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Assessment of Farmers' Indigenous Knowledge on Soil Conservation; a case of Karcha District; Southern Ethiopia

Bayisa Bussa[1*], Adugna Babu[1] and Nigusie Godana[1]

[1]Bule Hora University, College of Agriculture Sciences, Department of Natural Resources Management

[*]Corresponding author's email: bayisabusa@gmail.com

ABSTRACT

Conservation of soil resources is important for sustainability of agriculture and environment. Due to anthropogenic and natural factors, this important component is under immense pressure and being deteriorating. However, soil conservation through indigenous knowledge practices is common in some parts of the world where the communities develops the norm of conservation practices and perpetuate from generation to generation. Thus, it is common to see different forms of soil conservation practices across the various indigenous societies of Africa where by Ethiopia is part and parcel. This study was all about assessing indigenous knowledge of farmers' in soil conservation practices at karcha district, Southern Ethiopia. The district was purposely selected as it is well known in soil conservation relatively and has medium agro ecological condition. Stratified random sampling technique was used for the study considering soil conservation activities. The study adopted a sample design of 10% of 3203 total households which is 320. In addition, ten respondents for intensive interview (based on experiences and position) and fifteen respondents were selected for focus group discussion. Respondents from each kebele were selected by simple random sampling method. For this study, both primary and secondary data sources were used. The collected data was analyzed using SPSS (statistical package for social Sciences, version 20). Based on the data gathered, descriptive statistical tools like frequency and percentage were used. The qualitative data were thematically analyzed through description, narrating and interpreting. Types of indigenous practices encountered, Community perception and challenges diluting this knowledge were identified. Some of the identified indigenous knowledge was the cultures of manure making (15.9%), vegetation stripping (13.1%), mulching (12.8%), crop residues (12.2%), crop mixing (11.3%), crop rotation (11.3%), terracing (9.7%) composting (6.6%) and agro forestry. Identified challenges in the study area were: inappropriate planning (16.3%), lack of resources (14.7%), poor understanding about the application and role of indigenous knowledge practices (14.4%), unclear accountability (11.9%) and poor information access (10.6%). About 96.6% of the respondents argued that indigenous knowledge of soil conservation applied even though relatively low capacity building (47.2%) and low promotion (41.6%). It is apparent from the entire discussion that people of the study area have long year indigenous knowledge of conserving natural resources

including soil. The finding of the study showed that indigenous knowledge of soil conservation practices was developed over a very long period of time and become their survival strategies in sustainable development based on the communities' perception. The significance and importance of the practices thus lies beyond their contribution to land productivity and economic significance. Therefore, it is important to encourage the participants of this study in particular and others who have similar practices in general to enhance their indigenous knowledge through scientific ideas in order to capacitate them more.

Keywords: *indigenous knowledge, soil conservation practices, soil erosion.*

1. Introduction

Soil degradation has been increasing globally both in terms of total land area cover and severity of degradation in eastern Africa highlands, where it causes wide spread of soil nutrients degradation (Abebe *et al.,* 2011). The poor conservation practices cause land degradation in sub- Saharan Africa countries cut across sectors of agricultural practices and construction. Insufficient length of drainage network, over grazing of rangelands, drainage constructed to earths' beds and the use of heavy machinery are some causes. Others are: absence of crop rotation and manure, lack of proper and adequate nurturing planted trees, poor human attitude and plugging of soil leads declining of soil organic matter of between 25 and 40 %, thereby exposing land to wind and water erosion (UNEP, 1998).

As Taddesse (1995) revealed that about one billion tons of topsoil eroded annually due to poor conservation practices. In-line, Zemenfes (1995) asserts that the average soil erosion is 42 tones per year in the crop lands. According to Mulugeta and Karl (2010), water erosion is the most threatening and degradation processes in the world and accounts 56% of the total degraded land surface of the world. In Africa alone, it is estimated that five to six million hectares of productive land is affected by water erosion each year. Regardless of the many problems listed above, Soil is an essential input for countries like Ethiopia, where agriculture is the backbone of the economy and the livelihood of the majority of the population (Liniger and Cahill, 2002). It is clear that soil with low fertility is unable to provide sufficient crop cover to sustain life. Erosion and low humus content of such soil decrease infiltration and moisture holding capacity of the soil. These all quest for the importance of soil conservation as precondition for sustainable rural development strategies (Alemayehu, 1992).

Ethiopia is one of the Sub-Saharan African countries that are well endowed with natural resources including biodiversity, particularly agro-biodiversity (Gete *et al.,* 2006). The country has predominantly

an agrarian economy with the vast majority of its population directly or indirectly involved in agriculture were about 95% of the country's agricultural output is produced by smallholders (MoARD, 2008). Although the country is endowed with enormous biophysical potential, it has been affected by the interlinked and reinforcing problems of land degradation and extreme poverty (USAID, 2010). This is further aggravated by high population pressure (currently more than 88 million with annual growth rate of, 3.2%) (ibid), top-down planning systems, limited use of sustainable land management practices, limited capacity of planners, researchers and land users as well as frequent organizational restructuring (Gete *et al.,* 2006). Land degradation manifests itself through soil erosion, nutrient depletion and loss of organic matter, acidification and salination (Bewket and Teferi, 2009; Haile and Fetene, 2012).

Increasing attention is being given to the environmental concerns of indigenous knowledge, most of the past researches have centered on Asia, Latin America, India and Australia with little attention being paid to Africa (Kelbessa, 2005). According to Kruger *et al.,* (1996), an extensive work on indigenous knowledge in land management shows the poor record and lack of appreciation of indigenous practices of conservation experts and policy makers. This agrees with review by Reij (1991) which shows the less attention given to indigenous soil and water conservation practices in many parts of Ethiopia.

By considering land degradation in the form of soil erosion and soil nutrient depletion as a major hindrance factors for economic growth and famine preparedness in Ethiopia, different measure have been made to overcome the problem particularly in the last quarter of the 20th century (Berry, 2003; Aklilu and Graff, 2006). Soil conservation measures have been carried out in different parts of the country that have been recommended for minimizing soil loss by erosion (Cerda and Doerr, 2008). For a number of years, the communities of Ethiopia have been carrying out traditional soil conservation measures like: the construction of terraces, reforestation, forestation of areas that have not been used for cultivation, inter cropping, managing grazing lands, the protection of regenerating natural vegetation, soil bunds, using traditional compost, manure making, mulching and micro basin (Cerda and Doerr, 2008; Shibru, 2010). Liniger and Critchley (2011) reviewed the best practices in sustainable land management in sub-Saharan Africa and described a case study on traditional water using system focusing on runoff and floodwater farming in Ethiopia.

