

Effects of enhanced weathering on soil gas fluxes across UK land uses

Supplementary Materials

S1.1 Analysis of soil properties

Soil pH was measured using a Mettler Toledo MP220 pH meter (Mettler Toledo, Leicester, UK) 10 g soil was mixed with 25 mL deionised water for 60 min using an orbital shaker, then allowed to stand for a further 60 min before taking pH measurement. Immediately prior to taking measurement, the suspension was inverted several times to re-suspend the soil. Three replicate measurements were conducted per sample.

Soil was ball milled to a fine powder using a ball mill (MM200 ball mill, Retsch, Haan, Germany). Carbonates (inorganic carbon) were removed from subsamples of milled soil (60 mg) by mixing with 6 M hydrochloric acid (800 μ L) and allowing to react for 24 h. Samples were then dried for 24 h at 105 °C before elemental analysis above to estimate organic carbon. Soil total carbon, organic carbon and nitrogen was measured by elemental analysis via dry combustion (Vario EL cube, Elementar, Germany).

17 S1.2 Supplementary tables

18 **Table S1** List of targeted VOCs for analysis and their mass-to-charge ratio (m/z) in the
19 GLOVOCS database (Yáñez-Serrano et al., 2021).

VOC	Formula	(m/z)
Acetylene	C_2H_2	27.02293
Formaldehyde	CH_2O	31.01784
Isoprene/other molecules fragment	C_3H_4	41.03858
Propanol/acetic acid fragment	C_2H_2O	43.01784
Acetaldehyde	C_2H_4O	45.033
Formic acid	CH_2O_2	47.01276
Ethanol	C_2H_6O	47.049
Methanethiol	CH_4S	49.01065
Methanol (water cluster)	$CH_3O - H_2O$	51.045
Acetone	C_3H_6O	59.049
Acetic acid	$C_2H_4O_2$	61.028
Isoprene	C_5H_8	69.06988
MACR (methacrolein) or MVK (methyl vinyl ketone)	C_4H_6O	71.049
Benzene	C_6H_6	79.054
Monoterpene fragment	C_6H_8	81.06988
Toluene	C_7H_8	93.06988
Phenol	C_6H_6O	95.049
Ethylbenzene, xylene	C_8H_{10}	107.0855
Benzyl alcohol	C_7H_8O	109.0648
Monoterpenes (toluene based)	$C_{10}H_{14}$	135.1168
Monoterpenes	$C_{10}H_{16}$	137.132
Oxygenated monoterpenes (toluene based)	$C_{10}H_{14}O$	151.1117
Oxygenated monoterpenes	$C_{10}H_{18}O$	155.143
Oxygenated monoterpenes	$C_{10}H_{20}O$	157.1587
Sesquiterpenes	$C_{15}H_{24}$	205.195
Oxygenated sesquiterpenes	$C_{15}H_{26}O$	223.2056

21 **Table S2** Total VOC flux characteristics at 20 °C. Uptake, emission and net are reported in ng g⁻¹ h⁻¹.

		n	Uptake	Emission	Net	Shannon diversity index (uptake)	Shannon diversity index (emission)
Arable	Control	16	-2.04 ± 0.170	2.32 ± 0.248	0.278 ± 0.146	1.97 ± 0.140	2.52 ± 0.252
	ERW	14	-2.17 ± 0.149	2.42 ± 0.220	0.250 ± 0.144	2.08 ± 0.121	2.67 ± 0.209
	p-value		0.560	0.755	0.890	0.580	0.661
Grassland	Control	15	-2.10 ± 0.0582	41.9 ± 12.7	39.8 ± 12.7	2.14 ± 0.0395	2.69 ± 0.158
	ERW	15	-2.19 ± 0.0675	37.9 ± 19.1	35.8 ± 19.2	2.13 ± 0.0414	3.01 ± 0.181
	p-value		0.359	0.866	0.864	0.941	0.184
Forest (broadleaf)	Control	9	-2.18 ± 0.0630	1.76 ± 0.214	-0.421 ± 0.181	2.16 ± 0.0313	3.19 ± 0.0874
	ERW	9	-2.13 ± 0.0934	1.30 ± 0.186	-0.832 ± 0.120	2.17 ± 0.0259	3.20 ± 0.132
	p-value		0.694	0.127	0.079	0.834	0.935
Forest (conifer)	Control	11	-2.24 ± 0.138	1.93 ± 0.243	-0.307 ± 0.191	2.20 ± 0.0331	3.27 ± 0.0519
	ERW	10	-2.45 ± 0.108	1.70 ± 0.182	-0.753 ± 0.164	2.25 ± 0.0492	3.12 ± 0.0880
	p-value		0.238	0.454	0.093	0.396	0.168

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23 **Table S3** Mean fluxes of chemical groups of VOCs from control and ERW-treated soils of different land uses, measured at 20 °C Fluxes and
24 standard error (SE) are reported in ng g⁻¹ h⁻¹. The p-value of a two-sample Welch t-test on control and ERW samples is also reported.

			Control	Control SE	ERW	ERW SE	p-value
Arable	Hydrocarbons	Net	-0.392	0.073	-0.414	0.066	0.830
		Emission	0.582	0.076	0.603	0.065	0.838
		Uptake	-0.974	0.090	-1.016	0.077	0.725
	O-compounds	Net	0.721	0.118	0.722	0.113	0.997
		Emission	1.403	0.139	1.487	0.127	0.659
		Uptake	-0.682	0.066	-0.765	0.066	0.380
	N-compounds	Net	0.066	0.036	0.079	0.041	0.802
		Emission	0.182	0.025	0.193	0.023	0.754
		Uptake	-0.117	0.042	-0.114	0.045	0.962
	S-compounds	Net	0.055	0.009	0.045	0.005	0.385
		Emission	0.055	0.009	0.046	0.005	0.384
		Uptake	0.000	0.000	0.000	0.000	0.969
	Halogen compounds	Net	-0.059	0.021	-0.062	0.023	0.920
		Emission	0.011	0.003	0.017	0.005	0.340
		Uptake	-0.070	0.021	-0.079	0.022	0.767
	Other	Net	-0.112	0.028	-0.121	0.031	0.823
		Emission	0.082	0.010	0.075	0.008	0.587
		Uptake	-0.194	0.030	-0.196	0.031	0.965
Grassland	Hydrocarbons	Net	7.683	2.416	6.980	3.816	0.878
		Emission	8.597	2.403	7.925	3.775	0.882
		Uptake	-0.915	0.022	-0.945	0.045	0.554
	O-compounds	Net	31.020	10.132	27.705	14.965	0.856
		Emission	31.820	10.143	28.553	14.976	0.858
		Uptake	-0.801	0.058	-0.848	0.058	0.567
	N-compounds	Net	0.939	0.262	0.914	0.386	0.958
		Emission	1.014	0.252	0.995	0.377	0.967

