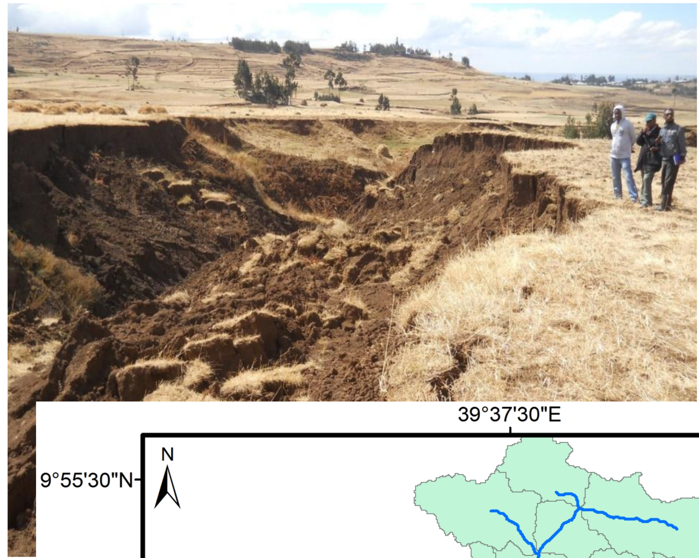
Impacts of SWC interventions and land use on discharge and sediment yield in the cool sub-moist Highlands of Ethiopia

Tesfaye Yaekob, Lulseged Tamene, Solomon Gebreyohanes, Solomon Seyoum, Kindu Mekonnen, Zenebe Adimassu, Kifle Woldearegay



Introduction

Soil erosion is a serious problem for agricultural production in Ethiopia. To tackle it, communities are engaged in various soil and water conservation (SWC) and water harvesting practices. Our study aimed to evaluate the impacts of activities to manage the watershed – specifically by measuring discharge and sediment yield at plot and watershed levels.

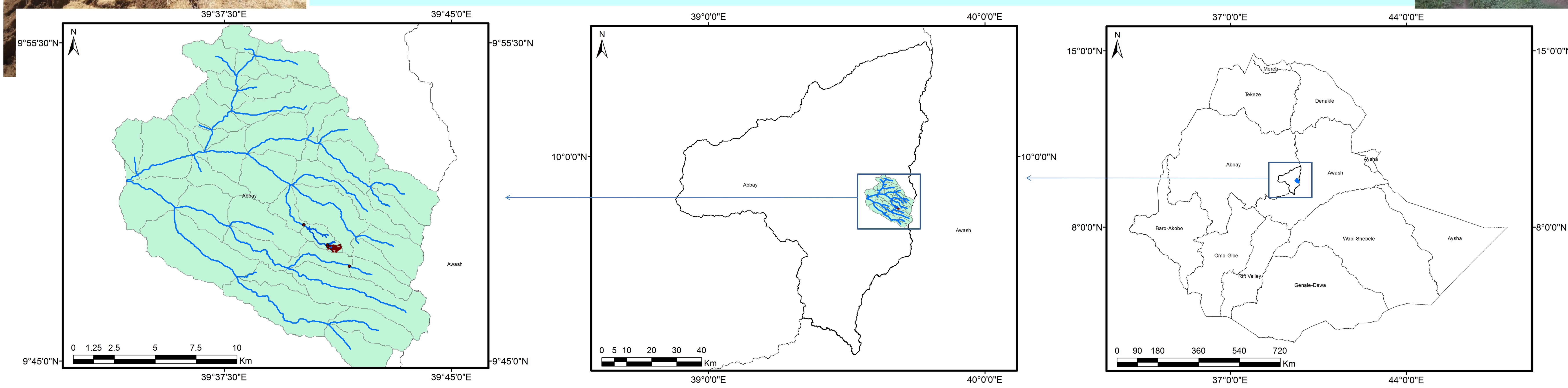


Figure 1. Location of the study area in the Basona Woreda of Gudoberet and Adisghe Kebeles, north Shewa, central Ethiopia

Methodology

In 2014, we set up runoff plots to evaluate the effect of different land uses and SWC practices on runoff and soil loss.

