



Post-fire forest sustainability in north-central Portugal: Assessing the impacts of pre- and post-fire ground preparations, logging and mitigation treatments on post-fire runoff and erosion.

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Wildfires have been reported worldwide as producing strong and sometimes extreme responses in runoff and soil erosion. However, in the case of North-Central Portugal, little research had been carried out regarding the hydrologic and erosive impacts of several land management activities in recently burnt areas (such as ground preparation, post-fire logging or post-fire mitigation treatments). This is the main objective of this research. Several pre- and post-fire ground preparation operations (down-slope rip-ploughed, contour ploughed and terracing), post-fire logging activities, and post-fire soil erosion mitigation treatments (forest residue mulches, polyacrylamide and hydromulch) were assessed from the first to the third post-fire years. Repeated rainfall simulation experiments (RSE's), micro-scale runoff plots and bounded sediment fences were installed immediately after the wildfire in twelve burnt slopes and monitored at weekly-basis intervals.

The results for the first post-fire year showed comparable runoff coefficient (20-60%) but lower sediment losses (1.2-10 Mg ha⁻¹) than prior studies in Portugal and worldwide, which corresponded well with the historic intensive land use in the area. Terracing sharply increased soil erosion (up to 30 Mg ha⁻¹) at the micro-plots scale during the first year after a wildfire and terracing. However, sediment limited erosion was measured in all the pre-fire ploughed sites, probably due to the time elapsed since ploughing. Post-fire logging activities enhanced 5- to 10- fold the sediment losses, which was related to the disturbance of the soil surface cover. The mulches (forest residue or hydromulch) were highly effective reducing post-fire soil erosion in more than 80%.

The increase on sediment losses of the recently terraced area and the measured sediment exhaustion at all the pre-fire ploughed sites as well as the increasing frequency of ploughing in the forest areas implies the need to consider ploughing as a hazardous activity in the region. Furthermore, logging activities that maintain the needle cast and/or logging litter over the soil surface are suggested. The best options for post-fire mitigation treatments were forest residue or hydromulch. Due to its comparatively lower price, the forest residue mulch is highly recommended.