

Perception of Pastoralist Towards Soil and Water Conservation Practice in Pastoralist Dry Land Area: The Case of Borena Southern Ethiopia

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Abstract

Land degradation, caused by soil erosion and deforestation, presents an obstacle on agriculture hence threatening the rural livelihoods in the country. Soil erosion is a global environmental and economic problem causing loss of fertile top soil and reducing the productive capacity of the land there-by putting at risk global food security. One of the factors causing soil erosion is highly intensity of rain fall and sloppy reliefs. The main objective of this study was to Perception of pastoralist towards soil and water conservation practice in Pastoralist Dry Land Area and specific objective was to assess the causes and consequence of soil erosion , To assess the biological soil water conservation measures ,to assess the pastoralist perception on different soil and water conservation measures and there effects. This study was under taken in pastoral districts of borana zone, more focus on dubuluk, Dhas, Dillo, and Yabello districts of the Borana zone of Oromia Regional State. Sources of Data collection Discussions and interviews with experts of zonal and Woreda office agriculture and NGOs working in the area as well as key informants from Borana pastoralists were held on the study research questions. to achieve the objectives of the research, a multi-stage sampling technique was employed. Multi-stage sampling is a sampling technique in which large groups are further sub-divided into smaller, to get more targeted groups for the purpose of surveying. Sampling technique to achieve the objectives of the research, a multi-stage sampling technique was employed. From results and discussion Soil erosion is the process of degrading soil structure and removing the soil resources from the surface of the land. Therefore to conclude this study preventing soil erosion considering the community participation that's their livelihoods depends on them will lead to sustainable development results. Recommendation the planning, designing and implementation process of activates should insure pastoralist participation and make use exciting local knowledge.

Keywords: soil erosion; Soil and water conservation; deforestation; overgrazing.

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1. Introduction

1.1. Background

Land degradation, caused by soil erosion and deforestation, presents an obstacle on agriculture hence threatening the rural livelihoods in the country. Bliake as cited in [6]. Valetin and Bresson as quoted by [26] indicate that soil sealing and crusting, as well as resulting reduced infiltration capacity and sparse vegetation cover, lead to increased overland flow and even higher erosion rates.

Soil erosion is a physical process of soil degradation and the most widespread form of land degradation Lal as quoted by [3]. Soil erosion is a complex process that involves soil properties, ground slope, vegetation rainfall and intensity [22]. Soil erosion therefore impacts agricultural production negatively by depleting nutrients needed for plant growth [18]. reports that in tropical regions where many soils have inherent low fertility that is concentrated in the top soil, loss of top soil by soil erosion results in a serious reduction in soil chemical fertility.

The intense and increased pressure on land leads to its degradation and pollution, in particular, resulting in a complete loss of its productive capacity [22]. Land degradation is the reduction in capacity of the land to produce benefits from land use that falls under a specified form of land management (Blaikie & Brookfield as quoted by Muchena and his colleagues 2004:23); Blaike & Brookfield as quoted by Haile [17,27,2]. Soil erosion is a global environmental and economic problem causing loss of fertile top soil and reducing the productive capacity of the land there-by putting at risk global food security. It also impacts negatively on the natural water storage capacity of catchments areas service of man-made reservoirs and dams, quality of surface water, aesthetic landscape beauty and ecological balance in general (Lal as quoted by [7] Between 30% and 50% of the World's arable land has been significantly affected by soil loss (Pimentel as quoted by [13].

Soil is an important resource, which needs much attention in its use and management. It is nourishes and provides with required the need for the whole of the nature. In many rural areas of the developing countries, land resource including soil, forest and water a serious under threat of degradation [19].

. Soil erosion is the root cause of land degradation and most dangerous ecological process in the country [21]. In Ethiopia, the impact of soil erosion was recognized after the 1973 famine occurred in the country.

