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Supplement of

Relationships between greenhouse gas production and landscape position during short-term permafrost thaw under anaerobic conditions in the Lena Delta

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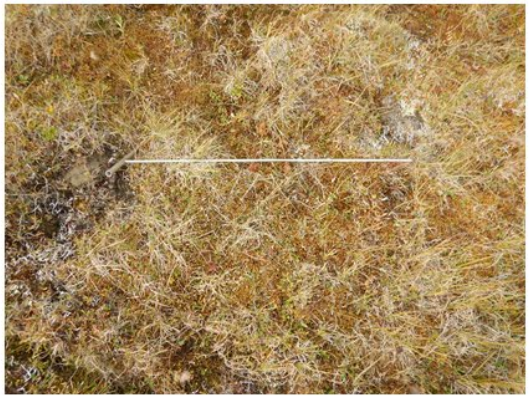
a. Upland – P15

d.



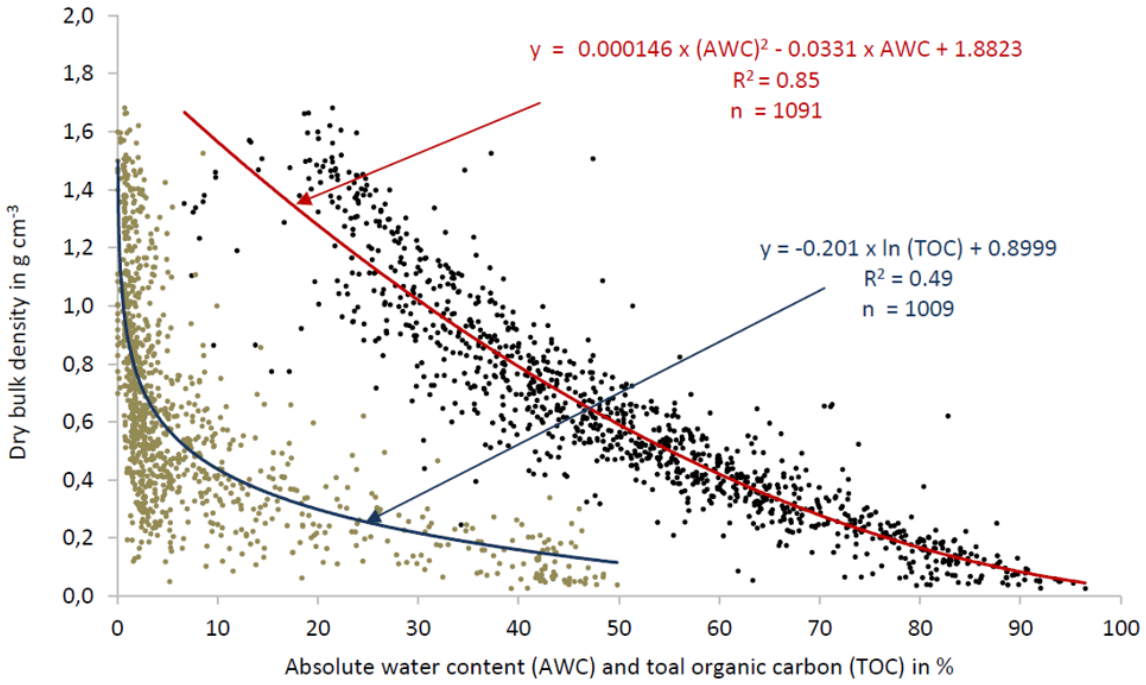
b. Slope – P16

e.

