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Cushion bog plant community responses to passive warming in southern Patagonia

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1 *Astelia pumila* leaf properties

Table S1. Areal number of plant individuals and amount of aboveground biomass. Sampling was performed on 29 and 30 April 2016 and therefore represent late growing season conditions. Conditions were recorded in 10 cm by 10 cm sampling rectangles in the warming treatment and control plots.

		Sampling rectangle					
Plot	Treatment	Dimensions, cm		Area, m²	Number of plants	Weight, g	Dry weight, g
10	Warming	8	9	0.0072	44	12.363	2.688
11	Warming	10	9.5	0.0095	45	15.676	3.308
12	Warming	9.5	9.5	0.009025	53	20.794	3.758
13	Warming	11.5	8	0.0092	43	24.789	4.570
14	Warming	10.5	10	0.0105	67	13.489	2.811
15	Warming	10	8	0.008	37	8.357	1.745
16	Warming	8.5	8	0.0068	66	17.873	3.762
17	Warming	9	10	0.009	57	14.970	2.914
18	Warming	9	11	0.0099	59	19.450	4.018
19	Warming	9.5	8	0.0076	39	21.038	4.204
20	Control	10.5	8	0.0084	53	20.398	4.177
21	Control	9	9	0.0081	54	15.706	3.058
22	Control	10	9	0.009	47	13.016	2.432
23	Control	9	8.5	0.00765	56	23.337	4.47
24	Control	5	8	0.004	25	8.342	1.871
25	Control	9	9	0.0081	65	14.473	3.081
26	Control	9	8.5	0.00765	61	15.013	3.069
27	Control	8.5	6	0.0051	34	11.092	2.276
28	Control	8.5	9	0.00765	39	20.153	3.889
29	Control	8	7.5	0.006	37	15.268	2.798

Table S2. *Astelia pumila* leaf area, weight and water content measurements during 12 measurement days in 2016 (LDMC: leaf dry mass content, SLA: specific leaf area, SLM: specific leaf mass). For statistical analysis (see Figure 3 in original article), we grouped the data set into midsummer (15 January to 06 February) and late summer (18 February to 04 March).

Date	Treatment	Area, mm²			Weight, mg			Dry weight, mg		Water content		LDMC, mg/g		SLM g/m²			SLA,cm²/g	
		n	Mean	SD	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD	n	Mean	SD	Mean	SD
2016-01-15	C	2	25.91	2.93	3	12.1	4	4.5	1.7	0.63	0.02	371.17	15.90	2	142.71	35.74	72.34	18.11
	W	3	24.01	2.38	3	8	2.8	3.6	0.9	0.54	0.05	455.35	49.03	3	147.63	28.52	69.69	15.15
2016-01-20	W	2	35.32	8.71	2	17.6	7.1	6	1.3	0.65	0.07	352.65	66.96	2	168.93	3.61	59.21	1.27
2016-01-22	C	1	38.16		1	9.4	0	4.8	0	0.49		510.64		1	125.80		79.49	
	W	3	30.73	6.27	3	10.8	2.2	3.7	0.3	0.65	0.05	350.71	52.88	3	122.80	17.64	82.52	11.41
2016-01-25	C	2	30.90	1.32	2	10.8	0.6	5.7	0.1	0.47	0.04	531.55	44.62	2	184.75	12.48	54.25	3.67
	W	2	29.59	2.71	2	7.1	0.6	4.4	0.4	0.38	0.11	621.82	106.28	2	147.07	1.54	68.00	0.71
2016-01-27	C	4	29.22	9.25	4	15.2	9.3	6.8	2.4	0.48	0.15	516.26	147.64	4	232.95	29.29	43.42	5.24
	W	3	29.88	7.91	3	18.4	11.5	8.5	4.4	0.47	0.09	530.45	94.42	2	229.83	35.01	44.02	6.71
2016-01-28	C	8	31.68	8.66	8	13.6	4.3	5.8	1.3	0.56	0.05	435.63	47.29	7	170.97	18.15	59.02	5.87
	W	8	30.34	6.44	8	14	5.3	6.4	2.1	0.53	0.05	473.10	54.49	7	195.41	39.79	53.23	12.00
2016-02-06	C	3	19.48	3.24	3	4	1.2	3	0.1	0.23	0.17	768.60	168.96	3	154.71	22.79	65.52	9.01
	W	3	23.45	7.58	3	5.3	2.3	3.8	1.5	0.27	0.06	731.05	55.95	3	161.13	13.40	62.34	5.08
2016-02-18	C	7	33.39	5.50	7	9	2.4	5.7	1.1	0.35	0.07	645.48	67.36	7	170.95	26.06	59.64	8.85
	W	4	25.80	2.06	4	7.5	1.8	4.6	0.6	0.37	0.12	628.16	124.67	4	177.82	21.57	56.86	6.88
2016-02-23	C	1	24.12		1	12.4	0	6.6	0	0.47		532.26		1	273.64		36.54	
	W	4	25.47	1.84	4	8.9	2.4	5.1	0.5	0.40	0.10	598.41	102.62	4	202.05	22.69	49.99	5.93
2016-03-02	C	3	25.90	4.94	2	4.6	0.8	3.7	0.6	0.17	0.04	831.37	44.37	3	145.75	19.69	69.53	10.18
	W	2	31.27	11.18	1	8.3	0	5.8	0.2	0.33		674.70		1	142.94		69.96	
2016-03-03	C	5	38.02	7.75	5	8.9	2.8	5.1	1.1	0.40	0.10	597.77	98.29	5	135.17	12.73	74.57	7.77
	W	7	33.24	5.70	7	9	2	5.1	0.8	0.42	0.09	575.67	89.75	7	155.95	32.92	67.14	16.93
2016-03-04	C	4	34.36	4.06	4	11.2	2	5.2	0.7	0.53	0.07	465.63	71.63	4	151.18	23.46	67.47	11.44
	W	4	31.45	6.57	4	9.5	4.9	4.8	1.7	0.47	0.08	534.47	80.26	4	150.73	34.37	68.52	12.75

Table S3. *Astelia pumila* leaf properties and site characteristics recorded in January 2016.