The perception of pastoralist to use soil water conservation measures especially in low income countries can be influenced by complex set of socio- economic institutional and bio physical factors. Understanding farmer's perception on soil erosion and conservation and conservation and its impact is important in promoting soil and water conservation technologies [12]. One of the factors causing soil erosion is highly intensity of rain fall and sloppy reliefs. In the high land Ethiopia, deforestation are reduced the three cover to 2 _7% of the surface area, Soil erosion is caused by lack of effort I conservation and largely remains a problem to be tackled as ensuring food security, poverty reduction and environmental sustainability. Soil erosion had led to the degradation of agricultural land and consequence reduction in agricultural production thus exposing the population to food insecurity [25]). The main objective of this study was to assess the perception of pastoralist towards soil erosion and soil water conservation practice in the study area and specific objective was to assess the causes and

consequence of soil erosion , to assess the biological soil water conservation measures ,to assess the pastoralist perception on different water conservation measures and there effects.

2. Materials and Methods

Description of study area: This study was under taken in pastoral districts of borana zone, more focus on Dubuluk, Dhas, Dillo, Dirre and Yabello districts of the Borana zone of Oromia Regional State. The pastoral rangeland of borana is found in the southern part of Ethiopia, lying between 3036'' 600 38'' N and 36043''- 410 40'' E geographical grids in the Southern part of the Regional State of Oromia, it has a spatial area of 69,373.3 km² (about 7.6-12.3% and 19.5% of the total land area of Ethiopia and Oromia, respectively [9])

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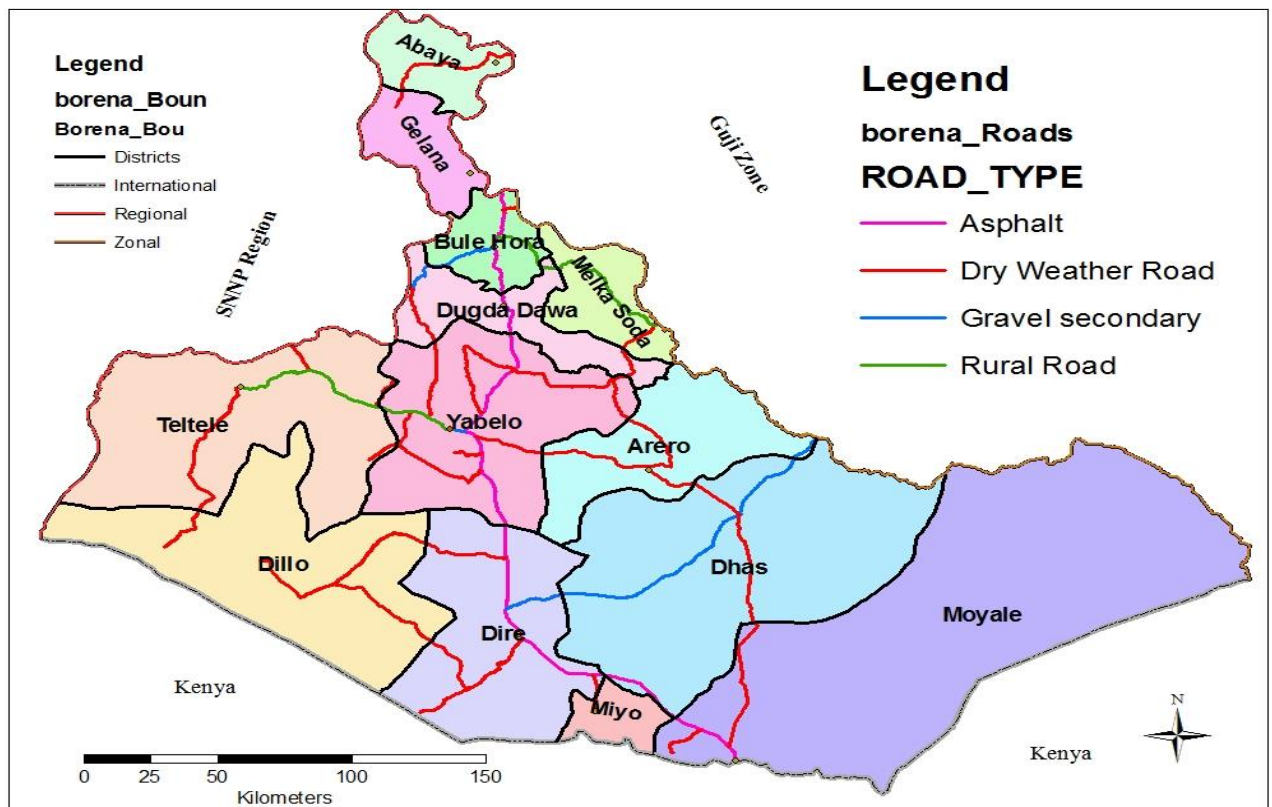


