Supporting information

Distinct fungal successional trajectories following wildfire between soil horizons in a cold-temperate forest

Teng Yang[1], Leho Tedersoo[2], Xingwu Lin[1], Matthew C. Fitzpatrick[3], Yunsheng Jia[1], Xu Liu[1], Yingying Ni[1], Yu Shi[1], Pengpeng Lu[4], Jianguo Zhu[1], Haiyan Chu[1*]

[1]State Key Laboratory of Soil and Sustainable Agriculture, Institute of Soil Science, Chinese Academy of Sciences, East Beijing Road 71, Nanjing 210008, China

[2]Natural History Museum, University of Tartu, 14a Ravila, Tartu 50411, Estonia

[3]Appalachian Laboratory, University of Maryland Centre for Environmental Science, Frostburg, MD 21532, USA

[4]Microbiology Institute of Shaanxi, Shaanxi Academy of Sciences, Xiying Road 76, Xi'an 710043, China

Corresponding author: Haiyan Chu

Tel: +86 02586881356, E-mail: hychu@issas.ac.cn

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Supplementary Results

Notes S1 The difference of soil properties between burned forests and unburned controls

We measured 27 soil properties in the Oe horizon, and 31 soil properties in the A1 and A2 horizons, respectively. Among these variables, fire occurrence significantly decreased the contents of DOC in the Oe horizon, as revealed by LMMs (Table S17). Additionally, fire occurrence also significantly decreased the contents of total Fe in the A1 and A2 horizons, but increased the proportion of sand in the A2 horizon (Table S17).

Notes S2 The variation of soil properties along time-since-fire

With the increasing time-since-fire, several soil properties significantly varied in either linear or non-linear patterns (Table S6 & S18). In the Oe horizon, available P and available Mn significantly decreased with the increasing time-since-fire monotonically, whereas available Mo and total Mo significantly increased with the increasing time-since-fire (Fig. S7). Total Mg and total Fe strongly increased in the late stage of time-since-fire in the Oe horizon (Fig. S7). In addition, available Fe showed a U shape with the increasing time-since-fire in the Oe horizon (Fig. S7). In the mineral horizons (A1 and A2), pH, total Mg and total Fe significantly increased with the increasing time-since-fire, while total Ca, total Mo and bulk density showed regular third-order polynomial fits with the increasing time-since-fire (Fig. S7). In addition, total K significant decreased with the increasing time-since-fire and total P increased with the increasing time-since-fire. Both of them were fitted by a quadratic polynomial function (Fig. S7).

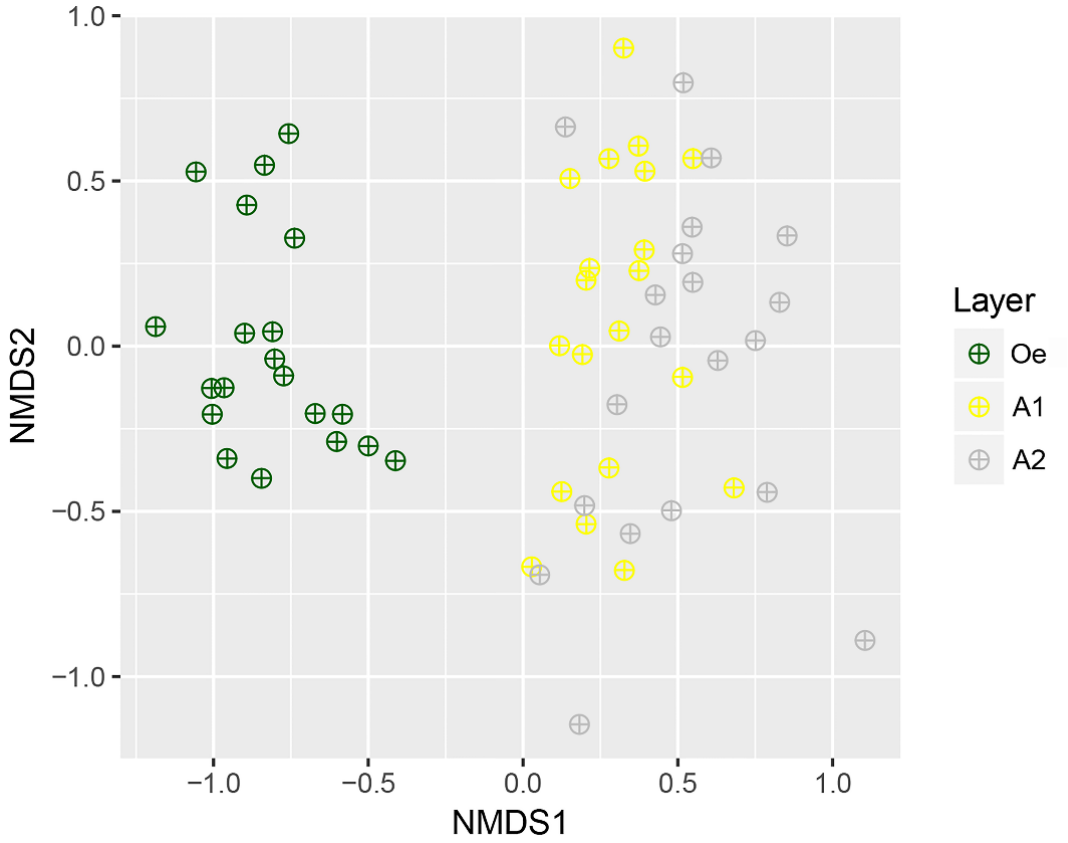

Fig. S1 Patterns of fungal community composition among soil horizons. ANOSIM showed the significant difference in fungal community composition among horizons (R=0.63, *P*=0.001). Here, the samples belonged to UC2016, UC2015, UC2009, UC2003 and PF (n=60).

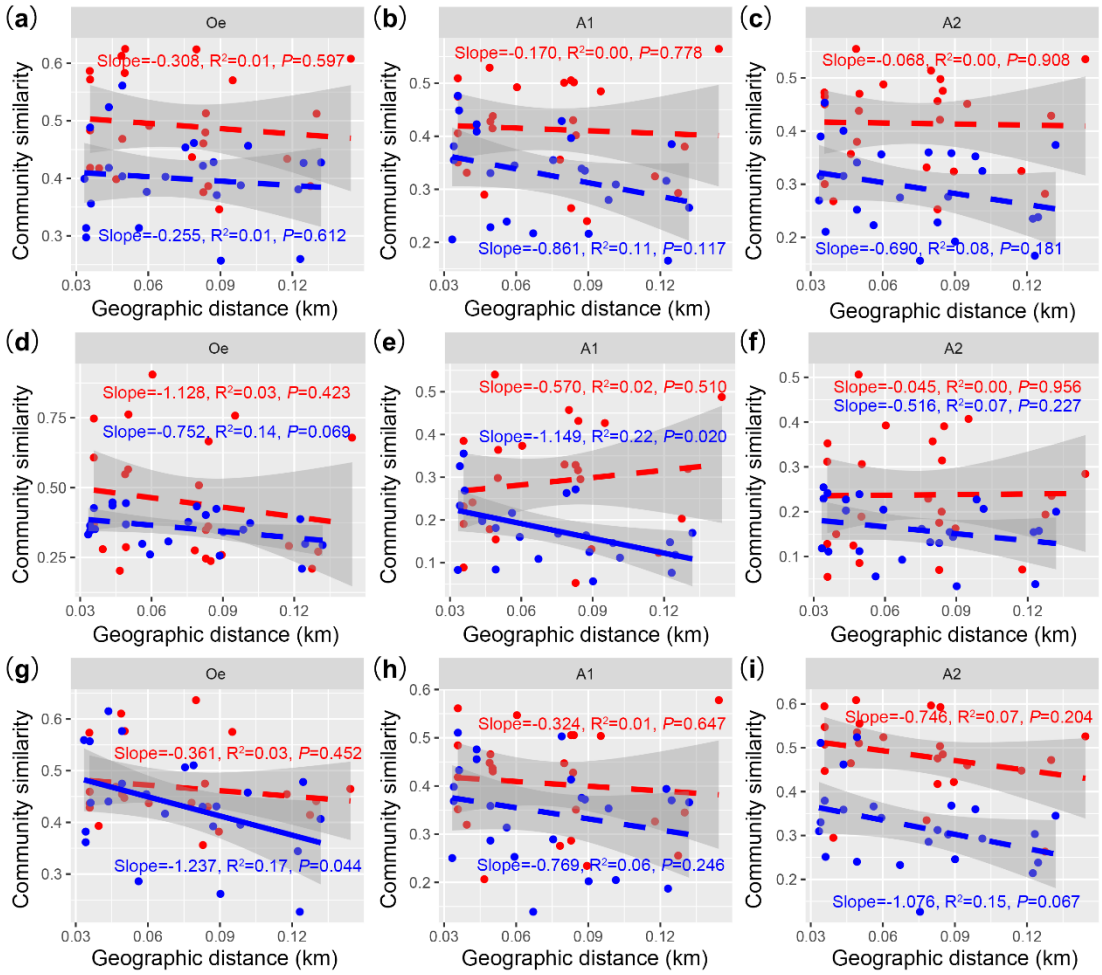

Fig. S2 Distance decay relationships of communities of total fungi (a, b and c), EcM fungi (d, e and f) and saprotrophs (g, h and i) at the within-site scale (< 1 km) in pairwise burned forests and unburned controls. Burned forests are represented in red color, and unburned controls are represented in blue color. Community similarity was represented by 1 - Bray-Curtis dissimilarity distance. The grey shaded areas show the 95% confidence interval of the fit. n=32 in each horizon.