Indigenous knowledge in natural resources management has played a vital role in ecosystem management for a generation in Ethiopia (Abebe *et al.,* 2011). It is highly associated with land management. Ethiopian farmers have been aware of the problems of soil degradation and they are traditionally conservation minded at the level of the farm (Brussel, 2009). In various places of the world, scientists and indigenous people are collaborating to build bridges between modern science and indigenous knowledge; among others, to improve ecological management of a particular region (Reijntjes, 2004). Policy makers and agricultural development planners are somewhat beginning to recognize the need to understand indigenous knowledge and have shown renewed interest on it (Warren and Rajasekaran, 1993).

To minimize severity of land degradation integrating indigenous knowledge into contemporary ecosystem management is taken as a step to overcome problems of global concern like climate change and unsustainable ecosystem services (Amede *et al.*, 2001; Mitiku *et al.,* 2006). Indigenous people have extensive knowledge in managing landscapes (Mathiui and Kariuki, 2007) with their own land management experiment that makes them more innovative (Reijntjes, 2004). These local innovations make indigenous practice to contribute for sustainable management of ecosystem and even carbon sequestration. The role of indigenous knowledge in pastoral areas for climate change adaption was described in GebreMichael and Kifle (2009). Other studies showed the role of indigenous knowledge in improving soil fertility, increasing crop yield and reducing erosion (Rist and Dahdouh-Guebas, 2006; Haileslassie *et al.*, 2006; Amede *et al.*, 2001; Nyssen, *et al.*, 2000; Assefa and Hans, 2014).

For a number of era, Guji community have long lasting conservation point of view for all natural resources categories as their perception is embraced in Gada system and part and parcel of the institution. In the Guji Oromo Gada system, sacred natural sites have special cultural recognition and implication which is deep-rooted in the life of the community (Gemeda, 2019). They preserve natural resources through customary laws and oral declaration as well as taboos. These may enhance conservation of soil resources as preserved sacred places prevent soil erosion and water run off where implemented well. According to Girma and Till (2012), Guji people believed that conservation has a link with their survival and the existence of natural resources in their environment.

However, a number of previous studies have pointed out that such schemes were unsuccessful and incompatible in prompting voluntary implementation of soil conservation practices among the smallholder farmers (Bizoza, 2014) due to the failure of conservation programs partly emerge from

the fact that planners and implementing agencies ignore or fail to consider socio-cultural factors and indigenous knowledge as key determinants of the success or failure of conservation programs (Miliyon and Belay, 2007). Therefore, the country still loses a tremendous amount of topsoil, and the threat of land degradation is broadening alarmingly (Eleni, 2008).

Sonneveld (2002) estimated that the loss of agricultural value of Ethiopia due to land degradation between 2000 and 2010 could be estimated at $US seven billion which is a huge sum in relation to current investments in sustainable land management. According to Mulugeta and karl (2010), water erosion is the most threatening and degradation processes in the world and accounts for 56% of the total degraded land surface of the world. Erosion reduces root depth, removes soil organic matter and nutrients and decreases water holding capacities of the soils.

An extensive work on indigenous knowledge in land management and in ecology shows there is poor record, lack of appreciation and less attention given by conservation experts and policy makers (Kruger *et al.,* 1996; Addis *et al.,* 2005). This is viable in many parts of Ethiopia (Rist and Dahdouh-Guebas, 2006; Mitiku *et al.,* 2006). However, most farmers in Ethiopia are aware of soil related problems and have attitude to conserve land at farm level.

In the study area, indigenous knowledge is threatened with less consideration and poor record over which the community participation is trivial. There is scarcity of structured information regarding indigenous knowledge of the specified community on natural resources management in general and on soil conservation in particular (except reports and limited brushers found at woreda offices). Locally acceptable and efficient practices in terms of implementation and cost effectiveness like indigenous knowledge of soil conservation in the study area has to be researched and linked or incorporated into existing scientific knowledge that can contribute to increasing self-sufficiency and mitigation of the rapidly changing natural environments. Structured information regarding the topic could be simply perpetuated to next generation without making gaps as that of oral transmission.

Therefore, the aim of this study was to assess farmers' indigenous knowledge on soil conservation in case of Karcha District; Southern Ethiopia. The spatial limitation that forced the researchers to focus on small area but very important component as soil resource is a base line for all things and indigenous practices is specifically to: 1) identify the indigenous knowledge type that farmers practice for soil conservation in the study area 2) assess challenges toward indigenous knowledge of farmers on soil

conservation and 3) explore perception of farmers on indigenous soil conservation that might be considered as baseline information for the study area.`

2. Materials and Methods

The study area: The study was conducted at Karcha District, specifically Galesa Dibisa, Lami kercha, Gurachu Jaldo, Baniko Guduba kebeles. Karcha District is located at about 471 km South of Addis Ababa, in the West Guji Zone of Oromia Regional State and approximately 40 km far from Zonal town (Bule Hora). Karcha District is bordered in North by Gedeb, West by Bule Hora, East by Birbirsa Kojowa, South by Melka Soda Districts. The District is geographically located between 06°10' N and 06°31' N, and 039°30' E and 039°45' E. Mean annual rainfall in the area actually varies from around 500-1800 mm and the annual temperature from 15^0C-32^0C (Karcha District Agricultural office, 2017; Mohammed and Jambo, 2015). Since it is one of the areas where agricultural activities have been practiced for a long period of time and population pressures were increasing, the status of forest cover has been minimized in the area.

The livelihoods of local communities of the study area are coffee, Inset, honeybee production, crops (both annual and Perennial), livestock production, timber and other non-timber forest products. It is one of the known districts in coffee production in the zone. A total of 237,909 human population and 49,564 households are inhabited in in Karcha District in 28 kebeles. Afaan Oromoo is dominantly spoken and Gedogna is next. Protestant, Orthodox, Waaqeffataa and Muslims are the religious followed by the communities in the area (Karcha District Agricultural office, 2017).

Study Design: The study district was purposely selected as is relatively well in soil conservation and has medium agro ecological condition (three climatic condition: highland, midland and lowland) as well as relatively close to collect data). The district consists of twenty eight kebeles. Stratified random sampling technique was used for the study considering soil conservation activities. The stratified random sampling is useful method for data collection if the population is heterogeneous (Singh *et al.*, 2014). In the study area, from the total existing kebeles, twelve kebeles were identified based on conservations intervention and use of indigenous knowledge on soil conservation using information from assistant at woreda level. From the identified kebeles, four of them were selected randomly as sampling site. In the identified sampling site, simple random sampling techniques were applied for respondents' selection. Ten respondents were intensively interviewed standing on their long experiences and position in the area, fifteen persons were selected for focus group discussion while

the rest were considered for close-ended questionnaire based on their residence and approval of their activity being farmers no matter how long they being on the activity.

