

Supplementary Materials

Table S1. Annual mean \pm standard error (SE) and mixed effect model results for environment variables during manual flux measurements during pre-DC (2018/19) and post-DC periods (2020/21), classified by ditch treatment effects (Control versus DC) and distance to ditches combinations (4m, 20m and 40m). Fixed factors of mixed effect models include clean treatment (T), distance to ditches (D) and their interaction (TD). Column N refers to the sample size of each model. Significant p *values ($\alpha = 0.05$) are represented in bold face.

		N	Mean \pm SE								p values from the mixed effect models	
			4m	Control area 20m	40m	all Control plots	4m	DC area 20m	40m	all DC plots	T	D
Ta (°C)	Pre DC	382	18.2 \pm 1.0	18.4 \pm 1.0	18.2 \pm 1.0	18.3 \pm 0.6	18.6 \pm 1.0	18.1 \pm 1.0	17.8 \pm 1.0	18.2 \pm 0.6	0.69	0.19
	Post DC	574	12.5 \pm 0.2	12.7 \pm 0.3	12.9 \pm 0.4	12.7 \pm 0.2	14.1 \pm 0.5	13.9 \pm 0.5	13.6 \pm 0.4	13.8 \pm 0.3	< 0.01	0.27
T _{s5} (°C)	Pre DC	376	12.0 \pm 0.6	12.2 \pm 0.7	12.2 \pm 0.6	12.1 \pm 0.4	12.4 \pm 0.6	12.7 \pm 0.6	12.6 \pm 0.6	12.6 \pm 0.4	0.20	0.48
	Post DC	574	12.0 \pm 0.4	12.4 \pm 0.4	12.9 \pm 0.5	12.4 \pm 0.3	12.6 \pm 0.5	13.1 \pm 0.5	12.6 \pm 0.5	12.8 \pm 0.3	0.03	< 0.01
T _{s10} (°C)	Pre DC	376	10.8 \pm 0.5	11.1 \pm 0.5	11.3 \pm 0.5	11.0 \pm 0.3	11.0 \pm 0.4	11.3 \pm 0.5	11.3 \pm 0.5	11.2 \pm 0.3	0.22	< 0.01
	Post DC	574	11.0 \pm 0.4	11.3 \pm 0.4	11.7 \pm 0.4	11.3 \pm 0.2	11.2 \pm 0.4	11.6 \pm 0.4	11.4 \pm 0.4	11.4 \pm 0.2	0.37	< 0.01
PAR ($\mu\text{mol m}^{-2} \text{s}^{-1}$)	Pre DC	373	762 \pm 64	830 \pm 62	786 \pm 58	793 \pm 35	805 \pm 58	810 \pm 62	703 \pm 57	773 \pm 34	0.06	0.13
	Post DC	573	643 \pm 48	674 \pm 48	683 \pm 48	666 \pm 28	710 \pm 45	729 \pm 46	702 \pm 45	714 \pm 26	0.02	0.59
WTL (cm)	Pre DC	382	-25 \pm 1	-29 \pm 2	-40 \pm 2	-31 \pm 1	-48 \pm 2	-40 \pm 2	-18 \pm 1	-36 \pm 1	0.22	0.13
	Post DC	543	-14 \pm 1	-16 \pm 1	-23 \pm 1	-17 \pm 1	-49 \pm 1	-35 \pm 2	-18 \pm 1	-34 \pm 1	< 0.01	< 0.01
