International Journal of Energy and Environmental Research
Vol.6, No.3, pp.29-48, September 2018
Published by European Centre for Research Training and Development UK (www.eajournals.org)

ASSESSMENT OF SMALLHOLDER FARMERS' PERCEPTION OF EFFECTS OF LAND DEGRADATION RISKS ON AGRICULTURAL PRODUCTIVITY IN JELDU DISTRICT IN WEST SHEWA ZONE, OROMIA, ETHIOPIA.

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ABSTRACT: *Accelerated land degradation has become the major threat to rural livelihoods in the country in general and to the study in particular. The main objective of this study was to assess the perceptions of farmers' towards the effects of land degradation risks on agricultural productivity decline associated with soil erosion and fertility loss. The study followed a multistage sampling procedure to select sample respondent households. The primary data were collected by using Semi-Structured Interview Schedule key informant interview, FGDs and field observation. Descriptive statistics and econometric methods were used for data analysis. Descriptive results show that of the total sampled households, 57% was perceived the severity and its effect on agricultural land productivity. The result of the study reveals that majority of the farmers perceived and aware of as land degradation is already happening, its causes, indicators and consequences in general. The following indicators of soil erosion and fertility loss were generally perceived and observed by farmers' in the study area: gullies formations, soil accumulation around clumps of vegetation, soil deposits on gentle slopes, exposed roots, muddy water, sedimentation in streams and rivers, change in vegetation species, increased runoff, and reduced rooting depth. The direct human activities which were perceived to be causing land degradation in the study area include; deforestation, clearing of vegetation, overgrazing, steep slope cultivation, continuous cropping and improper fertilizer uses. Farmers perceived effects of land degradation experienced in the study area includes decline in crop yields, reduced responses to inputs, reduced productivity of irrigated land, lower and less reliable food supplies and increased labour requirements. The regression model was employed to identify the determinants of farmers' perception of the severity and its effects on land productivity. Their possibility of perceiving its effect on agricultural land productivity from slight to severe was primarily determined by institutional and demographic factors as well as weakly by biophysical factors. Farmers who perceive their land as fast deteriorating and producing less than desired, tend to adopt good land management practices. On the other hand, farmers who perceive their soils to be fertile tend to have low adoption of conservation practices. In order to overcome this land degradation and its consequent effects, the study recommended a need for the government to enforce effective policies to control and prevent land degradation and these policies should be community inclusive /participatory founded up on indigenous and age-honored knowledge and tradition of agricultural land management practices. The study also recommended a significant investment to be made by the government through promotion of land use systems that provide permanent vegetative cover to protect the soil, increase fertility and optimize water penetration.*

KEYWORDS: Farmers' Perception, Land Degradation, Effects of Land Degradation, Agricultural Productivity

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

INTRODUCTION

Background of the Study

Societies everywhere are closely and inextricably linked to the natural environment in which they are embedded (UNEP, 2013). Human productive and social activities and thus social structures and relations are shaped to a significant degree by the natural resource mix available, by physical geography, by weather patterns, by the amenability of natural conditions to transformation, and by a variety of other characteristics of the environment (FAO, 2013; Lal, 2012). Land is a vital resource for producing food and other ecosystem goods and services including conserving biodiversity, regulating hydrological regimes, cycling soil nutrients, and storing carbon, among others(Nachtergaele, 2010; Nickerson,2012;). Indeed, the most significant geo-resource or natural capital asset is productive land and fertile soil (Lal, 2012). For those communities that rely heavily on land as their main asset, especially the rural poor, human well- being and sustainable livelihoods are completely dependent upon and intricately linked to the health and productivity of the land (Pingali, 2012). In spite of this, for a long time, the true value of land has been underappreciated and in particular the ecosystem services they provide have been taken for granted (Wagayehu, 2006; Wood, 2013; Samel, 2012; FAO, 2010). Land degradation is a major development problem in most countries despite considerable investment in rehabilitation. It is estimated that 25% of global land is degraded and that affects 1.5 billion people worldwide (Nkonya, 2012). In Africa, land degradation affects 46% of the total land area (WMO, 2005).