Sample Size, and Sampling Techniques: The study adopted a sample size design of 10% of the total 3203 target households based on Mugenda and Mugenda (2003) and Kothari (1985) as a sample size can be selected between 10% and 30% of the total target populations (households). Based on this ground point of view out of total households 3203, the sample size that selected for this study was 320 individuals (households) based on the above assumption. In addition to these, the investigators selected 10 respondents for intensive interview (based on experiences and position) and fifteen respondents as a focus group discussion from each randomly selected kebele.

Method of Data Collection: Both primary and secondary data were collected to accomplish the objective of the study. Secondary data were collected from concerned offices, books, journals and reports. Primary data were collected from selected respondents in the study area through questionnaires, focus group discussions, field observation and intensive interviews with key informants. Questionnaires were used as a primary instrument to collect primary data from the selected samples households. Investigators prepared close-ended types of questioners for the sample respondents and it was completed by the help of assigned assistant data collectors in case of the respondents couldn't read and write. Since majority of the farmers in the study area speak Afaan Oromoo, the questionnaires initially prepared in English were translated to Afaan Oromoo. For Gedeofaa speakers, assistant data collector directly translated from English to Gedeofaa to grasp information from them. Key informants interview was conducted with ten experienced respondents to generate information on indigenous knowledge of soil conservation, measures to be taken in the problem solving strategies. Focus group discussion was held to gather information of indigenous knowledge sharing among elders, challenges and opportunities existing to their indigenous knowledge, mechanism to solve existing challenges and ways of participation by communities in all implementation of this indigenous knowledge in the study area.

Data Analysis: The collected data was analyzed using statistical package for social Sciences, version 20 (SPSS20). Based on the data gathered, descriptive statistical tools like frequency and percentage were used. The qualitative data collected during focus group discussion, intensive interview and personal observation were thematically analyzed and interconnected through description, narrating and interpreting.

3. Results and Discussion

This section presents the profile of the sampled households and the analyzed data on farmers' indigenous soil conservation practice. As already noted in the preceding section a questionnaire with 320 sample households was done. In addition to this, focus group discussion with fifteen individuals, intensive interview with ten respondents and field observation were carried out to address the objective of the study at all.

3.1. Famers' Perception towards Indigenous Soil Conservation in the Area

According to figure 1, respondents agreed that there is implementation of indigenous soil conservation (96.6%) in the area, but low promotion (41.6%) and capacity building (47.2%) respectively. On the other hand, majority of respondents (58.8%) assured that they may exercise their knowledge without any interference.

According to Shibru (2010), for a number of years, the communities of Ethiopia have been carrying out traditional soil conservation measures like: construction of terraces, reforestation, forestation of areas that have not been used for cultivation, inter cropping, controlling livestock population, regenerating natural vegetation, soil bunds, traditional compost, manure making, mulching and micro basin. There was no disagreement among all the respondents on the presence of soil conservation through their age in the study area. Farmers' attitude towards soil conservation measures considerably vary in relation with control over nature, knowledge about processes of soil erosion and consequent problems from the practices (Yeshambel, 2013).

As respondents' reflection, their attitudes towards soil conservation measures necessarily determined by the socio-economic acceptability and its sustainability implications. There were also reviews on traditional (indigenous knowledge) conservation measures by Reij (1991), bench terracing for chat (Catha edulis), Nyssen *et al.* (2000) on traditional technique "daget" in Tigray and indigenous fallowing in Wolyita Zone (Amede *et al.,* 2001). Role of indigenous knowledge in wet land management in South Western part of Ethiopia has been documented (Dixon, 2002). Soil conservation indigenously showed high significance in combating desertification in the study area.

In spite of the fact that farmers in the study area have a long history of soil conservation practices along with their indigenous knowledge, the record and promotion activities encountered so far were very low. The study by Desalegn (2001) revealed that, farmers in Ethiopia have a wide variety of indigenous land management techniques that they have been employing for generations though word

of mouth in which some of them are in danger of being lost. The respondents agreed that the decision they make on the practices and knowledge transmission is not enough to fully perpetuate to next generation. This agrees with review by Reij (1991) which shows the less attention given to indigenous soil and water conservation practices in many parts Ethiopia in spite of the fact farmers have good practices. It needs collaboration with scientific ideas that may enhance natural resources management in general.

In general, perceptions of the farmers towards indigenous knowledge practices of soil conservation in the study area were highly positive as they proud to have such types of practices. Even though every community of the world has its own mechanisms of natural resources conservation and management system, the existence of Gada system that has direct relation with natural resources conservation for the survival of human beings and nature conservation point of view was recognized as per respondents' reflections. This could be due to soil conservation has direct relations with other surrounding environment. Other studies showed the role of indigenous knowledge practices in improving soil fertility, increasing crop yield and reducing erosion is common (Haileslassie *et al.*, 2006; Amede *et al.*, 2001; Nyssen, *et al.*, 2000; Assefa and Hans, 2014). Integrating indigenous knowledge into contemporary ecosystem management is taken as a step to overcome problems of global concern like climate change and unsustainable ecosystem services (Mitiku *et al.,* 2006). Other authors also revealed that indigenous people have extensive knowledge in managing landscapes (Mathiui and Kariuki, 2007) with their own land management experimentation makes them more innovative (Reijntjes, 2004). These local innovations make indigenous practices contribute to sustainable management of ecosystem and even carbon sequestration.

3.2. Types of Indigenous Soil Conservation Practices in the Study Area

According to figure 2, commonly manure making and using it accounts (15.9%) and vegetation strips alone accounts (13.1%) in decreasing order as reflection by respondents. But from the given option soil burning accounts only 0.6%. The others important indigenous soil conservation practices were mixed cropping (11.3%), crop rotation (11.3%), crop residues (12.2%), mulching (12.8%), and terracing accounts (9.7%) according to respondents' reflection in the study area.

From their long experiences respondents assured that farmland continuously used fertilizers have less organic matter and hence gives poor production or yields in long run. In other way, the use of manure, local compost, crop rotation, mulching and terracing have more importance in terms of budget

consumption and production rate on farmland for future time. Soil conservation measures have been carried out in different parts of the country that have been recommended for minimizing soil loss by erosion (Cerda and Doerr, 2008). These measures are broadly grouped as physical, vegetative, and agronomic methods resulted from gradual learning process observation, experimentation, experience and wisdom (Krüger *et al.,* 1996).