	S-compounds	Uptake	-0.076	0.035	-0.081	0.039	0.914
		Net	0.254	0.108	0.294	0.088	0.775
		Emission	0.272	0.106	0.302	0.086	0.826
	Halogen compounds	Uptake	-0.019	0.009	-0.009	0.007	0.391
		Net	-0.023	0.020	-0.039	0.022	0.598
		Emission	0.017	0.004	0.015	0.003	0.687
	Other	Uptake	-0.040	0.018	-0.054	0.021	0.630
		Net	-0.111	0.024	-0.093	0.029	0.621
		Emission	0.144	0.016	0.158	0.024	0.607
		Uptake	-0.255	0.019	-0.251	0.024	0.902
Forest (broadleaf)	Hydrocarbons	Net	-0.572	0.057	-0.722	0.041	0.051
		Emission	0.478	0.060	0.295	0.045	0.028
		Uptake	-1.050	0.043	-1.017	0.043	0.597
	O-compounds	Net	0.099	0.117	-0.091	0.113	0.260
		Emission	0.905	0.114	0.722	0.127	0.298
		Uptake	-0.806	0.077	-0.812	0.051	0.943
	N-compounds	Net	0.075	0.087	0.070	0.058	0.966
		Emission	0.176	0.040	0.130	0.018	0.317
		Uptake	-0.101	0.058	-0.059	0.048	0.589
	S-compounds	Net	0.040	0.011	0.050	0.012	0.527
		Emission	0.041	0.011	0.051	0.011	0.531
		Uptake	-0.001	0.000	-0.001	0.000	0.906
	Halogen compounds	Net	-0.082	0.021	-0.117	0.018	0.235
		Emission	0.015	0.004	0.009	0.002	0.199
		Uptake	-0.097	0.021	-0.126	0.018	0.302
	Other	Net	0.019	0.029	-0.023	0.016	0.225
		Emission	0.143	0.029	0.094	0.012	0.143
		Uptake	-0.124	0.005	-0.117	0.012	0.619
Forest (conifer)	Hydrocarbons	Net	-0.478	0.073	-0.737	0.061	0.014
		Emission	0.558	0.083	0.395	0.054	0.117

		Uptake	-1.036	0.063	-1.131	0.036	0.211
	O-compounds	Net	0.253	0.154	0.201	0.123	0.792
		Emission	0.923	0.129	0.934	0.107	0.951
		Uptake	-0.670	0.069	-0.733	0.071	0.530
	N-compounds	Net	-0.050	0.061	-0.100	0.072	0.597
		Emission	0.185	0.028	0.161	0.023	0.499
		Uptake	-0.235	0.066	-0.261	0.069	0.790
	S-compounds	Net	0.081	0.017	0.048	0.016	0.174
		Emission	0.084	0.016	0.064	0.014	0.379
		Uptake	-0.003	0.002	-0.016	0.007	0.089
	Halogen compounds	Net	-0.018	0.016	-0.033	0.025	0.637
		Emission	0.008	0.003	0.012	0.004	0.432
		Uptake	-0.026	0.015	-0.044	0.022	0.511
	Other	Net	-0.095	0.030	-0.132	0.035	0.432
		Emission	0.170	0.022	0.131	0.013	0.150
		Uptake	-0.266	0.030	-0.264	0.035	0.967

26 **Table S4** Mean fluxes of chemical groups of hydrocarbon VOCs from control and ERW-treated soils of different land uses, measured at 20 °C
 27 Fluxes and standard error (SE) are reported in ng g⁻¹ h⁻¹. The p-value of a two-sample Welch t-test on control and ERW samples is also reported.

	DBE		Control	Control SE	ERW	ERW SE	p-value
Arable	0	Net	0	0	0	0	
		Emission	0	0	0	0	
		Uptake	0	0	0	0	
	1	Net	0.012	0.003	0.012	0.002	0.965
		Emission	0.012	0.003	0.012	0.002	0.965
		Uptake	0	0	0	0	
	2	Net	0.226	0.037	0.239	0.032	0.802
		Emission	0.269	0.033	0.279	0.028	0.809
		Uptake	-0.042	0.005	-0.041	0.004	0.759
	3	Net	-0.388	0.042	-0.411	0.038	0.687
		Emission	0.184	0.021	0.193	0.019	0.767
		Uptake	-0.572	0.057	-0.603	0.049	0.675
	≥4	Net	-0.220	0.033	-0.228	0.028	0.842
		Emission	0.116	0.021	0.118	0.018	0.960
		Uptake	-0.336	0.034	-0.346	0.029	0.824
Grassland	0	Net	0	0	7.03E-06	7.03E-06	0.334
		Emission	0	0	7.03E-06	7.03E-06	0.334
		Uptake	0	0	0	0	
	1	Net	0.185	0.035	0.198	0.054	0.852
		Emission	0.185	0.035	0.198	0.054	0.852
		Uptake	0	0	0	0	
	2	Net	5.147	1.518	4.959	2.568	0.950
		Emission	5.155	1.516	4.975	2.566	0.953
		Uptake	-0.008	0.005	-0.016	0.006	0.312
	3	Net	2.394	0.846	1.783	1.139	0.670
		Emission	2.930	0.831	2.333	1.100	0.668

