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The importance of pine needles in reducing soil erosion following a low/medium intensity wildfire in Junceda (Portugal) – an experimental design

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Introduction

Portugal is traversed each year by fires, showing a positive trend for an annual increase in their number and in the area scorched, as well as an increase in the recurrence of fires (Ferreira-Leite et *al.*, 2011) and occurrence of large fires (Ferreira-Leite, 2010).

As a consequence, the erosion of the top layer of soil occurs. In most Portuguese soils, it is in these layers that the only nutrients are available (Burch *et al*. 1989; Imeson *et al*. 1992; Shakesby *et al*. 1993; Scott & Schulze 1992; Scott 1993; Andreu et al. 1994; Coelho *et al*. 1995a, b; Pierson *et al*. 2002; Coelho *et al*. 2004; Cerdà & Lasanta 2005; Benavides-Solorio & MacDonald 2005, Bento-Gonçalves *et al*., 2008).

In a climate of Mediterranean characteristics, the export of sediments and nutrients usually occurs within the first 4 / 6 months after the fire, so it is essential to study and implement a set of solutions that reduce the loss of materials (Shakesby *et al.*, 1993, Bento-Gonçalves e Coelho, 1995, Shakesby *et al.*, 1996, Walsh, 1998; Ruiz and Luque, 2010, Bento-Gonçalves e Lourenço, 2010, Vega *et al.*, 2010).

However, this process is highly dependent on the recurrence of fires, their intensity and severity , spatial variability of soil hydrophobicity (Jungerius e DeJong 1989; Ritsema e Dekker 1994; Coelho *et al.* 2004) as well as on the local characteristics (altitude, slope, exposure, climate, geology, ...), so it is necessary to adapt the different soil strategies to each situation, as was demonstrated in early research in Central Portugal (Lourenço, 1989; Lourenço and Bento-Gonçalves, 1990; Lourenço, Bento-Gonçalves and Monteiro, 1991).

Objectives

Most of the soil protection measures after fire are expensive and difficult to implement. Thus, the Soil Protec[1] (Emergency measures to protect soils after forest fires) project aims to test low cost treatments to reduce soil erosion immediately after low/medium intensity forest fires in *Pinus pinaster* stands in the northwest of Portugal.

[1] Funded by CEGOT – Centro de Estudos em Geografia e Ordenamento do Território.

We aim to test the role of pine needles available at the actual site of the fire - which are partly due to them falling after the fire of low/medium intensity - as a protective agent against soil erosion (photos 1 and 2) and, also, compared with the role of straw.

Photo 1 and 2. Pine needles

Methodology

Following the great fire (1479.68 ha) which occurred in Geres, in the municipality of Terras de Bouro ('freguesias' of Covide, Rio Caldo and Vilar da Veiga), in August 2011, six plots were installed in a low to medium intensity scorched area of Pinus pinaster. Each plot was 10 meters long by 2,5 meters wide (Fig. 1).

