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Using magnetite tracer to evaluate a novel plot experimental design for the assessment of soil and water conservation impacts of stone bunds in Ethiopia

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In the Ethiopian highlands the removal of native forests and rangelands for crop cultivation dramatically increased the vulnerability of the soils for rainfall driven soil erosion. Overlaid with intensive rainfalls occurring during the rainy season the steep and unprotected areas of the highlands became seriously endangered regarding land degradation. In the Gumara-Maksegnit watershed near Gonder (Amhara region) a plot study was conducted to assess soil erosion processes on agricultural fields affected by stone bund soil and water conservation (SWC) interventions. Novel plot experimental design was set up to monitor surface runoff and sediment yield on treated and untreated hill slopes during rainy season 2013. The experiment indicated about sixty percent less surface runoff and about forty percent less sediment yield from the SWC plot compared to untreated plot conditions. However, the efficiency of the protection measure strongly related to the time elapsed since the last stone bund maintenance. To evaluate potential plot experimental effects on the observed erosion pattern a confined magnetite tracer segment was incorporated within the SWC plot. After a few rainfall events, approximately one meter grid soil sampling was performed to gain a deeper insight into the spatial distribution of the translocate tracer. Spatial interpolation techniques conclude that the tracer and consequently the eroded sediments deposited in front of the SWC structure. The derived tracer map also indicates channelized sediment movement along the graded stone bund. The magnetite tracer study allowed various back draws on the spatial soil erosion pattern and the plot experimental interferences at the intersected hill slope level - providing suggestions for further tracer experimental campaigns for advanced SWC evaluation in Ethiopia.