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Erosion and sedimentation on a hillslope cultivated with vineyards: analysing their spatial distribution using multivariable statistics

José Arnáez (1), José Angel Llorente-Adán (1), Teodoro Lasanta (2), Noemí Lana-Renault (1), and Purificación Ruiz-Flaño ()

(1) Universidad de La Rioja, Logrono, Spain (jose.arnaez@unirioja.es), (2) Instituto Pirenaico de Ecología (CSIC), Zaragoza, Spain

In vineyards, high soil losses have been recorded with high-intensity, low-frequency rainfall events, especially when the soil is not protected by vegetation cover (from November to May). Besides, ephemeral gullies, sheet wash erosion and small mudflows can be generated by less intense and more frequent rainstorm events. These processes are related to environmental, topographic factors and cultivation techniques. The aim of this work is to present the spatial organisation of soil erosion forms and processes in a hillslope cultivated with vineyards after two storms (31.2 and 36.6 mm h-1 for 10 min) and to identify the factors that influence this organisation. The spatial distribution of the erosion processes was analysed using cartography, geographic information systems and multivariate statistical analysis. The study was conducted in La Rioja (Spain), where vineyards have great economic significance. Moderate sheet wash erosion affected 35.6% of the study site, and 17.5% was affected by severe sheet wash erosion. Sedimentation areas occupied 41.1% of the site. In general, severe sheet wash erosion was observed on the upper slope sector, and sedimentation areas were located on the bottom slope. A good relationship between the erosion processes, the distance to the parcel boundaries, the distance to the depressions and the slope gradient was observed. The spatial organisation of the erosion and sedimentation processes at the hillslope scale was principally determined by the distribution of the parcel boundaries and rural roads which act as sediment traps, favouring sedimentation. Downslope of these structures, the discriminant analysis predicted areas that could be affected by rills and gullies. The rills, once initiated, followed the direction of the small drainage network masked by ploughing. The application of a discriminant analysis helped to determine the role of these factors and to make a map of the spatial organisation of the processes.

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