15. Using the sediment of Mayleba reservoir for land reclamation

Gebreyohannes Girmay[1,2], Jan Nyssen[3], Jean Poesen[2], Roel Merckx[2], Hans Bauer[1,2], Mitiku Haile[1], Jozef Deckers[2]

(after Gebreyohannes et al., 2011)

[1] Department of Land Resources Management and Environmental Protection, Mekelle University, Ethiopia
[2] Department of Earth and Environmental Sciences, K.U.Leuven, Belgium
[3]Department of Geography, Ghent University, Belgium

Accelerated soil erosion leads to siltation of reservoirs in Northern Ethiopia and decline of their life span (Nigussie et al., 2006). As in northern Ethiopia the reservoirs are dry at the end of the dry season, we evaluated the potential of recycling these sediments for land reclamation. This land reclamation method, that seems obvious, is however poorly described in literature (Fonseca et al., 1998). The Mayleba catchment (Van de Wauw et al., 2008) was chosen for this study.

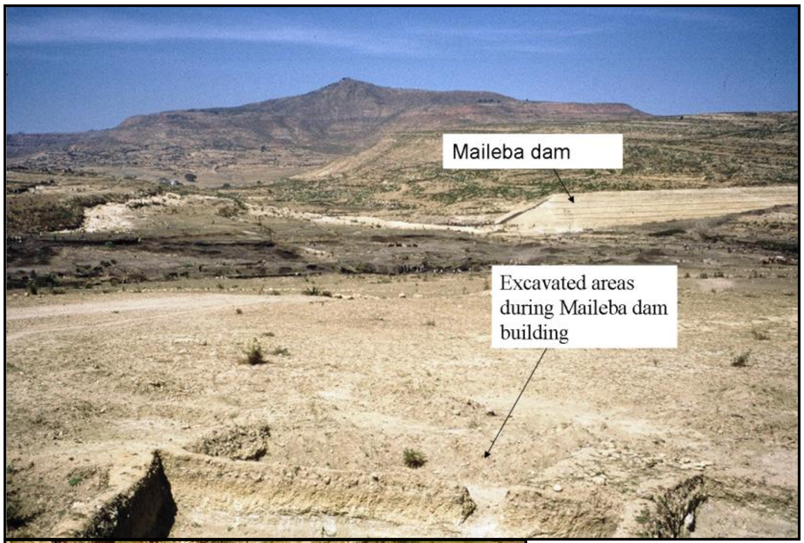

Figure 1. Maileba dam under construction in 1998, looking downstream. The core of the dam consists of compacted black clay soil excavated from the valley bottom, whereas the bulk fill material is composed of weathered marl excavated on the valley sides, including the area where the experiment was conducted in 2009 (at left on the photograph).

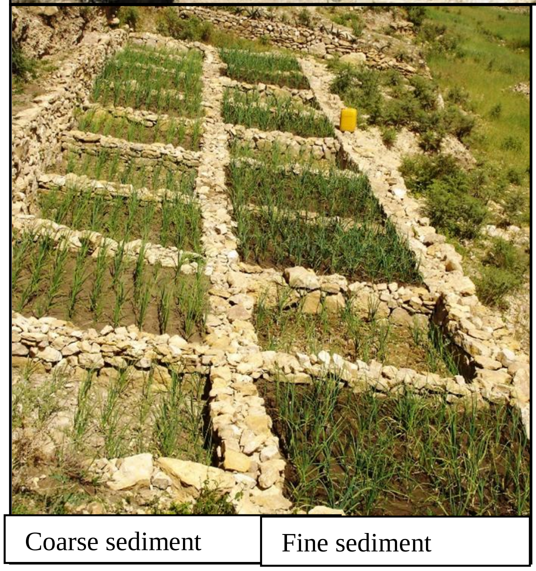

Figure 2. Plot lay out and performance of garlic (Allium sativum) (August, 2009). The planting date was July 4, 2009. One plot size is 2 m x 2 m. Coarse sediment (left line of plots) represents application of silty clay loam sediment and fine sediment represents application of silty clay sediment as treatments of the sub-plots, except for the control plots without sediment applied, such as the lower left plot.

Bare lands, from where fill material had been excavated (Fig. 1), were reclaimed with 15 cm and with 30 cm thick layers of sediments, and planted with a local garlic (*Allium sativum*) cultivar

(Fig. 2). Total biomass and bulb yield were 3 times higher on the reclaimed plots than on the control plots (11.7 t/ha versus 3.6 t/ha for the biomass; 7.7 t/ha versus 2.0 t/ha for the yield); however, sediment thicknesses did not make any significant difference in crop productivity (Fig. 3). When transport and labour cost are taken into account, plots with 15 cm of sediments had in the first cropping season already a benefit-cost ratio of 3, while those with 30 cm had a benefit-cost ratio of 0.9. This study shows that using reservoir sediments is an economically viable strategy for land reclamation as it may improve income with as much as 76%. In view of the magnitude of reservoir sedimentation in semi-arid areas throughout Tigray, the outcome of this research shows the way to turn this major problem into an opportunity which will contribute to poverty alleviation.

