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Landslide Susceptibility Evaluation on agricultural terraces of DOURO VALLEY (PORTUGAL), using physically based mathematical models.

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The work focuses the evaluation of landslide susceptibility in Douro Region agricultural terraces, supported by dry stone walls and earth embankments, using two physically based models.
The applied models, SHALSTAB (Montgomery et al.,1994; Dietrich et al., 1995) and SINMAP (PACK et al., 2005), combine an infinite slope stability model with a steady state hydrological model, and both use the following geophysical parameters: cohesion, friction angle, specific weight and soil thickness. The definition of the contributing areas is different in both models. The D∞ methodology used by SINMAP model suggests a great influence of the terraces morphology, providing a much more diffuse flow on the internal flow modelling. The MD8 used in SHALSTAB promotes an important degree of flow concentration, representing an internal flow based on preferential paths of the runoff as the areas more susceptible to saturation processes.
The model validation is made through the contingency matrix method (Fawcett, 2006; Raia et al., 2014) and implies the confrontation with the inventory of past landslides. The True Positive Rate shows that SHALSTAB classifies 77% of the landslides on the high susceptibility areas, while SINMAP reaches 90%. The SINMAP has a False Positive Rate (represents the percentage of the slipped area that is classified as unstable but without landslides) of 83% and the SHALSTAB has 67%. The reliability (analyzes the areas that were correctly classified on the total area) of SHALSTAB is better (33% against 18% of SINMAP). Relative to Precision (refers to the ratio of the slipped area correctly classified over the whole area classified as unstable) SHALSTAB has better results (0.00298 against 0.00283 of SINMAP). It was elaborate the index TPR/FPR and better results obtained by SHALSTAB (1.14 against 1.09 of SINMAP). SHALSTAB shows a better performance in the definition of susceptibility most prone areas to instability processes. One of the reasons for the difference of predictive capacity of the models is related with the construction methods of contributory areas. The SHALSTAB susceptibility map shows better discrimination of the unstable areas, which is important to the estates decision makers in order to organize the priority of the hazard mitigation process.

References

Dietrich, W. E.; Reiss, R.; Hsu, M-L.; Montgomery, D.(1995) - A process-based model for colluvial soil depth and shallow landsliding using digital elevation data. Hydrological Processes. ISSN 1099-1085. Vol. 9, n.º 3-4, pp.383-400.

Fawcett, T.(2006) - An introduction to ROC analysis. Pattern Recognition Letters. ISSN 0167-8655. Vol. 27, n.º 8, pp.861-874.

Montgomery, David R.; Dietrich, William E.- A physically based model for the topographic control on shallow landsliding. Water Resources Research. ISSN 1944-7973. Vol. 30, n.º 4 (1994), p.1153-1171.

Raia, S., [et al.]- Improving predictive power of physically based rainfall-induced shallow landslide models: a probabilistic approach. Geoscientific Model Development. ISSN 1991-959X. Vol. 7, n.º 2 (2014), p.495-514.