Land degradation is a broad, composite, and value-laden term that is complex to define but generally refers to the loss or decline of biological and/or economic productive capacity (UNE, 1992; FAO, 2014, Global Environmental Facility, 2012). Land degradation is a temporary or permanent decline in the productive capacity of the land or its potential for environmental management. Land degradation includes soil erosion which is a major problem in smallholder farming systems (Haile and Fetene, 2012). Sustained soil erosion and household poverty are related (Jamu, *et al*.., 2011) and these two are now a threat to the social livelihoods of smallholder communities. Soil degradation is a narrower term: soil degradation is a component of land degradation (FAO 2005; UNEP, 2006; Uphoff *et al*., 2006). It refers to a process that lowers the soil's current and/or potential capacity to produce goods or services (Bruce and Mearns, 2004; FAO, 2010). Six specific processes are recognized as the main contributors to soil degradation: soil erosion, wind erosion, waterlogging, excess salts, chemical degradation, biological degradation, and physical degradation (Gewin, 2002). In East Africa, it is the smallholder farming systems on the highlands which are the hardest hit with soil erosion (Kangalawe & Lyimo, 2010). On these highlands, many farmlands experience declining crop yields because of soil erosion (Kassie, *et al*., 2010) Achieving land degradation neutrality, i.e. when the pace of restoring the already degraded land is at least equals, but preferably exceeds, the rate of new land degradation, is thus essential to achieve the sustainable development goal of reducing poverty (Lal *et al*. 2012). The Rio+20 Conference has called for zero land degradation. Without zero net land degradation, it would be also very difficult to meet other global sustainable development targets such as preventing further biodiversity loss, or mitigating and adapting to climate change. Despite these dynamics requiring urgent attention to prevention of land degradation, the problem has not been appropriately addressed, especially in the developing countries (Pender and Gebremedhin, 2004; Bekele, and Holden, 1999).

Land degradation is an outcome of policy and institutional failures, basically, a consequence of missing markets and consequently wrong incentives. Imperfect or unenforced land rights,

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

distorted and volatile market prices, lack of information about future damages related to degradation, and imperfect or missing credit markets are among the factors that may prevent farmers from investing in potentially profitable sustainable land management (SLM) practices and soil conservation measures(Azene, 2010; Berhanu and Swinton, 2011; FAO 2004). Anything that creates uncertainty about the future benefits of conservation measures reduces farmers' incentives to adopt them (FAO, 2010; Leonard, 2003)

Ethiopia is one of the Sub-Saharan Africa countries most seriously affected by land degradation. Agriculture is the economic mainstay of the overwhelming majority of Ethiopian people and will continue to remain so in the near future (Pender, and Berhanu, 2004; USAID, 2000; Wagayehu, 2003). However, the on-going land degradation has threatened undermining the sustenance of their livelihood. Land degradation is a major cause of the country's low and declining agricultural productivity, persistent food insecurity, and abject rural poverty (Million, 2001). The minimum estimated annual costs of land degradation in Ethiopia range from 2 to 3 percent of agricultural GDP (FAO, 2010). This is a significant loss for a country where agriculture accounts for nearly 45 percent of GDP, 90 percent of export revenue, and is a source of livelihood for more than 82 percent of the country's 100 million people (Pender, and Berhanu, 2004; USAID, 2000).In Ethiopia, land degradation, low and declining agricultural productivity, and poverty are severe and interrelated problems that appear to feed off each other. If urgent measures are not taken to arrest Ethiopia's serious land degradation, the country is headed for a "catastrophic situation" (Getinet and Tilahun, 2005). Programs addressing land conservation are not succeeding where they are most needed (Pender and Gebremedhin, 2004; Bekele, and Holden, 1999). Understanding, preventing and mitigating Land Degradation (LD) at the local scale seem to require more than technical knowledge and perception by external agents such as agricultural advisors and government officials (Mulugeta, 1999; Nigussie and Fekadu, 2003).

