



Simwe model application on susceptibility analysis to linear erosion: a case study in Alto Douro wine region.

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ABSTRACT

The wine production in Alto Douro Wine Region - one of the world's oldest regulated and demarcated wine region - is based on a slope system organized in agricultural terraces once supported exclusively by dry stone walls. It has been undergoing the necessary changes for the introduction of technological innovations partially associated to the mechanization of vineyards work. In this sense, different forms of terrain framing have been implemented, namely the substitution of stone walls by earth embankments. This evolution raises a group of problems related to the hydric soil erosion and landscape preservation, since Alto Douro Wine Region is classified as UNESCO World Heritage Site since 2001.

The study area is mostly occupied by vineyards planted in the agriculture terraces without continuous vegetation, the flow proceeds superficially influenced by the weak infiltration capacity and hydraulic conductivity. So, because of this conditioning factor the erosive features present non-significant depth, and the length thereof is limited essentially by the slope of the land, where was registered 64 gullies and 78 rills

This paper focuses on the evaluation of susceptibility to linear erosion, through the application of SIMWE (SIMulated Water Erosion), (Mitas and Mitasova, 1998), using a digital elevation model, with pixel of one square meter of spatial resolution, created through detail aerial photographs, (side pixel of 50 cm), submitted to automatic stereo-correlation procedures in Agisoft PhotoScan software.

The results provided by the model are compared with hydrological characteristics of the soil, (infiltration capacity, and hydraulic conductivity), soil texture, and soil structure parameters (identified by electrical resistivity measurement) where obtained from field monitoring.

This approach demonstrates an association between the spatial distribution of erosive features with high values of soil saturation, and reduced water discharge (10-110 cm³/s), that are consistent with the lower values of electrical resistivity. The areas with the highest amount of erosive features are related to medium sediment flux values, (13.8-334.2 g/ms), medium or high transport capacity (250.3g/ms – 9.4 kg/ms), and sediment concentration with medium or very high classes where register more than 70% of gullies.

These values, combined with low hydraulic conductivity with average Ks values 0.0004 cm³/s, and soil infiltration capacity with values from 0.11 to 0.36 cm/min, derives from the fine texture of soils - gravel (18.8 – 47.9%), sand (10.8 – 20.5%) and silt/clay (32.1 - 64.9%), induce an increased runoff and the development of linear erosion.

The obtained results seem to indicate a good performance of the SIMWE model in the identification of the areas more susceptible to the hydric erosion of the soils, indeed, the most critical areas show the connection between the inventoried erosive forms.

Keywords: Water Erosion, SIMWE, Agricultural Terraces, Alto Douro Wine Region

References

Mitas, H. e Mitasova, L. (1998). Distributed Soil Erosion Simulation for effective erosion prevention. *Water Resources Research*, Vol. 34(3), pp. 505-516.