Supplementary materials

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Table S1. Main soil characteristics of each site (NA = non-available). Due to Finnish classification, approximations were made for sand (0.06–2.0 mm), silt (0.002–0.06 mm) and clay (<0.002 mm).

| Site ID | Experiment | Year | Soil texture | Physical characteristics | | | | Chemical characteristics | | | | | | |
				Soil density (kg m^{-3})	sand (%)	silt (%)	clay (%)	pH	CEC (cmol kg^{-1})	K (mg L^{-1})	P (mg L^{-1})	SOC (%)	SON (%)	CN ratio
VKI lawn	intensive	2021	Sandy loam	873	72.2	25.6	2.2	6.3	NA	220	18.0	2.8	0.19	14.5
VKI meadow	intensive	2021	Sandy loam	3166	72.4	17.1	10.5	6.1	NA	120	3.8	2.5	0.17	14.9
KMP lawn	intensive	2020	Sandy loam	865	69.5	22.1	8.4	5.6	NA	97	12.0	3.8	0.25	14.8
KMP meadow	intensive	2021	Sandy loam	2265	59.1	31.8	9.1	6.5	NA	230	380.0	5.6	0.46	12.3
JMT3C	satellite	2022	Silt loam	NA	5.2	68.9	26.0	5.3	20.3	220	4.6	5.0	0.46	10.8
JMT3T	satellite	2022	Loamy sand	NA	73.7	23.5	2.8	6.5	15.8	84	1.9	4.6	0.18	25.7
JMT7C	satellite	2022	Loamy sand	NA	82.7	14.9	2.4	6.5	16.5	150	26.5	4.0	0.26	15.0
JMT7T	satellite	2022	Loamy sand	NA	81.4	16.0	2.6	6.5	14.8	155	23.3	3.2	0.21	15.3
KO4C	satellite	2022	Sandy loam	NA	66.2	29.4	4.4	6.4	15.3	73	2.2	4.4	0.29	15.4
KO4T	satellite	2022	Sandy loam	NA	63.3	32.7	4.0	6.1	13.8	125	5.2	4.0	0.19	20.9
PK3C	satellite	2022	Sandy loam	NA	68.8	27.6	3.6	6.2	14.5	92	2.2	4.0	0.19	21.1
PK3T	satellite	2022	Sandy loam	NA	68.4	27.1	4.5	6.1	15.0	99	2.8	5.4	0.32	17.2
SK1C	satellite	2022	Sandy loam	NA	57.3	33.9	8.8	5.6	15.5	125	3.3	4.5	0.37	12.3
SK1T	satellite	2022	Sandy loam	NA	54.1	36.5	9.4	5.4	13.3	163	4.0	4.2	0.35	12.0
SMT12C	satellite	2022	Loam	NA	47.7	42.7	9.7	5.8	11.3	155	5.6	3.6	0.29	12.8
SMT12T	satellite	2022	Loam	NA	51.8	39.6	8.6	6.1	16.5	160	5.3	4.4	0.31	14.2

Table S2. Model parameters used in JSBACH

Parameters	KMP lawn	VKI lawn	KMP meadow	VKI meadow
			Sites	
root depth	0.12	0.12	0.20	0.18
field capacity	0.14	0.05	0.11	0.05
wilting point	0.34	0.25	0.33	0.21
max LAI	2.2	1.6	4.1	1.1
fcrit	0.9	0.9	0.8	0.9
fwilt	0.33	0.2	0.28	0.28