	≥4	Uptake	-0.537	0.017	-0.551	0.040	0.752
		Net	-0.078	0.036	-0.005	0.052	0.259
		Emission	0.270	0.032	0.349	0.051	0.204
		Uptake	-0.348	0.008	-0.354	0.006	0.513
Forest (broadleaf)	0	Net	0	0	0	0	
		Emission	0	0	0	0	
		Uptake	0	0	0	0	
	1	Net	0.014	0.006	0.009	0.003	0.425
		Emission	0.014	0.006	0.009	0.003	0.427
		Uptake	0	0	-2.24E-05	2.24E-05	0.347
	2	Net	0.117	0.024	0.080	0.020	0.249
		Emission	0.164	0.024	0.125	0.022	0.240
		Uptake	-0.047	0.002	-0.046	0.004	0.727
	3	Net	-0.508	0.020	-0.526	0.018	0.529
		Emission	0.110	0.015	0.080	0.015	0.188
		Uptake	-0.618	0.027	-0.606	0.026	0.750
	≥4	Net	-0.168	0.028	-0.259	0.019	0.018
		Emission	0.189	0.025	0.080	0.013	0.002
		Uptake	-0.357	0.015	-0.340	0.014	0.406
Forest (conifer)	0	Net	0	0	0	0	
		Emission	0	0	0	0	
		Uptake	0	0	0	0	
	1	Net	0.016	0.003	0.010	0.002	0.117
		Emission	0.016	0.003	0.010	0.002	0.117
		Uptake	0	0	0	0	
	2	Net	0.132	0.026	0.099	0.023	0.364
		Emission	0.177	0.027	0.152	0.022	0.491
		Uptake	-0.045	0.004	-0.052	0.005	0.213
	3	Net	-0.496	0.027	-0.565	0.019	0.051
		Emission	0.111	0.020	0.095	0.015	0.525

	≥4	Uptake	-0.608	0.037	-0.660	0.020	0.230
		Net	-0.103	0.047	-0.253	0.031	0.017
		Emission	0.255	0.046	0.137	0.024	0.038
		Uptake	-0.358	0.023	-0.390	0.014	0.238

29 **Table S5** Mean emission rates ($\pm$ standard error) in $\text{ng g}^{-1} \text{h}^{-1}$ of the VOCs with the top 10 highest emission and uptake rates, as well as a selection
30 of target VOCs, from control and ERW samples of the arable soil, measured at 20 °C. Also listed is the formula assigned with GLOVOCS matching
31 mass-to-charge ratio (m/z), and proposed compounds according to GLOVOCS and previous studies of soil VOCs, as well as the p-values of the
32 two-sample Welch t-test.

Measured m/z	GLOVOCS m/z	Formula	Suggested compounds	Control	ERW	p-value
Emission						
73.065	73.065	C ₄ H ₈ O	Methyl ethyl ketone	0.701 ± 0.072	0.719 ± 0.062	0.848
43.018	43.018	C ₂ H ₂ O	Propanol fragment or acetic acid fragment	0.213 ± 0.033	0.257 ± 0.039	0.395
41.039	41.039	C ₃ H ₄	Isoprene fragment or hydrocarbon fragment	0.21 ± 0.023	0.219 ± 0.02	0.773
95.049	95.049	C ₆ H ₆ O	Phenol	0.18 ± 0.018	0.19 ± 0.015	0.683
39.023	39.023	C ₃ H ₂	Isoprene fragment or cyclopropenylidene	0.171 ± 0.019	0.179 ± 0.017	0.759
101.060	101.060	C ₅ H ₈ O ₂	Various	0.074 ± 0.008	0.076 ± 0.007	0.806
59.049	59.049	C ₃ H ₆ O	Acetone	0.062 ± 0.006	0.062 ± 0.005	0.991
69.033	69.033	C ₄ H ₄ O	Furan	0.056 ± 0.006	0.058 ± 0.005	0.750
74.067	74.071	C ₂ H ₇ N ₃	Methylguanidine	0.036 ± 0.004	0.037 ± 0.003	0.880
55.054	55.054	C ₄ H ₆	Various	0.032 ± 0.005	0.033 ± 0.004	0.859
Uptake						
53.039	53.039	C ₄ H ₄	Cyclobutadiene or butenyne	-0.572 ± 0.057	-0.603 ± 0.049	0.675
77.039	77.039	C ₆ H ₄	Alkyl fragment or benzyne	-0.296 ± 0.03	-0.304 ± 0.025	0.848
46.000	46.005	CHO ₂	Hydrocarboxyl radical	-0.253 ± 0.058	-0.298 ± 0.062	0.594
47.013	47.013	CH ₂ O ₂	Formic acid	-0.205 ± 0.021	-0.228 ± 0.02	0.423
45.994	46.029	CH ₃ NO	Formamide	-0.11 ± 0.042	-0.102 ± 0.045	0.902
204.949	204.949	C ₆ H ₅ BrO ₃	Various	-0.084 ± 0.025	-0.075 ± 0.028	0.814
44.001	44.008	CH ₃ Si	Methyl silane	-0.073 ± 0.007	-0.079 ± 0.007	0.602
30.994	31.018	CH ₂ O	Hydroxymethylene	-0.072 ± 0.019	-0.068 ± 0.017	0.856
204.941	204.941	C ₇ H ₆ BrCl	p-Bromobenzyl chloride	-0.049 ± 0.019	-0.031 ± 0.017	0.493
63.008	63.008	CH ₂ O ₃	Methaneperoxoic acid	-0.045 ± 0.005	-0.057 ± 0.005	0.118
27.023	27.023	C ₂ H ₂	Acetylene	-0.042 ± 0.005	-0.041 ± 0.004	0.759
31.018	31.018	CH ₂ O	Formaldehyde	-0.044 ± 0.014	-0.049 ± 0.016	0.811

Target compounds						
49.011	49.011	CH4S	Methanethiol	0.001 ± 0.0	0.001 ± 0.001	0.354
61.028	61.028	C2H4O2	Acetic acid	0.016 ± 0.005	0.023 ± 0.005	0.306
69.070	69.070	C5H8	Isoprene or hydrocarbon fragment	0.015 ± 0.004	0.015 ± 0.003	0.998
71.049	71.049	C4H6O	Methacrolein or methyl vinyl ketone	0.006 ± 0.001	0.005 ± 0.001	0.743
79.054	79.054	C6H6	Benzene	0.003 ± 0.001	0.002 ± 0.001	0.703
81.070	81.070	C6H8	Monoterpene fragment	0.008 ± 0.002	0.009 ± 0.002	0.842
93.070	93.070	C7H8	Toluene	0.007 ± 0.001	0.006 ± 0.001	0.682
107.086	107.086	C8H10	Xylene or ethylbenzene	0.006 ± 0.003	0.001 ± 0.001	0.118
109.065	109.065	C7H8O	Benzyl alcohol	0.002 ± 0.001	0.001 ± 0.0	0.145
135.117	135.117	C10H14	Monoterpenes (toluene-based)	0.001 ± 0.0	0.001 ± 0.0	0.701
137.132	137.132	C10H16	Monoterpenes	0.001 ± 0.0	0.001 ± 0.0	0.901
151.112	151.112	C10H14O	Oxygenated monoterpenes (toluene-based)	0.0 ± 0.0	0.0 ± 0.0	0.990

