

Water & Land  
Resource  
Centre

# Gully Rehabilitation

What Does It Costs to Heal Gullies and Make them Productive?



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## Gully formation

Gully erosion is one of the most common problems of crop and grassland use. Gully formation is a common feature in high rainfall areas associated with deep but highly erodible or low organic matter as well as poorly drained soils. The problem is worse in areas where there is intensive over grazing, on plots with farm drainage ditches for runoff disposal, and on Vertisols. In addition to its on-site effects, gully erosion contributes heavy sediment that causes sedimentation of reservoirs and water bodies, and damage other infrastructures. In the learning watersheds, farmlands and graslands are highly dissected by gully erosion.



# Objectives of gully rehabilitation

Rehabilitating gullies and managing gully erosion is the application of integrated practices aimed at combating gully development and convert the wasteland into productive land, through the rehabilitation of land damaged by gully erosion and protect further expansion of the gully. Gully erosion management controls excess or concentrated runoff generation upstream of the gully catchment area, diverts excess runoff upstream of gully heads, and controls further expansion of the gully using appropriate structural and vegetative measures in the bed, on the sides and on the head of the gully. The process will eventually convert gullies into productive land and requires full consultation and involvement of the local community.

## Gully rehabilitation practices

Gully rehabilitation begins with assessment and mapping of gully damages and upstream runoff source areas and later involves the treatment of upstream catchment area, gully head and gully section. It combines different kinds of vegetative measures (trees and shrubs, grasses, fruits) and structural conservation measures (reshaping, check dams, cut-off drains, waterways, bunds, and pits) in order to control the speed and volume of concentrated runoff, reduce the slope gradients by breaking the gully section into shorter slope lengths, retain sediments, and improve the ground cover and biomass. Indirectly, it also stabilizes the soil and increases infiltration. Close monitoring and recurrent maintenance of physical structures and replanting is required to avoid collapse of structures and further damage. The overall function of gully management is to rehabilitate and mitigate land degradation due to gully erosion and modify landscapes to stabilize the soils and improve productivity.

### Box 1. Costs of gully rehabilitation and development

Gully rehabilitation and upstream catchment management using integrated structural and vegetative practices within the gully and gully catchment involves high costs for establishment and recurrent maintenance. The cost is covered by voluntary labor committed from the community. Costs vary greatly depending on the availability of the construction material and seedlings around the construction site, on the type of soil and the agro-ecological conditions of the area as well as on the type of check dam and fodder species. The characteristics of the gully (slope, depth, width and runoff catchment) also affect the costs. Considering the cases of gully management in the Learning Watersheds, the following cost summaries are made:

- The total costs of gully rehabilitation and development amounts to US\$ 17,180.0 per hectare. Of this total amount, land users contribute about 55% of the gully rehabilitation and development costs, mainly contributing for labor and local materials; WLRC through the extension service support nearly 45% for the preparation of seedlings (tree, shrub, and grasses) and supply of hand tools for poor farmers as an incentive. Farmers spend more of their labor and time in the construction of physical structures in gullies through community mobilization which accounts for the significant amount of opportunity costs.
- The total establishment and management costs required for structural measures (55%) and vegetative measures (45%) add up to US\$ 9462 and US\$ 7720 respectively per hectare. Of the total costs for structural measures at establishment stage, reshaping and hand tools share is about 59 % (i.e., 32.5 % of total gully treatment costs) and 3.7% respectively. Whereas, of the total costs of vegetative measures at establishment and maintenance stages, seedling preparation constitutes 91 % of the costs (i.e., 41 % of total gully treatment costs). The share of seedling preparation and supply amounts to 75% of the total management costs.

- Establishment of gully rehabilitation requires 77% of the total costs (US\$ 13305 per hectare) compared to management costs (that includes maintenance), which is estimated at about 23% share (US\$ 3876 per hectare). About 31% and 42% of the establishment costs will be spent on seedling preparation and reshaping of the gully sides respectively. At establishment stage, the major costs include community labor (i.e., collective labor) for reshaping gully sides, for collecting and transporting materials, and for constructing check dams, cut-off drains and waterways upstream of head cut of the gully. In addition, raising and transporting seedlings for vegetative plantation in gullies increase the costs for gully rehabilitation and development.



