Supporting Information for

Occurrence, region-specific distribution and potential source of legacy and novel per- and polyfluoroalkyl substances in grassland soils from remote pastoral areas, China

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Text S1 Sample pretreatment

Firstly, the collected soil samples were lyophilised, ground and sieved through an 80-mesh sieve. Then, 3 g of the weighed soil was transferred to a 15 ml polypropylene (pp) centrifuge tube, 1 ng of mass-labelled internal standard PFAS standard and 6 ml of 2.5 mM ammonium acetate methanol solution were added and vortexed until the samples were homogenized. Subsequently, the mixture was extracted by ultrasound at 40 degrees Celsius for 30 minutes. The extracted sample was placed in a centrifuge and centrifuged at 4000 rpm for 10 min and the supernatant was poured into a pear-shaped bottle. The above extraction process was repeated three times. The solid phase extraction column was activated with 4 ml of 1% ammonium hydroxide methanol solution, 4 ml of methanol, and 4 ml of Milli-Q water, respectively. The resulting extract was spun to near dryness, added to an Oasis WAX solid phase extraction column for extraction, washed with 5 ml of 2.5 mM ammonium acetate buffer and dried with a vacuum pump to improve recovery, and then eluted with 5 ml of methanol, and 5 ml of 1% ammonium hydroxide methanol solution, respectively, to elute the target PFASs. The eluates were evaporated to dryness under mild nitrogen, and re-solubilised by adding 0.5 ml of methanol. The samples were filtered through a nylon syringe filter membrane before entering the instrument for analysis.

The target PFASs were analyzed by ultrahigh-performance liquid chromatography coupled to a triple quadrupole mass spectrometry/mass spectrometry system (UPLC-MS/MS, TSQ Quantis, Thermo Fisher Scientific), with detection in the negative electrospray ionization and multiple reaction monitoring mode, with details in **Table S3**.

Text S2 Measurement of organic matter

The cleaned porcelain crucible was dried in the oven and weighed, then 4~6 g of soil sample was weighed and put into the porcelain crucible, dried in the oven at 60℃ and weighed. Subsequently, the porcelain crucible with soil samples was placed in a muffle furnace. After burning at 450°C for 24 h to the constant amount, it was placed in the desiccator, cooled to room temperature and weighed.

Table S1 The specific information of individual PFASs.

Acronym	Full name	CAS Number	Retention Time(min)	Parent Ions (m/z)	Products Irons (m/z)	Recoveries (%)
PFBA	Perfluorobutanoic acid	375-22-4	2.61	213	168.9	95-103
PFPeA	Perfluoropentanoic acid	2706-90-3	3.92	262	219	93-102
PFHxA	Perfluorohexanoic acid	307-24-4	4.64	313.1	269/169	95-99
PFHpA	Perfluoroheptanoic acid	375-85-9	5.12	363	319/169	98-103
PFOA	Perfluorooctanoic acid	335-67-1	5.49	413	369/169	97-102
PFNA	Perfluorononanoic acid	375-95-1	5.75	463	419/219	90-94
PFDA	Perfluorodecanoic acid	335-76-2	6.00	513	468.9/219	95-98
PFUdA	Perfluorodecanoic acid	2058-94-8	6.25	563	519/269	96-101
PFDoA	Perfluorododecanoic acid	307-55-1	6.39	613	568.9/318.9	84-95
PFTrDA	Perfluorotridecanoic acid	72629-94-8	6.51	663	618.9/368.9	90-94
PFTeDA	Perfluorotetradecanoic acid	376-06-7	6.63	713	668.9/318.9	95-102
PFHxDA	Perfluorohexadecanoic acid	67905-19-5	6.75	812.9	768.9/419	92-98
PFBS	Perfluorobutanesulfonic acid	375-73-3	4.16	299	99/80	98-103
PFHxS	Perfluorohexanesulfonic acid	335-46-4	5.13	399	169/99	95-101
PFHpS	Perfluoroheptanesulfonic acid	375-92-8	5.50	449	99/80	90-102
PFOS	Perfluorooctanesulfonic acid	1763-23-1	5.76	499	335/80	93-98
PFDS	Perfluorodecanesulfonic acid	335-77-3	6.26	599	99/80.1	95-102
PFOSA	Perfluorooctanesulfonamide	754-91-6	6.35	498	477.9/78	99-102
N-MeFOSA	Heptadecafluoro-N-methyloctanesulphonamide	31506-32-8	5.52	510	493.9/428	92-101
N-EtFOSA	N-ethyl perfluorooctane sulfonamide	4151-50-2	6.84	526	218.9/169	89-95
N-MeFOSAA	N-methyl perfluorooctane sulfonamidoacetic acid	2355-31-9	6.14	570	511.9/418.9	84-96
N-EtFOSAA	N-ethyl perfluorooctane sulfonamidoacetic acid	2991-50-6	6.26	584	525.9/419	96-102
8:2 FTUCA	2H-Perfluoro-2-decenoic Acid	70887-84-2	5.86	457	413/393	93-102
6:2 FTSA	6:2 fluorotelomer sulfonic acid	27619-97-2	5.14	425	169.1	94-98
8:2 FTSA	8:2 fluorotelomer sulfonic acid	39108-34-4	6.01	527	506.8/486.8	97-101
8:2 DiPAP	8:2 polyfluoroalkyl phosphoric acid diester	678-41-1	6.76	989	542.9/522.9	84-91
6:2 Cl-	6:2 chlorinated	756426-58-1	5.89	530	350.9/448.9	95-101

