Global Journal of Science Frontier Research: D
Agriculture and Veterinary
Volume 20 Issue 6 Version 1.0 Year 2020
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4626 & Print ISSN: 0975-5896

Documentation of Indigenous and Introduced Soil and Water Conservation Practices in Southern Ethiopia

By Birhanu Wolde & Wudinesh Naba
Southern Agricultural Research Institute (SARI)

Abstract- In Ethiopia soil erosion by water significantly contributes to food insecurity among rural households and poses a real threat to the sustainability of existing subsistence agriculture. In many parts of Ethiopia particularly southern Region many introduced and indigenous soil and water conservation practices were implemented using different approach. However, indigenous soil and water conservation practices adopted at farmers field, types, their names, technical dimension and their socio economic importance in the village is not well documented for further studies. Therefore, the present study was conducted in Gamo Gofa, Segen area peoples and Basketo special distict of the Sothern Ethiopia. As a methodology, discussion was organized at zonal and woreda level agricultural offices and sample of woredas and kebeles having similar farming system were selected with systematic sampling approach.

Keywords: indigenous, introduced, soil and water conservation practices.

GJSFR-D Classification: FOR Code: 050399

Strictly as per the compliance and regulations of:

Documentation of Indigenous and Introduced Soil and Water Conservation Practices in Southern Ethiopia

Birhanu Wolde [α] & Wudinesh Naba [σ]

Abstract- In Ethiopia soil erosion by water significantly contributes to food insecurity among rural households and poses a real threat to the sustainability of existing subsistence agriculture. In many parts of Ethiopia particularly southern Region many introduced and indigenous soil and water conservation practices were implemented using different approach. However, indigenous soil and water conservation practices adopted at farmers field, types, their names, technical dimension and their socio economic importance in the village is not well documented for further studies. Therefore, the present study was conducted in Gamo Gofa, Segen area peoples and Basketo special distict of the Sothern Ethiopia. As a methodology, discussion was organized at zonal and woreda level agricultural offices and sample of woredas and kebeles having similar farming system were selected with systematic sampling approach. Focus group discussion, questioner and transect walk were made in the selected kebele and the technical aspects of identified SWC practices were measured and described as well. Some of the most common identified indigenous and introduced conservation practices are, mulching, Intercropping, Trenches, cut of drain, grass integrated with soil ,stone terraces , Targa, pataya, korayida, Aflimayita fanyajju terraces, Agro-forestry practices like Home garden, live fence, park land agro forestry (combination of Moringa Stenophetala , Mangifera indica, Gravelia rebusta Terminalia browenii ,Cordia africana, banana, maize and other fruit tree species. Therefore, the identified practices provide information for researchers, extensions and other conserved body to do more in the area of soil and water conservation and should be proven in the research. It is better to conduct detail study and disseminate.

Keywords: indigenous, introduced, soil and water conservation practices.

I. Introduction

In Ethiopia soil erosion by water significantly contributes to food insecurity among rural households and poses a real threat to the sustainability of existing subsistence agriculture (Yirga, 2007). In response to this problem, soil and water conservation (SWC) activities were launched by government to implement physical and biological soil and water conservation measures by community collective action (mass movement). On the other way, different land enhancing technologies and practices have been introduced by research institutions, extension and other development practitioners in the region (Wagayehu and Lars, 2003).

Indigenous soil and water conservation is the method used different farmers to facilitate optimum level of production from a given area of land while keeping soil loss below a critical value. The soil loss tolerance value is defined as the rate of erosion at which soil fertility can be maintained over at least 25 years (Hurni, 1983). Indigenous soil and water conservation practices have very often been ignored or underestimated by development agents, researchers, soil conservationists and government staff (IFAD, 1992).

Although the objectives of knowing indigenous soil and water conservation practices give us an understanding of farmers' way of thinking about the measures (Hudson, 1992). Farmers use a number of indigenous soil and water conservation technologies to prevent the problem of soil erosion. Among these are cut- of -drains, leaving crop residues in the field, distribution of manure, contour farming, fallowing, planting root crops by preparing bunds, tree planting on slope farm, use of trash lines on contour, row planting, alley cropping, intercropping, strip planting, and plantation of Sisal (*Agave sisalana Perrine*) and euphorbia (*Euphorbia classenii*) on the farm etc. The indigenous soil conservation practice of Konso community is developed over a very long period of time. *(Yeshambel 2013)* UNESCO has registered the terraces of the Konso people of Southern Ethiopia as one of the world heritage (Shimelis, 2011). According to Genene M. and Abiy G. (2014), most of the farmers in south western Ethiopia practices introduced and indigenous soil and water conservation activities like; contour farming, furrow making, residue leaving, agronomic practices, putting trash lines on contour etc.