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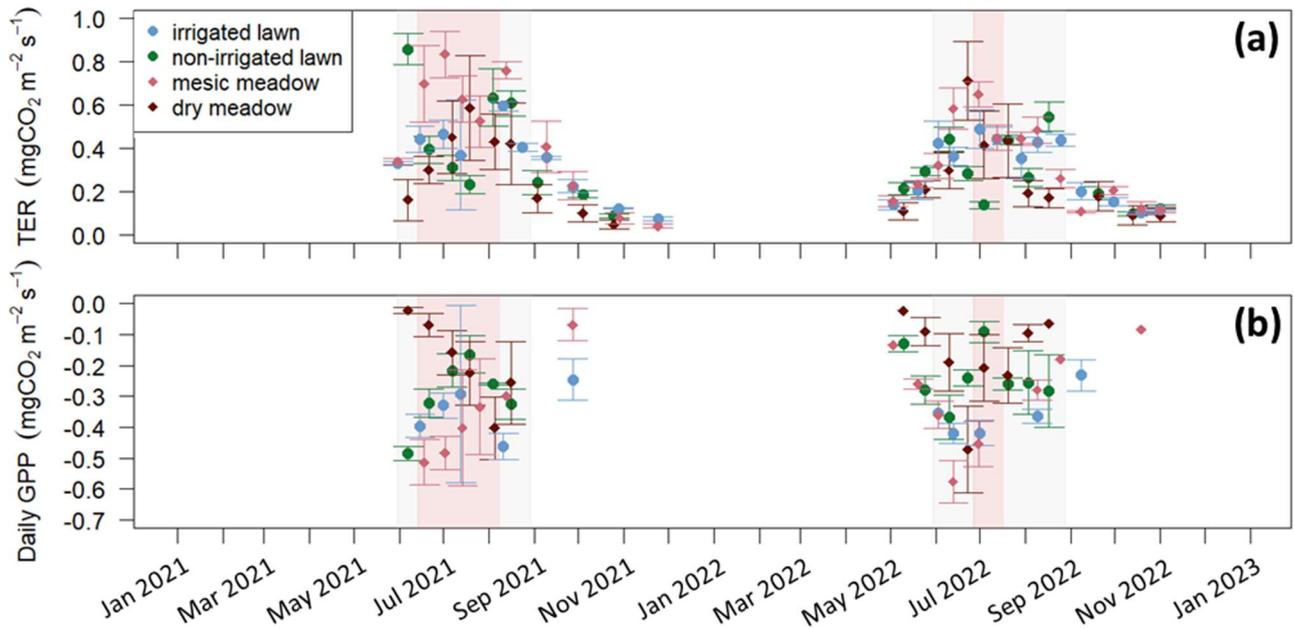


