

SEEDING AND MULCHING + SEEDING EFFECTS ON POST-FIRE RUNOFF, SOIL EROSION AND SPECIES DIVERSITY IN GALICIA (NW SPAIN)

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ABSTRACT

The effects of two different soil rehabilitation treatments on runoff, infiltration, erosion and species diversity were evaluated in a shrubland area in Galicia (NW Spain) after an experimental fire by means of rainfall simulations. The treatments compared were: seeding, seeding + mulching and control (untreated). Rainfall simulations were conducted 9 months after fire and the application of soil rehabilitation treatments. A rainfall rate of 67 mm h⁻¹ was applied for 30 min to each runoff plot. Seeding significantly increased plant species richness in the treated plots relative to the control plots, although it had no effect on diversity or evenness. Rehabilitation treatments did not significantly increase soil cover or affect runoff and infiltration. Soil losses were low in all cases, varying from 75.6 kg ha⁻¹ in the seeded + mulched plots to 212.1 kg ha⁻¹ in the untreated plots. However, there were no significant differences in sediment yields between treatments. The percentage of bare soil appeared to be a critical variable in controlling runoff and erosion. Copyright © 2010 John Wiley & Sons, Ltd.

KEY WORDS: seeding; mulch; post-fire rehabilitation; hydrologic parameters; sediment yields; Spain

INTRODUCTION

Wildfire promotes the reduction or elimination of vegetation and ground cover, which exposes the mineral soil to raindrop impact, usually leading to increased soil erosion (e.g. Robichaud and Brown, 2000; Johansen *et al.*, 2001; Martin and Moody, 2001; Meyer *et al.*, 2001; Benavides-Solorio and MacDonald, 2005; Fernández *et al.*, in press). Fire can also alter the soil structure, thus inducing changes in infiltration (e.g. Imeson *et al.*, 1992; Pradas *et al.*, 1994; Cerdá, 1998; Martin and Moody, 2001; Cerdá and Lasanta, 2005). Fire-induced hydrophobicity (De Bano, 1981; Robichaud, 2000; Huffman *et al.*, 2001; Keizer *et al.*, 2008) can also result in increased soil losses.

The application of emergency post-fire rehabilitation treatments is generally proposed in severely burned areas (Napper, 2006). Treatments such as mulches and seeding are used to increase ground and vegetation cover. However, the effectiveness of these treatments in the field has been tested in only a few studies (e.g. Bautista *et al.*, 1996; Robichaud *et al.*, 2006; Wagenbrenner *et al.*, 2006; Groen and Woods,

2008; Fernández *et al.*, in press) and the results are somewhat inconclusive. Grass seeding is widely used as a post-fire erosion control treatment because of its relatively low cost and ease of application (Beyers, 2004). However, some recent field studies in the United States (Robichaud *et al.*, 2006; Wagenbrenner *et al.*, 2006; Groen and Woods, 2008) have shown that post-fire grass seeding may be ineffective in increasing ground cover or reducing post-fire erosion rates, particularly in the first year after fire when the risk of erosion is highest. Seeding may also have other ecological consequences, as it interferes with natural recovery of vegetation (e.g. Beyers, 2004; Keeley, 2004; Dodson and Peterson, 2009) and may degrade the ecosystem.

Over the last 11 years, there have been about 9000 fires per year in Galicia, representing 47 per cent of forest fires in Spain (Ministerio Medio Ambiente, 2006). Increases in wildfire frequency and burned area are anticipated under the expected future climate scenarios in NW Spain (Vega *et al.*, 2009) and therefore an increase in post-fire erosion compared to that previously observed after wildfire in Galicia (e.g. Vega *et al.*, 1982; Díaz-Fierros *et al.*, 1982; Fernández *et al.*, in press) is also predicted. In this region, advanced planning for post-wildfire rehabilitation is a relatively new concept (Vega, 2007), despite the large number of fires that occur annually and the high population

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