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# Combination of techniques for mapping structural and functional connectivity of soil erosion processes: a case study in a small watershed

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Sediment connectivity is understood as the interaction of sediment sources, the sinks and the pathways which connect them. During the last decade, the research on connectivity has increased, as it is crucial to understand the relation between the observed sediments at a certain point, and the processes leading them to that location. Thus, the knowledge of the biogeophysical features involved in sediment connectivity in an area of interest is essential to understand its functioning and to design treatments allowing its management, e. g. to reduce soil erosion.
The structural connectivity is given by landscape elements which enable the production, transport and deposition of sediments, whereas the functional connectivity is understood here as variable processes that lead the sediments through a catchment. Therefore, 2 different levels of connectivity have been considered which superpose each other according to the catchments conditions.
We studied the different connectivity features in a catchment almost completely covered by an olive grove. It is located south of Córdoba (Spain), close to the city of Puente Genil. The olive plantation type is of low productivity. The soil management was no tillage for the least 9 years. The farmer allow weed growing in the lanes although he applied herbicide treatment and tractor passes usually in the end of spring.
Firstly, a detailed mapping of geomorphodynamic features was carried out. We identified spatially distributed areas of increased sheet-wash and crusting, but also areas where rill erosion has leadedto a high density of rills and small gullies. Especially within these areas rock outcrops up to several $m^2$ were mapped, showing like this (former) intense erosion processes.
In addition, field measurements with different methodologies were applied on infiltration (single ring infiltrometers, rainfall simulations), soil permeability (Guelph permeameter), interrill erosion (rainfall simulator) and concentrated flow (rill experiment). The measurements were conducted at representative areas identified in advance by precedent mapping.
Preliminary results show that the rills are highly effective in producing sediments, but also in connecting fast the different sources with the catchment's outlet. But also they act as a disconnecting feature to the areas of observation, as they may lead the runoff (and the transported sediments) outside the catchment.
On the other side, the experiments showed that the evidently degraded areas produce only very delayed runoff, and thus also sediments, whereas the areas with stable deep soils show evidences of fast runoff and erosive responses.
The preliminary results of the combination of mapping and experimental techniques demonstrate the different levels at where functional and structural connectivity have to be evaluated. The latter one may be, as a geomorphological feature, the result of former process distributions, whereas the directly observable (functional) connectivity may shift in time due to internal feedbacks, such as the result of soil degradation.