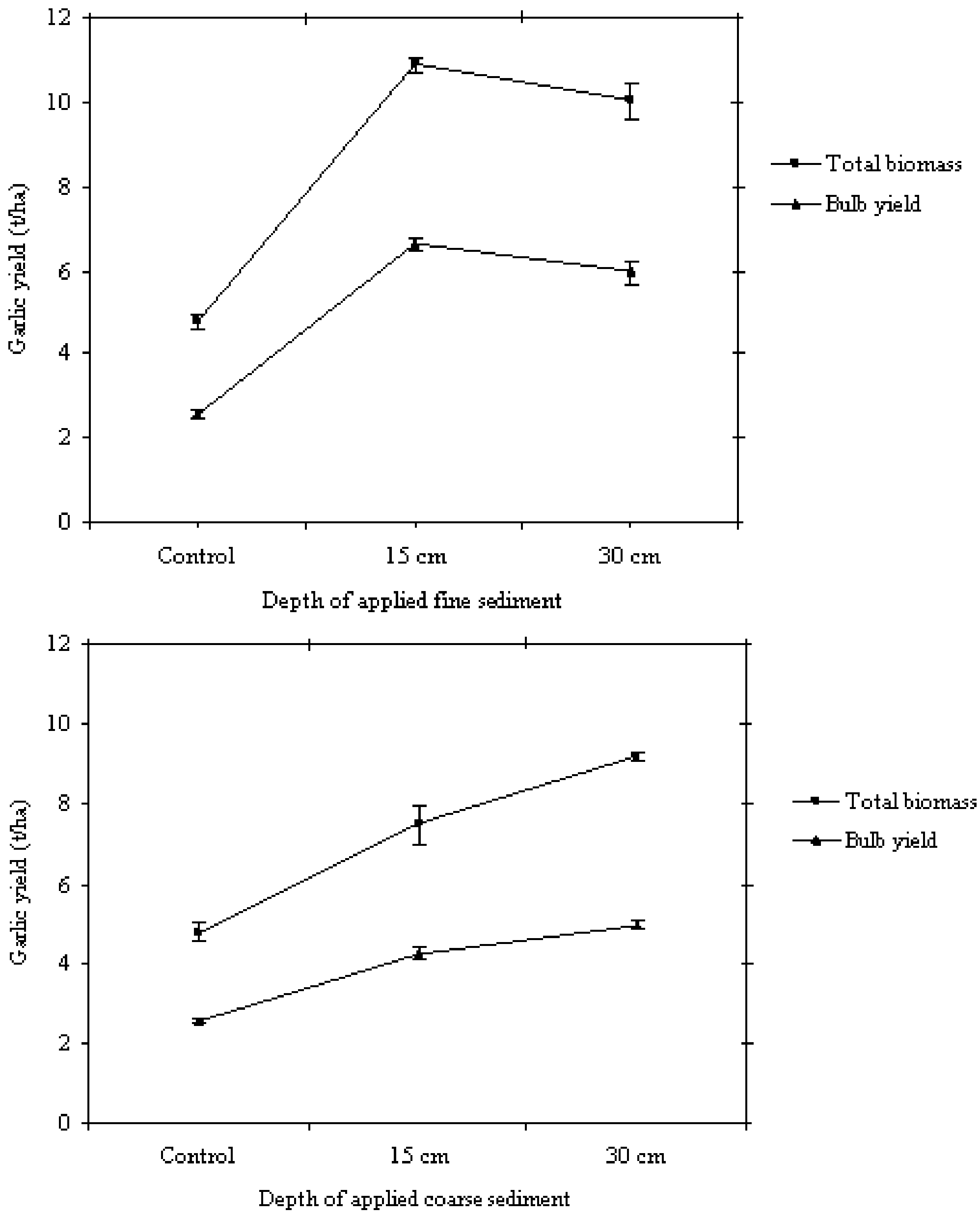

Figure 3. Effects of the application of different depths of sediment on garlic yield (t/ha) (n = 6). Top: fine sediment; bottom: coarse sediment.

References

Gebreyohannes Girmay, Nyssen, J., Poesen, J., Merckx, R., Bauer, H., Mitiku Haile, Deckers, J., 2011. Land reclamation using reservoir sediments in Tigray, northern Ethiopia. Soil Use and Management, submitted.

Fonseca, R., F.J.A.S. Barriga and W.S. Fyfe, 1998. Reversing desertification by using dam reservoir sediments as agriculture soils. Episodes. 21, 4; 218-224.

Nigussie Haregeweyn, Poesen, J., De Wit, J., Mitiku Haile, Govers, G., Deckers, J. 2006. Reservoirs in Tigray: characteristics and sediment deposition problems. Land Degradation & Development 17, 211-230.

Van de Wauw, J., Baert, G., Moeyersons, J., Nyssen, J., Nurhussein Taha, Amanuel Zenebe, Mintesinot Behailu, Poesen, J., Deckers, J., 2008. Soil-landscape relationships in the basalt dominated uplands of Tigray, Ethiopia. Catena, 75: 117-127.