Effect of fire residues (ash and char) on microbial activity, respiration and methanogenesis in three subtropical wetland soils

CA Medvedeff, B. Hogue, PW Inglett

Abstract:

Prescribed fire is a common restoration technique in the southern United States. Prescribed burns coupled with frequent natural fires in South Florida can have devastating effects on ecosystem function. To determine the effect fire residues have on C biogeochemical cycling litter material from restored and reference marl wetlands in Everglades National Park was manipulated in a laboratory setting to produce ash and vegetation derived char. Based on biomass removal pre and post fire (*insitu*) an appropriate aliquot of each residue was added to experimental microcosms. Soil enzymes (β-glucosidase, cellobiohydrolase, phosphatase, bis-phosphate and leucine amino peptidase), aerobic and anaerobic respiration (CO_2) potentials, extractable C and methanogenesis were monitored over a 25 day period.

C enzymes immediately responded to both amendments resulting in elevated extractable C. In restored sites ash and char inhibited methanogenesis, had no effect on anaerobic CO_2 potentials, while stimulating aerobic respiration.

In contrast, immediate stimulation of aerobic respiration was observed from amended reference soils. Phosphatase activity decreased in the ash treatment suggesting ash released a pulse of P. Ash stimulated methanogenesis while suppressing anaerobic CO_2 production suggesting P may limit methanogens in this ecosystem. Moreover, increased C substrates from ash amended soil suggests P stimulated higher trophic level microbial pathways resulting in a simultaneous pulse of C suggesting methanogens may also be dependant on C substrates derived from aerobic microbial processing. This study illustrates the variable response of C parameters to complete and incomplete combusted byproducts from prescribed and natural fires with particular importance to fire adapted ecosystems.