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Coarse woody debris: Effects on post-fire ecosystem process rates.

Forest fire is a well-studied disturbance in lodgepole pine (*Pinus contorta* var. *latifolia)* ecosystems but little is known about the long-term implications of fire-generated forest structure on ecosystem processing. While the connection between ecosystem structure and function is recognized to be important, the empirical link between the two is weak. The extensive, stand replacing fires in Yellowstone National Park of 1988 created a natural mosaic of coarse woody debris abundance and distribution and lodgepole pine sapling density, providing an excellent setting to explore the relationships between fire-generated forest structure and variability in ecosystem process rates. At three 0.25 ha sites, we compared both lab and field measures of nitrogen (N) transformations, microbial community composition, and enzymatic activity in mineral soil among different conspicuous structural features created by the fire including under logs that had fallen since the 1988 fire (both elevated logs and logs touching the ground), under highly decayed logs, under lodgepole pine saplings, and in exposed sites. *In situ* net N mineralization in the exposed mineral soil was almost twice as high (15.7 $mg*Kgsoil^{-1}*yr^{-1}$, SE ± 2.4) and significantly different than all other treatments ($p < 0.0001$) yet the lab (gross) N mineralization was not different among treatments or by site. Lipid abundance (phospholipid fatty acid analysis) varied slightly by site ($R^2 = 0.08$, $p = 0.03$) but was not significantly different among treatments. Non-metric multi-dimensional scaling, a common ordination technique, showed the microbial community composition was different among treatments (2-axis cumulative $R^2 = 0.65$) as was the enzymatic activities (2-axis cumulative $R^2 = 0.96$). Additionally, specific enzyme activities were correlated with lipids indicating a connection between the microbial composition and enzymatic activity. Fire-generated forest structure can create broad-scale heterogeneity across the landscape but also introduces fine-scale variation in ecosystem processing.