

Table.S1 Soil characteristics of grassland and shrubland before and after long-term warming.

Soil depths	Treatment	SOC (g/kg)	TN (g/kg)	TP (g/kg)	pH
0-2 cm	GW	99.21±4.70	8.62±0.45	0.86±0.01	7.88±0.05
	G	122.73±5.22	9.13±0.36	0.85±0.02	7.66±0.11
	SW	122.00±7.96	8.91±0.74	0.87±0.02	6.65±0.06
	S	125.89±9.13	9.84±0.71	0.87±0.02	6.52±0.03
2-7 cm	GW	46.36±2.84	4.93±0.20	0.75±0.01	/
	G	71.62±4.56	5.56±0.46	0.71±0.01	/
	SW	94.27±3.49	7.49±0.37	0.82±0.02	/
	S	89.36±7.42	7.28±0.63	0.79±0.03	/
7-12 cm	GW	27.47±3.18	4.02±0.21	0.72±0.01	/
	G	47.06±0.86	4.00±0.09	0.69±0.02	/
	SW	79.88±5.39	6.68±0.45	0.77±0.01	/
	S	76.27±3.64	6.35±0.31	0.77±0.01	/

Note: SOC, TN, and TP represent soil organic carbon, total nitrogen, and total phosphorus, respectively.

Table.S2 Ratios of log-transformed C-, N-, and P- acquiring enzymes for the different treatments and under different soil depth.

Depth	GW	G	SW	S
0-2cm	1:0.904:1.006	1:0.932:1.006	1:0.909:1.159	1:0.878:1.103
2-7cm	1:0.958:1.098	1:0.955:1.076	1:0.865:1.127	1:0.934:1.151
7-12cm	1:0.874:1.063	1:0.895:1.087	1:0.955:1.153	1:0.925:1.144

Table.S3 Vegetation characteristics of grassland and shrubland before and after long-term warming

Parameters	GW	G	SW	S
Relative Coverage	1±0.068	1.16±0.066	0.94±0.087	1.14±0.052
Evenness index	0.93±0.02	0.94±0.034	0.79±0.024B	0.95±0.011A
Diversity Index	2.6±0.094	2.91±0.139	1.55±0.164B	2.91±0.097A
Abundance	16.83±1.327b	22.17±1.195a	7.67±1.382B	21.5±1.628A
Aboveground biomass(g·m <sup>-2</sup> )	92.56±14.432a	53.65±8.74b	146.75±22.57	99.17±11.241

Note: Different lowercase letters in the same row indicate significant differences between different treatments in the grass plot at  $p < 0.05$  and different capital letters in the same row indicate significant differences between different treatments in the shrub plot at  $p < 0.05$ . No comparison was made between grass plots and shrub plots. Evenness index is the Pielou's evenness  $J'$ , and Diversity Index is the Shannon-Wiener diversity index.