PFESA	polyfluoroalkyl ether sulfonic acid					
HFPO-DA	Hexafluoropropylene oxide dimer acid	13252-13-6	4.76	329	285/169	92-97
HFPO-TA	Hexafluoropropylene oxide trimer acid	13252-14-7	5.87	495	185/119	85-96
ADONA	ammonium 4,8-dioxa-3H-perfluorononanoate	919005-14-4	5.24	377	251	90-95
OBS	Sodium p-perfluorous nonenoxybenzene sulfonate	271794-15-1	6.15	602.8	171.6	92-96

Table S2 Geographical location and total concentrations (pg/g, d.w.) of different sampling sites of PFASs in soil samples

Section	Sampling sites	Longitude (E°)	Latitude (N°)	Σ_{10}Legacy PFASs	Σ_{12}Novel PFASs	Σ_{9}PFASs Precursors
Section 1	S1	118.811389	45.795833	489.71	39.08	3.25
	S2	118.825000	45.761389	741.35	71.28	5.75
	S3	118.841389	45.724167	609.58	83.94	5.58
	S4	118.819167	45.695556	1042.11	61.62	0.81
	S5	118.828889	45.661667	786.73	100.21	64.69
	S6	118.836811	45.633333	655.69	161.96	6.56
	S7	118.851111	45.610000	635.73	245.55	18.19
	S8	118.853333	45.587500	777.10	415.86	6.87
	S9	118.851389	45.568611	1023.13	26.53	5.40
	S10	118.841667	45.538056	688.04	93.41	10.20
	S11	118.844167	45.508056	602.42	39.92	35.44
	S12	118.840278	45.473611	708.58	351.85	4.33
	S13	118.853056	45.439167	833.06	86.93	12.02
	S14	118.864167	45.411944	872.30	151.03	45.69
	S15	118.866667	45.386667	1016.02	165.37	24.91
	S16	118.866111	45.359722	495.67	39.64	6.03
	S17	118.870000	45.334444	667.87	86.70	73.15
	S18	118.876111	45.308056	667.35	148.95	7.80
	S19	118.874722	45.248611	680.67	316.82	16.69
	S20	118.873056	45.246667	982.15	141.28	3.48
	S21	118.859444	45.217500	1039.69	312.99	97.93
	S22	118.844167	45.187778	1135.14	277.77	7.78
	S23	118.822222	45.156944	623.39	81.49	17.20
	S24	118.802778	45.127500	677.01	123.83	3.67
	S25	118.790833	45.095278	1078.64	419.14	97.98
	S26	118.780833	45.066667	1146.83	373.17	73.43
	S27	118.778611	45.030556	726.12	84.32	10.69
	S28	118.764167	45.008611	1029.08	122.13	8.49
	S29	118.779444	45.031389	445.39	13.29	4.59
	S30	118.678889	44.940000	647.38	440.20	7.86
	S31	118.676389	44.929722	907.11	46.07	13.27
	S32	118.632778	44.895833	355.90	57.45	18.76
	S33	118.637500	44.897778	443.98	2024.02	13.23
	S34	118.550556	44.837222	220.25	53.34	36.31
	S35	118.514167	44.811944	192.54	2253.14	399.28
	S36	118.476944	44.779444	189.72	1286.97	7.43
Section 2	S37	118.427222	44.773889	349.18	123.87	104.05
	S38	118.389652	44.769584	174.36	410.07	316.73
	S39	118.302568	44.760589	304.31	4.73	5.79
	S40	118.246389	44.756389	235.66	13.24	419.07