Even though the practices showed variation among kebeles and individual respondents, the communities in the study area exercises them. Cover cropping and mulching are effective at reducing soil erosion by leaving a cover over the soil which reduces soil displacement; reduce the volume and velocity of runoff over the soil in the study area. According to Richard *et al., (*2014), the importance of mulch is to cover the top of the soil hence preventing it from direct sunshine and runoff. This tradition helps to retain soil moisture while increasing fertility after decomposition of the mulch, and protects the soil from erosion (Yeshambel, 2013).

Crop rotation is a tool that enables farmers to increase soil organic matter content, soil structure and rooting depth in the study area. This is accomplished by growing secondary crops which enhance soil health. Cross slope farming is also effective method to control large volumes of runoff that flow over a long field at the area. As respondents' reflection, due to scarcity of land there is less implementation of crop rotation. As study by Kajembe *et al.* (2003), the increasing pressure on land associated with population growth in many places made rotational cropping and/or fallowing generally not feasible. Conservation tillage is field operations aimed at preserving soil aggregates, organic matter and surface residue from previous crops which is practiced in the area.

Diversion terraces are shallow grassed ditches, with a berm on the downhill side, which are constructed across the slope to intercept surface runoff water moving down the field in many parts of the study area. Study by Alemayehu (1992) focus on role of traditional ditches in controlling soil erosion in increasing production. Assefa and Hans (2014) reviewed terracing practice in Ethiopia taking into account the geographic variation in Tigray, Shewa, Harerghe and Gamo Gofa region. The study shows significance of the indigenous terracing as key to survival in vulnerable areas of Konso in Southern Gamo Gofa.

Residue management is a facet of conservation tillage that is designed to leave crop residue on the soil surface to prevent erosion in the study area. But at the study area, there is scarcity of residues from crops since it is mainly used as a food for cattle. Buffer strips are vegetative areas that separate field

boundaries from watercourses. These buffer strips are effective at stabilizing stream banks with their extensive root system. The finding of this study shows the significance of the indigenous practice in combating desertification. Previous study at Gedio's agro-forestry system and konso's indigenous terrace building and innovative land use management practices in North Shewa Zone were well described (EPA, 2004).

The use of animal dung, ash and household trash to crop land that respondents revealed during focus group discussion is common practice to improve soil fertility in the study area. The overall improvement from these indigenous practices in reducing effect of drought, availing soil moisture and improving soil nutrient has role in ecosystem management and climate change adaptations. GebreMichael and Kifle (2009), Herweg (2002) concluded similar scenario.

Compost preparation is another practice in the study area which may play a role in enhancing soil organic matter as respondents' justified. Even though the way and the input they were using have variation, the communities of the study area use this practice accordingly. According to local community idea during intensive interview and focus group discussion, some of the production invalid from misunderstanding of its technical activity. They reason out that the compost they produced was damaged in some places because they hadn't properly manage the amount of raw material and duration of the preparation at all. Some of the respondents revealed that they work with experienced farmers to prepare productive compost to enhance its efficiency that showed their collaboration in soil resources conservation. Other congruent studies show that farmers use various soil conservation strategies including use of manure, soil bund, crop residue, crop rotation, terracing and cover crops (Amede *et al*, 2001; Haileselaee *et al*, 2006; Assefa and Hans, 2014).

3.3. Challenges towards Indigenous Soil Conservation in the Study Area

According to figure 4, the main challenges to soil conservation practices through indigenous knowledge in the study area are in appropriate planning (16.3%), lack of resources (14.7%), poor understanding about indigenous knowledge practices (14.4%) and distance and dispersal problem (14.1%). Similarly unclear accountability, poor information access and devolution of IK accounts 11.9%, 10.6% and 8.4% respectively. On the other hands, an unidentified community need accounts (9.7%) as explained as in figure.

In the study area, shortage of firewood leads to the utilization of straw and leaves for fuel that may reduce mulching and compost production. Depletion of organic matter and destruction of soil

aggregates lead to increase the rates of soil losses in cultivated areas. As previous study underlined, the resource deterioration cumulatively leads to environmental and land degradation (Antoci *et al.,* 2009) which is more or less in lined with our study. The respondents in some places also outlined that the devolution of indigenous knowledge by less experienced development agents to follow only what they bring as important. Distance and dispersal problems were also common in the study area based on the nature of landscape. Some of the farmers have low information access towards implementation of soil conservation, especially for short term soil nutrient rehabilitation through compost preparation and manure making as there was information gaps from farmer to farmer. The limited time to use the compost locally is not equally understood as this could be grasped from deep-experienced farmers through information sharing. During data collection, investigators observed many problems like over grazing, deforestation, and sand and stone extractions. According to Abebe *et al.* (2011) unsustainable and exploitative land use practice is due to an increasing demand by the growing human and livestock population that are responsible for accelerated soil erosion in many parts of Ethiopia. Resource deterioration cumulatively leads to environmental and land degradation (Antoci *et al.,* 2009). Globally, agricultural activities that make the land surface more susceptible to soil erosion account for 28% two billion hectares), overgrazing for 34% and deforestation for 29% of soil degradation (Tekalegni, 2011).

The information gathered from the study area revealed that the communities have traditionally better experiences regarding how resources are managed in general and soil problems in particular. However, there might be especial circumstances in that some of the community levels (some youth class) couldn't understand the effectiveness and important signature of soil problems due to low grasped experiences in farming activity. In line with this, they know when fertility of the soil is declined from different symptoms including low level of plant growth (dwarf), the color of the plants (becomes yellow), growth of unwanted herbs and shrubs than previously existed grass or crops and reduction in yield. Other study revealed that, farmers have a higher degree of perception and knowledge towards soil problems (Forch, 2003; Yeshambel, 2013).

When soil problems are shown on plants, they give response through identification of what deficiencies the crops are encountered (soil bund, construction of terraces, mulching, traditional ditches, crop rotation, and some application of organic material such as compost preparation and animal dung). Ethiopian farmers have long aware of soil erosion problems and devised techniques to halt soil (Reij *et al.* 1996; Herweg and Ludi, 1999; Nyssen *et al.*, 2000; Osman and Sauerborn, 2001; Besha 2003; Mitiku *et al.*, 2006).

