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Top-down effects of crust-eating macro-arthropods on biocrust microtopography and carbon cycling

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Biological soil crusts (biocrusts) are key regulators of soil C and N cycling, soil erosion, and water (re)distribution in drylands. Nevertheless, huge knowledge gaps exist about one core aspect of biocrust ecology, namely how these processes are affected by biocrust-eating macro-arthropods. We addressed this knowledge gap by exposing biocrusts to varying levels of isopod crustivory (i.e. grazing intensity), and quantifying the consequences for CO_2 efflux, C fixation and microtopography. Biocrust CO_2 efflux decreased with increasing crustivory and recovered after several wetting events. Crustivory had a negative effect on biocrust C fixation, but only after the CO_2 efflux recovered to pre-crustivory levels. Biocrust surface roughness increased with increasing crustivory to a peak and then began to decrease, implying that varying levels of crustivory may have opposing consequences for water infiltration and runoff generation. Our findings suggest that macro-crustivores may play a key role in regulating biocrust ecological functioning, introducing a whole new line of crustivory research that will be instrumental in conceptualizing various ecosystem dynamics in drylands.