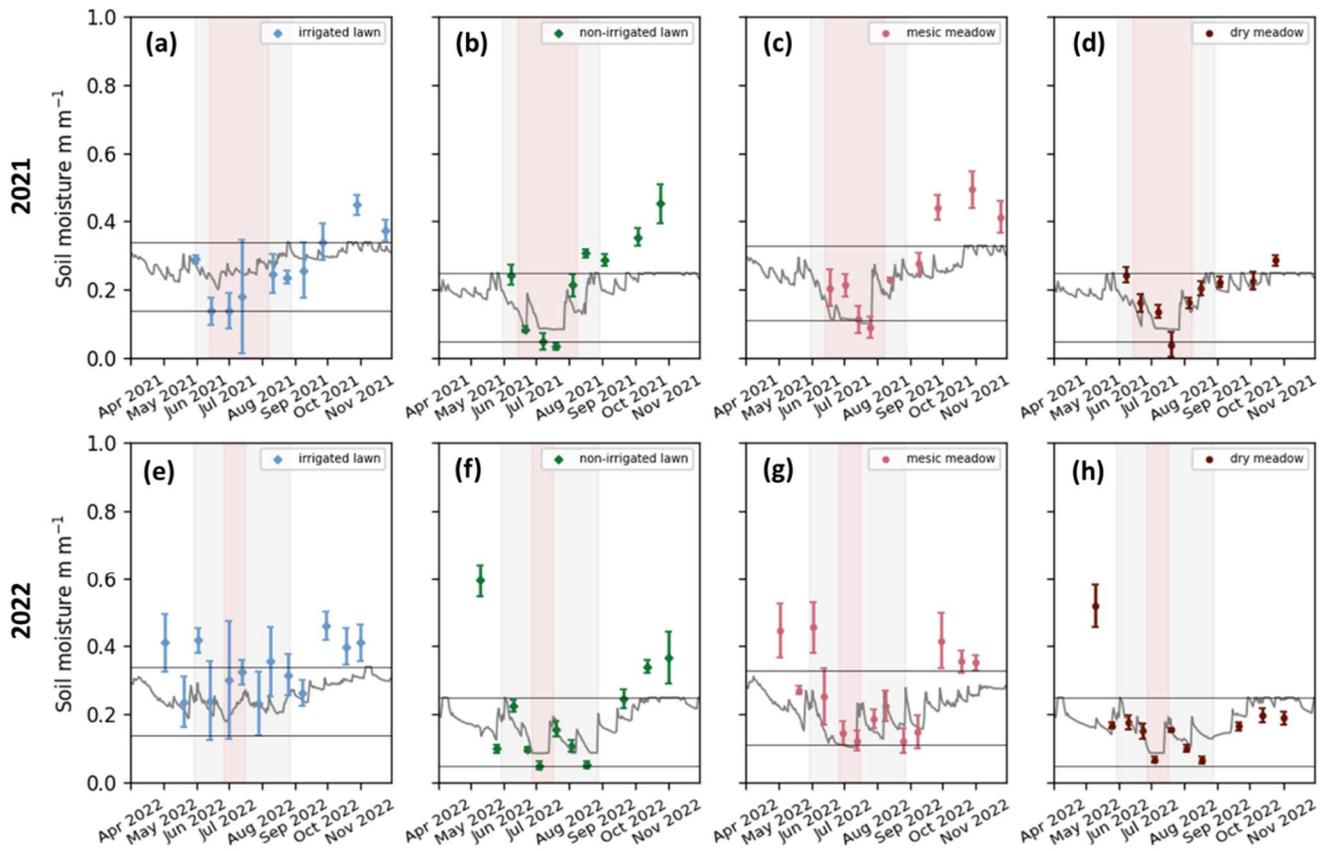
Figure S1. Dynamics of the measured TER (a) and calculated daily GPP (b), where irrigated lawn is KMP lawn, non-irrigated lawn is VKI lawn, mesic meadow is KMP meadow, and dry meadow is VKI meadow. Red rectangles indicate the drought periods according to the SPEI and light grey rectangles represent the summer season.

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Figure S2. Annual dynamics of soil moisture at the four intensive sites. Grey continuous lines represent JSBACH simulations and diamonds and dots represent the mean of manual measurements with standard deviation bars. (a, e) Irrigated lawn = KMP lawn; (b, f) non-irrigated lawn = VKI lawn; (c, g) mesic meadow = KMP meadow; (d, h) dry meadow = VKI meadow. Red rectangles

35 **indicate the drought periods according to the SPEI and light grey rectangles represent the summer season.**

