Unmanned Aerial Vehicle (UAV) data for monitoring and maintenance of terraced landscapes – a case study in Lombardy vineyards (Italy)

Anton Pijl, Michele Tosoni, Giulia Roder, Giulia Sofia, and Paolo Tarolli
Department of Land, Environment, Agriculture and Forestry, University of Padova, Legnaro (PD), Italy
(anton.pijl@phd.unipd.it)

Vineyard terraces represent a valuable landscape type, bearing a strong economic and cultural heritage worldwide. However, they are progressively subject to land degradation in the form of superficial erosion and landslides, due to unsuitable design and lack of maintenance affecting hydrologic processes. The Valcamonica valley in Lombardy (Italy) provides a typical example of an ancient thriving wine growing region, which is increasingly showing eroded and overgrown terrace systems resulting from land abandonment and harshening climatic conditions. In order to preserve the cultural, environmental and economic functioning of such landscape, there is an urgent need for low-cost and flexible techniques for terrain analysis and restoration of the drainage functioning. The usage of Unmanned Aerial Vehicle (UAV) for retrieving high-resolution topographic data could play a key role in this regard, as already proven by established applications in other sectors. In this study, UAV data were used applying photogrammetric Structure-from-Motion (SfM) techniques in order to map a vineyard terrace site in Valcamonica that is currently being renovated. For an objective analysis of artificial hydrologic concentration points and preferential pathways present in the study area, the Relative Path Impact Index (RPII; Tarolli et al. 2013) was used. In order to resolve critical zones, a set of drainage design scenarios was composed with varying cross-sections and spatial networks. RPII analysis under these scenarios showed good potential for mitigating uncontrolled run-off, while the optimal drainage design depends on the local situation. The results suggest that UAV topographic data and SfM processing, combined with RPII analysis and drainage system scenarios, provide a good example of low-cost methods for high-resolution analysis and preliminary assessment of new designs. This can improve the efficiency of maintenance and restoration activities in diminished landscapes such as the presented vineyard terraces in Valcamonica.

Reference:
Tarolli, P., Calligaro, S., Cazorzi, F., Dalla Fontana, G. (2013). Recognition of surface flow processes influenced by roads and trails in mountain areas using high-resolution topography, European Journal of Remote Sensing, 46, 176-197, doi:10.5721/EuJRS20134610