

## **Runoff, Erosion, and Effects of Mulching on Burned Pine and Eucalyptus Plantations, Central Portugal.**

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**Abstract.** Post-fire erosion is an important concern in forested areas, and recent studies show mulching can greatly reduce post-fire erosion. However, few studies have examined post-fire erosion in exotic tree plantations and mulching with residues from logging. The objectives of this study were to: (1) measure post-fire runoff and erosion in eucalyptus and pine plantations in central Portugal; (2) determine the key controlling factors, such as rainfall and soil water repellency; and (3) determine the relative effectiveness of chopped bark and logging slash for reducing post-fire runoff and erosion.

Twelve 16 m<sup>2</sup> bounded plots were installed in October 2007, two months after a moderate-to-high severity wildfire in central Portugal. The burned eucalyptus plantation had four control plots and four plots treated with chopped eucalyptus bark. The burned pine forest had two control plots and two plots treated with eucalyptus logging slash from an adjacent unburned clearcut. Rainfall, soil moisture, soil water repellency, and ground cover were monitored in or adjacent to each plot. Runoff and sediment yields were measured with tipping buckets and tanks.

Total rainfall from October 2007 to December 2008 was 1500 mm. The overall runoff coefficient of 22% for the untreated eucalyptus plots was significantly higher than the overall value of 6% for the pine plots ( $p < 0.001$ ). This difference can be attributed to the extreme soil water repellency present for 56% of the time in the eucalyptus plots as compared to just 7% of the time in the pine plots, and also to the mean value of 73% bare soil in the eucalyptus plots versus 41% in the pine plots ( $p < 0.001$ ). The chopped bark applied to the eucalyptus plots reduced the mean runoff coefficient by 43% ( $p < 0.001$ ), while the logging slash applied to the pine plots did not significantly reduce runoff.

Sediment yields were 5 Mg ha<sup>-1</sup> for the untreated eucalyptus plots as compared to only 0.3 Mg ha<sup>-1</sup> for the untreated pine plots ( $p < 0.001$ ), and this is attributed to the greater runoff and percent bare soil. The chopped bark treatment reduced sediment yields by 85% ( $p < 0.001$ ), but again the logging slash applied to the pine plots did not show significantly reduce sediment yields.

The results indicate more severe post-fire runoff and erosion in the eucalyptus plantation than the pine plantation, and greater effectiveness of the chopped bark mulch than the logging slash. More research is needed to assess the relative importance of soil water repellency and ground cover for increasing post-fire runoff and erosion, and to understand whether the chopped bark can be effective at larger scales.

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