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Perception and Adoption of Famers to Soil and Water Conservation Practices in Upper Turkwel Watershed in Kenya

A. K. Toromo, E. K. Ucakuwun and E. C. Kipkorir
University of Eldoret, P.O. Box 1125, Eldoret

Abstract

This study was carried out in Kapenguria area of Upper Turkwel Dam in West Pokot County with an objective of determining the factors that influence the perception and adoption of soil and water conservation practices by farmers in the area. A structured questionnaire was used to collect information on household head characteristic, land tenure, crop yield trends and adoption of conservation measures among others. The study used purposeful sampling such that areas selected included both highland and lowland farmers so as to reflect the entire watershed. Data was collected from 100 farmers using face-to-face interviews spread over 12 sub locations with 50% each from highland and lowland. The data was analyzed using SPSS Version 23 and description derived from tables accordingly. Based on the study 98% of the farmers recognized that soil and water conservation had the overall effect of increasing crop production and therefore good for sustainable development. The result showed that the majority (69%) of the farmers interviewed had used SWC structures on their farms but a few had stopped citing lack of funding and lack of technical knowhow among others. Majority of the farmers (77%) in the survey area acknowledged decreased crop production in especially the lowlands where steady decline in maize yield was observed from 2013 to 2016. The yield declined from 6.83(90kg bag of maize yield) in 2013 to 4.86 bags of maize per acre in 2016. Future conservation efforts should put in place measures to address the issues of lack of sustainability after project implementation. The study concludes that clear understanding of the benefits of SWC measures by farmers is a remedy that can assure conservation and sustainability once conservation projects were stopped. Based on the study, approaches that enhance farmer training, understanding and active involvement in soil and water conservation from project inception was necessary and not mere technical support from the development agencies if conservation sustainability was to be realized.

Keywords: Adoption, Perception, Soil and Water Conservation, Sustainability, Catchment Conservation, Soil Erosion

INTRODUCTION

Turkwel dam is located in the Kerio Valley Basin at latitude 1^0 55' N and longitude 35^0 20' E. A number of previous studies have pointed out that past conservation efforts have been unsuccessful and incompatible in prompting voluntary implementation of soil and water conservation practices among the small holder farmers (Bizoza, 2014; Ndah *et al*., 2015). The major causes could be land tenure systems, education/ experience (Erenstein, 2003) pressure on the land (Cerda & Doerr, 2005; Bolligeret *et al*., 2006), institutional control (Giller *et al*., 2009) economic incentives (Fan *et al*., 2004), political stability and social status (Ligonja & Shrestha, 2015) among others.

Poor land and water management practices coupled with lack of effective planning and implementation approaches to soil and

water conservation are responsible for negative environmental impact and major economic losses from decreased agricultural productivity especially in Arid and semi-arid lands (ASAL) areas and from off-site effects on infrastructures and water quality by sedimentation process (Yihenew *et al*., 2012; Pravat *et al*., 2015). Soil erosion creates several limitations to sustainable agricultural land use as it reduces soil productivity leading to food insecurity (Tegegne, 2014; Simeneh, 2015).

The severity rate of soil erosion varies from place to place. In Upper Turkwel topography of the land, inadequate soil water conservation practice, overgrazing and land use problem especially in view of communal land ownership which is still prevalent in some parts of the catchment are among the main factors which accelerates soil erosion. Farmers frequently do not adopt the newly introduced soil water conservation practices even when they were aware of the fact that the measures protect and improve productivity of the lands (Ebabu *et al*., 2019). Assessing the factors which affect the attitude of the farmers towards soil water conservation in Upper Turkwel was necessary in understanding the reasons why earlier conservation efforts by Governments, NGO's and parastatals failed to achieve continuity of conservation efforts once funding was stopped.

