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Supplement of

Contrasting potential for biological N_2 fixation at three polluted central European *Sphagnum* peat bogs: combining the $^{15}N_2$-tracer and natural-abundance isotope approaches

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Supplement:

Fig. S1. Boxplots of $\delta^{15}N$ values of various forms of atmospheric N_r deposition. Different letters mark statistically different sample types ($p < 0.05$).

Fig. S2. Fluctuations of water table level at BRU and UHL.

Fig. S3. Schematic sketch suggesting a strategy for testing whether a discrepancy between $\delta^{15}N$ values of atmospheric deposition and living *Sphagnum* can be related to biological N_2-fixation. The vertical axis shows randomly selected numbers of $\delta^{15}N$ observations. Simplified from Novak et al. (2019).

Table S1. Nitrogen concentration and $\delta^{15}N$ values of living *Sphagnum* samples.

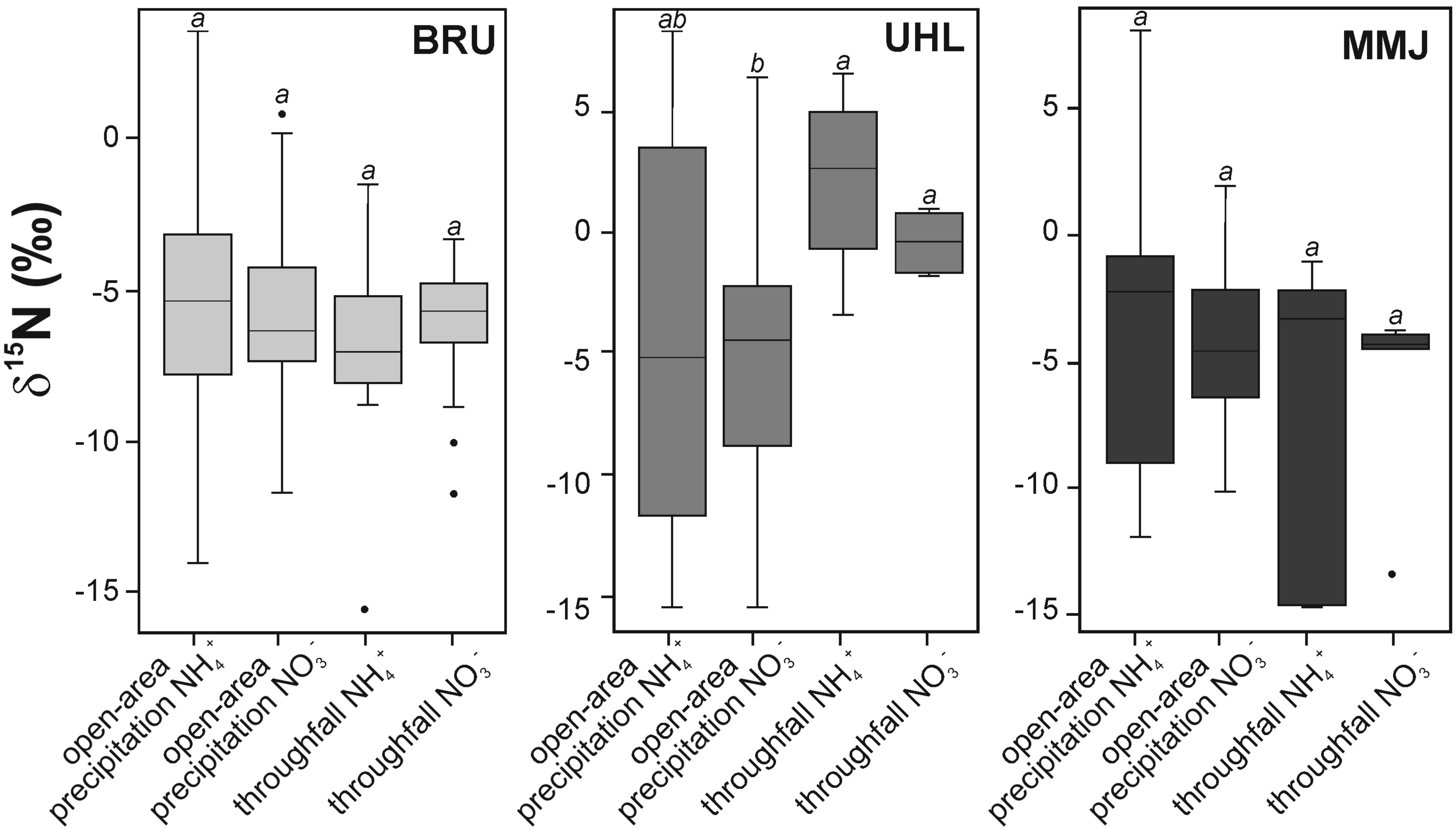
Table S2. Concentrations and isotope composition of liquid N_r forms.

Table S3. Comparison of concentrations of major chemical species in atmospheric deposition, surface runoff and bog water at the study sites. N : P ratios of atmospheric input are based on vertical wet deposition. Data from October 2018.

