Participatory Community-based Gully Rehabilitation on the Ethiopian Highlands: The Case of Birr Watershed

Soil erosion by water is a major problem in Ethiopia. The Ethiopian highlands have undergone substantial land use/cover changes that have resulted in changes in the hydrological processes of the landscape of the highlands (Tesemma *et al.,* 2010). More surface and subsurface water flow is produced, which, in turn, leads to the creation of gullies that carry off this excess water.

Gullies are a major threat to food security by swallowing fertile land, endangering environmental sustainability, and diminishing prospects for water resource development on the Ethiopian highlands (Teshome *et al.,* 2013; Tebebu *et al.,* 2010). In addition to its direct biophysical effects, gully erosion negatively affects the community's social and economic activities (Poessen *et al.,* 2003; Frankl *et al.,* 2011). The soil and water conservation practices so far on the Ethiopian highlands have usually targeted the steep slope areas through a top-down approach (Bewket and Sterk, 2002), not giving enough attention to gullies. For example, the new soil and water conservation campaign initiated by the

government in 2012 focused only on putting bunds on the hill slopes and cultivated lands. However, gully erosion removed soil with an equivalent depth of 4 cm per year over these highlands (Tilahun *et al.*, 2013; Tebebu *et al.,* 2010).

The Birr watershed on the Ethiopian highland is one of the hot spot areas affected by gullies, swallowing agricultural and cultivated land (Ayele *et al.,* 2014). The bottom part of a particular sub-watershed (called Ene-Chilala) in the upper Birr watershed is dominated by active gullies on grazing and cultivated land. However, the communities have been mobilized through a top-down approach to dig deep infiltration furrows in the uplands since 2012. The overall objective of this case story is, therefore, to develop a participatory gully rehabilitation approach incorporating religious leaders and local elders in the Ethiopian highlands.

This paper describes the effect of a participatory gully rehabilitation work in Ene Chilala sub-watershed of the Birr area. The study was carried out under the umbrella of the Partnership for Enhanced Engagement in Research science program funded by the United States Agency for International Development.

Intervention approach

To start the community mobilization process, the researcher first conferred with religious leaders and local elders, and then with local village farmers about the possibility of rehabilitating the gully.

Biological and physical conservation measures the farmers undertook were check dams from wood and stones placed within the gully. They, then, planted local grass species and 214 *Sesbania sesban* in a mixed pattern. They also set 50 Ethiopian birr per animal as a fine for anyone who allowed his cattle into the enclosed gully.

The amount of sediment deposited in and around the gully was measured using 15 erosion pins installed in the gully and along the right and left sides of the shallow subgullies. Cross-sectional measurements were taken before and after the rainy season on the studied gully and on two other control gullies located near the rehabilitation gully. The measurements were taken on 23 April 2013 and on 3 September 2013.

Results

The conservation practice was able to reduce soil loss with the harvest of soil water in the gully. The measurements of cross-sectional change revealed that the cross-section of the studied gully was reduced in depth by 0.68 m and 0.55 m in the lower and middle areas of the gully, respectively. The width of the gully in the lower and middle areas of the gully remained unchanged. On average, the total depth of sediment trapped throughout the gully by both physical and biological conservation was 0. 26 m, and the total amount of soil trapped in one rainy season was approximately 2,300 tons. During the same period, the two non-treated gullies expanded greatly. One gully expanded in length by 23 m, the depth increased by 1.9 m and the width expanded

by 13 m. Soil loss was estimated at 1,900 tons. The gully that began in 2013 became 19 m long, 0.9 m deep, and 40 m wide with a soil loss of 1,500 tons.

The estimated forage yield from 0.7 ha of gully during the rainy season was 8.36 tons. This generated an estimated income of 10,200 Ethiopian birr from grass harvested in one rainy season. Most of the farmers used the grass harvested as feed for their cattle during the dry period. Those who did not have cattle, one male and two female household heads, sold the grass to other farmers for 460 Ethiopian birr each. Farmers as a group were able to negotiate with the Wereda Office of Agriculture to use their mandatory labor contribution for constructing soil and water conservation structures to rehabilitate the gullies.

However, this economic benefit resulted in conflict among the communities. The 22 farmers whose land surround the rehabilitated gully were reluctant to share the grass with the other 20 farmers who assisted with rehabilitation activities. In addition, they argued that they had not been allowed to graze their cows on this land as would have been the case if the rehabilitation had not been there and, therefore, demanded a greater share of the benefits. On the day that the 22 farmers began to harvest the grass, the farmers from the other villages stopped them from harvesting additional grass. This conflict was resolved by the elders in the village who eventually made the 22 farmers apologize and sign a promissory note to contribute labor and wood in the next program (2014 rainy period) to rehabilitate a gully in a second village.

This conservation practice was advocated to the adjacent villages, the development agents, and the community, and there was an uptake by the general community in the Ene-Chilala area of the Birr watershed. In the 2014 rainy season, communities from different villages of the watershed are taking their own initiatives to rehabilitate five more gullies.

The most significant accomplishment of the project was that the rehabilitation process, endorsed by the religious leaders and elders, modified the belief of farmers that God created gullies as a means of punishing them for their wrongful acts. The study showed that it is possible to alter the erosion dynamics of gullies. However, the study also notes that it is essential to address the root causes of the problem to prevent gullies from being formed in the first place.

A limitation of the study is that it is based on applied research in only one watershed where the community shares the same religion. It should be applied and tested in other communities with more diverse social backgrounds.

Conclusion

The importance of rehabilitating gullies should be advocated to soil conservation experts, development organizations, and policymakers. This form of environmental protection is often neglected. However, it can provide economic benefit to communities, decrease sediment concentration in rivers, and slow down siltation of downstream reservoirs.

This case study also showed the value of an approach that addressed a single hot spot erosion area and that communities would replicate the approach once they are convinced of its value. It also showed that farmers can be empowered to negotiate with authorities about the kind of land rehabilitation work they should be doing. Finally, the study found that it was important to involve religious leaders and elders in the process, since the possibility of conflict is significant, especially given that the environmental management initiative results in an economic benefit.

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