From Soil and Water Conservation to Small Scale Irrigation

Chris T. Annen
GTZ/SUN Tigray
gtasuutg@ethionet.et

The project was implemented in Tigray region on the location shown on figure 1.

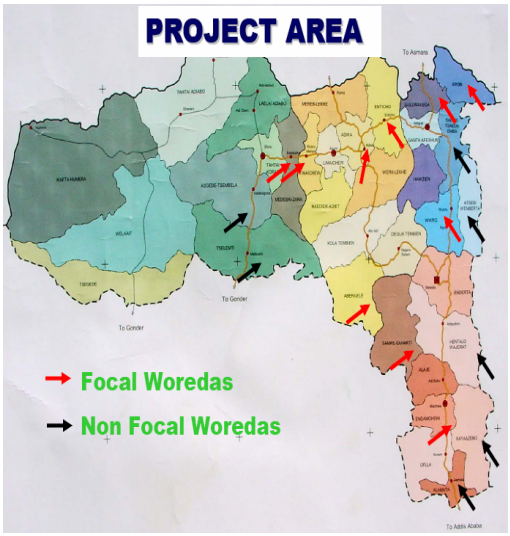

Figure 1. Location of the project area

The project intervention areas were watersheds as shown in figure 2

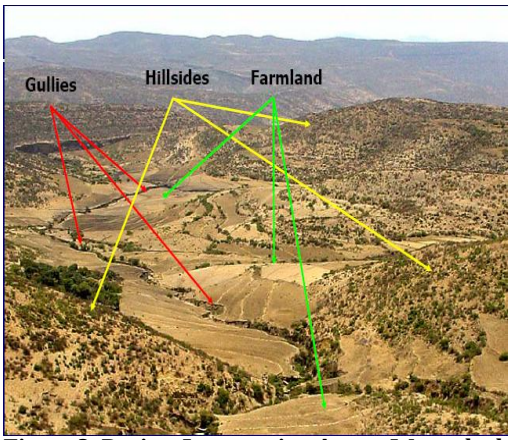

Figure 2. Project Intervention Areas: Watersheds

The major stakeholders involved in this project were Bureau of Agriculture and Rural Development as implementing agency, Tigray Food Security Coordination Office for regional coordination and administration, GTZ Sustainable Utilization of Natural Resources for technical support

Project Objective

The objective of the project was to improve food security by sustainable utilization of natural resources

Approaches

The approaches employed by the project were:

- Adoption, Testing and Development of innovative food security relevant watershed management techniques
- Action-oriented community engagement and participation
- Recognizing and Realizing potentials and short term benefits for farmers
- Integration of indigenous knowledge and
- Farmer to farmer experience exchange.

A. Managing Water in Hillsides

A.1 Traditional Sediment Storage Dams

One of the selected and applied watershed management techniques was traditional sediment storage dam (figure 3)

Figure 3. Traditional sediment storage dams

A.2 Semi-Circle Terraces

Semi circle terraces were also tested and it is found out that they have the following advantages and disadvantages:

Figure 4. Semi circle terraces on hillsides

Advantages of Semi Circle Terraces

- Effective soil conservation and water harvesting structures
- Short –term benefits
- Can render unproductive hillsides into intensively cultivated units with supplementary irrigation
- Individual user rights can be applied
- Can provide income for land less farmers

Disadvantages of SCTs

- Need to be protected from livestock and wild animals (Baboons, Porcupines, and Rodents)
- Require skill, training
- Are Labor Intensive?
- Require a nearby water source for optimum productivity (ponds, springs)
- Establishment of individual user right in most cases causes user right disputes