Figure 1

Source borana zone Agriculture and natural resource offices 2013.

2.2. Methods of Data Collection

2.2.1. Types and Sources of Data

Discussions and interviews with experts of zonal and Woreda office agriculture and NGOs working in the area water shade technical committee ,counselor, traditional elders as well as key informants from Borana pastoralists were held on the study research questions. Then a reconnaissance survey was conducted with the purpose of assessing, identifying and selecting the soil erosion representing four woredas.

2.2.2. Sampling technique

To achieve the objectives of the research, a multi-stage sampling technique was employed. Multi-stage sampling is a sampling technique in which large groups are further sub-divided into smaller, to get more targeted groups for the purpose of surveying. Through these techniques the study woredas, and communities within the woredas and 374 sampled households were selected.

The study woredas were purposively selected from cluster of rangeland management (area given priority because of highly soil erosion on going) that planned by Woreda agriculture and natural resources office. After this, sample households were selected by listing households' names found in eight selected Woredas zones of four woredas through simple random sampling. The whole sample households within each woredas were equally divided to selected zones. Accordingly, within the eight Woredas and 374 sample households were selected from four study woredas (eight Woredas).

2.2.3. Sampling frame and determination of sample size

Borana zone has 13 woredas; four woredas were purposively selected from zone (Yabello, Dillo, Dhas and dubuluk) based on priority given area (Woredas) because of highly soil erosion on going that clustered by Woreda forest, environment and climate change authority office to foster for conservation and Agricultural and natural resources offices. The woreda had 13,384 household inhabitants [8]

To determine the sample size, the [20] formula was used in estimating the sample size from total population which was given by as follows:
$$n = \frac{Z^2 \cdot p \cdot q \cdot N}{e^2 \cdot (N-1) + Z^2 \cdot p \cdot q}$$
 Where; n= desired sample size from population, Z= value of standard score at a desired confidence level (in most case at 95% confidence level the value is taken to be 1.96), p= intended proportion of the population to be included in the sample. It is advised to use the conservative figure of 50 % (0.5) in most case, q=1-p (0.5), N=total population number/size, e= error margin of 5% (0.05) in most case.

Based on the above equation, the sample sizes of the four study Woredas were calculated as below.

$$n = \frac{(1.96)^2 \cdot 0.5 \cdot 0.5 \cdot 13,384}{(0.05)^2 \cdot (13,384-1) + (1.96)^2 \cdot 0.5 \cdot 0.5} = 374$$

Table 1: Total number of households from Woredas and their respective sample size

Woredas	Total numbers of household	Household selected sample
dubuluk	$n1x=3546 \cdot 374/13,384$	100
Dillo	$n2x=3274 \cdot 374/13,384$	92
Dhas	$n3x=3336 \cdot 374/13,384$	92
Yabello	$n4x=3228 \cdot 374/13,384$	90
Total	13,384	374

2.2.4. Data analysis

The collected data was analyzed by using descriptive statistics and was presented by using pie-charts, table and percentage and the completion of data collection, the results of the analysis were interpreted and discussed by using qualitative approach. The method of analysis used under this study was a qualitative approach of thematic analysis. Thematic analysis is a method used for “identifying, analyzing, and reporting themes within the data [10].

