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Influence of wood source and temperature on pyrogenic organic matter-induced priming effect in a high-latitude forest soil.

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The relationship between wood source and pyrolysis temperature on pyrogenic organic matter (PyOM) induced priming effects (PE) are poorly understood. There are currently no studies utilizing isotopically labelled substrates to discretely assess PyOM and native soil carbon (NSC) reactivity in field or laboratory decay studies at loading rates relevant to natural systems. To address this knowledge gap, we investigated the interactive effects of wood species (red maple and jack pine) and pyrolysis temperature (200, 300, 450 and 600^0C) on native soil C (NSC) in a sandy, temperate North American forest soil.

We hypothesized that wood source and pyrolysis temperature would shape PyOM-induced PE with the greatest effects expected in the lower temperature PyOM and wood. To test this, highly 13C enriched ($\sim$ 3 atom %) jack pine (JP) or red maple (RM) wood precursor or wood-derived PyOM was added to a low carbon soil (0.5%) at 11% of NSC, then incubated in the dark at 60% water holding capacity and 25°C for 6 months. Periodic measurements of $13CO_2$ indicated that both pyrolysis temperature and species played a significant role in PyOM and NSC mineralization. The mineralization of RM PyOM was $\sim$25% higher than JP at temperatures < 600^0C from day 1 to 3 and $\sim$5% from day 3 to 17. Additionally, soils in contact with RM PyOM exhibited positive priming (increased NSC mineralization) from days 1 to 3 followed by negative priming (decreased NSC mineralization)for the remainder of the incubation (days 3- 180). For both species, 300^0 C represented a thermal transition point resulting in significantly negative NSC priming and distinct chemical alterations that were most evident in jack pine. These results highlight how differences in PyOM physiochemical characteristics linked to a species thermal transformation threshold may be a predictor in determining microbial response and biological reactivity in soil.