Response of Soil Microbial Communities to Prescribed Fire in a Semi-Arid Grassland

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Prescribed fires are a commonly used management tool in the southwestern US, but their impact on biotic soil crusts is not well documented. We investigated the effects of fire on the microbial crust community at the Sevilleta National Wildlife Refuge four years post-burn by measuring total soil carbon (C) and nitrogen (N), chlorophyll content, and activity of seven extracellular enzymes (EEA). Crust samples were collected from burn plots September 2007 and April 2008, and compared with controls. Chlorophyll a showed a consistent effect of fire and was 3.5 times (70%) lower in the burned sites compare to control sites. In contrast, chlorophyll b showed a significant effect of sampling date rather than fire treatment. Fire had a significant effect on the EEA, with the strongest effect detected in September; however the direction in which burned and control plots differed was not the same for each sampling date. For the September collection, phenol oxidase, leucyl aminopeptidase, and peroxidase activities were higher in the burned plots compared to controls, while Ÿ-glucosidase, cellobiohydrolase, and N-acetylglucosaminidase activities were lower. Alkaline phosphatase activity showed no response to treatment. These data suggest a shift in carbon cycling properties in the post-burn microbial community toward lower C-fixation and decreased labile carbon processing and enhanced mineralization of more recalcitrant organic matter. For the April collection, the direction of many of the patterns found in September was reversed, suggesting that the effect of fire on EEA may depend temperature and/or precipitation patterns and associated soil moisture.

2009. 62nd Society for Range Management Annual Meeting. Paper No. 1030-24.