Broadly the conservation measures are classified as agronomic measures, physical /structural/ measures and biological/vegetative/ measures (IFAD, 1992). The definition of each broad type of ISWC practices is as follows:

Agronomic: These are measures undertaken within the cropping area for crop production purposes and include practices such as intercropping, contour cultivation, minimum tillage, mulching, manure etc. which:

- Are usually associated with annual crops

Author α: Soil and Water conservation researcher, Southern Agricultural Research Institute (SARI). e-mail: birhanuwolde2016 @gmail.com
Author σ: Arba Minch Agricultural Research Center, Ethiopia.

- Are repeated routinely each season or in a rotational sequence
- Are of short duration and not permanent
- Do not lead to changes in slope profile
- Are not zoned
- Are independent of slope

Biological/Vegetative/: These measures involve the deliberate planting of trees, shrubs, grasses etc, or retention of areas of natural vegetation (eg. reforestation, contour hedgerows, and natural vegetative strips) which:

- Involve the use of perennial grasses/pasture legumes, shrubs or trees
- Are of long duration
- Often lead to a change in slope profile
- Are often zoned on the contour or at right angles to wind direction
- Are often spaced according to slope

Structural/ physical/: Measures which involve the construction of physical structures (e.g. graded banks or bunds, contour stone lines, level bench terraces, artificial waterways and drop structures) which:

- Lead to a change in slope profile
- Are of long duration or permanent
- Are carried out primarily to control runoff and erosion
- Require substantial inputs of labour or money when first installed
- Are zoned on the contour
- Are spaced according to slope

Appropriate soil and water conservation technologies are those which offer for a given production situation an optimal solution for using the land for sustainable and productive agricultural purposes. Appropriate technologies are not necessarily "simple" technologies. However, in the context of many developing countries, the appropriate technologies will be ones which are not capital-intensive and which use local resources and the existing labour force in an optimal way.

It should be emphasized that before introducing a new technology it is necessary to check whether local soil and water conservation measures already exist and why and how farmers apply these indigenous technologies. If such technologies exist and continue to be applied by farmers, then, providing they have not been introduced and maintained by legal force and state authority, they can be considered successful and on investigation will be found to provide tangible benefits. Understanding the reasons why farmers use such technologies, i.e. the production and conservation benefits they get from them, is the key to the successful introduction of any "new" technology, which must at least match and preferably improve on the benefits to be obtained from the existing ones (CARDI, 2010).

The effect of soil and water conservation measure in reducing soil loss generally varies with soil type, land use, land cover, topography, climate and intensity of the measures. Among the factor major contribution for reducing erosion is from farming system in general and land use land cover specifically. In this regard the major factors are related to every day activity of land owner/farmers/. Therefore, they protect their soil indigenously for their crop productivity. Different authors assessed many ISWC practices that can reduce soil loss however it was not organized as a form of integrating its historical analysis, source, and property, technical social, economical and cultural aspects. For this reason, this project was initiated to identify and investigate different ISWCP that could add value on reducing soil erosion and increasing moisture on farms so that, it will be documented for future development.

Therefore, the objectives of study was to identify indigenous and introduced SWC practices, to measure and describe identified indigenous and introduced soil and water conservation practices and to document the identified practices for further reference.

II. Methodology

a) Site selection

Two zones and one special district were selected for this study. Based on their agro ecological condition, farming practice and land use land type. Bonke, Boreda and Zala woredas from Gamo Gofa zone high land, midland and, lowland respectively was selected. Konso and Derashe woreda from Segen area peoples zone and Basketo special districts was also selected.

During selection of site, Focus Group Discussion (FGD) was made at zonal and woreda basis using checklist prepared for the objectives of the activity. Detail discussion was organized with zonal agricultural department so that woreda were grouped under similar farming system. Discussion was be undertaken with selected multi-disciplinary team from (NRM, Crop, Animal science, socio-economic, irrigation) who have experience about all woredas, having detail information and share on issues of farming system in the woreda. Sample of woredas having similar farming system was selected. Detail discussion was organized with woreda agricultural and natural resource office and kebelese was selected based on the detail farming system. Preliminary survey was being made using developed checklist to group kebeles in to similar farming system. Sample of kebeles with similar farming system was selected for detail study.

b) Data collection and organization

i. *Transect walk*

Transect walk was made in the selected woredas and kebele. A transect walk is a tool for describing and showing the location and distribution of resources, features, cropping and farming practices, soil and water conservation practices , landscape, main land uses along a given transect. It can be used for identifying and explaining about traditional and modern knowledge of natural resource management of the communities.

ii. *Focus group discussion (FGD)*

Focus group discussion (FGD) was made to identify the practices. A focus group discussion involves gathering people from similar backgrounds or experiences together to discuss a specific topic of interest. It is a form of qualitative research where questions are asked about their perceptions attitudes, beliefs, opinion or ideas. In focus group discussion participants are free to talk with other group members; unlike other research methods it encourages discussions with other participants.