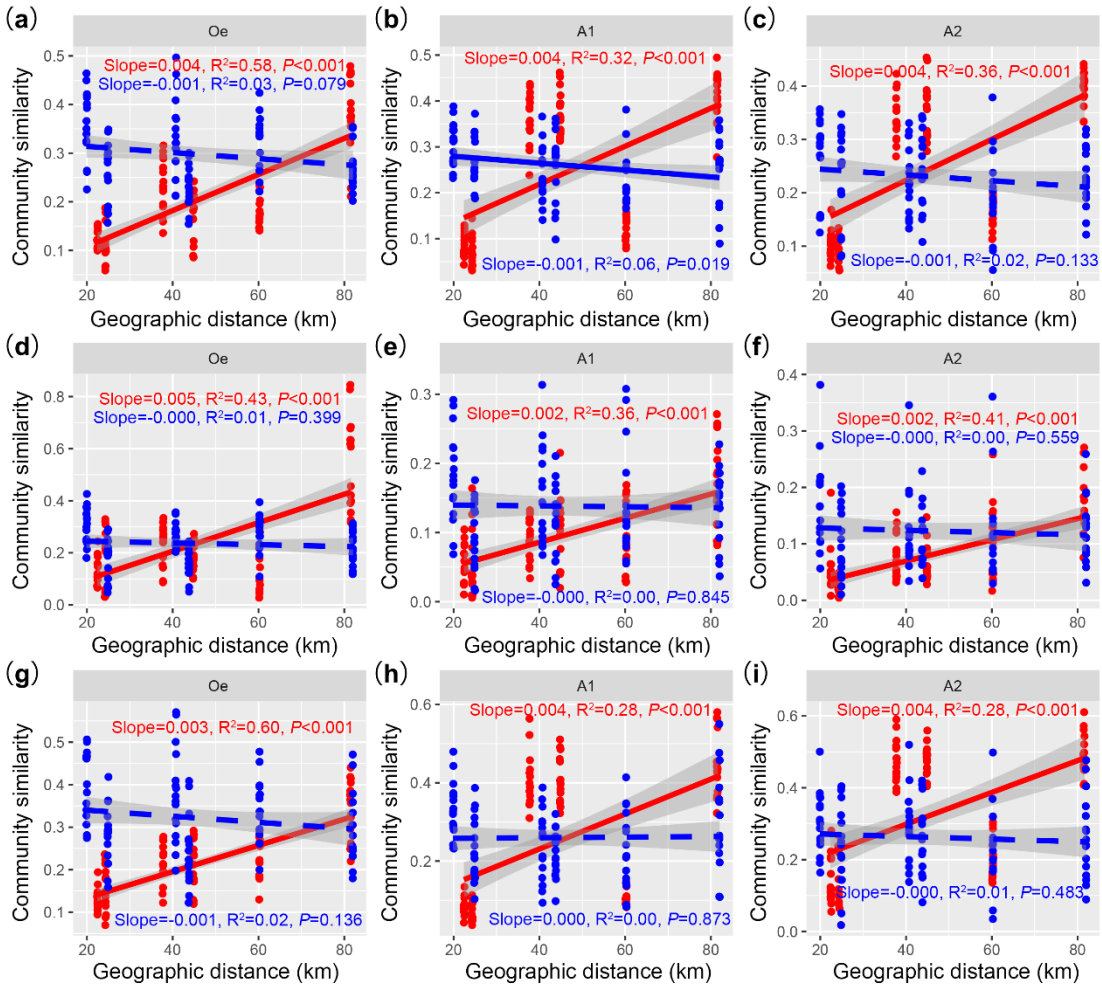

Fig. S3 Distance decay relationships of communities of total fungi (a, b and c), EcM fungi (d, e and f) and saprotrophs (g, h and i) at the among-site scale (20 - 80 km) in pairwise burned forests and unburned controls. Burned forests are represented in red color, and unburned controls are represented in blue color. Community similarity was represented by 1 - Bray-Curtis dissimilarity distance. The grey shaded areas show the 95% confidence interval of the fit. n=32 in each horizon.

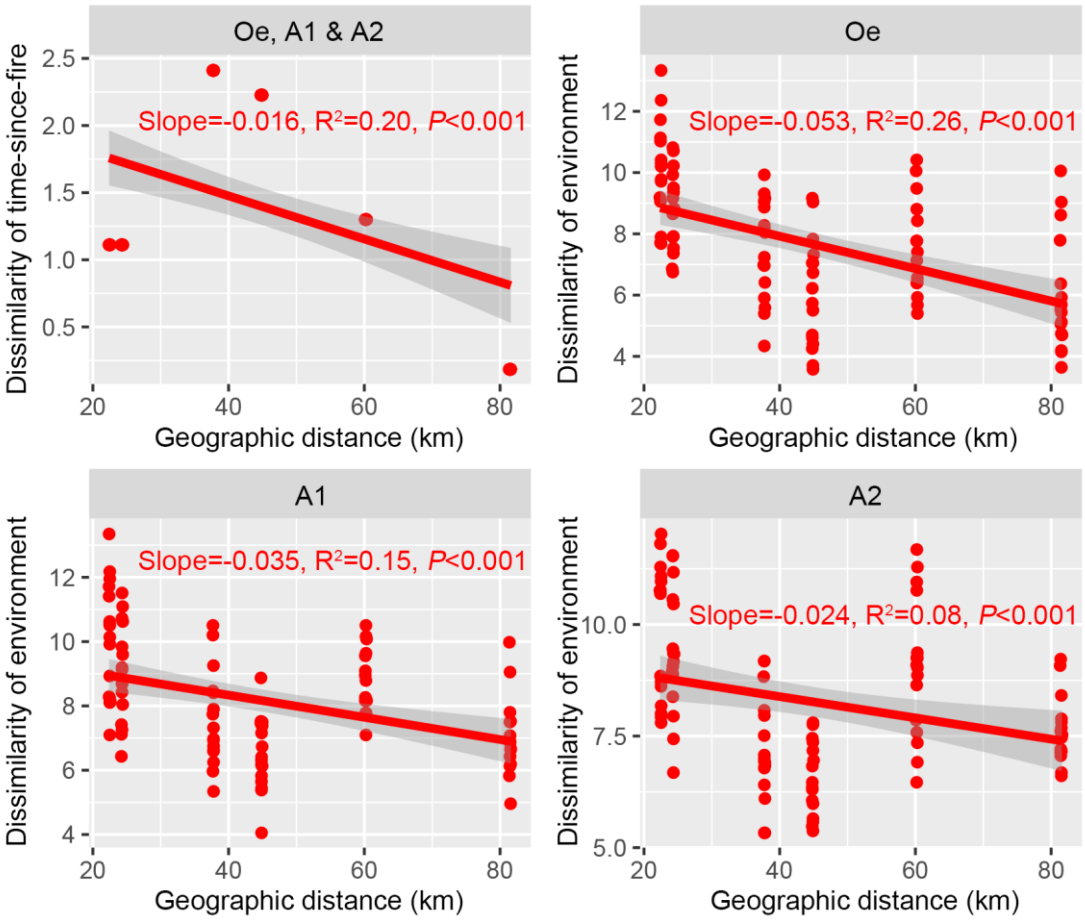

Fig. S4 The among-site variation in dissimilarities of time-since-fire and soil environment along geographic distance in burned forests. After standardization and centralization of time-since-fire and soil environmental variables, dissimilarities of time-since-fire and soil environment were calculated by Euclidean distance. The grey shaded areas show the 95% confidence interval of the fit. n=16 in each horizon.

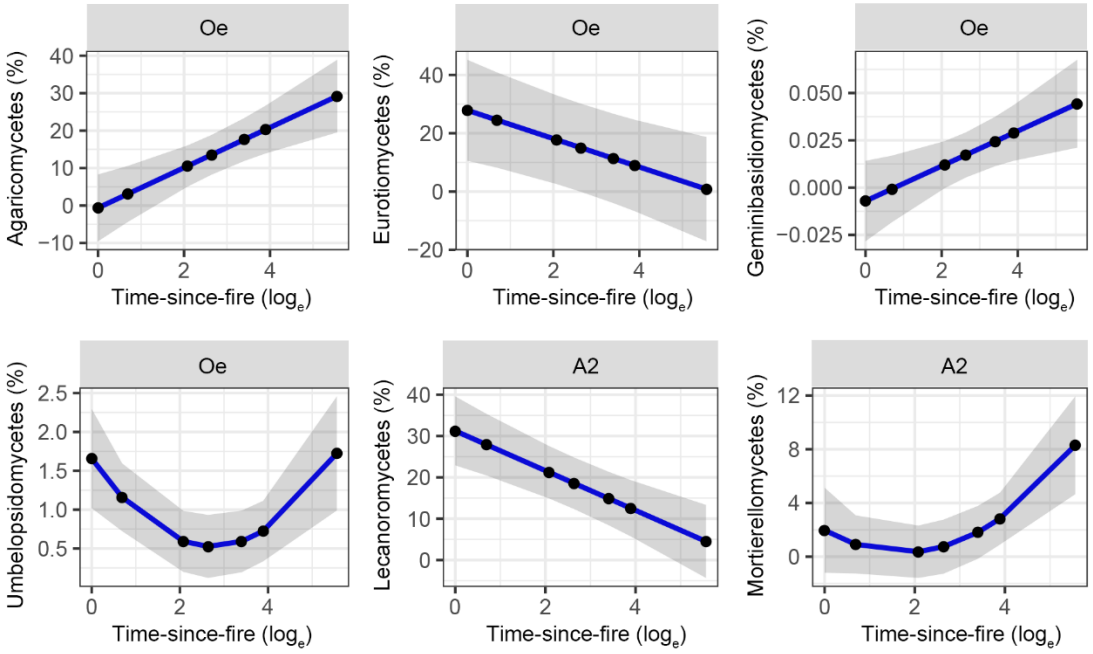

Fig. S5 The variation of relative abundances in fungal classes along time-since-fire, as revealed by the marginal effects in linear mixed-effects models. Only the significant relationships were shown. The grey shaded areas show the 95% confidence interval of the fit. The details, including parameters, were summarized in Table S14.