Respondents in the study area reflected that their indigenous knowledge toward soil conservation is transmitted from generation to generation orally and practically. Field training by members of families, traditional meetings and ritual ceremonies are the ways. "When young boys are passed from boyhood to manhood in ritual ceremonies they are taught how to conserve the environment, how to handle wives and children; they have to learn from the previous knowledge". As other study raveled, old age indigenous soil conservation process developed from empirical knowledge and experience (Yeshambel, 2013).

According to 'Gadaa' system which better institution in study area, elders and knowledgeable persons have the responsibilities to aware their successor from different perspectives (self-protection in time of war, clarify Gada stage, power division and its ceremony, spiritually respected tree species and their importance, traditional medicinal trees, natural resources conservation techniques and important proverbs that gives morals in group works). According to (Dixon, 2002; Ajibade, 2003), indigenous knowledge is transferred from one generation to another through indigenous communication channels which in-line with us.

Shortage of stone for terracing and scarcity of seedling for agro forestry are some limitation in the surrounding community. Some farmers might not consider the long term benefits of such activities especially organic matter enhancement than inorganic one. As the study of Assefa and Hans (2014) revealed, despite their environmental compatibility and a socio-economic benefit, the indigenous knowledge is not without limitations. Most of the indigenous knowledge applications are based on approximations which are sometimes mainly affect farm lands some times.

3.4. Farmers' Knowledge of Soil Problems

The information gathered from the study area revealed that the communities have traditionally better experiences regarding how resources are managed and soil problems in particular. In-line with this, the respondents also underlined that how they know when fertility of the soil is declined. Some of the symptoms include growth of unwanted herbs and shrubs than previously existed grass or crops and reduction in yield, color change low level of plant growth (dwarf). Again according Forch (2003) farmers believed in rain drops impact on bare and steep gradient soils as the main causes for soil loss from their farm.

When these characteristics are shown on plants, they give response through identification of what deficiencies the crops are encountered. And thereafter according to their perception, they implement

some management mechanisms that can replace nutrient depleted from the soil. This could be implemented either in short and long term strategy of the farmers in the study area. In short run they could use organic material such as compost preparation and animal dung (manure) that might enhance nutrients as well as for long term (Soil bund, construction of terraces, mulching, traditional ditches, and crop rotation) are among justified options to recover from the problem. The finding of this study revealed with other study that Ethiopian farmers have a long aware of soil erosion problems and devised techniques to halt soil erosion and to conserve land resources, as part and parcel of agricultural systems. Hence, there is a wide range of soil management practices such as structural, agronomic, and biological measures as study by (Reij *et al.* 1996; Herweg and Ludi, 1999; Nyssen *et al.*, 2000; Osman and Sauerborn, 2001; Besha 2003; Mitiku *et al.*, 2006).

3.5. Farmers' Knowledge Transfer System on Soil Conservation

Respondents in the study area outlined that indigenous soil conservation practices were transmitted from generation to generation orally and practically on the field work. According to Samal *et al.* (2010) indigenous knowledge is unique knowledge developed over time and continues to develop by people in a given community or geographic area and transmit to next generation. As surrounding communities are in the center of Gada system, elders in the study area transmit their traditional knowledge to their youth through it.

In Gada philosophy, position holders (Abbaa Gadaa), elders and knowledgeable persons have the responsibilities to aware their successor from different perspectives including nature conservation and techniques to be practiced in co-existence with natures. It is considerable that everybody including youth should accept advice from knowledgeable and in this chain information it shall reach to the next generation. According to Dixon (2002), Indigenous Knowledge is transferred from one generation to another through indigenous communication channels and indigenous knowledge tends to be communicated through daily routine activities, storytelling, village meetings, drama and in many other ways. As of Ajibade (2003), Indigenous Knowledge information can also be extracted from traditional folktales from one generation to another in the form of stories, tales or proverbs. In the same way, according Wallace, (2007), information is passed on through generations and refined into a system of understanding of natural resources and relevant ecological processes on oral way.

Various methods of acquiring traditional knowledge and practices were mentioned by respondents during focus group discussion and intensive interview. Participants mentioned field training by

members of families or clans, traditional meetings, ritual ceremonies, government expertise like extension officers and forest agencies are among the methods used to acquire traditional knowledge and practices. This indicates that young boys are taught to handle the land resources during ritual ceremonies and Youth are ready to adopt any resources conservation activities in time of communities are working in group. Study by Kelbessa (2005), African indigenous traditions contain symbolic and ethical messages and are passed on next to ensure respect and compassion for parts of ecosystem. As other revealed, old age indigenous soil conservation process developed from empirical knowledge and experience of the individual and of the way in which these relations change through short and most extensive periods of time (Yeshambel, 2013).

However, the young generations spent most of their time in school with very limited touch to livelihoods in the rural setting, which make them to miss such training for large extent and sometimes undermine local and traditional one. Furthermore due to globalization and interactions among different communities traditional customs are no longer practiced some times, for example, ritual ceremonies in the area especially in urban centers do not exist any longer. As of respondents revealed during depth interviews, reinstatement of indigenous knowledge specifically through ritual ceremonies could be better way to transmit from one generation to the next. The tragedy of the impending disappearances of indigenous knowledge is most obvious to those who have developed it and make a living through it. But implications for others can be detrimental as well, when skills, technologies, artifacts, problem solving strategies and expertise are lost (Kelbesa, 2005).

3.6. Soil Conservation Practices Comparison with Other Study Area

When compared to other areas like konso community, tigrian people, Gedeo people and other respective site, the study area has similar deep rooted knowledge in indigenous soil conservation practices like agro forestry, inter cropping, manure making, mulching, vegetation stripping and mulching system. But in this study area rotational cropping/grazing is practiced in lower level based on the land availability as respondents. Terracing also applied in a lower manner when compared to other experienced areas like konso and tigrian people as investigators compared from existing literatures. Shibru (2010) revealed that for a number of years, communities of Ethiopia have been carrying out different types of traditional soil conservation measures even though its level showed variation from place to place.

4. Summary and Conclusion

Although indigenous knowledge have remained something of the past, they are locally rated as a superior means of dealing with natural resource management problems, especially in land management challenges. Throughout the discussion, the emphasis is on the necessity for development planners to take into account the indigenous skills of the people among whom they work with. Farmers in the study area have a wealth of knowledge about their land resources, its characteristics, limitations, potentials, and management options. The indigenous practices of conserving soil resources in the area are emanated from the worldview of Guji Oromo about culture–nature interconnection. Unlike western anthropocentric view that dichotomizes the nature and human culture as separate phenomena, Guji communities perceive that natural environment is in an integral part of their livelihood especially under Gada system. The Guji's mutualistic view about traditional practices and natural resources linkage is the source of origination and development of indigenous mechanisms of conserving natural resources in general and soil resources in particular.

