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Effects of early post-fire moss biocrusts on soil abiotic and biotic properties in a Mediterranean forest

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After wildfires in Mediterranean forests, mosses have been described as faster colonizers in early successional stages when soil surface is more vulnerable and exposed to rainfall events. Soil erosion mitigation is an ecosystem service of high relevance provided by moss-dominated biocrusts, but information about additional functional roles of early post-fire colonization of mosses is still limited. In August 2018, a wildfire in "Sierra de Beneixama" (E Spain) affecting a total of 862 ha was followed by salvage logging management that triggered rill formation and soil erosion processes. Six months after the fire and subsequent management disturbances, the presence of mosses covering the soil reached 30%, appearing where no soil water repellency was detected. The aim of the study was to assess the short-term effects of mosses on the nutrients content and the stability of soils underlying the crust (2.5 cm depth), as well as the soil microorganisms and functions they deliver as key elements in soil recovery. Our results showed a strong decrease in the available phosphorous content in soils under the crust, suggesting consumption of this element released from the fire to moss development. In the same way, a slight decrease in soil organic carbon and nitrogen content was detected in soils beneath the biocrust. The labile fraction of organic carbon released by the fire may provide the substrate for heterotrophic soil microbes living beneath the biocrust, but while a beginning recovery of microbial biomass under mosses was observed, no higher microbial activity was detected six months after the fire. No greater differences in the microbial functionality, measured by enzymatic activities involved in carbon, nitrogen, and phosphorus cycles, were observed in soils associated with the crust. However, the response of the microbial parameters was mainly influenced by the nitrogen and phosphorous content of soils, highly released in post-fire environments. The lower developmental stage of the biocrust and the short-time since the disturbance might be an important factor in the functional recovery of the microbial community associated. Since wildfires are predicted to increase in frequency and severity due to climate change, monitoring biocrust impact on ecological functions recovery is essential to understand ecosystem resistance and resilience to future disturbances.

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