ECOSYSTEM RESTORATION AND WILDFIRE MANAGEMENT TREATMENTS AFFECT SOIL ORGANIC MATTER AND MICROBIAL ACTIVITY IN FOUR CONTRASTING FORESTS

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As part of a national-scale evaluation of the consequences of restoration and wildfire fuel reduction treatments in ecosystems that historically had frequent fire (www.ffs.fs.fed.us), we determined the effects of reintroduction of dormant season fire (functional restoration) and thinning from below (structural restoration) on soil organic matter characteristics and microbial activity in two mixed oak forests in the central hardwoods region, and contrasted them with the effects of the same treatments in two conifer forests. The hardwood forests were located on the Allegheny Plateau of southern Ohio (Ohio Hills/OH) and in the southern Appalachian Mountains of North Carolina (Green River/NC). The conifer forests were a pine-oak site in the piedmont of South Carolina (Clemson Forest/SC) and a pine-fir site in the southern Cascades of northern California (Goosenest Adaptive Management Area/CA).

At OH and SC fire resulted in reduced soil organic C and total soil N, both alone and in combination with thinning. In contrast, thinning alone did not affect either C or N at OH, SC, or CA. Soil C:N ratio decreased in the plots that were burned at OH and SC, but not in those that were thinned or thinned+burned; at CA soil C:N ratio decreased in response to thinning. Fire, thinning, and the combination of the two resulted in reductions in acid phosphatase activity in soils at OH and SC, whereas at CA only the combination of fire and thinning reduced this metric of overall microbial activity. Chitinase activity was reduced by all three treatments at OH and SC. At CA, chitinase activity decreased in the order Control>Thin>Thin+Burn. Phenol oxidase activity changed little, and did not differ among treatment types at OH, SC, or CA.

Multiple regression models predict that posttreatment enzyme activity in these forests is more closely linked to changes in organic matter quality (soil C storage) and organic matter quality (N content, C:N ratio, phosphatase:phenol oxidase ratio) produced by the experimental treatments than to macroclimate, landscape-scale microclimate, geomorphological, or soil textural variations among treatment units within a site. These results suggest that the short term (1-2 yr) consequences of restoration treatments on soil microbial activity vary within and among ecosystem types in relation to their effects on the quality and quantity of soil organic matter, more so than in relation to vegetation, macroclimate, or geological setting.

This is contribution number X of the National Fire and Fire Surrogate Research Project, and additional funding was supplied by the U.S.D.A. Forest Service National Fire Plan.

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