The problem of soil erosion in Kenya has been a major challenge since colonial times. Increased pressure on land especially on hilly slopes has resulted in soil losses in the highlands and medium altitudes (Tegegne, 2014; Tesfaye & Kasahun, 2015). Soil erosion in association with inappropriate land management practices is one of the main factors causing land degradation. To address this problem, considerable efforts have been made since 1920's by the government of Kenya to rehabilitate degraded environments and stop further degradation (Thomas *et al*., 2005). By these effort several areas have been covered with terraces and trees planted in many areas including in Upper Turkwel through the combined efforts of world Bank Funded project in the 1990's, VI Agroforestry Project, MOA Soil Conservation Extension service and KVDA -Upper Turkwel Catchment Conservation and Rehabilitation Project in the 2000 to 2010 using Integrated Ecosystem Approaches similar to those used in Ethiopia (Yeshambel, 2013; Tegegne, 2014). Various soil conservation practices applied by farmers on their own farm plots are critical components of natural resource management where the aim is to achieve acceptable sustainable agricultural ecosystem integrity (Tegegne, 2014; Tesfaye & Kasahun, 2015). Soil erosion problem is also aggravated by other factors such as topography, soil type and land cover and climate change among others.

The study objective was to determine farmers' perception and adoption of soil and water conservation practices in the Upper Turkwel Catchment in both lowland and highlands following past conservation efforts by development agencies with a view to establish sustainable development. The specific objective was to interview the particular farmers that benefited from past conservation efforts know their perception to soil and water conservation practice and determine the factors that influences their perception, adoption and sustainability of SWC measures in Upper Turkwel.

MATERIALS AND METHODS

A structured questionnaire was clearly discussed with the selected enumerators all of whom served as Field Assistance for Kerio Valley Development Authority (KVDA) during the Upper Turkwel Catchment Conservation and Rehabilitation Project implementation. The enumerators were earlier trained on laying out soil and water conservation and could identify the type of conservation structures with ease. The enumerators understood the local Pokot language for ease and effective communication during the administration of the questionnaire to the respondents. They were given training on how to approach and

fill out the questionnaire before they visited each household and interviewed the respondents in person. A total of 100 questionnaires were administered to 100 household heads spread over 12 sub locations selected on purposeful sampling based on locations, sub locations and villages; 50 in the highlands and 50 in the lowlands.

In this study information data collected included average land holding, major types of crops grown and history of SWC practices. Primary data such as socio-economic data, institutional support, types and effectiveness of SWC were also enquired using the questionnaires. The necessary socio-economic and environmental data were collected from respondents using an open ended and close ended questionnaire. Preliminary ideas and concepts for the survey were conceived from a literature review and the personal experiences of the researcher having worked in the area in the past. The questions could produce reliable and relevant data type and included number of animals kept by respondents, type of grazing systems during the wet and dry seasons. Perceptions and adoption of SWC measures and its importance to them for instance an enquiry on the years they had been practicing conservation was made.

Household characteristics such as age, sex and education status of the respondent, number of household members, socio-economic characteristics including main sources of income, area of cultivated land were established since these factors influenced farmer perception and adoption of conservation. Questions on Conservation measures practiced by farmers on their cultivated land and how they viewed their performance and constraints faced in implementation. Aspects of conservation sustainability were determined in the questionnaire such as continuity after project funding was stopped for those who received assistance from development agencies and since when MOA extension strategy changed to demand driven.

The quantitative data was analyzed using Statistical Package for Service Solutions (SPSS) version 23. A binary logistic regression model was used to analyze the relationship between the dichotomous dependent variable and the independent variables. It enabled the determination of the impact of multiple independent variables on the dependent variable. The results were then analyzed with respect to selected questions that ranged from household head characteristics, land management, current status of soil and water conservation measures and future sustainability of the conservation efforts in the area among others.

RESULTS AND DISCUSSIONS

All 100 questionnaires were responded to by the respondents from the highlands and the lowlands. The respondent's age category varied from 22-70 years with a mean of 41.92 years, with 75% indicating that they could read and write while 25% could not.

The literacy rate per regions indicated that more women were literate in the lowlands as opposed to those on highlands 18 (36%), 7 (14%) respectively this again being attributed to men being engaged in herding livestock in the lowlands and started the activity when they were young boys, the inverse was true for men indicating that more men were literate in the highlands than lowlands 43 (86%), 32 (64%) respectively a fact which could be attributed to nomadic pastoralism in the lowlands where most men/and boys migrate at certain periods of the year in search for pasture and would not therefore go to school.

