Geophysical Research Abstracts
Vol. 15, EGU2013-6612, 2013
EGU General Assembly 2013

The Effect of Soil Warming on Decomposition of Biochar, Wood, and Bulk Soil Organic Carbon in Contrasting Temperate and Tropical Soils

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Biochar and wood are known to decay at different rates in soil, but the longterm effect of char versus unaltered wood inputs on soil carbon dynamics may vary by soil ecosystem and by their sensitivity to warming. We conducted an incubation experiment to explore three questions: (1) How do decomposition rates of char and wood vary with soil type and depth? (2) How vulnerable to warming are these slowly decomposing inputs? And (3) Do char or wood additions increase loss of native soil organic carbon (priming)?

Soils from a Mediterranean grassland (Hopland Experimental Research Station, California) and a moist tropical forest (Tabunoco Forest, Puerto Rico) were collected from two soil depths and incubated at ambient temperature (14°C, 20°C for Hopland and Tabonuco respectively) and ambient +6°C. We added 13C-labeled wood and char (made from the wood at 450oC) to the soils and quantified CO_2 and $13CO_2$ fluxes with continuous online carbon isotope measurements using a Cavity Ringdown Spectrometer (Picarro, Inc) for one year.

As expected, in all treatments the wood decomposed much (about 50 times) more quickly than did the char amendment. With few exceptions, amendments placed in the surface soil decomposed more quickly than those in deeper soil, and in forest soil faster than that placed in grassland soil, at the same temperature. The two substrates were not very temperature sensitive. Both had Q10 less than 2 and char decomposition in particular was relatively insensitive to warming. Finally, the addition of wood caused a significant increase of roughly 30% in decomposition losses of the native soil organic carbon in the grassland and slightly less in forest. Char had only a slight positive priming effect but had a significant effect on microbial community. These results show that conversion of wood inputs to char through wildfire or intentional management will alter not only the persistence of the carbon in soil but also its temperature response and effect on microbial communities.