



*Supplement of*

## **Excess soil moisture and fresh carbon input are prerequisites for methane production in podzolic soil**

**Mika Korkiakoski et al.**

*Correspondence to:* Mika Korkiakoski ([mika.korkiakoski@helsinki.fi](mailto:mika.korkiakoski@helsinki.fi))

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Table S1. pH, soil moisture (SM), and organic matter content (OM) of different soil layers sampled in August 2018 and 2019.

Sample	Layer	2018			2019		
		pH	SM [%]	OM [%]	pH	SM [%]	OM [%]
C1	O	4.5	40.57	29.67	4.63	48.99	34.14
	E	5.22	19.99	4.58	4.89	24.18	6.57
	I	5.24	18.41	4.91	5.13	21.64	6.19
	C	5.3	14.15	2.45	5.58	17.25	3.31
C3	O	4.9	65.24	69.45	4.76	43.81	34.73
	E	4.65	22.28	6.74	4.75	24.14	6.07
	I	5.14	21.58	6.62	5.25	24.8	7.01
	C	5.46	19.59	3.77	5.49	21.53	4.54
C4	O	4.99	65.98	85.9	5.1	53.43	39.32
	E	4.8	17.86	3.27	4.71	23.87	5.08
	I	5.6	23.68	7.33	5.27	26.22	8.65
	C	5.48	18.51	3.64	5.62	17.22	3.86
C5	O	4.45	57.72	81.35	4.28	56.54	43.97
	E	4.62	22.52	4.92	4.31	27.48	7.49
	I	5.09	27.91	8.94	5	25	6.44
	C	5.45	23.04	5.25	5.5	23.27	4.87
C6	O	5.06	76.16	87.47	4.91	63.5	51.59
	E	4.6	22.58	6.86	5.05	24.53	5.48
	I	5.19	18.18	5.69	5.33	25.24	8.33
	C	5.46	16.36	2.13	5.89	16.88	3.21
C7	O	4.68	47.94	67.83	4.38	59.45	49.76
	E	4.56	22.7	3.47	4.48	24.53	4.54
	I	5.01	23.95	8.3	5.13	26.94	9.44
I1	O	4.82	76.65	59.62	5.12	58.58	36.9
	E	4.78	25.72	3.34	4.84	24.41	4.88
	I	5.34	25.65	5.46	5.38	24.94	7.21
	C	5.62	23.38	3.63	6.36	24.11	4.77
I2	O	4.68	81.43	71.97	4.39	68.49	45.84
	E	5.26	27.69	4.87	4.69	27.81	5.2
	I	5.49	32.97	7.86	4.92	29.65	7.29
	C	5.8	20.91	3.39	5.11	17.9	2.68
I3	O	4.91	83.76	73.82	4.46	63.79	37.36
	E	4.92	27.93	4.02	4.36	25.28	4.73
	I	5.37	26.57	5.17	5.03	26.54	6.17
	C	5.92	21.49	2.35	5.79	18.33	2.14
I4	O	4.75	81.89	86.68	4.88	60.41	33.83
	E	4.66	33.22	6.61	4.7	27.84	4.74
	I	5.07	35.61	12.27	4.76	33.76	12.24
	C	5.1	23.5	5.64	5.2	22.53	4.54
I6	O	4.65	77.18	64.8	4.85	49.39	23.44
	E	4.83	25.13	4.25	4.41	25.99	5.49
	I	5.16	30.01	7.4	4.73	31.12	8.16
	C	5.44	21.56	3.02	5.61	22.52	3.44
I8	O	4.53	81.42	64.59	4.76	44.03	16.91
	E	4.46	33.92	8.2	4.44	28.42	6.21
	I	5.01	29.74	8.57	5.11	30.06	9.75
	C	5.07	23.71	5.62	5.52	20.45	4.25



Table S3. List of measurement points and soil moisture (SM) and soil temperature (ST) sensors used. HM = HOBO EC5 Soil Moisture Smart Sensor, HT = HOBO Pendant data logger, SS = Soil Scout online sensor.

Point	SM sensor	ST sensor
C1	HM	HT
C2	SS	SS
C3	HM	HT
C4	HM	HT
C5	HM	HT
C6	HM	HT
C7	HM	HT
C8	HM	HT
C9	HM	HT
C10	HM	HT
I1		
I2		
I3		HT
I4		HT
I5	SS	SS
I6	SS	SS
I7	SS	SS
I8	SS	SS
I9	SS	SS
I10	SS	SS

Table S4. Long-term (1981–2010) monthly mean temperatures and precipitation sums, and their deviations from that mean during the measurement period in 2017–2019.