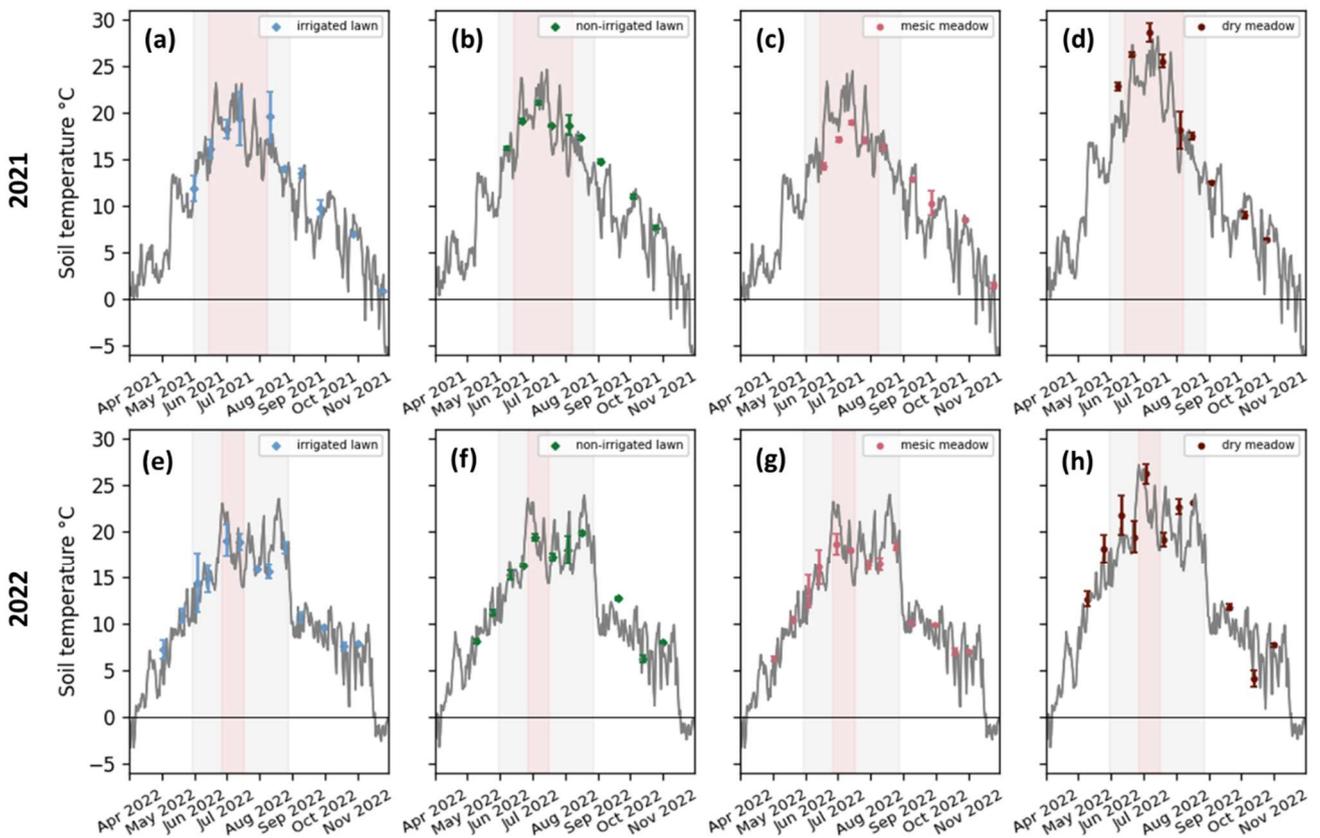



Figure S3. Annual dynamics of soil temperature at the four intensive sites. Grey continuous lines represent JSBACH simulations and diamonds and dots represent the mean of manual measurements with standard deviation bars. (a, e) Irrigated lawn = KMP lawn; (b, f) non-irrigated lawn = VKI lawn; (c, g) mesic meadow = KMP meadow; (d, h) dry meadow = VKI meadow. Red

40 **rectangles indicate the drought periods according to the SPEI and light grey rectangles represent the summer season.**