Table S4. Chemical characteristics and $\delta^{15}N$ values of peat core samples.

Table S5. Rates of biological N_2-fixation (BNF) in pristine and polluted Sphagnum bogs compiled from recent literature. ARA – acetylene reduction assay.

Supplement. Methodology of chemical analysis of liquid and solid samples.



BRU
UHL
MMJ
δ15N (‰)
a
ab
b
5
0
-5
-10
-15
open-area precipitation NH4+
open-area precipitation NO3-
throughfall NH4+
throughfall NO3-

Fig. S1

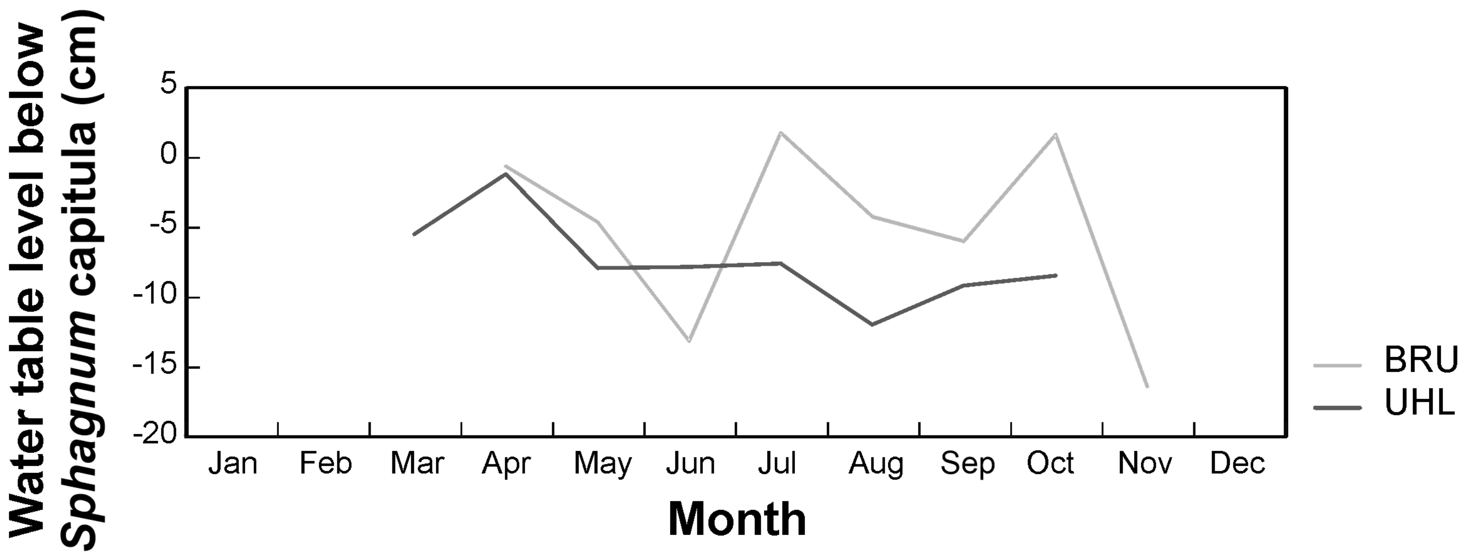
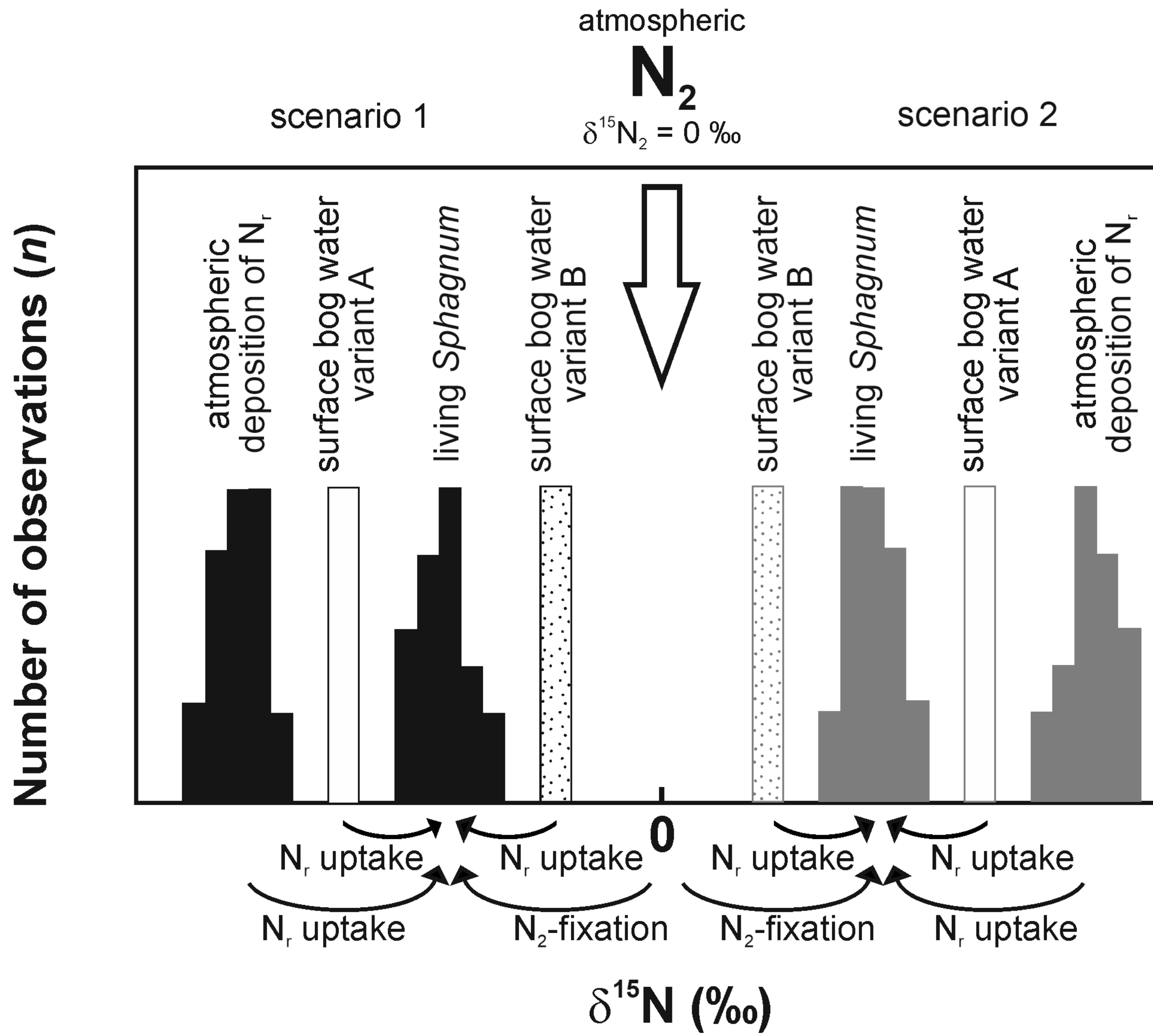

