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Field methods for measuring concentrated flow erosion

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Many studies have stressed the importance of gully erosion in the overall soil loss and sediment yield of agricultural catchments, for instance in recent years (Vandaele and Poesen, 1995; De Santisteban et al., 2006; Wu el al, 2008).
Several techniques have been used for determining gully erosion in field studies. The conventional techniques involved the use of different devices (i.e. ruler, pole, tape, micro-topographic profilers, total station) to calculate rill and gully volumes through the determination of cross sectional areas and length of reaches (Casalí et al, 1999; Hessel and van Asch, 2003). Optical devices (i.e. laser profilemeters) have also been designed for the purpose of rapid and detailed assessment of cross sectional areas in gully networks (Giménez et al., 2009). These conventional 2d methods provide a simple and un-expensive approach for erosion evaluation, but are time consuming to carry out if a good accuracy is required.
On the other hand, remote sensing techniques are being increasingly applied to gully erosion investigation such as aerial photography used for big-scale, long-term, investigations (e.g. Martínez-Casasnovas et al., 2004; Ionita, 2006), airborne and terrestrial LiDAR datasets for gully volume evaluation (James et al., 2007; Evans and Lindsay, 2010) and recently, major advances in 3D photo-reconstruction techniques (Welty et al. 2010, James et al., 2011).
Despite its interest, few studies simultaneously compare the accuracies of the range of conventional and remote sensing techniques used, or define the most suitable method for a particular scale, given and time and cost constraints. That was the reason behind the International Workshop Innovations in the evaluation and measurement of rill and gully erosion, held in Cordoba in May 2011 and from which derive part of the materials presented in this abstract.
The main aim of this work was to compare the accuracy and time requirements of traditional (2D) and recently developed techniques (3D) for measuring erosion from concentrated flow (pole, laser profilemeter, photo-reconstruction and terrestrial LiDAR)
The comparison between two- and three-dimensional methods has showed the superiority of the 3D techniques for obtaining accurate cross sectional data. The results from commonly-used 2D methods can be subject to systematic errors in areal cross section that exceed magnitudes of 10 % on average. In particular, the pole simplified method has showed a clear tendency to understimate areas. Laser profilemeter results show that further research on calibrating optical devices for a variety of soil conditions must be carried out to improve its performance.
For volume estimations, photo-reconstruction results provided an excellent approximation to terrestrial laser data and demonstrate that this new remote sensing technique has a promising application field in soil erosion studies. 2D approaches involved important errors even over short measurement distances. However, as well as accuracy, the cost and time requirements of a technique must be considered.