In this study Focus Group Discussion (FGD) has taken with zone and woreda level. At zone level discussion under taken with experts from multi disciplinary teams like (natural resource, irrigation, animal science, and plant science departments) they have detail information's about all woredas of the zone so that, grouping of woredas was done based on its agro ecologies and expectation to have indigenous and introduced soil and water conservation practices. In this regard representative woredas/ districts/ were selected. Similar trend of FGD to identify sample kebeles based on the existence of indigenous and introduced soil and water conservation practices.

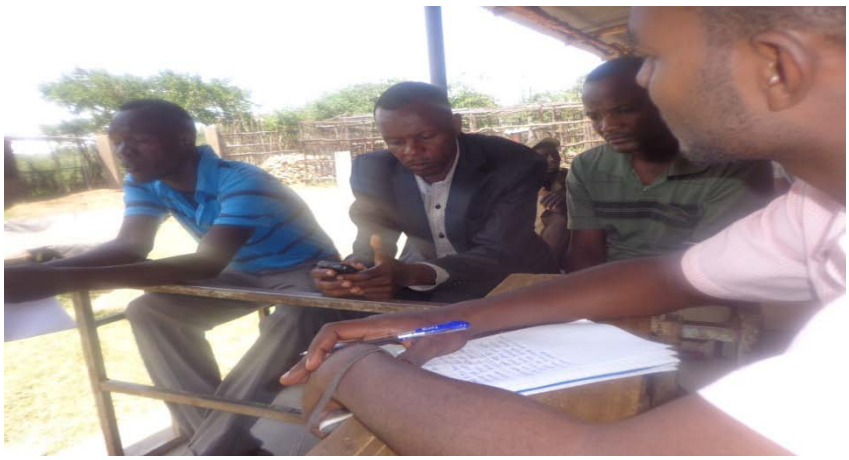

Figure 1: Focus group discussion in Konso (source field survey 2018)

iii. *Interview*

An interview is a conversation where questions are asked and answers are given. In common parlance, the word "interview" refers to a one-on-one conversation between an interviewer and an interviewee.

Key informant interview was made at respective administrations from zone to kebele level by participating administrators, experts and elder farmers well known to the area in order to get information on the area where soil and water conservation practices found. In other way this discussion helps to identify those farmers practicing indigenous and introduce soil and water conservation practices. The selection of those farmers was purposively based on availability of representative indigenous or introduced soil and water conservation techniques to reduce the problem of soil erosion and increase soil moisture content.

c) Data Analysis Presentation

Targeting the objective of documentation of findings, data analysis was done more with qualitative description and explanation supporting it with picture or figure. The analysis focused on discussion on zonal basis in the region so as to summarize the documentation of indigenous and introduced SWC practices and measure by using Tables and Figures.

III. Result and Discussion

a) Characterizing indigenous soil and water conservation methods in study area

i. *Physical indigenous SWC*

a. *Stone terrace*

Stone terrace are one of the physical soil and water conservation practices which are traditional well practiced in the study area. From selected woredas of study area Konso and zala has majorly practiced stone terrace for the purpose of erosion prevention. The people of Konso are a hundred of year experience of constructing stone terrace for the purpose of soil management, water harvesting, and deference wall. Most of the agricultural land and communal land are covered with different stone terrace in Konso zone.