The highest level of education acquired by the respondents showed that 24% had no formal education hence the 25% of the respondents who could not read and write, there were 47% accounting for almost half of the respondents who had attained Primary Education while minority 4% had college or University Education. The

respondents indicated that farming was done by 55% which indicates a majority followed by agro pastoralists at 38%. There were some business people and pastoralists 3% and 4% respectively. There was more mixed farming in lowlands 62% compared to 48% in the highlands while agro pastoralists were more in highlands at 50% and lowlands 26%. The family size ranged from 2-25 persons per household and a mean of 8 persons per household in the entire survey area.

Land Management

In the highland (86%) land is owned and managed by individuals while in the lowlands (44%) was owned by the community. Majority of the interviewed farmers (85%) acknowledged that it did not matter the type of land tenure since it did not influence their involvement is soil conservation activity but (15%) thought otherwise. More farmers (72%) generally agreed that they would use the farm throughout their lifetime while 20% said they would be leaving it fallow or constrained by the tenure system. The right to pass land to children as a form of inheritance was acknowledged by 82% while 17% could not pass it to their children. Some 23% respondents agreed that they could sell their land if granted access as reported while 72% said no and those that indicated difficulty to decide were 5%.

There were 38% agro pastoralists in both highlands and lowlands which are considered to have a negative impact on soil erosion and land use dynamics at the watershed scale. The main sources of feeds was grazing and free roaming of animals at 97% while 3% used crop residue. Shortage of animal feed was reported by 94% while 4% had sufficient feed which could be attributed to the frequent droughts. The activities that most farmers engaged on their farms were crop and livestock keeping (76%) with 21% of the farmers engaged only in crop farming while only 3% kept livestock only indicating that farmers in the highlands and lowland were generally involved in mixed farming as shown in Table 1.

Table 1: Land Management

Land Management	**Frequency**	**Percent**
Crop farming	21	21
Livestock farming	3	3
Crop and Livestock production	76	76
Total	**100**	**100**

The activities that most farmers engaged on their farms were farming (48%) and 62% in the highlands and lowlands respectively. With 2% of the farmers engaged in pastoral activities in the highland and 6% in the lowlands. More farmers were agro pastoralist in the highlands (50%) and in the lowlands (26%). This was attributed to the fact that many households in the lowlands moved their animals to wider areas for grazing and only maintained a few lactating animals in their homes for milk supply during droughts. Some 6% respondents in the lowlands were engaged in business activities while 94% were engaged in agricultural activities and yet the low altitude is more prone to land degradation as summarized in Figure 1.

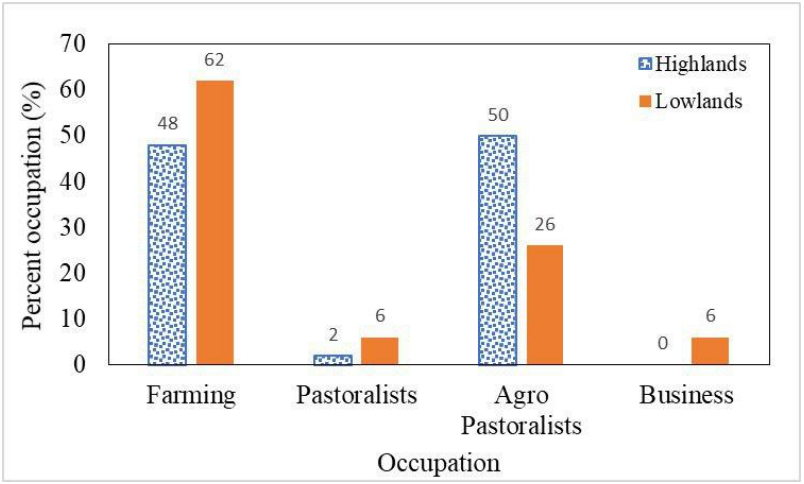

Figure 1: Occupation of Respondents.