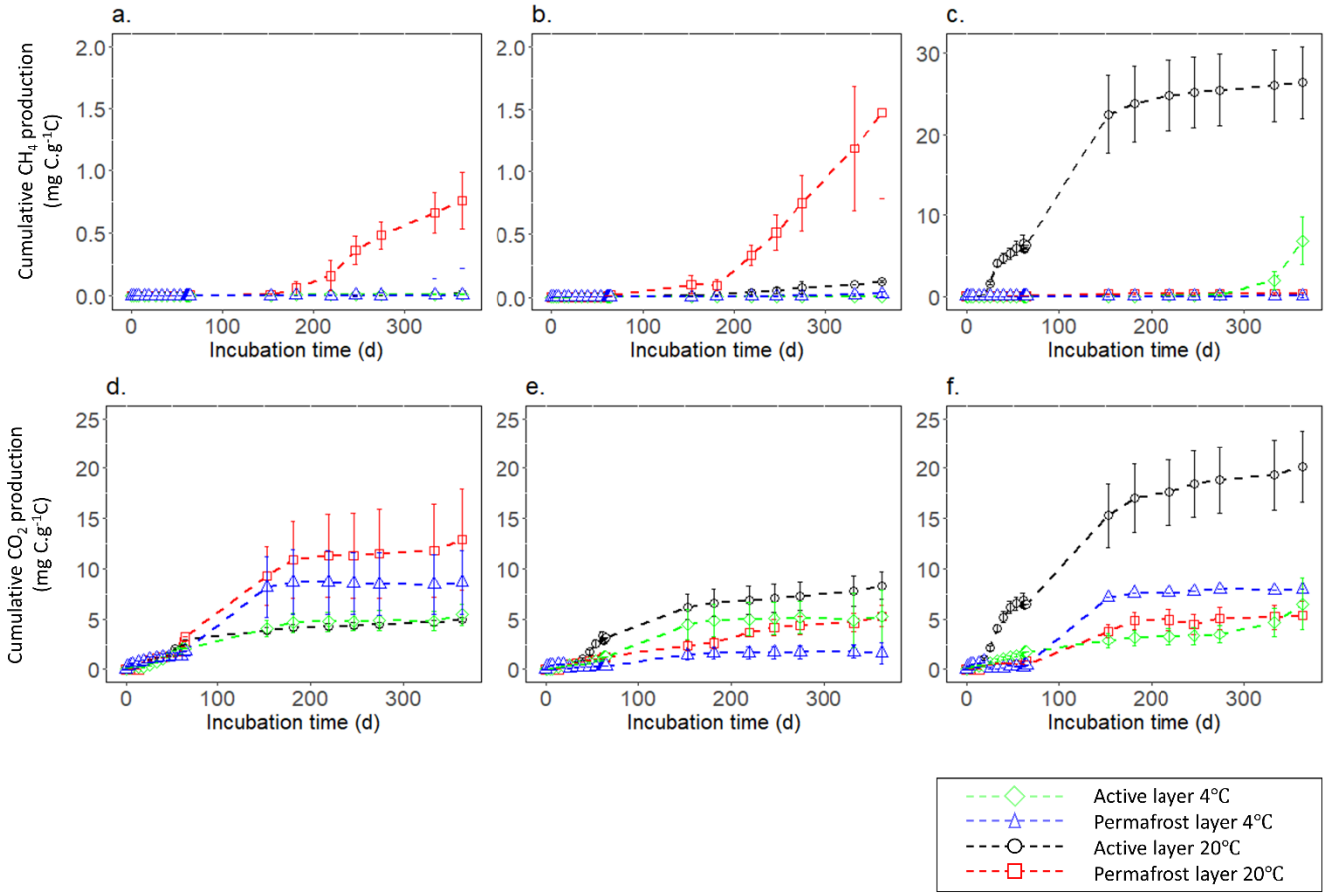
c. Floodplain – P17

f.