Treatment	Watertable, cm			Immature fruits			Leaf dimensions, mm					Number of leaves							
							length			width		Total		Juvenile		Senescent		Dead	
	n	Mean	SD	n	Mean	SD	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
C	90	28.67	5.11	27	3.59	3.57	100	16.59	2.53	4.64	0.66	7.02	1.21	2.06	0.34	1.30	0.75	1.00	1.02
W	90	30.33	5.08	27	3.81	3.45	100	15.72	2.45	4.71	0.73	7.09	1.41	2.09	0.38	1.15	0.67	0.84	0.97

Table S4. *Astelia pumila* leaf properties and site characteristics recorded in April 2016.

Treatment		Leaf dimensions		Number of leaves					
		length, mm		Juvenile		Senescent		Dead	
	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Control	98	17.97	2.69	3.89	0.73	0.72	0.67	2.09	0.80
Warming	97	17.01	2.42	4.04	1.03	1.03	0.83	2.11	0.74

Table S5. *Astelia pumila* leaf properties and site characteristics recorded in September 2017 and March 2018.

Treatment	September 2017								March 2018					
	Watertable, cm			leaf dimensions length, mm			Number of leaves Total		leaf dimensions length, mm			Number of new leaves		
	n	Mean	SD	n	Mean	SD	Mean	SD	n	Mean	SD	n	Mean	SD
Control	45.00	20.89	13.63	100	16.69	2.43	4.68	0.63	64.00	19.02	2.57	64.00	19.02	2.57
Warming	30.00	18.77	2.84	100	17.15	2.42	4.81	0.72	72.00	18.75	2.42	72.00	18.75	2.42

Table S6. Spectrophotometrically derived leaf chlorophyll and carotene contents.

			Chlorophyll a per dry mass, mg/g		Chlorophyll b per dry mass, mg/g		Total chlorophyll per dry mass, mg/g		Chlorophyll a/ Chlorophyll b		Carotene per dry mass, mg/g	
Date	Treatment	n	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
29 January 2016	Control	4	2.17	0.66	0.58	0.14	1.59	0.55	3.71	0.54	0.67	0.22
	Warming	5	2.76	0.4	0.74	0.15	2.02	0.28	3.79	0.38	0.82	0.08
13 February 2016	Control	6	1.87	0.37	0.84	0.12	1.03	0.26	2.21	0.15	0.43	0.07
	Warming	6	1.69	0.34	0.76	0.1	0.92	0.26	2.2	0.26	0.4	0.1
2 May 2016	Control	10	2.58	0.28	0.71	0.11	3.28	0.38	3.68	0.24	0.69	0.06
	Warming	10	2.56	0.72	0.75	0.18	3.31	0.88	3.41	0.51	0.67	0.19
24 November 2016	Control	10	3.74	0.96	1.11	0.32	4.85	1.27	2.02	0.49	1.29	0.35
	Warming	10	3.98	0.67	1.25	0.25	5.22	0.91	2.1	0.56	1.3	0.25
28 September 2017	Control	10	2.68	0.37	0.73	0.11	3.41	0.46	3.69	0.28	0.97	0.16
	Warming	10	2.91	0.82	0.88	0.34	3.79	1.14	3.42	0.55	1.03	0.26

