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TRADITIONAL LAND MANAGEMENT PRACTICES: THE ROLE OF FARMERS OF KAMBA WOREDA

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Abstract
This paper assesses the status of farmers' knowledge and their perceptions of land degradation and their knowledge of the existing soil and water conservation measures in Kamba woreda, Gamo-Gofa zone, Southern Ethiopia. The main source of livelihood in the study area is mixed subsistence agriculture. Field observations, focus group discussion, structured and semi-structured household surveys were carried out in five selected Kebeles, with 117 household heads. The results indicate that farmers were aware of the on-going land/soil degradation and of several erosion control measures and land management practices. However, land degradation resulted in reduced yields, soil change and soil erosion due to rill and gully formation often resulting in removal. Farmers preferred water diversion ditch, ridges and counter ploughing practices for soil and water conservation; chemical fertilizer, crop rotation and mixed cropping for soil fertility amendment while they did not recognize agro forestry and farm yard manure as a conservation and fertility amendment measure. Farmers faced several constraints in adopting SWC measures: decrease in farm size, its inconvenience during free movement of oxen plough, and multiplication of rats in the stone bunds. Any programme designed to address land degradation, especially soil degradation should consider those farmers criteria for adoption.

Key Words: *Conservation, Degradation, Farmer, Land, Management, Kamba*

Introduction

Land degradation is one of the world's major socio-economic and environmental problems, affecting one billion people in 110 countries worldwide and is prevalent across about 40 percent of the earth's surface (UNEP, 2000). The main causes for land degradation are complex and attributed to a combination of biophysical, social, economic and political factors (Omar *et al.,* 2013; Low, 2013; Gomiero, 2016). It is necessary to bring healthy, politically and economically motivated care for the land, as subsistence agriculture, poverty, and non-literacy can be important causes of land degradation

(Mitiku *et al*., 2006). Milas (1987) noted that African countries are caught up in a worsening spiral of expanding population size, diminishing reserves, intensifying under development and continuing global environmental degradation (Eswaran *et al*., 2001). Due to land degradation in most developing countries, in particular, agricultural productivity showed a dramatic decline (Reynolds and Stafford-Smith, 2002; D'Odorico and Ravi, 2016) and reached the level beyond the subsistence requirement of a household (Abalu, 2002); has declined (Lal, 1997, 2001, 2004, 2007, 2013, 2015); 50% due to soil erosion and desertification in Africa (Dregne, 1990).

More than 90% of Ethiopian population lives in the highlands with 93% cultivated land, 75% livestock and accounts over 90% of the country's economic activity (Belete *et al*., 1991; Bezu and Holden, 2014; Hawando, 2000; Bielli *et al*., 2001; Berry, 2003; Mesene, 2017). Land degradation is seriously threatening the economic and social development of the country as a whole (Hawando, 2000). The problem manifests itself in the form of soil (Teferi, 1999; Omar *et al*., 2013; Gashaw *et al*., 2014), water degradation and loss of biodiversity (Aklilu, 2006) which is a crucial challenge for the farmers (Alemneh, 2003) largely impeding socio-economic development (Ginjo, 2000). However, the factors like environmental and socio-economic and political effects involve a complex interplay of biophysical and anthropogenic factors acting at different spatial and temporal scales (Helmut *et al*., 2004). This situation is due to both internal and external pressures (Paulos, 2001), such as population growth and agricultural stagnation because of soil erosion and nutrient depletion (Ludi, 2000; Alemneh *et al*., 2002; Tan *et al*., 2008); natural resource degradation (Shibru and Lemma, 1998; EPA, 2001; Getachew and Demele, 2000); excessive deforestation (RCS, 2003). This may lead to overexploitation of soil resources, loss of ecosystem productivity, shifts in vegetation composition and loss of livelihood (D'Odorico and Ravi, 2016).

The objective of the study is to assess the farmers' knowledge and perception towards land degradation and to identify the use of traditional techniques and practices to mitigate land degradation.

