High-severity wildfire reduces richness and alters the composition of ectomycorrhizal fungi in low-severity adapted Ponderosa pine forests

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Abstract

Soil fungal communities are vital for post-fire ecosystem restoration because of their ability to cycle nutrients and form symbiotic partnerships with regenerating trees. However, understanding is limited about how high-severity wildfires influence the fungal community of ecosystems adapted to low-severity fires. We studied an 11-year-old chronosequence of high-severity burn ponderosa pine (Pinus ponderosa) in eastern Washington, USA. Using Illumina MiSeq of the ITS1 rRNA, we examined changes in soil geochemistry, and drivers of ectomycorrhizal (EcM) and saprobic fungal richness, community shifts, and post-fire fungal succession. High-severity wildfires reduced EcM fungal richness by an average of 45.8% and saprobic richness by 11.7%, leading to significant, long-term alterations to the post-fire fungal communities that did not return to unburned levels even after 11 years. Over time, differences in the post-fire fungal community were driven by the dominance of several pyrophilous fungi, including the EcM Ascomycete genera Pustularia and Wilcoxina, and the saprobic Basidiomycete genus Geminibasidium, which decreased in abundance with time post-fire. EcM fungi and saprobes were intimately linked to the soil environment: total nitrogen, total carbon, and depth of organic matter predicted EcM richness, while total carbon predicted saprobic species richness. We conclude that high-severity wildfires reduced both EcM and saprobic fungal richness and significantly altered the fungal community of this fire-adapted ecosystem, selecting for resilient and fire-adapted species, such as W. rehmii and Geminibasidium sp., thus initiating post-fire succession.

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