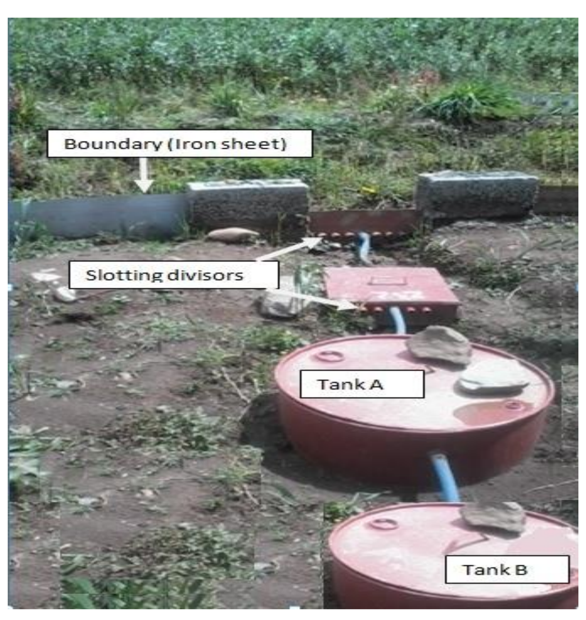


Figure 2. Setup of the experimental plot at the Gudo Beret Kebele, central Ethiopia

We evaluated three major land use/cover types (cultivated, grazing and eucalyptus woodlots) and different SWC practices (soil bunds, trenches, grass strips). Hydrologically bounded runoff plots of 22m length and 4m width were installed for each treatment (Figure 2). Tankers were fitted mid-slope to receive runoff and eroded soil collected from each plot. We measured the depth of water in both tanks every day in the morning to determine the volume of runoff. We took 500ml suspended sediment samples, oven dried at 105 ^{0}C for 24 hours, to determine sediment concentration.

To measure runoff and sediment yield (Fig. 3) hydrological stations were installed at two sub-watersheds: one treated with SWC measures and the other without.

Both watersheds have similar characteristics and land use/cover types. Each measurement consisted of flow depth, determining instantaneous runoff discharge (Q, $m^3 s^{-1}$) and sampling suspended sediments.