Water table level below
Sphagnum capitula (cm)
5
0
-5
-10
-15
-20
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Month
BRU
UHL

Fig. S2



atmospheric
N2
δ15N2 = 0 ‰
scenario 1
scenario 2
atmospheric deposition of Nr
surface bog water variant A
living Sphagnum
surface bog water variant B
surface bog water variant B
living Sphagnum
surface bog water variant A
atmospheric deposition of Nr
Number of observations (n)
0
Nr uptake
Nr uptake
Nr uptake
Nr uptake
Nr uptake
N2-fixation
N2-fixation
Nr uptake
δ15N (‰)

Fig. S3

Table S1. Nitrogen concentration and $\delta^{15}N$ values of living *Sphagnum* samples.

Site	**Sample I.D.**	***Sphagnum* species**	**N (%)**	**$\delta^{15}N$ (‰)**
BRU	BRU 1	*Sphagnum cuspidatum* Ehrh.	1.0	-1.9
	BRU 2	*Sphagnum magellanicum* Brid.	0.9	-4.6
	BRU 3	*Sphagnum cuspidatum* Ehrh.	1.0	-3.3
	BRU 4	*Sphagnum magellanicum* Brid.	0.8	-4.2
	BRU 5	*Sphagnum papillosum* Lindb.	1.0	-3.3
	BRU 6	*Sphagnum rubellum* Wils.	0.8	-4.7
	BRU 7	*Sphagnum cuspidatum* Ehrh.	0.9	-3.6
	BRU 8	*Sphagnum cuspidatum* Ehrh.	1.0	-3.7
	BRU 9	*Sphagnum cuspidatum* Ehrh.	1.0	-4.1
	BRU 10	*Sphagnum rubellum* Wils.	0.7	-5.7
	BRU 11	*Sphagnum magellanicum* Brid.	0.8	-6.0
	BRU 12	*Sphagnum papillosum* Lindb.	0.8	-4.1
UHL	UHL 1	*Sphagnum girgensohnii* Russow	0.9	-5.6
	UHL 2	*Sphagnum russowii* Warnst.	0.6	-4.6
	UHL 3	*Sphagnum girgensohnii* Russow	0.8	-3.4
	UHL 4	*Sphagnum girgensohnii* Russow	1.0	-4.3
	UHL 5	*Sphagnum girgensohnii* Russow	0.8	-6.0
	UHL 6	*Sphagnum girgensohnii* Russow	0.7	-4.2
	UHL 7	*Sphagnum russowii* Warnst.	0.7	-3.8
	UHL 8	*Sphagnum russowii* Warnst.	0.6	-4.2
	UHL 9	*Sphagnum girgensohnii* Russow	1.1	-3.7
	UHL 10	*Sphagnum girgensohnii* Russow	1.2	-5.1
	UHL 11	*Sphagnum russowii* Warnst.	0.7	-4.6
	UHL 12	*Sphagnum nemoreum* Scop.	0.6	-4.1
MMJ	MMJ 1	*Sphagnum girgensohnii* Russow	1.1	-5.2
	MMJ 2	*Sphagnum flexuosum* Dozy et Molk.	1.6	-3.4
	MMJ 3	*Sphagnum flexuosum* Dozy et Molk.	1.8	-2.6
	MMJ 4	*Sphagnum girgensohnii* Russow	1.1	-4.5
	MMJ 5	*Sphagnum girgensohnii* Russow	1.0	-4.5
	MMJ 6	*Sphagnum girgensohnii* Russow	1.6	-5.9
	MMJ 7	*Sphagnum girgensohnii* Russow	1.5	-6.2
	MMJ 8	*Sphagnum girgensohnii* Russow	1.3	-6.0
	MMJ 9	*Sphagnum girgensohnii* Russow	0.9	-4.7
	MMJ 10	*Sphagnum girgensohnii* Russow	0.9	-5.3
	MMJ 11	*Sphagnum girgensohnii* Russow	1.6	-4.7
	MMJ 12	*Sphagnum girgensohnii* Russow	1.1	-5.0