As the preceding study of soil conservation shows, many practices were taken into account to the local culture conditions particularly society's preferences, skills, knowledge, cost effectiveness and feasibility. To ensure sustainable development in the long run, the government, nongovernmental institutions, and the communities in the locality should work in collaboration on strengthening and promotion of this important long lasting knowledge through integrating with scientific knowledge. Solving existing problem with locally available resources and socially acceptable practices enhance sustainable development of the society in general and in particular for the study area.

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6. References

Abebe Shiferaw, Hans, H., Getez Zeleke and Berhanu Debele, (2011). Indigenous Knowlage in Land Management for Sequestration and Soil Based Ecological Services in Damot Sore (Wolayta), Southern Ethiopia, A Report Submitted to international start secretariat. (Report No 3).

Addis, G., Urga, K., Dikasso, D., (2005). An Ethno botanical study of Edible Wild Plants in Some Selected Districts of Ethiopia, *Journal of Human Ecology,* Vol. 33, No 1, pp 83-118.

Ajibade, L.T., (2003). A Methodology for the Collection and Evaluation of Farmers' Indigenous Environmental Knowledge in Developing Countries, INDILINGA, *African Journal of Indigenous Knowledge System*, 2: 99- 113.

Aklilu, A. and D.J. Graff, (2006). Farmers' Views of Soil Erosion Problems and their Conservation Knowledge at Beressa Watershed, Central Highlands of Ethiopia, Environmental Management, Volume 23, pp. 99-108.

Alemayehu, M., (1992). The Effect of Traditional Ditches on Soil Erosion and Production. Soil Conservation Research Report. University of Bern, Switzerland and Ministry of Agriculture, Bern and Addis Ababa.

Amede, T., Belachew, T. and Geta, E., (2001). Reversing the degradation of arable land in the Ethiopian Highlands, Managing Africa's Soil No 23.

Antoci, A., Russu, P., Ticci E., (2009). Distributive impact of structural change: Does environmental degradation matter? Structural Change and Economic Dynamics.

Assefa, E. and Hans, R. (2014). Long-Term Indigenous Soil Conservation Technology in the Chencha Area, Southern Ethiopia: Origin, Characteristics, and Sustainability.

Berry, L., (2003). Land degradation in Ethiopia: its impact and extent in Berry L, Olson J. and Campbell D (ed): Assessing the extent, cost and impact of land degradation at the national level: findings and lessons learned from seven pilot case studies. Commissioned by global mechanism with support from the World Bank.

Besha, T., (2003). Understanding farmers: Explaining soil and water conservation in Konso, Wolaita and Wello, Ethiopia. Tropical Resource management papers, No. 41. Wageningen, Netherlands: Wageningen University.

Bewket, W. and Teferi, E., (2009). Assessment of soil erosion hazard and prioritization for treatment at the watershed level: case study in the Chemoga watershed, Blue Nile basin, Ethiopia, *Land Degrad. Dev.*, 20: 609–622.

Bizoza, A. R., (2014). Three-stage analysis of the adoption of soil and water conservation in the highlands of Rwanda, *Land Degrad. Dev.*, 25: 360–372.

Brussel, S.E.C., (2009). Adapting to climate changes: the challenge for European agriculture and rural areas. Commission of the European communities. Commission working staff working document accompanying the white paper No. 147.

Cerdà, A. and Doerr, S. H., (2008). The effect of ash and needle cover on surface runoff and erosion in the immediate post-fire period, Catena, 74: 256–263.

Desalegn Rahamato, (2001). "The Landscape of Development: A complex Reality." Keynote Address. In Food Security through Sustainable Land Use: Population, Environment and Rural Development Issues for Sustainable Livelihoods in Ethiopia.

Dixon, A. B., (2002). The Role of Indigenous Knowledge in: Wetland Management: Mechanisms of knowledge acquisition and development as a basis for sustainable use, University of Bern, Switzerland.

Eleni, T., (2008). Continued use of Soil and Water Conservation practices: a Case study in Tulla District, Ethiopia. Erosion and soil & water conservation group and Environmental Policy Group, Wegeningen University, The Netherlands.

EPA (Environmental protection Authority) (2004). *State of Environmental Report for Ethiopia*, Addis Ababa.

Forch, W., (2003). Case Study: The Agricultural System of the Konso in South Western Ethiopia FWU Water Resources Publications 2003:1.

GebreMichael, Y. and Kifle, M., (2009). Local Innovation in Climate-Change Adaptation by Ethiopian Pastoralists, Final Report submitted to PROLINNOVA-Ethiopia and Pastoralist Forum Ethiopia, Addis Ababa, Ethiopia. Available at www.prolinnova.net/.../climate change.../Ethiopia pastoral climate change pdf.

Gemeda Odo, (2019). Indigenous mechanisms of preserving sacred natural sites in Guji Oromo, Adoola Reedde and Anna Sorra districts, southern Ethiopia. *Cogent Food & Agriculture*, Vol. 5, pp.2-14. Research article.

Gete, Z., Menale, K., Pender, J. and Mahmud Y., (2006). Stakeholder Analysis for Sustainable Land Management (SLM) in Ethiopia: Assessment of Opportunities, Strategic Constraints, Information needs and Knowledge gap.

Girma Kelbero and Till, S., (2012). Contesting the National Park theorem? Governance and land use in Nech Sar National Park, Ethiopia. ZEF Working Paper Series, No. 104, University of Bonn, Center for Development Research (ZEF), Bonn.

Haile, G. W. and Fetene, M., (2012). Assessment of soil erosion hazard in Kilie catchment, East Shoa, Ethiopia, *Land Degrad. Dev*., 23, pp. 293–306.

Haileslassie, A., Priess J., Veldkamp E., Teketay D., Lesschen, J.P., (2006). Assessment of soil nutrient depletion and its spatial variability on smallholders' mixed farming systems in 25. Ethiopia using partial versus full nutrient balances, Agriculture Ecosystems and Environment.

Herweg, K., Ludi, E., (1999). The performance of soil and water conservation measures case studies from Ethiopia and Eritrea. Catena.

Herweg, K., (2002). Indigenous soil management, In; Encyclopedia of Soil Science Lal, R. (Ed.), Marcel Dekker, Inc, New York. pp 679-682.

