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Effects of land use on annual runoff and soil loss -a meta-analysis of a European and Mediterranean plot database-

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Runoff and soil loss caused by water erosion are important desertification processes. While previous studies have shown the important effect of land use on annual soil loss (SL_a), quantification of these effects based on field-measured data is limited and the effect of land use on annual runoff (R_a) and the relation between R_a and SL_a has largely been neglected in the past. Nevertheless, runoff generation plays an equally important role as soil loss in desertification, especially in drier areas, where water is a key resource. Hence, sustainable land management practices to mitigate interrill and rill erosion should also consider the effects on runoff.

Therefore, in the framework of the FP6 project DESIRE (http://www.desire-project.eu), the largest currently available database of plot runoff and soil loss data in Europe and the Mediterranean was compiled to investigate effects of land use on R_a, annual runoff coefficient (RC_a) and SL_a. This database comprises 227 plot-measuring sites in Europe and the Mediterranean, with SL_a for 1061 plots (PL) representing 7 234 plot-years and R_a for 807 PL representing 5 357 plot-years. Bare soil, vineyards and tree crops were found to have high mean RC_a (5-10 %) and mean SL_a (10-20 $Mg.ha^{-1}.yr^{-1}$). Cropland and fallow show similar mean annual RC_a (8.0 and 7.3 %), but lower SL_a (6.5 and 5.8 $Mg.ha^{-1}.yr^{-1}$). Plots with (semi-)natural vegetation cover show the lowest mean annual RC (<5 %) and SL (<1 $Mg.ha^{-1}.yr^{-1}$). Most land use types show positive correlations between R_a and SL_a. For most land uses, SL_a in the Mediterranean is less than in temperate zones (e.g. for cropland: mean SL_a is 2.9 $Mg.ha^{-1}.yr^{-1}$ in the Mediterranean and 9.6 $Mg.ha^{-1}.yr^{-1}$ in temperate zones), due to stony or clayey soils having a low erodibility, while RC_a in the Mediterranean was generally higher than in temperate zones (e.g. for cropland: mean RC_a is 8.6% in the Mediterranean and 3.3% in temperate zones). Furthermore, the effect of land use on the relations between R_a, RC_a and SL_a and plot slope length, plot slope gradient and annual precipitation are explored. The results allow a rapid assessment of the impact of land use changes and proposed sustainable land management practices on annual R_a, RC_a and SL_a, based on field-measured plot data.

Keywords: runoff plot, interrill and rill erosion, land use, runoff-soil loss relation, climatic zone, annual precipitation