Table S2. Concentrations and isotope composition of liquid N_r forms (n.d. – not determined).

Site	**Date**	**Sample type**	**[NH_4^+-N] (mg L^{-1})**	**[NO_3^--N] (mg L^{-1})**	**$\delta^{15}NH_4^+$-N (‰)**	**$\delta^{15}NO_3^-$-N (‰)**
BRU	January 25, 2016	open-area precipitation	1.6	4.0	-9.1	-6.7
	February 9, 2016		0.6	4.4	-7.8	-2.7
	March 9, 2016		0.7	0.4	-9.2	-7.3
	April 6, 2016		1.6	3.1	-1.9	-2.6
	May 10, 2016		1.7	0.4	-2.4	-7.8
	June 9, 2016		0.1	0.5	-3.0	-6.3
	July 13, 2016		0.2	0.6	-4.0	0.8
	August 4, 2016		0.8	0.5	-3.8	-6.7
	September 6, 2016		0.5	0.4	-5.9	-7.8
	October 6, 2016		0.1	0.4	-3.1	0.2
	November 7, 2016		0.2	1.0	-4.2	-7.4
	December 6, 2016		0.2	1.0	-4.9	-7.3
	January 9, 2017		0.3	2.2	-8.9	-8.9
	February 8, 2017		0.5	3.5	-7.8	-5.1
	March 8, 2017		0.4	3.1	-14.0	-11.7
	April 6, 2017		1.4	7.1	-8.3	-6.3
	May 15, 2017		1.3	3.0	-5.6	-8.2
	June 8, 2017		1.6	0.4	0.4	-5.0
	July 11, 2017		0.6	0.9	0.3	-2.4
	August 7, 2017		0.1	0.5	-6.3	-7.4
	September 6, 2017		0.2	0.4	-3.1	-6.4
	October 17, 2017		0.1	3.5	3.5	-4.2
	November 7, 2017		0.2	3.5	-5.2	-7.2
	December 6, 2017		0.2	1.8	-7.4	-5.6
	January 9, 2018		0.3	3.5	-7.0	-6.1
	February 7, 2018		0.0	3.1	-6.0	-2.3
	November 7, 2016	throughfall	0.1	1.2	-4.0	-6.0
	December 6, 2016		0.1	0.7	-4.5	-4.8
	January 9, 2017		0.1	4.0	-8.6	-4.8
	February 8, 2017		0.3	4.0	-8.2	-3.7
	March 8, 2017		0.4	3.1	-15.5	-11.7
	April 6, 2017		0.8	9.7	-6.6	-4.0
	May 15, 2017		1.2	4.0	-7.8	-5.3
	June 8, 2017		0.6	1.0	-3.1	-8.9
	July 11, 2017		0.3	1.4	-8.8	-10
	August 7, 2017		0.5	3.1	-1.5	-6.0
	September 6, 2017		1.3	4.4	-7.9	-6.4
	October 17, 2017		0.4	0.9	-7.2	-6.7
	November 7, 2017		0.2	0.9	-7.2	-6.7
	December 6, 2017		0.3	3.5	-5.9	-5.0
	January 9, 2018		0.3	1.8	-6.9	-5.3
	February 7, 2018		0.0	3.1	-5.9	-3.3
	March 9, 2016	runoff	0.1	0.4	0.5	-1.2
	April 6, 2016		0.0	3.5	-3.0	-4.6
	May 10, 2016		0.3	0.4	3.3	-2.4
	June 9, 2016		0.3	3.0	1.2	-2.9
	July 13, 2016		0.3	0.1	0.6	0.7

