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Biochar and biological carbon cycling in temperate soils

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Production of biochar, the recalcitrant residue formed by pyrolysis of plant matter, is suggested as a means of increasing storage of stable carbon (C) in the soil (1). Biochar has also been shown to act as a soil conditioner, increasing the productivity of certain crops by reducing nutrient leaching and improving soil water-holding capacity. However, the response of soil carbon pools to biochar addition is not yet well understood. Studies have shown that biochar has highly variable effects on microbial C cycling and thus on soil C storage (2,3,4). This discrepancy may be partially explained by the response of soil invertebrates, which occupy higher trophic levels and regulate microbial activity. This research aims to understand the role of soil invertebrates (i.e. Collembola and nematode worms) in biochar-mediated changes to soil C dynamics across a range of plant-soil communities. An open-air, pot-based mesocosm experiment was established in May, 2011 at the Centre for Ecology and Hydrology, Edinburgh. Three treatments were included in a fully-factorial design: biochar (presence [2 % w/w] or absence), soil type (arable sandy, arable sandy loam, grassland sandy loam), and vegetation type (Hordeum vulgare, Lolium perenne, unvegetated). Monitored parameters include: invertebrate and microbial species composition, soil C fluxes (CO_2 and trace gas evolution, leachate C content, primary productivity and soil C content), and soil conditions (pH, moisture content and water-holding capacity). Preliminary results indicate that biochar-induced changes to soil invertebrate communities and processes are affected by pre-existing soil characteristics, and that soil texture in particular may be an important determinant of soil response to biochar addition.

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