	S41	118.190833	44.772222	491.11	4185.93	183.12
	S42	118.127778	44.762222	172.48	1527.97	518.28
	S43	118.048333	44.747778	553.71	47.59	514.71
	S44	117.993056	44.713889	839.43	5271.11	22.24
	S45	117.925556	44.689167	298.27	15.80	2.96
	S46	117.871944	44.655000	408.53	355.81	14.19
	S47	117.799444	44.635278	225.78	7213.76	1056.94
	S48	117.709167	44.606667	286.42	25.16	1295.75
	S49	117.605368	44.605897	480.92	5548.72	788.60
	S50	117.591667	44.609722	575.52	16097.12	123.18
	S51	117.564444	44.584167	302.30	85.97	875.88
	S52	117.521944	44.558611	536.93	2094.69	303.29
	S53	117.463333	44.534444	739.58	3869.87	1159.02
	S54	117.410000	44.525278	537.96	173.54	158.83
	S55	117.357778	44.506389	503.72	1094.50	791.99
	S56	117.308889	44.485833	253.01	676.70	516.55
	S57	117.244444	44.478889	740.61	148.42	269.94
	S58	117.196111	44.470278	705.71	78.98	8.17
	S59	117.132778	44.458333	648.78	1668.35	497.81
Section 3	S60	117.065000	44.444444	1163.00	3231.00	542.13
	S61	116.995000	44.427222	463.20	153.31	1228.48
	S62	116.937500	44.416667	363.93	10.30	1520.47
	S63	116.867778	44.400833	383.65	33.56	12.98
	S64	116.815000	44.382500	512.59	41.51	821.29
	S65	116.763056	44.350000	711.58	853.35	82.86
	S66	116.704444	44.323611	681.76	584.07	81.90
	S67	116.637500	44.298611	492.16	94.77	1709.97
	S68	116.555278	44.256667	1415.69	2268.90	603.81
	S69	116.491111	44.214167	219.67	1123.42	51.32
	S70	116.430000	44.172778	233.63	19.47	10.65
	S71	116.322778	44.119167	818.77	3334.22	277.21
	S72	116.248889	44.063611	838.03	13202.04	579.25
	S73	116.173611	43.997222	561.32	476.03	464.49
	S74	116.155556	43.990556	510.39	341.14	1369.21

Table S3 LC-MS/MS instrument parameters for quantification of target PFASs.

Instrument	UltiMate 3000 UPLC system coupled to a TSQ Quantis Plus mass spectrometer (Thermo Fisher Scientific, San Jose, CA, U.S.A.)			
Chromatographic column	Hypersil GOLD C18 column (2.1mm×100mm, 1.7μm, Thermo Scientific)			
Column temperature	50℃			
Mobile phase	A: Methanol; B: Water with 5 mM ammonium acetate			
Gradint	Time(min)	Flow rate(mL/min)	A (%)	B (%)
	Initial	0.30	10	90
	6	0.30	35	65
	17	0.30	100	0
	20	0.30	10	90
	24	0.30	10	90
Ion source	Ion Source Tpye		H-ESI	
	Ion Transfer Tube Temp (℃)		300	
	Vaporizer (℃)		350	
SRM	Polarity		Negative	

Table S4 Maximum (Max), minimum (Min), median, standard Errors (SE), mean concentration (pg/g d.w.) and detection frequency (DF %) of target compounds in soil samples (n=74).