Site	Date	Sample type	[NH_4^+-N] (mg L^{-1})	[NO_3^--N] (mg L^{-1})	$\delta^{15}NH_4^+$-N (‰)	$\delta^{15}NO_3^-$-N (‰)
	August 4, 2016		0.1	4.0	-5.1	-3.9
	September 6, 2016		0.1	0.4	1.1	-2.5
	October 6, 2016		0.1	7.0	-8.4	-8.3
	November 7, 2016		0.1	1.0	0.2	-1.6
	December 6, 2016		0.1	0.8	1.0	-0.6
	January 9, 2017		0.1	2.2	1.0	-1.5
	February 8, 2017		0.2	3.5	-9.2	-2.3
	March 8, 2017		0.1	3.1	-11.1	-2.4
	April 6, 2017		0.4	7.1	-3.4	-7.0
	May 15, 2017		0.3	2.7	-1.0	-5.5
	June 8, 2017		0.3	0.4	-4.0	-4.0
	July 11, 2017		0.1	0.4	-8.3	-5.2
	August 7, 2017		0.2	0.7	-1.0	-3.5
	September 6, 2017		0.2	0.9	1.7	-1.6
	October 17, 2017		0.1	4.9	-2.7	-3.2
	November 7, 2017		0.2	4.9	2.1	-1.4
	December 6, 2017		0.0	1.3	-2.0	-3.1
	January 9, 2018		0.1	1.8	-6.2	-5.6
	February 7, 2018		1.3	1.3	-2.9	-2.9
	June 17, 2019		0.1	0.2	-2.5	-1.8
	June 17, 2019	bog water	0.4	0.2	5.3	-0.04
	June 17, 2019		n.d.	n.d.	n.d.	n.d.
	June 17, 2019		0.1	0.0	-1.7	1.2
	June 17, 2019		1.3	0.1	2.2	1.4
	June 17, 2019		0.8	0.6	-0.8	-0.2
UHL	February 2, 2016	open-area precipitation	0.6	4.9	-9.4	-4.0
	March 2, 2016		0.9	0.4	-9.9	-8.9
	April 6, 2016		1.6	1.8	-9.9	-6.5
	April 30, 2016		0.8	1.8	-10.2	-10.1
	May 30, 2016		0.9	0.4	-8.1	-10.2
	July 14, 2016		0.6	0.1	-1.9	-7.0
	August 11, 2016		0.1	0.1	-3.4	-5.8
	September 2, 2016		1.4	0.1	n.d.	n.d.
	October 1, 2016		0.1	0.1	-3.9	-5.5
	November 3, 2016		0.1	0.1	-8.5	-9.5
	November 30, 2016		0.2	0.1	-2.6	-5.3
	January 4, 2017		0.1	0.1	-6.0	-4.9
	February 1, 2017		0.7	6.2	-6.1	-3.7
	March 2, 2017		0.6	4.4	-7.4	-4.5
	March 31, 2017		1.7	5.3	-8.7	-5.8
	July 15, 2019		0.7	0.9	-0.7	-1.5
	August 12, 2019		0.4	0.9	-1.2	-5.8
	September 12, 2019		0.3	0.9	-5.0	-7.5
	October 16, 2019		0.4	0.9	-2.1	-5.1
	July 15, 2019	throughfall	1.0	2.1	-5.4	-4.6
	August 12, 2019		2.5	2.5	-1.4	-3.6
	September 12, 2019		2.3	1.5	-2.7	-4.7
	October 16, 2019		0.5	0.5	-3.2	-3.7

Site	Date	Sample type	$[NH_4^+\text{-}N]$ (mg L^{-1})	$[NO_3^-\text{-}N]$ (mg L^{-1})	$\delta^{15}NH_4^+\text{-}N$ (‰)	$\delta^{15}NO_3^-\text{-}N$ (‰)
	June 6, 2019	runoff	0.2	1.5	-7.4	-7.4
	August 12, 2019		0.1	0.3	-4.0	-3.4
	September 12, 2019		0.1	0.4	-5.3	-4.2
	June 6, 2019	bog water	1.2	0.8	3.6	1.9
	June 6, 2019		0.5	1.5	2.9	1.9
	June 6, 2019		1.8	1.1	3.3	2.1
	June 6, 2019		2.3	1.7	1.6	0.3
	June 6, 2019		0.5	1.3	1.5	-0.9
MMJ	January 22, 2016	open-area precipitation	1.2	6.6	-10.9	-3.8
	February 5, 2016		1.1	0.9	-6.1	-7.9
	March 4, 2016		0.1	0.4	-10.2	-4.3
	April 4, 2016		1.1	6.6	-9.6	-6.4
	May 3, 2016		1.1	0.4	-8.3	-10.2
	June 8, 2016		0.8	0.1	-1.9	-4.4
	July 1, 2016		0.7	0.1	6.2	0.7
	August 5, 2016		0.8	0.1	8.0	1.2
	September 10, 2016		0.1	0.1	7.4	1.9
	October 10, 2016		0.5	0.1	-2.3	-4.6
	November 7, 2016		0.4	0.1	-2.0	-4.6
	December 6, 2016		0.2	0.1	-4.7	-6.6
	January 10, 2017		0.4	3.3	-3.6	-2.2
	February 10, 2017		0.9	6.2	-10.7	-4.9
	March 3, 2017		0.8	6.5	-12.0	-6.5
	April 10, 2017		1.2	1.2	-0.3	-2.7
	May 5, 2017		0.9	3.1	-9.1	-8.0
	June 8, 2017		0.9	0.0	1.1	-5.0
	July 10, 2017		0.9	0.0	-0.9	-1.8
	August 10, 2017		0.2	0.0	-1.7	-5.8
	September 5, 2017		0.3	4.9	-1.7	-0.3
	April 10, 2017	throughfall	2.0	3.5	-14.7	-3.8
	May 5, 2017		1.4	1.4	-14.8	-13.4
	June 8, 2017		2.1	0.0	-3.8	-4.0
	July 10, 2017		3.9	1.8	-1.1	n.d.
	August 10, 2017		2.9	1.8	-2.8	-4.4
	September 5, 2017		0.8	1.8	-2.2	-4.5
	June 3, 2019	runoff	0.1	0.2	-5.9	-4.3
	June 3, 2019	bog water	n.d.	n.d.	n.d.	n.d.
	June 3, 2019		0.0	0.0	-0.3	-2.9
	June 3, 2019		1.3	1.0	-2.4	-2.8
	June 3, 2019		2.0	1.0	-1.4	-2.6
	June 3, 2019		2.2	2.7	-1.4	-1.7