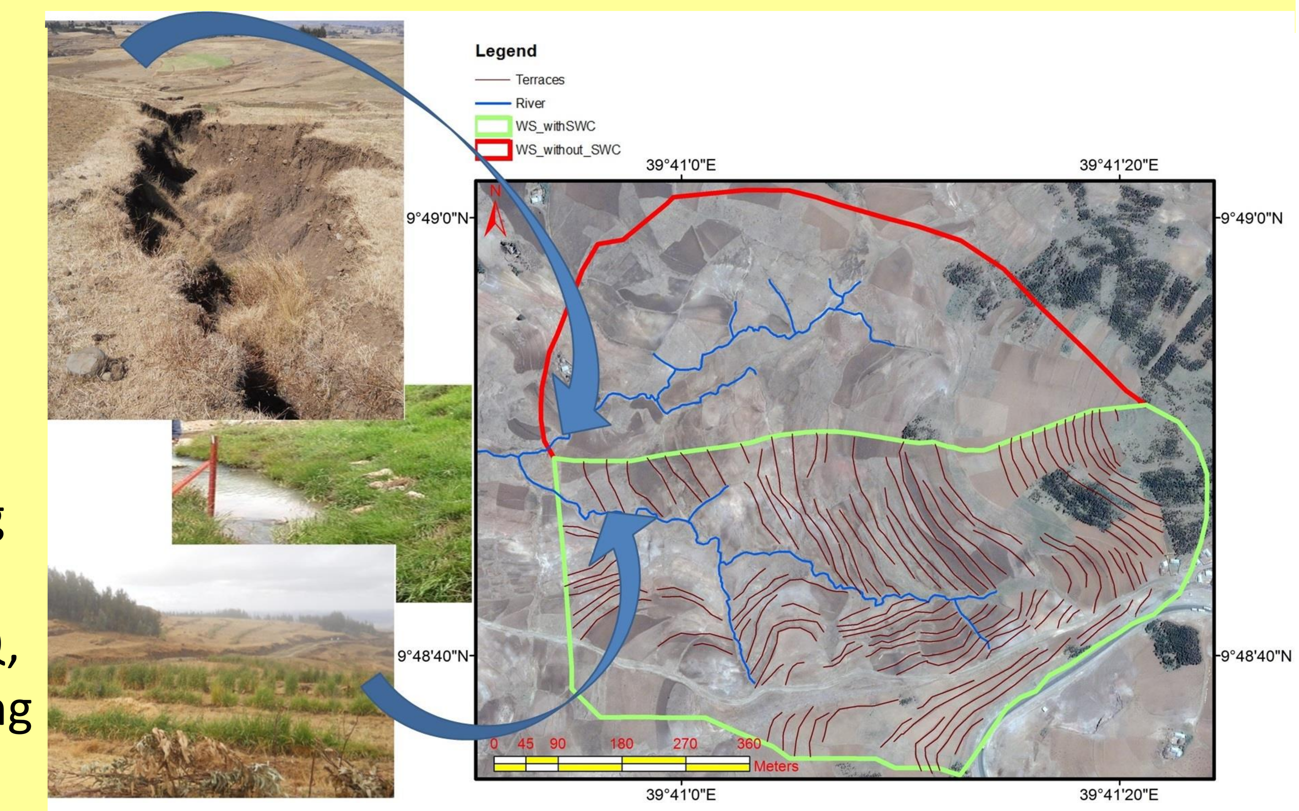


Figure 3. Two small watersheds with hydrological stations

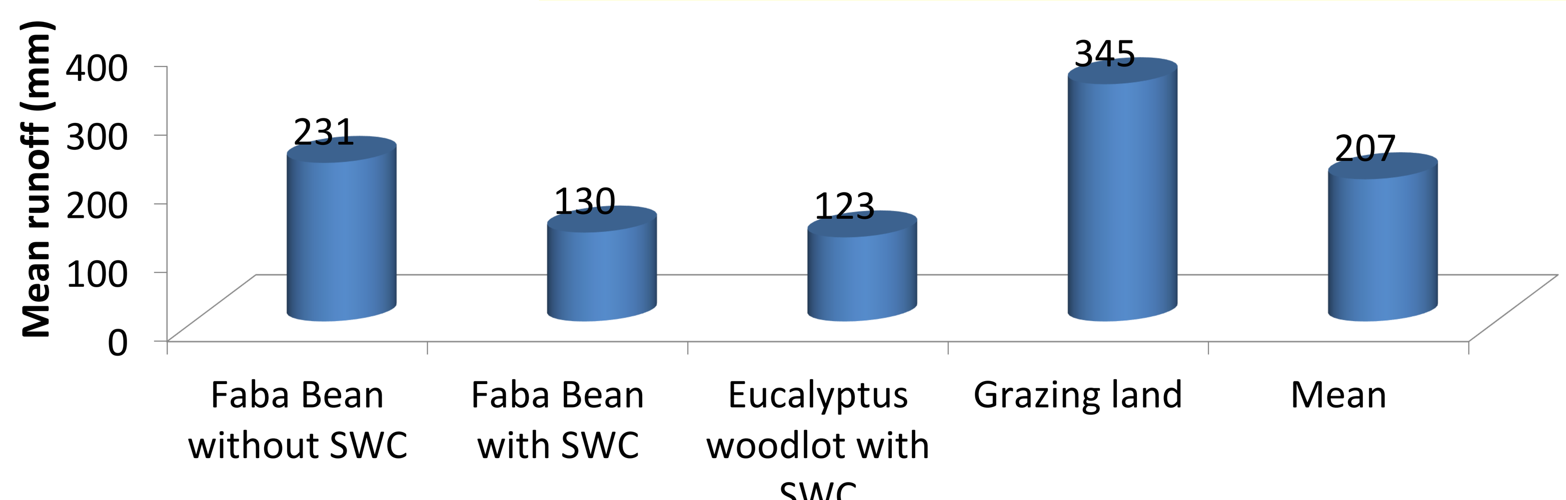


Figure 4. Runoff estimated for different land use and management at Gudoberet Kebele, central Ethiopia

From 15 runoff events, the highest average runoff (345 mm) was observed on grazing land (Figure 4). Terrace with trench on cropland has reduced runoff and soil loss by 44 % and 52%, respectively (Figure 4 & 5).

