

Physicochemical properties and oxidoreductive enzymes activity of undrained and drained peatlands

Table S1. Physicochemical properties of undrained peatlands: Mukhrino; Tagan Mire 1; Stążka Mire in 0–50 cm and 50–100 cm layers.

Physicochemical properties	Mukhrino				Tagan Mire 1		Stążka Mire	
	Bog peat		Fen peat		Fen peat		Fen peat	
	Layers (cm)		Layers (cm)		Layers (cm)		Layers (cm)	
	0–50	50–100	0–50	50–100	0–50	50–100	0–50	50–100
Age (AD/BC)	AD 712–780				BC 4594–3979		AD 655–779	
Moisture (%)	88.13±4.19	93.09±3.07	81.92±4.28	86.20±2.72	86.57±3.54	90.45±4.07	90.05±4.04	91.95±4.47
Ash content (%)	3.67±0.22	5.43±0.29	4.68±0.15	9.18±0.73	4.93±0.27	7.18±0.28	2.42±0.25	4.68±0.27
Bulk density (g cm ⁻³)	0.09±0.01	0.11±0.01	0.11±0.01	0.16±0.01	0.11±0.01	0.12±0.01	0.09±0.01	0.11±0.01
Porosity (%)	93.00±2.88	92.57±4.90	91.90±3.78	88.88±2.92	92.75±5.46	92.53±5.09	93.00±4.63	92.57±3.48
pH (1M KCl)	2.40–3.28	2.41–2.77	3.72–4.43	3.75–4.33	4.83–5.21	4.71–5.32	5.61–5.79	7.04–7.26
CHWE (g kg ⁻¹)	15.33±0.62	14.67±0.86	14.64±0.70	10.12±0.54	10.34±0.63	7.18±0.27	10.08±0.61	5.40±0.25
TOC (g kg ⁻¹)	413.68±20.64	437.54±19.25	416.93±15.05	447.45±26.01	417.90±16.80	433.40±23.14	544.15±24.32	561.63±28.92
TN (g kg ⁻¹)	12.10±0.85	11.16±0.80	16.13±0.89	13.66±0.62	30.24±1.92	25.76±1.26	21.41±1.35	19.36±0.92
N-NH ₄ ⁺ (mg kg ⁻¹)	27.30±0.96	18.64±0.83	37.86±1.25	28.94±1.03	57.46±2.24	42.75±1.92	17.49±0.55	17.31±0.75
N-NO ₃ ⁻ (mg kg ⁻¹)	26.53±0.84	15.96±0.76	32.14±1.37	22.78±0.67	28.46±1.38	31.15±1.64	12.33±0.43	15.01±0.77
C/N	34.19±1.29	39.20±1.99	25.85±1.04	32.76±1.32	13.82±0.54	16.81±0.77	25.42±0.95	29.01±1.76

$\bar{X} \pm \Delta \bar{X}$ – confidence interval of average at confidence level $\alpha=0.05$ for n-1 degree of freedom

Table S2. Physicochemical properties of drained peatlands: Wrześnica River valley; General Dezydery Chłapowski Landscape Park 1, 2, 3, 4; Tagan Mire; Great Batorowskie; Zieleniec Mire in 0–50 cm and 50–100 cm layers.