Table S3. Comparison of concentrations of major chemical species in atmospheric deposition, surface runoff and bog water at the study sites. N : P ratios of atmospheric input are based on vertical wet deposition. Data from October 2018.

Site	Sample type	NH_4^+	Na^+	Mg^{2+}	K^+	Ca^{2+}	Mn^{2+}	Fe_{tot}	$(HCO_3)^-$	$(NO_3)^-$	F^-	$(SO_4)^{2-}$	Cl^-	DOC	TON	P_{tot}	N:P	pH	Conductivity (µS cm^{-1})
				mg L^{-1}			µg L^{-1}				mg L^{-1}					µg L^{-1}			
BRU	Atmospheric deposition*	0.33	0.15	0.05	0.07	0.15	< 5.0	< 0.05	< 0.5	0.86	< 0.02	0.76	0.27	0.38	0.07	< 6.0	169	5.46	< 8.00
	Bog water	2.09	1.68	0.73	1.85	1.90	13.0	0.64	15.3	0.31	0.04	6.01	3.92	79.7	2.31	165	23.8	4.31	74.6
	Surface runoff	0.64	3.25	0.39	1.36	2.00	786	0.67	9.2	0.75	0.05	8.86	1.42	2.50	0.21	29.4	29.3	6.26	44.6
UHL	Atmospheric deposition	0.14	0.51	0.07	0.10	0.24	16.0	< 0.05	< 0.5	1.22	< 0.02	1.07	0.78	0.75	0.17	9.3	60.1	4.97	12.9
	Bog water	0.27	3.60	1.98	9.05	7.75	216	2.95	12.2	< 0.10	0.18	47.4	1.96	66.6	3.48	490	7.6	4.02	165
	Surface runoff	0.04	3.22	1.71	0.47	7.72	567	0.96	2.4	< 0.10	0.19	33.7	1.21	4.45	0.18	40.2	5.5	4.48	98.3
MMJ	Atmospheric deposition	0.84	0.52	0.15	0.19	0.62	10.0	< 0.05	< 0.5	3.97	< 0.02	2.30	0.68	1.50	0.20	15.5	112	6.37	24.5
	Bog water	1.56	1.01	0.16	1.97	0.53	9.0	0.36	9.2	0.39	0.04	0.69	2.20	46.9	1.33	172	15.0	4.88	41.6
	Surface runoff	0.27	2.64	2.71	1.81	31.1	164	0.37	110	1.23	0.05	6.17	3.27	6.11	0.12	12.4	48.4	7.40	190

*open-area precipitation

Table S4. Chemical characteristics and $\delta^{15}N$ values of peat core samples.

