

SOILUTION SYSTEM: innovative solutions for soil erosion risk mitigation and better management of vineyards in hills and mountain landscapes

Paolo Tarolli¹, Eugenio Straffellini¹, Chiara Mattiello², Aldo Lorenzoni²

¹Università degli Studi di Padova, Land, Environment, Agriculture and Forestry, University of Padova, 35020 Legnaro, Italy (paolo.tarolli@unipd.it)

²Consorzio Tutela Vini Soave e Recioto di Soave, 37038 Soave (VR), Italy (consorzio@ilsoave.com)

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Cultivating in high-steep slope hilly and mountainous landscapes, requires a great effort in terms of economic and human resources, especially if the territory is particularly complex from a geomorphological point of view and historically affected by landslides such as the Italian peninsula. This fragility is also combined with two other factors. The first is linked to agricultural mechanization, which causes soil compaction and a consequent alteration of its draining capacity. The second is related to climate change, responsible for an increase of extreme rainfall events characterized by intense, shorter and localized precipitations. The combination of these elements makes agricultural terraced landscapes at risk and prestigious vineyards, particularly important for historical, cultural, landscaping and economic reasons, increasingly sensitive to soil erosion processes. In response to these problems, the project SOILUTION SYSTEM is proposed (www.soilutionsystem.com), aiming to identify an integrated system of environmentally and economically sustainable interventions able to reduce the risk of erosion and improve soil management in the terraced area of Soave (Veneto region), one of the two Italian GIAHS-FAO site. Indeed, in such terraced areas, the hydrogeological risk is high due to the steep-slope where heroic vineyards are cultivated. The project is also focused on multidisciplinary, capable of combining expertise from the academic world, farmers and other stakeholders, in order to promote a sustainable production approach to ensure greater soil resilience, as well as to protect biodiversity.



Landslides & collapses in a hilly terraced vineyard

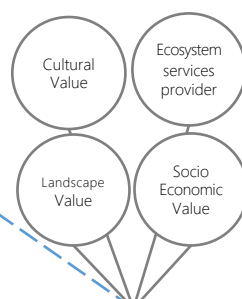
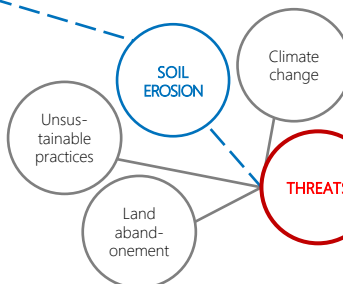
- Hilly/mountainous agriculture is a perfect example of iteration between environment and human needs, together for the creation of unique landscapes that deserve to be protected;
- Such landscapes, in their complexity of forms and elements become the essence of the territory and the place where people, customs, traditions and historicity live together;



GIAHS-FAO rural landscape of Soave, Veneto (Italy)

The cultivated areas of hills and mountains are often characterized by a complex morphology induced over the centuries by humans to support agriculture. They are therefore intrinsically susceptible to hydrogeological risk and soil erosion. To this condition, other factors are added:

- Land abandonment, with consequential lack in maintenance;
- Unsustainable practices. Particularly related to mechanization, increasingly frequent also in high steep viticulture, that causes soil compaction;
- Climate change. In North Italy, increase of rainfall event expected by the end of this century (Gao et al., 2006; Zollo et al., 2016), a trend already observed for the past century (Sofia et al., 2017).

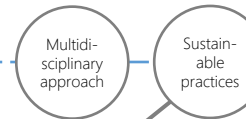


- In steep areas is very common the use of terraces, historically used for levelling the soil and reducing slope. They are also ecosystem services provider (Tarolli et al., 2014).