Name	Max	Min	Median	SE	Mean	DF
Legacy PFASs						
PFOA	1268.4	143.26	450.08	27.74	483.34	100%
PFNA	277.7	n.d.	36.54	5.68	53.04	93%
PFDA	53.2	n.d.	9.77	1.41	12.37	74%
PFUdA	83.7	n.d.	9.75	1.70	14.06	89%
PFDoA	25.6	n.d.	3.20	0.58	4.44	79%
PFTrDA	45.6	n.d.	3.78	0.93	6.98	81%
PFTeDA	19.60	n.d.	2.35	0.58	4.46	78%
PFHxDA	4.51	n.d.	0.18	0.09	0.51	54%
PFOS	287.32	n.d.	29.59	4.31	33.55	84%
PFDS	45.94	n.d.	n.d.	0.80	3.03	47%
Novel PFASs						
PFBA	245.03	n.d.	15.88	4.44	28.32	92%
PFPeA	184.20	n.d.	5.64	2.56	9.36	77%
PFHxA	37.60	n.d.	n.d.	1.26	6.98	44%
PFHpA	87.44	n.d.	15.50	1.99	16.96	74%
PFBS	100.49	n.d.	2.02	1.76	6.23	53%
PFHxS	18.94	n.d.	1.05	0.33	1.81	53%
PFHpS	6.43	n.d.	n.d.	0.22	1.18	32%
6:2 Cl-PFESA	20.15	n.d.	0.62	0.42	2.24	50%
OBS	45.17	n.d.	4.37	1.07	7.73	74%
ADONA	3.42	n.d.	0.34	0.09	0.60	60%
HFPO-DA	16059.97	n.d.	n.d.	317.52	1041.26	28%
HFPO-TA	754.93	n.d.	n.d.	14.69	57.01	28%
PFAS Precursors						
PFOSA	0.63	n.d.	n.d.	0.02	0.03	6.7%
N-MeFOSA	1520.47	n.d.	n.d.	45.16	228.11	34%
N-EtFOSA	101.79	n.d.	5.09	1.87	10.66	85%
N-MeFOSAA	3.56	n.d.	n.d.	0.12	0.59	28%
N-EtFOSAA	4.97	n.d.	0.98	0.15	1.27	69%
8:2 FTUCA	6.36	n.d.	n.d.	0.19	1.09	38%
8:2 FTSA	4.72	n.d.	n.d.	0.07	0.12	9.5%
8:2 DiPAP	11.87	n.d.	0.36	0.26	1.41	51%
6:2 FTSA	370.44	n.d.	n.d.	8.08	33.45	34%
Σ_{10}Legacy PFASs	1415.69	143.26	616.49	32.66	615.77	100%
Σ_{12}Novel PFASs	16097.12	n.d.	157.63	312.25	1179.68	100%
Σ_{9}PFASs Precursors	1709.97	n.d.	48.51	48.80	276.72	100%
Σ_{31}Total PFASs	16795.82	263.76	1142.80	324.91	2072.18	

Table S5 PNEC values of 12 PFASs in soil.

Compound	$PNEC_{soil}$ (pg/g)
PFOA	3676659
PFNA	3512243
PFDA	3316221
PFDoA	3101511
PFUdA	2877906
PFOS	4793849
PFBA	3600936
PFPeA	3786323
PFHxA	3838451
PFHpA	3792634
PFBS	5450125
PFHxS	5279056

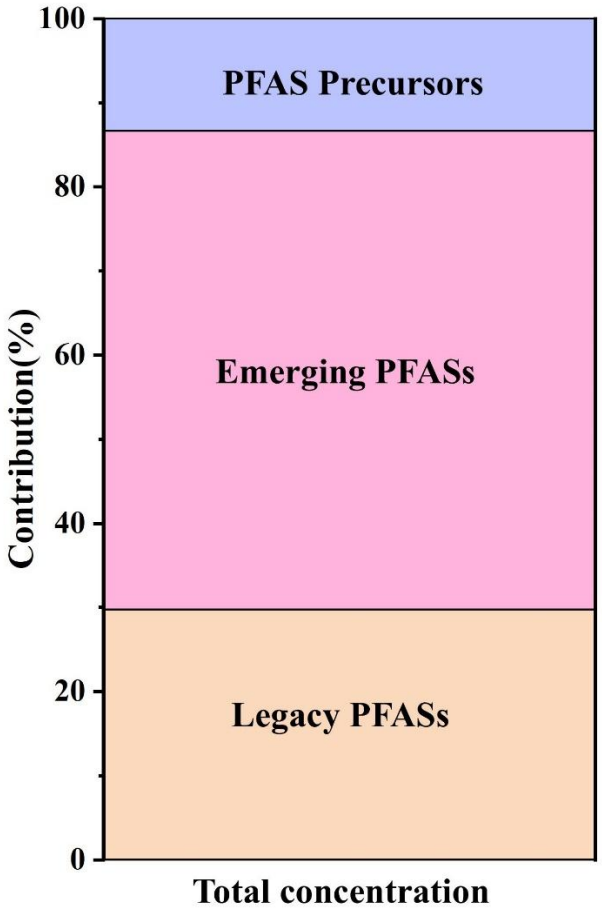

Fig. S1. The relative abundances of legacy, emerging PFASs and PFASs precursors to Σ_{31}PFASs in grassland soil.

