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Fungal response to wildfire in southeastern forests: effects at the urban-forest interface

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ABSTRACTS - Oral Presentations

Fungal response to wildfire in southeastern forests: effects at the urban-forest interface

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Wildfires affect above and belowground components of ecosystems by altering plant communities, physical and chemical soil characteristics, and the belowground microorganisms critical for nutrient cycling. Fungi in particular are key to belowground ecosystem function, yet post-fire recovery of fungal abundance and composition has not been examined in the majority of ecosystems, such as the southeastern temperate region of the US. Wildfires occurring in 2016 in the Great Smoky Mountains National Park (GSMNP) and surrounding urban landscape (Gatlinburg, TN) presented a novel opportunity to study post-fire fungal response in neighboring urban-forest ecosystems. We surveyed soils and plants in GSMNP and Gatlinburg 1.5-2 years post-fire to assess colonization rates of arbuscular mycorrhizal fungi (AMF, aseptate hyphae) and decomposers/pathogens (septate hyphae) from 13 plant species across 18 sites, (9 park, 9 urban). We hypothesized that increasing fire intensity would decrease both intra- and extraradical fungal abundance in GSMNP and the surrounding urban landscape, but that fire disturbance would have a greater negative effect on fungal abundance in GSMNP due to a lower disturbance regime compared to neighboring urban communities in Gatlinburg.

Overall, colonization by aseptate (intraradical R^2 = 0.46, P = 0.03) and septate (intraradical R^2 = 0.19, P = 0.01; extraradical R^2 = 0.07, P = 0.03) hyphae decreased with increasing fire intensity. Septate colonization decreases were primarily driven by GSMNP sites (intraradical, R^2 = 0.28, $P < 0.01$; extraradical R^2 = 0.26, $P < 0.01$)— These decreases suggest the decomposer/pathogen community recovers more slowly after wildfire than AMF. Meanwhile, aseptate hyphal colonization decreased overall in roots but not soils (extraradical $R^2 < 0.01$, P = 0.74), suggesting that soil recovery precedes root recovery for symbiotic AMF. Mycorrhizal colonization often declines post-fire and these declines are often assumed to be transient, however our results indicate that fungal abundance is still depleted two years post-fire, illustrating that burns and urbanization can have long-lasting impact belowground. Given the sensitivity of aseptate and septate fungal abundance to the 2016 fire, shortened wildfire return intervals predicted with climate change may lead to large declines in fungal abundance throughout southeastern temperate forests.