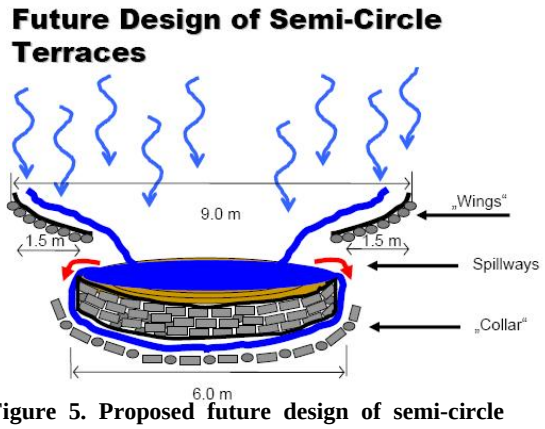

Figure 5. Proposed future design of semi-circle terraces

B. Harvesting Gully Water

The other watershed management techniques tested were those which are used to harvest gully runoff. These are biophysical gully treatment, gully runoff harvesting using serial ponds and river bank cultivation. Benefits and shortcomings these methods are:

B. 1 Biophysical Gully Treatment

Advantages of Biophysical Gully treatment

- Effective gully erosion control
- Direct short-term benefit (forage biomass)
- Effective ground water recharge
  - ➢ Drinking water supply
  - ➢ Small-scale irrigation

Disadvantages of Biophysical Gully treatment.

- Labor intensive physical gully treatment
- Requires reshaping of gully walls
  - ➢ Loss of arable land or pasture
- Requires livestock exclusion
- Necessity to establish clear cut user rights
- Likely to cause user right disputes

Figure 6. Biophysical gully treatment

B.2 Gully Water Harvesting with Serial Ponds

Advantage of Serial Ponds

- Effective ground water recharge
- Drinking water Supply
- SSI from hand dug wells

Disadvantages of Serial Ponds

- Labor intensive, costly pond construction work
- Large ponds occupy land
- Increased risk of Malaria

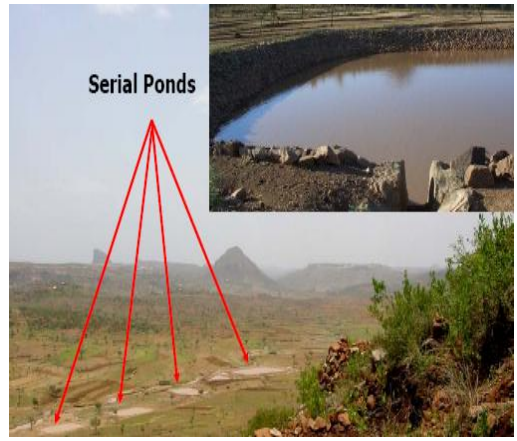

Figure 7. Gully runoff harvesting using serial ponds

B.3 Riverbank cultivation

Figure 8. Riverbank cultivation

C. Managing Water on Farmland

Techniques which are tested to manage water on farmland include soil bunds, ponds for micro scale irrigation and trench bund

C.1 Soil Bunds- An Ecological Niche for Development

Advantages of Soil Bund cultivation

- Can provide short-term benefits to farmers
  (Bee forage, oilseed)
- Does not compete with arable production

- Low labor input
- Can provide an incentive to farmers to maintain soil bunds and trench bunds

Disadvantages of Soil Bund Cultivation

- Most farmers are not familiar with sunflower
- More awareness creation is needed
- Weeding, thinning out is essential
- Sunflower can be susceptible to pests
- No oil extraction device available
- Short cycle Sunflower (non hybrid) is not yet available

Figure 9. Soil bunds integrated with sunflower

C.2 Pond Construction for Micro-Scale Irrigation

Advantages of Pond construction

- Short-term benefits (household income and nutrition)
- Community skill development
- No User right disputes on individual farmland

Disadvantages of pond construction

- Labor intensive construction of ponds
- Requires livestock exclusion or fencing
- Requires skilled masons
- Requires external inputs (cement, plastic sheeting)
- Increases household labor input
- Increases risk of Malaria

