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## Monitoring mulch-based solutions to reduce runoff and erosion in a variety of land uses in the Alentejo agro-silvo-pastoral systems

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### Monitoring mulch-based solutions to reduce runoff and erosion in a variety of land uses in the Alentejo agro-silvo-pastoral systems

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Soil erosion is a critical socio-environmental problem for rural Mediterranean ecosystems and landscapes. Erosion inflicts multiple, serious damages in agro-ecosystems, including vineyards and olive groves, and also in other semi-natural ecosystems such as the Montado (cattle-sheep pastureland combined with *Quercus sp.* trees). In particular, erosion reduces the water storage capacity, soil organic matter, nutrients and valuable soil biota, which are transported off-site with runoff water. Nature-based solutions, such as the application of organic mulching, reduces runoff

and soil erosion between 40% and 90%, respectively. Agri-forest residues such as olive and vineyard by-products can also be transformed to *biochar* and applied to the soil, increasing soil organic matter, soil moisture and, ultimately, improving the soil status and agronomic soil properties.

Our aim was to verify the effects of the application of combined mulch and *biochar* upon the mitigation of runoff and soil erosion. Runoff-erosion experimental plots were developed to independently measure runoff, by using pressure sensors, and erosion, by emptying, drying and weighing the sediments stored in sediment fences. A total of 60 plots were installed and monitored during 3 months in olive orchards, vineyards and Montado, which were consistently treated with mulch (2 Mg ha<sup>-1</sup> straw/olive leaves) and mulch + *biochar* (2 Mg ha<sup>-1</sup> straw + 10 Mg ha<sup>-1</sup>). All plots were located across Alentejo, the region of Portugal with a most marked Mediterranean climate.

Preliminary results showed that mulch reduced runoff peakflows in 7% and mulch + *biochar* reduced it in 28%. Soil erosion was reduced around 60 and 80%, respectively. There were important differences between olive orchards, vineyards and Montado systems. In general, the vineyards and olive orchards are much more prone to erosion when compared to the Montado. Further research is being carried out and will allow the assessment of the effects of mulch and mulch + *biochar* in other ecosystem services, such as water retention, carbon storage, soil habitat protection and soil fertility.

**Keywords:** Agriculture, climate change, sustainability, water storage, soil fertility