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Soil and nutrient losses by hydric erosion under different land uses in a mountain catchment in the Ebro Basin (NE Spain)

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Land degradation by water erosion is one of the main problems in Mediterranean areas. This problem is of particular relevance in mountain areas, where intensive farming and land use changes including land abandonment and changes in soil cover occur. This research analysed the contribution of different land uses to soil and nutrient losses in an ephemeral stream catchment (23 km^2) located in the central part of the Ebro Basin (NE Spain). The climate is continental Mediterranean, characterised by cold winters and hot and dry summers, with strong rainfall events, mainly occurring in autumn. Within the catchment, five land uses/covers: forest, schrub, agricultural, afforested and a very degraded soil, were selected. Soils were sampled and subjected to simulated rainfall of intensity values usually recorded in the area during storms. Soil properties such as organic matter content, texture and N and P were analysed. Simulated rainfall was applied to soil plots in boxes 30cm*20cm. The boxes had a double base to prevent supersaturation, allowing collecting the percolated water. The soil in the boxes was compacted to a density similar to the measured in the field and the slope value was also similar (between 10 and 20%). Rainfall intensity was calibrated before and after each run. Runoff volumes were collected at 10 minute intervals from the time that runoff was generated. The steady infiltration rate as well as the average runoff and rates and soil losses were evaluated for each land use. In the runoff samples, sediment concentration and nutrients (N and P) were analysed using different aliquots. The enrichment factors for N and P in the sediments were evaluated. The results showed runoff rates higher than 60% in the agricultural soils and in most degraded soils, after 20 minutes of rainfall, after which the steady infiltration rates were reached. However, in soils under forest, schrub and afforestation, runoff rates were about 10% for the same rainfall intensity and period. Soil sealing was the main factor reducing infiltration in the agricultural soils, while in the other cases runoff was mainly produced after saturation. The highest soil losses were observed in the most degraded soils (about 460 g/m^2) and in agricultural soil (about 280 g/m^2) while in the other land uses were much lower (about 20 g/m^2 in forest, 15 g/m^2 in schrub and about 5g/m^2in the afforested areas) (data referred to 30 min of rainfall). Nitrogen losses in agricultural soils were about 20 times higher than in forest, schrub or in afforested areas, with N losses of about 850 mg/m^2 in 30 minutes of rainfall. There was an enrichment of nitrogen in the sediment in relation to the original soil, which ranged between 1.04 (in the most degraded soils) and 1.35 (in the agricultural soils). Phosphorous losses were about 5 times higher in the agricultural soils than in the forest or schrub soils, with P losses of up to 10 mg/m^2 in 30 minutes. P concentration in the sediments were higher than in the original soils in the most degraded soils.