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Patterns of longer-term climate change effects on CO_2 efflux from biocrusted soils differ from those observed in the short term

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Treatment	Comparison	*Seven-month periods* t_d (g C m^{-2})	*Active photosynthesis periods* t_d (g C m^{-2})
control	2007 - 2006	-3 [-16.2, 12.4]	-6.5 [-8.7, -4.4]
control	2013 - 2006	9.2 [-3.7, 19.9]	-4.7 [-7.9, -1.6]
control	2014 - 2006	36.2 [21.7, 52.9]	2.2 [-2, 6.3]
warmed	2007 - 2006	-2 [-18.3, 13.1]	-8.6 [-11.8, -5.3]
warmed	2013 - 2006	-6.6 [-19, 8.3]	-7.4 [-12.5, -2.4]
warmed	2014 - 2006	29.9 [8.6, 45.3]	1 [-2.1, 4.2]
watered	2007 - 2006	-4.4 [-14.9, 5.2]	-11.5 [-13.7, -9.4]
watered	2013 - 2006	-12.4 [-23.5, 2.8]	-11.5 [-14.7, -8.2]
watered	2014 - 2006	20.2 [9.9, 32.3]	-3.9 [-6.9, -0.8]
combined	2007 - 2006	-6.7 [-21.6, 6.2]	-10 [-12.1, -8]
combined	2013 - 2006	-20.8 [-36.2, -6.6]	-9.7 [-12.8, -6.6]
combined	2014 - 2006	17.6 [-1.2, 40.6]	-2.4 [-3.8, -1]

Table S1. Differences in NSE between 2006 values and later years within each treatment with 95% confidence intervals. Analyses correspond to the NSE data shown in Fig. 4.

Treatment	Time period	Comparison	t_d (%)
Light cyano	2017 – 2005	Warmed - Control	19.5 [-2.42, 41.4]
Light cyano	2017 – 2005	Watered - Control	23.2 [-9.94, 56.4]
Light cyano	2017 – 2005	Combined - Control	40.5 [11.1, 70.0]
Dark cyano	2017 – 2005	Warmed - Control	-1.50 [-11.0, 8.02]
Dark cyano	2017 – 2005	Watered - Control	5.93 [-6.42, 18.3]
Dark cyano	2017 – 2005	Combined - Control	-4.58 [-12.6, 3.46]
Lichen	2017 – 2005	Warmed - Control	4.82 [-1.57, 11.2]
Lichen	2017 – 2005	Watered - Control	1.77 [-11.2, 14.8]
Lichen	2017 – 2005	Combined - Control	0.364 [-11.2, 11.9]
Moss	2017 – 2005	Warmed - Control	-17.7 [-24.6, -10.7]
Moss	2017 – 2005	Watered - Control	-26.2 [-49.4, -2.99]
Moss	2017 – 2005	Combined - Control	-27.3 [-46.2, -8.48]

Table S2. Differences in cover (calculated as cover in 2017 minus cover in 2005) between treatments and controls with 95% confidence intervals for four biocrust constituents: light cyanobacteria, dark cyanobacteria, a mix of lichens (mostly *Collema spp.)* and moss (*Syntrichia caninervis*). Analyses correspond to the NSE data shown in Fig. 4.