Month	Deviation from mean air temperature [C]				Deviation from precipitation sum [mm]			
	2017	2018	2019	1981-2010	2017	2018	2019	1981-2010
May	-3.3	3.2	-0.9	4.9	-19	-21	41	40
June	-1.9	-1.8	-0.5	10.9	-13	-7	20	59
July	-0.9	4.9	-1.3	13.9	54	-47	-42	75
August	-0.9	0.8	0.2	11.2	31	51	8	74
September	0.7	1.2	0.4	5.6	-14	21	34	48

Table S5. CH<sub>4</sub> balances measured at different chamber points and groups of points. Gaps in the data were filled by linear interpolation.

	CH <sub>4</sub> balance [mg CH <sub>4</sub> m <sup>-2</sup> ]		
	2017	2018	2019
C1	-900	-1240	-1160
C2		-790	-790
C3		-640	-750
C4	-470	-700	-640
C5		-580	-580
C6	-680	-890	-820
C7		-990	-940
C8	-950	-1280	-1130
C9		-890	-980
C10		-480	-490
I1		-560	-780
I2	-870	-720	-860
I3	-620	-570	-630
I4	-880	-740	-610
I5		-300	-450
I6		-530	-740
I7		-180	-360
I8		-240	-270
I9	-530	-410	-530
I10		-280	-460
C1,C4,C6,C8	-750±110	-1030±140	-940±120
I2,I3,I4,I9	-720±90	-610±80	-660±70
C1-10		-850±80	-830±70
I1-10		-450±60	-570±60

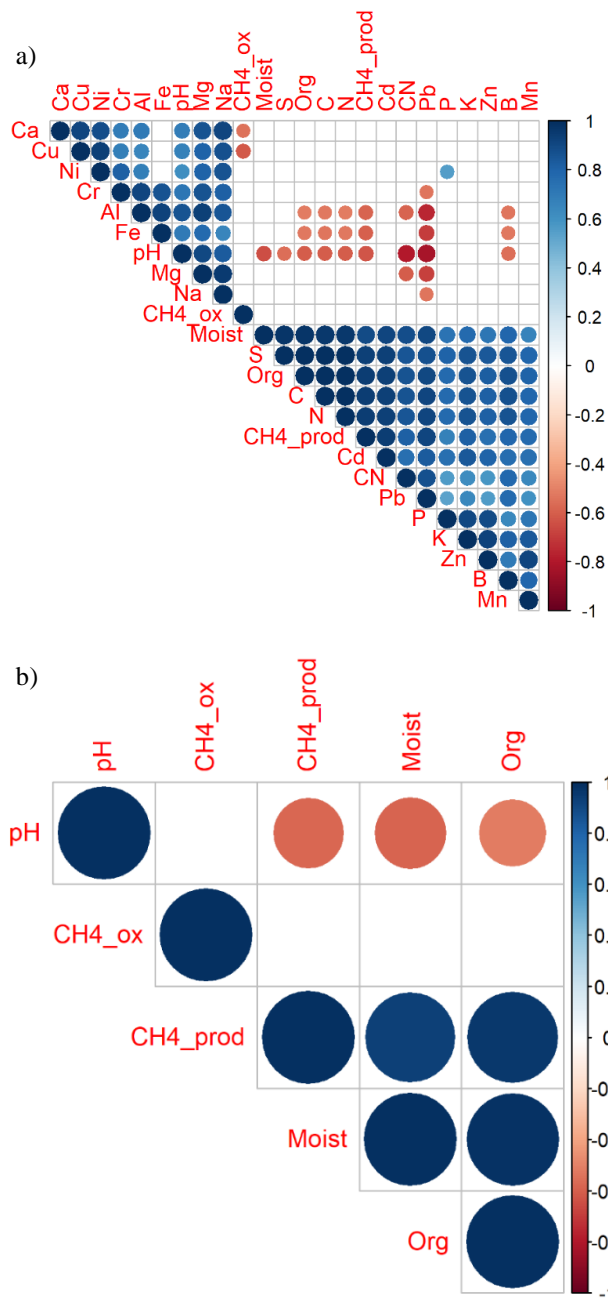


Figure S1. Pearson correlations between potential CH<sub>4</sub> oxidation (CH<sub>4\_ox</sub>) and production (CH<sub>4\_prod</sub>) rates and measured soil pH, moisture (Moist), organic matter content (Org) and elements from a) 2018 samples and b) 2019 samples. Significance level is  $p = 0.01$ . Insignificant correlation coefficients are shown as blanks.