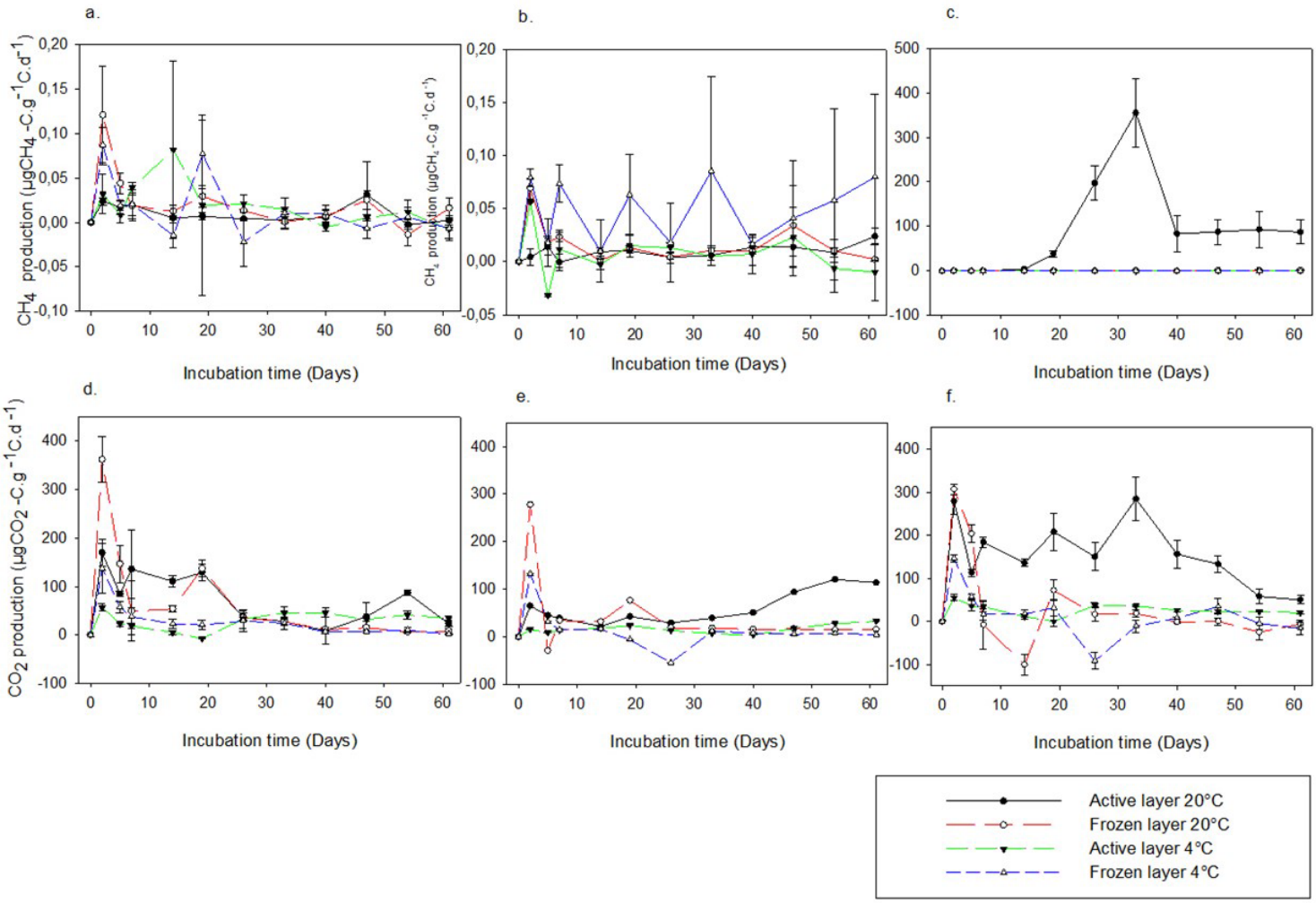
Supplementary Figure 1: Pictures of the three sampling sites. The left column (a.. b.. c.) shows the site topography. and the right column (d.. e.. f.) shows the vegetation.