2 Seasonally averaged diurnal air and soil temperature cycles

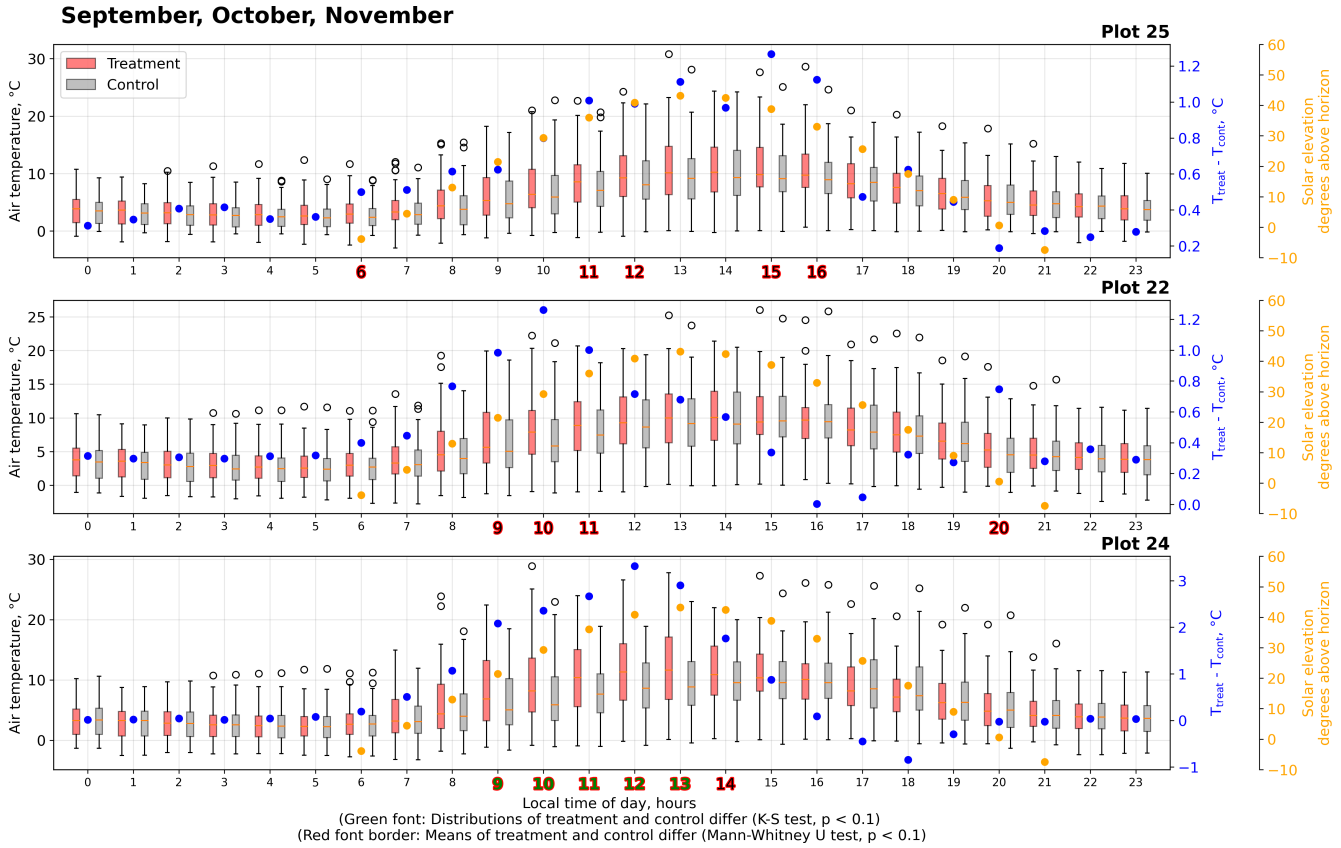

Figure S1. Average diurnal air temperature (1 cm above canopy) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in spring for the measurement period from January 2018 to January 2019.

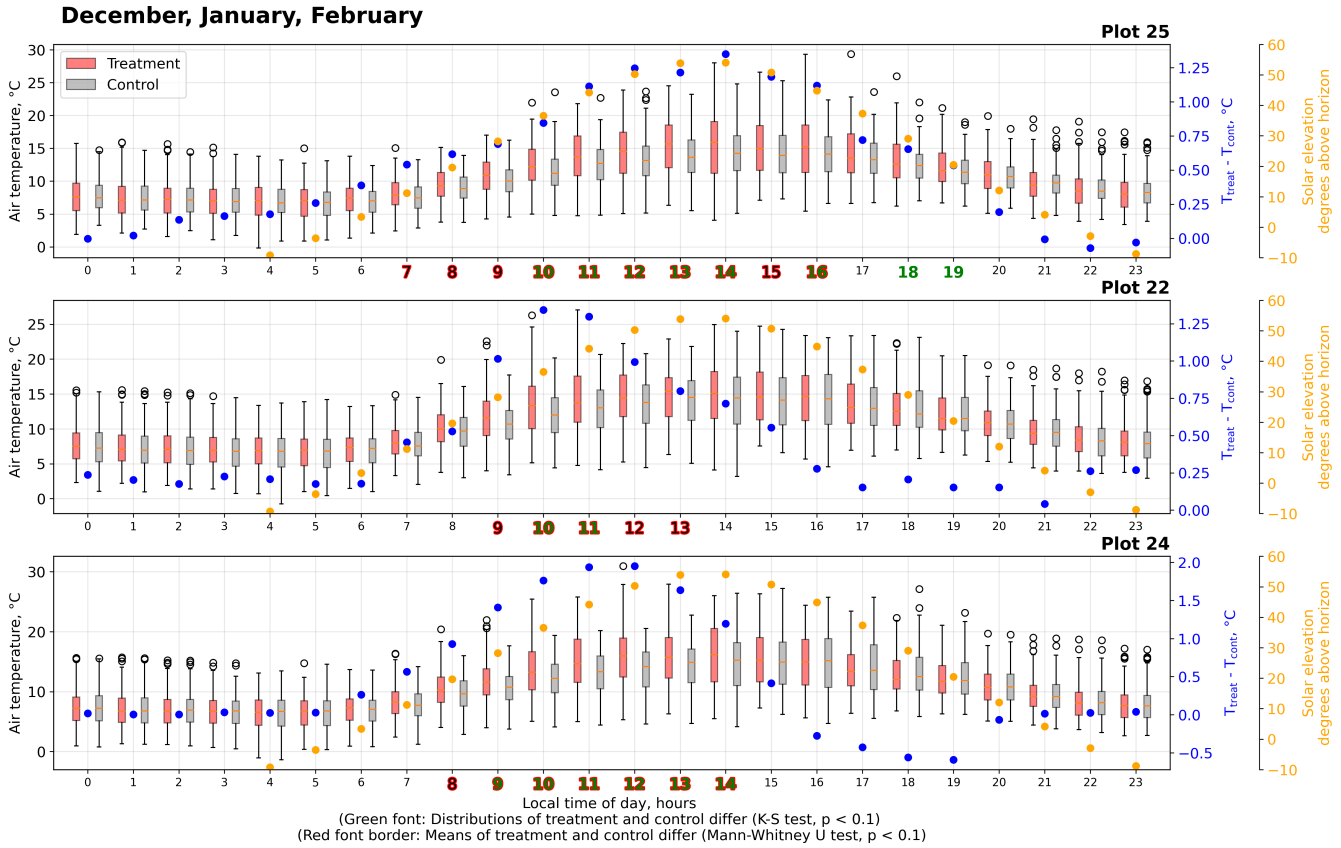

Figure S2. Average diurnal air temperature (1 cm above canopy) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in summer for the measurement period from January 2018 to January 2019.