Site	Depth (cm)	Na (mg kg^{-1})	K (g kg^{-1})	Mg (mg kg^{-1})	Ca (g kg^{-1})	C (%)	N (%)	P (%)	N:P	Ash content (%)	Density (g cm^{-3})	$\delta^{15}N$ (‰)
BRU	-1	391	2.73	397	1.19	43.5	0.86	0.03	30.8	1.70	0.04	-4.51
	-3	448	2.24	394	1.27	43.8	1.25	0.02	32.2	1.39	0.03	-4.11
	-5	464	1.64	362	1.08	46.5	1.36	0.03	30.3	1.26	0.04	-3.67
	-7	207	0.77	320	1.01	45.1	1.32	0.04	19.7	1.34	0.05	-2.73
	-9	190	0.47	314	0.99	44.5	1.26	0.04	19.3	1.58	0.05	-2.35
	-11	162	0.38	358	1.15	44.8	1.05	0.04	20.1	1.30	0.06	-2.52
	-13	164	0.19	228	0.74	44.7	1.02	0.04	21.1	1.21	0.06	-2.53
	-15	247	0.27	242	0.80	45.2	0.98	0.03	27.2	1.41	0.06	-1.97
	-17	257	0.60	285	0.64	44.2	1.17	0.05	27.5	4.42	0.08	-1.74
	-19	173	0.30	207	0.64	46.8	1.18	0.04	27.8	2.74	0.07	-1.37
	-21	467	1.17	263	0.72	46.0	1.34	0.04	37.3	8.50	0.12	-1.53
	-23	197	0.37	200	0.90	53.1	1.43	0.03	42.7	2.76	0.10	-1.74
	-25	155	0.16	188	0.94	49.0	1.48	0.03	41.4	1.00	0.09	-1.83
	-27	256	0.15	221	1.04	46.6	1.66	0.03	37.7	1.46	0.10	-1.58
	-29	142	0.18	249	1.09	47.8	1.58	0.03	39.5	1.41	0.10	-1.94
UHL	-1	262	2.14	455	1.62	41.9	0.90	0.07	12.1	4.55	0.03	-2.69
	-3	226	1.06	475	1.96	41.4	0.76	0.10	12.2	6.48	0.03	-1.93
	-5	261	0.82	452	2.02	41.7	0.78	0.10	13.0	5.35	0.05	-1.37
	-7	319	0.73	444	1.99	42.2	0.74	0.11	11.8	5.20	0.06	-1.04
	-9	243	0.48	394	1.90	42.1	0.79	0.11	11.3	5.65	0.06	-0.62
	-11	193	0.40	418	2.29	41.5	0.86	0.10	10.9	5.37	0.05	-0.31
	-13	247	0.44	426	2.22	41.8	0.81	0.09	11.5	4.88	0.04	-0.18
	-15	249	0.35	415	2.13	38.5	0.95	0.09	11.3	5.32	0.06	0.08
	-17	222	0.43	370	1.67	42.8	1.32	0.09	13.0	7.48	0.08	0.38
	-19	236	0.43	361	1.59	41.3	1.03	0.09	12.8	8.05	0.08	0.42
	-21	292	0.61	434	1.56	39.8	1.61	0.10	13.3	10.91	0.11	0.09
	-23	310	0.89	538	1.57	40.4	1.36	0.11	13.1	15.54	0.11	0.32
	-25	468	1.77	821	1.50	33.8	1.23	0.12	12.7	29.40	0.10	0.33
	-27	385	1.55	713	1.44	35.3	1.07	0.11	14.8	28.13	0.13	0.23
	-29	424	1.53	641	1.43	34.0	1.07	0.12	13.3	29.25	0.18	0.78
MMJ	-1	519	5.50	335	0.67	43.0	0.58	0.08	7.0	1.16	0.04	-3.54

Site	**Depth (cm)**	**Na (mg kg^{-1})**	**K (g kg^{-1})**	**Mg (mg kg^{-1})**	**Ca (g kg^{-1})**	**C (%)**	**N (%)**	**P (%)**	**N:P**	**Ash content (%)**	**Density (g cm^{-3})**	**δ ^{15}N (‰)**
	-3	357	1.65	359	0.93	42.7	0.42	0.06	7.2	1.18	0.04	-2.07
	-5	191	0.43	257	1.06	42.6	0.52	0.06	8.3	1.16	0.04	-2.01
	-7	150	0.31	223	1.02	43.3	0.60	0.05	11.2	1.09	0.04	-1.94
	-9	124	0.28	258	1.10	43.4	0.71	0.07	10.6	1.57	0.05	-2.23
	-11	73.1	0.22	226	1.08	43.5	0.69	0.05	13.1	1.09	0.05	-2.20
	-13	71.4	0.17	228	1.09	44.6	0.72	0.05	15.7	1.46	0.05	-2.08
	-15	69.3	0.20	226	1.12	44.2	0.96	0.05	17.9	2.70	0.06	-1.87
	-17	122	0.18	231	1.08	44.0	1.08	0.06	17.8	1.81	0.06	-1.65
	-19	103	0.15	231	1.15	44.6	1.19	0.06	18.8	2.16	0.05	-1.63
	-21	170	0.25	239	1.22	41.7	1.63	0.08	21.6	3.15	0.04	-1.80
	-23	136	0.24	221	1.25	46.2	1.45	0.07	21.9	2.90	0.05	-1.22
	-25	114	0.25	214	1.32	48.8	1.18	0.06	21.0	2.54	0.05	-1.39
	-27	126	0.24	214	1.48	46.0	1.12	0.05	20.5	2.39	0.06	-1.72
	-29	136	0.34	217	1.56	45.1	1.15	0.06	18.3	3.25	0.05	-1.75

Table S5. Rates of biological N_2-fixation (BNF) in pristine and polluted *Sphagnum* bogs compiled from recent literature. ARA – acetylene reduction assay.

