



Significant or negligible sediment and nutrient losses after fire? Pre- and post-fire comparisons

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Prescribed fire (or a controlled burn) is a management tool used in wildfire-prone areas to reduce the fuel load of living and dead biomass, while attempting to keep disturbance of the ground surface and soil to a minimum. We know that wildfire, particularly of moderate or extreme severity, can cause important changes to the chemical and physical properties of soil, typically leading to a reduction in aggregate stability, surface roughness and water storage capacity, and an increase in overland flow. It has also been shown that wildfire disturbance can cause major loss of soil, particularly at plot and hillslope scales. There is less information on soil losses at catchment scales, but it is known that losses particularly of organic-rich fine sediment and nutrients can undergo hillslope to channel transfer, where they can affect water quality. Far less research has been carried out into the effects of prescribed fire on soil and nutrient losses at all scales, but particularly at catchment scales. This paper considers the impact of an experimental fire (equivalent to a severe prescribed fire) on soil and nutrient losses. These losses have been monitored at a range of scales (small rainfall simulation plots, long-term erosion plot, erosion plot, hillslope sediment traps (sediment fences) and catchment) before and after the fire in a 10-ha catchment near Góis, central Portugal, which forms part of the 5-year DESIRE research programme concerning desertification and its mitigation at a range of study sites worldwide. The catchment has steep slopes covered mainly with scrub vegetation ranging from c. 0.15 to 2m in height. The soil is thin, stony and highly water repellent. Long-term pre-burn erosion rates are known from a c. 10-year record of soil losses from a small erosion plot (8 x 2m in size) and sediment accumulation in the weir pool of a subcatchment gauging station. Rainfall simulations carried out under dry and wet antecedent conditions before and after the fire, eroded soil collected in sediment fences installed in strategic locations on the catchment slopes and suspended sediment and bedload determinations at the catchment gauging station provide the evidence for pre- and post-fire erosional losses. Comparison with wildfire effects is provided by instrumented scrub-covered hillslopes burnt in early summer 2008 in the same area. In addition to monitoring soil losses in the small catchment, losses of selected nutrients in eroded soil and runoff together with determinations of pre- and post-fire vegetation cover, fuel loads and soil water repellency have been determined. The soil degradational implications are discussed and placed in the context of the literature on prescribed fire and wildfire impacts from elsewhere in the Mediterranean and from further afield.