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Supporting Information for

Large methane emissions from tree stems complicate the wetland methane budget

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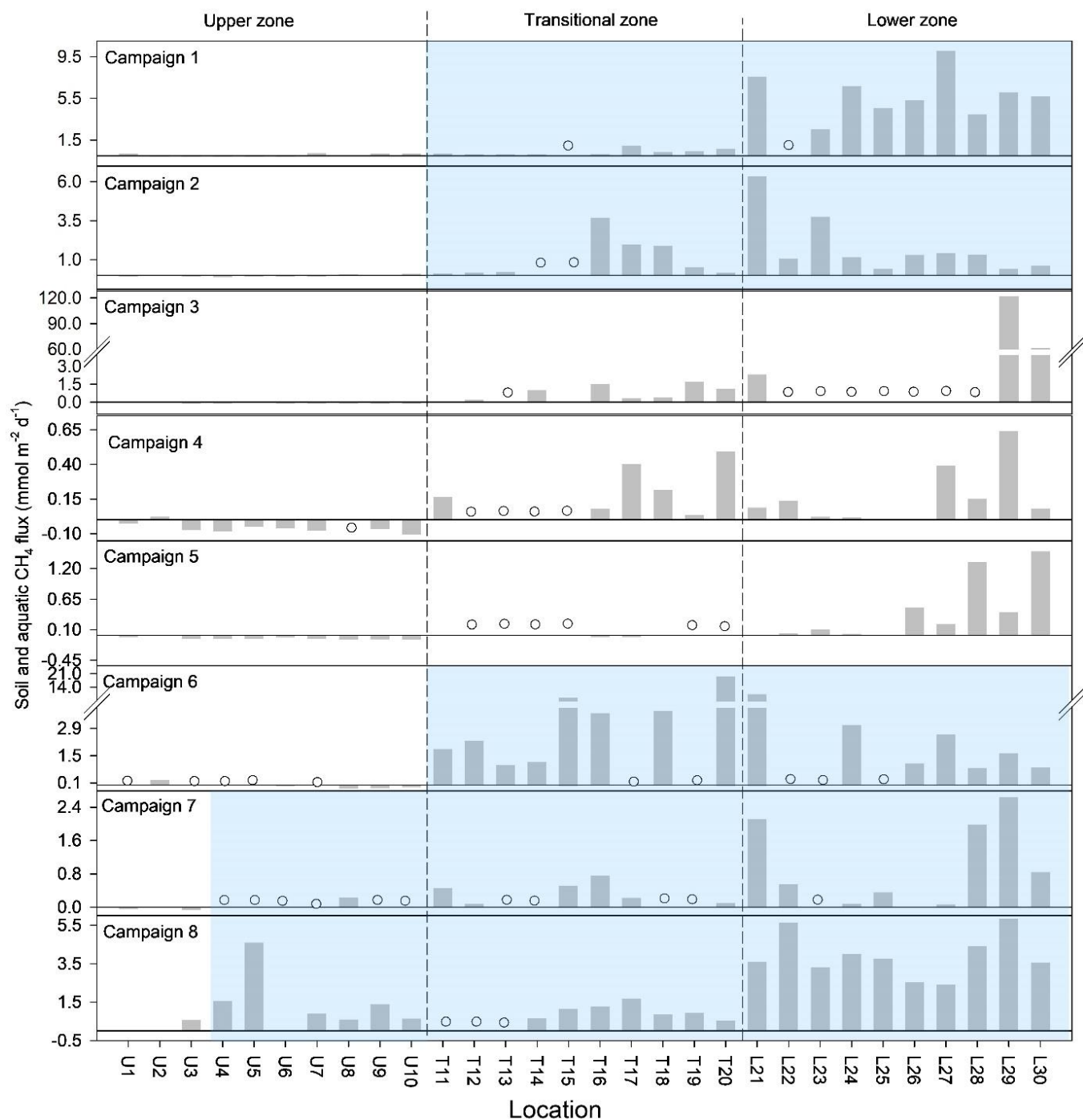


Figure S1. Seasonal variation in soil (white areas) and aquatic (blue areas) CH_4 emissions ($\text{mmol m}^{-2} \text{d}^{-1}$). Note: Different y-axis. White circles indicate where no data was measured or removed due to low r^2 linear fluxes.

