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Terraced slopes on active coastal landslides. The case of Le Grazie hill (Genoa Metropolitan Area, Italy).

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This study is aimed at reconstructing the recent increase of agricultural terraces taking place on Le Grazie Hill in the eastern section of the metropolitan area of Genoa. This section of the Ligurian coast has historically been the object of geological research, especially since the end of the Nineteenth Century because of the presence of numerous active landslides surmounted by infrastructure and buildings of historical value, specifically the medieval sanctuary.
Moving from east to west, it is possible to identify the landslides of Belvedere, Colonia Piaggio, Via Aurelia, the sanctuary mentioned above, and the Liggia. Recent studies of the stability of the high rocky Ligurian coast have identified a possible serious gravitational deformity on the slope which is causing the landslides to occur.
Among the drivers of the landslides are geological conditions (a heterogeneous flysch), geomorphological processes (tectonic uplift and wave erosion of the slope toe), physical processes (intense, short periods of rainfall or prolonged high levels of precipitation) and, finally, man-made processes (excavation of the slope toe, defective maintenance of drainage systems, change in land use, quarrying and underground galleries).
Analysis of the hundred-year-old thermopluviometric series provided by the meteorological station in Chiavari has shown a significant change in the rainfall regime, and recent decades have seen an intensification of rainfall events, with their inevitable repercussions: floods and shallow landslides.
Due to its exposure and its morphological characteristics, Le Grazie Hill is the site of centuries-old terraces; constant management of the landscape guaranteed their regular maintenance until the end of World War Two. With the post-war improvement of social and economic conditions, agricultural activity was abandoned, leading in turn to neglect of the terraces and their connected drainage systems. The consequence has been to trigger landslides, particularly under conditions of extreme rainfall events.
The lack of maintenance of hydrogeological balance has therefore determined increase hazard for important infrastructures and scattered inhabited areas.
The study was carried out using a LiDAR flight and available aerial photographs, as well as regional and local cartography. The terraces were first extracted using feature extraction methods and then classified according to three types: abandoned; undergoing abandonment; in use. Thanks to the historical comparison of land use along the Le Grazie Hill, and the geological and geomorphological identification of the current situation of the entire section between the crest and sea level reassuring, results have been obtained in terms of possible remedies to reduce risk: among the most urgent and necessary are measures for restoring the terraces.