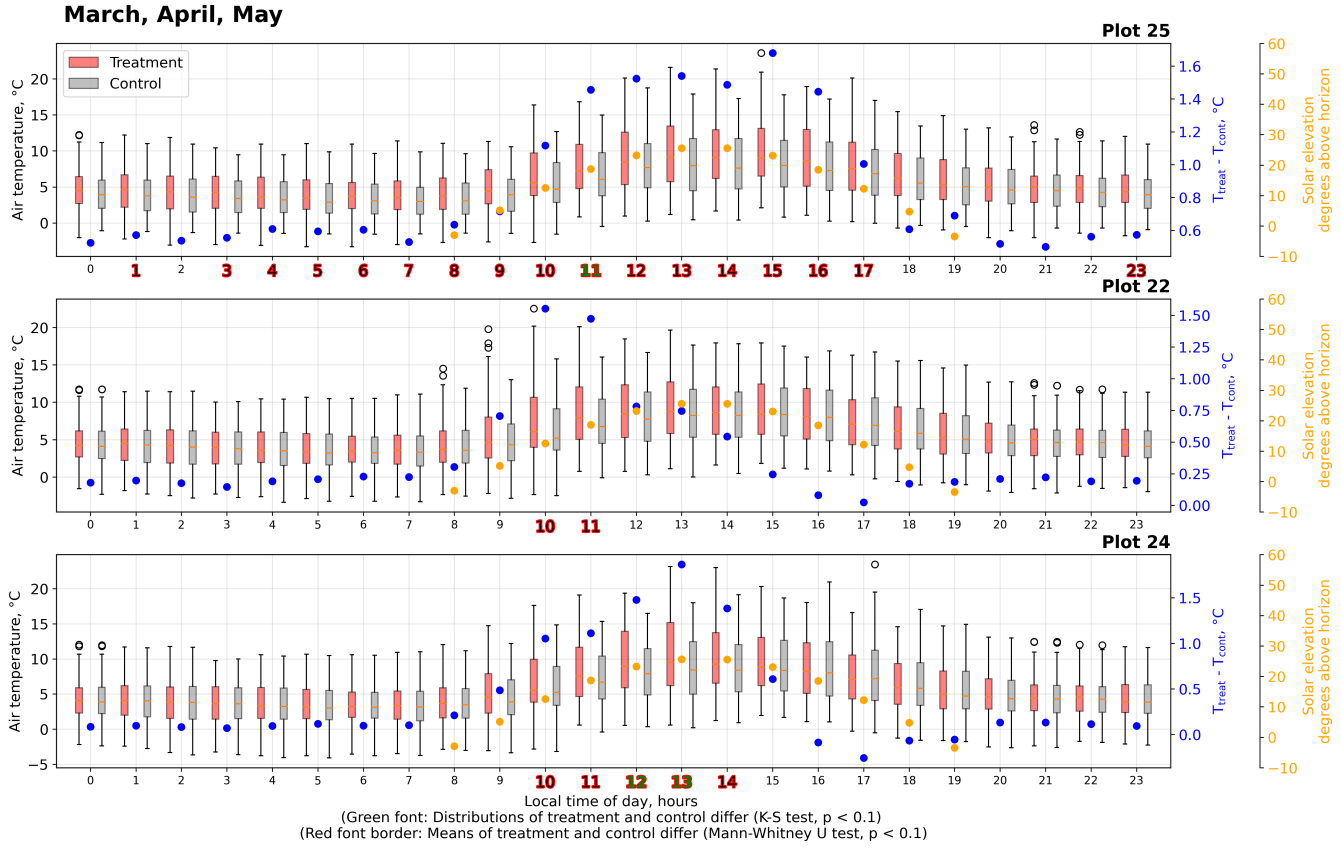

Figure S3. Average diurnal air temperature (1 cm above canopy) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in autumn for the measurement period from January 2018 to January 2019.