2.3. RESULT and Discussion

2.3.1. Demographic characteristics of the Respondent

The characteristics of the household such as age, sex and marital status, family size, education level and farming size are important factors which influence the perception of farmers.

2.3.2. Age of sample house households

With respect to the age of the sample households from total household the highest respondent belongs to age group of 33% and the list of respondent belongs to the age group of above 65(15%) .The result indicates medium age group of the respondent easy to adopt or perceive the SWC Technologies .because middle age group of the respondent adult and be force able to work and to do properly (**Table 2**).

Table2: Age of sample household head by age group.

Age group	Frequency	Percentage
20-30	125	33
31-40	65	17
41-50	56	15
51-65	72	19
Above 65	56	15
Total	374	100

Source sample survey 2013

Out of the total sample respondents in the study area 70% and 30% were males and females respectively. The marital status the household head were 42% and 38% single and married respectively, whereas divorce and widowed were 13% and 6% respectively (**Table 3**).

Table 3: Distribution of sample household heads by sex and marital status

Sex	Respondent	
	number	Percent
Male	262	70
Female	112	30
Total	374	100
Marital status		
Single	158	42
Married	142	38
Divorce	50	13
Widowed	24	6
Total	374	100

2.3.3 Family size of the sample household

The family size of the households ranges from 1-8 persons. The dominant family size of the household were from 3-5(45.65%) and the list family size of the householder were belongs to 1-2(21.174%). The family size of the total sample household is from 6-8(32.62%) (Table: 4).

Table 4: distribution of sample household heads by family size

Family size	Respondent	
	frequency	Percent
1-2	10	21.74
3-6	21	45.65
6-8	15	32.62
Total	46	100

2.3.4 Level of sample household head

The level of education is one of the demographic characteristics of the household. Which have an important role to increase the farmer ability to obtain and use of information with reverent to the perception of the improved agricultural SWC technologies .The sample of the respondent 56% were illiterate and 38.16% were read and write only. 10.86% were complete primary education and 6.52% are only attended formal education. Similarly, findings in Bale Zone of Oromia region supported this research; the low level of education witnessed in common for many pastoral areas of Ethiopia [1]. Demographic information of respondents influences

household's decision of choice of their livelihoods, their perceptions of soil and water conservation. Therefore, it is crucial to consider the influence of age, sex and education level of household heads in analysis of livelihood and soil erosion.

Table 5: Educational status of the sample household by farmers group

Educational level	Respondent	
	number	Percent
Illiterate	26	56.5
Read and write only	17	38.16
Above grade 8	3	6.52
Total	46	100
Source sample survey 2016		

2.3.5 Farm size of the sample households

The survey result show that the size of owned land holding varies from 1.5-4ha. It was founded that about 10.86 % of the sample households have a farm land below 1.5h.

Table 6: distribution of sample household by farm size

Farm size	Respondent			
	number	Percent		
Below 1.5	5	10.86	Below 1.5	5
2-3	20	43.48	2-3	20
Above 4	21	45.66	Above 4	21
Total	46	100	Total	46

Source: sample survey 2016

The area of the farm plots was affected the perception of farmers for improved SWC technologies. Farmers who have the number of farm plots far away the home stead may face difficultly to take care of their land using SWC structure on the other hand. A number of farms Plot may be associated with the size of land holding and enables the farmers to be willing to leave some part of their farm lands for soil conservation activities (**Table 6**).

2.4. Causes of soil erosion

Soil erosion is not completely reduced, but its excessive can be reduced at manageable or tolerable level to minimize adverse effect of productivity, especial it's common in borana pastoralist like Dubuluk, Dhas, Dillo, and Yabello districts of the Borana zone of Oromia Regional State.

