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Investigation of the Impact of Stone Bunds on Erosion and Deposition Processes combining Conventional and Tracer Methodology in the Gumara Maksegnit Watershed, Northern Highlands of Ethiopia

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Ethiopia is one of the poorest countries of the word, with over 85 % of total population dependent from agriculture. Massive deforestation in the past and missing soil and water conservation (SWC) measures cause severe soil erosion problems in the northern highlands of Ethiopia. Different SWC methods are supposed to prevent ongoing land degradation, which is triggered by rainfall driven soil erosion in the Ethiopian agricultural lands. Common technologies for soil and water conservation are stone bunds, which reduce surface runoff and sediment loss.

In June 2015 two field experiments were set up in the Gumara-Maksegnit watershed in Northern Ethiopia. The objective of this study was to evaluate the impact of graded stone bunds on surface runoff and sediment yield by using conventional and tracing approaches.

Three consecutive runoff plots of 20 x 4 m length and width, respectively were established along the maximum slope direction. Each one was separated to the downstream one by a stone bund. The experimental setup allowed the measurement of surface runoff along each stone bund and the measurement of overflow over the lowest stone bund. To assess the pathway and the spatial distribution of the sediments a different tracer (Magnetite, Hematite and Goethite) was applied in a 40 cm wide strip at the top of each one of the plots.

The second tracer experiment was conducted on the same hillslope. It consisted of a 20 m long hillslope without borders in which a 4 m long and 40 cm wide Magnetite strip was placed at the top. At the end of August 2015 soil samples of 0-2 cm depth were taken in a 1.5 x 1.5 m grid within the area of the hillslope. Soil samples parallel to the stone bund (above and underneath) were taken along 16 m to assess the soil movement/deposition.

Tracer concentrations of soil and sediment samples in both trials were analysed. Runoff and sediment were collected in weekly intervals from July to September.

Runoff and erosion data, as well as the evaluation of the tracer experiments are presented. Preliminary results give an insight of the spatial pattern of sediment flow paths and accumulation areas to understand sediment dynamics within these systems. Gained knowledge on erosion processes provides information about the efficiency of the stone bunds as a SWC measure, very useful to optimize their design which affect indirectly to soil fertility and therefore to crop yield.