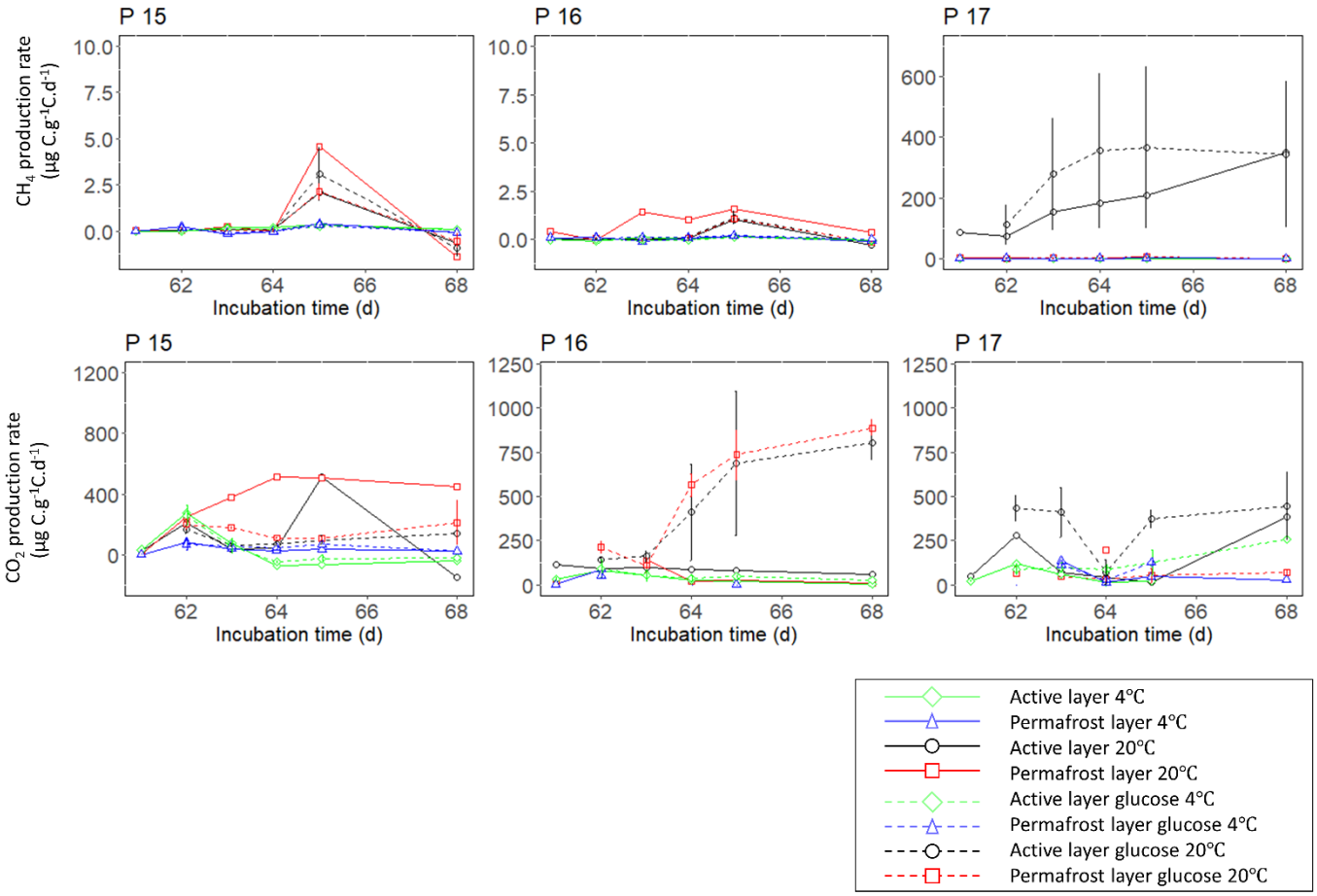
Supplementary Figure 2: Relationship between absolute water content/total organic carbon and dry bulk density. Samples from Kurungnakh Island mostly were used to make these transfer functions. (Fuchs 2019).