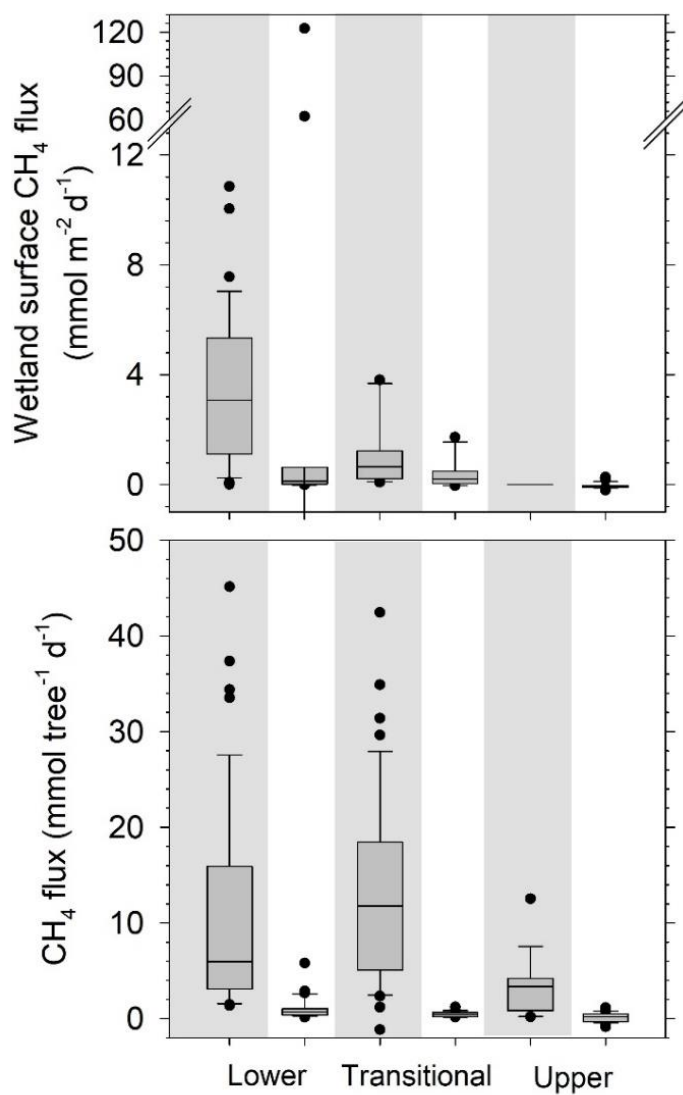


Figure S2. Box plots showing CH₄ fluxes from Wet (grey shaded areas) vs Dry (white areas) campaigns showing soil/water CH₄ fluxes at top; and tree stem CH₄ fluxes at bottom, for each zone. Dots are the outliers and solid lines the mean.