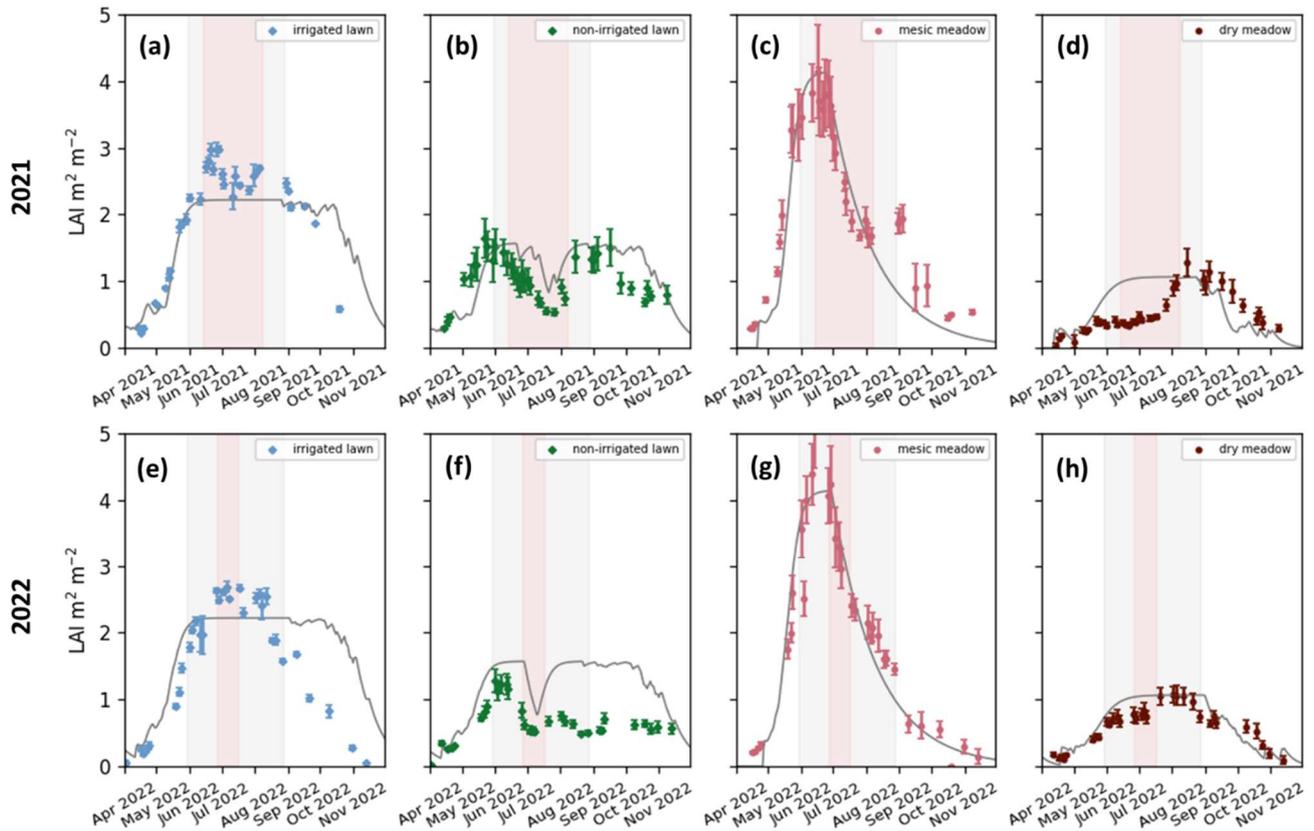



Figure S4. Annual dynamics of leaf area index (LAI) at the four intensive sites. Grey continuous lines represent JSBACH simulations and diamonds and dots represent the mean of manual measurements with standard deviation bars. (a, e) Irrigated lawn = KMP lawn; (b, f) non-irrigated lawn = VKI lawn; (c, g) mesic meadow = KMP meadow; (d, h) dry meadow = VKI meadow. Red rectangles indicate the drought periods according to the SPEI and light grey rectangles represent the summer season.

