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Hydrological and erosion processes in terraced agricultural fields: observations from a wet Mediterranean region in northern Portugal

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Traditional agriculture in the mountainous humid regions of the northwestern Iberian peninsula has relied on terraces for soil retention. In the last decades, a strong afforestation (in many cases with commercial species) has led to the appearance of large forest areas coexisting with traditional agricultural landscapes. Soil erosion research in this region has therefore focused on the impact of forest management practices and associated disturbances such as wildfires. However, there has been little research on the impacts of traditional terracing practices on erosion, and therefore it has been difficult to connect forest research with the wider issue of sediment connectivity in this complex agroforestry landscape.

This work tried to address this research gap by monitoring an agricultural terrace in the Caramulo mountains, northern Portugal, during two years. The field site is located in a humid Mediterranean climate region, with c. 1500 mm/y rainfall, overlaying granite bedrock; agricultural practices are a traditional rotation between winter pasture and summer (irrigated) corn cultivation. During this period, the soil properties of the terrace were characterized, and there was a continuous monitoring of rainfall, soil moisture and surface runoff at the outlet, as well as 1 or 2-weekly collections of runoff to measure sediment yield. Occasional measurements of vegetation cover and erosion features (rills) within the plot were also made.

Preliminary results indicate that runoff generation occurred mostly due to saturation-excess, possibly linked with the accumulation of groundwater in the lower layers of the soil. After one of the largest events, there was a clear inflow of runoff from outside the terrace, through either the irrigation network linking all terraces or by resurfacing of groundwater. Sediment yield was linked with runoff, but sediment concentration was linked with vegetation cover and was highest during the early stages of pasture growth. However, sediment yield was one order of magnitude lower than erosion observed inside the terrace due to re-deposition near the terrace wall.

In summary, this terrace appears to be responsible for the accumulation of groundwater and therefore for an increase in surface runoff rates. The resulting increase in erosion would be offset by the decrease in sediment connectivity caused by terrace walls. These results imply that terraces have a strong impact on water and sediment connectivity for headwater catchments in the areas of the Caramulo mountains where traditional agriculture is present, which have been strongly modified by the recent afforestation of the region.