

Impacts of Stone Bunds on Soil Loss and Surface Runoff: A Case Study from Gumara Maksegnit Watershed, Northern Ethiopia

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Ethiopia is highly affected by land degradation and one of the key problems is soil erosion. It is mainly caused by the rapid population increase, deforestation, low vegetation cover and unbalanced livestock and crop production. As about 85% of the Ethiopian population is dependent upon agricultural production for their livelihood and source of food, it is essential to prevent or reduce further degradation.

In the Northern Highlands of Ethiopia stone bunds are widely used as a soil and water conservation (SWC) measure. Stone bunds are small embankments of stones along the contour line, and influence the translation processes of surface runoff.

In June 2015 a field experiment in the Gumara Maksegnit Watershed was carried out to investigate the impact of stone bunds on surface runoff and soil erosion using 4 m wide by 20 m long bounded plots monitoring surface runoff and sediment yield with and without stone bunds (Figure 1). The average slope of the plots was about 8%. The novel design of the plots (with stone bunds) allowed the monitoring of runoff along the contour (stone bund) as well as the bund overflow (Klik et al., 2015). The sideflow and overflow were separately collected and routed via a multi-slot-divider to different storage ponds (Figure 2). Representative samples were taken in weekly intervals for sediment concentration assessment. Precipitation was measured in daily intervals next to the study site.



Figure 1. Layout of the erosion plots.

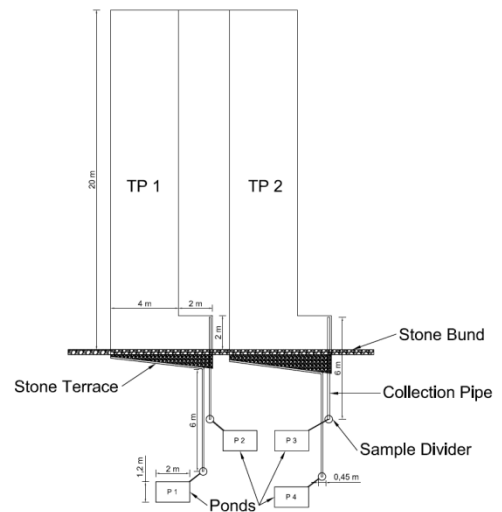


Figure 2. Diagram of the plots with stone bunds.

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Total rainfall for the observation period in 2015 (July to September) was 601 mm. During the same time period plots without stone bunds generated approximately 15 t ha⁻¹ of soil loss, whereas plots with stone bunds produced approximately 5 t ha⁻¹. However, only 18% of the sediment from the treated plots was transported over the stone bunds, the rest (82%) either deposited in front of the bund or moved along and was spilled as side flow. Throughout the investigation period 94 mm of surface runoff were produced. This corresponds to a runoff coefficient of 0.16, and 32% of this runoff overtopped the stone bunds, the remaining part ran off along the contour and partially infiltrated there.

Overall, stone bunds can be seen as effective soil conservation measures under the conditions of the Ethiopian Highlands.

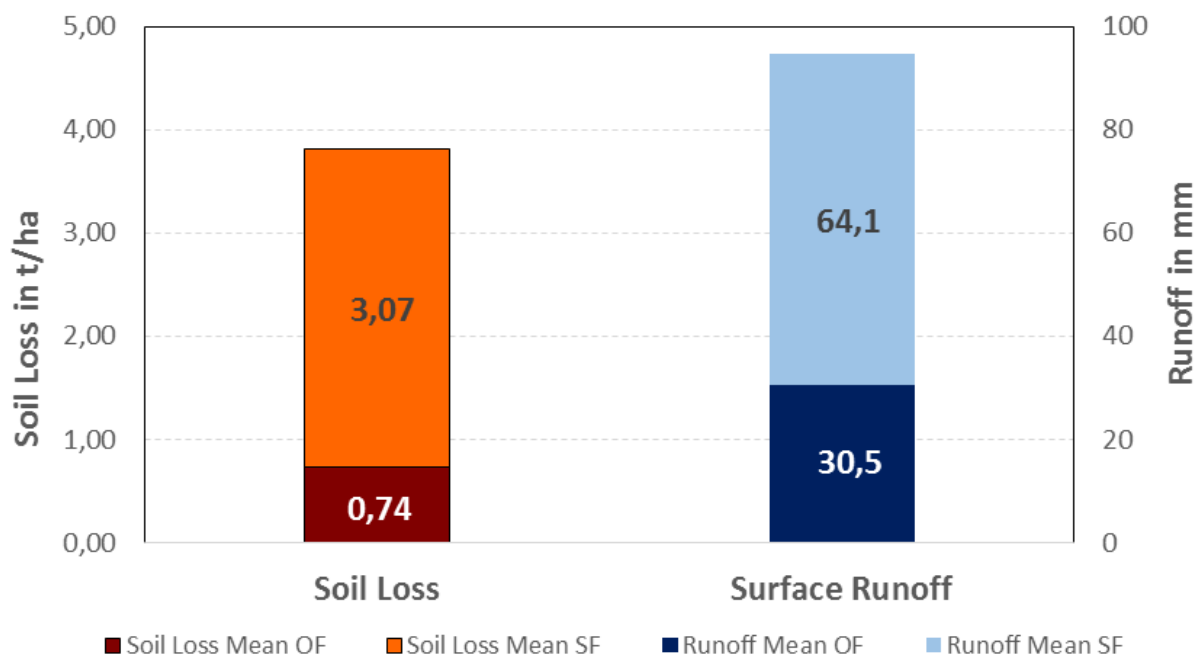


Figure 3. Surface runoff and soil loss throughout the investigation period divided into overflow over the stone bund (OF) and side flow (SF).

References

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