Blaikie and Brookfield (1987) observed that land and water degradation and its effect on agricultural activities may be unintentional and unperceived; it may result from carelessness or from the unavoidable struggle of vulnerable populations for the necessities of survival. It is essential to enable smallholder farmers' to expand and adopt more effective conservation measures by implementing appropriate land conservation programs. Understanding the local people's perceptions on environmental issues is thus a prerequisite in making successful and sustainable resource management strategies (Tesfaye, 2003; Pender, and Berhanu, 2004; Wagayehu, 2003). Any effort towards this direction should begin from a research that aims at exploring location specific factors influencing the adoption of land management practices (Johnson *et al*, 1999; Lefroy *et al*., 2000). Understanding the local people's perceptions of the risk of land degradation is thus a prerequisite in making successful and sustainable resource management strategies.

Statement of the Problem and Justification of the Study

Land degradation is an insidious, gradual process, and farmers may not easily perceive its severity (UNEP, 2013). The smallholder farmers' decision-making procedures are strongly based on their perceptions of the forces that drive degradation (FAO, 2000; Aklilu, 2006; Adesina, and Baidu-Forson, 1995). Perception will partly control awareness, goals and practical actions. Local perception refers to the causes and status of land degradation as farmers detect and express it as occurring on their lands. Both perception and knowledge guide decision making and consequently, farmers' action on land conservation and adoption of sustainable land management practices (Shiferaw and Holden, 1999). Interpretations of environmental

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

change are culturally constructed and need to be thoroughly examined for a sound understanding of farmer behavior (German 2006; Lyamchai, 2007). In addition to limitations presented by availability of technology and the capacity for learning, other elements including perceptions and knowledge considerations within society fundamentally limit agricultural land management (Ervin, and Ervin, 1982). For farmers to decide whether or not to adopt a particular measure to cushion themselves against the potential livelihood losses, they must first perceive that land degradation has actually occurred and it's severe effects on agriculture productivity (Desta *et al*.,2005; Wagayehu and Drake,2003). Before a problem can be addressed, it must be perceived. Addressing soil erosion with the adoption of conservation practices is no exception. Unfortunately, the literature on determinants of the adoption of conservation technologies has given little attention to perception variables (Wossink et al., 1997; Negatu and Parikh, 1999; Adesina and Baidu- Forson, 1995). Agricultural technology adoption studies in Ethiopia started in the 1970's, but few of them considered the role of farmer perceptions in the adoption of improved varieties (Yirga, 1993; Dadi, 1992). The paucity of adoption studies that incorporate the effect of perceptions led Adesina and Baidu-Forson (1995) to call for more research into how farmers' perceptions of technology characteristics affect their adoption decisions. A better understanding of farmer perceptions regarding severe effect of land degradation and benefits of adoption sustainable implementation of SLM measures and their determinants will be important to inform policy for future successful adaptation of the agricultural sector (Gebremedhin, 1998). Therefore, to enhance policy towards tackling the challenges that land degradation poses to farmers, it is important to have full understanding of farmers' perception on land degradation and its severe effects on their agricultural productivity (Fosu-Mensah *et al.,* 2010).

Perceptions are important in the introduction of sustainable farming techniques at the farm level (Wossink, *et. al*., 1995). An understanding of the levels and determinants of farmer perceptions of soil erosion and conservation can facilitate the development and transfer of appropriate conservation technologies. However, as in the general agricultural technology adoption literature, perceptions have often been overlooked in the conservation literature. Also, the farmers' perception is highly certain socio-culture context specific in its very nature. Therefore, this study designed to fill the gap in knowledge stock in this particular area. The specific objectives of the study are: 1) to explore farmers' perception of the effects of land degradation risk on agricultural productivity; 2) to analyze the determinants of farmers' perception of the effects of land degradation risks on agricultural productivity in the study area.