Methodology

Study Area

The study area is located in Kamba *woreda* of Gamo Gofa zone, Southern Nation, Nationalities and People Region. The *woreda* constitutes 39 *Kebeles* (smallest unit of administration) of which 38 rural and 1 rural town *Kebele.* The *woreda* is commonly divided in to three major agro ecological zones (*Dega, woina-Dega and kola*). The people of Kamba *woreda* practice mixed agriculture and also practice crop production and livestock rising. Land and soil degradation, reoccurring drought, small farm plots, high population density and input shortage including draught animal and improved seed are the major agricultural problems of the *woreda*. Agricultural production problems are enhanced with poor delivery of research technology and extension support. Cash income for household financial requirements is mainly generated from sale of livestock and crop products.

Data Collection

Primary data were collected through administering structured and semi-structured questionnaire, interview, and formal and informal group discussions with elders, development agents, *Kebele* administrators and conducting field observation. Iinterview was conducted with village/ *Kebele* extension workers to gather information about the farmers` perception of land degradation, management practice and to check if there is communication gap between farmers and extension workers. The last level of theinterview was conducted with village extension workers. The interviews were intended to gather information about the type of soil conservation and fertility practice, farming practices, extent of using inputs such as fertilizers, improved seeds, and the type of extension services rendered.

A systematic random sampling procedure in selecting the farmer's household heads to be surveyed was adopted. The basic sampling unit in this study was the farmers' household who derive their livelihood largely from agricultural activities. Out of the total *Kebeles*, five *Kebeles* were selected purposely with the help of *woreda* agricultural officers who have extensive experience and knowledge of the study area. These *Kebeles* were selected because they are relatively considered more degraded than the rest of KPA'S. Thus, five percent of the target population, i.e. head of farm households were selected from of the five KPA's.

Data Analysis

The data thus collected was interpreted using descriptive statistics; frequencies and mean are presented in tables to enable easy interpretation and quick visual comparisons of variables within the study area. The data is summarized, categorized and coded for all the qualitative responses into numeric values and then entered them into SPSS software, so as to analyze the quantitative data for various parameters.

Results and Discussion

The total population of the sampled households is 893 drawn from Belta Beke, Lagefu, Mero Shile, Shamal and Dombe Salle villages. The male population (465) exceeds in number than that of the female population (428) giving a sex ratio of 92%. The mean household size is 7.63 persons.

A large number of children (49%) when compared to adults indicate growing demand for land in future and the pressure on land resource may become much more severe given the limited arable land and shortage of employment opportunity in other sectors. The age dependency ratio is 118.8%, which is composed of 105.76% young-age dependency and 3% old-age ratio (Table 1).

Table 1: Age-sex composition of the sample households by age and sex

Vill	Belta Beke			Lagefu			Mero Shile			Shamala			Dombe Salle		
Sex	Age Group			Age Group			Age Group			Age Group			Age Group		
	0-14	I5-64	≥65	0-14	15-65	≥65	0-14	15-64	≥65	0-14	14-64	≥65	0-14	14-64	≥65
M	45	44	3	55	61	3	42	41		39	44	1	46	40	5
F	42	37	2	50	57	2	39	37	2	37	38	2	42	31	4
T	87	81	5	105	118	5	81	78	4	76	82	3	88	71	9

Vill-Village; M-Male; F-Female; T-Total

Such high age-dependency ratio places a considerable burden on producers. Land availability often influences farming practice, and affects the land degradation process. Most of the agricultural land in the study area has so far been subdivided to the smallest land holdings that are no longer economically viable for smallholders' subsistence. Farmers in the study area cannot expand land holdings because the frontier is limited and the availability of arable land has shrunk dramatically from 0.4 to 0.2 hectare per capita over the past 30 years (CSA, 2005).