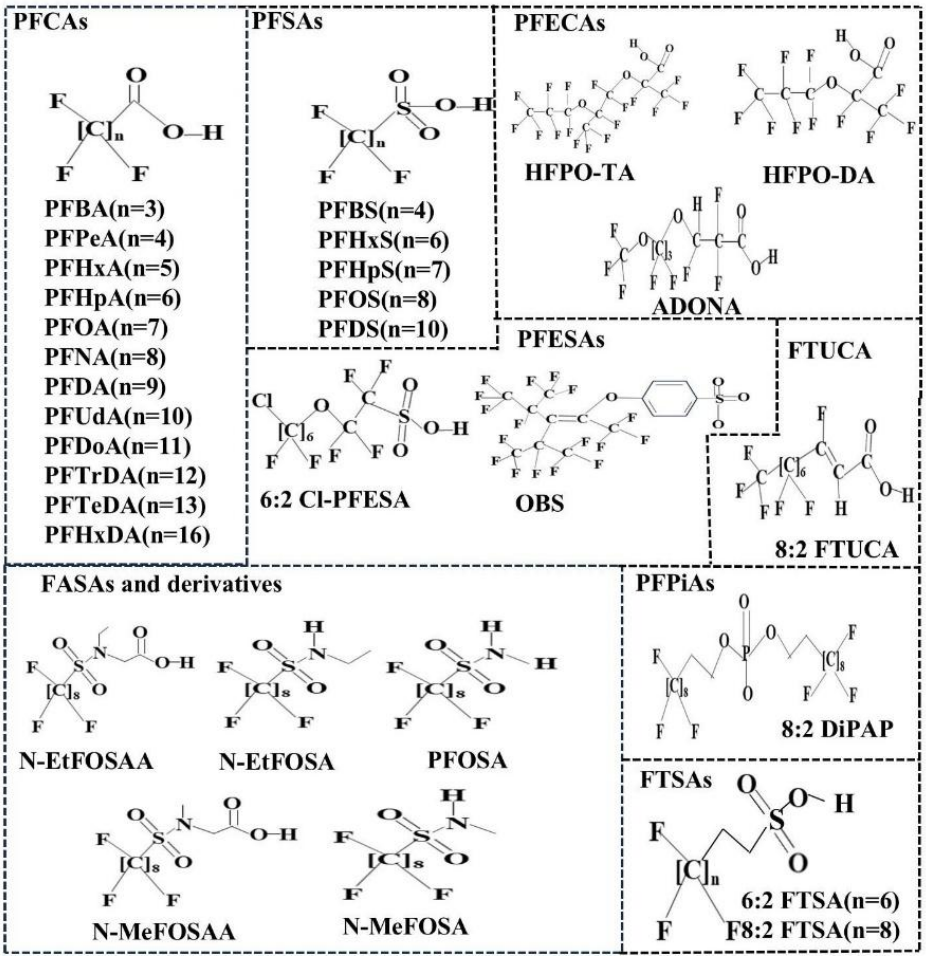

Fig. S2. Structures of the target PFASs analyzed in the current study.

