

Title: Landslide in terraced cultural landscape of the Mediterranean area: influence of agricultural practices and dry-stone walls' efficiency on landslide hazard.

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Research program

Due to the ongoing climate change, Mediterranean regions are experiencing a rise in summer drought and a growing frequency of severe rainfall events. While drought has direct consequences on agricultural systems and food production, severe rainfalls induce landslides and floods, threatening human lives, exacerbating soil erosion and damaging landscapes. Areas with specific environmental peculiarities can be particularly vulnerable to such climate-driven processes, making communities overexposed to their effects. Examples of particularly vulnerable areas are those characterized by terraced landscape, like the Italian UNESCO cultural landscape sites of the Cinque Terre and the Amalfi Coast. In such areas, dry-stone walls are used to adapt steep slopes to human needs, extending available areas for agricultural food production (i.e., cultivation and livestock) and promoting landscape safety fruition (i.e., instability prevention). Although their original function is to host new areas for cultivation, dry-stone walls have also a hydrological function, as they stem the natural tendency to fail of soils and control their erosion. Recent studies have indicated that such function is consistently related to their state of maintenance that, due to the ongoing abandonment of rural areas, is being compromised in many geographic contexts. Such aspect, along with an increasing occurrence of extreme hydro-meteorological events, accelerates the dry-stone walls decay and collapse, as well as the instability of single terraces and consequently of the whole terraced slope. On this basis, although a number of studies have contributed to the understanding of factors controlling landslide initiation in such kind of environment, it is still not fully clear how agricultural practices act in controlling slope evolution. In addition, although state of conservation of dry-stone walls seems to control landslide initiation, the process behind such cause-effect relation is still not fully documented, especially in a quantitative manner (i.e. through monitoring data). In this perspective, further contributions are needed for a better understanding of conditions for landslide initiation in terraced landscapes of the Mediterranean area, paying particular attention to: i) the potential influence on slope stability of differentiated agricultural practices and ii) the modification of both hydrological slope dynamics and the mechanical equilibrium of the complex dry-stone wall-soil due to dry-stone walls degradation.

Proposal for a PhD position

The Department of Earth, Environmental and Resources Sciences at the University of Naples Federico II invites applications for one PhD position in the context of the research program described above. The proposed PhD research project will be aimed at contributing to a better understanding of the i) influence of specific agricultural practices in predisposing slopes to landslide initiations and ii) influence of hydrological and mechanical equilibrium change due to dry-stone wall degradation on landslide development in terraced landscape. In addition, specific methods will be tested/developed for hazard assessment and prospective scenario generation, accounting for quantitative data acquired by field monitoring. In this perspective, the project will use data from i) literature analysis, ii) field monitoring and surveys, iii) remote sensing analysis, iv) laboratory testing and v) numerical modeling.

The project will be consistently organized in multiple subsequent phases:

i) literature analysis (6 months), ii) sites identification and monitoring instrumentations' installation (6 months), iii) soil sampling and geotechnical analysis (6 months), iv) cause-effect relation deciphering by monitoring and field data analysis (6 months); v) landslide hazard modeling and prospective scenarios identification (6 months), vi) PhD thesis preparation (6 months).

Study areas will be preferentially identified in the Cinque Terre and Amalfi Coast UNESCO cultural landscape sites.

The candidate expenses for field and other activities related to the PhD project will be covered by the Engineering Geology and Geotechnics Group departmental funds. The candidate is expected to have solid background in physics and a general knowledge of informatics. The candidate is expected to complete a training/research period at a foreign institution.

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