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Effectiveness and sustainability of large scale soil and water conservation interventions in the sub-humid Ethiopian highlands; Evidence from Debre Mawi watershed

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Abstract: Using measured runoff and sediment monitoring, the effectiveness of large scale soil and water conservation (SWC) implementations are analyzed from a five year (2010-2014) study, in the 95 ha Debre Mawi watershed and four nested sub-watersheds. Under the large scale government led SWC program, terraces with infiltration furrows were installed in 2012. The results indicate that runoff, sediment loads and sediment yields decreased significantly after the implementation of SWC practices. Sediment loads were reduced mainly because of the reduced runoff. Though sediment concentration decreased in the sub-watersheds, it decreased only marginally for the main watershed because of the entrainment of loose soil from the collapse of unstable banks of gullies. Infiltration furrows were effective in collecting runoff and suspended sediment (from rills) on the hillsides where Nitisols dominate (very deep, well-drained, permeable soils where rain water could infiltrate easily). But, on the saturated flat bottom lands and fields dominated by vertisols (that form wide-deep cracks during the dry season and swell during the rainy season), infiltration was restricted and conservation practices became conduits for carrying excess rainfall. Our continuous observations and photo monitoring of bunds on Nitisols and saturated bottomlands indicate that installing soil bunds on these areas caused the collapse of soil bunds in to the furrows. The soil from the collapsed bund is then easily washed away in a concentrated runoff and further initiated gullies in the Debre Mawi watershed. Large scale soil and water conservation interventions have short term effectiveness of reducing runoff and sediment loads. However, long term benefits can only be sustained with continuous maintenance of uphill infiltration furrows, as most ditches are filled up with sediments within two-three years. In addition, large scale soil and water conservation interventions should give priority to gully treatments, should consider local soil types and saturation dynamics to install bunds in the sub-humid Ethiopian highlands.

Keywords: Runoff; Soil loss; Gully erosion; Soil and water conservation; Sub-humid climate; Ethiopian Highlands