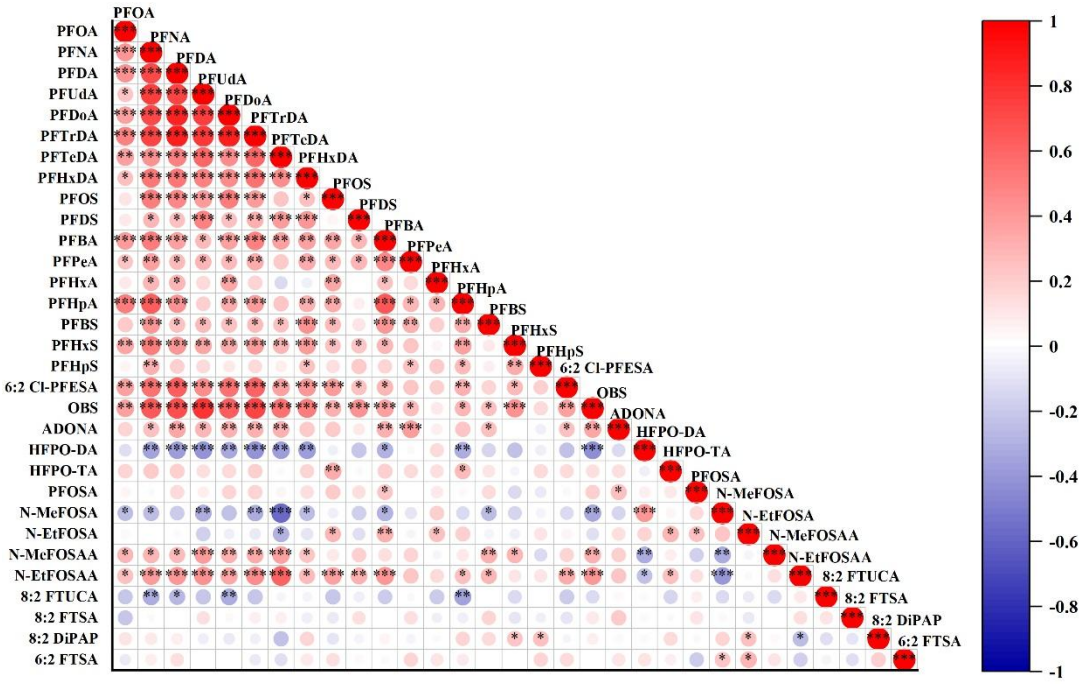

Fig. S3. Heat map showing the Pearson correlation among the 31 individual PFASs. The shade of the color represents the correlation coefficient (r), "***" indicates a significance level of $p < 0.001$, "**" shows a significance level of $p < 0.01$, "*" shows a significance level of $p < 0.05$.

(a)

	PFOA	PFNA	PFDA	PFDoA	PFUdA	PFOS	PFBA	PFPeA	PFHxA	PFHpA	PFBS	PFHxS
1	0.000098	0.000023	n.d.	0.000002	0.000010	n.d.	0.000005	0.000002	n.d.	n.d.	n.d.	0.000001
2	0.000121	0.000026	0.000015	0.000008	0.000020	0.000008	0.000004	0.000002	0.000003	0.000002	n.d.	0.000001
3	0.000136	0.000014	0.000003	0.000003	0.000003	0.000006	0.000007	0.000002	0.000003	0.000005	0.000002	n.d.
4	0.000232	0.000029	0.000005	0.000003	0.000004	0.000009	0.000005	0.000001	0.000001	0.000004	0.000001	0.000001
5	0.000173	0.000007	0.000006	0.000001	0.000007	0.000007	0.000003	0.000003	0.000004	0.000002	0.000001	n.d.
6	0.000132	0.000023	0.000005	0.000002	0.000007	0.000006	0.000018	0.000005	0.000003	0.000011	0.000001	n.d.
7	0.000122	0.000018	0.000006	0.000002	0.000007	0.000014	0.000014	0.000007	n.d.	0.000007	0.000001	n.d.
8	0.000167	0.000022	0.000004	0.000001	0.000006	0.000006	0.000033	0.000005	n.d.	0.000023	0.000003	0.000001
9	0.000227	0.000017	0.000009	0.000005	0.000014	0.000005	n.d.	n.d.	n.d.	0.000002	n.d.	0.000001
10	0.000147	0.000021	0.000003	0.000001	0.000003	0.000009	0.000011	n.d.	n.d.	0.000008	0.000001	0.000001
11	0.000127	0.000010	0.000003	0.000001	0.000004	0.000013	0.000002	0.000001	n.d.	0.000002	n.d.	n.d.
12	0.000172	0.000007	0.000001	0.000001	0.000001	0.000008	0.000015	0.000002	0.000007	0.000009	n.d.	n.d.
13	0.000187	0.000024	0.000004	0.000001	0.000006	n.d.	0.000006	n.d.	0.000006	0.000005	0.000002	n.d.
14	0.000149	0.000042	0.000009	0.000003	0.000012	0.000014	0.000016	0.000002	n.d.	0.000008	n.d.	0.000001
15	0.000160	0.000079	0.000010	0.000003	0.000012	0.000009	0.000016	0.000002	0.000008	0.000007	0.000004	n.d.
16	0.000071	0.000023	0.000010	0.000002	0.000012	0.000010	0.000002	n.d.	n.d.	0.000003	n.d.	0.000001
17	0.000145	0.000017	0.000003	0.000001	0.000005	0.000006	0.000010	0.000002	n.d.	0.000005	0.000002	n.d.
18	0.000149	0.000021	0.000002	0.000001	0.000003	0.000004	0.000024	0.000002	n.d.	0.000012	0.000001	n.d.
19	0.000122	0.000021	0.000006	0.000004	0.000015	0.000009	0.000007	n.d.	n.d.	0.000005	0.000001	n.d.
20	0.000204	0.000027	0.000008	0.000002	0.000009	0.000007	0.000014	0.000007	n.d.	0.000008	n.d.	0.000001
21	0.000223	0.000028	0.000005	0.000002	0.000006	0.000009	0.000015	0.000004	n.d.	0.000009	0.000004	0.000001
22	0.000244	0.000027	0.000007	0.000002	0.000007	0.000014	0.000003	0.000001	n.d.	0.000005	0.000014	0.000004
23	0.000155	0.000008	0.000001	n.d.	0.000001	n.d.	0.000007	0.000002	n.d.	0.000011	n.d.	n.d.
24	0.000153	0.000020	0.000003	0.000001	0.000003	n.d.	0.000014	0.000003	n.d.	0.000008	0.000001	0.000002
25	0.000211	0.000038	0.000010	0.000003	0.000013	0.000011	0.000037	0.000007	n.d.	0.000007	0.000001	n.d.
26	0.000253	0.000027	0.000006	0.000002	0.000007	0.000009	0.000068	0.000005	0.000010	0.000008	0.000003	0.000001
27	0.000182	0.000010	0.000001	n.d.	0.000002	n.d.	0.000006	0.000002	n.d.	0.000008	n.d.	0.000001
28	0.000198	0.000010	0.000009	0.000007	0.000029	0.000004	0.000016	0.000002	n.d.	n.d.	0.000002	n.d.
29	0.000110	0.000004	0.000002	0.000001	0.000003	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
30	0.000085	0.000054	0.000010	0.000003	0.000008	0.000010	0.000006	0.000049	0.000001	0.000006	0.000018	0.000001
31	0.000217	0.000019	0.000005	0.000001	0.000004	n.d.	n.d.	n.d.	n.d.	0.000006	n.d.	0.000001
32	0.000068	0.000007	0.000005	0.000002	0.000010	n.d.	0.000006	0.000004	0.000002	n.d.	n.d.	n.d.
33	0.000076	0.000014	0.000002	0.000002	0.000006	0.000014	0.000013	0.000004	0.000005	n.d.	0.000001	n.d.
34	0.000056	n.d.	n.d.	n.d.	n.d.	n.d.	0.000012	n.d.	n.d.	n.d.	n.d.	0.000001
35	0.000049	n.d.	n.d.	n.d.	n.d.	0.000002	0.000001	0.000002	n.d.	n.d.	0.000001	n.d.
36	0.000039	0.000003	n.d.	n.d.	n.d.	0.000006	0.000001	0.000001	n.d.	n.d.	n.d.	n.d.

