Elevated atmospheric CO$_2$ does not conserve soil water in the Mojave Desert

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Abstract Numerous studies, including those of desert plants, have shown reduced stomatal conductance under elevated atmospheric CO$_2$. As a consequence, soil water has been postulated to increase. Soil water was measured for >4 yr at the Nevada Desert Free Air CO$_2$ Enrichment (FACE) Facility to determine if elevated atmospheric CO$_2$ conserves soil water for a desert scrub community in the Mojave Desert. We measured soil water in the top 0.2 and 0.5 m of soil with time domain reflectometry and to 1.85 m with a neutron probe for the three treatments at Desert FACE: elevated CO$_2$ (550 μmol/mol), blower control (ambient CO$_2$), and non-ring treatments. The treatment main effect was not significant in any analyses of variance. Although the treatment x date interaction was significant for soil water in the top 0.5 m of soil, the expected greater soil water for elevated CO$_2$ vs. ambient CO$_2$ only occurred on one sampling date. In contrast, soil water for that same depth was significantly lower under elevated CO$_2$ on six dates. Thus, we infer that increased water use from increased primary productivity (and therefore leaf area) under elevated CO$_2$ offset the decreased water use from reduced stomatal conductance, and hence soil water was not conserved under elevated CO$_2$ in the Mojave Desert, unlike other ecosystems.