Reference	**Estimated atmospheric deposition of N_r ($g\ ha^{-1}\ yr^{-1}$)**	**Mean BNF rate ($mg\ N\ m^{-2}\ d^{-1}$)**	**Minimum and maximum BNF rates ($mg\ N\ m^{-2}\ d^{-1}$)**	**Method of measurement**	**Site details**	
					Location	***Sphagnum* species/diazotrophs**
Stuart et al., 2021	< 2	0.80	0-3.2	$^{15}N_2$ assimilation	Alaska, USA	*Sphagnum* spp.
Vile *et al.*, 2014	0.8-2.0	18.4	3.43-44.5	$^{15}N_2$ assimilation, ARA	Alberta, Canada	Methanotrophs associated with *Sphagnum*
Knorr *et al.*, 2015		90.6	27-216	$^{15}N_2$ assimilation, ARA	southern Patagonia, Chile	*Sphagnum magellanicum*
Saiz *et al.*, 2021	2	0.15		$^{15}N_2$ assimilation	Sweden	*S. majus, S .balticum, S. fuscum, S. papillosum*
Patova *et al.*, 2020	2.7		10-23.3	ARA	Russia	*Sphagnum* associated cyanobacteria
van den Elzen *et al.*, 2020	6	0.03		$^{15}N_2$ assimilation	southern Sweden	*S .capollifolium* subsp. rubellum/ *S. fuscum*
Saiz *et al.*, 2021	6	0.07		$^{15}N_2$ assimilation	Scotland	*S. cuspidatum, S. falax, S. capillifolium, S. papillosum*
Chapman and Hemond, 1982	7	6.67		$^{15}N_2$ assimilation, ARA	Massachusetts, USA	*Sphagnum* spp.
Zivkovic *et al.*, 2022	8.0-10.0	1.57		ARA	Ontario, Canada	*S. fallax, S. angustifolilum, S. capillifolium, S. divinum, S. medium (s.magellanicum)*
Urban and Eisenreich, 1988	10.4		0.4-0.56	ARA	Minnesota, USA	*Sphagnum* spp.
Warren *et al.*, 2017	10.4	54.8		$^{15}N_2$ assimilation, ARA	Minnesota, USA	*S. fallax, S. angustifolium*
Rousk *et al.*, 2018	15	< 2.3		ARA	Copenhagen, Denmark	*Sphagnum* spp.
Saiz *et al.,* 2021	17	0.05		$^{15}N_2$ assimilation	Wales	*S. cuspidatum, S. falax, S. capillifolium, S. papillosum*
this study	18.6*	8.22		$^{15}N_2$ assimilation	Male Mechove jezirko, Czech Republic	*S. girgensohnii Russow*

Reference	Estimated atmospheric deposition of N_r (g ha^{-1} yr^{-1})	Mean BNF rate (mg N m^{-2} d^{-1})	Minimum and maximum BNF rates (mg N m^{-2} d^{-1})	Method of measurement	Site details	
					Location	***Sphagnum* species/diazotrophs**
van den Elzen *et al*., 2017	25	2.4		$^{15}N_2$ assimilation	Netherlands	*S. palustre, S. squarrosum*
Saiz *et al*., 2021	27	0.03		$^{15}N_2$ assimilation	England	*S. cuspidatum, S. falax,* *S. capillifolium, S. papillosum*

*including horizontal deposition

Supplement

Methodology of chemical analysis of liquid samples

Concentrations of Na^+, K^+, Ca^{2+}, Mg^{2+}, Mn^{2+}, and Fe_{tot} were measured by flame atomic absorption spectrometry (FAAS; AAnalyst 100, PerkinElmer) with the limits of quantification (LOQ) of 0.01 mg L^{-1} and 0.005 mg L^{-1} for Fe. Concentrations of NH_4^+ and P_{tot} were determined spectrophotometrically (PMT; Perkin-Elmer Lambda 25; LOQ of 0.02 and 0.006 mg L^{-1}, respectively). Concentrations of Cl^-, SO_4^{2-} and NO_3^- were determined by ion chromatography (HPLC; Knauer 1000; LOQ of 0.15, 0.5, and 0.3 mg L^{-1}, respectively). Concentrations of F^- were measured potentiometrically (ION 85 Radiometer Inc.; 0.02 mg L^{-1}). Concentrations of HCO_3^- were measured by titration (LOQ of 0.6 mg L^{-1}). Dissolved organic carbon (DOC) and total dissolved nitrogen (TN) were determined on an Apollo 9000 analyzer (Tekmar-Dohrmann; LOQ of 0.1 and 0.5 mg L^{-1}). Measurement of pH was carried out on PHM-62 Radiometer, and conductivity on CDM-83 Radiometer Denmark.

Methodology of chemical analysis of solid samples

Ash content in peat was determined on a 0.5 g aliquot at 550 °C. Concentrations of Na, Mg, K, and Ca were measured by flame atomic absorption spectrometry (FAAS; AAnalyst 100, PerkinElmer) with the limits of quantification (LOQ) of 50 ppm. Phosphorus content was determined spectrophotometrically (P-E Hitachi 200; LOQ of 50 ppm). A 10-mg aliquot of each homogenized peat sample was placed in a tin capsule and combusted in a Fisons 1108 elemental analyzer at 1040 °C. Carbon concentrations in peat were determined with a reproducibility of 1.0 %.