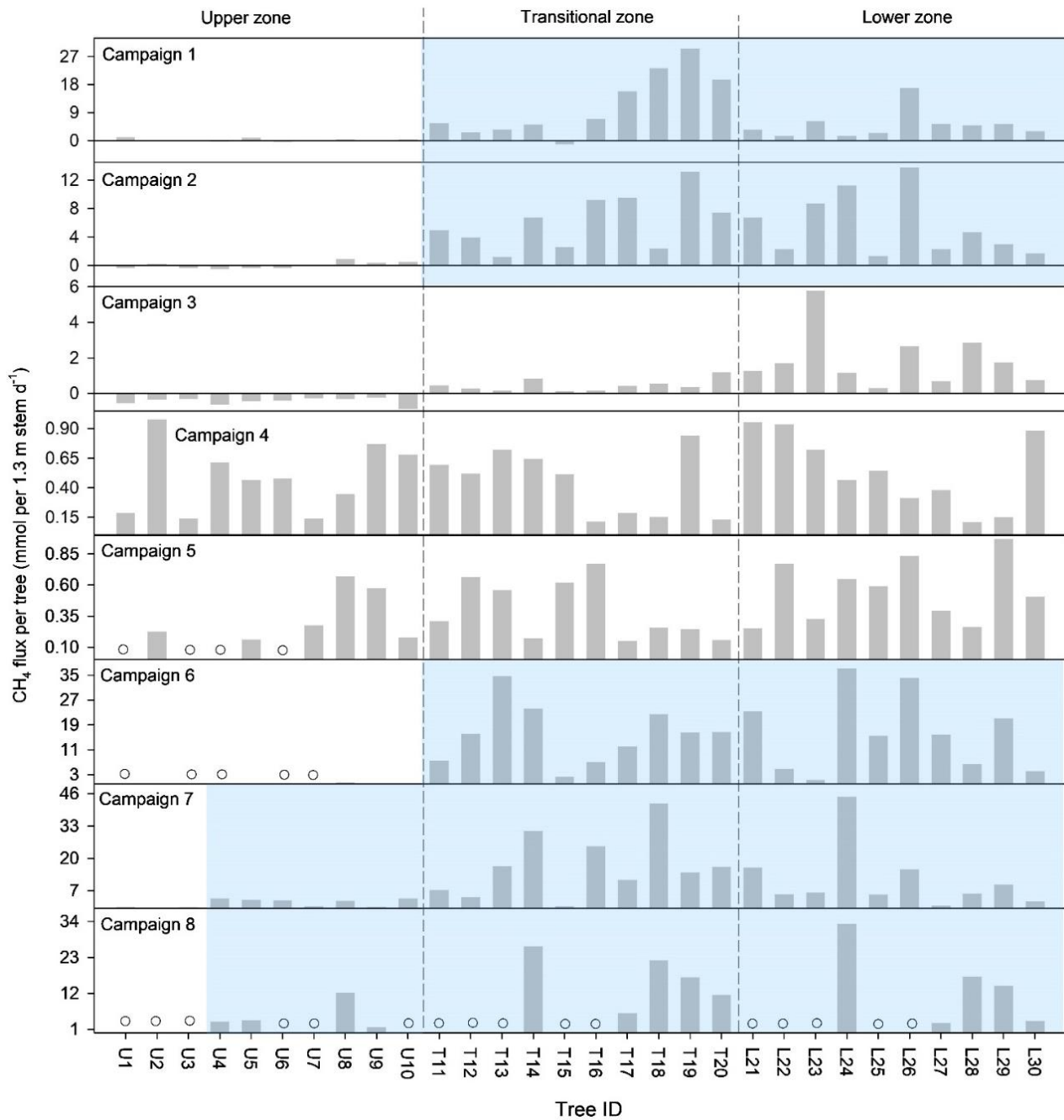


Figure S3. Seasonal variation in tree stem CH₄ emissions from each tree up to to 1.3 m stem height (mmol per tree d⁻¹). Note: Different y-axis. White circles indicate where no data was measured and blue areas represent inundated tree stems.