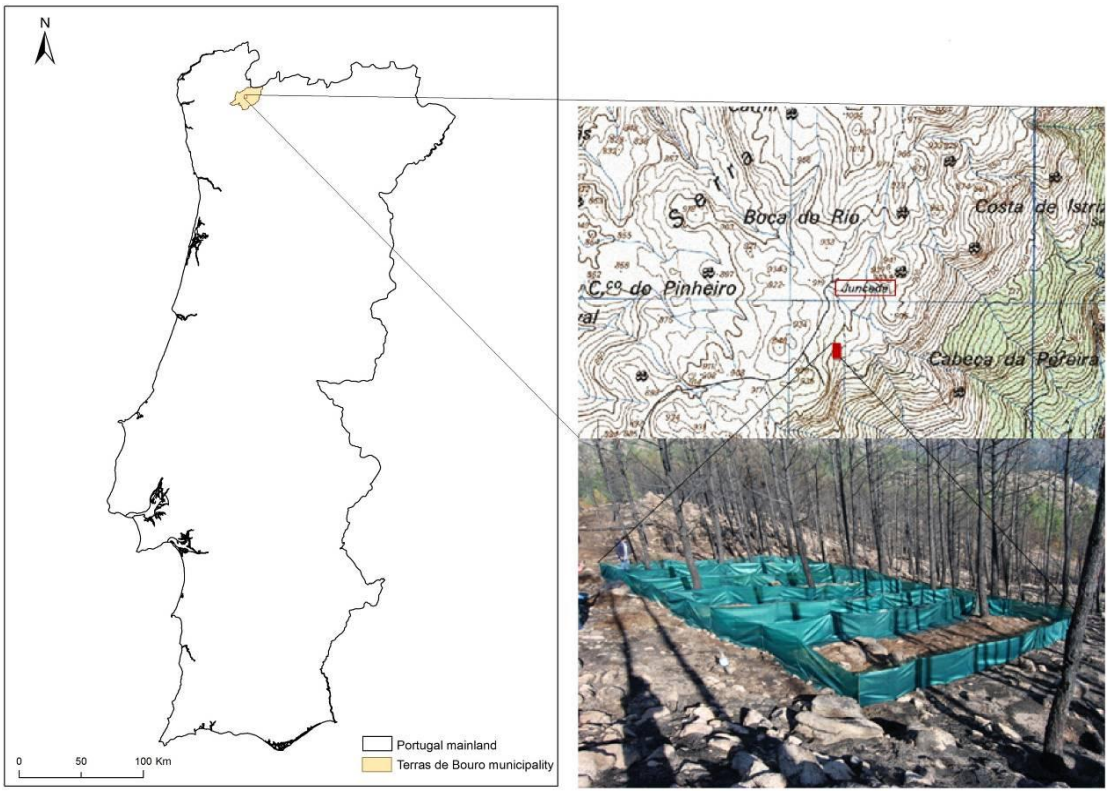

Figure 1. Study area (Junceda, Terras do Bouro - Portugal)

Each plot (photo 3) was mapped using a total station (photo 4), thus allowing not only to identify the exact area of each plot, but also to trace 3 cross sections (at the top, in the middle and at the base) in each one, which we repeated systematically.

Photo 3. Burnt control plot;

Photo 4. Survey of the plots and the study area with a total station

Were subsequently applied straw (2, 4 and 8 kg) and pine needles (2 and 4 kg) in five plots and one was left as a control sample (Fig. 2).

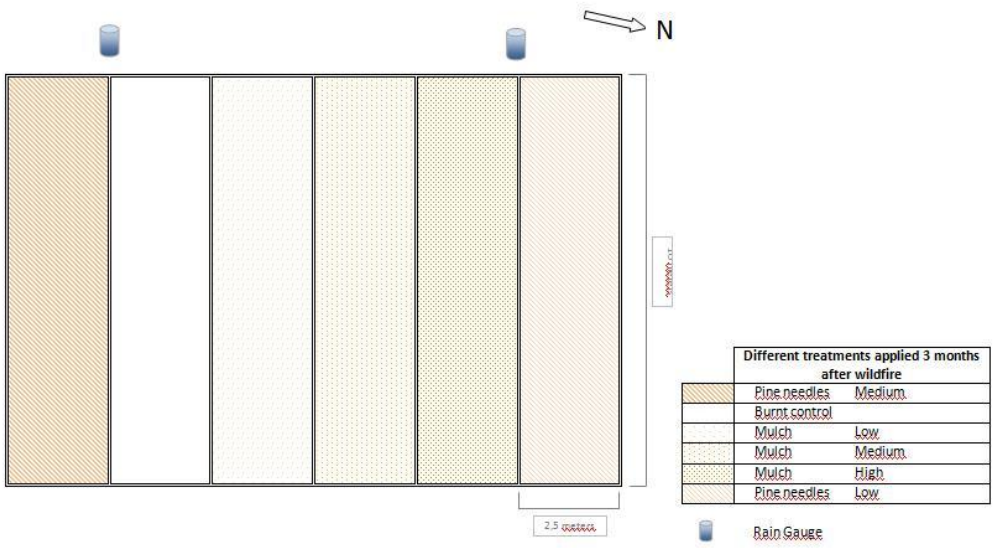

Figure 2. Research design for testing post-wildfire urgent mitigation measures

At the same time a topographic survey was conducted, also using a total station, of the slope where the plots were installed.

Conclusions

The geomorphologic Modeling we are implementing through the "Soil Protec" project will help us to understand the processes acting on the slopes and their response to the proposed remediation mechanisms, enabling the production of relevant information for the development of inexpensive strategies for soil protection.

The ultimate goal is to recommend measures that will allow those responsible for the management of the scorched areas, after a swift identification of the critical areas in which the interventions should occur, to obtain the best conservation results at the lowest possible price and without introducing external elements to the forest environment of the

mountain. This procedure will have a significant impact on the conservation of soil, on vegetation recovery, and therefore on the functioning of the ecosystem.

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