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35 **Table S6** Mean emission rates ($\pm$ standard error) in $\text{ng g}^{-1} \text{h}^{-1}$ of the VOCs with the top 10 highest emission and uptake rates, as well as a selection
36 of target VOCs, from control and ERW samples of the grassland soil, measured at 20 °C. Also listed is the formula assigned with GLOVOCS
37 matching mass-to-charge ratio (m/z), and proposed compounds according to GLOVOCS and previous studies of soil VOCs, as well as the p-values
38 of the two-sample Welch t-test.

Measured m/z	GLOVOCS m/z	Formula	Suggested compounds	Control	ERW	p-value
Emission						
59.049	59.049	C ₃ H ₆ O	Acetone	12.942 $\pm$ 4.08	13.468 $\pm$ 7.047	0.949
31.018	31.018	CH ₂ O	Formaldehyde	8.337 $\pm$ 2.686	8.661 $\pm$ 4.768	0.953
43.018	43.018	C ₂ H ₂ O	Propanol fragment or acetic acid fragment	7.532 $\pm$ 2.779	4.035 $\pm$ 2.509	0.358
41.039	41.039	C ₃ H ₄	Isoprene fragment or hydrocarbon fragment	2.997 $\pm$ 0.853	2.809 $\pm$ 1.362	0.908
39.023	39.023	C ₃ H ₂	Isoprene fragment or cyclopropenylidene	2.798 $\pm$ 0.806	2.185 $\pm$ 1.069	0.651
55.054	55.054	C ₄ H ₆	Various	1.247 $\pm$ 0.404	1.487 $\pm$ 0.916	0.813
73.065	73.065	C ₄ H ₈ O	Methyl ethyl ketone	0.96 $\pm$ 0.115	1.011 $\pm$ 0.277	0.865
61.028	61.028	C ₂ H ₄ O ₂	Acetic acid	0.94 $\pm$ 0.366	0.347 $\pm$ 0.234	0.185
27.023	27.023	C ₂ H ₂	Acetylene	0.646 $\pm$ 0.227	0.308 $\pm$ 0.198	0.271
60.052	60.056	CH ₅ N ₃	Guanidine	0.443 $\pm$ 0.14	0.45 $\pm$ 0.233	0.979
Uptake						
53.039	53.039	C ₄ H ₄	Cyclobutadiene or butenyne	-0.537 $\pm$ 0.017	-0.551 $\pm$ 0.04	0.752
46.000	46.005	CHO ₂	Hydrocarboxyl radical	-0.367 $\pm$ 0.052	-0.358 $\pm$ 0.052	0.906
77.039	77.039	C ₆ H ₄	Alkyl fragment or benzyne	-0.304 $\pm$ 0.007	-0.314 $\pm$ 0.005	0.284
47.013	47.013	CH ₂ O ₂	Formic acid	-0.272 $\pm$ 0.012	-0.29 $\pm$ 0.015	0.328
204.949	204.949	C ₆ H ₅ BrO ₃	Various	-0.107 $\pm$ 0.024	-0.118 $\pm$ 0.026	0.763
44.001	44.008	CH ₃ Si	Methyl silane	-0.075 $\pm$ 0.001	-0.078 $\pm$ 0.002	0.364
45.994	46.029	CH ₃ NO	Formamide	-0.067 $\pm$ 0.036	-0.073 $\pm$ 0.039	0.908
51.023	51.023	C ₄ H ₂	1,3-Butadiyne or diacetylene	-0.039 $\pm$ 0.001	-0.04 $\pm$ 0.001	0.643

30.994	31.018	CH ₂ O	Hydroxymethylene	-0.038 ± 0.008	-0.041 ± 0.007	0.793
63.008	63.008	CH ₂ O ₃	Methaneperoxoic acid	-0.036 ± 0.005	-0.048 ± 0.006	0.164
Target compounds						
49.011	49.011	CH ₄ S	Methanethiol	0.022 ± 0.007	0.107 ± 0.039	0.049
69.070	69.070	C ₅ H ₈	Isoprene or hydrocarbon fragment	0.166 ± 0.039	0.245 ± 0.083	0.398
71.049	71.049	C ₄ H ₆ O	Methacrolein or methyl vinyl ketone	0.053 ± 0.016	0.08 ± 0.043	0.558
79.054	79.054	C ₆ H ₆	Benzene	0.044 ± 0.013	0.046 ± 0.024	0.943
81.070	81.070	C ₆ H ₈	Monoterpene fragment	0.068 ± 0.01	0.065 ± 0.016	0.892
93.070	93.070	C ₇ H ₈	Toluene	0.015 ± 0.002	0.014 ± 0.003	0.824
95.049	95.049	C ₆ H ₆ O	Phenol	0.207 ± 0.005	0.206 ± 0.006	0.929
107.086	107.086	C ₈ H ₁₀	Xylene or ethylbenzene	0.01 ± 0.002	0.013 ± 0.003	0.433
109.065	109.065	C ₇ H ₈ O	Benzyl alcohol	0.007 ± 0.002	0.005 ± 0.002	0.593
135.117	135.117	C ₁₀ H ₁₄	Monoterpenes (toluene-based)	0.008 ± 0.001	0.011 ± 0.002	0.176
137.132	137.132	C ₁₀ H ₁₆	Monoterpenes	0.007 ± 0.001	0.008 ± 0.002	0.342
151.112	151.112	C ₁₀ H ₁₄ O	Oxygenated monoterpenes (toluene-based)	0.0 ± 0.0	0.0 ± 0.0	0.651

40 **Table S7** Mean emission rates ($\pm$ standard error) in $\text{ng g}^{-1} \text{h}^{-1}$ of the VOCs with the top 10 highest emission and uptake rates, as well as a selection
 41 of target VOCs, from control and ERW samples of the broadleaf and conifer soils, measured at 20 °C. Also listed is the formula assigned with
 42 GLOVOCS matching mass-to-charge ratio (m/z), and proposed compounds according to GLOVOCS and previous studies of soil VOCs, as well
 43 as the p-values of the two-sample Welch t-test.