METHODOLOGY OF THE STUDY

Description of the Study Area

The study was conducted in Jeldu district, West Shewa Zone, Central Ethiopia (9° 02' 47" to 9° 15' 00" N and 38° 05' 00" to 38° 12' 16" E which is delineated by Meta Robi, Dendi and Ejere woredas in East, Gindeberet Woreda in West, Abuna Gindeberet Woreda in North and Eliphata Woreda in South. It has an elevation range of 2500 – 3200 meter above sea level (masl). The district has a total area of 139, 389 hectares with variable agro ecology of high lands (45%), midlands (30%) and lowlands (25%). Undulating slopes divided by V-shaped valleys of seasonal and/or relatively permanent streams characterize the topography of the study area. Steep slopes are found along the valley sides, where slopes greater than 30% are very common. Rainfall pattern is bimodal with the main rainy season from June to September

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

and the short rainy season from February to March. The mean annual rainfall of the area ranges from 1800 to 2200 mm. The maximum and minimum temperature of the area ranges from 17 to 22ºC. The farming system of the area is mainly rain-fed. The soil type is characterized as clay and clay-loam type, but the riverbed has a loam and sandy-loam type of soil. A eucalyptus globule is the main tree planted in the area. Soil erosion in the area is mainly attributed to the steep slopes, population pressure, deforestation, poor farming methods and vulnerable soil type. However, the major factor fuelling soil erosion on the steep slopes is that farmers are increasingly destroying contour bunds on terraces to pave way for more farmland. As a result, soil erosion has been accelerated which in periods of heavy rainfall results in silting and flooding of the valley-bottom fields and landslides are also becoming very common. This regular practice has reduced the attraction of placing more long-term erosion control devices such as grass lines or hedgerows of agro-forestry species.

Data Collection Techniques and Tools

Data for the study were collected from both primary and secondary sources. The data collected includes information on socio-demographic and economic characteristics, institutional, plot level characteristics, various land management practices practiced by farmers (collectively or singly), resources farmers use in the practices and farmers' perceptions on the practices and their impacts. Secondary sources are very crucial in order to full information gap from primary data sources. Secondary sources of information which was used for this study include published materials such as reports, plans, official records, census records, project reports, research papers and data files from web sites. Thus, these are data collected by other people and that was used carefully by counter checking for their authenticity. Primary data were collected by using the following data collection techniques and tools:

1. Semi-Structured Interview Schedule: A semi-structured interview schedule was used to collect both qualitative and quantitative information from the respondents. The survey collected detailed information about household characteristics and labor resources, institutions and social capital, household assets, land resources and plot characteristics, and SLM investments. The data collected included information on demographic and socio-economic characteristics, institutional services, biophysical characteristics, plot level characteristics, various land management practices used by farmers (collectively or singly), resources farmers use in the practices and farmers' perceptions and attitudes on the practices and their impacts. Fifteen enumerators, who had experience in data collection, know the area and the communities languages were recruited and trained for two day by researcher. A structured interview schedule was used for the field interviews. The questionnaire, with close and open ended type, was pre-tested by administering it to selected respondents. On the basis of the results obtained from the pre-test, necessary modifications were made on the questionnaire. To reduce the response error and clarify unclear questions a pilot test of a draft questionnaire was run with 15 selected farmers from each of the three units, extension workers and enumerators. A final questionnaire was then produced to use for interviewing farmers.

2. Focus Group Discussion (FGDs): In this study, four (4) focus group discussions were held in the study area. The composition of these groups included both men and women aged between 26 and 67 years. These FGDs was conducted in order to get some in-detail information on land degradation nature, causes and consequences, commonly practiced land management practices, community perceptions towards land degradation and its effects on agricultural activities and agricultural performance in general and determinants of adoption of sustainable land management(SLM) practices. One focus group discussions was held in each of the sample

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

kebeles. The discussion was carried out with group of farmers comprising 8-10 members that consists of ordinary men and women farmers and development agents. The major issue which was explored during the group discussion includes: the extent of the farmers' participation in the SLM practices in reference to their awareness and perception of erosion hazards, and the effectiveness of the technologies under implementation. Here the researcher was limited to facilitating the discussion using a checklist of topics to guide the sessions in an orderly way

3. Key Informant Interview*:* Key informants drew from woreda agricultural and rural development experts, extension workers, aged community members and village religious leaders. To complement the interview schedule and to have a detailed insight into soil conservation practices in the area, a discussion covering different topics with agricultural experts and farmers have been conducted. This helped to capture some points that were not clearly obtained from the interview.

