STUDYING THE IMPACT OF LITTER QUANTITY AND PROPERTIES ON SPLASH EROSION USING RAINFALL SIMULATION

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INTRODUCCIÓN

The role of litter in the hydrological and erosional response of forest soils is still poorly understood. Some properties of litter (eg, amount, origin and shape of residues) have been studied in relation to soil runoff and erosion. But still there are some gaps in research. Although it is known that the amount of litter conditions of runoff and erosion rates, it is necessary to quantify the effect of the amount and type of litter on splash erosion. Soil response to the impact of raindrops may vary with rainfall intensity and soil properties, but also with litter characteristics. In addition, litter from forest soils shows an heterogeneous distribution, varying in quantity and depth. In this project, it is hypothesized that properties of soil litter condition the amount of sediments redistributed by the impact of raindrops, creating a patchy pattern of soil responses through the hillslope. Therefore, this projects aims to the study of the influence of different morphological types of litter (eg, *Quercus* spp., *Eucalyptus* spp. or *Pinus* spp.) in the soil response to simulated rainfall under laboratory conditions. This is a previous stage to the analysis of the spatial distribution of splash erosion under natural conditions, which should help to understand and model connectivity among different points of the slope may be assessed indirectly by studying the amount of runoff on the soil surface.

EXPERIMENTAL DESIGN AND METHODS

Two diferent experiments were designed in order to study [i] evolution of soil water repellency and runoff in burned and unburned soils after rainfall simulations and [ii] the relationship of infiltration and runoff generation with different types of litter cover. Soil samples were collected from pine and oak forest in sandy areas near Wageningen (Gelderland, The Netherlands; Fig. 1).

[i] Soil samples were arranged in four boxes (1 m long × 0.5 m wide, 0.5 m deep) and exposed to different treatments: (1) unburned bare soil, (2) burned bare soil, (3) unburned litter and soil and (4) burned litter and soil. At each box, the surface of the soil sample was divided in a grid (9 rows × 4 columns, 36 cells). In order to study the impact of rainfall on soil water repellency, persistence of soil water repellency (WDPT) was assessed at each cell immediately before and after rainfall simulations, and classified according to Bisdom (1993).

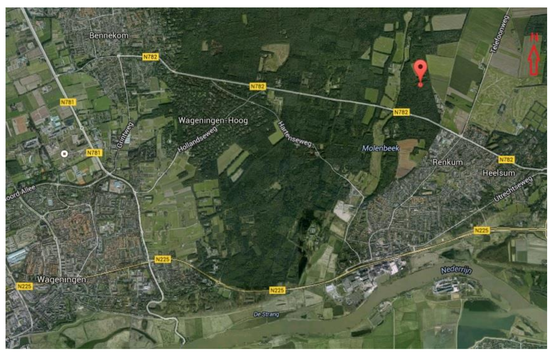

Figure 1. Sampling site in a forest soil near Wageningen, The Netherlands

Figure 2. Details of the soil sampling site.

[ii] For the second experiment, soil samples with different types of organic residues (oak and pine litter) and litter cover (0, 25, 50, 75 and 100%) were prepared in order to analyze the relation between runoff generation and infiltration dynamics under different types of litter and cover. Runoff and infiltration rates and sediment yield were recorded at each case.

RESULTS

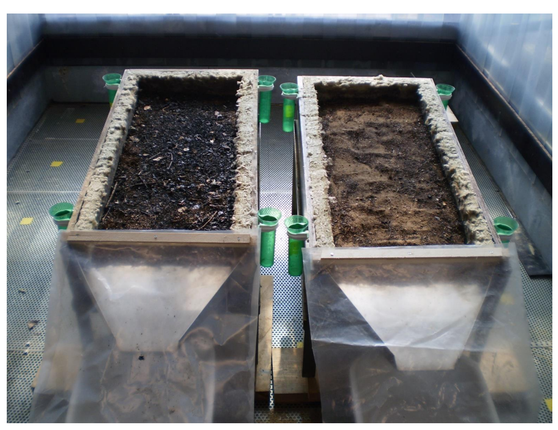

Figure 3. Left: burned litter and soil. Right: burned bare soil.

Figure 4. Left: unburned litter and soil. Right: unburned bare soil.

Soil water repellency strongly decreased after rainfall simulations in burned and unburned soil samples. In burned bare soils, soil water repellency decreased from extremely to slightly severe. In most cases, extreme persistence of soil water repellency persisted, although WDPT decreased significantly. In the rest of cases, severity of water repellency shifted to severe (19%), strong (11%) and moderate (3%).

In unburned soil samples, a range of severities of water repellency was determined previously to rainfall simulation: extreme (48%), strong (33%) and slight (19%). After rainfall, water repellency decreased significantly to slight (69%) and moderate (17%) or was destroyed (14%).

Figure 5. Ángel in the soil erosion lab.

In the second experiment, sediments and runoff water were determined after rainfall simulations. In soil samples under pine litter, higher cover classes (75 and 100%) did not show significant differences, although sediment yield generally decreased with increasing litter cover. In contrast, sediment yield from oak-litter samples was not correlated with litter cover, showing an irregular response. Runoff and infiltration rates were not related with litter cover, varying between 16 and 43% (pine litter) and 35 and 45% (oak litter).

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Figure 6. Soil samples prepared with different litter cover proportions.