Geophysical Research Abstracts
Vol. 14, EGU2012-539, 2012
EGU General Assembly 2012

Microbial response to the effect of quantity and quality soil organic matter alteration after laboratory heating

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Fire-induced soil changes influence indirectly on soil microbial response, mainly due to pH increases and organic matter alterations. Partial carbon combustion can originate both, an increase in microbial activity due to dissolved organic carbon increases (Bárcenas-Moreno and Bååth, 2099, Bárcenas-Moreno et al., 2011), as well as limitation of microbial growth, either due to diminution of some fractions of organic matter (Fernández et al., 1997) or due to the formation of toxic compounds (Widden and Parkinson, 1975; Diaz-Raviña et al., 1996). The magnitude or direction of these changes is conditioned mainly by fire intensity and plant species, so forest with different vegetation could promote different quantity and quality alterations of soil organic matter after fire which leads to different soil microbial response.

The objective of this work was to differentiate between the effect of reduction of carbon content and the presence of substances with inhibitory effect on soil microorganisms, inoculating microorganisms from an unaltered forest area on heated soil extract-based culture media. Soil collected from two different vegetation forest, pine (P) and oak (O) forests, with similar soil characteristics was sieved and heated at 450 ºC in a muffle furnace. Heated and unheated soil was used to prepare culture media resulting in different treatments: pine unheated (PUH), pine heated at 450 ºC (P450), Oak unheated (OUH) and oak heated at 450 ºC (O450). To isolate inhibition of microbial proliferation and nutrient limitation, different nutritive supplements were added to the media, obtaining two levels of nutrient status for each media described above: no nutrients added (-) and nutrients added (+). Colony forming units (CFU) were enumerated as estimation of viable and cultivable microbial abundance and soil parameters characterization was also realized.

Significant differences were found between CFU isolated using heated and unheated soil extract-based media, independent of the nutrients status, evidencing the existence of some inhibitory factor in heated soil. Culture media made with soil extract from heated pine forest soil showed most marked decrease from microbial abundance than oak forest soil-based media, with and without nutrients.

This preliminary study evidences that not only carbon content diminution limits microbial proliferation after fire, but pyrogenic compounds could be inducing negative effect on soil microorganisms. In addition, the identification of plant species which promote more intense inhibitory effect can involve an important tool after a wildfire for possible human decision related to forest management.

References:

Bárcenas-Moreno, G., Bååth, E., 2009. Bacterial and fungal growth in soil heated at different temperatures to simulate a range of fire intensities. Soil Biology and Biochemistry 41, 2517-2526.

Bárcenas-Moreno, G., Rousk, J., Bååth, E., 2011a. Fungal and bacterial recolonisation of acid and alkaline forest soils following artificial heat treatments. Soil Biology and Biochemistry 43, 1023-1033.

Díaz-Raviña, M., Prieto, A., Bååth, E., 1996. Bacterial activity in a forest soil after soil heating and organic amendments measured by the thymidine and leucine incorporation techniques. Soil Biology and Biochemistry 28, 419-426.

Fernández, I., Cabaneiro, A., Carballas, T., 1997. Organic matter changes immediately after a wildfire in an Atlantic forest soil and comparison with laboratory soil heating. Soil Biology and Biochemistry 29, 1-11

Widden, P., Parkinson, D., 1975. The effects of a forest fire on soil microfungi. Soil Biology and Biochemistry 7, 125-138.