

## Supplementary Table Captions

**Table S1.** The relative abundance of Prokaryote and fungi at phylum level under different water table treatments in short-term and long-term drainage peatlands.

								<i>p</i>		
Phyla		S2	S10	S50	L2	L10	L50	drainage age	WT	drainage age×WT
Prokaryote	Proteobacteria	44.777 ± 2.157	38.42 ± 1.504	41.181 ± 0.512	45.464 ± 1.336	40.728 ± 1.721	34.064 ± 1.874	<b>0.05</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
	Acidobacteria	25.055 ± 3.741	18.674 ± 1.095	23.533 ± 2.115	26.552 ± 1.761	15.486 ± 2.306	19.047 ± 1.532	<b>0.038</b>	<b>&lt;0.001</b>	<b>0.039</b>
	Actinobacteria	8.458 ± 0.693	9.086 ± 1.01	8.402 ± 1.508	8.729 ± 0.502	12.965 ± 0.941	8.634 ± 0.885	<b>0.002</b>	<b>&lt;0.001</b>	<b>0.002</b>
	Chloroflexi	5.736 ± 1.179	10.295 ± 0.56	8.531 ± 0.761	5.049 ± 0.901	12.233 ± 2.937	10.993 ± 0.32	<b>0.044</b>	<b>&lt;0.001</b>	0.082
	Bacteroidetes	2.263 ± 0.867	5.696 ± 0.441	2.817 ± 0.606	2.015 ± 0.32	2.517 ± 0.098	3.191 ± 0.455	<b>0.005</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>
	Crenarchaeota	1.459 ± 0.882	4.666 ± 1.245	2.81 ± 0.414	0.367 ± 0.132	2.779 ± 1.099	3.513 ± 0.359	<b>0.032</b>	<b>&lt;0.001</b>	<b>0.014</b>
	Planctomycetes	2.894 ± 0.822	1.475 ± 0.691	1.332 ± 0.676	2.62 ± 0.403	1.921 ± 0.987	2.445 ± 0.218	0.141	<b>0.014</b>	0.155
	Gemmatimonadetes	1.746 ± 0.182	1.016 ± 0.204	1.317 ± 0.151	2.262 ± 0.374	1.578 ± 0.198	1.402 ± 0.185	<b>0.001</b>	<b>&lt;0.001</b>	0.096
	Nitrospirae	1.338 ± 0.29	0.954 ± 0.295	1.568 ± 0.27	1.278 ± 0.11	1.14 ± 0.176	2.209 ± 0.267	<b>0.02</b>	<b>&lt;0.001</b>	<b>0.031</b>
	Firmicutes	0.411 ± 0.153	1.377 ± 0.208	2.183 ± 2.367	0.366 ± 0.06	0.544 ± 0.202	2.7 ± 1.462	0.799	<b>0.006</b>	0.508
	Chlorobi	0.529 ± 0.153	1.897 ± 0.346	1.231 ± 0.229	0.463 ± 0.056	1.119 ± 0.195	2.028 ± 0.172	0.859	<b>&lt;0.001</b>	<b>&lt;0.001</b>
Others	5.335 ± 0.749	6.444 ± 1.28	5.096 ± 0.512	4.835 ± 0.165	6.992 ± 0.309	8.772 ± 0.523	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	
Fungi	Ascomycota	55.303 ± 16.363	76.829 ± 4.838	85.925 ± 5.59	35.701 ± 1.25	84.374 ± 12.134	93.454 ± 2.31	0.683	<b>&lt;0.001</b>	<b>0.009</b>
	Basidiomycota	37.559 ± 15.706	13.184 ± 6.478	9.646 ± 5.278	40.737 ± 4.308	7.792 ± 8.813	3.595 ± 2.48	0.43	<b>&lt;0.001</b>	0.482
	Chytridiomycota	0.015 ± 0.012	0.63 ± 0.459	0.293 ± 0.273	0.011 ± 0.01	0.061 ± 0.05	0.043 ± 0.024	<b>0.007</b>	<b>0.024</b>	0.058
	Glomeromycota	0.961 ± 0.433	1.176 ± 0.7	0.514 ± 0.251	0.319 ± 0.077	0.803 ± 0.716	0.048 ± 0.033	<b>0.017</b>	<b>0.022</b>	0.838
	Zygomycota	0.312 ± 0.19	0.168 ± 0.085	0.11 ± 0.032	2.376 ± 2.21	0.105 ± 0.052	0.039 ± 0.019	0.099	<b>0.019</b>	<b>0.046</b>
	Unassigned	5.849 ± 2.13	8.014 ± 3.059	3.511 ± 1.705	20.852 ± 5.692	6.861 ± 2.704	2.822 ± 0.376	<b>0.003</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>

Notes: All results are means (± SE) of four replicates. Significant differences are in bold ( $p < 0.05$ ).