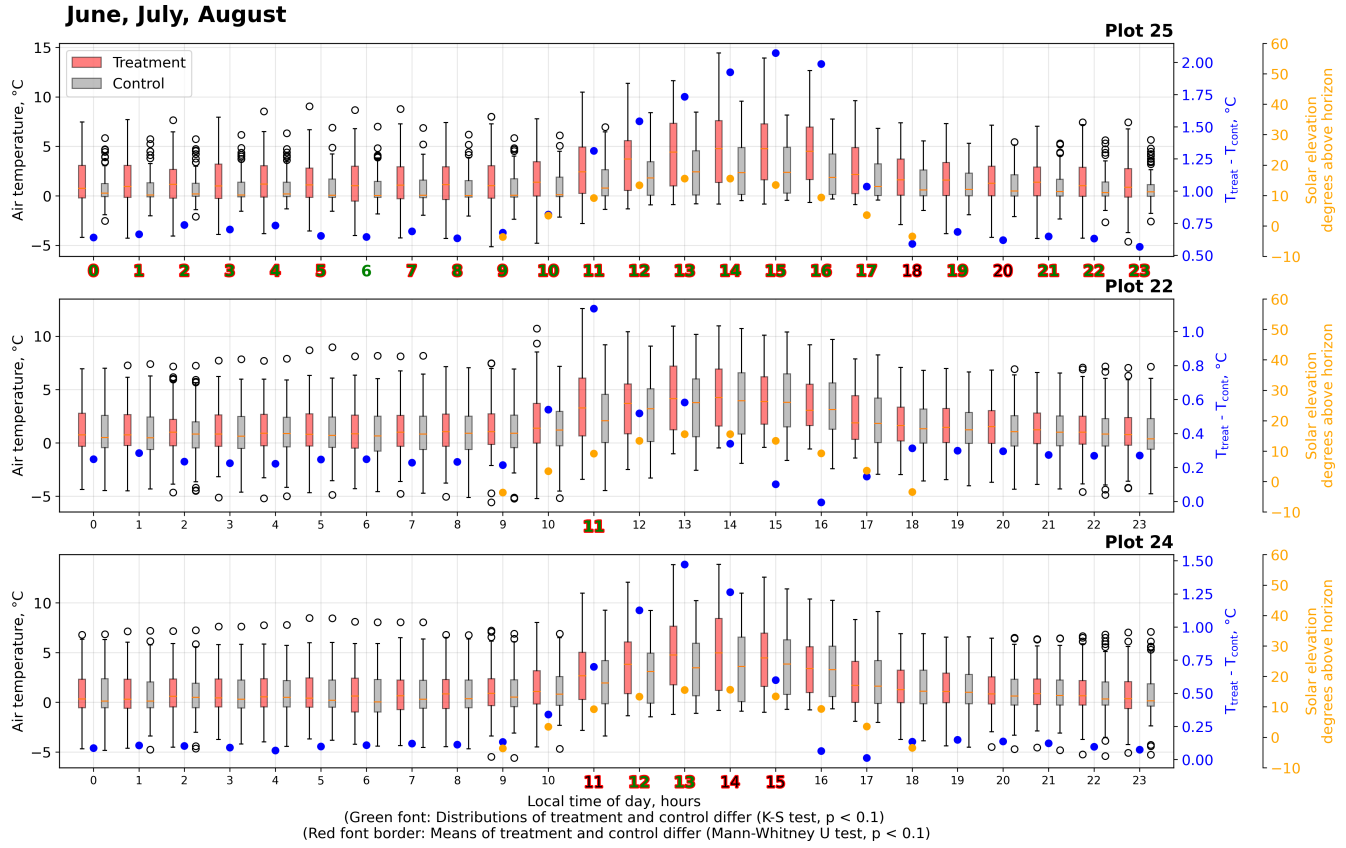

Figure S4. Average diurnal air temperature (1 cm above canopy) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in winter for the measurement period from January 2018 to January 2019.

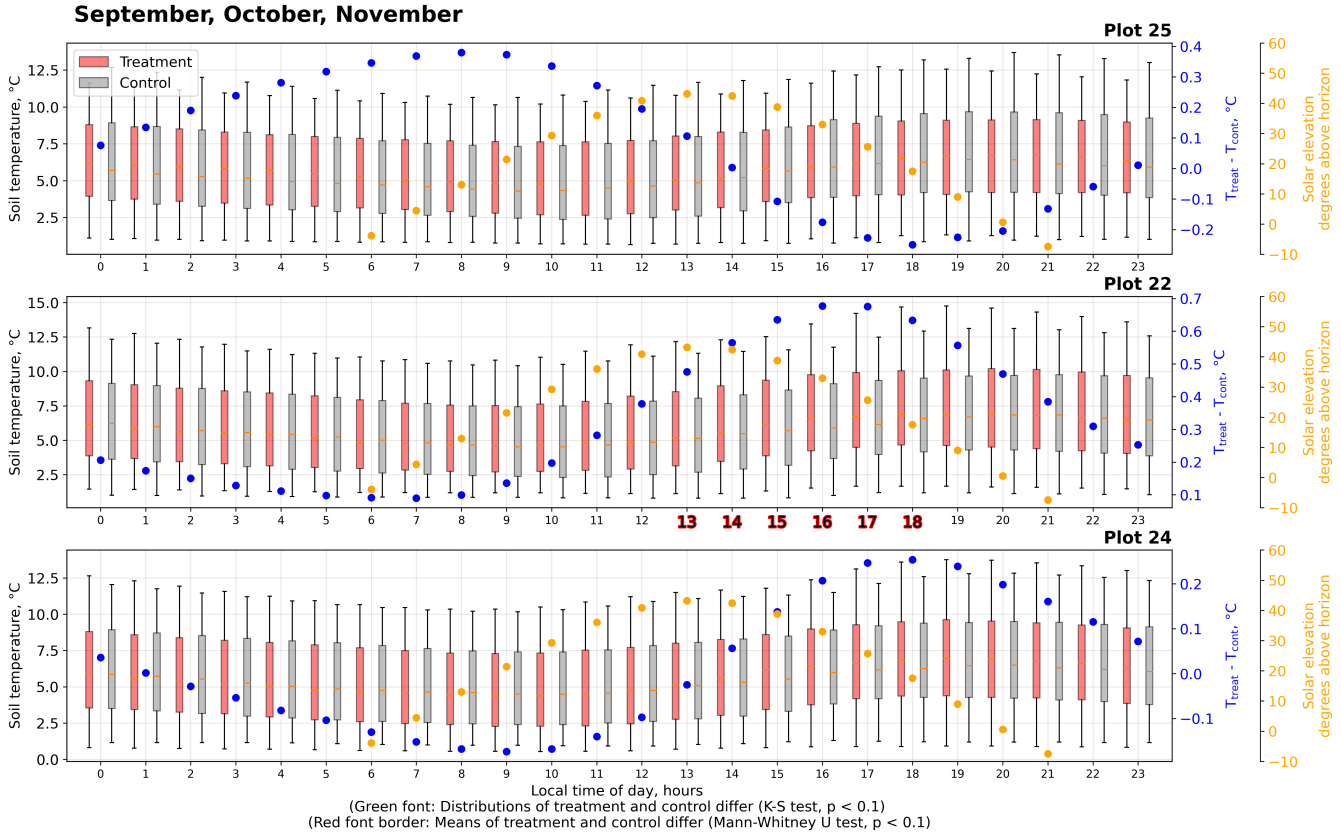

Figure S5. Average diurnal soil temperature (10 cm depth) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in spring for the measurement period from January 2018 to January 2019.