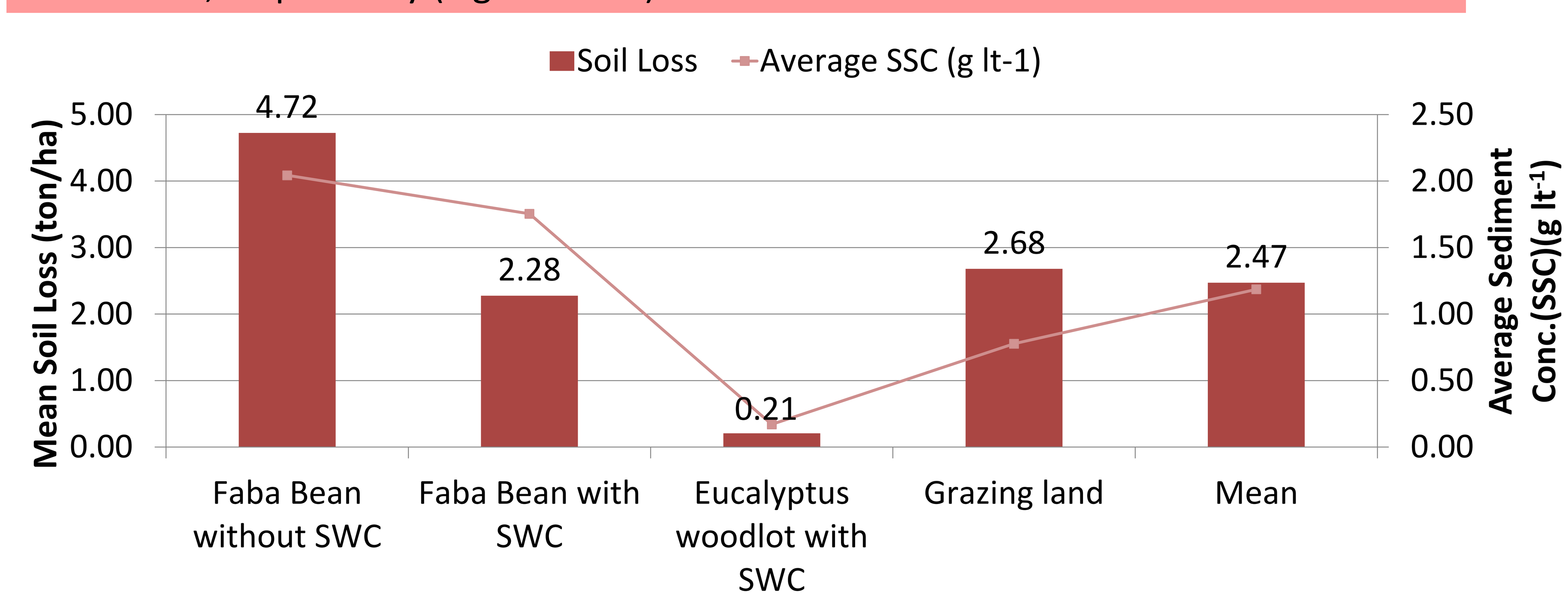


Figure 5. Effects of land use and management on soil loss at Gudoberet Kebele, central Ethiopia

Results

Our results from three-month's discharge show that the total suspended sediment yield of the unmanaged sub-watershed was about three-fold compared with the managed one. Sediment yield also reduced by about 70 % due to implementation of SWC and water harvesting measures at the watershed scale.

