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Changes in Topsoil Properties after Forest Fires studied by Thin Section Analysis

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Changes in top soil properties resulting from forest fires with different intensities are discussed. Understanding these alterations is essential to understand infiltration and erosion processes after forest fires. Sites in Northern Greece (wildfire) and Eastern Spain (experimental fire) were compared to non-burned sites. Thin sections were used to study the undisturbed topsoil properties for burned and non-burned sites in addition to classical soil structure, aggregation and infiltration measurements. Main results obtained from the topsoil analysis were:

-Burned plots showed changes in the distribution of soil aggregation, indicating an increase in the amount of coarser aggregates over 4 mm in size and an increase of micro-aggregates smaller than 0.106mm. This effect was more clearly present in the crust than in the sub-crust. It was shown by the thin section analyses that for the larger aggregates the amount of 'lithorelicts' (mineral grains) increased, which indicated degradation of the natural aggregates after fire. The observed increase of micro-aggregates may be related to dis-aggregation of coarser aggregates as inter-aggregate bonding between finer aggregates and primary particles in coarse aggregates are dominated by polysaccharides. In this case the bindings, which apparently are more vulnerable to heating than the finer micro-aggregates that are more dominated by physico-chemical bonding types.

-Stability of the macro-aggregates (4-4.8 mm) was clearly lower for the burned areas in comparison to non-burned areas, also hinting towards a decrease in the amount of

organic bonding compounds such as roots, hyphae and polysaccharides.

-Infiltration experiments were carried out with a dripping plate rainfall simulator. These showed lowest infiltration rates for burned soil, when compared to non-burned sites

-The thin section analyses showed results confirming those observed for soil aggregation and structure with regard to the changes in aggregate size, but revealed more information about its composition and changes.

From the foregoing it can be concluded that the top soils of sites were adversely affected by forest fire reducing coarse soil aggregation and porosity, which is also expressed by the rainfall simulator experiments enhancing erosion vulnerability and runoff production.

These results confirm the broader scale outcomes of the erosion studies after the fire, with strongly increased runoff and sediment yield on the burned sites in comparison to the unburned ones. The thin section analysis was found to be a very useful technique to study the in-situ physical arrangement of the soil structure and was in accordance with the analysis of the standard sampling techniques giving additional information on the changes in the top soil after forest fires.