

## **Effectiveness of soil and water conservation measures in two contrasting environments of the Ethiopian highlands**

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### **Abstract**

Excessive runoff resulting from severe land degradation is posing serious on-site and off-site problems in the Ethiopian highlands. Many soil and water conservation (SWC) measures have been implemented since the 1980s and these efforts were mainly concentrated in the north and northeast part of Ethiopia where problems were felt first. However since recent years, the SWC initiatives have been expanded to other parts of Ethiopia such as the northwestern parts where there is relatively better rainfall and agricultural land productivity but with high land degradation activity.

Previous studies concerning the effects of SWC were mainly focused on northern Ethiopia and little has been studied in high rainfall region of Ethiopia such as in the northwest. Therefore this study evaluates and compares the effectiveness of SWC measures in these two contrasting watershed environments: on Guder (dry subhumid) in the northwest and May Leba (semiarid) in the north parts of Ethiopia.

It involved one season monitoring of daily runoff from bounded runoff plots ( $n = 39$ ; area = 150-1000 m<sup>2</sup>) treated with or without SWC measures, recording of daily rainfall and runoff, monitoring of seasonal changes in land use practices, vegetation cover and soil characteristics. The plots were replicated over representative land use types (cultivated and vegetated surfaces) and slope ranges (medium and steep). The data were analyzed and interpreted using the runoff coefficient (RC) approach which is computed as percent ratio between runoff and rainfall.

Seasonal runoff from control plots in Guder watershed ranged between 134-451 mm whereas in May Leba between 75 -250 mm. The overall variation in RC between land uses for control plots

in Guder was found to vary between 17-42% and that of May Leba was 10-50%, implying the significant variability of runoff both within and across the two studied environments.

Runoff coefficient (RC) from croplands treated with soil bunds combined with or without biological measures in Guder varied between 14% and 23%, whereas the values from control plots were in the range 18-42%. Vegetated land use types (grassland, *Acacia decurrens*, eucalyptus plantation and degraded bush land), treated with trench yielded RC values in the range between 12-16% and the values from control plots were in the range 18-42%. In May Leba, RC was found to vary from 6-35% for rangelands (degraded grassland) treated with trench while that of the control plots was 37-50%. The RC for cropland treated with stone bunds combined with or without trench varied from 4-12% and that of the control plots was 10-15%. The overall effectiveness of SWC in reducing runoff ranged between 3-25% and 4-31% for Guder and May Leba watersheds respectively.

Generally, runoff responses within and between land use types in both environments are highly variable over space. So is the effectiveness of the SWC measures. This high variation could be attributed to a combination of several factors such as variation in soils properties (bulk density), land management practices (tillage), surface cover (vegetation and stoniness) and rainfall characteristics (intensity). As more data become available a more detailed analysis is required to understand better the mechanisms of runoff responses in such heterogeneous environments.

**Keywords:** Semiarid; Dry subhumid; Runoff coefficient; Guder; May Leba; Ethiopia