SM ($\text{m}^3 \text{m}^{-3}$)	Pre DC	324	0.35 \pm 0.02	0.37 \pm 0.02	0.29 \pm 0.02	0.34 \pm 0.01	0.28 \pm 0.01	0.30 \pm 0.01	0.32 \pm 0.02	0.30 \pm 0.01	< 0.01	0.32
	Post DC	458	0.49 \pm 0.02	0.48 \pm 0.02	0.34 \pm 0.01	0.44 \pm 0.01	0.26 \pm 0.01	0.27 \pm 0.01	0.31 \pm 0.02	0.28 \pm 0.01	< 0.01	< 0.01
Peak in-frame green areal coverage [#]	Pre DC	24	0.34 \pm 0.07	0.25 \pm 0.08	0.05 \pm 0.02	0.21 \pm 0.05	0.20 \pm 0.01	0.20 \pm 0.07	0.22 \pm 0.12	0.21 \pm 0.05	0.89	0.49
	Post DC	24	0.56 \pm 0.05	0.61 \pm 0.10	0.35 \pm 0.13	0.51 \pm 0.06	0.46 \pm 0.17	0.65 \pm 0.12	0.59 \pm 0.14	0.57 \pm 0.08	0.98	0.35
Peak surrounding green areal coverage [#]	Pre DC	24	0.31 \pm 0.02	0.24 \pm 0.04	0.16 \pm 0.01	0.24 \pm 0.02	0.13 \pm 0.01	0.17 \pm 0.05	0.19 \pm 0.06	0.16 \pm 0.02	0.04	0.50
	Post DC	24	0.69 \pm 0.02	0.62 \pm 0.04	0.57 \pm 0.04	0.62 \pm 0.02	0.51 \pm 0.02	0.57 \pm 0.07	0.49 \pm 0.08	0.52 \pm 0.03	< 0.01	0.29
Peak in-frame greenness index [#]	Pre DC	24	0.35 \pm 0.05	0.23 \pm 0.01	0.17 \pm 0.01	0.25 \pm 0.03	0.23 \pm 0.07	0.23 \pm 0.03	0.28 \pm 0.10	0.25 \pm 0.04	0.89	0.49
	Post DC	24	0.60 \pm 0.02	0.59 \pm 0.06	0.40 \pm 0.10	0.53 \pm 0.04	0.44 \pm 0.12	0.62 \pm 0.08	0.53 \pm 0.12	0.53 \pm 0.06	0.56	0.41
Peak surrounding greenness index [#]	Pre DC	24	0.28 \pm 0.02	0.24 \pm 0.03	0.19 \pm 0.01	0.24 \pm 0.01	0.19 \pm 0.02	0.21 \pm 0.02	0.20 \pm 0.01	0.20 \pm 0.01	0.03	0.09
	Post DC	24	0.53 \pm 0.03	0.47 \pm 0.02	0.44 \pm 0.02	0.48 \pm 0.02	0.37 \pm 0.02	0.40 \pm 0.05	0.38 \pm 0.04	0.39 \pm 0.02	< 0.01	0.23
Top soil (10cm) C concentration (%)		24	34 \pm 10	14 \pm 4	21 \pm 7	23 \pm 5	32 \pm 11	25 \pm 13	24 \pm 10	27 \pm 6	0.60	0.32
Top soil (10cm) N concentration (%)		24	1.21 \pm 0.35	0.39 \pm 0.10	0.71 \pm 0.25	0.77 \pm 0.17	1.16 \pm 0.39	0.79 \pm 0.42	0.78 \pm 0.38	0.91 \pm 0.21	0.61	0.18
Top soil (10cm) C:N ratio		24	27 \pm 1	33 \pm 3	31 \pm 2	30 \pm 1	28 \pm 1	31 \pm 1	35 \pm 5	31 \pm 2	0.70	0.08

