Modeling regional management scenarios for soil erosion control in a Mediterranean watershed

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Soil erosion is the most widespread form of land degradation in Europe as well as in the Mediterranean areas. EU Member States are called to decrease the land degradation by identifying the areas under a high risk of soil erosion and by adopting Best Management Practices (BMPs). In this study, the Soil and Water Assessment Tool (SWAT) was applied to simulate the baseline hydrologic and soil erosion processes in the Carapelle watershed, a medium size watershed located in the south-central Italy (Puglia region) where lands are largely cultivated with winter wheat. The results show that in the Carapelle, soil erosion is mostly contributed by cultivated croplands and it exceeds new soil formation rate, as the estimated average annual sediment load is 6 t ha-1 yr-1. Using the calibrated SWAT model, three management scenarios, which are based on the implemented regional policies, were implemented: contour farming (BMP1), no-tillage (BMP2); reforestation (BMP3). A threshold of sediment yield was selected to discretize target treatment areas for BMPs application. Results show that for erosion control BMP2 was the most effective single scenario (30% reduction; from 6.0 to 4.2 t ha-1) followed by BMP1 (22%; from 6.0 to 4.6 t ha-1) and BMP3 (14%; from 6.0 to 5.0 t ha-1). Moreover, the cumulative effect of combining contour farming and reforestation (BMP4) was tested (37% reduction; from 6.0 to 3.7 t ha-1). The analysis of the farmer return-production cost ratio (FR/PC) revealed that the baseline (no treatment) and BMP1 were both economically sustainable in non-steep slope areas (FR/PC=1.12 and 1.11, respectively). In steep slope areas, the baseline scenario had no economic advantage (FR/PC = 0.93) while BMP3 was ranked at the top (FR/PC=1.49) followed by BMP2 (FR/PC=1.41). The results from this study offer actionable information to policymakers and practitioners considering BMPs implementation in two aspects: how they perform and if they are economically beneficial. Further developments could include the analysis of management scenarios aimed at environmental restoration as well as the cumulative effect of combining different BMPs at the watershed scale.