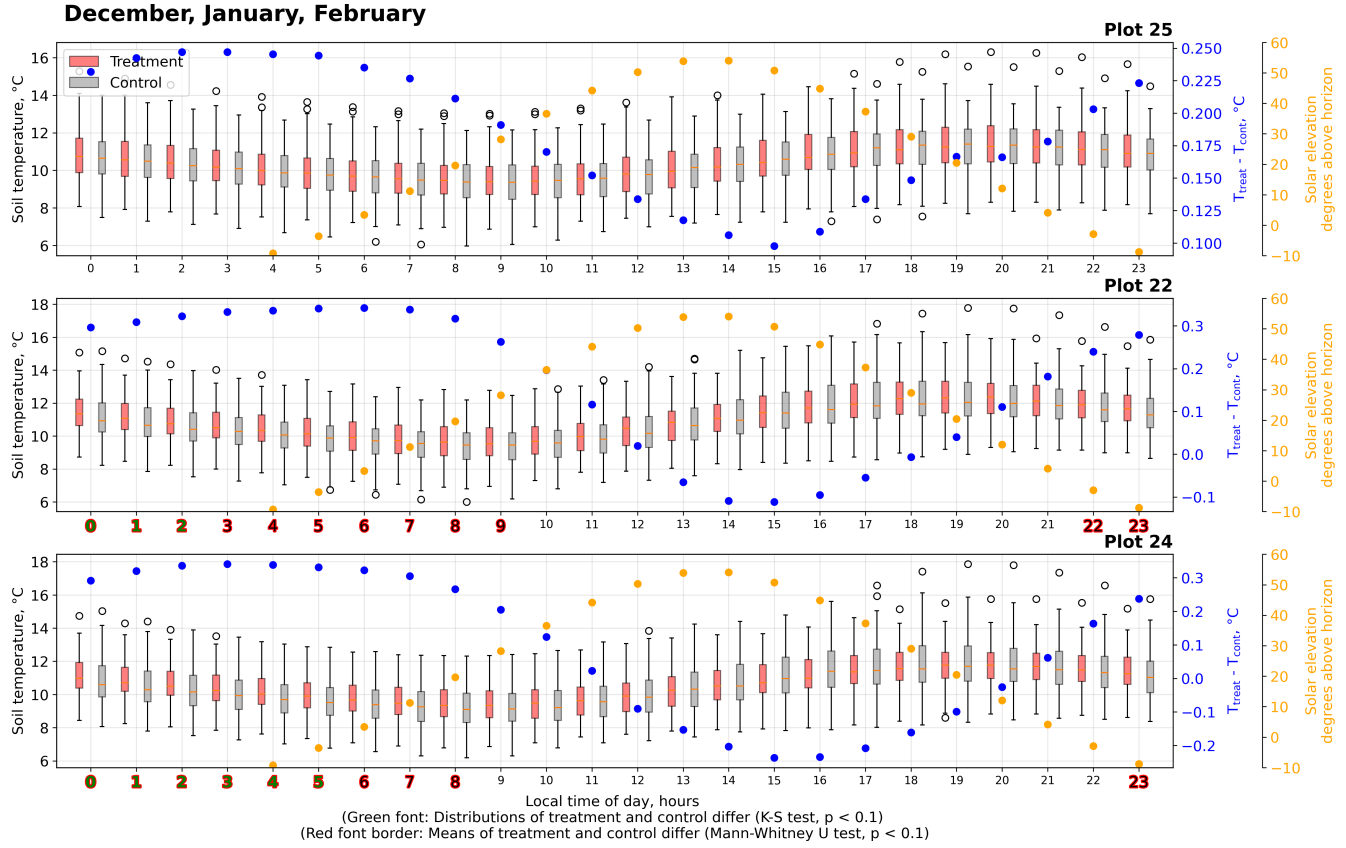

Figure S6. Average diurnal soil temperature (10 cm depth) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in summer for the measurement period from January 2018 to January 2019.