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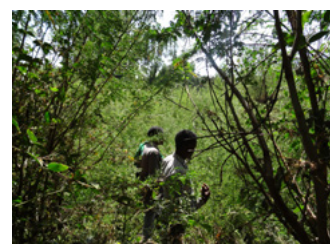
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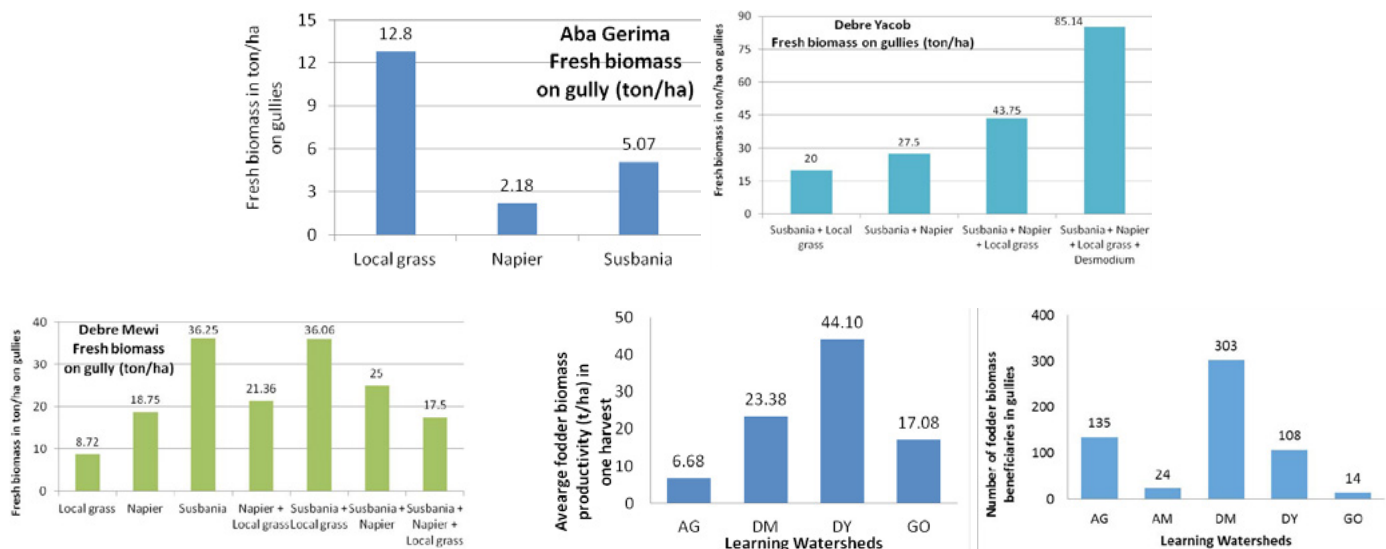
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## Box 2. Benefits of gully development

Rehabilitation of severe gully damages in the Learning Watersheds can only take about two years during which gully beds and sides could be converted into productive land for livestock feed and growing fruit trees. Using proper management, the following outcomes could be achieved:

- The gully sections fully covered with dense vegetation for forage and fruit production,
- Washed soil silted up in the check dams, scouring effect of incoming runoff reduced,
- Upstream expansion of gully heads minimized.

The anticipated short term benefits of gully rehabilitation are slightly higher than (positive) the establishment and maintenance costs. The anticipated long term benefits are, however, much higher than the costs.



**FIG.1. ONE TIME AVERAGE FRESH BIOMASS HARVEST OF GRASS AND LEGUME SPECIES ON TREATED GULLIES AND THE NUMBER OF BENEFICIARIES IN EACH OF THE LEARNING WATERSHEDS**

The direct and immediate benefits obtained from gully rehabilitation and development are mainly related to on-site benefits such as reduced surface runoff and soil loss, increased soil cover and biomass production, and safe disposal of excess runoff before causing damage. Short term economic production benefits were an increase in fodder production and, to some extent, production of diversified products like fodder, fruit and honey. Farmers organized in groups shared the fodder biomass. There are a total of 584 beneficiary farmers (in 15 user groups) from the treated gully biomass harvest in the five learning watersheds (135 in Aba Gerima, 24 in Atari Mesk, 303 in Debre Mewi, 108 in Debre Yacob, and 14 in Gosh). In those learning watersheds where gullies are prevalent, about 20-40 tons/ha fresh fodder biomass of either local grass or Napier or Susbania or a combination of them can be harvested at one time harvest in October. The biomass can be as high as 40-80 tons/ha under good vegetation cover and when different legume and grass species are planted in combination.

Farmers are motivated to practice income generating activities like fattening using the high amount of fodder biomass harvest. Local communities and experts have also gained conservation knowledge, becoming capable of strengthening their local institutions for collective actions and benefit sharing, and mitigating conflict of neighbors over gully erosion damages. As part of the off-site impacts, there are benefits in terms of increased stream flows during the dry season and recharging of aquifers, reduced damage on roads and houses, and reduced downstream reservoir siltation.

## Lessons learned

- Integartion of gully rehabilitation prcatices & community ownership, control of free grazing, & entitlement of group use rights are critical enabling conditions for gully rehabilitation.
- The high investment incurred to gully rehabilitation provides immediate responses and pays back in short period.
- Establishing nursery and ensuring continuous supply of seedling materials are important stages for the sustainability of gully development.
- The benefit of gully rehabilitation can be maximized if it is integrated with income generating activities like fattening and apiculture.
- Formulating bylaws for controlling free grazing and equitable share of benefits are important incentives to sustain the uptake and scaling up of the gully rehabilitation.