The crop yield in the lowlands was indicated to be medium by 70% of the respondents and 19% indicated low production in lowlands and 11% indicating high production. Compared to production on slopes the production was indicated to be declining by 81% and increasing by 10% and only 9% reported no change. This could be attributed to excess erosion and leaching of nutrients on sloppy farms leading to more land degradation. The reason for declining production was mainly soil erosion as per 66% of the respondents and poor fertility by 17% of the respondents, 8% and 9% indicated soil filtration and poor rainfall respectively. Soil erosion was cited by 74% of the lowland respondents and 58% of the highland residents respectively as a major issue that led to declining production. In the highlands 30% of the respondents reported poor soil fertility while only 4% in the lowlands. This could be due to sedentary lifestyle and crop farming in the highlands compared to shifting cultivation which is still prevalent in the lowlands. In the highlands 30% reported soil dryings quickly after rains while only 12% reported the same in the lowlands. In a similar study in Ethiopia the highlands farmers reported that 56% of had built SWC structures on cultivated land and farmers in low potential areas acknowledged that soil erosion damages cultivated and grazing lands and was negatively affecting both crop and livestock production (Kaspar *et al*,2015)

Current Status Soil Erosion and Water Conservation

There was soil erosion reported in 88 % of the farms with 11% indicating no erosion. 70% of the respondents reported that there was medium erosion on their farms and 23% stated that there was high erosion and only 7% reported low erosion rates. The results indicate that erosion is widespread in farms throughout Upper Turkwel watershed affecting both highlands and lowlands as shown in Figure 2.

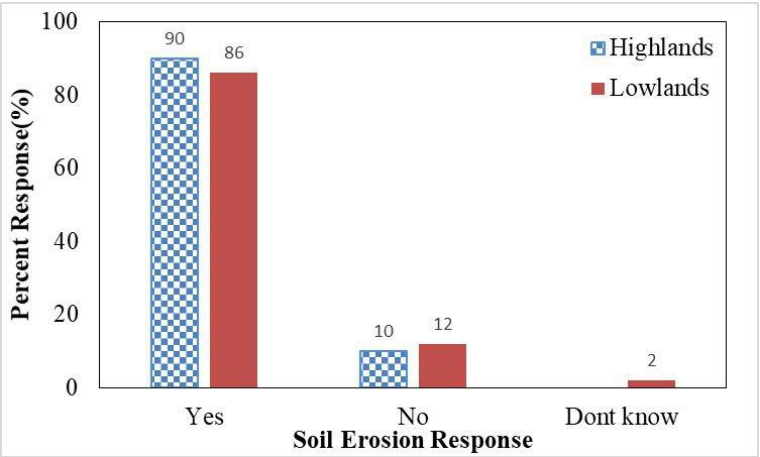

Figure 2: Soil Erosion on Farms.

The highest severity of erosion was reported by 32% and 14% of the respondents in the lowland and highland respectively. This was attributed to more overgrazing and consequent low vegetation cover in the low lands which led to more rain splash, overland flow erosion and consequently more river bank erosion. This further resulted in formation of excessively large gullies in many areas in the lowlands such as Mtembur, Kamaiyech, Karenger, Katikomor, Serewo and Kutung sub locations. 74% and 66% respondents in the highland and lowland respectively reported medium erosion and this could be attributed to the soil and water conservation measures put in place by the local community following the intensified extension service by government and development agencies in the last twenty years.

The respondents were asked to report on the impact of soil erosion on land and fertility impact and it was observed that 87% of the respondents described the impact as severe while 10% reported very severe and only 3% reported no much change. The causes of soil erosion was reported to be repeated ploughing by 34%, deforestation by 29%, steep slopes 23%, high amount of rainfall 12% and overgrazing 2%. The major cause cited by highland repondents was deforestation at 44% and repeated ploughing by 48%. A fact attributed to individual land tenure and arising sedentary farming and deforestation to expand area under arability in the highlands. Similar observations were reported elsewhere in a similar study (Karamage *et al*., 2016). Soil and water conservation was carried out by 75% of the respondents and 25%were not carrying out conservation measures on their farms. This was reported by 86% of highland respondents and 64% of Lowlands. Only 14% of the respondents in the highlands and 36% of Lowlands respectively acknowledged not carrying out conservation measures on their farms as shown in Table 2.

Table 2: Soil and Water Conservation

Region	Response	Frequency	%
Highlands	Yes	43	86
	No	7	14
Lowlands	Yes	32	64
	No	18	36

The high number of farmers practicing conservation was attributed to individual land tenure system and more sensitization on conservation by extension agencies in the highlands. However, the low conservation practice in the lowland is attributed to communal land ownership coupled with low extension services.

Similar observation was suggested by earlier studies elsewhere (Tenaw *et al*., 2009).