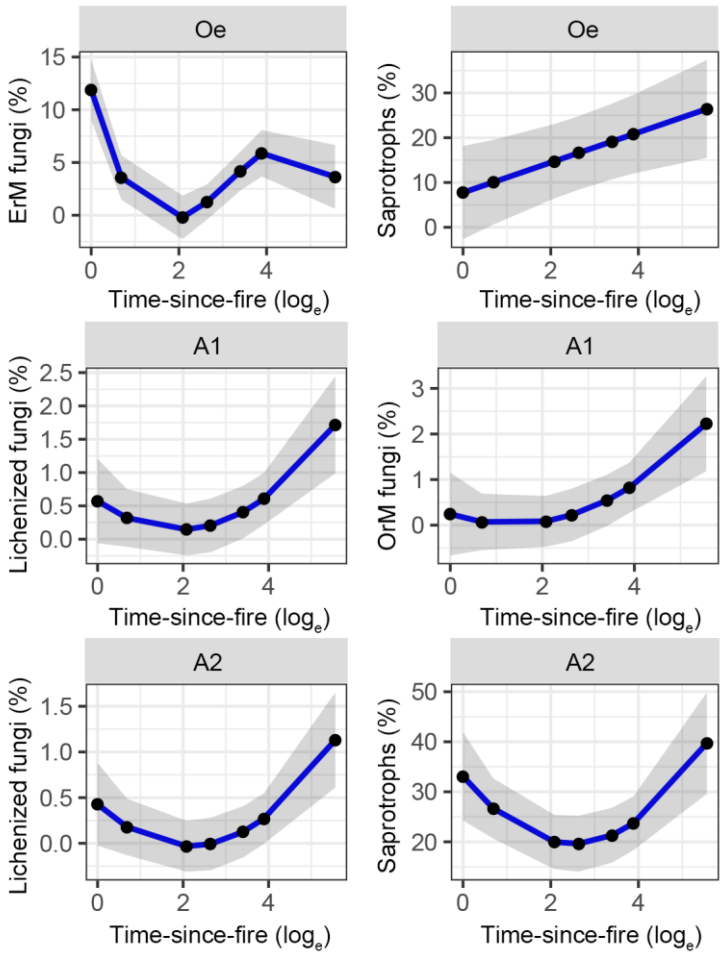

Fig. S6 The variation of relative abundances in functional guilds along time-since-fire, as revealed by the marginal effects in linear mixed-effects models. Only the significant relationships were shown. The grey shaded areas show the 95% confidence interval of the fit. The details, including parameters, were summarized in Table S15.

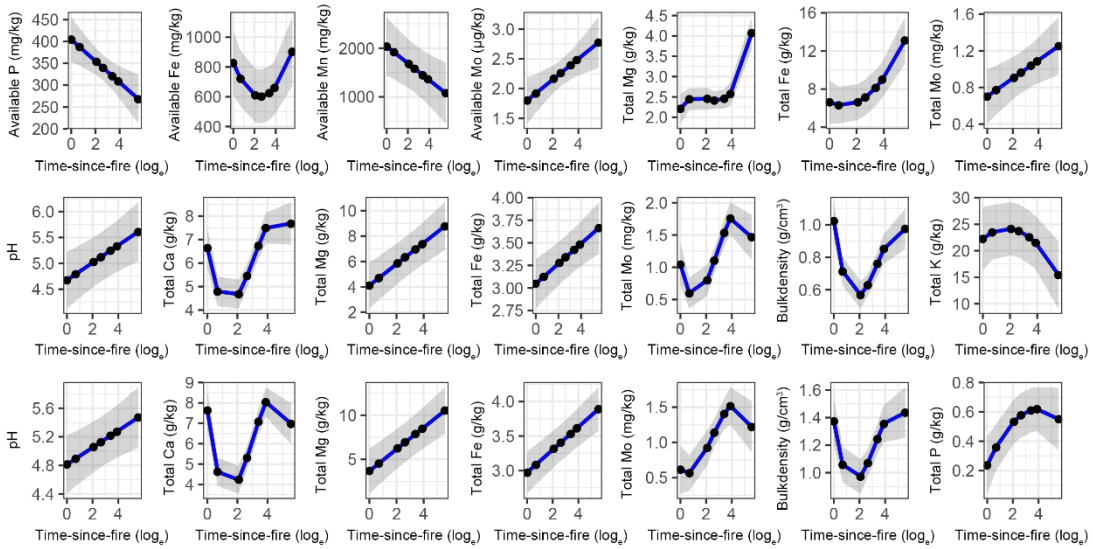

Fig. S7 The variation of soil properties along time-since-fire, as revealed by the marginal effects in linear mixed-effects models. Available Mo in Oe was logarithm-transformed; Total Fe in A1 and A2 were logarithm-transformed. Only the significant relationships were shown. For clarity, DOC and available Ca that respectively decreased and increased with the increasing time-since-fire in the A1 horizon were not shown here. The grey shaded areas show the 95% confidence interval of the fit. The details, including parameters, were summarized in Table S18.

Table S1 Assignments of 5,887 fungal OTUs to functional guilds in this study.

Functional guilds	No. genera	No. OTUs	No. sequences	Proportion (%)	Frequency (No. samples)
Animal pathogens	18	229	75,216	2.0	132
EcM fungi	47	856	884,502	24.1	132
Endophytes	29	275	119,559	3.3	132
ErM fungi	1	139	135,573	3.7	130
Lichenized fungi	12	102	23,297	0.6	119
OrM fungi	1	84	24,942	0.7	122
Plant pathogens	51	186	58,462	1.6	129
Saprotrophs	220	1347	824,376	22.5	132
Unknown	135	2669	1,525,025	41.5	-
Total	504	5,887	3,670,862	100.0	-

Due to the small proportion of sequences (< 0.5%), fungal parasites and arbuscular mycorrhizal fungi are classified to unknown for clarity.

Table S2 The variation of soil properties, fungal biomass, richness and enzymes among soil horizons.

	Oe	A1	A2
No. of plots	20	20	20
Soil moisture (W/W %)	91.29~324.24(a)	27.36~103.66(b)	19.81~71.34(c)
pH	4.03~5.40(b)	3.95~5.78(b)	4.26~5.79(a)
TC (%)	25.92~41.16(a)	3.88~12.53(b)	1.11~5.50(c)
TN (%)	1.05~1.87(a)	0.12~0.15(b)	0.04~0.35(c)
C/N ratio	20.76~29.22(a)	17.73~31.33(a)	15.82~28.14(b)
N/P ratio	8.81~24.07(a)	2.68~27.09(b)	1.71~9.69(b)
SOC (%)	25.92~41.16(a)	3.01~11.06(b)	0.97~4.82(c)
NO_3^--N (mg/kg)	0.04~0.70(a)	0.07~0.48(b)	0.19~0.75(a)
NH_4^+-N (mg/kg)	23.12~280.56(a)	4.49~18.87(b)	0.01~6.61(c)
DON (mg/kg)	68.64~376.53(a)	0.89~8.64(b)	0.98~6.67(b)
DOC (mg/kg)	1271.59~8815.62(a)	119.65~705.83(b)	125.65~321.09(c)
Available K (mg/kg)	702.5~1786.5(a)	139.6~352.7(b)	86.9~263.8(c)
Available P (mg/kg)	196.4~467.5(a)	9.2~42.7(b)	3.0~59.6(b)
Available Ca (mg/kg)	3369.5~8767.4(a)	572.4~5269.7(b)	790.8~3686.1(b)
Available Mg (mg/kg)	480.0~1223.2(a)	111.4~761.4(b)	149.4~580.4(b)
Available Al (mg/kg)	748.8~2065.8(a)	1142.1~2111.6(a)	1175.4~2155.2(a)
Available Fe (mg/kg)	566.2~1084.6(a)	376.1~571.8(b)	349.4~521.7(c)
Available Mn (mg/kg)	625.8~3119.8(a)	17.6~206.8(b)	19.9~69.3(c)
Available Mo (μg/kg)	4.4~41.6(a)	1.4~7.4(b)	0.7~7.7(b)
Total K (g/kg)	3.11~9.89(b)	15.33~23.30(a)	15.00~28.37(a)
Total P (g/kg)	0.49~1.40(a)	0.12~1.05(b)	0.20~1.03(b)
Total Ca (g/kg)	4.29~12.71(a)	3.60~10.78(b)	4.06~11.14(b)
Total Mg (g/kg)	1.51~5.34(b)	4.08~9.82(a)	4.35~12.32(a)
Total Al (g/kg)	9.54~33.70(c)	53.24~87.08(b)	70.00~93.02(a)
Total Fe (g/kg)	4.20~14.86(b)	17.83~41.71(a)	20.16~52.44(a)
Total Mn (g/kg)	0.92~6.20(a)	0.30~2.05(b)	0.30~1.39(c)
Total Mo (mg/kg)	0.44~1.98(a)	0.01~2.09(a)	0.03~20.37(a)
Bulk density (g/cm^3)		0.3~1.2(b)	0.9~1.6(a)
Clay (%)		24.1~66.4(a)	22.0~53.6(a)
Silt (%)		21.1~44.9(a)	25.4~43.1(a)
Sand (%)		12.5~36.0(b)	16.3~41.1(a)
Ergosterol (μg/g)	5.04~108.62(a)	0.97~20.59(b)	0.07~3.54(c)
Soil fungal richness	328~833(a)	278~559(b)	244~482(b)
β-glucosidase (U/g)	32.27~78.30(a)	6.22~28.34(b)	2.32~12.24(c)
Laccase (U/g)	41.48~338.48(a)	15.98~202.11(b)	20.20~11.84(b)
Mn-peroxidase (U/g)	0.98~23.45(a)	0.02~13.53(b)	1.07~8.21(c)
Urease (U/g)	233.73~950.35(a)	118.21~1064.44(b)	44.63~484.97(c)
Acid phosphatase (U/g)	0.14~2.97(b)	8.73~20.45(a)	11.24~17.74(a)

TC: total carbon, TN: total nitrogen, SOC: soil organic carbon, NO_3^--N: nitrate nitrogen, NH_4^+-N: ammonium nitrogen, DON: dissolved organic nitrogen, DOC: dissolved organic carbon. The different lower cases in parentheses of each row indicate the significant differences among soil horizons, which are performed by Games-Howell tests and independent *t* tests (for bulk density, clay, silt and sand content). Here, the samples belonged to UC2016, UC2015, UC2009, UC2003 and PF (n=60).