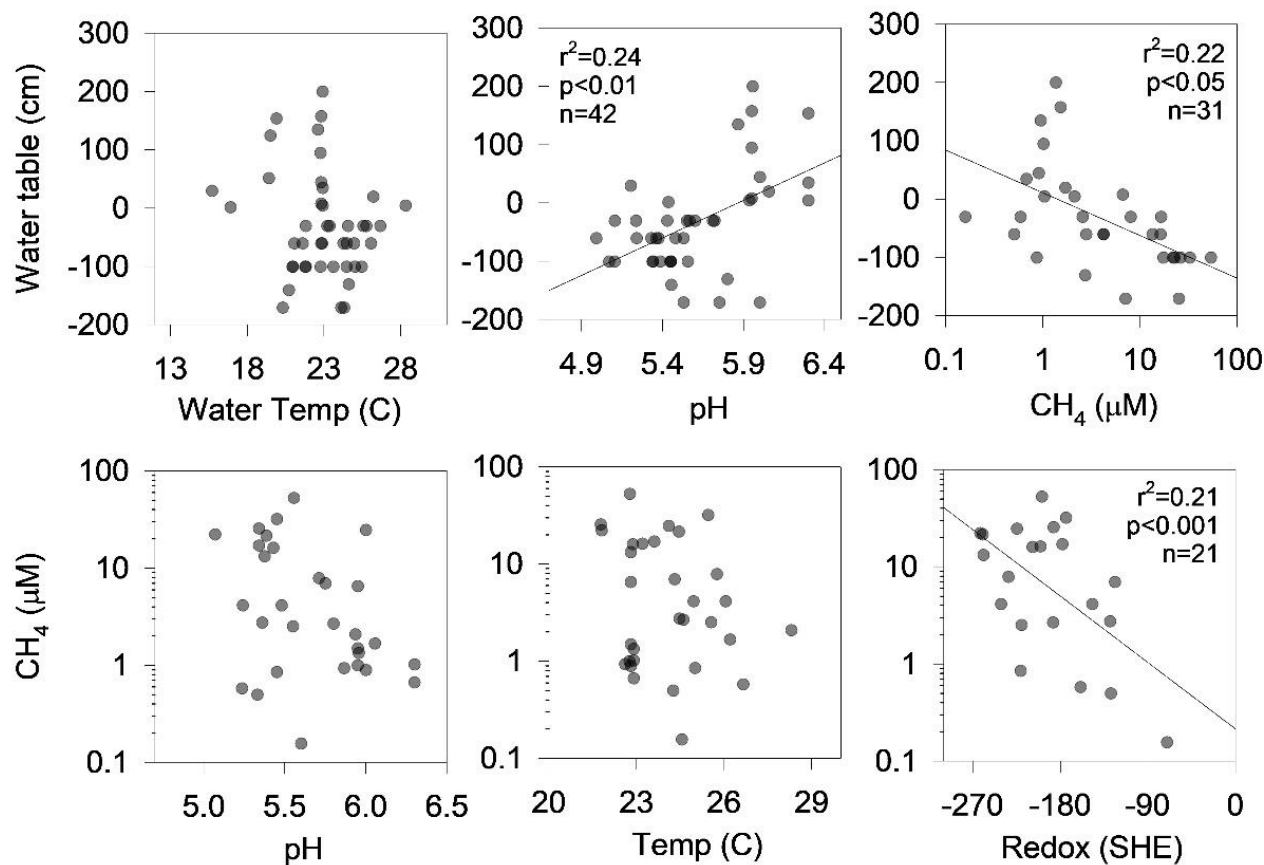


Figure S4. Correlations between changes in water table depth vs pH, temp and dissolved CH₄ (top) and correlations with dissolved CH₄ vs physicochemical parameters (bottom). Note: The log scale y-axis for bottom plots.

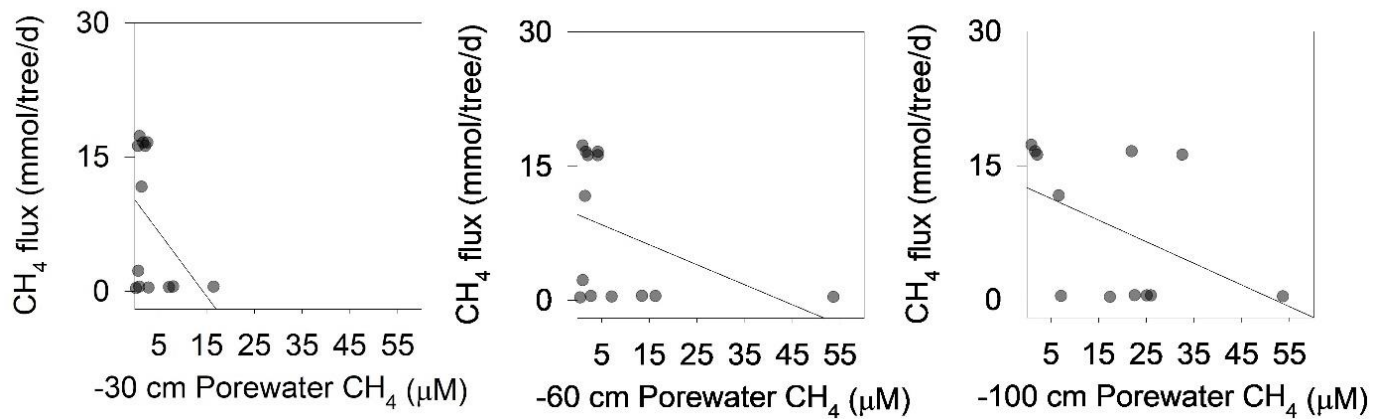


Figure S5. Negative but non-significant trends with wetland porewater and mean tree stem CH_4 fluxes.