The most common technologies of SWC in both highland and lowlands were terracing and stone bunds with a means of (64%) and check dams (14%), strip cropping/ cover/ pasture was done by 9% and 13% did not respond as summarized in Figure 3. Similar studies found similar results and pointed out these measures as some of the useful conservation measures (Meshesha & Tripathi, 2016).

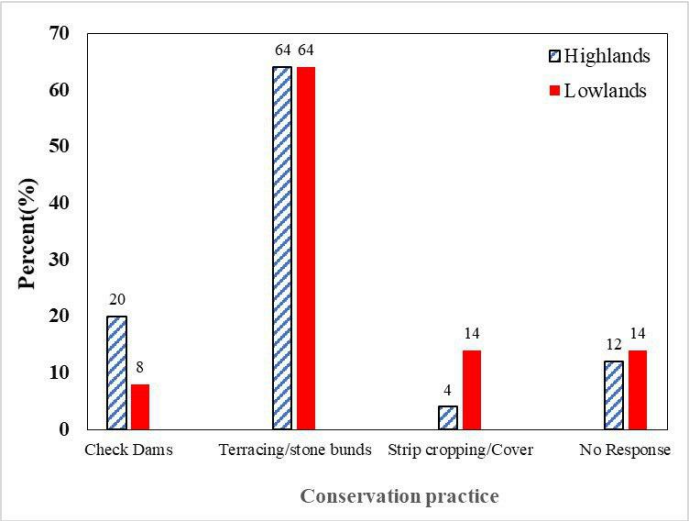

Figure 3: Soils and Water Conservation Practice.

There were varied reactions as to why SWC structure maintenance was not being carried out. Most farmers majorly pointed out lack of funds 13%, and lack of manpower by another 13%, no education/know how by another 11% of the respondents. Other reasons included land ownership and end of project funding like by KVDA, VI Agroforestry and Food for work programs.

The routine maintenance of conservation structures was done by 62% and 36% did routine maintenance of the SWC structures in the highlands and lowlands respectively as shown in Table 3. This could be due to variation in land tenure and availability of extension service in the highlands. The importance of routine maintenance of conservation structures has been highlighted by other studies (Mushir & Kedru, 2012).

Table 3: Routine Maintenance of Structures

Region		**Frequency**	**Percent**
Highlands	Yes	31	62.0
	No	19	38.0
	Total	50	100.0
Lowlands	Yes	18	36.0
	No	31	62.0
	No Response	1	2.0
	Total	49	98.0
Total		50	100.0

Some of the respondents were not using conservation measures while previously did. Some 69% of the respondents reported that they had SWC measures but were no longer maintaining them while 26% have never used them. The reasons for stoppage of using SWC measures varied and included project support ending cited by 32% and labour shortage by 26%, shortage of farmland by 7%, land is in steep sloppy areas by 7%, it harbored rodents 5%, environmental conflicts 2% and no benefits realized 1%.A Similar study in Ethiopia pointed out socioeconomic and bio physical problems as major reasons for farmers not maintaining and extending introduced soil and water technologies (De Graaff *et al.*, 2008).

On average financial constraints were cited by 41% of the respondents both from highlands and lowlands as the reason for not going on with conservation. Another 24% and 23% pointed out that they were not aware of the technologies and that conservation was expensive respectively. Another 4% cited too much labour as the reason for not continuing as shown in Figure 4. The above responses could be explained by declining extension service by both KVDA and MOA in the County and also the wrong precedence set earlier in the watershed by development partners using reward system in conservation efforts and top down approach with minimum farmer involvement which led to conservation stoppage upon project funding phase out.

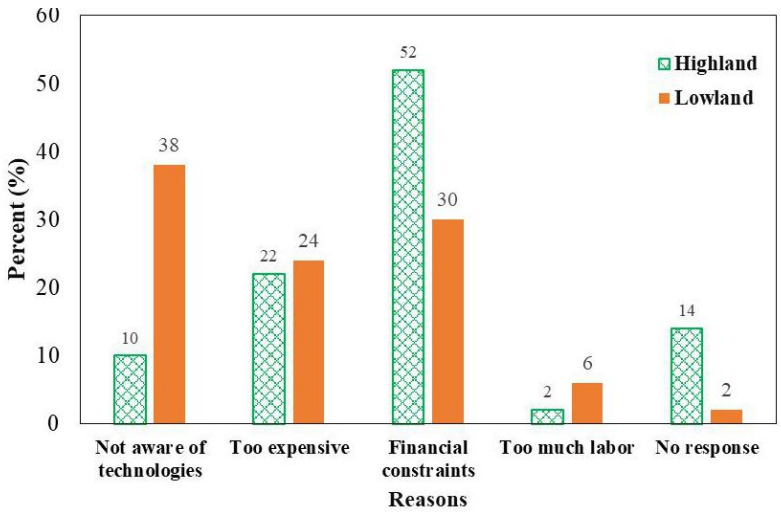

Figure 4: Reasons for not Using Soil/Water Conservation Measures.

