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The fuzzy effect of soil conservation practices on runoff and sediment yield from agricultural lands at the catchment scale

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Intensive soil degradation of agricultural lands during the past decades led local authorities in the Harod Catchment, northern Israel, to implement soil and water conservation practices. Herein, for the first time in Israel, we quantified the impact of these practices on water discharge, runoff/rainfall, and sediment yields at the catchment scale. We monitored two neighboring tributaries of the Harod River: Shkedim and Shunem. Both are dominated by intensive agriculture, are similar with respect to soils and rain patterns, but differ in terms of tillage and soil conservation practices - implemented in abundance in the Shkedim catchment. Inner-catchment processes were studied at the plot scale using a structure for motion photogrammetry, utilizing an unmanned aerial vehicle. At the catchment scale, we used airborne LIDAR to provide a better understanding of the extent to which different geomorphometric characteristics might influence flood discharge, suspended sediment concentration, and yield. We monitored the impact of temporal changes in vegetation cover with remote sensing. Intense storms occurring in early winter when the soil was bare and freshly tilled generated much runoff and sediment. During three field seasons, measured mean annual sediment yields were 820 and 2,000 t km⁻² y⁻¹ for Shkedim and Shunem, respectively. The benefits of soil conservation practices applied in the Shkedim catchment are manifested by lower runoff yields and peak discharges. Conservation practices together with milder topography were identified to limit flow continuity and to promote sinks, while in the Shunem, tillage parallel to contour lines induced higher hydro-geomorphic connectivity. Still, Shkedim soil loss is high due to cultivation of riparian zones, lack of maintenance of engineered structures, and a larger area of bare soil during winter due to rotational cropping. These blur the efficiency of soil conservation practices at the catchment scale.