Measured <i>m/z</i>	GLOVO CS <i>m/z</i>	Formula	Suggested compounds	Broadleaf control	Broadleaf ERW	Broadleaf p-value	Conifer control	Conifer ERW	Conifer p-value
Emission									
73.065	73.065	C ₄ H ₈ O	Methyl ethyl ketone	0.403 $\pm$ 0.054	0.316 $\pm$ 0.062	0.305	0.392 $\pm$ 0.066	0.414 $\pm$ 0.054	0.794
95.049	95.049	C ₆ H ₆ O	Phenol	0.172 $\pm$ 0.023	0.144 $\pm$ 0.028	0.457	0.178 $\pm$ 0.02	0.194 $\pm$ 0.022	0.602
43.018	43.018	C ₂ H ₂ O	Propanol fragment or acetic acid fragment	0.124 $\pm$ 0.022	0.094 $\pm$ 0.020	0.326	0.132 $\pm$ 0.030	0.11 $\pm$ 0.026	0.589
41.039	41.039	C ₃ H ₄	Isoprene fragment or hydrocarbon fragment	0.123 $\pm$ 0.017	0.092 $\pm$ 0.019	0.237	0.125 $\pm$ 0.019	0.116 $\pm$ 0.017	0.729
39.023	39.023	C ₃ H ₂	Isoprene fragment or cyclopropenylidene	0.098 $\pm$ 0.013	0.073 $\pm$ 0.014	0.234	0.098 $\pm$ 0.017	0.087 $\pm$ 0.013	0.615
129.070	129.070	C ₁₀ H ₈	Naphthalene or azulene	0.071 $\pm$ 0.016	0.018 $\pm$ 0.006	0.012	0.106 $\pm$ 0.021	0.039 $\pm$ 0.009	0.012
101.060	101.060	C ₅ H ₈ O ₂	Various	0.049 $\pm$ 0.003	0.041 $\pm$ 0.004	0.11	0.049 $\pm$ 0.005	0.053 $\pm$ 0.003	0.506
143.085	143.085	C ₄ H ₁₀ BF ₃ O	Trifluoroboron etherate	0.027 $\pm$ 0.018	0.006 $\pm$ 0.006	0.295	0.048 $\pm$ 0.016	0.024 $\pm$ 0.008	0.207
143.086	143.086	C ₁₁ H ₁₀	Methyl naphthalene isomers	0.042 $\pm$ 0.009	0.022 $\pm$ 0.004	0.068	0.043 $\pm$ 0.017	0.025 $\pm$ 0.011	0.377
59.049	59.049	C ₃ H ₆ O	Acetone	0.036 $\pm$ 0.004	0.025 $\pm$ 0.005	0.107	0.037 $\pm$ 0.007	0.028 $\pm$ 0.005	0.285
69.033	69.033	C ₄ H ₄ O	Furan	0.034 $\pm$ 0.005	0.027 $\pm$ 0.005	0.294	0.033 $\pm$ 0.005	0.035 $\pm$ 0.004	0.693

155.086	155.086	C ₁₂ H ₁₀	Vinyl naphthalene, biphenyl or acenaphthene	0.024 ± 0.01	0.008 ± 0.005	0.179	0.038 ± 0.014	0.023 ± 0.01	0.379
Uptake									
53.039	53.039	C ₄ H ₄	Cyclobutadiene or butenyne	-0.618 ± 0.027	-0.606 ± 0.026	0.75	-0.608 ± 0.037	-0.66 ± 0.02	0.23
46.000	46.005	CHO ₂	Hydrocarboxyl radical	-0.334 ± 0.064	-0.362 ± 0.047	0.729	-0.19 ± 0.067	-0.171 ± 0.07	0.852
77.039	77.039	C ₆ H ₄	Alkyl fragment or benzyne	-0.313 ± 0.014	-0.297 ± 0.012	0.398	-0.314 ± 0.02	-0.343 ± 0.013	0.249
47.013	47.013	CH ₂ O ₂	Formic acid	-0.269 ± 0.006	-0.261 ± 0.01	0.522	-0.265 ± 0.014	-0.294 ± 0.016	0.179
45.994	46.029	CH ₃ NO	Formamide	-0.087 ± 0.058	-0.047 ± 0.047	0.595	-0.224 ± 0.065	-0.247 ± 0.068	0.811
204.941	204.941	C ₇ H ₆ BrCl	p-Bromobenzyl chloride	-0.096 ± 0.021	-0.118 ± 0.017	0.427	-0.011 ± 0.007	-0.01 ± 0.01	0.937
204.949	204.949	C ₆ H ₅ BrO ₃	Various	0	0	N/A	-0.142 ± 0.028	-0.132 ± 0.031	0.818
44.001	44.008	CH ₃ Si	Methyl silane	-0.084 ± 0.004	-0.078 ± 0.007	0.507	-0.071 ± 0.006	-0.076 ± 0.006	0.55
30.994	31.018	CH ₂ O	Hydroxymethylene	-0.057 ± 0.005	-0.062 ± 0.008	0.655	-0.052 ± 0.006	-0.044 ± 0.008	0.426
27.023	27.023	C ₂ H ₂	Acetylene	-0.047 ± 0.002	-0.046 ± 0.004	0.722	-0.045 ± 0.004	-0.052 ± 0.005	0.213
63.008	63.008	CH ₂ O ₃	Methaneperoxoic acid	-0.046 ± 0.006	-0.046 ± 0.004	0.913	-0.052 ± 0.005	-0.055 ± 0.004	0.707
Target compounds									
31.018	31.018	CH ₂ O	Formaldehyde	-0.034 ± 0.023	-0.018 ± 0.018	0.568	-0.044 ± 0.023	-0.099 ± 0.027	0.146
49.011	49.011	CH ₄ S	Methanethiol	0	0	N/A	0.0 ± 0.0	0.0 ± 0.0	0.341