**Table S2.** The average GHG emission rate and temperature sensitivity ( $Q_{10}$ ) of three different water table treatments in short- and long-term drainage peatlands under two temperatures (8 °C and 18 °C).

Treatments		Greenhouse gases emission( $\mu\text{g g}^{-1} \text{d}^{-1}$ )						$Q_{10}$		
		8C°			18C°			CO2	CH4	N2O
		CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O	CO <sub>2</sub>	CH <sub>4</sub>	N <sub>2</sub> O			
Short-term drainage	S2	24.628 ± 3.464b	0.026 ± 0.006ab	0.037 ± 0.013b	45.169 ± 5.247b	0.025 ± 0.003a	0.053 ± 0.008b	1.857 ± 0.282b	0.984 ± 0.22a	1.618 ± 0.709a
	S10	58.505 ± 4.979d	0.041 ± 0.002c	0.011 ± 0.004a	99.273 ± 8.223c	0.038 ± 0.002c	0.017 ± 0.003a	1.705 ± 0.186ab	0.941 ± 0.063a	1.706 ± 0.515a
	S50	25.88 ± 3.512b	0.035 ± 0.008bc	0.011 ± 0.004a	45.364 ± 6.344b	0.035 ± 0.008bc	0.059 ± 0.028b	1.753 ± 0.042ab	1.026 ± 0.158a	5.466 ± 2.068b
long-term drainage	L2	14.29 ± 2.108a	0.025 ± 0.002a	0.006 ± 0.001a	30.4 ± 1.411a	0.022 ± 0.002a	0.015 ± 0.008a	2.153 ± 0.24b	0.91 ± 0.107a	2.386 ± 1.12a
	L10	34.687 ± 1.91c	0.033 ± 0.004ac	0.008 ± 0.003a	46.528 ± 4.839b	0.029 ± 0.002ab	0.012 ± 0.003a	1.342 ± 0.123a	0.891 ± 0.15a	1.422 ± 0.205a
	L50	23.777 ± 3.789b	0.026 ± 0.001ab	0.005 ± 0.001a	50.779 ± 3.812b	0.024 ± 0.003a	0.009 ± 0.001a	2.163 ± 0.255b	0.9 ± 0.118a	1.673 ± 0.383a
<i>p</i>	drainage age	<b>&lt;0.001</b>	<b>0.003</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.189	0.175	<b>0.018</b>
	WT	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.001</b>	<b>0.007</b>	<b>&lt;0.001</b>	0.805	<b>0.003</b>
	drainage	<b>&lt;0.001</b>		<b>&lt;0.001</b>	<b>&lt;0.001</b>	0.089	<b>0.006</b>	<b>0.003</b>	0.868	<b>0.001</b>
	age×WT		0.229							

Notes: All results are means (± SE) of four replicates. Significant differences are in bold ( $p < 0.05$ ).

**Table S3.** Soil DOC and TDN concentration variations under different water table (WT) treatments in short-term and long-term drainage peatlands.

	Short-term drainage			long-term drainage			<i>p</i>		
	S2	S10	S50	L2	L10	L50	drainage age	WT	drainage age×WT
8°C-DOC	58.797±9.786	370.456±73.244	400.066±101.392	29.122±10.17	120.425±86.963	212.999±65.166	<b>&lt;0.001</b>	<b>&lt;0.001</b>	<b>0.013</b>
18°C-DOC	-34.88±21.705	141.98±63.323	122.509±37.549	11.133±13.294	91.15±106.159	78.415±28.563	0.477	<b>&lt;0.001</b>	0.174
8°C-TDN	272.379±74.195	64.19±24.364	83.975±39.761	325.202±74.348	52.247±12.581	46.68±14.523	0.952	<b>&lt;0.001</b>	0.177
18°C-TDN	312.724±76.456	56.775±17.205	114.45±95.352	443.545±115.595	80.661±22.142	42.575±11.335	0.345	<b>&lt;0.001</b>	<b>0.031</b>

Notes: All results are means (± SE) of four replicates. Significant differences are in bold ( $p < 0.05$ ).