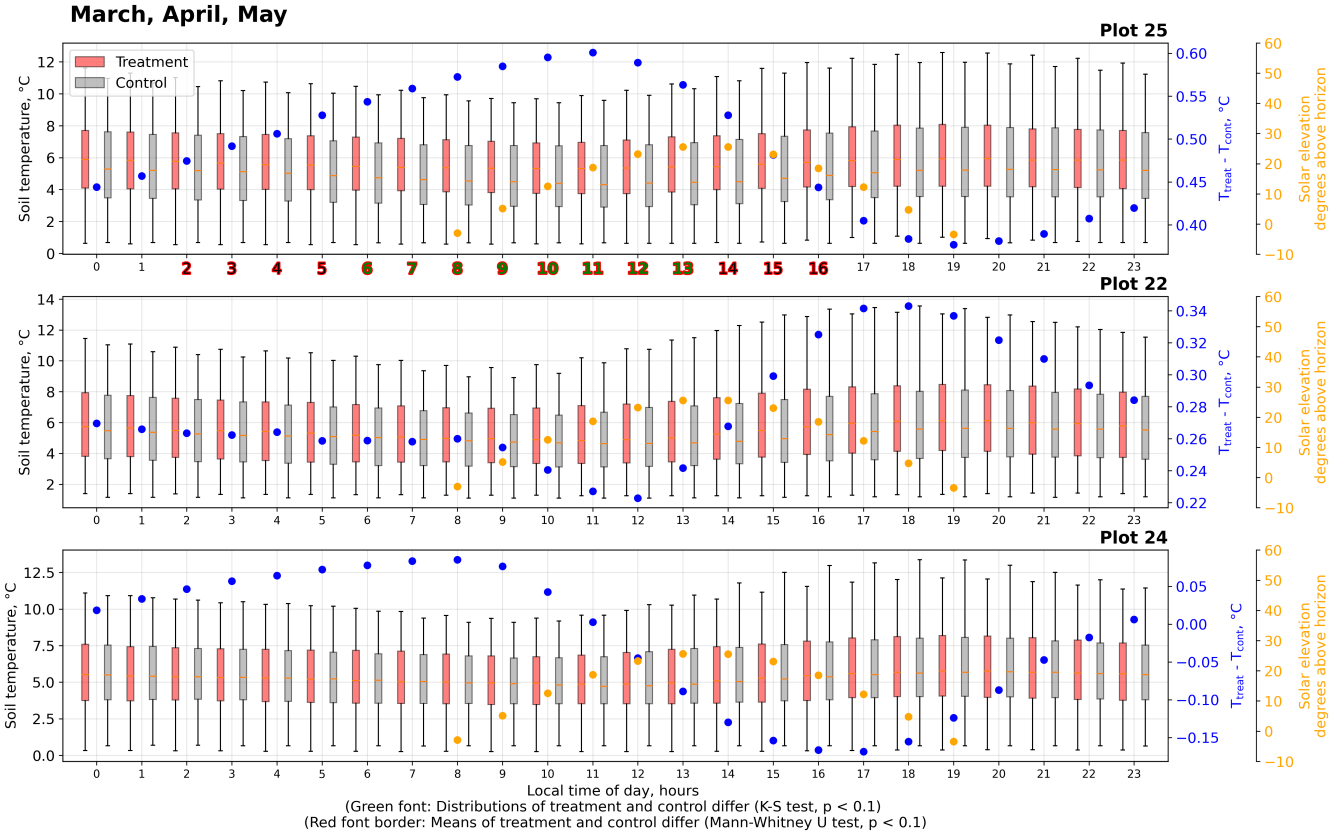

Figure S7. Average diurnal soil temperature (10 cm depth) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in autumn for the measurement period from January 2018 to January 2019.