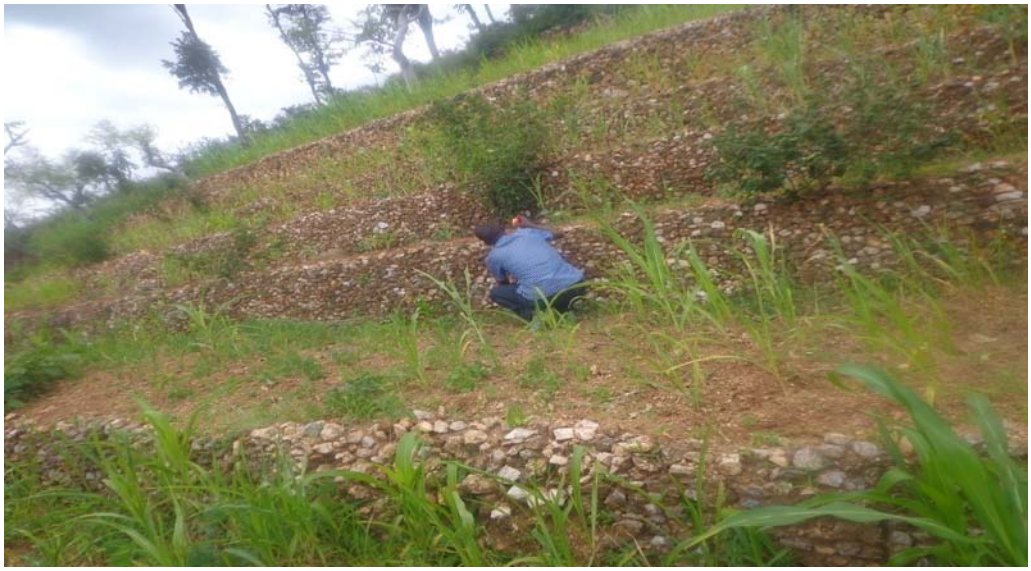

Figure 2: "Afilmayta " in konso (source field survey 2018)

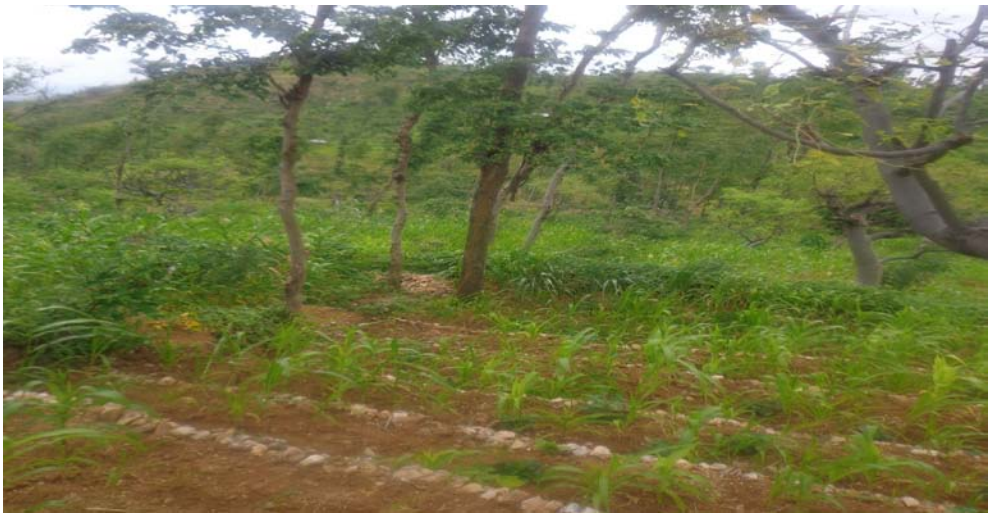

Figure 3: "korayida" in konso (source field survey 2018)

Table 1

No	Local name	Main advantages	Existing districts	Categories	Dimension				
					Av. Length (m)	Av. Depth (m)	Av. Height (m)	Av. Spacing (m)	Av. Width (m)
01	"*Kama* "	Conserving soil	Konso	Indigenous	Farm size	--------	0.3	4.5	0.2
02	"*Afilmayita* "	Fence, defence	Konso	Indigenous	1.5	1	2.5	10	1.5
03	"*korayida*"	SWC	Konso	Indigenous	Farm size	0.5	1.35	5	1.2
04	"*Shucha kela* "	SWC	Zala	Indigenous	Farm size	0.4	1	3.5	0.5

b. *Targa*" *and*" *pataya*"

The word "Targa," and " Pataya" means Derash language or Derashigna. It is an indigenous in situ moisture conservation techniques practiced by Derash people of southern Ethiopia. "Targa," and/ " pataya" means a rectangular shaped on farm moisture conservation technique in which the embankment has built from soil or plant residue (sorghum or maize straw).

In the study area the people of Dherash largely cultivated maize, sorghum and teff. Most of lowland kebles of the worda like (Kola mashile, Holite, Ateya, Nota,Walesa, Shelale, Keyama, Wolayite and Argoba) were majorly practiced "Targa," and " Pataya". The differences between "Targa," and " pataya" were only dimension.

Table 2

No	Local name	Main advantages	Existing districts	Categories	Dimension				
					Av. Length (m)	Embankment width (m)	Av. Height (m)	Av. Spacing (m)	Av. Width (m)
01	"*Targa* "	Moisture conservation	Dherasha	Indigenous	3.4	0.3	0.4	5	2
02	"*Pataya*"	Moisture conservation	Dherasha	Indigenous	1.5	0.2	0.3	2	1

Figure 3: "*Targa and Pataya* " in Dherashe *(source field survey 2018)*

c. *Cut-off drain*

A cut-off drain are earth structures constructed across a field used to intercept run off and divert surface run-*off* from the slope above and *drain* it to a safe outlet. In the study area special in Boreda woreda of Gamo zone the farmers were constructed cut- off drain on their farm land and locally called "*Dio ogiya*".