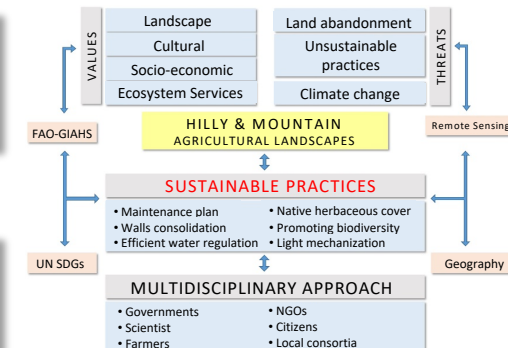


Moments of discussion and knowledge sharing among the stakeholders of the SOILUTION SYSTEM project

- In complex context as high-steep vineyards, the use of sustainable agricultural practices becomes crucial. Suitable solutions must respond to the criterion of multidisciplinary, where stakeholders collaborate by offering their specific knowledge in a shared intention of problem-solving (Tarolli & Straffellini, 2020).



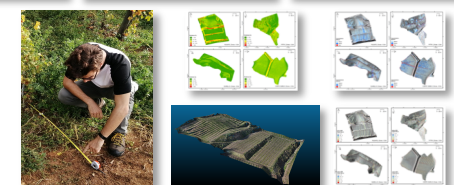
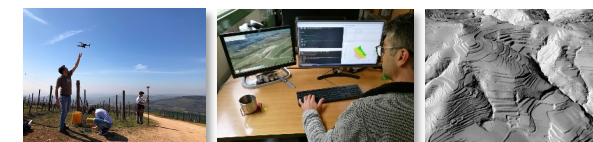
Example organic farm (Coffe Estate)



Framework for monitoring and sustainable management of hilly and mountainous agricultural landscapes (Tarolli & Straffellini, 2020)

Innovative solutions for soil erosion risk mitigation and a better management of vineyards in hills and mountain landscapes

- Test innovative survey techniques using low-cost drone to analyze erosion processes in vineyards;
- Install innovative tools for the monitoring of surface runoff in the field;
- Test new prototypes with low impact on the soil and able to work on steep slopes;
- Provide an innovative technique for the consolidation of dry stone walls;
- Introduction of conservative agriculture using native herbaceous species as grass cover for erosion reduction;
- Evaluate the efficiency of the proposed management in considering biodiversity conservation purposes.



High-resolution topography survey with drones, spatial data analysis, maps creation and in-field results validation within SOILUTION SYSTEM

REFERENCES

- Tarolli, P., & Straffellini, E. (2020). Agriculture in Hilly and Mountainous Landscapes: Threats, Monitoring and Sustainable Management. *Geography and Sustainability*. <https://doi.org/10.1016/j.geosus.2020.03.003>
- Gao, X., Pal, J. S., & Giorgi, F. (2006). Projected changes in mean and extreme precipitation over the Mediterranean region from a high resolution double nested RCM simulation. *Geophysical Research Letters*, 33(3).
 - Sofia, G., Roder, G., Dalla Fontana, G., & Tarolli, P. (2017). Flood dynamics in urbanised landscapes: 100 years of climate and humans' interaction. *Scientific reports*, 7, 40527.
 - Tarolli, P., Preti, F., & Romano, N. (2014). Terraced landscapes: From an old best practice to a potential hazard for soil degradation due to land abandonment. *Anthropocene*, 6, 10-25.
 - Tarolli, P., Calligaris, S., Cazorzi, F., & Dalla Fontana, G. (2013). Recognition of surface flow processes influenced by roads and trails in mountain areas using high-resolution topography. *Europ. J. of Remote Sensing*, 46, 176-197.
 - Zollo, A. L., Rillo, V., Buchignani, E., Montesarchio, M., & Mercogliano, P. (2016). Extreme temperature and precipitation events over Italy: assessment of high-resolution simulations with COSMO-CLM and future scenarios. *International Journal of Climatology*, 36(2), 987-1004.

- The recognized value of traditional rural landscapes now under threats, has led the FAO to launch the Globally Important Agricultural Heritage Systems (GIAHS) programme, with the aim of protecting, preserving and managing traditional agricultural knowledge and the landscapes in which they develop

- Remote sensing (as lidar or UAV-SfM) offer high-resolution mapping of the vineyards, providing DTM with cell < 1m. This is a strategic way for understanding processes on the surface, thanks to the calculation of morphological indicators. Some are the slope, curvature, drainage area and RPI for the identification of areas potentially susceptible to erosion (Tarolli et al., 2013). Crucial, is then the in-field validation of results.