Physicochemical properties	Wrześnica River valley				General Dezydery Chłapowski Landscape Park								Tagan Mire 2		Great Batorowskie		Zieleniec Mire	
	Fen peat				Fen peat								Peat-moorsh		Bog peat		Fen peat	
	1		2		1		2		3		4							
	Layers (cm)		Layers (cm)		Layers (cm)		Layers (cm)		Layers (cm)		Layers (cm)		Layers (cm)		Layers (cm)		Layers (cm)	
	0–50	50–100	0–50	50–100	0–50	50–100	0–50	50–100	0–50	50–100	0–50	50–100	0–50	50–100	0–50	50–100	0–50	50–100
Age (yr)	BC 549–398				-								BC 4594–3979		BC 4225–3961		BC 166–AD 20	
Moisture (%)	64.60±2.64	75.15±2.95	52.92±1.82	70.86±2.93	68.29±2.04	81.21±4.18	71.95±3.19	83.60±3.55	75.28±3.36	86.44±2.59	77.66±3.54	80.75±4.04	83.85±5.14	88.43±2.58	82.95±2.80	90.97±2.60	84.38±4.82	93.14±5.50
Ash content (%)	57.23±1.65	38.18±1.37	57.58±2.22	35.23±1.39	50.30±2.05	22.25±1.03	37.23±1.41	17.43±0.55	42.28±2.33	12.35±0.75	42.40±2.53	20.68±1.23	22.40±0.94	10.30±0.44	7.53±0.46	2.45±0.17	5.48±0.22	2.78±0.08
Bulk density (g cm ⁻³)	0.32±0.01	0.24±0.01	0.32±0.01	0.23±0.01	0.29±0.01	0.18±0.01	0.24±0.01	0.16±0.01	0.26±0.01	0.14±0.01	0.26±0.01	0.17±0.01	0.18±0.01	0.13±0.01	0.12±0.01	0.09±0.01	0.11±0.01	0.10±0.01
Porosity (%)	84.60±3.46	87.22±3.45	84.85±4.14	87.66±5.22	84.00±3.94	89.00±4.01	85.00±2.56	90.00±4.12	84.00±2.78	91.00±3.36	83.00±3.03	89.00±3.75	89.00±5.25	91.00±2.56	92.14±4.31	93.68±2.68	92.68±3.91	93.47±2.73
pH (1M KCl)	5.54–6.44	5.64–6.14	5.52–6.31	5.49–6.02	5.13–5.30	5.69–5.91	5.78–5.91	5.81–5.83	6.28–6.64	5.71–6.30	4.63–5.29	5.86–6.09	5.14–5.42	5.81–5.95	2.50–2.68	2.64–2.85	2.55–2.81	2.75–2.92
CHWE (g kg ⁻¹)	5.29±0.18	4.18±0.17	4.32±0.16	3.98±0.18	8.49±0.29	4.58±0.18	11.16±0.55	8.02±0.43	8.31±0.27	5.94±0.26	13.02±0.64	6.17±0.32	10.32±0.51	6.65±0.38	20.20±1.02	16.14±0.71	14.99±0.69	11.20±0.44
TOC (g kg ⁻¹)	208.10	332.27	144.01	252.67	328.98	475.55	409.32	479.84	369.95	497.40	425.6	496.79	395.70	425.10	479.34	502.24	472.50	496.45
	±8.76	±7.91	±7.21	±7.53	±15.73	±20.26	±18.58	±16.65	±17.54	±16.51	0±15.02	±13.16	±18.60	±12.58	±22.82	±11.55	±14.69	±24.23
TN (g kg ⁻¹)	16.20±0.58	17.70±0.62	12.32±0.38	18.75±0.64	22.75±0.54	24.61±0.50	25.82±1.27	27.66±1.11	21.40±0.78	27.18±1.02	24.54±1.26	27.58±0.91	29.32±1.23	30.80±1.34	12.63±0.27	9.11±0.28	12.88±0.44	9.87±0.29
N-NH ₄ ⁺ (mg kg ⁻¹)	2.65±0.06	3.33±0.13	5.66±0.28	7.44±0.37	11.09±0.24	14.84±0.56	16.61±0.69	20.91±0.73	15.77±0.72	19.21±0.48	18.14±0.55	23.83±0.82	47.90±1.89	76.99±3.47	20.97±0.73	39.82±1.99	41.60±1.84	70.71±1.97
N-NO ₃ ⁻ (mg kg ⁻¹)	2.18±0.08	1.69±0.07	2.76±0.13	2.46±0.10	9.57±0.21	7.02±0.14	8.56±0.31	8.08±0.26	10.37±0.38	9.49±0.29	15.38±0.73	12.03±0.56	11.20±0.39	10.01±0.48	15.45±0.38	25.64±0.84	22.28±0.86	37.84±1.07
C/N	12.84±0.57	18.77±0.47	11.69±0.31	13.48±0.44	14.46±0.40	19.32±0.47	15.85±0.52	17.35±0.53	17.29±0.40	18.30±0.78	17.34±0.74	18.01±0.47	13.50±0.53	13.80±0.27	37.95±1.54	55.13±2.27	36.68±3.92	50.30±4.82

$\bar{X} \pm \Delta \bar{X}$ – confidence interval of average at confidence level $\alpha=0.05$ for n-1 degree of freedom.

Table S3. Oxidoreductive enzymes activity of undrained peatlands: Mukhrino; Tagan Mire 1; Stażka Mire in 0–50 cm and 50–100 cm layers.

Oxidoreductive enzymes activity	Mukhrino						Tagan Mire 1			Stażka Mire		
	Bog peat			Fen peat			Fen peat			Fen peat		
	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers
	0–50	50–100		0–50	50–100		0–50	50–100		0–50	50–100	
Xanthine oxidase ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	19.55±0.51	15.73±0.81	↓ 20	10.51±0.27	8.39±0.41	↓ 19	37.43±1.06	27.22±0.64	↑ 38	23.03±0.47	16.25±0.40	↓ 29
Urate oxidase ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	-	-	-	-	-	-	-	-	-	14.27±0.50	9.76±0.37	↓ 32
Phenol oxidase ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	31.03±0.65	29.23±0.82	↓ 6	33.84±0.83	32.08±1.52	↓ 5	13.80±0.29	6.18±0.25	↓ 55	70.89±3.27	56.39±1.25	↓ 21
Peroxidase ($\text{nmol h}^{-1} \text{g}^{-1}$)	7.16±0.32	6.52±0.23	↓ 9	9.22±0.24	8.06±0.41	↓ 13	6.40±0.25	4.30±0.10	↓ 33	5.70±0.25	3.80±0.09	↓ 34
Nitrate reductase ($\text{nmol h}^{-1} \text{g}^{-1}$)	0.11±0.01	0.07±0.01	↓ 36	0.09±0.01	0.06±0.01	↓ 33	0.98±0.03	1.43±0.07	↑ 46	2.20±0.06	3.85±0.08	↑ 75

↓ - % decrease of oxidoreductive enzyme activities in depth, ↑ - % increase of oxidoreductive enzyme activities in depth, $\bar{X} \pm \Delta \bar{X}$ – confidence interval of average at confidence level $\alpha=0.05$ for n-1 degree of freedom.