Table S3 The comparison between linear and non-linear models for the effects of time-since-fire on fungal biomass, richness and enzymes with site as a random factor, based on corrected Akaike Information Criterion for small data sets.

AICc	Oe			A1			A2		
	linear	quadratic	cubic	linear	quadratic	cubic	linear	quadratic	cubic
Fungal biomass	**255.4**	257.5	256.4	**137.6**	139.7	139.6	**40.1**	40.7	44.0
Total fungal richness	**362.0**	364.3	367.3	**316.6**	318.6	321.4	330.3	**329.0**	332.1
EcM fungal richness	**261.0**	263.9	266.1	**8.7**	11.7	14.9	**237.4**	240.1	243.4
Saprotrophs richness	**287.4**	289.9	292.2	268.4	**265.2**	268.2	269.1	**268.1**	270.8
β-glucosidase	226.3	**226.2**	227.0	**37.7**	38.6	41.5	**33.3**	36.0	37.9
Laccase	**59.1**	61.8	61.8	**288.7**	291.5	294.7	**260.1**	262.5	263.3
Mn-peroxidase	166.1	163.8	**153.3**	**149.6**	151.9	154.2	**27.7**	30.5	33.7
Urease	**28.8**	31.8	34.9	50.4	47.5	**35.5**	81.9	82.4	**76.7**
Acid phosphatase	**83.3**	83.5	86.7	**124.0**	126.6	129.9	**131.0**	133.2	136.4

AICc: corrected Akaike Information Criterion for small data sets. n=28 in each horizon. The lowest AICc values are in bold, which indicate the best fitted model type.

Table S4 The comparison between linear and non-linear models for the effects of time-since-fire on the relative abundances of fungal classes with site as a random factor, based on corrected Akaike Information Criterion for small data sets.

AICc	Oe			A1			A2		
	linear	quadratic	cubic	linear	quadratic	cubic	linear	quadratic	cubic
Agaricomycetes	**-25.4**	-22.5	-19.2	**-1.5**	0.9	3.0	**2.4**	4.4	6.6
Dothideomycetes	**-72.8**	-69.9	-72.1	**-78.1**	-75.1	-73.7	**-113.6**	-110.7	-108.2
Eurotiomycetes	**-56.3**	-53.9	-51.0	**-76.5**	-73.8	-70.9	**-60.4**	-57.7	-54.4
Geminibasidiomycetes	**-361.2**	-359.2	-355.9	-145.6	**-148.1**	-145.0	-141.6	**-143.0**	-140.8
Lecanoromycetes	**-116.4**	-114.1	-110.8	**-44.1**	-41.1	-39.1	**-45.5**	-42.9	-39.9
Leotiomycetes	**-42.3**	-40.7	-41.8	**-22.2**	-20.7	-17.8	**-23.9**	-23.5	-22.6
Microbotryomycetes	**-60.8**	-58.7	-56.7	**-280.5**	-279.9	-276.8	-281.3	**-281.9**	-278.7
Mortierellomycetes	**-42.9**	-40.7	-37.6	**-104.5**	-101.5	-100.2	-87.6	**-89.8**	-86.6
Mucoromycetes	**-42.4**	-40.6	-37.4	**-244.2**	-241.3	-239.5	-325.0	**-328.8**	-325.6
Pezizomycetes	-183.8	**-184.8**	-182.3	**-163.9**	-161.8	-161.7	**-185.4**	-183.0	-179.7
Saccharomycetes	**-101.8**	-99.1	-100.0	**-173.1**	-170.3	-167.7	**-194.6**	-191.9	-188.7
Sordariomycetes	**-53.8**	-51.0	-47.7	**-220.5**	-217.5	-217.6	**-212.1**	-210.5	-211.6
Tremellomycetes	**-37.5**	-35.4	-32.9	**-209.4**	-206.6	-206.4	-182.5	**-182.6**	-181.4
Umbelopsidomycetes	-177.5	**-181.0**	-177.9	-222.0	**-224.9**	-221.7	**-195.7**	-195.7	193.1

AICc: corrected Akaike Information Criterion for small data sets. n=28 in each horizon. The lowest AICc values are in bold, which indicate the best fitted model type.

Table S5 The comparison between linear and non-linear models for the effects of time-since-fire on the relative abundances of fungal guilds with site as a random factor, based on corrected Akaike Information Criterion for small data sets.

AICc	Oe			A1			A2		
	linear	quadratic	cubic	linear	quadratic	cubic	linear	quadratic	cubic
Animal pathogens	**-95.0**	-92.1	-88.8	-200.1	**-200.4**	-197.6	**-138.2**	-135.4	-132.7
EcM fungi	**-17.7**	-16.4	-13.2	**1.4**	3.6	6.8	**6.2**	7.2	9.6
Endophytes	**-62.2**	-59.3	-60.1	**-130.9**	-128.0	-126.5	**-125.4**	-123.4	-120.1
ErM fungi	-92.1	-92.0	**-99.2**	**-108.0**	-105.1	-102.1	**-113.4**	-110.4	-107.1
Lichenized fungi	**-138.0**	-135.6	-132.8	-177.1	**-179.9**	-178.8	-193.9	**-198.8**	-195.7
OrM fungi	**-187.4**	-185.0	-182.1	-159.5	**-159.9**	-157.4	**-148.4**	-147.9	-145.5
Plant pathogens	**-80.5**	-77.6	-75.8	**-214.6**	-214.9	-212.1	**-223.3**	-220.9	-218.9
Saprotrophs	**-41.3**	-39.2	-37.6	**-16.0**	-14.6	-11.4	-27.0	**-32.6**	-31.2

AICc: corrected Akaike Information Criterion for small data sets. n=28 in each horizon. The lowest AICc values are in bold, which indicate the best fitted model type.

Table S6 The comparison between linear and non-linear models for the effects of time-since-fire on soil properties with site as a random factor, based on corrected Akaike Information Criterion for small data sets.

AICc	Oe			A1			A2		
	linear	quadratic	cubic	linear	quadratic	cubic	linear	quadratic	cubic
Moisture	287.6	**286.4**	288.0	**223.8**	226.2	229.2	**9.7**	11.2	14.0
pH	**27.4**	30.3	33.1	**21.2**	24.2	27.2	**5.7**	7.2	6.7
TC	**146.6**	147.2	150.3	**115.1**	117.8	121.0	**90.3**	90.3	94.8
TN	**-7.6**	-5.8	-3.1	**-36.4**	-34.0	-31.9	**-54.5**	-52.4	-50.9
C/N ratio	**139.4**	142.2	144.2	**167.0**	169.7	170.8	**148.9**	151.8	154.0
N/P ratio	190.3	**189.9**	193.1	**168.6**	171.2	172.3	**116.2**	119.2	119.9
SOC	**146.6**	147.2	150.3	**108.4**	111.1	114.3	**81.9**	84.0	86.5
NO_3^--N	**40.4**	43.4	45.9	**19.5**	22.3	21.8	**-38.1**	-35.1	-37.8
NH_4^+-N	**43.3**	45.8	48.2	**166.0**	166.4	169.3	**170.3**	172.8	173.8
DON	**302.8**	304.4	305.7	**63.1**	65.8	67.6	**20.9**	23.8	26.3
DOC	**53.4**	54.0	54.6	**347.6**	348.8	351.9	**31.3**	34.0	37.3
Available K	**389.6**	392.5	392.2	**315.6**	318.2	319.5	**17.7**	20.6	23.1
Available P	**332.8**	333.4	336.5	**60.5**	63.4	65.2	**65.6**	68.4	71.5
Available Ca	**473.0**	474.8	478.1	**466.3**	468.8	471.5	**456.2**	459.0	460.1
Available Mg	**354.2**	357.2	360.4	**33.4**	35.4	38.5	**340.1**	340.6	343.2
Available Al	**413.5**	414.8	417.0	**381.9**	383.4	386.3	383.3	**382.0**	384.1

Available Fe	359.8	**356.8**	360.0	322.1	**320.7**	323.3	**331.9**	332.8	336.0
Available Mn	**435.0**	436.5	439.5	**44.5**	47.4	50.2	40.9	**39.1**	42.1
Available Mo	**59.4**	62.4	63.7	**173.3**	176.0	174.6	**56.3**	58.3	61.3
Total K	**-13.2**	-10.6	-7.5	151.7	**151.4**	154.6	**148.9**	149.4	152.7
Total P	17.6	**15.5**	18.7	**11.6**	13.6	15.1	-10.4	**-11.1**	-8.1
Total Ca	**117.7**	120.6	122.5	98.9	99.5	**91.2**	108.2	110.2	**96.6**
Total Mg	49.2	45.5	**44.4**	**80.2**	80.9	83.3	**96.6**	97.7	99.4
Total Al	**-1.7**	-1.0	1.4	**195.7**	197.2	195.8	**186.9**	189.6	192.7
Total Fe	110.6	**108.2**	109.3	**-18.8**	-17.1	-16.4	**-10.1**	-7.9	-7.4
Total Mn	**105.0**	107.1	110.2	39.1	**36.8**	37.3	**5.7**	7.6	10.8
Total Mo	**24.3**	27.3	29.2	42.3	45.3	**37.3**	40.1	40.1	**39.8**
Bulk density				-8.0	-13.4	**-20.0**	8.0	6.4	**1.9**
Clay				**200.9**	203.8	206.8	**200.5**	202.8	204.6
Silt				**167.5**	169.4	167.8	**169.2**	172.2	169.7
Sand				**8.1**	11.1	12.6	**214.5**	217.0	217.1

AICc: corrected Akaike Information Criterion for small data sets. n=28 in each horizon. The lowest AICc values are in bold, which indicate the best fitted model type.

Table S7 The Spearman's product-moment correlation (r) between total fungal composition (Bray-Curtis distance) and candidate variables in a fire chronosequence.