Figure 4: "*Dio ogiya* " on farm land and around home garden in Boreda *(source field survey 2019)*

Table 3

No	Local name	Main advantages	Existing districts	Categories	Dimension		
					Av. Length (m)	Av. Depth (m)	Av. Width (m)
01	" *Dio ogiya*"	Soil conservation	Boreda	Indigenous	Farm size	0.4	0.5

ii. *Agronomic indigenous SWC*

a. *Mulching*

Mulching mean leaving crop residues on the field after traditionally in the study district .The farmers in the study area traditionally leave the straw of sorghum or maize on their farm land after harvest to improve soil fertility and to conserve soil from rain drop erosion.

Figure 5: Mulching with maize & sorghum straw in Basketo sp. district *(source field survey 2019*

b. *Inter cropping*

Intercropping is a farming method that involves planting or growing more than one crop at the same time and on the same piece of land. It means having more than one type of crop growing in the same space at the same time. The most common goal of intercropping is to produce a greater yield on a given piece of land by making use of resources or ecological processes that would otherwise not be utilized by a single crop. In the study area farmers traditionally practiced sowing different crops simultaneously at the same cropping season. The major intercropping crops are maize with common bean, maize with mung bean, maize with sun flower and sorghum with other legumes in the mid and low land of study area.

Figure 6: Intercropping inter cropping maize with sun flower in Basketo sp. district *(source field survey 2019)*

c. *Crop rotation*

Crop rotation is the practice of cyclically growing a sequence of different plant species on the same parcel of land following a defined order of the crop succession with a fixed length. It is done so that the soil of farms is not used for only one set of nutrients. It helps in reducing soil erosion and increases soil fertility and crop yield.

iii. *Biological indigenous SWC*

a. *Park land agro forestry*

Agro forestry refers to a land management practice in which cultivation and use of trees and shrubs with crops and livestock in agricultural system. Agro forestry seeks positive interactions between its components, aiming to achieve a more ecologically diverse and socially productive output from the land than is possible through conventional agriculture. Farmers in the study area had good experiences on use of integrated agro forestry *Moringa Stenophetala*, *Mangifera indica, Gravelia rebusta Terminalia browenii*, *Cordia Africana*, Banana, and other fruit tree species planted traditionally based on contour line with the integration of animal fatting grasses.

Figure 7: Park land agro forestry in Zala district Gofa Zone (source field survey 2019)

b. *Home garden Agro forestry*

The home garden can be defined as a farming system which combines different physical, social and economic functions on the area of land around the family home. *Home garden* is an area of land, individually owned, surrounding a *house* and usually planted with a mixture of perennials and annuals Inset based, coffee based, root and tuber crop, fruit tree based and other types of home garden agro forestry were majorly practiced in the lowland, mid land and high land agro ecology of the study area.

Figure 8: Home garden Agro forestry in Zala district Gofa Zone (source field survey 2019)

