BU)
Total C (%)	47.61±0.17	47.34±0.16	48.81±0.22
Total N (%)	0.97±0.01	1.04±0.00	0.84±0.03
C/N	48.92±0.20	45.52±0.15	58.38±2.18
Total lignin/N	43.13±0.25	39.74±0.00	56.27±1.90
Initial Mg (µg/g dry mass)	204.00±50.27	294.33±197.28	157.93±54.19
Initial K (µg/g dry mass)	3076.67±545.01	4596.67±2500.11	2443.33±120.97
Initial Ca (µg/g dry mass)	593.33±142.55	964.33±576.11	344.33±70.61
Initial P (µg/g dry mass)	187.67±41.50	152.67±27.43	157.33±20.84
Initial Mn (µg/g dry mass)	32.87±9.64	26.47±11.65	20.53±5.56
Initial Fe (µg/g dry mass)	5.60±2.52	4.67±2.80	7.37±9.14
Initial Cu (µg/g dry mass)	0.91±0.37	0.62±0.07	0.40±0.04
Initial Co (µg/g dry mass)	0.01±0.00	0.02±0.01	0.01±0.00
Initial V (µg/g dry mass)	0.02±0.00	0.02±0.00	0.02±0.02

Table S5. Correlation among different PLFA markers for (A) Gram-positive bacteria (15:0 iso, 15:0 ante, 16:0 iso, 17:0 iso and 17:0 ante), (B) Gram-negative bacteria (16:1ω5c, 16:1ω7c and 16:1ωw9c) and (C) general fungi (18:1ω9, 18:2ω6,9c and 18:3ω3,6,9c). All correlations were significant ($P < 0.001$).

(A) Gram-positive bacteria

	a15:0	i15:0	i16:0	a17:0
a15:0				
i15:0	**0.97**			
i16:0	**0.98**	**0.99**		
a17:0	**0.98**	**0.98**	**1.00**	
i17:0	**0.93**	**0.99**	**0.98**	**0.97**

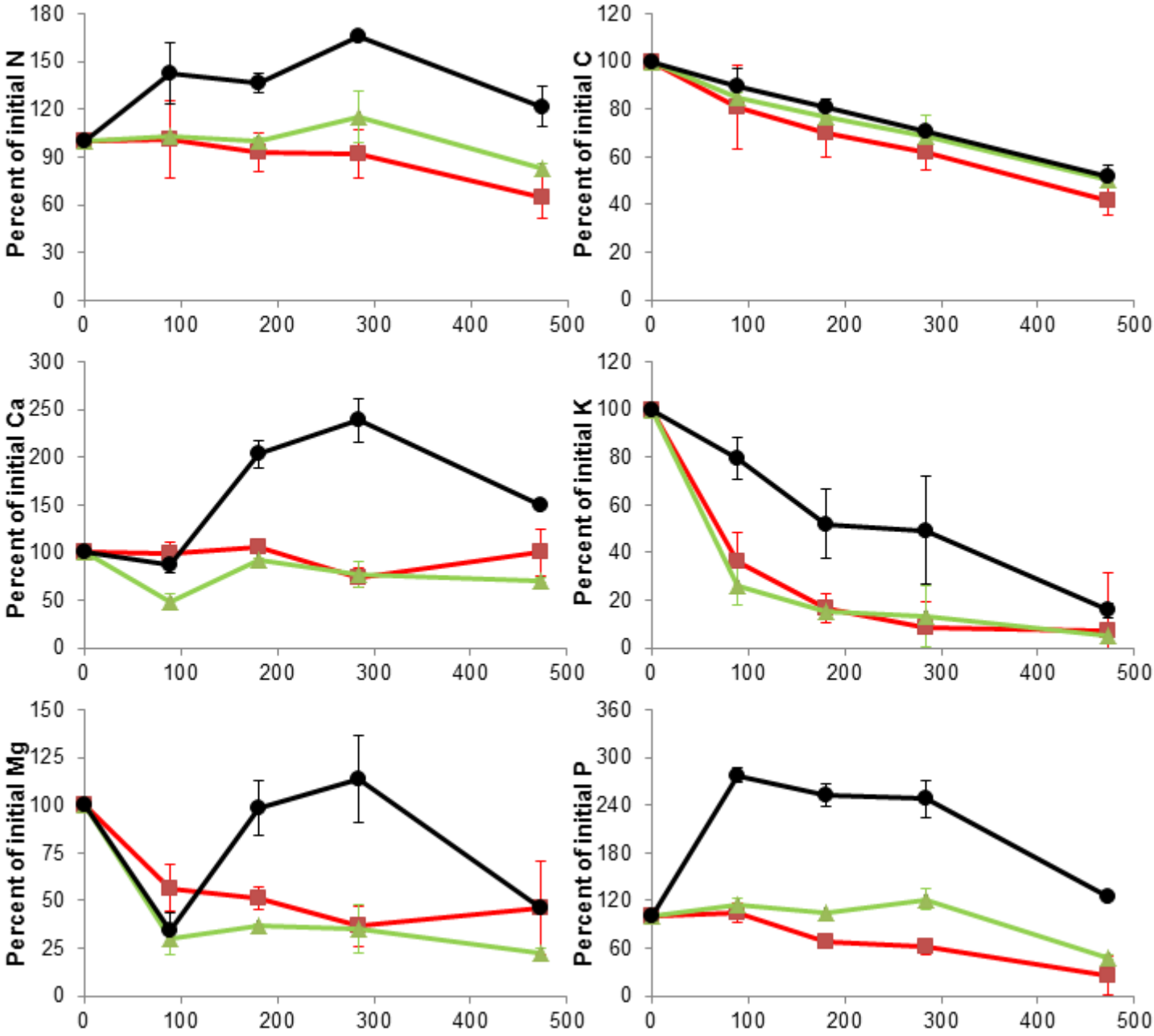
(B) Gram-negative bacteria

	16:1ω5c	16:1ω7c
16:1ω5c		
16:1ω7c	**0.94**	
16:1ωw9c	**0.98**	**0.97**

(C) General fungi

	18:1ω9	18:2ω6,9c
18:1ω9		
18:2ω6,9c	**0.97**	
18:3ω3,6,9c	**0.95**	**0.94**

Figure S1. Percent of initial nitrogen (N), carbon (C), calcium (Ca), potassium (K), magnesium (Mg), and phosphorous (P) during decomposition under different forest system management practices[1]. European beech age-class forest (red, BA), European beech selection cutting forest (green, BS) and unmanaged deciduous forest reserves dominated by European beech (black, BU) (mean ± SD, n = 3).



Reference

1. Purahong, W. et al. Influence of different forest system management practices on leaf litter decomposition rates, nutrient dynamics and the activity of ligninolytic enzymes: a case study from Central European forests. *PLoS ONE* 9: e93700 (2014).