	Oe		A1		A2	
	r	*P*	r	*P*	r	*P*
Soil moisture	0.19	**0.004**	0.29	**0.002**	0.28	**0.008**
pH	0.44	**0.001**	0.28	**0.004**	0.15	0.061
TC	0.04	0.319	0.19	**0.033**	0.28	**0.008**
TN	0.24	**0.003**	0.51	**0.001**	0.48	**0.001**
C/N ratio	0.38	**0.001**	0.58	**0.001**	0.46	**0.001**
N/P ratio	0.15	**0.044**	0.36	**0.003**	0.26	**0.021**
SOC	0.04	0.317	0.15	0.054	0.29	**0.004**
NO_3^--N	0.16	**0.033**	0.24	**0.017**	0.45	**0.001**
NH_4^+-N	0.18	**0.011**	0.02	0.331	0.33	**0.019**
DON	0.21	**0.007**	0.20	**0.047**	0.36	**0.005**
DOC	0.17	**0.028**	0.12	0.105	0.04	0.338
Available K	0.01	0.386	-0.02	0.551	-0.08	0.728
Available P	0.18	**0.011**	0.02	0.370	0.07	0.240
Available Ca	0.31	**0.001**	0.34	**0.001**	0.26	**0.005**
Available Mg	0.28	**0.002**	0.45	**0.001**	0.23	**0.010**
Available Al	0.17	**0.012**	0.08	0.189	0.04	0.270
Available Fe	0.28	**0.001**	0.04	0.307	0.04	0.305
Available Mn	0.19	**0.013**	0.09	0.188	-0.11	0.844
Available Mo	0.20	**0.008**	0.00	0.421	-0.09	0.744
Total K	0.03	0.351	0.20	**0.032**	0.23	**0.022**
Total P	0.06	0.241	0.19	**0.024**	0.01	0.418
Total Ca	0.42	**0.001**	0.14	0.069	0.18	**0.016**
Total Mg	0.13	0.063	0.31	**0.001**	0.27	**0.003**
Total Al	0.04	0.238	0.06	0.256	0.04	0.261
Total Fe	0.05	0.213	0.24	**0.003**	0.22	**0.005**
Total Mn	0.07	0.177	-0.03	0.559	0.29	**0.004**
Total Mo	0.09	0.126	0.19	**0.028**	0.17	**0.019**
Bulk density			0.06	0.257	0.27	**0.011**
Clay			0.26	**0.010**	0.12	0.096
Silt			-0.05	0.768	-0.16	0.976
Sand			0.05	0.268	0.00	0.483
Larch/birch ratio	0.01	0.467	-0.17	0.950	-0.23	0.992
Geographic distance	0.40	**0.001**	0.12	0.065	0.12	0.072
Time-since-fire	0.28	**0.002**	0.30	**0.009**	0.30	**0.004**

Significant *P* values are in bold. n=28 for each horizon.

Table S8 The Spearman's product-moment correlation (r) between EcM fungal composition (Bray-Curtis distance) and candidate variables in a fire chronosequence.

	Oe		A1		A2	
	r	*P*	r	*P*	r	*P*
Soil moisture	0.21	**0.003**	0.13	0.079	0.14	0.070
pH	0.18	**0.011**	0.33	**0.001**	0.17	**0.029**
TC	0.02	0.371	0.19	**0.026**	0.21	**0.022**
TN	0.10	0.058	0.28	**0.009**	0.29	**0.007**
C/N ratio	0.22	**0.004**	0.29	**0.002**	0.31	**0.001**
N/P ratio	0.08	0.133	0.10	0.143	0.10	0.167
SOC	0.02	0.393	0.18	**0.028**	0.21	**0.020**
NO_3^--N	0.04	0.296	0.19	**0.016**	0.38	**0.001**
NH_4^+-N	0.05	0.206	-0.02	0.552	0.14	0.068
DON	0.19	**0.007**	-0.03	0.610	0.21	**0.035**
DOC	0.21	**0.006**	0.13	0.090	0.23	**0.016**
Available K	-0.06	0.861	0.16	**0.011**	0.17	**0.042**
Available P	0.08	0.119	0.11	0.123	0.05	0.303
Available Ca	0.14	**0.015**	0.38	**0.001**	0.27	**0.004**
Available Mg	0.08	0.091	0.50	**0.001**	0.34	**0.002**
Available Al	0.09	0.073	0.08	0.184	0.07	0.185
Available Fe	0.18	**0.010**	0.03	0.369	0.01	0.416
Available Mn	0.29	**0.001**	-0.03	0.604	0.02	0.403
Available Mo	0.28	**0.001**	-0.15	0.956	-0.05	0.665
Total K	0.02	0.346	0.24	**0.003**	0.19	**0.040**
Total P	0.02	0.371	0.08	0.137	0.04	0.277
Total Ca	0.19	**0.006**	0.13	0.058	0.04	0.294
Total Mg	0.12	**0.050**	0.26	**0.001**	0.16	**0.019**
Total Al	0.08	0.098	0.05	0.293	0.13	**0.036**
Total Fe	0.15	**0.023**	0.19	**0.005**	0.12	**0.037**
Total Mn	0.06	0.184	-0.05	0.675	0.05	0.245
Total Mo	0.17	**0.014**	0.09	0.135	0.13	0.038
Bulk density			-0.04	0.658	0.26	**0.002**
Clay			0.35	**0.002**	0.21	**0.005**
Silt			0.07	0.161	0.03	0.363
Sand			0.21	**0.010**	0.15	**0.023**
Larch/birch ratio	0.08	0.171	-0.16	0.935	-0.18	0.959
Geographic distance	0.18	**0.011**	0.29	**0.001**	0.28	**0.002**
Time-since-fire	0.46	**0.001**	0.19	**0.017**	0.09	0.156

Significant *P* values are in bold. n=28 for each horizon.

Table S9 The Spearman's product-moment correlation (r) between saprotroph composition (Bray-Curtis distance) and candidate variables in a fire chronosequence.

	Oe		A1		A2	
	r	*P*	r	*P*	r	*P*
Soil moisture	0.12	**0.028**	0.31	**0.005**	0.24	**0.015**
pH	0.44	**0.001**	0.22	**0.018**	0.15	0.068
TC	0.04	0.296	0.19	**0.040**	0.22	**0.031**
TN	0.18	**0.019**	0.55	**0.001**	0.43	**0.003**
C/N ratio	0.38	**0.001**	0.65	**0.001**	0.4	**0.001**
N/P ratio	0.16	0.054	0.38	**0.001**	0.24	**0.035**
SOC	0.04	0.276	0.13	0.090	0.23	**0.023**
NO_3^--N	0.19	**0.017**	0.29	**0.007**	0.45	**0.001**
NH_4^+-N	0.15	**0.026**	0.02	0.380	0.21	**0.030**
DON	0.16	**0.016**	0.23	**0.029**	0.33	**0.003**
DOC	0.14	0.067	0.09	0.170	0.05	0.293
Available K	0.04	0.267	-0.02	0.573	-0.10	0.828
Available P	0.19	**0.019**	0.00	0.482	0.06	0.287
Available Ca	0.37	**0.001**	0.20	**0.024**	0.24	**0.011**
Available Mg	0.3	**0.002**	0.28	**0.003**	0.16	0.062
Available Al	0.12	0.061	0.01	0.457	0.05	0.260
Available Fe	0.19	**0.008**	-0.02	0.560	-0.04	0.627
Available Mn	0.15	**0.031**	0.11	0.139	-0.12	0.875
Available Mo	0.16	**0.046**	-0.01	0.479	-0.13	0.914
Total K	0.01	0.421	0.11	0.124	0.12	0.129
Total P	0.05	0.273	0.13	0.070	-0.05	0.785
Total Ca	0.41	**0.001**	0.13	0.087	0.2	**0.005**
Total Mg	0.13	0.092	0.22	**0.012**	0.21	**0.009**
Total Al	0.02	0.389	0.02	0.406	0.01	0.360
Total Fe	0.08	0.182	0.20	**0.005**	0.17	**0.021**
Total Mn	0.11	0.099	-0.07	0.731	0.30	**0.001**
Total Mo	0.08	0.169	0.20	**0.021**	0.16	**0.020**
Bulk density			0.06	0.261	0.19	**0.021**
Clay			0.14	0.091	0.08	0.179
Silt			-0.03	0.636	-0.20	0.999
Sand			-0.03	0.626	-0.06	0.765
Larch/Birch ratio	0.00	0.457	-0.08	0.745	-0.20	0.976
Geographic distance	0.44	**0.001**	0.12	0.074	0.06	0.208
Time-since-fire	0.31	**0.001**	0.20	**0.033**	0.26	**0.016**

Significant *P* values are in bold. n=28 for each horizon.

Table S10 Results of linear mixed-effects models for the effects of time-since-fire on fungal biomass, richness and enzymes with site as a random factor, based on Data set 2.

	Oe					A1					A2				
	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c
Fungal biomass	L	0.143	6.11	0.178	0.648	L	0.847	-0.21	0.024	0.198	L	0.745	-0.02	0.007	0.254
Total fungal richness	L	0.096	40.31	0.205	0.511	L	0.847	-1.95	0.004	0.119	Q	**0.025**	147.91	0.274	0.274
EcM fungal richness	L	**<0.001**	9.92	0.407	0.407	L	0.847	0.01	0.004	0.615	L	0.745	1.33	0.024	0.358
Saprotrophs richness	L	0.096	13.05	0.244	0.663	Q	0.088	58.04	0.220	0.220	Q	0.232	47.88	0.138	0.138
β-glucosidase	Q	**0.012**	-25.74	0.354	0.438	L	0.969	-0.01	0.004	0.374	L	0.675	0.05	0.056	0.393
Laccase	L	0.736	0.03	0.007	0.263	L	0.969	0.93	0.002	0.002	L	0.760	0.69	0.003	0.003
Mn-peroxidase	C	**<0.001**	-17.27	0.764	0.764	L	0.740	0.42	0.060	0.240	L	0.675	0.03	0.022	0.037
Urease	L	0.056	0.11	0.226	0.420	C	**<0.001**	-2.18	0.815	0.815	C	**<0.001**	-2.74	0.598	0.598
Acid phosphatase	L	0.736	0.06	0.013	0.417	L	0.969	0.01	0.000	0.000	L	0.675	0.14	0.014	0.014

Type: the best type among linear (L), quadratic (Q) and cubic (C) polynomial models based AICc; P_{adj}: *P* values after adjustment based on Benjamini–Hochberg procedure; β_{fixed}: Estimate of fixed effect, i.e., Estimate of time-since-fire effect for the maximum item; R^2_m: the variance explained by fixed effects; R^2_c: the variance explained by both fixed and random effects. Data set 2 included a fire chronosequence (n=28 in each horizon). Significant P_{adj} values are in bold. Urease and laccase in Oe were logarithm-transformed; β-glucosidase, urease and EcM fungal diversity in A1 were logarithm-transformed; β-glucosidase, urease and Mn-peroxidase and fungal biomass in A2 were logarithm-transformed.