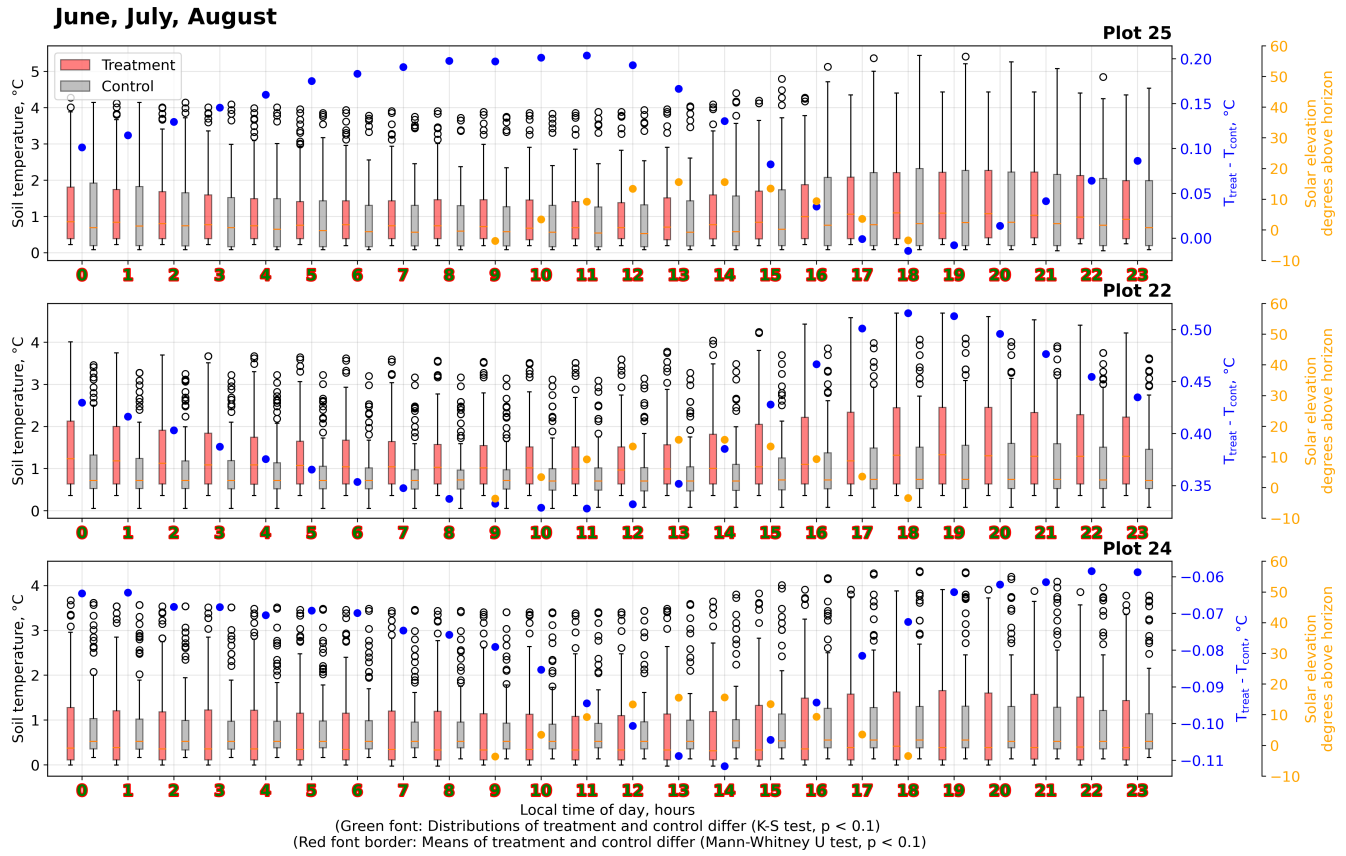

Figure S8. Average diurnal soil temperature (10 cm depth) cycle at the treatment (T_{treat}) and control (T_{cont}) plots in winter for the measurement period from January 2018 to January 2019.

3 Investigation of wind shelter effects

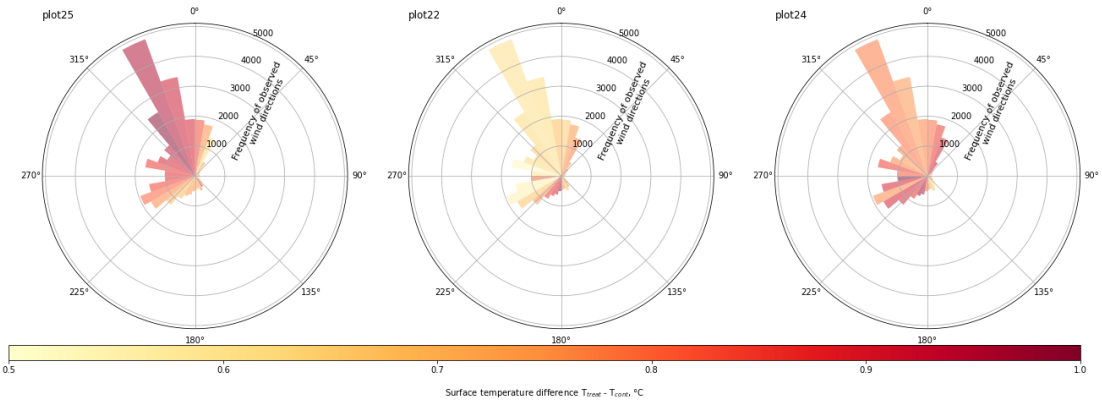

Figure S9. Polar histograms showing the frequency of wind directions as measured at the nearby eddy covariance station between January 2018 and January 2019 colored by the difference of observed surface temperatures inside (T_{treat}) and outside (T_{cont}) the three replicate plots where temperature sensors were deployed. Wind sheltering effect and thereby enhanced warming during phases of southern wind directions are not noticable consistently across the replicates. At plot 25 for example, the most efficient warming was archieved during phases of north-northwestern winds.

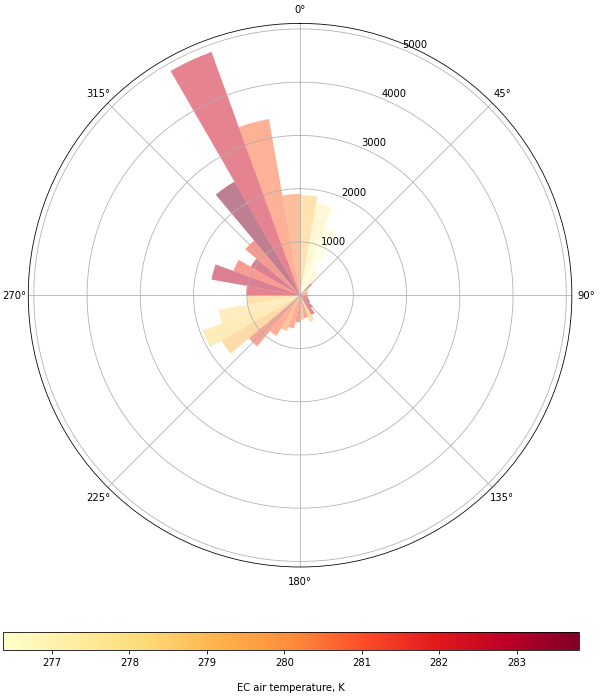

Figure S10. Polar histograms showing the frequency of wind directions as measured at the nearby eddy covariance station between January 2018 and January 2019. The color indicates 2 m air temperature measured at the same station.

4 Timing of sampling

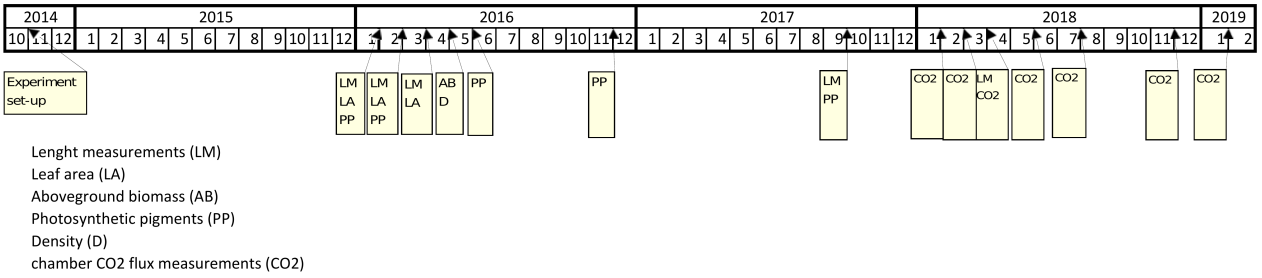

Figure S11. Timeline of field work