Kajembe, G.C., Mwaipopo, S. and Kijazi, M., (2003). The Role of Traditional Institutions in the Conservation of Forest Resources in East Usambara, Tanzania. *International Journal of Sustainable Development and World Ecology*, **10**, 101-107.

Karcha District Agricultural Report (2017). Unpublished written report taken from office.

Kelbessa, W., (2005). The Rehabilitation of Indigenous Environmental Ethics in Africa, Diogenes, 52 (3): 17-34.

Kotheri., (1985). Sample size determination techniques.

Kruger, H. J., Berhanu, F., GebereMichael, Y. and Kejela, K., (1996). Inventory of indigenous soil and water conservation measures on selected sites in Ethiopian Highlands. Soil Conservation Research Report 34. Centre for Development and Environment (CDE), University of Bern, Switzerland.

Liniger, H.P. and Cahill, (2002). Categorization of SWC Technologies and Approaches- a global need? Proceedings of ISCO Conference (2002), Vol. III: Beijing.

Liniger, H.P. and Critchley, W., (2011). Where the land is greener: case studies and analysis of soil and water conservation initiatives worldwide, World Overview of Conservation Approaches and Technologies (WOCAT), Joint publication of CTA FAO, UNEP, CDE, 376 pp.

Mathiui, M., Kariuki, P., (2007). Cover Essay: Indigenous Eco health Practices in East Africa. Eco Health, 4, pp 536-538.

Million, T. and Belay, K., (2007). Factors influencing adoption of soil conservation measures in southern Ethiopia: The Case of Gununo Area. *Journal of Agriculture and Rural Development in the Tropics and Subtropics* 105(1): 49-62.

Mitiku, H., Herweg, K. and Stillhardt, B., (2006). Sustainable Land Management: A New Approach to Soil and Water Conservation in Ethiopia. Mekelle, Ethiopia. pp. 269.

MoARD., (2008). Sustainable Land Management Secretariat. Ethiopian strategic investment framework for sustainable land management. MoARD, Addis Ababa, Ethiopia. (Unpublished project document).

Mohammed, A., Jambo, A., (2015). Importance and Characterization of Coffee Berry Disease (*Colletotrichum kahawae*) in Borena and Guji Zones, Southern Ethiopia. *J Plant Pathol Microb* 6: 302. doi:10.4172/2157-7471.1000302.

Mugenda, O. and Mugenda, A., (2003). Research Methods: Quantitative and Qualitative Approaches. Nairobi, Kenya: Acts Press.

Mulugeta, D. and Karl, S., (2010). Assessment of integrated soil and water conservation measures on key soil properties in South Gonder, North-Western Highlands of Ethiopia.

Nyssen, J., Haile, M., Moeyersons, J., Poesen, J. and Deckers, J., (2000). Soil and water Conservation in Tigray (Northern Ethiopia): The traditional Technique and its integration with Introduced Techniques, Land Degradation and Development, 11: 199-208.

Osman, M., Sauerborn, P., (2001). Soil and water conservation in Ethiopia. Experiences and lessons. Journal of Soil and Sediments. 2:117–123.

Reij, C., (1991). Indigenous Soil and Water Conservation in Africa, Gate keeper Series No.27, pp35,IIED,London.http://www.iiav.nl/epublications/1991/indigenous_soil_and_water_conservation_in_africa.pdf.

Reij, C., Scoones, I., Toulmin, C., (1996). Sustaining the Soil: Indigenous Soil and Water Conservation in Africa. London: Earth scan. pp. 1–27.

Reijntjes, C., (2004). Bridging local knowledge and global science, COMPAS Magazine, pp 41-43.

Richard, Y. M., Christine, N., Felician, S.K., Godwin, N., Martin, M., (2014). Understanding of Traditional Knowledge and Indigenous Institutions on Sustainable Land Management in Kilimanjaro Region, Tanzania, *Open Journal of Soil Science.*

Rist, S. and Dahdouh-Guebas, F., (2006). Ethno sciences- a step towards the integration of scientific and indigenous forms of knowledge in the management of natural resources for the future, *Environment Development and Sustainability*, 8 , pp 467-493.

Samal, P.K, Dhyaani, P. P. and Dollo, M., (2010). Indigenous medicinal practices of Bhotia tribal community in Indian Central Himalaya, Indian Journal of Traditional Knowledge, 9(1): 140-144.

Shibru Tefera, (2010). Land Degradation and Farmers' Perception: The Case of Limo Woreda, Hadya Zone of Snnpr, Ethiopia.

Singh, Ajay, S. and Masuku, Micah, B., (2014). Sampling techniques & determination of sample size in applied statistics research: an overview, International Journal of Economics, Commerce and Management, Vol. II, United Kingdom.

Sonneveld, B. S., (2002). Land under pressure: The impact of water erosion on food production in Ethiopia. Available at: Wiley. Inter Science. www.interscience.wiley.com

Taddese Berisso, (1995). Deforestation and Environmental Degradation in Ethiopia: The Case Study of Jam Jam Province. In. Marcus, *et.al.* (eds). In North East Africa Studies. Volume 2, Number 2, pp.139-155. USA: Michigan State University Press.

Tekalegni, N., (2011). Farmers' Perception on the Role of Vetiver Grass in Soil and Water Conservation in South Western Ethiopia:-*The Case of Tulube Peasant Association; Metu District.2011.*

USAID., (2010). Amhara National Regional State food security research assessment report. Available at: http://crsps.org/amhara/amhara_rpt.pdf.

UNEP (United Nation Environmental Program) (1998). Protecting our planet –Securing our future. Linkages among global environmental issues and human needs.

Wallace, K.J., (2007). Classification of ecosystem services: Problems and solution. Biological Conservation.

Warren, D. M. and Rajasekaran, B., (1993). Putting Local Knowledge to Good Use, International Agricultural Development13; 8-10.

Yeshambel, M., (2013). Indigenous Knowledge Practices in Soil Conservation at Konso People, South western Ethiopia Journal of Agriculture and Environmental Sciences, Vol. 2.

Zemenfes, Ts., (1995). The Political Economy of Land Degradation in Ethiopia. Marcus *et.al.* (eds) In North East African Studies. Volume 2, Number 2, pp.71- 98. Michigan State University Press, USA.

