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# BIOGEOCHEMICAL PARAMETERS SURROGATED TO THE RECOVERY OF SOILS AFTER FOREST FIRE EVENTS

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Forest fires are considered as the main disturbance in the Mediterranean basin (Naveh, 1990) and exerts both immediate and lasting ecological and environmental impacts. This is in part caused by a depth transformation of soil physical, chemical and biological characteristics associated to qualitative and quantitative changes in the organic matter (OM) (González-Pérez *et al.*, 2004) which is reflected in the structure of the whole system including microbial populations (Pastor and Post, 1986; Pietikäinen *et al*., 2000). This negatively affects soil health and quality favouring the occurrence of erosive processes and the lost of a non-renewable natural resource such is soil.

However, the effects of fire on soil colloidal properties and on the microbial community are reversible. After the passage of fire soil properties may naturally revert to a situation close to that before fire; erodibility is reduced and soil functionality is again achieved (Cerdá, 2004). This is especially evident in the so-called cold fires including controlled burnings and fires in open forest at semiarid environments with pyrophytic vegetation (Mutch, 1970; Pyne, 1996). The starting hypothesis is that if reversible effects do occur, then we may be able to find out biogeochemical surrogated indicators informing on the recovery of soil quality. An early detection of the impact of fire in soil and the possibilities for soil recovery is relevant for decision making and planning of environmental restoration actions.

The objective of this work was the identification of proxies for the recovery potential of soils affected by forest fires. This was approached by a transdisciplinary study of fire affected soils at different time scale (cronosequences) chosen in a variety of scenarios from Andalusia (Southern Spain). Included were different soil types affected by fires during the past 10 years under different vegetation, located close to control soils with no recent history of forest fires.

Changes in soil chemical properties and in different forms of OM (free lipid fractions, fulvic acids and humic acids and other highly resilient forms of C that may be incorporated like charred biomass) were studied by different techniques including molecular-level analytical techniques (chromatographic, spectroscopic and degradation methods). The effect of fire on soil microbiota was approached using standard techniques for biodiversity estimation (viable counts in adequate culture media, microbial total count by fluorescence microscopy), microbial activity (soil respiration and SIR) as well as by the use of specific molecular techniques (DGGE, FISH and cloning 16S rRNA) and by establishing physiological profiles (enzyme activities) (Arias et al., 2005).

Among the main results obtained is the detection of markers to monitor the recovery of soils short time after fire events by the analysis of thermoevaporation products, mainly furan derivatives, released from whole soil samples using sub-pyrolysis temperatures. Shifts in fatty acid patterns and other families of pyrolysis products from soil were observed by conventional Py-GC/MS. Extracted soil lipids were also a valid proxy and differences were found in the distribution pattern of certain aliphatic series and terpenes. Main results obtained on the biodiversity analysis through conventional, biochemical and molecular techniques allow to discriminate different patterns of microbial populations between fire affected soils and unburned soils

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