Sample farmers' responses also revealed the existing land shortage. Out of 117 total interviewed farmers, 86.2 percent of households reported that their present landholdings are too small compared to the land needs of the household and they are not in a position to inherit land to their children. However, multigenerational households, with married children living with parents until their death, have become more common as household land holdings have decreased. Over 90% of sampled households have less than 1.0 hectare of land; the mean landholding is 0.79 ha and the mean house hold size is 7.63 (Table 2).

Table 2: Family Size, Education and Landholding details

Characteristics		Mean	SD
Family Size		7.63	0.238
Male household members		3.97	1.70
Female household members		3.66	1.40
EA household members		3.64	1.50
ED house hold members		4.31	1.88
Land holding(ha)		2.02	0.643
Oxen(heads)		1.32	0.956
Other cattle (heads)		3.61	1.25
Goats and sheep (heads)		2.41	3.54
Chicken (heads)		1.89	0.4
Donkey, mule and horse (heads)		0.98	1.09
Formal education	Percent		
None	35	-	-
1-3 years	19	-	-
4-6 years	18	-	-
≥6years	28	-	-

EA = Economically Active = Family member > 15 and < 65 years old.
ED = Economically Dependent = Family member < 15 and > 65 years old.

Out of interviewed farmers, 74.9% reported that fodder shortage is currently the biggest obstacle to rear livestock. A similar report was covered in the field of agriculture by Jitendra (2017) that potentially cripples rural economy. In the kiremt (summer) season, the livestock are dependent on heavily degraded (overgrazed) communal lands and on some crop residues collected in bega (winter) season. In the bega (winter) season, crop residues are the main fodder. There is also a serious shortage of on farm grazing land. For example, 72% of sampled households reported that grazing areas on their farm was decreasing. 52.8%

of the respondents reported that the grazing land was needed for increased crop production, 16.3% reported a combination of expanding crop production and tree planting, and 2.9% needed more land for their house.

It is reported that many households are increasing the proportion of cultivated land planted with food crops at the expense of on-farm grazing land to address the food insufficiency due to increasing family size that many households are currently facing. The increase in stocking rates over time has very detrimental effects on grazing lands and crop lands, given that of the decrease in the size of communal grazing areas and on-farm grazing land, and lack of intensive methods of fodder production.

This research revealed that 71% of farmers experienced soil erosion on their fields in spite of the existing SWC structures on most of their farms. A significant farmer's experience and perceptions of soil erosion were discussed in the central highlands of Kenya (Graaff, 1993; Okoba and Graff, 2005), in Southern Ethiopia (Mekonnen and G/Michael, 2014), in Sebeta of Oromia (Kediro, 2015). Farmers were aware of soil erosion processes, which they defined it as "carrying away of soil or removal of top-soil by water or loss of soil triggered by human activities". Farmers' perceived reasons for continued soil erosion processes were listed and scored.

Table 3: Farmers' awareness of the existence of soil erosion on their land

Kebeles	Yes (%)	No (%)
Belta Beke	83.2	16.8
Lagefu	85.3	14.7
Mero Shile	75.9	24.1
Shamala	73.5	26.5
Dombe Sale	90.8	9.2

The highest number of farmers (Table 3) reported an awareness of soil erosion on their fields was in Dombe Salle (90.8%), followed by Lagefu (85.3%), Belta Beke (83.2%), Mero Shile (75.9%) and Shamala (73.5). The linear erosion features such as rills and gullies are denser in all Kebeles. Most of the natural drainage ways are actively eroding and topography is broadly different in rainfall and soil type. Belta Beke is the highest elevated area with reddish colored soil, as result, intensity of rainfall and soil erodibility is high which is found to be relatively low in other Kebeles.