Table 1. Sediment and discharge summary data

Parameters	Watersheds	
	With SWC	Without SWC
Area (Ha)	33.83	22.08
Rainfall (mm)	737.60	737.60
Discharge (m^3/watershed)	134682.40	105933.00
Discharge (m^3/ha)	3981.15	4797.69
Sediment Yield (ton/watershed)	31.03	102.05
Sediment Yield (ton/ha)	0.92	4.62

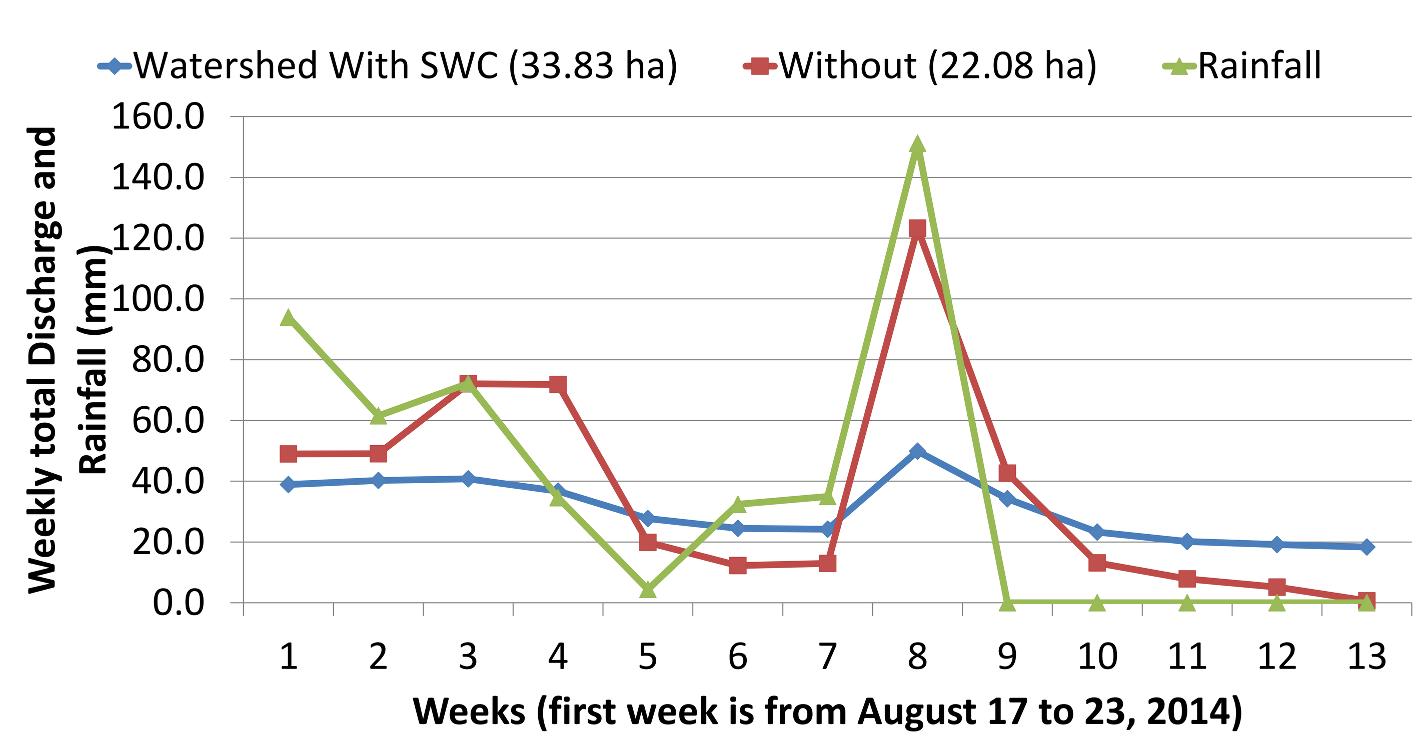


Figure 6. Water yield of the study sub-watersheds

Conclusion

Our results show that the soil and water conservation mobilization program achieved the intended target to reduce soil erosion and increase retention capacity of the watersheds. Integrating physical measures with biological options and supplementing these with water harvesting structures can promote their adoption. Further analysis is being done to estimate the impacts of the various interventions of soil nutrient loss and crop productivity.

Acknowledgement

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