4. Field Observation: Field visits involved observations of various land degradation features, such as soil erosion and sedimentation, surface runoff, sandiness of soils, crop vigour, presence of indicator-plant species; and agricultural practices, including among others, types of crops grown, cropping patterns and on-farm soil conservation measures. Field observation was conducted throughout the whole process of the research in order to ensure the validity of information obtained from the farmers. In this regard, the majority of the respondents' fields were observed in order to assess what they did on conservation measures constructed on their cultivated fields. To complement the questionnaire and to have a detailed insight into soil conservation practices in the area, a discussion covering different topics with agricultural experts and farmers have been conducted. This helped to capture some points that were not clearly obtained from the interview.

Sampling Design of the Study

This study employed a multi-stage sampling procedure. Fist Jeldu district was purposively selected because it is one of the worst affected highland areas in the country in terms of land degradation and soil erosion. The district is a highland area with steep slopes, intensely cropped hillsides and high population densities. Second, threer *kebeles* (*Seriti, Kolu Galan and Chillanko*) selected from the complete list of kebeles in the District using a simple random sampling technique. Following the selection of the sample kebeles, the sample size of the study was determined by using Gujarati sample size determination formula (Gujarati, 2004. So, the sample size of the study was 156 households. A random sampling technique was employed in selecting the sample households from lists of household heads that were made for each of these villages.

Methods of Data analysis

The study employed both descriptive and inferential statistics to analyze data collected from the sample respondents. To run statistical analysis, data were coded and entered in to a computer program known as statistical package for social studies (SPSS) version 20 software packages. The information generated through the informal and focus group discussions was used to substantiate and augment findings from the quantitative analysis of the structured questionnaires.

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Specification of Empirical Model

Linear Logistic regression model is a widely applied statistical tool to study farmers' perception of land degradation and conservation technologies (Shiferaw, 1998; Neupane *et al.*, 2002). Linear Logistic regression allows predicting a discrete outcome from a set of variables that may be continuous, discrete, and dichotomous or a combination of them. The dependent variable, (i.e., perception of soil and water conservation practices) is dichotomous discrete variable that is generated from the questionnaire survey as a binary response, and the independent variables are a mixture of discrete and continuous. Following the methods of used by Abera (2003) and Mekuria (2005), the logistic regression model characterizing perception of the sample households is specified as:

$$P_i = F(\alpha + \beta X_i) = \frac{1}{1 + e^{-(\alpha + \beta X_i)}}$$

Where *i* denotes the *i*th observation in the sample; Pi is the probability that an individual will make a certain choice given Xi; e is the base of natural logarithms and approximately equal to 2.718; Xi is a vector of exogenous; variables *α* and β are parameters of the model, β1, β2……, βk are the coefficients associated with each explanatory variables X1, X2, …, Xn. The above function can be rewritten as:

$$\ln [P/(1-P)] = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k$$

Where the quantity *P/ (1-P)* is the odds (likelihoods); *β0* is the intercept; *β1, β2* … and *βk* are coefficients of the associated independent variables of *X1, X2*…and *Xk*.. It should be noted that the estimated coefficients reflect the effect of individual explanatory variables on its log of odds {ln[P/(1- P)]}**.** The independent variables of the study are those which are expected to have association with farmers' perception of soil erosion and conservation practices. More precisely, the findings of past studies on the farmers' perception, the existing theoretical explanations, and the researcher's knowledge of the farming systems of the study area were used to select explanatory variables. The definition and units of measurement of the dependent and explanatory variables used in the logistic regression model is presented in Table 1.