(b)

	PFOA	PFNA	PFDA	PFDoA	PFUdA	PFOS	PFBA	PFPeA	PFHxA	PFHpA	PFBS	PFHxS
37	0.000081	n.d.	n.d.	n.d.	n.d.	0.000008	0.000028	n.d.	n.d.	0.000006	n.d.	n.d.
38	0.000044	n.d.	n.d.	n.d.	n.d.	0.000002	0.000001	n.d.	n.d.	n.d.	n.d.	n.d.
39	0.000073	0.000005	n.d.	n.d.	0.000002	0.000002	n.d.	0.000001	n.d.	n.d.	n.d.	n.d.
40	0.000058	0.000002	n.d.	n.d.	0.000002	0.000002	n.d.	0.000001	n.d.	n.d.	0.000002	n.d.
41	0.000114	0.000008	n.d.	n.d.	0.000002	0.000008	0.000001	n.d.	n.d.	n.d.	0.000001	n.d.
42	0.000044	0.000001	n.d.	n.d.	0.000000	0.000001	n.d.	0.000001	n.d.	n.d.	n.d.	n.d.
43	0.000131	0.000010	n.d.	n.d.	0.000002	0.000006	0.000002	0.000002	n.d.	0.000006	0.000001	0.000001
44	0.000223	0.000001	n.d.	n.d.	0.000001	0.000003	0.000004	0.000003	n.d.	n.d.	0.000001	n.d.
45	0.000049	0.000008	n.d.	n.d.	0.000012	0.000007	0.000001	n.d.	0.000001	n.d.	n.d.	n.d.
46	0.000084	0.000015	n.d.	n.d.	0.000006	0.000005	0.000003	0.000001	0.000002	0.000004	0.000002	n.d.
47	0.000051	0.000002	n.d.	n.d.	0.000003	0.000004	0.000002	n.d.	n.d.	n.d.	n.d.	n.d.
48	0.000051	0.000013	0.000003	0.000001	0.000004	0.000006	0.000001	0.000002	n.d.	0.000002	n.d.	n.d.
49	0.000094	0.000020	n.d.	0.000001	0.000005	0.000009	0.000002	0.000005	0.000002	0.000002	n.d.	n.d.
50	0.000132	0.000012	0.000003	0.000001	0.000003	0.000005	0.000002	0.000002	0.000002	0.000001	0.000001	n.d.

