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Studying the effects of wildfires on soils (or how to get smudged with ash)

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I work in the Department of Crystallography, Mineralogy and Agricultural Chemistry at the University of Seville, where I coordinate the MED_Soil Research Group since 2008, which is affiliated to the department of Crystallography, Mineralogy and Agricultural Chemistry (University of Sevilla). The group is formed by a multidisciplinary stable team of researchers (biologists, chemists, geomorphologists, geographers, physicists and agricultural engineers), collaborators, auxiliary staff, students and staff associated to research projects. Other involved researchers belong to the University of Córdoba, University Miguel Hernández, the University of Valencia and the Institute for Natural Resources and Agrobiology of Sevilla (IRNAS/CSIC), in Spain, the University of Western Australia (Australia), University of Algarve (Portugal), Mykolas Romeris University (Lithuania), Michoacan University San Nicolás de Hidalgo (México), University of Naples (Italy) and the National Research Centre of Cairo (Egypt).
In general, my research lines include the study of rainfall-induced soil erosion processes, the effects of wildfires on soil properties and soil degradation in Mediterranean areas. Fires are frequent and recurrent phenomena in Mediterranean ecosystems, with several ecological and environmental impacts caused in part by short and medium-term effects on soil physical, chemical and biological characteristics as well as on organic matter composition, properties and dynamics. Altered fire regimes negatively affect soil health and quality favouring the occurrence of erosive processes and the loose of a non renewable natural resource. Also, due to the large carbon pool present in soils, small variations in soil organic matter content may have a significant effect in the biogeochemical cycles and on the global climate change. As a consequence of fire, new forms and thermal modifications of organic molecules lead to the formation of substances with weak colloidal properties and enhanced resistance to chemical and biological degradation.
An example of the impact of the reorganization and translocation of organic molecules in the soil is the appearance of soil water repellency. The accumulation of certain organic compounds such as aliphatic hydrocarbons and amphiphilic compounds, are responsible for soil water repellency. Translocation and concentration of organic substances during burning may contribute to generate a water-repellent soil layer. In that case, water infiltration may be inhibited or delayed during periods of time between a few seconds and hours or days (if extreme repellency exists). Water repellency has great implications on soil behaviour. Delayed infiltration contributes to enhanced runoff rates and accelerated water erosion processes, increasing water and nutrient losses by the generation of preferential flow paths, limiting plant production and affecting microbial activity and germination.
However, the effects of fire on soil are reversible. Under natural fire regimes, soil properties may naturally return to a situation close to the initial one in a variable period of time. But restoration of burned areas is complicated, as there is not an unique answer. Too often, decision-makers apply the same measures to different situations, regardless of the severity of the fire, natural conditions or the ability of soil and vegetation to regenerate themselves. For this reason, it is necessary to study and understand in detail the processes that are triggered in fire-affected soils in order to provide adequate responses to each situation. An early detection of soil recovery is important for decision making and planning of environmental restoration actions in the postfire.