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Prescribed fire and soil mulching with fern in Mediterranean forests: Effects on surface runoff and erosion

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Abstract

Prescribed burning is increasingly used to reduce the wildfire risk, and the need to limit runoff and erosion suggest treating burned soils with mulching. To this aim, fern residues may be more advisable compared to the commonly used straw, since this material is directly available in forests and has lower drawbacks. However, the post-fire hydrological effects of both prescribed fire and soil mulching are contrasting in literature, and fern has not previously experimented as mulching material in Mediterranean forests. To fill these gaps, this study has evaluated the soil hydrological response in small plots installed in three Mediterranean forests (pine, chestnut and oak) after a prescribed fire and mulching treatment with fern. Compared to the unburned soils, runoff and erosion significantly increased immediately after fire (by 150% to 375% for the runoff coefficients, and by 100% to 800% for the soil losses). However, these increases are much lower compared to the highest values reported by some studies. The negative impacts on the hydrological response in burned soils were limited to three-four months. Subsequently, the pre-fire runoff and erosion rates of the burned soils were practically restored, and the hydrological changes were not significant compared to the unburned soils. In the short term after prescribed fire application, soil mulching with fern residues was effective to limit the increase in the hydrological response of the burned and not treated soils, since runoff coefficients and erosion were reduced by 25-30% in oak soils and 70-80% in chestnut and pine forests. The changes surveyed in soil hydrology were associated with variations in the infiltration rates and water repellency immediately after fire, previously detected in the same experimental site. The restoration of water infiltration rates and disappearance of soil repellency gained

importance over time, and the incorporation of mulch residues become beneficial in driving the short-term runoff and erosion response of the burned soils.

Keywords: ecological engineering techniques; post-fire management; hydrological response; pine; chestnut; oak.

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