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The viability of prescribed fire for mitigating the soil degradational impacts of wildfire

R.A. Shakesby (1), C.P.M. Bento (1,2), C.S.S. Ferreira (2), A.J.D. Ferreira (2), C.R. Stoof (2,3,4), E. Urbanek (1), and R.P.D. Walsh (1)

(1) Department of Geography, Swansea University, United Kingdom (r.a.shakesby@swansea.ac.uk, +44 1792 295955), (2) Escola Superior Agraria de Coimbra, Portugal, (3) Wageningen University, The Netherlands, (4) Cornell University, USA

Prescribed (controlled) fire has become an important strategy primarily to limit the likelihood of more devastating wildfire. The considerable increase in wildfire activity in recent decades throughout the Mediterranean, and in Portugal in particular, has meant that this strategy has become increasingly popular despite inherent fears of people about fire of any sort. Despite many studies of the impact of wildfire on soil erosion and degradation, relatively little research has assessed impacts of prescribed fire on soil in Portugal or elsewhere in the Mediterranean. As part of the DESIRE research programme, this paper addresses this research gap by investigating hillslope-scale losses of soil, soil organic matter and selected nutrients before and after an experimental fire (representing a 'worst case-scenario' prescribed fire) in a shrub-vegetated catchment in central Portugal. Comparison is provided by post-fire monitoring of a nearby hillslope affected by a wildfire of moderate severity. Hillslope-scale measurements were carried out over c. 3 years using sediment fences with contributing areas of up to c. 0.5 ha. Eroded sediment was periodically removed from the fences both before and after the fire at intervals ranging from a few weeks to several months depending on rainfall characteristics and logistics. Erosion expressed as g/m^2 and g/m^2/mm of rainfall was determined. Figures for long-term (c. 10 years) erosion under unburnt conditions for this vegetation type were obtained from a small bounded plot and from sediment accumulating in a weir pool draining a sub-catchment within the prescribed-fire catchment. In addition, soil organic matter and selected nutrients, including K_2O, P_2O_5 and Total N, were measured in the eroded sediment and in the pre-burn and post-burn *in situ* soil. The results indicate that both the wildfire and prescribed fire caused erosion that was orders of magnitude higher than for long-term plot-scale and hillslope-scale erosion recorded under unburnt conditions. Total post-fire erosion measured over $2^1/_2$ years was relatively high for this worst case scenario prescribed fire even when compared with published results from smaller-scale plots monitored after wildfire elsewhere in the Mediterranean, which would be expected to be higher. Nevertheless, the post-fire hillslope-scale losses appear to have had a relatively low impact on the thin, stony, degraded soils. This is thought also to be the case following the wildfire, even though it caused somewhat higher erosion. Its other serious effects (damage to habitat and property, loss of life), however, mean that wildfire can never be viewed as acceptable, particularly where people live in close proximity to highly fire-prone terrain. The results support the viability of prescribed fire as a strategy for combating wildfire on shrub-vegetated terrain in this wet Mediterranean environment. This view of a low impact of prescribed fire on the terrain may be different where the stability of the soil is reduced by disturbance through ploughing, where soils are very thin or contain relatively few stones, or where fire is carried out too frequently.