61.028	61.028	C2H4O2	Acetic acid	0.01 ± 0.003	0.007 ± 0.002	0.407	0.01 ± 0.004	0.012 ± 0.003	0.6
69.070	69.070	C5H8	Isoprene or hydrocarbon fragment	0.011 ± 0.003	0.009 ± 0.002	0.52	0.014 ± 0.002	0.01 ± 0.002	0.113
71.049	71.049	C4H6O	Methacrolein or methyl vinyl ketone	0.004 ± 0.001	0.004 ± 0.001	0.82	0.005 ± 0.001	0.005 ± 0.0	0.579
79.054	79.054	C6H6	Benzene	0.0 ± 0.0	0.0 ± 0.0	0.698	0.001 ± 0.001	-0.0 ± 0.001	0.055
81.070	81.070	C6H8	Monoterpene fragment	0.007 ± 0.002	0.004 ± 0.001	0.247	0.008 ± 0.002	0.006 ± 0.002	0.402
93.070	93.070	C7H8	Toluene	0.004 ± 0.001	0.001 ± 0.001	0.126	0.003 ± 0.001	0.003 ± 0.001	0.915
107.086	107.086	C8H10	Xylene or ethylbenzene	0.001 ± 0.0	0.001 ± 0.0	0.667	0.002 ± 0.0	0.001 ± 0.0	0.118
109.065	109.065	C7H8O	Benzyl alcohol	0	0	N/A	0.0 ± 0.0	0.0 ± 0.0	0.499
135.117	135.117	C10H14	Monoterpenes (toluene-based)	0.002 ± 0.001	0.001 ± 0.0	0.334	0.002 ± 0.001	0.0 ± 0.0	0.085
137.132	137.132	C10H16	Monoterpenes	0.002 ± 0.001	0.001 ± 0.0	0.605	0.002 ± 0.0	0.001 ± 0.0	0.036
151.112	151.112	C10H14O	Oxygenated monoterpenes (toluene-based)	0.0 ± 0.0	0.0 ± 0.0	nan	0.0 ± 0.0	0.0 ± 0.0	nan

S1.3 Supplementary figures

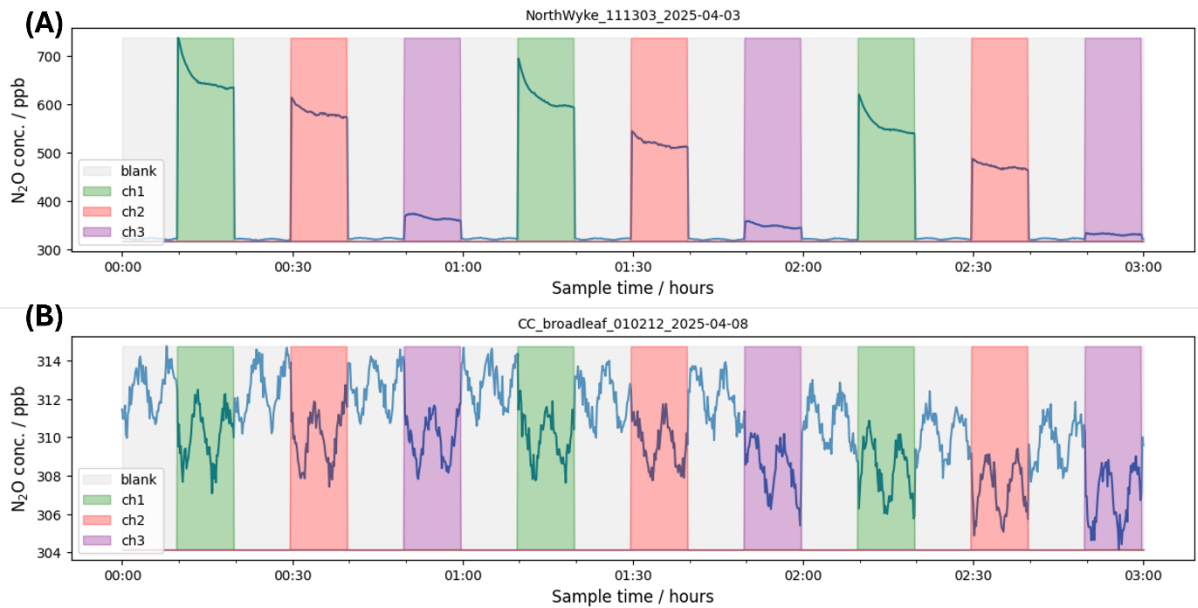


Figure S1 Concentrations of N₂O (ppb) during two sets of constant temperature (20 °C) measurements, where the chamber being measured is indicated by the coloured shading. These example plots demonstrate the sinusoidal concentration variation caused by the zero-air generator that is negligible at high chamber concentrations of N₂O (A) but noticeable at low concentrations (B).

