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Does temperature of charcoal creation affect subsequent mineralization of soil carbon and nitrogen?

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Forest fire is the most common form of natural disturbance of boreal forest ecosystems and has primordial influence on successional processes. This may be due in part to the pre-disturbance vegetation development stage and species composition, but these successional pathways could also vary with differences in fire behavior and consequently in fire intensity, defined as the energy released during various phases of a fire. Fire intensity may also affect soil C and N cycling by affecting the quality of the charcoal that is produced. For example, the porosity of coal tends to increase with increasing temperature at which it is produced Higher porosity would logically increase the surface area to which dissolved soil molecules, such as tannins and other phenolics, may be adsorbed. We report on a microcosm study in which mineral and organic soils were jointly incubated for eight weeks with a full factorial array of treatments that included the addition of Kalmia tannins, protein, and wood charcoal produced at five different temperatures. A fourth experimental factor comprised the physical arrangement of the material (stratified vs. mixed), designed to simulate the effect of soil scarification after fire and salvage harvest. We examined the effects of these treatments on soil C and N mineralisation and soil microbial biomass. The furnace temperature at which the charcoal was produced had a significant effect on its physico-chemical properties; increasing furnace temperatures corresponded to a significant increase in % C ($P<0.001$), and a significant decrease in %O ($P<0.001$) and %H ($P<0.001$). Temperature also had significant impacts on microporosity (surface area and volume). Temperature of production had no effect ($P=0.1355$) on soil microbial biomass. We observed a linear decreasing trend ($P<0.001$) in qCO_2 with increasing temperature of production, which was mainly reflected in a decline in basal respiration. Finally, we found a significant interaction ($P=0.010$) between temperature of charcoal production x soil mixing in controlling post incubation NH4+ concentrations. We discuss the results in relation to potential implications for changing fire regime and C and N cycles.