Considering the highlands and the lowlands it was observed that 60.5% of the farmers discontinued conservation efforts owing to financial constraints while 38% of the lowland dwellers cited not being aware of the technologies as the main reason this could be due to the fact that more extension service coverage was done earlier in the highland than low lands and the fact that most of the highland dwellers relied on hired labour for their farm work rather that doing it themselves compared to the lowland farmers.

The SWC was deemed to harbor rodents by some farmers and the most notorious one was terracing (57%), check dams (25%) and cut-off drains 18%.The farmers gave the reasons for adopting SWC measures in their farms as to reduce erosion hazards by 43%, increase soil fertility by 37%, increase productivity of land by 18% and keep and pass land to future generation 2%. It was generally acknowledged by farmers (92%) that conservation increases production while 2% in the highlands (88.5%) reported that conservation increased production and in

lowlands 96% reported the same in the lowlands as shown in Figure 5. Similar studies by Mekuria *et al.* (2018) have suggested similar factors as influencing adoption of conservation measures.

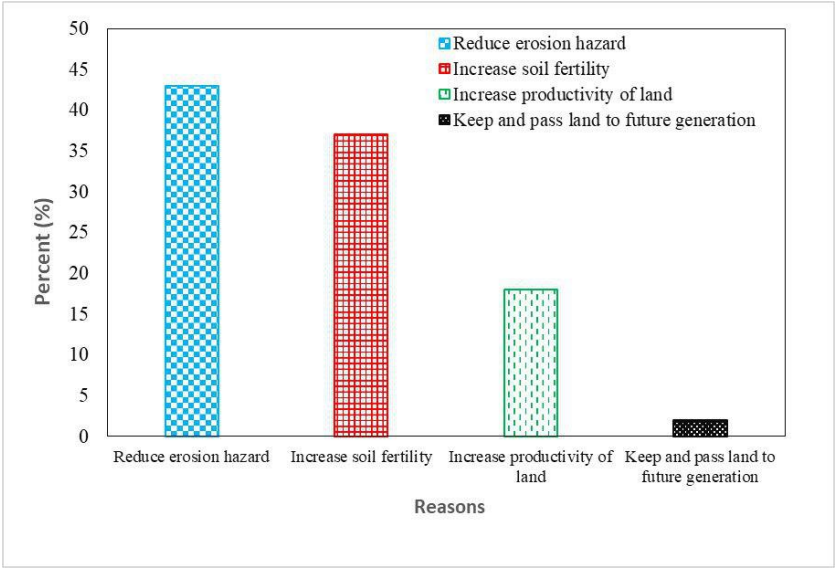

Figure 5: Reason for Adopting Soil and Water Conservation.

A Pearson correlation showed that soil conservation and crop production were directly proportional to regions area with high correlation of R^2=0.952, meaning that the greater the conservation effort the more the crop production sustainability.

There was clear evidence that the farmers in the highlands 98%) recognized that soil and water conservation had the overall effect of increasing crop production and therefore good for sustainable development. It was found that SWC measures had been done in the study area for an average of at least 14 years since 2003 and the earlier ones from the 1980's especially those reached by agricultural extension service in the highlands. Most of the farmers begun construction of conservation structures in 2007 (17%) and 2004 (10%) especially through the efforts of KVDA during the Upper Turkwel Catchment Conservation and Rehabilitation Project.

The cultural SWC being used was crop rotation (33%), contour farming 32% and tree planting (23%) and others cited grass strips. The lowlands practiced more crop rotation (42%) mainly due to the fact that land was not yet scarce compared to the highlands and shifting cultivation was still going on in the lowlands. Contour framing was practiced by 36%. The highlands adopted more tree planting (34%) and less grass strips (14%). This was mainly due to the introduction of subsidized tree seedling supplied by eight tree nurseries started by KVDA and the rigorous commercial forestry and agroforestry tree planting campaigns in schools and villages through public meetings (barazas).