Figure 10 Ponds for Micro-scale irrigation

C.3 Trench Bund

Advantages of Trench Bund Cultivation

- Effective combination of runoff water harvesting with supplementary irrigation (ponds, hand dug wells, springs)
- Does not compete with arable production
- Can increase household income and improve household nutrition within three years
- Can provide an incentive to farmers to maintain trench bunds
- No user right disputes on individual farmland

Disadvantages of Trench Bund Cultivation

- Requires livestock exclusion on farmland
- May require protection from rodents (Baskets) during the first two years
- Requires supplementary irrigation (ponds, springs and hand dug wells)
- Increases household labor input (supplementary irrigation, weeding, harvesting, marketing etc)

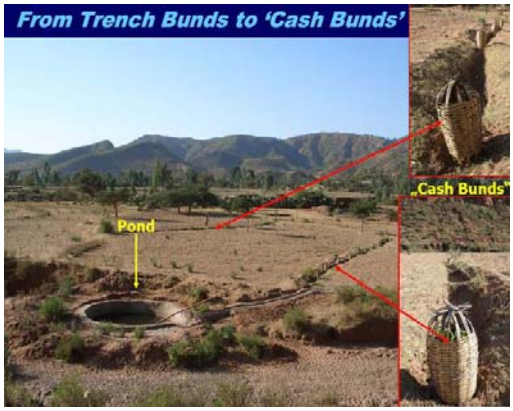

Figure 11. Cash bunds

D. Hand –Dug Wells for SSI

Another water management technique for small scale irrigation is Hand dug well. Its economic viability can be calculated as follows:

Economic Viability:

Example: 1ha irrigation by 3 HDWs
-Construction. Cost (3 HDWs): Birr 10'1667
Estimated annual net crop return: Birr 40'000
Irrigation cost: Birr 6'940
Net profit: Birr 33'060
1st year cost/benefit ratio: 1:3.3
Operational lifetime: 15 years
15-years cost /benefit ration: 1:49
Note:
Irrigation cost will reduce considerably once farmers are able to purchase their own pump
Income of rainfed crop is not considered

Advantages of Hand Dug Wells

- Considerable improvements of household economy and nutrition within six months
- Skill development (crop diversification, irrigation agronomy, marketing)

Disadvantages of Hand Dug Wells

- Requires livestock exclusion on farmland or fencing
- Considerable increase in household labor input
- Requires external inputs (pumps, seeds)
- Requires substantial skill development (irrigation agronomy, soil fertility management, crop protection and marketing)
- Risk of over utilizing groundwater reserves
- Increased risk of Malaria
- Risk of loss of livestock and human due to drowning incidences

Figure 12. Hand dug wells and small scale irrigation

E. Gravity Drip Irrigation

Advantages of Gravity Drip Irrigation

- Improvements of household economy
- High irrigation water efficiency
- Can be applied with small water sources (Not less than 250 m3 per annum / 500m2)
- Can prevent over utilization of groundwater reserves

- Skill development (crop diversification, irrigation agronomy, soil fertility management, marketing)

Disadvantages of Gravity Drip Irrigation

- Requires livestock exclusion on farmland or fencing
- Increase in household labor input
- Relatively high investment for external inputs (drip system, pupmps barrels, seeds) on a small unit of land
- Requires good marketing of cash crops to recover investment
- Drip lines need to be replaced after 5-7 years
- Requires substantial skill development (irrigation agronomy, soil fertility management, crop protection and marketing)

Figure 13.Crop production using gravity drip irrigation

F. Indigenous Irrigation Schemes

F.1 Traditional Stream Diversions and crossings

Advantages of Indigenous irrigation schemes

- Communal irrigation schemes strengthen community self help capacity
- Low cost, low input technology
- Increased food security and household income

Disadvantages of Indigenous irrigation schemes

- Requires livestock exclusion on farmland or fencing
- Increase in household labor input
- Low irrigation water efficiency
- Low productivity
- Not recognized by agriculture extension service