(c)

	PFOA	PFNA	PFDA	PFDoA	PFUdA	PFOS	PFBA	PFPeA	PFHxA	PFHpA	PFBS	PFHxS
51	0.000075	0.000002	n.d.	n.d.	0.000001	0.000003	0.000002	0.000001	n.d.	0.000001	n.d.	n.d.
52	0.000101	0.000017	0.000003	0.000002	0.000004	0.000015	0.000007	0.000001	0.000004	0.000005	0.000001	n.d.
53	0.000180	0.000005	0.000006	0.000001	0.000003	0.000005	0.000001	0.000004	0.000005	0.000002	n.d.	n.d.
54	0.000126	0.000007	0.000002	n.d.	0.000001	0.000007	0.000004	0.000002	n.d.	0.000004	n.d	n.d.
55	0.000117	0.000010	0.000002	0.000001	0.000001	0.000005	0.000002	0.000001	0.000004	0.000010	0.000001	n.d.
56	0.000062	n.d.	0.000001	n.d.	0.000001	0.000004	n.d.	0.000001	n.d.	n.d.	n.d.	n.d.
57	0.000175	0.000009	0.000003	0.000001	0.000003	0.000009	0.000005	0.000001	0.000005	0.000004	n.d.	n.d.
58	0.000181	0.000006	0.000003	0.000001	0.000001	n.d.	0.000002	n.d.	n.d.	0.000006	n.d.	n.d.
59	0.000159	0.000010	0.000003	0.000001	0.000004	n.d.	0.000004	0.000001	0.000001	0.000003	n.d.	n.d.
60	0.000296	0.000009	0.000002	0.000001	0.000001	0.000005	0.000003	n.d.	n.d.	0.000002	n.d.	n.d.
61	0.000102	0.000017	0.000005	0.000001	0.000002	n.d.	0.000012	n.d.	0.000009	0.000016	0.000001	0.000001
62	0.000061	0.000010	0.000007	0.000002	0.000008	0.000007	n.d.	n.d.	0.000001	n.d.	n.d.	n.d.
63	0.000071	0.000009	0.000003	0.000002	0.000003	0.000013	0.000003	n.d.	0.000001	0.000002	0.000001	n.d.
64	0.000112	0.000009	0.000005	0.000002	0.000004	0.000006	0.000003	0.000006	n.d.	n.d.	n.d.	0.000001
65	0.000096	0.000041	0.000016	0.000007	0.000010	0.000018	0.000006	0.000002	0.000007	0.000008	n.d.	n.d.
66	0.000123	0.000035	0.000008	0.000003	0.000005	0.000010	0.000010	0.000003	0.000008	0.000013	0.000002	n.d.
67	0.000074	0.000028	0.000007	0.000002	0.000005	0.000013	0.000007	0.000002	0.000005	0.000006	0.000001	0.000001
68	0.000345	0.000021	0.000003	0.000001	0.000003	0.000009	0.000010	0.000001	0.000009	0.000013	n.d.	n.d.
69	0.000057	0.000001	n.d.	n.d.	n.d.	0.000002	0.000002	n.d.	0.000001	n.d.	n.d.	n.d.
70	0.000059	n.d.	n.d.	n.d.	n.d.	0.000003	0.000003	0.000001	n.d.	0.000001	n.d.	n.d.
71	0.000214	n.d.	n.d.	0.000001	n.d.	0.000005	0.000001	n.d.	0.000001	0.000001	n.d.	n.d.
72	0.000126	0.000016	0.000005	0.000001	0.000002	0.000060	0.000019	0.000003	0.000010	0.000011	0.000001	0.000001
73	0.000119	0.000010	0.000002	0.000001	0.000001	0.000014	0.000005	0.000004	0.000002	0.000004	0.000001	n.d.
74	0.000115	0.000007	0.000003	0.000001	0.000002	0.000008	0.000009	n.d.	0.000002	0.000004	n.d.	n.d.

Fig. S4. The risk quotients of PFASs in grassland soil from Section 1 (S1-S36) (a), Section 2 (S37-S50) (b) and Section 3 (S51-S74) (c) (n.d. means the target compound was not detected).