Geophysical Research Abstracts, Vol. 7, 00069, 2005
SRef-ID: 1607-7962/gra/EGU05-A-00069

Effects of wildfire on the physical properties of Atlantic forest soils and comparison with laboratory soil heating

M.E. Varela, E. de Blas and E. Benito

Departamento de Biología Vegetal y Ciencia del Suelo, Universidad de Vigo, 36310 Vigo, Spain (eteijeiro@uvigo.es)

The persistence of forest fires in NW Spain is posing serious environmental problems not only because of their destructive effects on the vegetation, but also because of the degradation that they can induce in soil. The impact of fire on soil is largely dictated by its intensity and duration; however, the soil type and climatic conditions following the fire are also influential. While fires of low or moderate intensity can increase soil fertility, high-intensity wildfires are usually detrimental to soil productivity and can trigger dramatic changes in runoff and erosion processes that have adverse effects on water resources.

Short-term changes in soil physical properties were examined in the surface layer of burned soils (0-5 cm) following two forest fires in NW Spain by comparison with the adjacent unburned soils that were also laboratory-heated at 170, 220, 380 and 460ºC. The following parameters were determined: aggregate size distribution, water aggregate stability, total porosity, pore size distribution, water repellency and hydraulic conductivity.

Fire was found not to significantly affect aggregate stability or total porosity; however, it increased the % of pores retaining available water and water repellency, and decreased hydraulic conductivity. Laboratory-heating below 220ºC was found to have no adverse effect on aggregation-related soil properties; rather, water aggregate stability increased over the temperature range 170-220ºC. Water repellency increased over that range and resulted in substantially decreased hydraulic conductivity up to 220ºC. The most adverse effect of heating on soil physical properties occur over the range 220-460ºC in correspondence to the combustion of organic matter. At such temperatures, water repellency was destroyed and the low hydraulic conductivity can be

attributed to the aggregate breakdown observed under dry and wet conditions. The results obtained in the controlled heating tests and their comparison whit those for the burned soils confirm that changes on the soil physical properties upon burning are strongly dependent on the temperature reached by the soil surface during a fire. It was observed a high similarity between the physical properties of the burned soils, the unburned ones and those heated at 170 and 220ºC, as well as marked differences from the soils heated at 380 and 460ºC. The strong water repellency of burned soils and reduced hydraulic conductivity, together with the loss of plant cover, can be assumed to be the main sources of the increased surface runoff and soil erosion many times found in burned areas of the wet Spanish region.

Acknowledgements: This research was supported by Xunta de Galicia PGIDT99PXI30101 and PGIDIT02RFO30101PR projects.