**Table S4.** Data on soil and plant properties in short-term and long-term drained peatlands.

		Short-term drainage			Long-term drainage		
		S2	S10	S50	L2	L10	L50
Soil properties	SWC (%)	207.76 ± 20.9	376.92 ± 9.17	317.37 ± 12.14	191.36 ± 12.14	261.26 ± 15.78	221.83 ± 13.53
	pH	5.71 ± 0.02	5.75 ± 0.1	6.05 ± 0.16	5.28 ± 0.16	5.9 ± 0.05	5.92 ± 0.13
	TC (%)	21.97 ± 1.39	27.5 ± 1.36	20.8 ± 1.85	21.34 ± 1.85	23.72 ± 1.51	21.98 ± 0.94
	TN (%)	1.78 ± 0.15	2.09 ± 0.03	1.64 ± 0.09	1.74 ± 0.09	1.86 ± 0.1	1.78 ± 0.03
	Soil C/N	12.35 ± 0.29	13.15 ± 0.52	12.73 ± 1.06	12.26 ± 1.06	12.78 ± 0.56	12.37 ± 0.38
	DOC (mg C kg <sup>-1</sup> )	306.09 ± 13.12	398.05 ± 16.21	312.72 ± 15.54	330.79 ± 15.54	435.21 ± 28.92	260.02 ± 16.43
	DON (mg N kg <sup>-1</sup> )	65 ± 15.91	102.65 ± 16.4	94.51 ± 16.4	67.07 ± 16.4	121.09 ± 6.41	81.23 ± 14.08
	TDN (mg N kg <sup>-1</sup> )	175.63 ± 11.13	154.52 ± 10.05	154.07 ± 26.55	179.31 ± 26.55	167.31 ± 9.27	119.36 ± 12.3
	NH <sub>4</sub> <sup>+</sup> -N (mg N kg <sup>-1</sup> )	99.65 ± 19.02	45.88 ± 12.23	52.81 ± 12.18	87.94 ± 12.18	43.12 ± 10.92	33.49 ± 3.33
	NO <sub>3</sub> <sup>-</sup> -N (mg N kg <sup>-1</sup> )	10.99 ± 3.67	5.99 ± 1.65	6.75 ± 4.44	24.3 ± 4.44	3.1 ± 1.44	4.64 ± 1.89
	MBC (g C kg <sup>-1</sup> )	1.5 ± 0.06	1.42 ± 0.1	1.99 ± 0.37	3.05 ± 0.37	2.18 ± 0.58	1.41 ± 0.21
	MBN (mg N kg <sup>-1</sup> )	91.2 ± 14.14	140.41 ± 18.95	141.07 ± 27.5	141.19 ± 27.5	157.83 ± 49.88	77.02 ± 9.36
	Microbial C:N	16.73 ± 2.87	10.27 ± 1.76	16.5 ± 2.21	21.91 ± 2.21	14.12 ± 2.5	18.29 ± 2.03
	BG (nmol h <sup>-1</sup> g <sup>-1</sup> )	256.49 ± 73.01	413.33 ± 221.26	283.67 ± 31.35	252.55 ± 31.35	248.38 ± 81.66	156.86 ± 73.11
	CBH (nmol h <sup>-1</sup> g <sup>-1</sup> )	113.04 ± 18.89	81.6 ± 22.57	48.48 ± 26.36	115.72 ± 26.36	130.06 ± 40.05	73.87 ± 16.37
	POX (μmol h <sup>-1</sup> g <sup>-1</sup> )	1.03 ± 0.1	0.96 ± 0.17	0.62 ± 0.16	0.74 ± 0.16	1.11 ± 0.13	1.01 ± 0.14
	PER (μmol h <sup>-1</sup> g <sup>-1</sup> )	5.54 ± 1.01	14.68 ± 1.78	6.4 ± 0.75	6.49 ± 0.75	7.73 ± 0.67	6.54 ± 0.6
Plant properties	Number of species	9	6	7	6	7	7
	Total coverage	95%	80%	70%	98%	75%	90%
	Aboveground biomass (g/m <sup>2</sup> )	555.68	422.40	400.60	191.44	354.60	343.76
	Shannon's index	1.80	1.48	1.72	1.43	1.53	1.58
	Species evenness	0.82	0.83	0.88	0.80	0.79	0.81