



Reconciling water harvesting and soil erosion control by thoughtful implementation of SWC measures

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Soil and water conservation (SWC) structures are largely present in Southeast Spain. Traditionally, SWC structures such as step terraces and earthen check dams were implemented in agricultural fields. They are usually found in semi-arid traditional rainfed agricultural systems that heavily rely on SWC structures to supplement the sparse rainfall. The on-site SWC measures favor water infiltration and reduce water runoff and soil erosion. In the river system (off site), large concrete/gabion check dams have been constructed since the 70's.

The analysis of orthophotographs and field survey observations indicate a severe decay of on-site SWC structures in the agricultural area. This has been observed for the Cárcavo catchment (Murcia). The density of step terraces and check dams decreased by 25% between 1956 and 2005. Changes in the agricultural area can be summarized as: (i) rapid expansion of rainfed crops in marginal areas and (ii) mechanization of agriculture associated with frequent tillage operations. It became evident that the high density of SWC structures has now become a nuisance in rainfed orchards that are maintained by regular shallow tillage. We constrained the effects of SWC structures on hydrological connectivity by assessing their functioning during a heavy storm (return period 8.2 yrs in 2006). The percentage of cropland draining directly on the river system without interference of a check dam has increased from 9% in 1956 to 31% in 2005 and 40 % after the storm in November 2006.

While there is a strong decrease of traditional SWC structures, several hundred large check dams have been constructed during the last decades in ephemeral streams (Almería). 36 of them have been investigated in selected Sierras. The volume of sediment retained was found low (mean: 1.4 t ha⁻¹ yr⁻¹). 67% of the variability has been explained by topographical, land use and agricultural activities. After a field survey in 2009, a large majority of check dams located in non-agricultural catchments have been found only partially filled with sediments. Extensive reforestation programs, recovery of natural vegetation (dense matorral) and abandonment of agricultural fields in the Sierras led to a strong reduction of the sediment transport towards the river system. Although the effect of the check dams on the transport of sediment has not been important, the check dams have played a major role in flood control in the area.

Our data indicate that thoughtful design of SWC schemes is necessary to reconcile water harvesting, erosion mitigation and flood control. Currently, the erosion hotspots are clearly localized in the agricultural fields, and not in the marginal lands in the Sierras. The combination of on-site and off-site SWC measures in the agricultural areas is highly efficient to reduce fluxes of sediment and surface water.