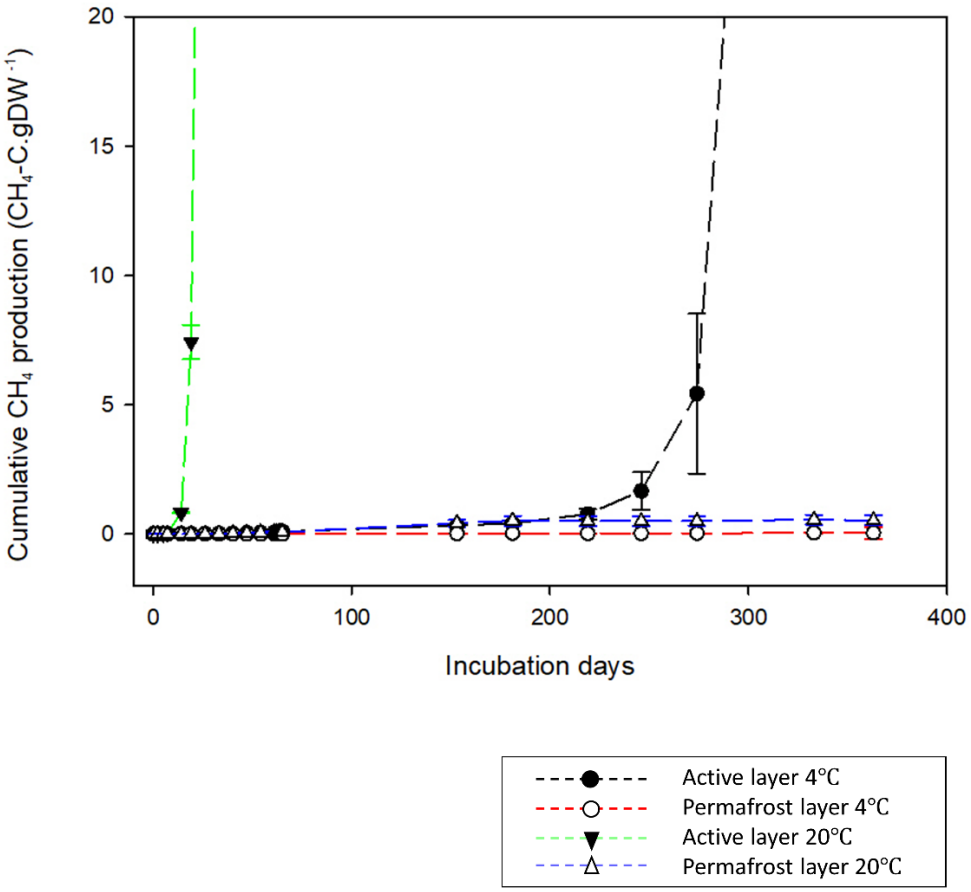
Supplementary Figure 3: Cumulative gas production per gram C at 4 °C and 20 °C for 363 days of incubation. CH_4 production of (a.) P15, (b.) P16 and (c.) P17. CO_2 production of (d.) P15, (e.) P16 and (f.) P17. Error bars show the standard deviation from the means ± standard error (n=3). Note differing y-axis scales between cores for CH_4



