A methodological approach for landslide economic damage estimation in rural contexts

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Land degradation due to mass wasting and accelerated water erosion represents at global scale a serious threat to socio-economic development not only in urban areas but also in rural and hence less populated territories where the main economic resources are frequently directly linked to the exploitation of the agricultural, pastoral and natural resources, often threatened especially by landslide phenomena. The assessment of damage induced by landslides, thus, provides an important contribution to support decision making concerning the sustainable management of land use. In this paper a methodological approach developed in GIS environment for valuing the economic damage induced by landslides in rural areas is presented. It allows direct damage estimation related to landslide phenomena by means of a synthetic approach which considers the loss of land value associated with landslides state of activity.

This approach was tested in a study area (a small-scale catchment in Molise Region, Southern Italy) which is highly representative of the Adriatic flank of the Molise Apennine, highly exploited for farming and, in the same time, very sensible to slope instability. Several environmental calculation matrices were defined at the pixel scale in relation to different states of activity of landslides. For each cell, soil uses and related Average Agricultural Values (AAVs) were determined. The economic damage value (DV) was computed by multiplying the obtained specified AAV with a specific landslide-damage index (LDI) which was calculated on the basis of the extent and state of activity of landslides within each cell. This procedure allowed the estimation of the DV and the real agricultural value for each cell. Summing up the results coming from each cell, the total loss of land value due to landslides and the residual total agricultural value for the entire study area were calculated.

Furthermore, in order to assess for the entire study area the landslide exposition of rural lands, a susceptibility analysis was performed for each cell. Hence the LDI values have been interpolated with the distinguished landslide susceptibility classes (very low, low, medium and high) obtaining a damage index matrix which provides various loss indicators, functions of the level of susceptibility and the landslides already occurred.

The proposed procedure is a methodological approach to assess landslide-induced economic damage, that can be effectively used to support decision makers in sustainable land use management and socio-economic planning.