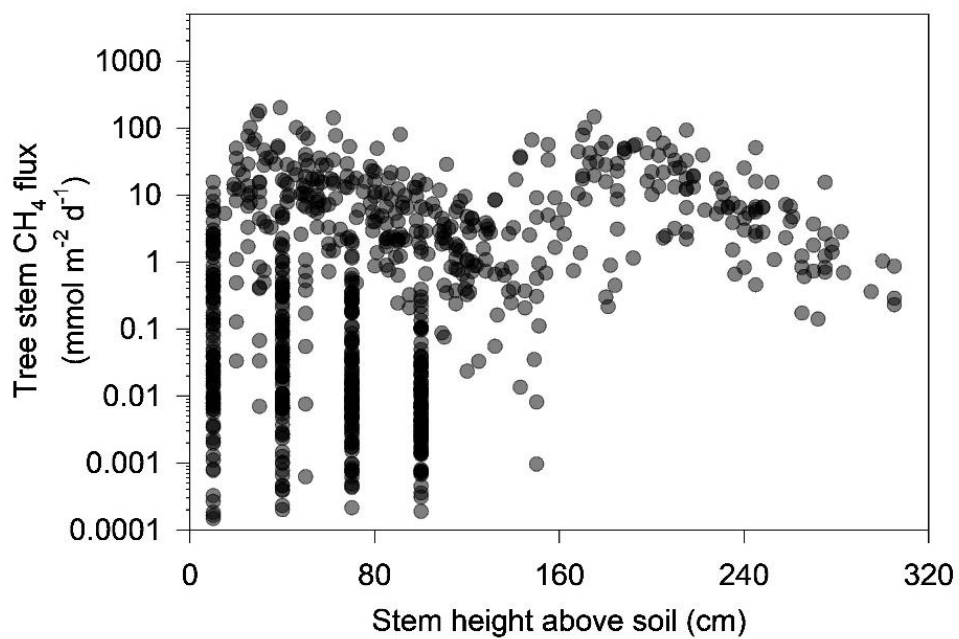


Figure S6. Positive tree stem CH_4 fluxes ($\text{mmol m}^{-2} \text{d}^{-1}$) vs height above soil surface (cm) for all campaigns. Note: The log scale of y-axis.

Table S1. Forest parameters and areas used in upscaling results.

Zone	Sampled trees DBH (cm)		Tree density (trees ha ⁻¹)	Tree basal area (m ² m ⁻²)	Tree basal area coverage (m ² ha ⁻¹)	Tree stem area (m ² ha ⁻¹)
	Min - Max	Average				
Lower	12 - 35	21.6 ± 7.1	5049	0.042	213.8	2444
Transitional	15 - 29	20.3 ± 4.2	4600	0.044	203.5	2296
Upper	16 - 42	20.1 ± 14.0	3466	0.059	206.1	2120

Table S2. Average aquatic and porewater physicochemical data and CH₄ concentrations.

Trip	Date	Site	Sample Type	Depth (cm)	Temp (°C)	pH	DO (% Sat)	Redox (mV)	CH ₄ (μM)
3	9/06/2021	Lower	Porewater	-30	21.8	5.20	20.2	-169.5	
		Lower	Porewater	-60	21.1	5.43	16.4	-194.5	
		Lower	Porewater	-100	21.0	5.57	11.0	-196.7	
		Transitional	Porewater	-30	23.4	4.99	14.5	-90.6	
		Transitional	Porewater	-60	21.6	5.10	11.6	-112.7	
		Transitional	Porewater	-100	21.0	5.11	7.2	-121.1	
		Upper	Porewater	-140	20.7	5.53	9.2	-131.9	
		Upper	Porewater	-170	20.3	5.45	8.1	-115.7	
4	10/27/2021	Lower	Porewater	-30	23.2	5.45	23.9	-200.5	16.5
		Lower	Porewater	-60	22.9	5.53	26.7	-208.6	16.3
		Lower	Porewater	-100	21.8	5.43	22.0	-186.9	25.9
		Transitional	Porewater	-60	24.5	5.34	69.2	-128.8	2.8
		Transitional	Porewater	-100	22.8	5.72	23.9	-199.0	53.6
		Upper	Porewater	-170	24.3	5.36	26.4	-123.9	7.1
5	11/21/2021	Lower	Porewater	-30	25.8	5.56	27.2	-233.4	8.0
		Lower	Porewater	-60	22.8	5.75	22.4	-259.1	13.4
		Lower	Porewater	-100	21.8	5.71	21.1	-262.4	22.6
		Transitional	Porewater	-30	24.6	5.38	43.7	-70.4	0.2
		Transitional	Porewater	-60	24.3	5.07	29.1	-128.1	0.5
		Transitional	Porewater	-100	23.6	5.60	21.0	-178.1	17.3
6	1/22/2022	Lower	Porewater	-30	25.6	5.33	15.5	-220.0	2.6
		Lower	Porewater	-60	25.0	5.34	13.4	-241.0	4.2
		Lower	Porewater	-100	24.5	5.55	12.6	-260.0	21.9
		Transitional	Porewater	-30	26.7	5.48	13.1	-159.4	0.6
		Transitional	Porewater	-60	26.1	5.39	10.9	-147.1	32.8
		Transitional	Porewater	-100	25.5	5.24	12.6	-174.2	32.5
		Upper	Porewater	-100	25.0	5.24	10.7	-220.9	0.9
		Upper	Porewater	-130	24.6	5.45	17.8	-187.5	2.7
		Upper	Porewater	-170	24.1	5.45	13.9	-224.7	25.0
		Lower	Surface Water	-20	26.2	5.80	30.3		1.7
		Transitional	Surface Water	-20	28.3	6.00	31.9		2.1
7	2/09/2022	Lower	Surface Water	-30	22.9	6.06	15.8		1.4
		Lower	Surface Water	-72	22.8	5.94	15.0		1.5
		Lower	Surface Water	-222	22.8	5.96	20.3		6.6
		Transitional	Surface Water	-30	22.6	5.95	12.5		0.9
		Transitional	Surface Water	-70	22.8	5.95	24.7		1.0
		Transitional	Surface Water	-120	22.8	5.87	14.1		0.9
		Upper	Surface Water	-30	22.9	5.95	16.2		0.7
		Upper	Surface Water	-60	22.9	6.00	23.4		1.0
8	22/05/2022	Lower	Surface Water	-20	19.9	6.30	19.0		
		Transitional	Surface Water	-20	19.5	6.30	24.4		
		Upper	Surface Water	-20	19.4	6.30	19.4		