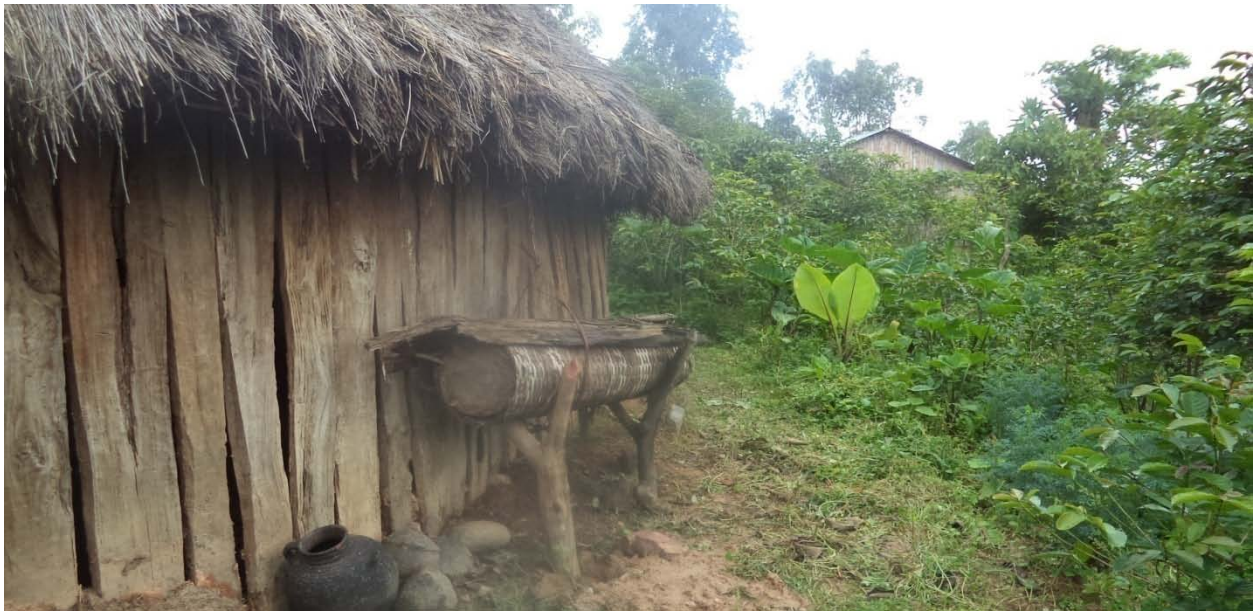

Figure 9: Home garden Agro forestry in Bonke district of Gamo Zone (source field survey 2019

c. *Living Fence agro forestry*

Living Fence agro forestry is a technology practiced in sloping areas in which hedgerows are established along the contours and other annual/cash crops are grown in the alleys between the hedges. *Contour Hedgerows* of Nitrogen-fixing Plants and Shelter/Protection Belts to Reduce Runoff and Soil Loss. Traditional in the study area farmers had practiced planting of different nitrogen fixing trees as a fence for the purpose of soil fertility improvement and erosion protection.

Figure 10: Live fence of Korch (Erythrina abyssinica) in Basketo special district (source field survey 2019

b) *Characterizing introduced soil and water conservation methods in study area*

i. *Stone bund*

Stone bunds are used along contour lines to slow down, filter and spread out runoff water, thus increasing infiltration and reducing soil erosion. Over time sediment, which is captured on the higher side of the bunds, accumulates to form natural terraces. The farmers in the study area had practiced stone bund with advanced way mostly in stony area. Besides to that most of the stone bund structures had with biological stabilizers like elephant and desho grasses.

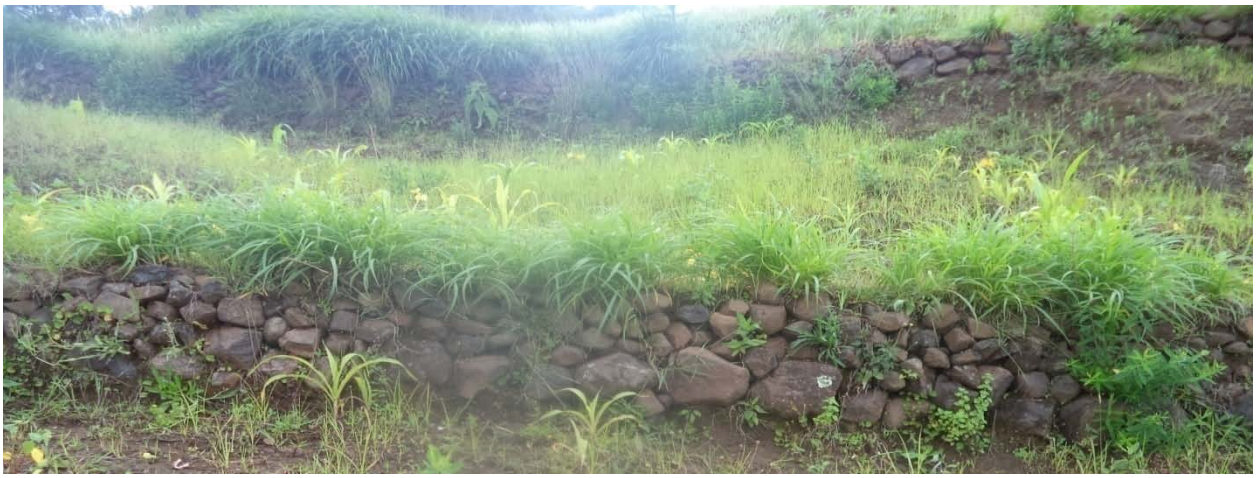

Figure 11: Stone bund with stabilizer desho grass in Bonke Gamo zone (source field survey 2019

Figure 12: Advance Stone bund Zala Gofa zone (source field survey 2019)

ii. *Grass strip*

Grass strip means planting different grass on contour line to slow the speed of water coming down the slope and allow the water to infiltrate. They also allow the washed away soil and nutrients to settle out above the hedgerows. In study area through the recommendation of development agents farmers locally plant desho grass on their farm lands.