Table S11 Results of linear mixed-effects models for the burning effects on the relative abundances of fungal classes with site as a random factor, based on Data set 1.

	Oe				A1				A2			
	P_{adj}	β_{fixed}	R^2_m	R^2_c	P_{adj}	β_{fixed}	R^2_m	R^2_c	P_{adj}	β_{fixed}	R^2_m	R^2_c
Agaricomycetes	0.479	-0.06	0.051	0.406	0.886	-0.09	0.034	0.368	0.542	-0.12	0.063	0.363
Dothideomycetes	0.569	0.02	0.021	0.236	0.886	-0.01	0.009	0.404	0.806	0.00	0.003	0.132
Eurotiomycetes	**0.031**	0.15	0.411	0.789	0.886	0.02	0.037	0.108	0.646	0.02	0.017	0.329
Geminibasidiomycetes	0.377	-0.00	0.047	0.047	0.886	0.00	0.016	0.016	0.646	-0.01	0.011	0.056
Lecanoromycetes	0.432	0.02	0.086	0.635	0.886	0.02	0.005	0.691	0.543	0.05	0.041	0.401
Leotiomycetes	0.221	0.09	0.143	0.388	0.886	0.05	0.023	0.277	0.542	0.09	0.080	0.309
Microbotryomycetes	0.221	-0.04	0.085	0.085	0.589	-0.00	0.088	0.088	0.542	-0.00	0.040	0.040
Mortierellomycetes	0.544	0.03	0.038	0.463	0.886	0.01	0.014	0.237	0.542	-0.01	0.094	0.388
Mucoromycetes	**0.042**	-0.04	0.169	0.169	0.962	0.00	0.000	0.000	0.542	0.00	0.033	0.039
Pezizomycetes	0.250	-0.01	0.083	0.143	0.886	-0.00	0.005	0.005	0.376	-0.01	0.125	0.125
Saccharomycetes	**0.011**	-0.01	0.321	0.388	0.886	0.00	0.014	0.014	0.543	0.00	0.020	0.020
Sordariomycetes	0.993	0.00	0.000	0.506	0.589	0.00	0.192	0.558	0.376	0.00	0.107	0.107
Tremellomycetes	**0.029**	-0.13	0.230	0.263	0.886	0.00	0.102	0.567	0.542	0.00	0.118	0.330
Umbelopsidomycetes	0.428	-0.01	0.058	0.244	0.886	0.00	0.002	0.002	0.543	0.00	0.032	0.219

P_{adj}: P values after adjustment based on Benjamini–Hochberg procedure; β_{fixed}: Estimate of fixed effect, i.e., Estimate of burning effect; R^2_m: the variance explained by fixed effects; R^2_c: the variance explained by both fixed and random effects. Data set 1 included the pairwise burned and unburned plots (n=32 in each horizon). Significant P_{adj} values are in bold.

Table S12 Results of linear mixed-effects models for the burning effects on the relative abundances of fungal guilds with site as a random factor, based on Data set 1.

	Oe				A1				A2			
	P_{adj}	β_{fixed}	R^2_m	R^2_c	P_{adj}	β_{fixed}	R^2_m	R^2_c	P_{adj}	β_{fixed}	R^2_m	R^2_c
Animal pathogens	0.393	3.98	0.154	0.630	0.482	-0.40	0.023	0.171	0.915	-0.08	0.000	0.000
EcM fungi	0.691	-2.28	0.018	0.067	0.292	-0.59	0.118	0.291	0.915	-5.12	0.012	0.337
Endophytes	0.393	7.15	0.168	0.697	0.482	0.65	0.030	0.169	0.915	0.15	0.001	0.001
ErM fungi	0.691	1.23	0.021	0.562	0.292	-0.35	0.105	0.105	0.915	0.27	0.004	0.004
Lichenized fungi	0.666	0.96	0.065	0.474	0.482	-0.19	0.017	0.017	0.782	-1.51	0.034	0.034
OrM fungi	0.691	0.30	0.014	0.510	0.292	-0.32	0.114	0.418	0.254	-0.73	0.173	0.286
Plant pathogens	0.691	0.95	0.008	0.182	0.292	0.20	0.054	0.054	0.782	0.15	0.046	0.046
Saprotrophs	0.210	-9.41	0.203	0.362	0.292	0.36	0.062	0.062	0.915	1.04	0.002	0.011

P_{adj}: *P* values after adjustment based on Benjamini–Hochberg procedure; β_{fixed}: Estimate of fixed effect, i.e., Estimate of burning effect; R^2_m: the variance explained by fixed effects; R^2_c: the variance explained by both fixed and random effects. Data set 1 included the pairwise burned and unburned plots (n=32 in each horizon). Significant P_{adj} values are in bold.

Table S13 The response ratios of soil fungal communities to fire occurrence in the Oe, A1 and A2 horizons at the OTU level.

OTU ID	RR	Error bar	Significance	Taxonomy	Guild	Relative abundance (%)
Oe						
OTU70	3.49	1.07	11.043	Dothideomycetes, *Didymella boeremae*	Animal pathogens	0.73
OTU2770	2.83	2.42	2.121	Sordariomycetes, *Gibberella tricincta*	Plant pathogens	0.59
OTU260	2.40	1.52	3.461	Leotiomycetes, *Oidiodendron griseum*	ErM fungi	0.13
OTU73	2.39	0.95	4.822	Eurotiomycetes, *Penicillium swiecickii*	Unknown	0.74
OTU4737	2.22	0.75	4.383	Eurotiomycetes, *Penicillium spinulosum*	Unknown	6.04
OTU5974	2.13	0.93	3.687	Dothideomycetes, *Ascochyta rabiei*	Plant pathogens	0.13
OTU3217	1.73	1.28	1.355	Eurotiomycetes, *Penicillium*	Unknown	0.10
OTU5260	1.35	1.07	0.683	Eurotiomycetes, *Penicillium*	Unknown	0.56
OTU319	1.29	0.85	0.927	Eurotiomycetes, *Penicillium lividum*	Unknown	0.12
OTU1089	-0.79	0.79	0.009	Leotiomycetes, *Phialocephala fortinii*	Endophyte	0.11
OTU434	-0.92	0.84	0.143	Eurotiomycetes, *Cladophialophora chaetospira*	Saprotrophs	0.06
OTU129	-0.94	0.75	0.320	Eurotiomycetes, *Cladophialophora sp.*	Saprotrophs	0.21
OTU84	-1.02	1.02	0.006	Leotiomycetes, *Phialocephala fortinii*	Endophyte	0.04
OTU5629	-1.28	1.26	0.043	Dothideomycetes, *Cenococcum_geophilum*	EcM fungi	1.10
OTU3986	-1.28	0.96	0.727	Sordariomycetes, *Trichoderma semiorbis*	Unknown	0.34
OTU52	-1.67	1.65	0.057	Sordariomycetes, *Trichoderma sp.*	Unknown	0.68
OTU121	-1.72	1.14	1.655	Tremellomycetes, *Saitozyma podzolica*	Unknown	0.08
OTU4192	-1.96	0.99	2.863	Leotiomycetes, unidentified sp.	Saprotrophs	0.92
OTU9	-2.06	1.10	3.050	Tremellomycetes, *Solicoccozyma terricola*	Unknown	2.97
OTU5512	-2.07	1.18	2.871	Saccharomycetes, unidentified sp.	Unknown	0.34
OTU248	-2.23	1.26	3.388	Tremellomycetes, *Syzygospora sp.*	Fungal parasites	0.11

OTU3902	-2.44	0.96	5.036	Leotiomycetes, unidentified sp.	Saprotrophs	0.86
OTU4448	-2.46	1.12	4.805	Sordariomycetes, *Chloridium sp.*	EcM fungi	0.27
A1						
OTU68	2.07	1.52	1.970	Mortierellomycetes, *Mortierella parvispora*	Unknown	0.11
OTU121	1.67	1.24	1.251	Tremellomycetes, *Saitozyma podzolica*	Unknown	0.13
OTU638	1.28	1.23	0.123	Dothideomycetes, unidentified sp.	Endophyte	0.02
OTU32	1.17	1.04	0.304	Leotiomycetes, *Pseudeurotium* sp.	Saprotrophs	0.12
OTU43	-0.66	0.59	0.085	Leotiomycetes, *Oidiodendron* sp.	ErM fungi	0.14
OTU172	-0.88	0.70	0.281	Leotiomycetes, *Leptodontidium* sp.	Endophyte	0.07
OTU2	-0.91	0.90	0.008	Leotiomycetes, *Oidiodendron chlamydosporicum*	ErM fungi	0.02
A2						
OTU4737	2.94	1.46	6.528	Eurotiomycetes, *Penicillium spinulosum*	Unknown	0.45
OTU46	2.30	1.17	3.914	Geminibasidiomycetes, *Geminibasidium* sp.	Saprotrophs	0.26
OTU4790	2.06	1.03	3.200	Leotiomycetes, unidentified sp.	Unknown	0.13
OTU3513	1.78	0.89	2.389	Leotiomycetes, *Phialocephala fortinii*	Endophytes	0.08
OTU330	1.57	1.12	1.195	Tremellomycetes, *Solicoccozyma fuscescens*	Unknown	0.05
OTU120	1.43	1.36	0.192	Leotiomycetes, *Oidiodendron sp.*	ErM fungi	0.16
OTU4895	0.93	0.80	0.218	Leotiomycetes, unidentified sp.	Saprotrophs	0.08
OTU4492	0.91	0.69	0.344	Leotiomycetes, unidentified sp.	Saprotrophs	8.72
OTU91	0.83	0.59	0.351	Ascomycota, unidentified sp.	Unknown	0.14
OTU257	-1.07	1.00	0.159	Leotiomycetes, unidentified sp.	Saprotrophs	0.06
OTU4054	-1.89	1.15	2.270	Mortierellomycetes, *Mortierella humilis*	Unknown	0.21

RR means response ratio. If RR is positive, it means the OTU positively responds to burning. If RR is negative, it means the OTU negatively responds to burning. Only the OTUs significantly respond are shown. n=32 in each horizon.

