COST Action ES 1306

STSM Short stay

Impact of ash type on soil properties and erosion. Implications to connectivity

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I. Introduction

Ash can change soil hydrological properties in the immediate period post-fire. This is dependent on the type of ash produced (e.g. temperature of combustion, specie affected and time of contact) and depth of ash layer (Pereira et al., 2015). The understanding of the impacts of ash in fire affected areas since they play a key role in the reduction or increase of post-fire erosion and the type and total amount of nutrients available to plant recuperation.

Burning litter in laboratory conditions allows to understand impacts of temperature and time of contact in a specific specie. This methodology have been widely used in previous works to observe the changes in ash physical and chemical according these parameters (Ubeda et al., 2009). Likewise rainfall simulations under controlled conditions permit to identify the effects of a determined rainfall intensity on soil properties.

In this STSM it was analysed the effects of a determined rainfall simulation intensity on a soil covered by ash produced at different temperatures and from different species.

II. Work carried out during STSM

During this STSM the objective was to identify the impacts of ash produced at different temperatures from different species on a) hydrological response after a simulated rainfall and b) impact of rainfall and wet and dry cycles on ash thickness, hydrophobicity and soil humidity. The methodology applied was previously discussed among all the participants.

III. Materials and Methods

Leaf litter from *Quercus robur* and *Picea abis* was collected in a forest located in The Netherlands (51 58’ N and 05 41’ E) in the autumn of 2016. About 3 to 4 kg were collected from an area of 15 m^2, from a site where threes were dominant (Ubeda et al., 2009). In the same place soil samples were collected for laboratory analysis and experiments. Samples were taken to laboratory and leafs were selected and separated from small branches and twigs. After this task, samples were cleaned with deionised water to remove all the impurities (Pereira et al., 2011). Before create ash, samples oven were dried at the temperature of 105 C during 24 hours in order to eliminate the effects of moisture in ash properties. Litter of both species were subjected to the temperature of 200 and 400 C during 2 hours.

After expose litter to the temperatures of contact, the following parameters were analysed in the ash produced: Mass loss, colour (Ubeda et al., 2009), hydrophobicity (Bodi et al., 2011), pH and Electrical conductivity (Ubeda et al., 2009). For the soils collected, we analysed: Hydrophobicity, Organic matter, pH and Electrical Conductivity.

A layer of 15 mm of ash produced at different temperatures of contact and species was spread over the soil in small boxes (24x32 cm) (Figure.1) for rainfall simulations. Rainfall simulations were carried out using the Wageningen University Rainfall simulator (Lassu et al., 2015). In total 3 plots per specie, Bare soil, Ash 200 and Ash 400). Plots were placed at 17% of inclination and we applied an intensity of 55 mm/h during 40 minutes (Bodi et al., 2013). A cycle of two rainfall simulations was carried out in order to identify the impact of rainfall events on ash covered soils and if they differ from bare soil in total runoff, runoff coefficient and sediment production and ash thickness. Runoff was measured with 1 minute interval. Each 5 minutes the overland flow was collected and stored to determine sediment content and erosion rates. After each rainfall simulation, the pots were stored in a Oven at 25 C during 4 days (Bodi et al., 2013).

The application of two rainfall simulations in the same plots, allowed also identifying the impacts of wet and dry cycles on ash thickness, ash hydrophobicity and soil moisture. After the first rainfall simulation, inside each plot a grid was created and a total 56 points were measured. In addition to this several photos were done before and after rainfall simulations in order to know their impacts on ash colour.

The results of this experiment will be presented in future COST meetings, European Geoscience Assembly 2016 and in international journals.

Figure 1. Plots used for rainfall experiments

IV. Contribution of the work to the action aims

- **WG2:** During this **STSM** we measured the effect of an ash layer on soil surface on time to ponding, total runoff, runoff coefficient, sediment yield, pH and EC. This allowed to have a better understanding about the effects of ash immediate impacts on runoff, sediment production and solutes production according different species and temperatures of contact. The analysis of ash thickness, hydrophobicity and soil moisture will help to understand the impacts of rainfall in soil protection and hydrological behaviour. This data is novel and will be fundamental for the understanding of connectivity in fire affected areas.

- **WG3:** The data collected during this **STSM** will be very important to understand the impact sediment connectivity in fire affected areas, since can be incorporated in soil erosion models. Presently, very few models integrate ash in soil erosion models applied in burned areas.

Overall, This STSM contributed for also for the exchange of methodologies and knowledge about ash impact on soil hydrological behaviour, fundamental for a better management of fire affected areas

V. References

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