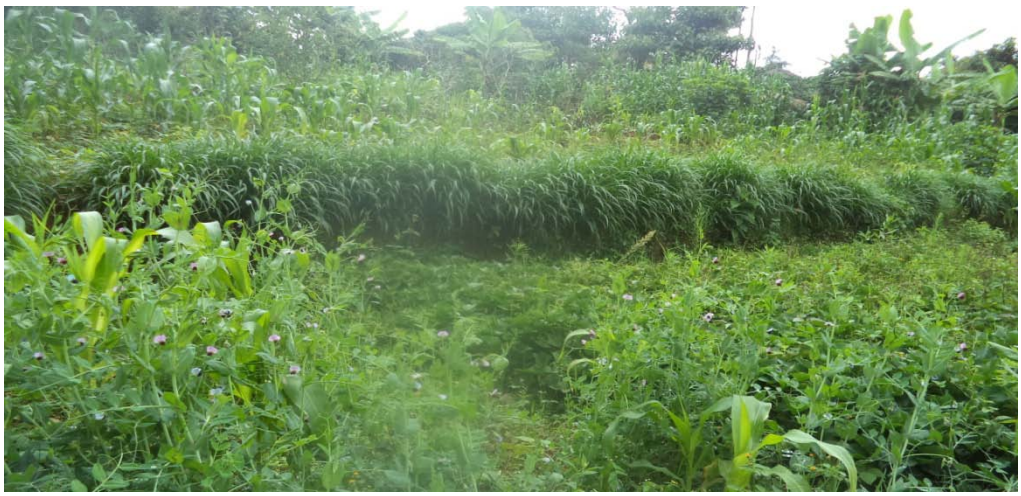

Figure 13: Grass strip in Bonke Gamo zone (source field survey 2019)

iii. *Rain water harvesting pond*

The rainwater can be collected in large quantity in ferro-cement or plastic line ponds. The roof water, runoff water (after filtration) or spring water may be diverted to the pond. A large sum of water can be harvested using such ponds, which in turn may be used for irrigation or household purposes.

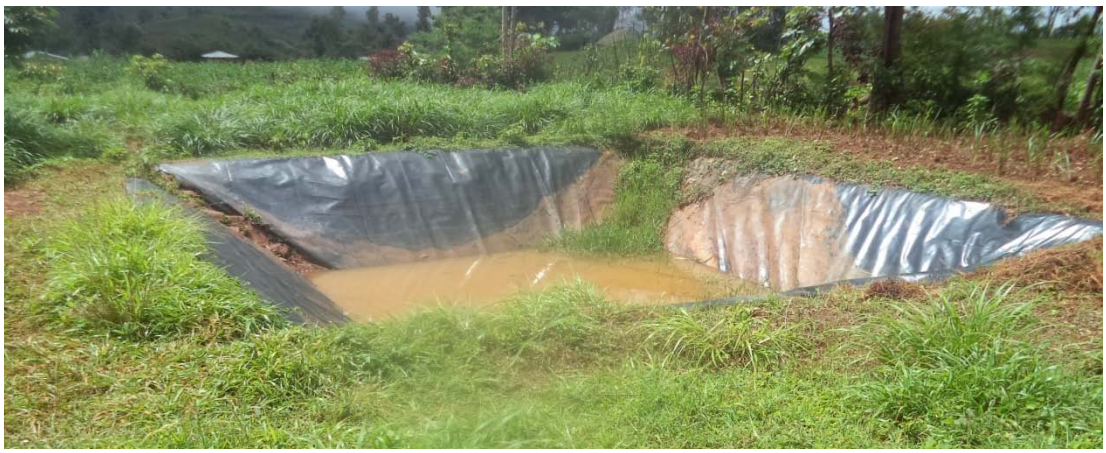

Figure 14: Rain water harvesting pond in Bonke Gamo zone (source field survey 2019)

iv. *Gabion*

Gabion a basket or container filled with earth, stones, or other material used for slope stability and erosion protection in construction.