*values ($\alpha = 0.05$) are represented in bold face.

Table S2. Model estimates for the total annual carbon dioxide (CO₂) and methane (CH₄) balances in control and ditch cleaning (DC) treatment areas. CO₂ fluxes includes its net exchange (NEE) and component fluxes of gross primary productivity (GPP) and ecosystem respiration (R_{eco}). Columns denotes the three distances (4m, 20m and 40m) from ditches estimated for the four study years (2018 to 2021). Values are in the unit of t-C ha⁻¹ year⁻¹ for CO₂ and of kg-C ha⁻¹ year⁻¹ for CH₄. Numbers are represented with ± standard error (SE).

Flux	Treatment	4m from ditch				20m from ditch				40m from ditch				Total			
		Pre-DC		Post-DC		Pre-DC		Post-DC		Pre-DC		Post-DC		Pre-DC		Post-DC	
		2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021	2018	2019	2020	2021
CO ₂ (t-C ha ⁻¹ year ⁻¹)																	
NEE	Control	6.1±1.2	4.4±2.0	2.2±1.4	0.5±1.5	6.0±1.2	4.7±1.9	2.9±1.4	1.8±1.6	6.2±1.4	4.6±1.7	3.8±1.4	1.7±1.5	6.1±1.2	4.6±1.9	3.0±1.4	1.3±1.5
	DC	6.6±1.3	4.1±1.6	3.1±1.5	1.9±1.7	7.4±1.7	4.2±1.7	3.3±1.6	1.9±1.8	7.6±1.7	4.0±1.5	2.9±1.4	1.8±1.7	7.2±1.6	4.1±1.6	3.2±1.5	1.8±1.8
GPP	Control	-	-4.8±0.7	-10.0±0.5	-11.7±0.7	-	-4.3±0.6	-9.4±0.5	-11.6±0.7	-	-3.6±0.5	-9.0±0.5	-11.2±0.6	-	-4.2±0.6	-9.5±0.5	-11.7±0.7
	DC	-	-3.8±0.6	-10.0±0.9	-12.4±1.1	-	-4.1±0.6	-10.5±0.9	-12.9±1.2	-	-3.8±0.6	-9.4±0.5	-12.4±1.1	-	-3.9±1.0	-10.3±0.9	-12.6±1.2
R _{eco}	Control	6.1±1.2	9.2±1.8	12.1±1.3	12.9±1.3	6.0±1.2	9.0±1.8	12.3±1.3	13.4±1.5	6.2±1.4	8.2±1.6	12.8±1.4	12.8±1.4	6.1±1.2	8.8±1.7	12.4±1.3	13.1±1.4
	DC	6.6±1.3	7.9±1.5	13.2±1.2	14.2±1.3	7.4±1.7	8.3±1.5	13.8±1.3	14.4±1.3	7.6±1.7	7.9±1.4	12.3±1.3	14.2±1.3	7.2±1.6	8.0±1.5	13.4±1.3	14.4±1.4
CH ₄ (kg-C ha ⁻¹ year ⁻¹)																	
	Control	-1.8±1.0	0.9±1.0	131±31	176±66	-1.4±1.1	-1.1±4.8	1.7±63	27±68	-4.1±1.4	-2.3±1.3	-1.3±1.0	-1.8±1.5	-2.2±0.7	-0.6±1.6	1.7±25.5	27±39
	DC	-3.2±0.5	-3.5±1.0	-3.1±0.8	-4.3±1.3	-2.3±0.5	-2.4±0.6	-2.0±1.4	0.2±3.3	-2.7±1.7	-2.4±9.8	1.3±14.8	1.4±30.1	-3.0±0.6	-3.0±3.3	-2.3±5.1	-2.7±10.2
Total balance ^d (t-C ha ⁻¹ year ⁻¹)																	
	Control	6.1±1.2	4.4±2.0	2.3±1.4	0.7±1.5	6.0±1.2	4.7±1.9	2.9±1.4	1.8±1.6	6.2±1.4	4.6±1.7	3.8±1.4	1.7±1.5	6.1±1.2	4.6±1.9	3.0±1.4	1.3±1.5
	DC	6.6±1.3	4.1±1.6	3.1±1.5	1.9±1.7	7.4±1.7	4.2±1.7	3.3±1.6	1.9±1.8	7.6±1.7	4.0±1.5	2.9±1.4	1.8±1.7	7.2±1.6	4.1±1.6	3.2±1.5	1.8±1.8

Table S3. The correlation coefficients (or loadings) of the each significant Principal components (PCs) with the input variables. Significant PCs are defined by the Kaiser criterion where the eigenvalues are greater than one. Five PCs were defined significant in the PCA with sample data for Pre-DC Period shown at the left columns, whereas four PCs were significant for the Post-DC period at the right columns. The total variance explained for each PC (in %) is presented at the first row.

Variance explained	PCs for Pre-DC Period					PCs for Post-DC period			
	PC1	PC2	PC3	PC4	PC5	PC1	PC2	PC3	PC4
	38%	15%	13%	9%	9%	33%	22%	14%	11%
Treatment variables									
Distance	-0.40	0.58	0.26	-0.01	-0.25	-0.32	0.11	-0.52	0.61
Clean	-0.12	-0.28	0.54	0.15	0.23	-0.24	-0.58	-0.19	-0.41
Flux variables									
NEE	-0.83	-0.12	-0.23	-0.10	0.22	-0.81	0.22	0.30	0.03
Reco	0.36	-0.68	-0.12	0.36	-0.07	0.23	-0.80	-0.21	-0.05
GPP	-0.86	0.31	-0.11	-0.30	0.22	-0.72	0.56	0.33	0.05
CH ₄	0.60	0.57	0.15	0.14	0.38	0.66	0.29	0.35	0.14
Environment variables									
T _{s5}	-0.52	-0.10	0.61	0.42	0.34	-0.68	-0.46	0.02	0.41
T _{s10}	-0.61	0.06	0.64	0.11	0.21	-0.62	-0.40	0.15	0.57
WTL	0.43	0.71	0.24	0.01	-0.24	0.47	0.64	-0.09	0.53
SM	0.63	0.52	-0.21	0.00	0.38	0.70	0.48	0.22	0.19
g _{cc}	0.86	-0.06	0.29	0.23	-0.12	0.87	-0.25	-0.22	0.08
VC	0.83	0.05	-0.04	0.36	-0.01	0.78	-0.34	-0.31	0.29
N	0.62	-0.26	0.41	-0.59	0.10	0.25	-0.54	0.69	0.24
C	0.59	-0.27	0.45	-0.59	0.01	0.24	-0.58	0.63	0.29
CN	-0.42	0.11	0.38	0.07	-0.73	-0.34	-0.06	-0.55	0.32