Majority of the farmers mentioned as high rainfall (96%) and steep slopes (80%) are the major causes to soil erosion and lack SWC structures design (25%). However, relatively few farmers observed root exposure and exposed underground rocks, and appearance of gravels in large proportion on crop lands was only acknowledged as indicators in Belta Beke. Despite the variation in observing erosion indicators, most farmers associated their development with high rainfall (28-64%), runoff (20-62%) and steep slopes (8-25%) (Table 4). These findings confirm that farmers are aware of the fact that erosion is damaging their fields. The farmers' perceptions are in some way in agreement with Sierra Leone farmers who associated the erosion problem on their land with high rainfall, steep slopes and lack of vegetation (Morgan, 1996; Nyssen et al., 2005; Mituku *et al*., 2006; Lakew et al., 2005; Negash and Mulualem, 2015). This brings about an idea of farmer's perception on soil erosion is learned through practice. This feature is identified as a key social factor that enables them to identify to control the losses (Graff, 1993).

Table 4: Percentage distribution of the observed Erosion Indicators and Causes

Erosion Indicators	Respondents *(N= 117)	%	Perceived causes (%)							
			Rain fall	%	Run of	%	Steep slopes	%	Others	%
Rills	80	68	29	25	20	17	16	14	6	5
Sheet wash	117	100	64	55	37	32	25	21	7	6
Gullies	63	54	41	35	26	22	19	16	4	3
Root exposure	27	23	32	27	59	50	15	13	5	4
Exposed underground rocks	32	27	48	41	45	38	8	7	16	14
Appearance of gravel / stoniness	7	6	28	24	62	53	21	18	4	3

It was learned during informal discussions, splash erosion is abstract process to the majority of the respondents. Out of the total of 117 farmers interviewed, more than 72 % opined that livestock do not contribute to land degradation. The remaining 14% believe that livestock contributes to soil erosion. In fact, they believe that livestock contributes to improve the land fertility. This implies that destocking will be a difficult strategy to embark on for land management purposes. Deforestation as cause of erosion was mentioned by only 4% of the respondents. The farmers' perception contradicts with the scientific knowledge which acknowledges that livestock exceeding the carrying capacity of grazing areas and deforestation are major causes of soil erosion.

To gain further insight in farmers' knowledge of land productivity and how it is affected by erosion, farmers were interrogated on what criteria they used to determine good soils. Farmers identified three land suitability criteria i.e. soil erosion status, level of soil fertility and crop yield/ production potential. In the study area most field holdings tended to stretch from the very steep hill slope to gentle slope segments. Therefore, farmers were in a position to express their perceptions for each slope position.

Results indicated that farmers recognize that the rate of soil loss and level of soil fertility are related, which consequently determined the crop yield potential on any landscape positions (Table 5). Majority of farmers indicated that steep and very steep slopes are landscape segments with high risk (4%) of soil erosion and low levels (88%) of soil fertility resulting in low crop yields. Gentle slopes were clearly ranked with fairly moderate (87%) yield potential. The farmers' description is in agreement with the effects of slope steepness on land productivity (Lal, 1994; Morgan, 1996), with farmers' observation (Rockstöm et al., 1999). The farmers' learned skills also coincide with the work of farmers in Rwanda who associated soil suitability with slope gradient (Steiner (1998). Steeper slopes generally had shallower soils whereas on plateau and foot slopes fine textured soils dominated, implying soils of high fertility.

Table 5: Perceived scores on different land suitability criteria by slope gradient (N=117)

Slope gradient	Land suitability criteria								
	Soil fertility rate (%)			Soil fertility (%)			Potential crop yield (%)		
	low	moderate	high	low	moderate	high	low	moderate	high
Very steep	88	5	4	92	8	2	93	15	6
Steep	87	13	2	84	7	1	85	20	7
Gentle	8	14	78	5	81	12	3	87	16

Farmers in the study area reported practicing some type of soil conservation measures (Table 6). In the study areas the soil management and soil conservation measures practiced like traditional terracing, traditional ditches, mulching, and stone bund when there is excess stone and high runoff are common.

In these areas, traditional ditches are widely used by farmers on cultivated land. These ditches are constructed during every ploughing season and run diagonally across the slope of cultivated land. These measures, however, are not enough to control land degradation in the form of soil erosion.

