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Analysis of the erosion processes in the Rendina watershed and development of PESERA-L for modelling the contribution of shallow landslides to sediment yield

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The Rendina dam watershed (Basilicata, Southern Italy) can be classified as a fragile zone in terms of desertification risk. From the climatic point of view, the area can be identified as "semiarid" and rainfalls are not sufficient to cover the water demand of the area. Moreover, the area is affected by diffuse soil erosion processes, mainly produced by poor land use management. The most evident consequence of such erosion processes is the progressive filling of the Rendina dam reservoir of sediments resulting from erosion all over the watershed.
The research has focused on the detection of the areas of highest erosion rates, of the main predisposing factors, of alternative strategies of land use and of eventual prevention techniques that are easily accessible to stakeholders. In particular, the monitoring work developed during the project has pointed out that erosion mainly results from bad practices of land use, that induce soil loss and reduction of fertility, as well as high sediment supply. Alternative techniques are proposed that can allow for benefits for agricolture and land management.
Shallow landslides also occur within the Rendina area, mainly during winter season, as a result from local severe degradation processes. In agriculture, mass movements inhibit farm operations due to loss of accessibility, exposure of infertile subsoil and also leave the soil surface unprotected against splash and rill erosion, and net downslope movement of the soil mass. As a consequence, diffuse landslides tend to increase desertification risk.
In the framework of DESIRE project, we developed an additional component for PESERA, which is called PESERA-L (PESERA-shallow Landslides), that is able to model the impact and contribution of shallow landslides to sediment yield delivered to the channel network.
In order to allow for a direct integration with PESERA model, PESERA-L has been developed according to the existing PESERA basic approach, with a set of stochastic components easy to be modeled at regional scale.
For each land unit system (LUS) to be identified by the user, the following parameters need to be defined in a stochastic way: hydrological parameters, soil geotechnical parameters, morphological parameters using a slope gradient spectrum, average runout of landslides and finally connectivity index for fluxes and sediment as developed by Borselli et al. (2008).
The core of the PESERA-L component is the regionalized landslide mobility parameter that allows to assess, along with the identified fraction of unstable soil mass for each LUS, the amount of sediment generated by mass movements that reaches the closest drainage network and thus contributes to additional sediment yield in the watershed.
The first application of PESERA-L at regional scale is presented for the Rendina Watershed. Alternative regional management strategies of implementation and comparison with badland type dominated environments are discussed.