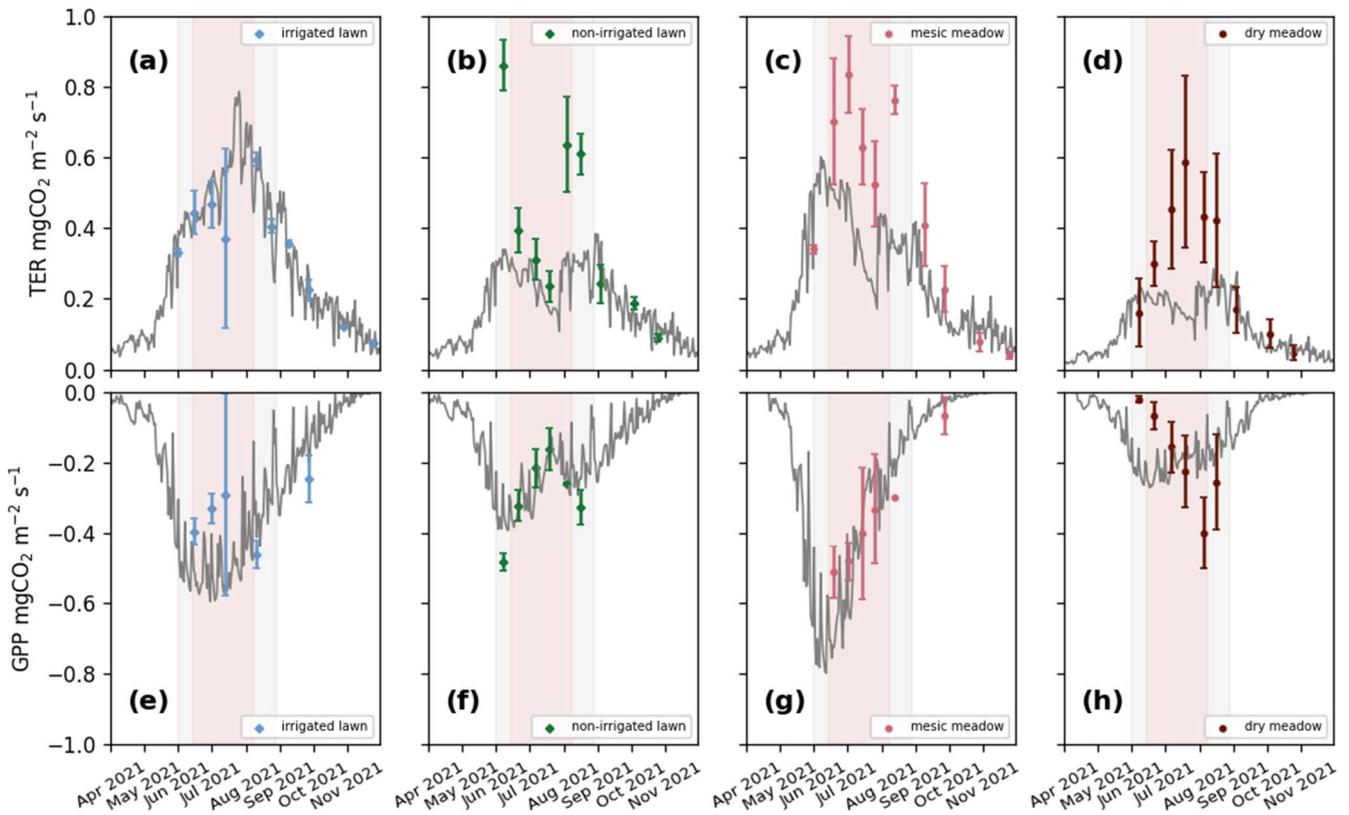



Figure S5. Seasonal dynamics of mean total ecosystem respiration (TER, abcd) and daily photosynthesis (GPP, efgh) in the four intensive sites in 2021. Grey continuous lines represent JSBACH simulations and diamonds and dots represent the mean of manual measurements with standard deviation bars. (a, e) Irrigated lawn = KMP lawn; (b, f) non-irrigated lawn = VKI lawn; (c, g) mesic meadow = KMP meadow; (d, h) dry meadow = VKI meadow. Red rectangles indicate the drought periods according to the SPEI and light grey rectangles represent the summer season.