The farmers were asked how they were striving to improve soil fertility and measures used varied including farm yard manure (57%), inorganic fertilizers (26%), compost (7%), improved seed variety (6%) and (3%) used for green manure. The use of farm yard manure was majorly used in the highlands by (72%) and in Lowlands (42.5%). The reduced use of manure in the lowlands could be attributed to the rich soil

transported and deposited on the fairly flat land from the slopes downhill due to erosion. The preferable means of maintaining soil fertility was seen to be physical soil/water conservation measures (47%) and government assistance (27%). On steep slope area, farmers (21%) apply manure and fertilizers whereas 4%acknowledged using indigenous knowledge to conserve soil and water.

The crop trends from the years 2013-2016 was investigated. In the past 10 years of farming, farmers (77%) reported decreased production while 15% aluded to increasing production in the farms and 7% stated that thre was no change. In the lowlands (80%) indicated more decreased production compared to 74% in the highlands and increased yield (22%) in the highlands. These were attributed to use of subsidized fertilizers in the highlands. The trend in the last four years showed that on the basis of 90kg bag per acre for maize crop yield a reduction in the lowlands from 2013-2016 was noted (6.83, 5.97, 5.24 and 4.86 which is a steady decline as in Figure 6.

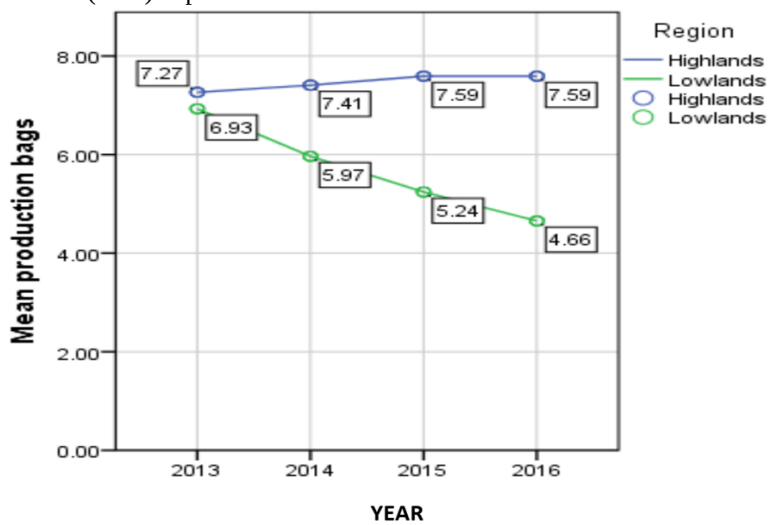

Figure 6: Maize Yield Trend in Turkwel Catchment.

This conforms to the findings in neighbouring Ethiopia that found that soil erosion creates several limitations to sustainable agricultural land use as it reduces on farm soil productivity and lower crop production leading to food insecurity (Tegegne, 2014; Simeneh, 2015). Lack of effective planning and management of soil and water conservation negatively impacted the plant environment and often lead to major economic losses especially in the ASAL area and from offsite effects on infrastructures and water quality by sedimentation process (Yihenew *et al*., 2012; Pravat *et al*., 2015). The production in highlands did not indicate such much increase from 7.27 bags in 2013 to 7.59 bags in 2016. This could be attributed to soil conservation in highlands and the use of subsidized fertilizers and manure as opposed to in the lowlands where less fertilizer was used. This is because the lowlands generally received less rainfall and depended on livestock more as a source of livelihood. Farmers perceived rainfall as a major threat to crop production in lowlands whereas in highlands rainfall was not a challenge.

The finding agrees with the research carried out by Egerton University based Tegemeo Institute whose studies showed a consistent growth in maize productivity across most agro-regional zones and pointed out key factors contributing to productivity growth in maize between 1997-2007 period, these factors included increased household use of

fertilizer, increased adoption of high-yielding seed varieties, and an increased density of fertilizer retail outlets leading to a decline in the distances to sellers of agricultural inputs. Fertilizer use dose rates on maize, however, remained fairly constant. Their further analysis revealed that some households especially in ASAL areas had declining yields attributed to risky and unprofitable use of inorganic fertilizers (Kibaara *et al*., 2008).