Soil erosion is the process of degrading soil structure and removing the soil resources from the surface of the land. Land is being degraded and its productivity diminished at an alarming step worldwide. In Oromia, cultivation of steep slopes, free grazing and deforestation are common practices that enhance land degradation. The removal of soil particles including plant nutrients and organic matter from agricultural land due to external erosive forces water and wind. It is one of the most chronic environmental and economic problems of the present situation, and is getting worse than it was ever before. In borana pastoralist area the major causes of soil erosion, Overstocking and overgrazing, Deforestation, Cultivation of steep slopes, Poor management or farming using inappropriate techniques, inappropriate road drainage, Unmanageable population growth. The perception of the households as to the causes of soil erosion is in line with studies conducted by others [29,15], who report that the most frequent cause of land degradation and soil erosion stem from excessive human pressure or poor management of the land, overgrazing, over-cultivation of crop land and deforestation, are the main culprits.

Table 7: causes of soil erosion

Causes of soil erosion	number	Percent
Deforestation	12	26.
Improper land use	9	20
Over grazing	17	37
Other factors	8	18
Total	46	100

2.4.1. Deforestation

Deforestation has two mains demission, climate change demission and urbanization that tend people to deforestation; climate change/variability is disturbing the livelihood of the pastoral and agro-pastoral societies.

26% of the respondent replied that the forest of the area is cleaned for fair wood, for cultivation, for agricultural purpose, for income and for construction of house. Gradual environment changes can be recognized in Dubuluk, Dhas, Dillo, and Yabello districts of the Borana zone of Oromia Regional State. So removing of vegetation may results decrease the infiltration and increasing run off, soil fertility diminishes, disfigure of soil structure increasing costs of production and external inputs, reduction in productivity, water scarcity and drought, declining of wildlife, soil erosion, sedimentation and gully formation, surface soil color change (redness), stoniness and rock exposure, bare land and exposure of roots, Pedestals and band sand dune formation, especially Dillo woreda, and Dubuluk similar to Dhas woreda . The findings of this study similarity [4] describes deforestation as continued land clearing for agriculture due to an exploitive farming system, tree

cutting for fuel, logging due to population growth accompanied by stagnating agricultural production, a lack of alternative energy and a lack of security of tenure which precludes long-term land improvement measures (Table: 7).

2.4.2. Improper land use

20%, of the respondent response that soil erosion caused by improper land use. This may due to high population density in the area and shortage of cultivated land (Table.7).

2.4.3. Over grazing

Has an impact of the area about 37% of the respondent replied that over grazing is removes too much of the soil protect vegetation covers and trampling compacts the soils, it increased run-off, caused by insufficient water holding capacity of the soil and to improve new gullies and enlarges the old ones. Allow too many animals graze an area of lands, damage soil structures, and remove plant cover (Table.7).

2.4.4. Effect of soil erosion

The respondent reported that soil erosion is a common phenomenon in the study area. Among this the common and serious problem are loss of fertile soil and information of gullies. Due to these, the land is exposed to many gullies and valleys *productivity losses*, the removal of valuable topsoil/organic matter and moisture, Compaction of soil structure, Reduction of soil depth and nutrient fertility, Poor seedling emergence and plant uprooting, Change in agro-ecology and encourage weeds, Rill and gully generation, Disfigure the landscape, diminish supply of water to the water table, rise food insecurity, in Dubuluk, Dhas, Dillo, Dirre and Yabello area the most principle effect of soil erosion was detoreiated of agricultural land, reduce water supply, depletion of natural resources. This finding is in line with Studies conducted elsewhere by the [24, 28] report that soil erosion usually further reduces soil quality.

Table 8: The effect of soil erosion in the area is identified by the respondent

Effect of soil erosion	Respondent	
	Number	Percent
Loss of fertile soil	10	21.73
Loss of land	15	32.6
Sedimentation	9	19.56
Loss of plant nutrients	7	15.21
Formation of gullies	5	17.4
Total	46	100

Source of questionnaires and field survey, 2021

The sampled respondent was identified the listed effect of soil erosion. Loss of fertile soil and loss of plant nutrient is the common in the area. The strongly agreed that a very serious problem in the study area is loss fertile soil. This result is a reduction of land productivity.