Table S14 Results of linear mixed-effects models for the effects of time-since-fire on the relative abundances of fungal classes with site as a random factor, based on Data set 2.

	Oe					A1					A2				
	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c
Agaricomycetes	L	**0.002**	0.05	0.357	0.361	L	0.258	0.06	0.186	0.502	L	0.088	0.06	0.218	0.350
Dothideomycetes	L	0.161	-0.01	0.175	0.376	L	0.701	-0.01	0.036	0.437	L	0.434	-0.00	0.061	0.233
Eurotiomycetes	L	**0.023**	-0.05	0.473	0.788	L	0.355	-0.01	0.101	0.246	L	0.434	-0.01	0.069	0.358
Geminibasidiomycetes	L	**0.025**	0.00	0.211	0.211	Q	0.158	0.03	0.187	0.187	Q	0.172	0.03	0.154	0.154
Lecanoromycetes	L	0.705	0.00	0.014	0.576	L	0.071	-0.05	0.401	0.748	L	**<0.001**	-0.05	0.475	0.517
Leotiomycetes	L	0.230	-0.03	0.163	0.587	L	0.992	0.00	0.000	0.312	L	0.668	-0.01	0.019	0.123
Microbotryomycetes	L	0.632	0.01	0.019	0.153	L	0.071	0.00	0.199	0.199	Q	0.172	0.00	0.154	0.154
Mortierellomycetes	L	0.698	0.01	0.014	0.276	L	0.925	0.00	0.003	0.435	Q	**0.019**	0.09	0.305	0.305
Mucoromycetes	L	0.089	0.02	0.146	0.146	L	0.415	0.00	0.054	0.054	Q	0.067	0.00	0.239	0.239
Pezizomycetes	Q	0.208	-0.01	0.136	0.136	L	0.925	-0.00	0.003	0.077	L	0.383	-0.00	0.053	0.053
Saccharomycetes	L	0.202	0.01	0.091	0.091	L	0.925	0.00	0.003	0.003	L	0.772	0.00	0.003	0.003
Sordariomycetes	L	0.235	-0.02	0.149	0.571	L	0.701	-0.00	0.044	0.512	L	0.716	-0.00	0.010	0.042
Tremellomycetes	L	0.509	0.02	0.056	0.459	L	0.415	0.00	0.095	0.404	Q	0.114	0.01	0.192	0.192
Umbelopsidomycetes	Q	**0.024**	0.03	0.292	0.304	Q	0.135	0.01	0.208	0.208	L	0.758	-0.00	0.006	0.078

Type: the best type among linear (L), quadratic (Q) and cubic (C) polynomial models based AICc; P_{adj}: P values after adjustment based on Benjamini–Hochberg procedure; β_{fixed}: Estimate of fixed effect, i.e., Estimate of time-since-fire effect for the maximum item; R^2_m: the variance

explained by fixed effects; R^2_c: the variance explained by both fixed and random effects. Data set 2 included a fire chronosequence (n=28 in each horizon). Significant *P* values are in bold.

Table S15 Results of linear mixed-effects models for the effects of time-since-fire on the relative abundances of fungal guilds with site as a random factor, based on Data set 2.

	Oe					A1					A2				
	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c
Animal pathogens	L	0.363	-0.01	0.116	0.689	Q	0.136	-0.01	0.166	0.166	L	0.266	-0.00	0.077	0.077
EcM fungi	L	0.188	0.03	0.122	0.218	L	0.322	0.04	0.092	0.300	L	0.308	0.04	0.074	0.227
Endophytes	L	0.274	-0.02	0.168	0.697	L	0.825	-0.00	0.005	0.005	L	0.670	-0.00	0.007	0.007
ErM fungi	C	**<0.001**	-0.14	0.584	0.584	L	0.815	0.00	0.017	0.283	L	0.670	-0.00	0.011	0.205
Lichenized fungi	L	0.704	0.00	0.013	0.489	Q	**0.013**	0.02	0.298	0.298	Q	**0.011**	0.02	0.317	0.317
OrM fungi	L	0.704	0.00	0.019	0.816	Q	**0.013**	0.02	0.297	0.297	L	0.053	0.00	0.168	0.168
Plant pathogens	L	0.117	-0.01	0.131	0.131	L	0.136	-0.00	0.120	0.120	L	0.308	-0.00	0.051	0.051
Saprotrophs	L	**0.028**	0.03	0.273	0.369	L	0.825	-0.00	0.002	0.002	Q	**0.011**	0.36	0.304	0.304

Type: the best type among linear (L), quadratic (Q) and cubic (C) polynomial models based AICc; P_{adj}: *P* values after adjustment based on Benjamini–Hochberg procedure; β_{fixed}: Estimate of fixed effect, i.e., Estimate of time-since-fire effect for the maximum item; R^2_m: the variance explained by fixed effects; R^2_c: the variance explained by both fixed and random effects. Data set 2 included a fire chronosequence (n=28 in each horizon). Significant *P* values are in bold.

Table S16 The variation of each soil fungal taxa along time-since-fire, as revealed by model-based analysis of multivariate abundance data.

OTU ID	Coefficient	Deviance	P_{adj}	Taxonomy	Guild	RAs (%)
Oe						
OTU4026	-1.8	39.37	0.001	Dothideomycetes, *Venturia hystrioides*	Plant pathogens	1.50
OTU47	-1.8	44.65	0.001	Sordariomycetes, *Coniochaeta decumbens*	Unknown	1.31
OTU211	1.1	32.00	0.001	Leotiomycetes, unidentified sp.	EcM fungi	0.11
OTU224	0.9	26.82	0.003	Microbotryomycetes, unidentified sp.	Unknown	0.05
OTU5924	-1.9	25.93	0.003	Leotiomycetes, *Calyptrozyma* sp.	EcM fungi	4.07
OTU5260	-0.8	24.20	0.004	Eurotiomycetes, *Penicillium* sp.	Unknown	0.53
OTU70	-1.2	24.60	0.004	Dothideomycetes, *Didymella boeremae*	Animal pathogens	0.82
OTU154	-1.1	24.89	0.004	Sordariomycetes, *Coniochaeta* sp.	Unknown	0.08
OTU3902	0.7	22.43	0.005	Leotiomycetes, unidentified sp.	Saprotrophs	0.55
OTU393	0.6	22.65	0.005	Umbelopsidomycetes, *Umbelopsis* sp.	Saprotrophs	0.02
OTU4384	-0.7	20.62	0.008	Eurotiomycetes, *Penicillium* sp.	Unknown	0.07
OTU5628	0.9	19.68	0.011	Leotiomycetes, unidentified sp.	Saprotrophs	0.39
OTU3217	-0.7	18.23	0.016	Eurotiomycetes, *Penicillium* sp.	Unknown	0.10
OTU2626	-0.8	18.12	0.018	Eurotiomycetes, *Penicillium* sp.	Unknown	0.06
OTU488	-0.8	17.25	0.024	Dothideomycetes, *Kalmusia* sp.	Saprotrophs	0.05
OTU253	-0.7	16.13	0.031	Umbelopsidomycetes, *Umbelopsis isabellina*	Saprotrophs	0.15
OTU319	-0.5	15.96	0.033	Eurotiomycetes, *Penicillium lividum*	Unknown	0.12

OTU1089	0.5	15.45	0.036	Leotiomycetes, *Phialocephala_fortinii*	Endophyte	0.14
OTU73	-0.8	15.18	0.039	Eurotiomycetes, *Penicillium swiecickii*	Unknown	0.83
A1						
257	0.9	36.93	0.001	Leotiomycetes, unidentified sp.	Ectomycorrhizal	0.03
89	-0.9	19.35	0.013	Leotiomycetes, Leohumicola sp.	Saprotrophs	0.19
269	0.8	17.20	0.025	Leotiomycetes, unidentified sp.	Unknown	0.10
95	0.7	16.03	0.041	Leotiomycetes, unidentified sp.	Saprotrophs	0.14
A2						

Only the OTUs that varied significantly along time-since-fire were shown. P_{adj} values were adjusted by multiple testing. After *P* adjustment, there were no OTUs that varied significantly along time-since-fire in the A2 horizon. RAs: relative abundance. n=28 in each horizon.

Table S17 Results of linear mixed-effects models for the burning effects on soil properties with site as a random factor, based on Data set 1.

