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Assessment of the predisposing factors for shallow landslides activation in terraced areas: the case of the Rupinaro catchment, Liguria (northwestern Italy).

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The shallow landslides occurrence is strongly correlated with climatic conditions and environmental settings. In the Liguria region (northwestern Italy), the landscape presents an ancient human intervention represented by terraces and, in the last century, by a general overbuilding, both in the few flat areas and in the steep slope hinterland. From the twentieth century, the progressive abandonment of agriculture generated a lack of maintenance of terraced areas, which associated to the urban and the road net development, supported the slope susceptibility to instability. This makes the assessment of the predisposing factors for shallow landslides a multidisciplinary task, combining natural and man-made issues. In this work, we try to define all the main predisposing factors of the Rupinaro catchment (southeast Liguria). We operate starting from a high-resolution Digital Terrain Model (DTM) supplied by an airborne LiDAR survey carried out after the autumn 2014 rainfall events. From this DTM, we mapped a total amount of 96 landslides in the study area. Then, we implemented a classification methodology based on a simple parametric score. In GIS environment we overlaid several layers: i) lithological and hydrogeological map, ii) slope iii) aspect, iv) the land use information, available by the CORINE land cover, and iv) the presence of terraces. Each spatial data was than reclassified according a numerical code. The sum, by raster math, of these factors provided an overall score raster for the entire basin. This method allows the characterization of the entire watershed, gathering all the predisposing factors for the shallow landslides activation. A categorization of the landslides area mapped from the DTM and stored in a vector layer has been made. In particular, we estimated the most frequent code within each landslide polygon, obtaining a representative data of the most influential factors that triggered shallow landslides. The results showed the prevalent occurrence of shallow landslides in correspondence of terraced areas, cultivated by olive grove, with an impervious bedrock, and presenting gently slope and variable exposure from east/west to south. Our approach focuses on the interaction of landslides susceptibility and the land use modifications over time, with more attention over maintenance level of terraces. This methodology represents a starting point for the correct assessment of shallow landslides occurrence factors, capable to generate a susceptibility map of the entire basin, taking in account of the characteristic features of this extremely man-made territory. In order to assess the spatial connectivity of the basin and in addition to highlight the road network and the terraces role in the shallow landslides occurrence, a future comparison of the obtained data with hydrological indexes is planned.