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The importance of rainfall drop size characteristics for splash erosion on terraced eucalyptus plantations in north-central Portugal

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Eucalyptus plantations have been introduced widely in Portugal since the mid 1950s, stimulated by the demand from cellulose and paper industries, and now dominate the hills and mountains of large parts of central Portugal. As a result of continuing technological advances over the past decades, the installation of new eucalyptus plantations has come to involve profound mechanical ground operations such as rip ploughing and, especially in the last few years, the construction of terraces on the steepest slopes. Although terraces are traditionally considered to reduce soil erosion, there are widespread concerns as to this effect, also due to the road network involved in the construction of terraces. A pilot study carried out on one of the sites of this study, indicated high erosion rates on the site's central road but also revealed a widespread occurrence of erosion processes on the majority of terraces, especially collapses of terrace sides and the formation of structural crusts due to the deposition of fines. Nonetheless, the hydrological and soil erosion processes on terraced forest plantations have received very little research attention. To this end, the present study addresses a key soil erosion process –splashing - with the main purpose of the research focused on clarifying the role of rain characteristics that are not commonly available in field splash experiments, i.e. those measured by a laser precipitation monitor (number of drops, their size and velocity).

The present study was carried out in the municipality of Sever do Vouga, in north-central Portugal. It involved two study areas in the surroundings of the localities of Soutelo and Pessegueiro do Vouga, and a total of three study sites. The Soutelo study site was terraced in spring 2007, following a wildfire during the summer of 2006. From the two Pessegueiro sites, one had been terraced prior to the occurrence of a wildfire in 2007, and the other several months afterwards. A Thiess laser precipitation monitor was installed in the immediate surroundings of the Soutelo site, together with a Davis Weather Monitor II which includes an automated rainfall gauge. A further PRONAMIC automated rainfall gauge was installed in the Pessegueiro area. One or more totaliser rainfall gauges were used to check the nearby automated gauges.

Splash erosion was measured using two designs, namely a funnel- and a cup-type model. The funnel model, following the design by Terry, comprises two funnels with a space between them to insert a filter to gather the soil released. The sampling diameter is 12 cm. This twin-funnel system ensures that the soil particles captured by the device will not be lost again, as it protects the filter from washout. The cup model, following the design by Molina and Llinares, consists of a 7 cm-long aluminium cylinder with a diameter of 10 cm. A 0.5 cm opening wire mesh is fixed inside the cylinder. The filter is secured on top of the mesh, and another mesh is fixed on top of the filter, this time a movable one with a much larger opening. The aim is to reduce the likelihood of the raindrops washing out the filters that have already collected samples of splashed soil particles. The device is fixed to the ground with legs instead of with long cylinders to avoid runoff water swirling down the slope and contaminating the filters with suspended and un-splashed soil particles.

At each of the three study sites, five terraces were selected for the installation of two cups and two funnels per terrace, at distances of at least one meter. At the Soutelo site, the cups and funnels at each terrace were placed in neighbouring pairs, whereas at the Pessegueiro sites they were placed in a totally random manner. The installation of the splash devices took place at different periods, ranging from May 2007 in the case of the Soutelo area and November 2007 in the case of the Pessegueiro area, although their monitoring ended at the same time, in May 2008. During the monitoring period, the filters were changed in the field at weekly intervals, unless, of course, no rain had fallen. The filters were then analysed in the laboratory using standard methods.

The proposed presentation will address the temporal patterns in soil losses by splash and relate them to rain

characteristics that are commonly used in splash erosion studies, such as rain total and maximum intensity, as well as to others whose measurement requires the use of a disdrometer. Also, the spatial patterns between and within the sites and the differences due to the type of splash device will be presented and discussed.