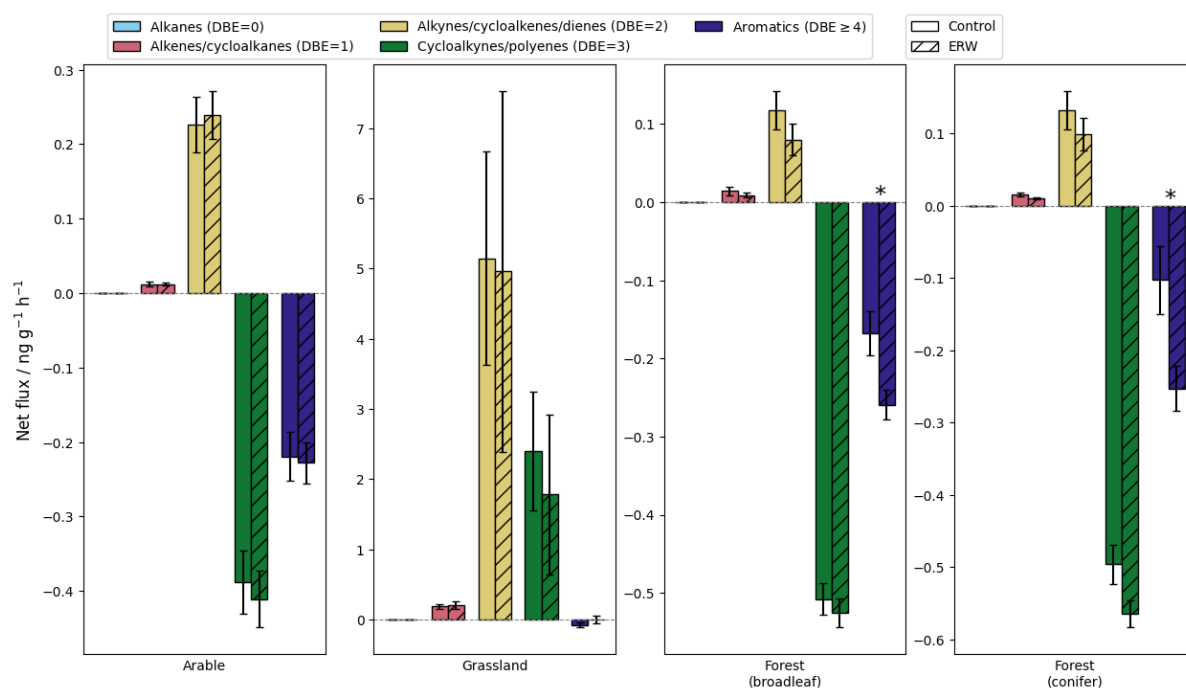


Figure S2 Net fluxes ($\text{ng g}^{-1} \text{h}^{-1}$) of hydrocarbons for control (clear bars) and ERW (hashed bars) soils from different land uses, measured at 20 °C. The error bars represent standard error. Note that grassland fluxes are represented on two separate axes due to the different scales of fluxes between hydrocarbons and O-compounds versus the other compound types. Asterisks indicate significant difference between control and ERW in Welch two-sample t-test (* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$).

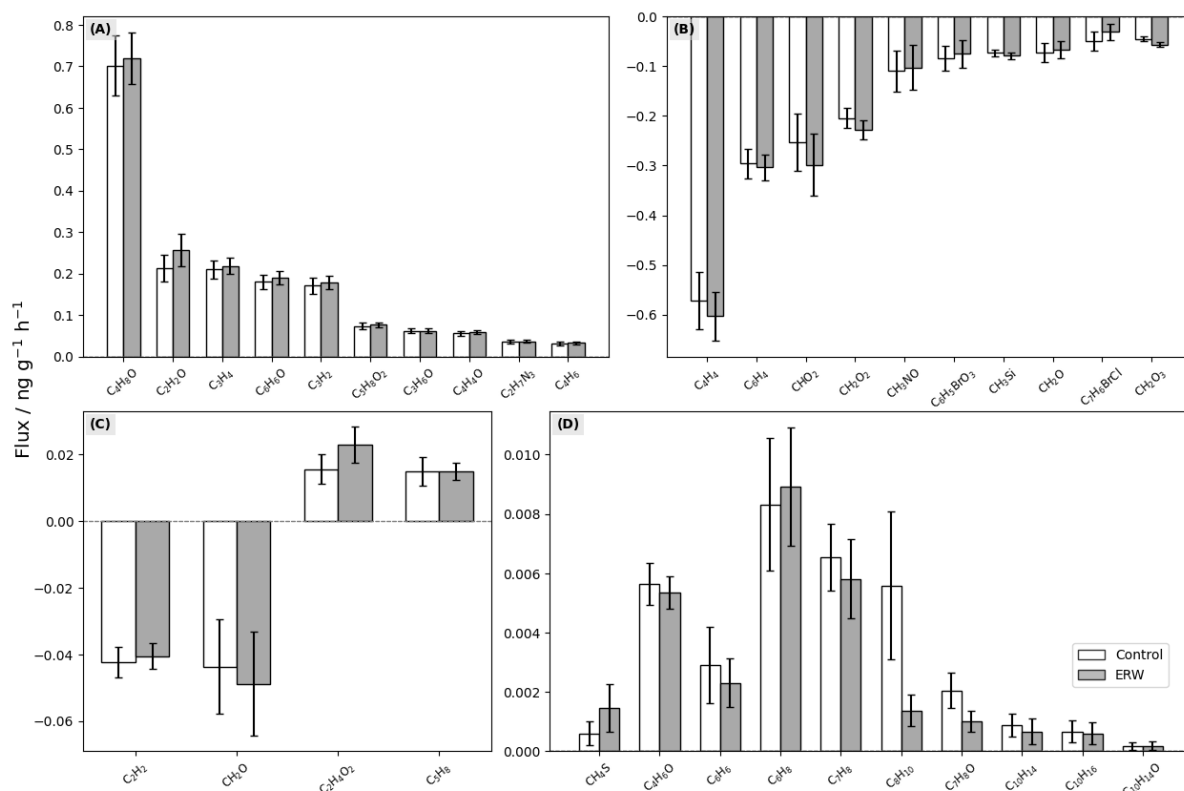


Figure S3 Fluxes of VOCs (ng g⁻¹ h⁻¹) with (A) top ten highest emission rates, (B) top ten highest uptake rates and (C, D) selected target compounds measured in control and ERW samples of arable soil at 20 °C Error bars show standard error. Asterisks indicate significant difference between control and ERW in Welch two-sample t-test (* P < 0.05, ** P < 0.01, *** P < 0.001).

