**Geomorphometric approach to estimate soil volumes stored in agricultural terrace systems for cultural landscape management**

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**Abstract.**

Agricultural terraces are highly productive and culturally distinctive socioecological systems. They are iconic landscapes recognised by UNESCO through the FAO Globally Important Agricultural Heritage Systems (GIAHS) program. Geomorphometric information can be exploited to study and manage such landforms in a world increasingly affected by anthropogenic activities and climate changes. High-resolution topographic (HRT) techniques allow the mapping and characterisation of geomorphological features with wide-ranging perspectives at multiple scales through high-resolution Digital Terrain Models (DTMs). By using riser bases as well as terrace edges (riser tops) and through the computation of geomorphometric parameters as the minimum curvature, it is possible to obtain environmentally useful information on these agricultural systems such as terrace soil thickness and volumes. This work aims to realize and test an innovative and rapid methodological workflow to estimate the minimum anthropogenic reworked and moved soil of terrace systems in three different terrace sites in central Europe. HRT techniques (i.e., Airborne Laser Scanning) were used to map terrace systems at large scale, while more detailed HRT surveys (i.e., Structure from Motion and Terrestrial Laser Scanning) to extract geomorphological features, from which the original theoretical slope-surface of terrace systems were derived. The exploitation of ground-truthing through field excavation and sampling confirmed the reliability of the methodology used across a range of sites, and in each case confirmed the nature of the reconstructed, theoretical original slope. Differences between actual and theoretical terraces from DTMs and excavation evidences were exploited to estimate the minimum soil volumes and masses used to remould slopes. Moreover, geomorphometric analysis through indices such as sediment connectivity permitted also to quantify the volume of sediment transported downstream. The quantification of terrace volumes can provide extremely useful standards for further multi-disciplinary analysis on the terrace sediments themselves, new benchmarks for soil erosion models, and new perspectives for land and stakeholders in terms of terrace management, preservation and natural hazard risk link to these important cultural landscapes.