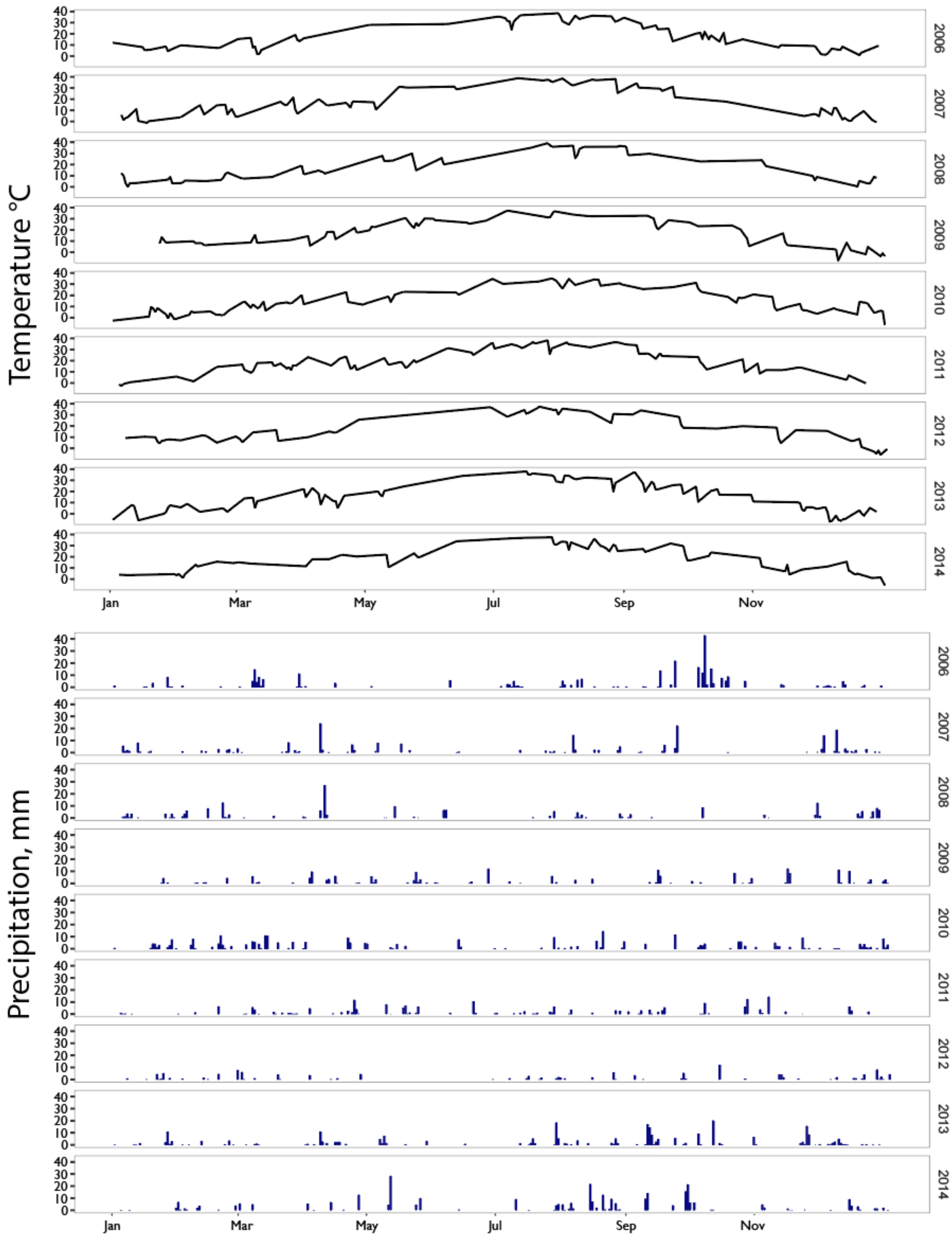

Fig. S1.Air temperature (daily maximum) and precipitation (24 hour rainfall totals) throughout the 9-year study period. Data are from instruments at our study site.

