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Technical solutions for landslide risk mitigation with law impact on landscape

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Landslide risk mitigation that takes into account the safeguarding of environmental landscape involves several technical difficulties. However, at present, it is fundamental to identify sustainable technical and economic solutions in order to preserve the Italian areas characterized by an undoubted landscape and environmental heritage.

In most cases, landscape is deeply and destructively hit both when a landslide occurs, both when countermeasures for its mitigation are taken. Indeed, traditional technical solutions to increase slope safety are often costly and very impacting on natural environment and landscape. A possible alternative for improving slope stability is based on the use of non-invasive naturalistic engineering techniques [1]. Such solutions have a low impact on landscape and natural environment, conserving landscape identity and characteristics. Unfortunately, nowadays the use of these solutions is limited, since they suffer of a lack of rational approaches that quantify their stabilizing action. To overcome such constraint, we carried out a numerical study to evaluate the efficiency of remedial works based on naturalistic engineering to improve slope stability, considering a wide range of ideal slopes and different combinations of pre- and post- conditions (geometry, materials, types of soil protection solutions, etc.). As shown by the results of the stability analyses, in all the cases considered, the adopted naturalistic engineering techniques are able to increase the level of safety of the slopes with a very limited impact on the natural environment and landscape, due to the use of natural materials for the construction.

In this work we present a summary of the main techniques adopted in the field of naturalistic engineering. After introducing the methods generally used in evaluating the slope stability, the role played by vegetation in the mitigation of hydrogeological instability will be presented, with particular reference to the mechanical effect exerted by the plant roots which typically increases the soil shear strength. Then, the numerical study carried out to quantify the stabilizing effects deriving from the presence of vegetation will be shown, together with the main results obtained. Finally design indications for the application of non-invasive reinforcement techniques are presented.

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