7. Tables and Charts

Table 1: Land Use Profile of Karcha District, 2017

No	Land use type	Total hectare	Percent
1	Coffee land	30,698.5	43.3
2	Inset land	15,802.5	22.3
3	Crop land	3,450	4.9
4	Forest Land	578	0.8
5	Grazing Land	2,959	4.2
6	Wet land	2,500	3.5
7	Investment Land	11,926	16.8
8	Rocky areas	15	0.1
9	Others social services	2,931.1	4.1
Total		**70,860.10**	**100**

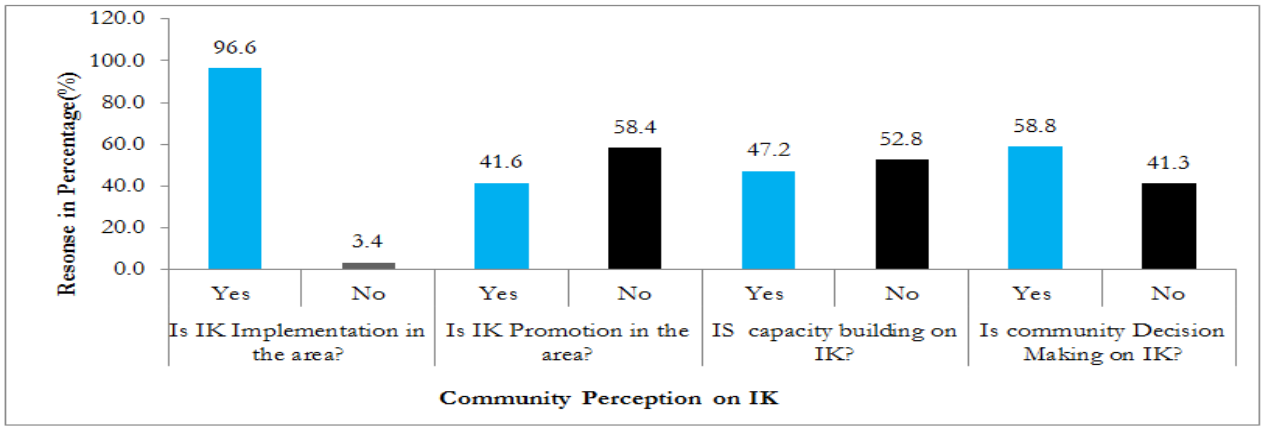

Figure 1: Community perception on indigenous knowledge of soil conservation in the study area (IK=indigenous Knowledge).

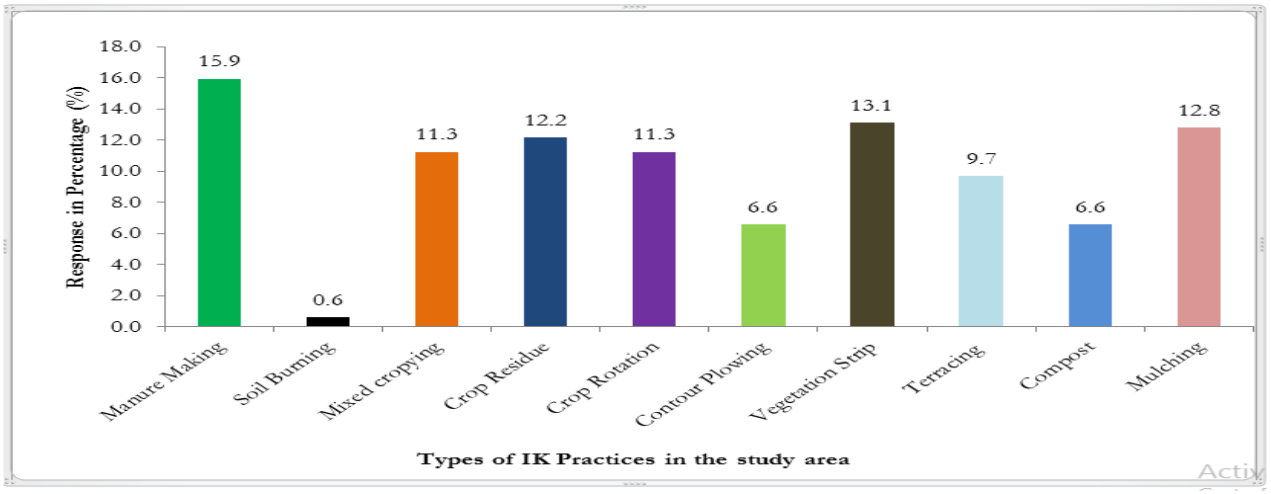

Figure 2: Indigenous soil conservation practices in the study area (IK=indigenous knowledge).

Animal Dung

Mulching and Agroforestry Practices

Coffee Fruit Residues

Enset Residues

Figure 3: Pictures represent types of indigenous soil conservation in the study area (2017).

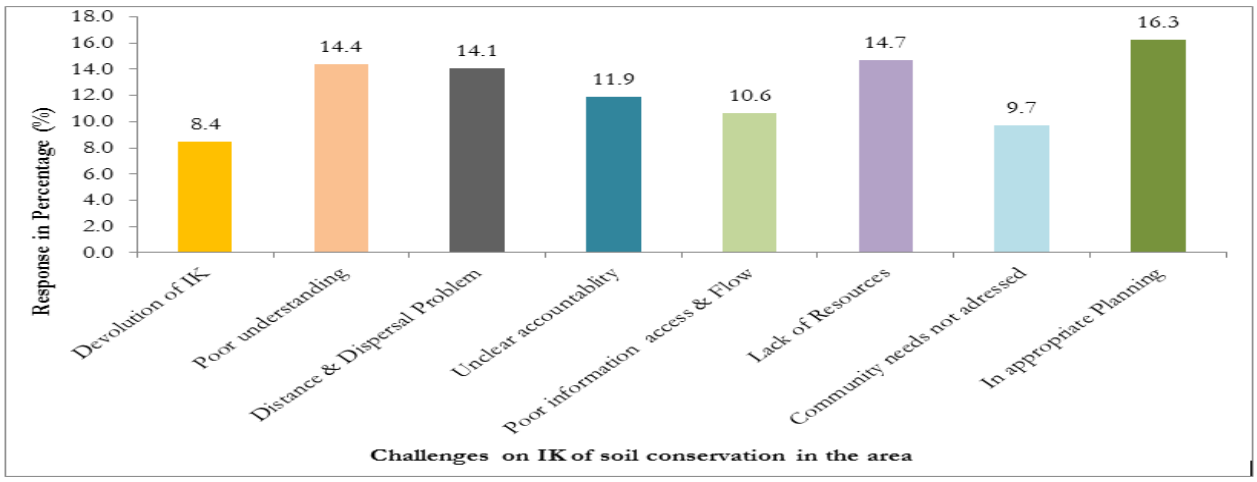

Figure 4: Some challenges that affect soil conservation practices in the study area, where IK= indigenous knowledge