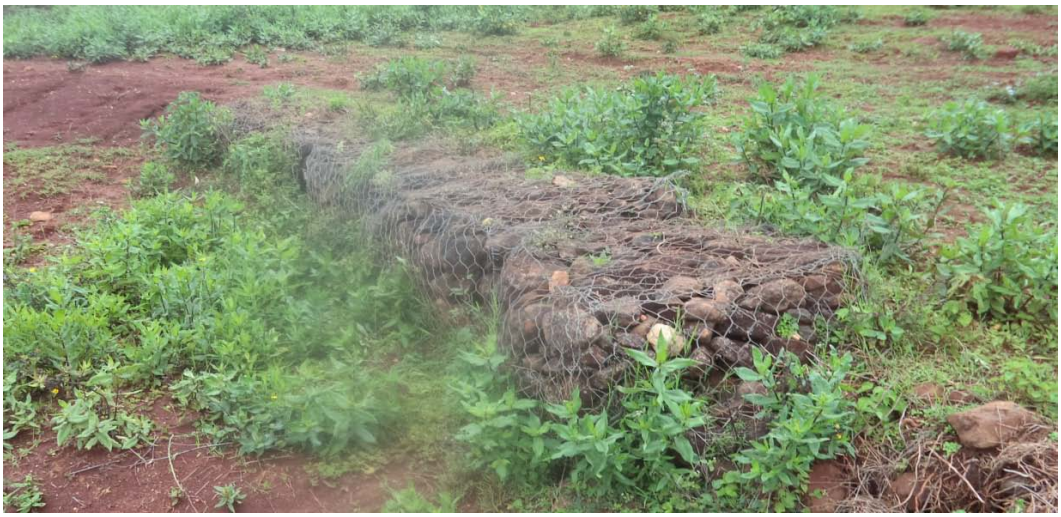

Figure 15: Water harvesting pond in Bonke Gamo zone (source field survey 2019)

IV. Conclusion and Recommendation

In the study area, various indigenous and introduced soil and water conservation measures had been implementing by farmers at different land use systems. However, indigenous SWC measures taken less attention by different stakeholders; Governments, nongovernmental organization, and research institute.

Thus, based on the finding, the following suggestion may be important; farmers construct indigenous SWC without any scientific calculation, which leads to farm land fragmentation and labor intensive. Therefore, these indigenous practices need attention for further improvement.

It is better to conduct detail study on its socio-cultural values, bio-physical properties and its effectiveness on soil erosion control with reference to other practices or farmers practice and disseminate technically, economically, socially and ecologically viable indigenous knowledge of Gamo Gofa, Segen areas people's zone and Basketo sp. districts practices to the areas with a similar agro-ecology.

In similar manner, some quality and technical imperfection were also observed and evaluated on introduced SWC against standard guideline developed by MoARD. This may be due to time interval between implementation and evaluation, free grazing, lack of regular maintenance, improper design and construction, and deliberate destruction of bunds by land owners.

References Références Referencias

1. BoFED, 2004. Regional Atlas. Southern Nation, Nationalities and Peoples Regional State, Bureau of Finance and Economic Development, Bureau of Statistics and population. Awassa, Ethiopia.
2. CSA Central Statistical Agency (2007) Population and housing census report. Addis Ababa, Ethiopia.
3. Haile M., Herwege K. and Stillhord B. 2006. Sustainable land management, a new approach to soil and water conservation in Ethiopia, University of Bern, Switzerland.
4. Hudson, N. 1992. Land husbandry. B. T. Batsford Limited, London. 192 pp.
5. Hurni H. 1983. Soil formation rate in Ethiopia. Working paper 2. FAO (Food and Agriculture Organization of the United Nations) /MOA (Ministry of Agriculture) joint project, Ethiopian Highlands Reclamation Study, Addis Ababa, Ethiopia.
6. IFAD, 1992. Soil and water conservation in Sub-Saharan Africa. Towards sustainable production by the rural poor. Centre for Development Cooperation Services, Free University, Amsterdam.
7. MoA (Ministry of Agriculture), 2012. 2011/12 (2004 E.C) Performance assessment report on the growth and transformation agenda in the spheres of agriculture.
8. Nyssen. J, Poesen. J, Gebremichael. D, Vancampenhout. K, D"aes. M, Yihdego. G, Govers. G, Leirs. H, Moeyersons. J, Naudts. J, Haregeweyn. N, Haile. M, and Deckers. J 2007. Interdisciplinary on-site evaluation of stone bunds to control soil erosion on crop land in Northern Ethiopia. Soil and Tillage Research No1, 94:151-153.
9. Shimelis D., 2011. Effectiveness of soil and water conservation measures for land restoration in the Wello area, northern Ethiopian highlands, PhD thesis, Ethiopia.
10. South western Ethiopia Journal of Agriculture and Environmental Sciences, Vol. 2 No. 2.
11. Tsegaye G. and Gebremichael A. 2014. Review on Overall Status of Soil and Water Conservation System and Its Constraints in Different Agro Ecology of Southern Ethiopia Journal of Natural Sciences Research. www.iiste.org. ISSN 2224-3186 (Paper) ISSN 2225-0921 (Online) Vol.4, No.7.

12. Wagayehu B and Lars D (2003). Soil and Water Conservation Decision of Subsistence Farmers in the Eastern Highlands of Ethiopia: a case study of the Hunde-Lafto.
13. Yeshambel M. 2013 Indigenous Knowledge Practices in Soil Conservation at Konso People,
14. Yirga C. 2007. The dynamics of soil degradation and incentives for optimal management in the central highlands of Ethiopia; PhD thesis, Pretoria, South Africa.