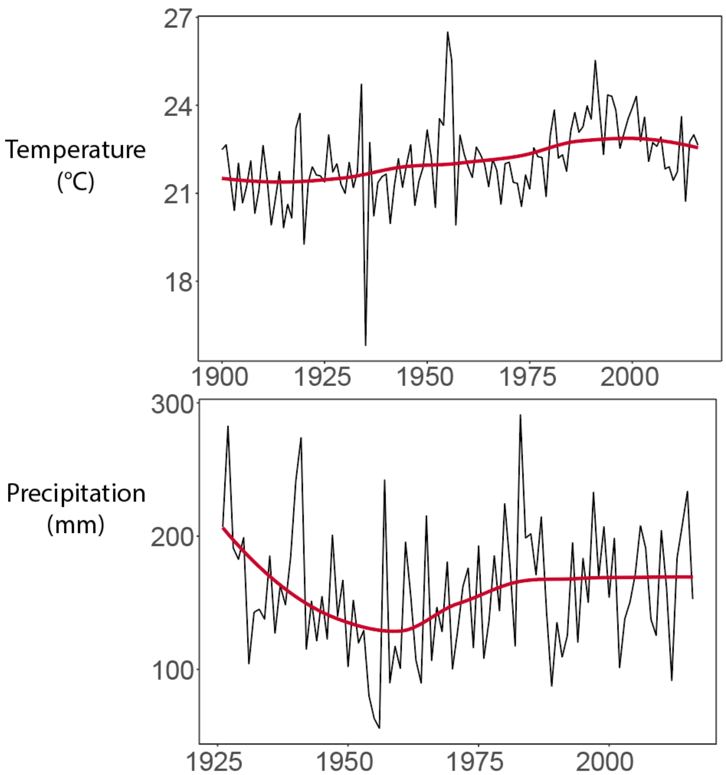

Fig. S2. Long-term climate records from a nearby weather station in Moab, UT. Reliable precipitation data from before 1925 data were not available. A loess smoother (red line) shows long-term trends.

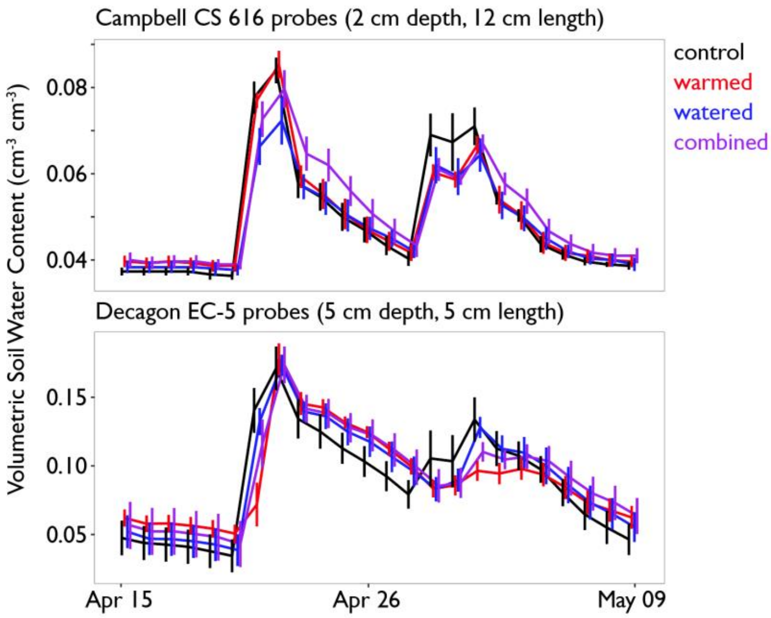

Fig S3. Daily maximum moisture values during a 2010 rain event, from April 15-May 9 in two sets of buried moisture probes (a) Campbell CS616 probes that were shortened to 12 cm and buried 2 cm below the surface (n = 3; probes were in 3 of 5 blocks) and (b) Decagon EC-5 probes buried 5 cm below the surface (n = 5, all five blocks were monitored). All values are mean ± SE.

Although there is variation among the probes, moisture data from multiple sets of buried probes indicated no evidence of a drying effect in the warmed plots (Figure S1). While the physical properties of the system dictate that at least some increased evaporative pressure would be applied to soil water due to warmer soil temperatures, the time series we show above is representative of what we observed during dozens of rain events over the nine-year period of the study. During these events, there is some uncertainty driven by probe to probe variability, but the rate of decline in soil moisture among treatments were similar.