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The influence of terracettes on surface hydrology and erosion on vegetated Alpine, mountain and steep-sloping environments

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Alpine and mountain slopes represent important pathways that link high altitude grazing areas to meadows and rangelands at lower elevations. Given the often acute gradient of mountain slopes, they represent a convenient and potentially highly efficient runoff conveyance route that facilitates the downslope transfer of fine-sediment and sediment-bound nutrients and contaminants during erosion events. Above a certain gradient, many slopes host small steps, or 'terracettes'. As these are generally orientated across slope, their genesis is usually attributed to a combination of soil creep, coupled with (and often accentuated by) grazing animals. Motivated by the prevalence of these distinct landform features and lack of information on their role as runoff conveyance routes, this communication reports preliminary results from an investigation to explore the possibility that terracettes may act as preferential flow-paths, with an as yet undocumented ability to greatly influence surface hydrology in mountainous and steeply-sloping environments. A ca. 40 m2 area of vegetated terracettes and section of adjacent thalweg, with gradients ranging from approximately 25-35o, were scanned using an automated Topcon IS03 Total Station at a resolution of 0.1 * 0.1 m. Data were converted to a Digital Elevation Model (DEM) in ArcGIS 10 Geographical Information System (GIS), and queried using Spatial Analyst (Surface Hydrology; Flow Accumulation function) to identify slope-sections that could act as preferential flow-pathways during runoff events. These data were supplemented by information on soil physical properties that included grain size composition, bulk density and porosity, in order to establish spatial variations in soil characteristics associated with the vertical and horizontal terracette features. Combining the digital and in-situ data indicate that the technique is able to identify preferential surface flow-paths. Such information could greatly benefit the future management of grazing and rangelands in Alpine, mountain and steeply sloping environments. With higher resolution data covering larger areas, as well as the possibility of using fallout radionuclide data to establish sediment residence times on depositional areas, it is envisioned that runoff and transportation of fine-sediment and sediment-associated nutrients and contaminants down these flow pathways could be modeled, predicted and their effects mitigated and perhaps eventually reduced.