Table S3. Pairwise Multiple Comparison Procedures (Dunn's Method) for soil vs aquatic CH₄ fluxes for each zone.

Soil vs water Comparison	Diff of Ranks	Q	P	P<0.050
Wet Lower vs Dry Upper	105.921	10.021	<0.001	Yes
Wet Lower vs Wet Upper	80.114	3.931	0.001	Yes
Wet Lower vs Dry Trans	49.535	3.532	0.006	Yes
Wet Lower vs Dry Lower	45.68	3.458	0.008	Yes
Wet Lower vs Wet Trans	23.942	1.937	0.791	No
Wet Trans vs Dry Upper	81.979	7.302	<0.001	Yes
Wet Trans vs Wet Upper	56.172	2.71	0.101	No
Wet Trans vs Dry Trans	25.593	1.762	1	Do Not Test
Wet Trans vs Dry Lower	21.738	1.582	1	Do Not Test
Dry Lower vs Dry Upper	60.242	4.955	<0.001	Yes
Dry Lower vs Wet Upper	34.435	1.621	1	Do Not Test
Dry Lower vs Dry Trans	3.856	0.253	1	Do Not Test
Dry Trans vs Dry Upper	56.386	4.325	<0.001	Yes
Dry Trans vs Wet Upper	30.579	1.405	1	Do Not Test
Wet Upper vs Dry Upper	25.807	1.309	1	No

Table S4. Pairwise Multiple Comparison Procedures (Dunn's Method) for tree CH₄ fluxes for each zone between flooded vs dry wetland conditions.

Tree flux Comparison	Diff of Ranks	Q	P	P<0.050
Wet Trans vs Dry Upper	127.362	9.964	<0.001	Yes
Wet Trans vs Dry Trans	111.644	7.579	<0.001	Yes
Wet Trans vs Dry Lower	85.911	5.832	<0.001	Yes
Wet Trans vs Wet Upper	51.578	2.768	0.085	No
Wet Trans vs Wet Lower	9.533	0.724	1	Do Not Test
Wet Lower vs Dry Upper	117.829	9.218	<0.001	Yes
Wet Lower vs Dry Trans	102.111	6.932	<0.001	Yes
Wet Lower vs Dry Lower	76.378	5.185	<0.001	Yes
Wet Lower vs Wet Upper	42.044	2.256	0.361	Do Not Test
Wet Upper vs Dry Upper	75.784	4.128	<0.001	Yes
Wet Upper vs Dry Trans	60.067	3.039	0.036	Yes
Wet Upper vs Dry Lower	34.333	1.737	1	No
Dry Lower vs Dry Upper	41.451	2.883	0.059	No
Dry Lower vs Dry Trans	25.733	1.595	1	Do Not Test
Dry Trans vs Dry Upper	15.718	1.093	1	Do Not Test

Table S5. Proportion of lower stem height tree CH₄ emissions (mmol per tree d⁻¹) to total tree stem CH₄ emissions of the Lower and Transitional zones ± SE.

Campaigns	Tree Stem height			
	10-40 cm		10-70 cm	
Wet	54.2% ±	2.5%	83.7% ±	1.5%
Dry	57.2% ±	3.2%	81.4% ±	2.4%
All	55.5% ±	2.0%	82.8% ±	1.3%