Table 6: Types of soil erosion control measures being practiced

Types of measures	Belta Soke	Lagefu	MeroShile	Shamala	Dombe Salle
Water diversion ditch	100	100	98	95	100
Ridges	100	100	94	100	97
Contour ploughing	82	75	78	83	86
Check dams	71	79	80	68	74
Terracing	14.2	20	32	15	18.5
Bunding	12.22	10	21	14.7	15
Tree planting	8	11.13	16	19	24

Based on the slope and the availability of stone, a combination of stone and soil bund, and hillside terrace were constructed. The results indicate that water diversion ditch (95-100%), ridges (94-100%) and contour ploughing (75-86%) were the most widely used traditional soil and water conservation measures. A significant proportion of farmers (71-80%) constructed check dams to refill and prevent further development of rills and gullies near their farm boundaries. Despite their wide fame, terracing and soil bunds were only adopted by a small percentage (21-32%) of the sample farmers. Least recognized as a SWC measure was the woodlot practices. This clearly states the importance of adoption of soil conservation methods (Lapar and Pandey, 1999).

Water diversion ditch, ridges and contour ploughing are relatively less labour intensive short-term SWC practices. This could explain the high adoption rate. Studies have shown that these measures are short-term water management practices to improve crop productivity rather than ways of keeping soil in place (Troeh et al., 1980; Young, 1997; Herweg and Ludi, 1999; IFAD, 2007; Schwab *et al*., 2002; Tenge *et al*., 2004, 2005; Gibremichael *et al*., 2005; Vancampenhout *et al*., 2006; Welle *et al*., 2006; Tesfaye, 2008; Girmay *et al*., 2009; Zougmore *et al*., 2009; Teshome *et al*., 2013; Mekuriaw *et al*., 2018). Interestingly, despite the observed, trees planted in the farm boundaries of most farmers in the research area, the results indicate that the contribution of trees to SWC was not recognized by farmers. Tree planting has always been promoted foremost as a source of construction timber and fuel-wood but not for soil erosion control, given that their dominant niches are on farm boundaries.

Conclusion

Land availability often influences farming practices, and hence affects the land degradation process. The farmers cultivated all their land with no room for expansion except in marginal areas. Sloppy lands which used to be grazing areas or tree plots became under cultivation. Other alternatives which can reduce the pressure on land and provide livelihood for farmers such as non-farm employment were not present.

They are knowledgeable of the water erosion processes and the consequent on-site erosion impacts. They have clear understanding of various forms of erosion indicators spread over the landscape and which adversely affect their soils. Rill and gully were most often mentioned indicators, followed by sheet wash (runoff flow paths), root exposure and appearance of gravels in large proportion on crop lands. They attributed the formation of these indicators to factors such as high rainfall, runoff from upslope fields, steep slopes and poorly designed or ineffective SWC measures, which they find themselves incapable to change. They however, did not see any linkage between the on-going erosion with overstocking, poor soil-cover and the excessive tillage practices.

Farmers understand the effects of erosion on crop productivity. They attributed soil fertility levels and crop yield potential to slope position. Fields on flat and gentle slopes were perceived to have highest potential for crop production. Fields on steep and very steep slopes were perceived to be eroded hence the likelihood of not realizing high crop yields.

Limited arable land and rapid population growth have increased pressure on the forest and grazing land resources besides aggravating soil degradation via extended farming into steep and marginal areas, shortened fallow system, tilling more frequently and unchecked depletion of the inherent soil nutrients. As a result of such land clearing activities, which usually involve deforestation and burning of vegetative covers from steep lands, more and more land and sometimes even a whole catchment is exposed to excessive erosion and land degradation. Such chain reactions of soil degradation leads to complete dry out of springs, desertification, etc., which finally make the environment of an area uninhabitable ending up in famine and population migration unless accompanied by integrated soil fertility management and diversified livelihood systems which reduce the pressure on land.

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