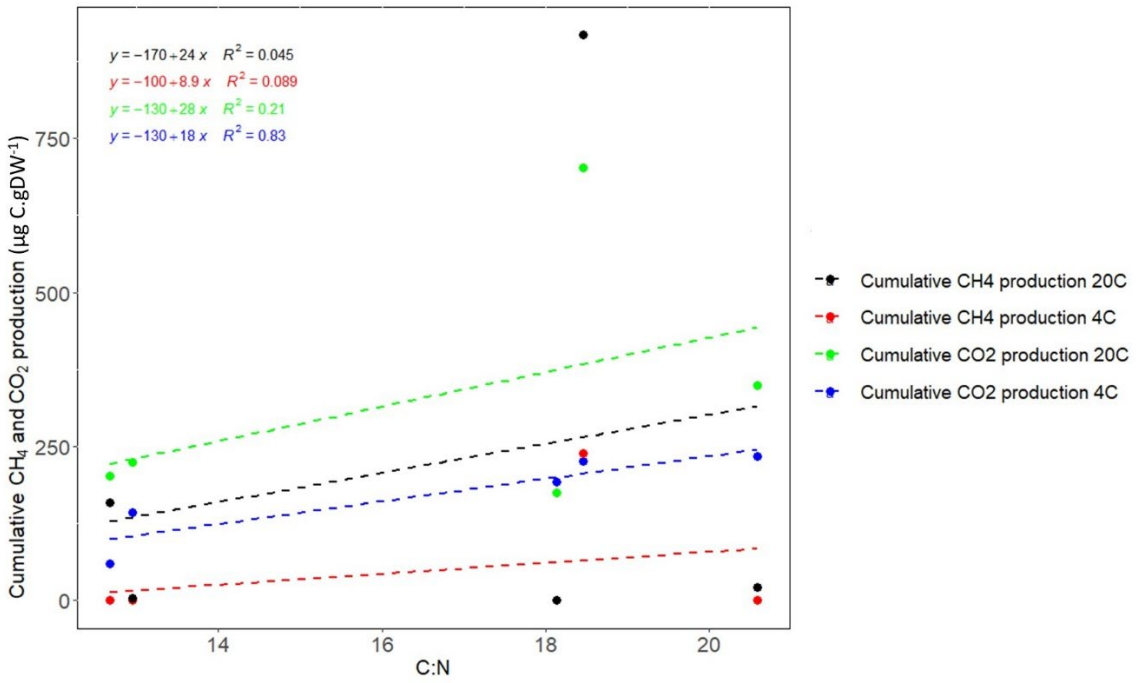
Supplementary Figure 4: Gas production at 4 °C and 20 °C for 60 days of incubation. CH_4 production of (a.) P15. (b.) P16 and (c.) P17. CO_2 production of (d.) P15. (e.) P16 and (f.) P17. Error bars show the deviation from the means ± standard error (n=3). Note differing y-axis scales between cores.



Supplementary Figure 5: Gas production after glucose injection at 4 °C and 20 °C between 61 and 67 days of incubation. The glucose injections were carried out on days 61 and 64. CH_4 production of (a.) P15, (b.) P16, and (c.) P17 and CO_2 production of (d.) P15, (e.) P16, and (f.) P17. Error bars show the deviation from the mean ± standard error (n=3). Note differing scales between cores.



Supplementary Figure 6: Zoom-in to the cumulative CH_4 production of the active floodplain P17.



Supplementary Figure 7: Linear regression between C:N and the cumulative CH4 and CO2 production per gDW at 4 °C and 20 °C

Supplementary Table 1: Grain size analysis of the samples and vegetation description

Samples	*Sand (%)*	*Silt (%)*	*Clay (%)*	*Vegetation*
P15-A	31.42	50.33	18.22	40% moss. 40% sedges. 5% lichen. 5% cassiope. 5% grass. 3% salix. 2% forbs
P15-F	28.75	53.45	17.81	
P16-A	30.09	50.8	19.13	Salix. equisetum. dwarf birch. almost no sedges. moss. Salix have a height of approx. 70 cm. On the plot itself no taller shrubs present. 65% Salix. 30% Equisetum. 5% Moss.
P16-F	26.73	55.12	18.07	
P17-A	18.89	45.40	35.72	Salix and moss were dominating with some sedges and equisetum. Height of salix shrubs: 10 cm. moss covered the surface.
P17-F	96.26	3.1	0.48	

Supplementary Table 2: Cumulative production of CO_2 and CH_4 per gramC and gram DW. Maximum production rate of CO_2 and CH_4 per gram C.