2.5. Soil and water conservation practices in the borana pastoralist area

To overcome the problem of land degradation, the government has implemented soil conservation activities, such as construction of physical structures (terraces) to reduce overland flow thereby preventing removal of soil, soil fertility improvement practices (compost application), agro-forestry and reforestation of deforested hilly areas through the interview and personal observation during field visit, biological soil and water conservation is major used in the area. Commonly used in Dubuluk, Dhas, Dillo, and Yabello physical SWC structures such as Terraces(Bunds - Level/Graded bunds, Soil and/or Stone bunds , Fanyajuu ,Level/Graded Bench ,Hillside, Disposal structures(Cut-off drains ,Water ways,)Moisture retention structures(Micro-basins, Eyebrow basins, Herring bones, Trenches, Improved pits, Gully rehabilitation structures, Check-dams (Stone, Brushwood, Sand bags, Gabion), As soil moisture is the most limiting factor in plant growth in arid and semi-arid regions, any mechanical and biological treatments of the range sites that could improve water infiltration will have a substantial effect on long term productivity. In general, soil conservationists working on rangeland have discovered that the best and perhaps the only method needed to control erosion is the management of vegetation and deforestation Area closure alone (without support measures) is a slow recovery process Combined with different soil and moisture conservation measures (multipurpose and nitrogen fixing trees, grass and specific cash crops)Require supplementary structural measures as per their specific requirements (trenches, eyebrow basins, improved pits, check dams and brushwood, cutoff drains and waterways or combinations of these. Land recovery is determined by soil fertility, slope, soil depth, rainfall, Recovery of the land for possible use as forest, grazing or cultivation Limitation of area closure is area lost people may be displaced more pressure on other areas.

About 32.6% of the respondent was argued on area closure, 6.52%, 8.69%, 17.39% and 34.78 % are planting grass, crop rotation, mixing crop and plantation respectively(**Table:9**)

Table 9: Soil and water conservation practices

SWC practicing in the area	Respondent	
	Number	Percent
Area closure	15	32.6
Planting grass	3	6.52
Crop rotation	4	8.69
Mixing crop	8	17.39
Plantation	16	34.78
Total	46	100



Figure 2

Source field survey: 2021.

2.6. Conclusion

In the study area assessed the perception of the farmers to the adoption of soil and water conservation practices and tried to assess the problem associated with conservation activates. It is identified that conservation activates do not well designed and farmer knowledge and experiences are not the designing and implementation of the practice. The perception of improved soil water conservation technologic in developing countries has attracted much attention for the farmers and policy makers mainly, because land degradation is a key problem for agricultural production.

In order to control soil erosion problem in the farm land, farmers were used different conservation practices such as Area closure, Planting grass, Crop rotation, Mixing crop and Plantation. Soil erosion is not completely reduced, but its excessive can be reduced at manageable or tolerable level to minimize adverse effect of productivity, especial it's common in borana pastoralist like Dubuluk, Dhas, Dillo, and Yabello districts of the Borana zone of Oromia Regional State. In borana pastoralist area the major causes of soil erosion, Overstocking and overgrazing, Deforestation, Cultivation of steep slopes, Poor management or farming using inappropriate techniques, inappropriate road drainage, Unmanageable population growth. Land recovery is determined by soil fertility, slope, soil depth, rainfall, Recovery of the land for possible use as forest, grazing or cultivation Limitation of area closure is area lost people may be displaced more pressure on other areas.

The perception of farmers towards soil water conservation practices is influenced by economic, institutional and physical as well as attitudinal factors. It was found the analysis that farm size, distance of the plot from the house stead, farmers preserved risk of loss of land in the future, availability of farm employment and perception of the benefit of conservation structures have significant impact on farmers retention behaviors. Therefore to conclude this study preventing soil erosion considering the community participation that's their livelihoods depends on them will lead to sustainable development results.

5.2. Recommendation

- The planning, designing and implementation process of activates should insure pastoralist participation

and make use exciting local knowledge.

- An appropriate system of land use must be adopted in the study area to minimize soil erosion
- The government and non-governmental organization should consider granting assistance to the pastoralist in the form of credit as this take action to use of SWC measure

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