Table S4. Oxidoreductive enzymes activity of drained peatlands: Wrześnica River valley; General Dezydery Chłapowski Landscape Park 1, 2, 3, 4; Tagan Mire 2; Great Batorowskie; Zielieniec Mire in 0–50 cm and 50–100 cm layers.

Oxidoreductive enzymes activity	Wrześnica River valley						General Dezydery Chłapowski Landscape Park												Tagan Mire 2		Great Batorowskie		Zieleniec Mire				
	Fen peat						Fen peat												Peat-moorsh		Bog peat		Fen peat				
	1		2		1		2		3		4																
	Layers (cm)		% changes between n layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers	Layers (cm)		% changes between layers			
	0–50	50–100		0–50	50–100		0–50	50–100		0–50	50–100		0–50	50–100		0–50	50–100		0–50	50–100		0–50	50–100		0–50	50–100	
Xanthine oxidase ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	7.12 ±0.36	11.54± 0.41	↑ 62	9.31 ±0.54	13.54 ±0.69	↑ 45	5.32 ±0.15	9.70 ±0.22	↑ 82	4.02 ±0.16	8.79 ±0.25	↑ 118	7.28 ±0.26	14.49 ±0.53	↑ 99	5.23 ±0.27	8.04 ±0.20	↑ 54	22.73 ±1.14	33.61 ±1.45	↑ 48	8.88 ±0.20	16.65 ±0.65	↑ 88	12.75 ±0.60	21.48 ±0.99	↑ 68
Urate oxidase ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	29.79 ±1.28	45.04 ±0.86	↑ 51	26.37 ±1.23	36.99 ±0.84	↑ 40	25.84 ±0.57	39.72 ±0.77	↑ 50	34.12 ±1.44	48.50 ±1.93	↑ 51	21.57 ±1.12	31.01 ±1.17	↑ 44	31.09 ±1.57	55.63 ±1.11	↑ 79	-	-	-	50.65 ±2.16	23.67 ±1.22	↓ 53	25.54 ±0.52	11.40 ±0.22	↓ 55
Phenol oxidase ($\mu\text{mol h}^{-1} \text{g}^{-1}$)	14.16 ±0.31	19.51 ±0.96	↑ 38	18.14 ±0.42	24.41 ±1.02	↑ 35	12.38 ±0.37	22.36 ±0.92	↑ 81	21.43 ±0.93	29.39 ±1.28	↑ 37	24.35 ±0.99	35.88 ±1.01	↑ 41	20.83 ±0.47	31.56 ±1.39	↑ 52	9.85 ±0.22	17.65 ±0.88	↑ 79	50.10 ±1.61	81.15 ±2.99	↑ 62	40.89 ±1.44	81.64 ±2.49	↑ 100
Peroxidase ($\text{nmol h}^{-1} \text{g}^{-1}$)	1.06 ±0.04	2.19 ±0.10	↑ 107	0.95 ±0.05	1.66 ±0.03	↑ 75	2.53 ±0.10	3.03 ±0.08	↑ 20	3.20 ±0.13	4.83 ±0.23	↑ 51	2.75 ±0.07	3.65 ±0.13	↑ 33	3.18 ±0.15	5.55 ±0.19	↑ 74	5.90 ±0.18	7.50 ±0.28	↑ 27	13.91 ±0.66	22.34 ±0.57	↑ 61	8.33 ±0.32	14.07 ±0.56	↑ 69
Nitrate reductase ($\text{nmol h}^{-1} \text{g}^{-1}$)	1.82 ±0.06	0.86 ±0.04	↓ 53	4.82 ±0.12	2.14 ±0.09	↓ 56	1.68 ±0.06	1.11 ±0.05	↓ 34	1.32 ±0.05	0.94 ±0.04	↓ 29	1.20 ±0.05	0.78 ±0.02	↓ 35	1.74 ±0.04	0.68 ±0.03	↓ 61	1.02 ±0.04	0.58 ±0.02	↓ 43	0.15 ±0.01	0.24 ±0.01	↑ 60	0.30 ±0.01	0.51 ±0.01	↑ 70

↓ - % decrease of oxidoreductive enzyme activities in depth, ↑ - % increase of oxidoreductive enzyme activities in depth, $\bar{X} \pm \Delta \bar{X}$ – confidence interval of average at confidence level $\alpha=0.05$ for n-1 degree of freedom.