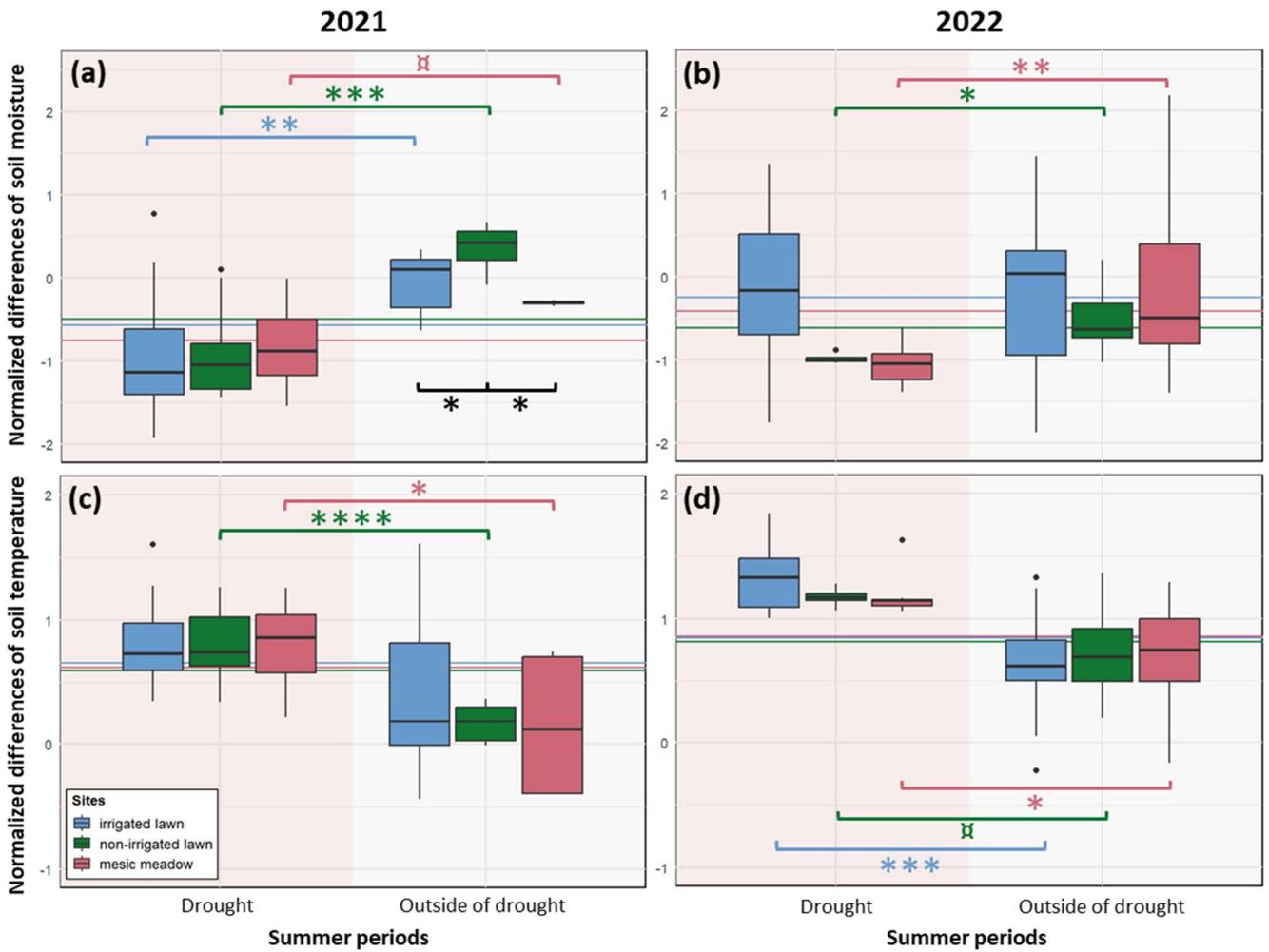



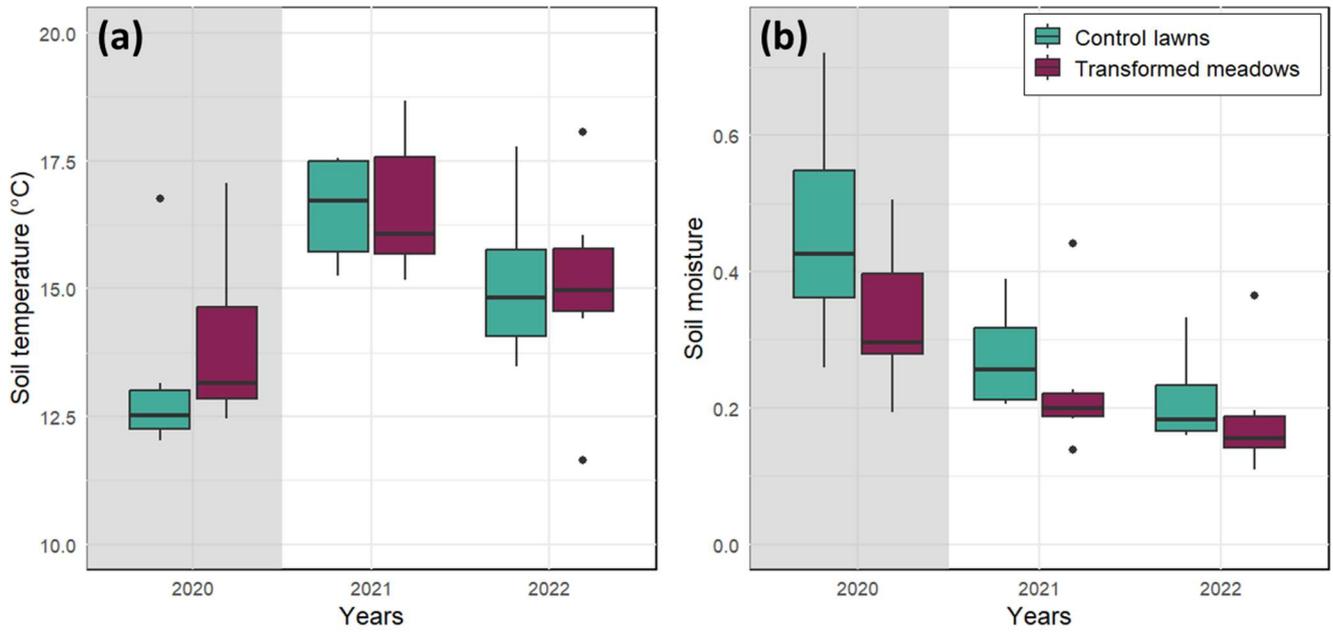
Figure S6. The resistance indices of lawns and meadows to drought events in 2021 and 2022, where irrigated lawn is KMP lawn, non-irrigated lawn is VKI lawn, mesic meadow is KMP meadow, and dry meadow is VKI meadow. The values are normalized differences between the measured values during the drought and outside it between June to August in 2021 (first column) and in 2022 (second column), calculated for the soil moisture at 5 cm depth ((a) and (b)) and the soil temperature at 10 cm depth ((c) and (d)). Horizontal lines represent the summer average of each site. Droughts were defined in Fig. 2 (June 14th–August 8th, 2021 and June 27th–July 17th, 2022). (¤ for p-value ≤ 0.10; * for p-value ≤ 0.05; ** for p-value ≤ 0.01; *** for p-value ≤ 0.001; and **** for a p-value ≤ 0.0001).

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Figure S7. (a) soil temperature at 10 cm depth, and (b) soil moisture at 5 cm depth measured on the satellite sites before and after transformation, which happened in the end of 2020 only on the transformed lawns (¤ for p-value ≤ 0.10; and * for p-value ≤ 0.05).