Most of the crop residue in the highlands is used as animal feed by 91% and conservation by only 4% and house construction by 3%. Crop residue in the lowlands is used by 2% for fuel wood while 86% use it as animal feed. This use of crop residue was highlighted by Duncan *et al*., (2016). The farmers who used crop residue reported that they faced shortage of animal feed 100% while 95.8% of grazing farmers reported shortage of feed to animals. Drought was the major challenge (71%), population pressure (18%), and common grazing field (6%) and livestock population (5%). All these factors aggravate vegetation degradation and lead to soil loss in the watershed. The shortage of grazing land (90%) was cited as a major threat and the only solution was to reduce livestock numbers (35%) while 26% agreed that increasing the grazing land was probable remedy compared to migration to other areas (22%) and controlled grazing (17%).

The animal dung was used as manure (91%) while fuel wood (4%) and no use (2%). The use of dung as fuel varied from regions with lowlands indicating 8% of usage while 2% used it in highlands. The animals holding capacity for the last 10 years indicates an overall decline at (83%) while increase by a mere (12%) and no change by (5%). This could be due to the reduced grazing land and more high milk production breeds being introduced in the area. This is true for highlands with 86% decline and 80% decline on lowlands and 12% increase for both lowlands and highlands. Use of cow dung at farm level had benefits to crop farming (Gebreegziabher, 2007).

The priority of animals causes of change in numbers per household was computed and seen that there was a general reduction but the major factors for reduction was found to be shortage of pasture for both lowland and highland farmers, diseases and pests also took a high priority and shortage of land with drought being the least concern for highlands but a major concern for lowland herders.

CONCLUSIONS

The study concludes that:

i. Crop farming was practiced by 55% of the respondents in the study area and 38% practiced agro pastoralism and this was expected to have negative impact on soil and land use dynamics if conservation was not practiced.

ii. Majority of the farmers (77%) in the survey area acknowledged decreased crop production in their farms especially in the lowlands where there was a steady decline from 2013 to 2016 from an average maize yield in the lowlands from 6.83 bags in 2013 to 4.86 bags of 90kg each per acre in 2016.

iii. Majority of farmers (97%) in the study area relied on grazing and free roaming of their animals and 94% reported shortage of pasture at certain times of the year which often left the ground bare and more prone to soil erosion especially at the onset of rains a fact which is responsible for the large areas of serious land degradation in the area.

iv. Individual land ownership (86%) was common in the highlands while in the lowland communal land ownership at (44%) was still more prevalent and led to lack of collaterals to access credit facilities and no serious attachment to land resource by the

farmers and explains why the low sustainability of conservation efforts in the lowlands.

v. Based on the study 98% of the farmers recognized that soil and water conservation had the overall effect of increasing crop production and therefore good for sustainable development a fact which supports the high awareness of conservation in the watershed.

vi. Some 69% of the respondents acknowledged having used SWC measures on their farms but have since stopped with 32% citing end of project support as the main reason for not continuing while 26% cited labour shortage. This could be an early sign of over dependency syndrome that arises in projects where monetary gains and reward systems are used in conservation as opposed to voluntary approach to conservation. This always led to laxity after project funding is stopped.

vii. A Pearson correlation showed that soil conservation and crop production were directly proportional to regions area with high correlation of R^2=0. 952.Meaning that the greater the conservation effort the more the crop production sustainability and therefore soil conservation was a major factor in future sustainable crop production in watersheds.

RECOMMENDATIONS

i. Conservation approaches should encourage farmers to do conservation on their farms so the aim should be increase sensitization on the gains of conservation rather than giving material or financial support to implement conservation or reward systems.

ii. Extension services need to be intensified in ASAL areas since many continue to state that they lack technical knowhow in conservation. These areas are not yet ready for demand driven extension service. More studies are needed so as to establish the best and most effective extension approaches to enhance sustainable development especially in the ASAL areas where demand driven extension still has challenges.

iii. Land Tenure systems should be revisited by government in especially ASAL areas with a view of converting to individual land holding with titles for the benefit of acquisition of credit facilities and more attachment by the farmers which is expected to enhance conservation efforts.

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