Samples	*Cumulative CO_2 production (µg CO_2-C .g DW^{-1})*	*Cumulative CO_2 production (mg CO_2-C .g C^{-1})*	*Max production rate CO_2 (µg C-CO_2.g $C^{-1}.d^{-1}$)*	*Cumulative CH_4 production (µg CH_4-C .g DW^{-1})*	*Cumulative CH_4 production (mg CH_4-C .g C^{-1})*	*Max production rate CH_4 (µg C-CH_4.g $C^{-1}.d^{-1}$)*
P15-A-4	192.15 ±38.23	5.42 ±1.08	75.54 ± 7.9	0.41 ± 0.15	0.01 ± 0.004	0.37
P15-F-4	234.00 ±85.85	8.66 ± 3.18	137.34 ± 51.40	0.14 ± 5.90	0.005 ± 0.02	1.90 ± 3.24
P16-A-4	142.04 ±70.86	5.26 ± 2.62	57.13	0.09 ± 0.02	0.003 ± 0.001	0.18
P16-F-4	59.93 ± 40.49	1.57 ± 1.06	132.45 ± 19.86	0.93 ± 0.87	0.02 ± 0.02	0.18
P17-A-4	226.43 ± 88.71	6.51 ± 2.55	62.51 ± 74.30	238.06 ± 103.26	6.84 ± 2.97	96.28 ±109.37
P17-F-4	26.66 ± 10.06	7.98	754 ± 590	0.05 ± 0.23	0.03 ± 0.13	4.46
P15-A-20	175.05 ± 7.10	4.94 ± 0.20	510.65	0.51 ± 0.14	0.01 ± 0.003	2.08
P15-F-20	348.34 ± 134.91	12.89 ± 4.99	510.48	20.52 ± 6.11	0.76 ± 0.23	4.59
P16-A-20	224.72 ± 37.11	8.32 ± 1.37	120.54 ± 40.04	3.34 ± 0.26	0.12 ± 0.01	7.35 ± 11.48
P16-F-20	201.52 ± 40.82	5.29 ± 1.07	277.84 ± 32.65	159.03 ± 154.91	1.48 ± 0.69	63.36 ±98.9
P17-A-20	701.43 ± 124.65	20.17 ± 3.58	382.78	917.18 ± 103.88	26.37 ± 4.45	355.52 ±77.17
P17-F-20	9.04 ± 2.33	5.35 ± 1.38	331.80 ± 274.53	0.52 ± 0.19	0.31 ± 0.11	5.94

Supplementary Table 3: Comparison of floodplain total CH_4 emissions between our study (P17) and incubation results of Herbst (2022) (P19. P24 and P25). Samples were incubated at 20°C for 61 days (P17) and 68 days (P19. P24. P25).

Samples	*P17*	*P19*	*P24*	*P25*
Mean Total CH_4 productions (µg CH_4-C .gC^{-1}) (n = 3) [Active layer]	6539.022 ± 1299.21	149.23 ± 35.79	38.15 ± 2.88	0.62 ± 0.69
Mean Total CH_4 productions (µg CH_4-C .gC^{-1}) (n = 3) [Frozen layer]	42.533 ± 15.79	72.39 ± 15.17	34.66 ± 5.17	0.16 ± 0.07

Supplementary Table 4: Characteristics of the samples for qPCR analysis. (*) indicates that DNA concentration is very low. explaining the absence of results for qPCR. (**) DNA concentration is below detection threshold.

Sample	*Weight (g)*	*Weight (g)*	*DNA concentration (ng/µL)*
A-P15-A*	0.228		0.09
A-P15-F*	0.293	0.276	
A-P16-A	0.189		1.01
A-P16-F	0.221		1.08
A-P17-A	0.232		3.39
A-P17-F*	0.26	0.248	
C-P15-A.1.20	0.255		0.186
C-P15-F.1.20*	0.229		0.057
C-P16-A.1.20	0.217		0.578
C-P16-F.1.20	0.233		1.95
C-P17-A.1.20	0.248		1.79
C-P17-F.1.20*	0.246		0.089
C-P15-A.1.4	0.227		0.71
C-P15-F.1.4*	0.231	0.227	
C-P16-A.1.4	0.228		1.22
C-P16-F.1.4	0.244		0.229
C-P17-A.1.4	0.22		4.94
C-P17-F.1.4*	0.22		0.069
D-P16-A.1.20	0.223		0.997
D-P17-A.1.20	0.271		1.6
D-P16-A.1.4	0.26		1.47
D-P17-A.1.4	0.249		5.54
G-P16-A.2.20	0.25		0.998
G-P17-A.2.20	0.261		2.63
G-P16-A.2.4	0.249		0.636
G-P17-A.2.4	0.264		5.53