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Plot runoff and soil loss rates under forest and shrubland in Europe and the Mediterranean. - A review -

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Forests and natural shrubland vegetation are commonly thought to offer the best protection against interrill and rill erosion. Nevertheless, the number of studies reporting field-measured plot-scale data on annual runoff (R_a), runoff coefficients (RC_a) and soil losses (SL_a) is limited compared to other land use types and an overview of the available data is currently lacking. Therefore this study aims to assemble and analyse available field-scale R_a, RC_a and SL_a data for Europe and the Mediterranean. From an extensive runoff and soil loss plot database, compiled in the framework of the FP6 project DESIRE (http://www.desire-project.eu), R_a data for 59 plots under forest and 84 plots under shrubland (corresponding to 301 and 372 plot-years of measurements respectively) and SL_a data for 59 plots under forest and 113 plots under shrubland (corresponding to 334 and 589 plot-years of measurements, respectively) are extracted and analysed. Forest plots show a median RC_a of 1.6% and a median SL_a of 0.1 Mg.ha^{-1}.yr^{-1}, while in shrubland a median RC_a of 1.1% and a median SL_a of 0.1 Mg.ha^{-1}.yr^{-1} is observed. Significant positive correlations between RC_a and SL_a are found for both forest and shrubland ($p<0.01$). More surprisingly, a significantly negative relation ($p<0.01$) between plot length and RC_a is found for forest plots, which is attributed to spatial heterogeneity of infiltration rates due to vegetation characteristics. For shrubland, the relation between plot length and RC_a was not significant, but the negative relation with slope gradient was significant ($p=0.04$), which is attributed to the high rock fragment cover often encountered on steeper slopes in Mediterranean shrublands. For forest plots, RC_a rates decrease with increasing annual precipitation between 0 and 750 mm.yr^{-1}, while for shrubland SL_a reaches a maximum between 250 and 500 mm.yr^{-1}, after which SL_arates decline again. These effects are attributed to a vegetation feedback effect, where the increased vegetation cover with increasing annual rainfall is able to offset the increased erosion potential. Further research also concentrates on the effects of wildfires on RC_a and SL_a. Unlike some alarming reports of extremely high SL_a rates after wildfires, the effect of wildfires was found to be limited (median RC_a: 0.9%, median SL_a 0.2 Mg.ha^{-1}.yr^{-1}) and declining in the years following a fire.

Keywords: land use, forest, shrubland, annual runoff and soil loss, plot scale, Europe and the Mediterranean, post-fire erosion