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The role of inter-row grass cover in steep viticulture: understanding soil erosion combining in-field observation and remote sensing

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Steep slope viticulture is a common practice in the Mediterranean basin offering landscapes of considerable environmental and socio-economic value. However, these agricultural systems are very fragile. One of the main problems is soil erosion due to extreme rainfall, both for drop splash and water accumulation. This may cause a progressive reduction in soil fertility and the occurrence of instabilities and land degradation phenomena. To worsen this condition there is the soil compaction by mechanization and the intensification of severe weather events due to climate change (Tarolli and Straffelini, 2020).

Sustainable farming techniques may provide innovative solutions to reduce the risk of soil erosion. A virtuous approach involves the use of herbaceous coverings between the rows of vines, for many reasons. They provide active protection from the kinetic energy of water droplets; reduce the amount of water flowing on the surface positively affecting the infiltration capacity of the soil; improve ecosystem services in the vineyard.

This work aims to evaluate the effectiveness of different types of grass cover in terms of erosion and runoff generation in steep slope viticulture. The research is part of the SOiLUTION SYSTEM project (www.soilutionsystem.com) within the EU Rural Development Programme (Programma di Sviluppo Rurale per il Veneto 2014-2020); it is proposed to identify an integrated system of environmentally and economically sustainable interventions to reduce the risk of erosion and improve soil management in the terraced area of Soave (Veneto region), one of the two Italian GHIAS-FAO site. In particular, we have set up an experimental vineyard, where different managements are being tested, one for each inter-row of equal size and slope. Downstream of each of them, a water/sediment trap has been developed, obtaining continuous measurements of water volume and sediment concentration over two years. In this way, it is possible to compare the measures understanding the propensity of managements to generate runoff and soil erosion.

Specifically, many types of managements have been evaluated. (1) *Continuous tillage*, or a bare soil row; (2) *Reference*, a row where the farm's traditional grass cover is proposed; (3) *Nectariferous*, or a mix of herbaceous species capable of attracting insects and thus increasing biodiversity in the row; (3) *Single tillage*, or a row tilled once a year; (4) *Native*, or a row sown with native species of the place where the vineyard is located.

In combination with in-field experiments, an analysis was carried out on remote sensing data. The evolution of high-tech in topography permits low-cost tools and methodology to create high-resolution Digital Terrain Models (DTMs). For this purpose, we used a RPAS (Remotely Piloted Aircraft Systems) paired with Structure from Motion technique (RPAS-SfM). 3D reconstruction provides detailed knowledge of the terrain features, offering interesting insight to understand the processes that took place in the vineyard. The integrated implementation of in-field measures with remote sensing data opens new opportunities in runoff and soil erosion understanding, providing stakeholders with useful guidelines for sustainable management.

Tarolli, P., & Straffelini, E. (2020). Agriculture in Hilly and Mountainous Landscapes: Threats, Monitoring and Sustainable Management. Geography and Sustainability, 1 (1) (2020), pp. 70-76. https://doi.org/10.1016/j.geosus.2020.03.003