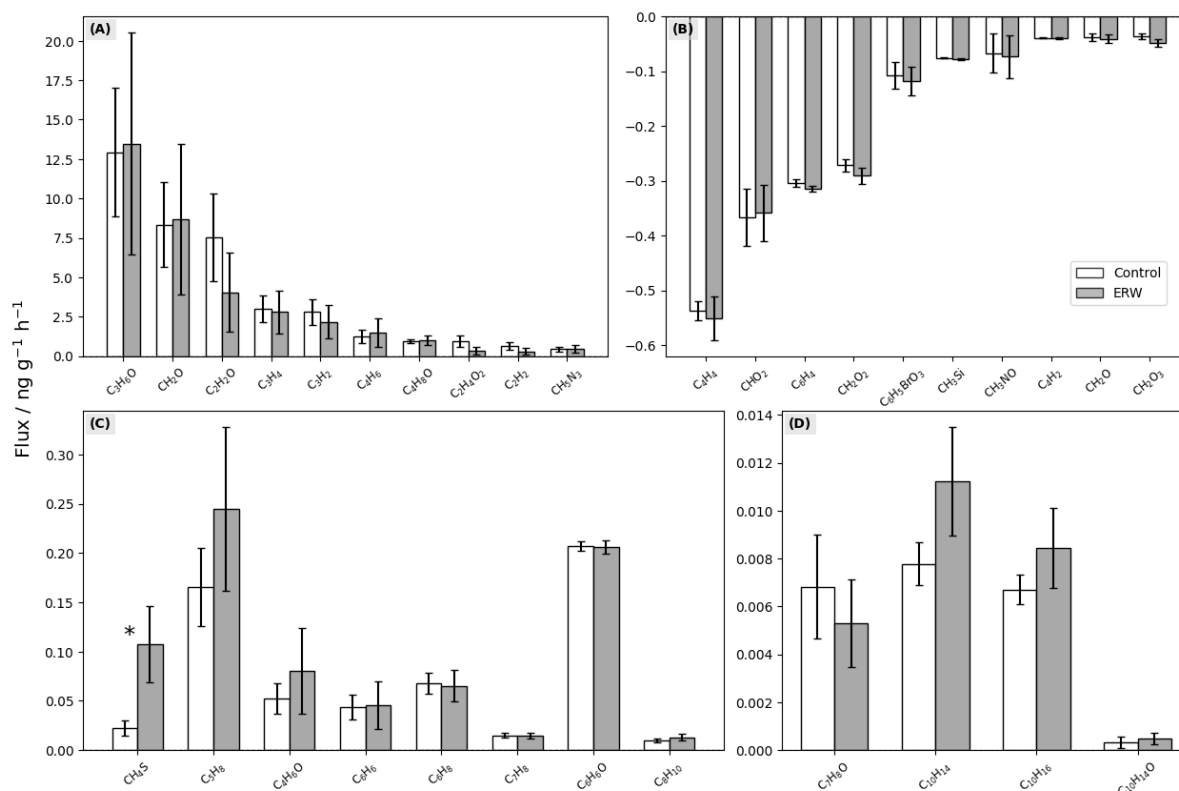


Figure S4 Fluxes of VOCs (ng g⁻¹ h⁻¹) with (A) top ten highest emission rates, (B) top ten highest uptake rates and (C, D) selected target compounds measured in control and ERW samples of grassland soil at 20 °C Error bars show standard error. Asterisks indicate significant difference

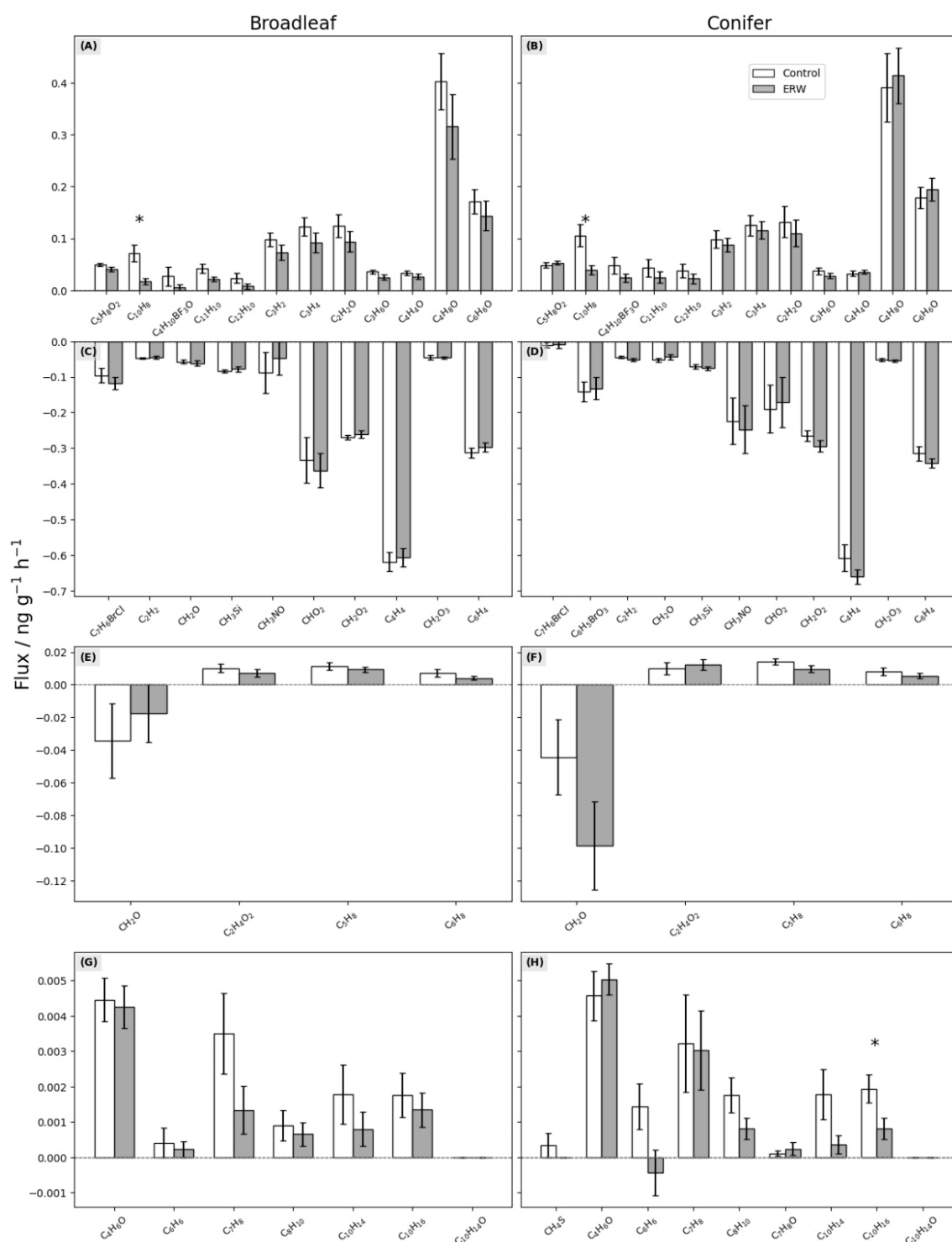


Figure S5 Fluxes of VOCs ($\text{ng g}^{-1} \text{h}^{-1}$) with (A, B) top ten highest emission rates, (C, D) top ten highest uptake rates and (E-H) selected target compounds measured in control and ERW samples of forest soils at 20 °C Subfigures A, C, E and F show the fluxes from the broadleaf soil whereas subfigures B, D, F and H show those from the conifer soil. Error bars show standard error. Asterisks indicate significant difference between control and ERW in Welch two-sample t-test (* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$).