	Oe				A1				A2			
	P_{adj}	β_{fixed}	R^2_m	R^2_c	P_{adj}	β_{fixed}	R^2_m	R^2_c	P_{adj}	β_{fixed}	R^2_m	R^2_c
Moisture	0.715	-0.16	0.095	0.538	0.450	-0.14	0.064	0.198	0.844	-0.06	0.012	0.212
pH	0.915	0.13	0.020	0.812	0.951	0.05	0.003	0.564	0.833	-0.11	0.030	0.521
TC	0.915	0.70	0.010	0.292	0.215	-1.51	0.137	0.212	0.841	-0.11	0.024	0.461
TN	0.973	-0.03	0.003	0.681	0.855	-0.03	0.021	0.603	0.923	0.01	0.002	0.562
C/N ratio	0.799	1.41	0.056	0.722	0.972	0.11	0.000	0.644	0.923	-0.33	0.002	0.445
N/P ratio	0.715	2.18	0.042	0.042	0.855	-1.36	0.012	0.290	0.923	0.02	0.001	0.281
SOC	0.915	0.70	0.010	0.292	0.215	-1.37	0.141	0.215	0.833	-0.12	0.028	0.472
NO_3^--N	0.799	0.21	0.052	0.540	0.253	0.15	0.074	0.190	0.533	0.13	0.116	0.608
NH_4^+-N	0.856	-0.31	0.044	0.748	0.450	-2.04	0.060	0.104	0.754	2.17	0.059	0.540
DON	0.159	-0.54	0.315	0.665	0.215	0.58	0.200	0.457	0.223	0.35	0.185	0.380
DOC	**0.032**	-0.89	0.394	0.581	0.253	-100.9	0.135	0.257	0.429	-33.35	0.066	0.066
Available K	0.159	-390.5	0.316	0.611	0.450	-31.32	0.061	0.222	0.326	-0.18	0.095	0.123
Available P	0.715	39.48	0.059	0.059	0.838	0.23	0.029	0.497	0.871	0.20	0.013	0.470
Available Ca	0.715	-983.5	0.134	0.630	0.375	-717.6	0.135	0.429	0.326	-586.8	0.153	0.382
Available Mg	0.799	-82.46	0.051	0.613	0.450	-0.31	0.100	0.449	0.533	-62.59	0.097	0.426
Available Al	0.984	-9.27	0.000	0.288	0.972	0.01	0.001	0.492	0.923	-25.09	0.002	0.332
Available Fe	0.371	-159.1	0.223	0.590	0.865	10.02	0.008	0.205	0.923	-7.67	0.003	0.380
Available Mn	0.715	-313.5	0.071	0.183	0.972	-1.26	0.000	0.069	0.754	-0.15	0.031	0.143
Available Mo	0.973	-0.06	0.003	0.031	0.450	-0.18	0.056	0.072	0.923	0.03	0.001	0.001

Total K	0.984	-0.02	0.000	0.387	0.213	0.16	0.262	0.520	0.223	3.75	0.232	0.497
Total P	0.792	-0.09	0.039	0.126	0.855	-0.04	0.006	0.006	0.833	-0.05	0.017	0.147
Total Ca	0.915	0.50	0.015	0.612	0.917	-0.19	0.008	0.632	0.844	-0.07	0.026	0.679
Total Mg	0.973	0.04	0.002	0.545	0.215	-0.85	0.213	0.413	0.223	-1.02	0.199	0.408
Total Al	0.973	-0.02	0.002	0.229	0.732	1.75	0.018	0.018	0.533	-2.61	0.055	0.124
Total Fe	0.799	-0.09	0.035	0.257	**0.029**	-4.97	0.318	0.391	**0.021**	-5.30	0.252	0.258
Total Mn	0.715	0.55	0.039	0.039	0.951	-0.05	0.003	0.435	0.831	-0.08	0.038	0.415
Total Mo	0.984	-0.00	0.000	0.401	0.648	-0.19	0.043	0.287	0.548	-0.19	0.041	0.041
Bulk density					0.450	0.11	0.084	0.423	0.923	-0.01	0.000	0.062
Clay					0.281	-0.24	0.167	0.460	0.161	-8.82	0.224.	0.362
Silt					0.855	-1.39	0.015	0.284	0.374	-4.02	0.148	0.457
Sand					0.081	10.20	0.294	0.449	**0.021**	12.84	0.336	0.452

P_{adj}: P values after adjustment based on Benjamini–Hochberg procedure; β_{fixed}: Estimate of fixed effect, i.e., Estimate of burning effect; R^2_m: the variance explained by fixed effects; R^2_c: the variance explained by both fixed and random effects. Data set 1 included the pairwise burned and unburned plots (n=32 in each horizon). Significant P_{adj} values are in bold. Moisture, NH_4^+-N, DON, DOC, available Mo, total Al and total Fe in Oe were logarithm-transformed; Moisture, TN, DON, available P, available Mg, available Al, available Mo, total K and clay in A1 were logarithm-transformed; Moisture, TC, N/P ratio, SOC, DON, available K, available P, available Mn, available Mo and total Ca in A2 were logarithm-transformed.

Table S18 Results of linear mixed-effects models for the effects of time-since-fire on soil properties with site as a random factor, based on Data set 2.

	Oe					A1					A2				
	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c	Type	P_{adj}	β_{fixed}	R^2_m	R^2_c
Moisture	Q	0.147	-179.03	0.395	0.805	L	0.600	-1.34	0.041	0.341	L	0.822	-0.02	0.012	0.430
pH	L	0.792	-0.02	0.010	0.642	L	**0.009**	0.17	0.452	0.696	L	**0.013**	0.12	0.419	0.668
TC	L	0.147	-1.02	0.246	0.620	L	0.750	0.10	0.012	0.217	L	0.766	0.12	0.029	0.609
TN	L	0.792	-0.02	0.011	0.764	L	0.849	0.01	0.004	0.703	L	0.942	0.00	0.004	0.722
C/N ratio	L	0.475	-0.50	0.086	0.597	L	0.682	-0.53	0.034	0.649	L	0.970	-0.03	0.000	0.726
N/P ratio	Q	0.260	11.0	0.130	0.130	L	0.777	-0.22	0.009	0.386	L	0.277	-0.34	0.115	0.321
SOC	L	0.147	-1.02	0.246	0620	L	0.682	0.11	0.019	0.230	L	0.755	0.12	0.034	0.622
NO_3^--N	L	0.419	-0.10	0.115	0.584	L	0.328	-0.06	0.103	0.323	L	0.339	-0.04	0.170	0.809
NH_4^+-N	L	0.555	-0.12	0.075	0.857	L	0.682	-0.38	0.026	0.343	L	0.395	-0.92	0.104	0.525
DON	L	0.648	8.44	0.047	0.786	L	0.763	-0.04	0.010	0.238	L	0.822	-0.02	0.012	0.472
DOC	L	0.419	0.16	0.135	0.754	L	**0.048**	-26.72	0.184	0.184	L	0.790	-0.02	0.008	0.008
Available K	L	0.663	-33.91	0.038	0.751	L	0.396	-7.96	0.059	0.122	L	0.970	-0.00	0.001	0.259
Available P	L	**0.027**	-24.54	0.244	0.244	L	0.503	0.10	0.072	0.475	L	0.755	0.08	0.035	0.523
Available Ca	L	0.952	13.04	0.000	0.613	L	**0.009**	396.2	0.392	0.570	L	0.109	278.2	0.283	0.617
Available Mg	L	0.768	-12.67	0.019	0.740	L	0.119	0.14	0.257	0.590	L	0.153	26.10	0.200	0.457
Available Al	L	0.475	76.00	0.090	0.703	L	0.297	-44.28	0.141	0.395	Q	0.086	-400.69	0.214	0.214

Available Fe	Q	**0.039**	570.19	0.443	0.668	Q	0.093	-156.61	0.220	0.251	L	0.755	8.10	0.030	0.398
Available Mn	L	**0.039**	-172.4	0.283	0.428	L	0.396	-0.06	0.048	0.048	Q	0.135	0.89	0.184	0.184
Available Mo	L	**0.034**	0.18	0.223	0.223	L	0.503	0.59	0.051	0.223	L	0.970	-0.00	0.000	0.000
Total K	L	0.475	0.03	0.076	0.559	Q	**0.048**	-10.32	0.428	0.691	L	0.081	-1.52	0.360	0.752
Total P	Q	0.071	-0.73	0.237	0.257	L	0.328	0.04	0.068	0.068	Q	**0.005**	-0.42	0.420	0.499
Total Ca	L	0.475	0.33	0.083	0.557	C	**<0.001**	-3.95	0.615	0.615	C	**<0.001**	-6.54	0.666	0.666
Total Mg	C	**<0.001**	0.94	0.686	0.686	L	**<0.001**	0.84	0.690	0.858	L	**<0.001**	1.23	0.718	0.881
Total Al	L	0.260	0.06	0.185	0.656	L	0.768	0.27	0.005	0.034	L	0.192	1.14	0.113	0.176
Total Fe	Q	**<0.001**	5.63	0.717	0.808	L	**<0.001**	0.11	0.599	0.782	L	**<0.001**	0.17	0.712	0.835
Total Mn	L	0.151	-0.26	0.111	0.111	Q	0.084	0.93	0.210	0.210	L	0.152	0.05	0.146	0.230
Total Mo	L	**0.039**	0.10	0.240	0.306	C	**<0.001**	-1.38	0.553	0.553	C	**<0.001**	-0.72	0.470	0.470
Bulk density						C	**<0.001**	-0.44	0.615	0.615	C	**<0.001**	-0.56	0.455	0.455
Clay						L	0.328	1.71	0.127	0.462	L	0.385	1.77	0.120	0.594
Silt						L	0.600	0.35	0.024	0.069	L	0.171	1.00	0.152	0.304
Sand						L	0.297	-0.06	0.161	0.524	L	0.242	-2.78	0.177	0.579

Type: the best type among linear (L), quadratic (Q) and cubic (C) polynomial models based AICc; P_{adj}: P values after adjustment based on Benjamini–Hochberg procedure; β_{fixed}: Estimate of fixed effect, i.e., Estimate of time-since-fire effect for the maximum item; R^2_c: the variance explained by the fixed effects; R^2_c: the variance explained by both fixed and random effects. Data set 2 included a fire chronosequence (n=28 in each horizon). Significant P values are in bold. NH_4^+-N, DOC, available Mo, total K and total Al in Oe were logarithm-transformed; DON, available P, available Mg, available Mn, total Fe and sand in A1 were logarithm-transformed; Moisture, DON, DOC, available K, available P, available Mn, available Mo and total Fe in A2 were logarithm-transformed, and NO_3^--N was square root-transformed.