Conceptual Model and Hypotheses and Identification of Variables

It has been argued that common resources, such as forests and open lands are best managed by the people who use them rather than by governments (Ostrom, 1990). Consideration of peoples' perception is thus an essential factor when making decisions on soil and water conservation. Smallholder Farmers' perceptions of the effects of land degradation and soil erosion could be influenced by the natural physical factors that influence land degradation, as well as the socio-cultural and institutional factors and household demographic characteristics that affect how physical processes are viewed. Physical factors include village level factors (rainfall, topography and level of land degradation) and plot level factors (soil type, slope, shape of slope, and location of plot) that may intensify land degradation and soil erosion. Institutional

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

factors include contact access to extension service , access to media and other information sources, availability of a sustainable land management interventions in the village, prior public conservation campaign works on the farmer's own land (for demonstration effects), and the current tenure status of the field. Household characteristics include education, age and gender. The physical factors that aggravate soil erosion, such as higher rainfall intensity, steep slopes and erodible soils, are hypothesized to raise farmer perceptions of soil erosion by aggravating soil loss. Distance of plot from homestead is expected to reduce perception, as distant plots are less frequently observed by farmers. The period of time the plot has been operated by the current owner is expected to raise erosion perceptions for the opposite reason. Field area (size) should raise perception since the absolute amount of soil and crop yield losses may be higher from larger plots. Farmers who have contact with extension services are expected to have higher erosion perception, since extension is expected to serve as a source of technical information to farmers. The availability of a resource conservation SLM intervention in the village is expected to create awareness perception through its demonstration effect on the need for conservation measures. The effect of public campaign conservation work on the farmer's own plot is ambiguous; it may raise erosion perception through its demonstration effect or reduce perception through its effect on soil loss.

Table1: Definition and Units of Measurement of Variables Included in the Model (N=156)

Explanatory Variables	Variable Code	Variable Type	Units of measurement
Age of household head (in years)	AHH	Continuous	Measured in years
Family Size (in number)	FS	Continuous	Measured in numbers
Sex of household head	SHH	Dummy	One if male, 0 if female
Education level of household head	ELHH	Continuous	Measured in years
Farming experience	FEHH	Continuous	Measured in years
Tenure type	TS	Dummy	1 if the HH certified 0 otherwise
Land certificate	LC	Dummy	1 if the HH certified, otherwise 0
Extension contact	EC	Dummy	1 if the HH certified, otherwise 0
Participation in conservation campaigns	PCC	Dummy	1 if the HH involved in conservation, otherwise, 0
Availability of SLM project	SLMP	Dummy	1 if SLM project is available, otherwise, 0
Slope of the plot	SP	Dummy	1 if the slope of the plot steep, 0 otherwise
Type of soil of the plot	TSP	Dummy	1 if the soil type is sandy, 0 otherwise
Distance from residence	DR	Continuous	Measured in kilometers
Area of the plot	AP	Continuous	Measured in square kilometer
Age of the plot	AP	Continuous	Measured in years of cultivation

RESULTS AND DISCUSSION

Characteristics of Sample Respondents

Demographic, socio-economic, institutional, bio-physical and psychological factors of the households are directly/indirectly related to characteristics influencing farmer's perception of the severity and effects land of land degradation and the use of introduced soil and water

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

conservation practices. Therefore, the demographic and socio-economic of sample respondents in the study areas were presented and discussed briefly in this section as follows:

Table 2: Demographic and Socio-economic attributes of the Respondents (n=156)

Variable		Frequency	Percentage
Sex	Male	96	61.53
	Female	62	39.74
Age	20-30	21	13.46
	31-41	60	38.46
	42-52	42	26.92
	53-63	17	10.89
	64-74	7	4.48
	>74	3	1.93
Education	No formal	87	55.77
	Primary	25	16.03
	Secondary	21	13.46
	Certificate and above	17	10.99
Farming experience (Years):	1-10	21	13.47
	11-21	33	21.15
	22-32	41	27.93
	33-43	45	26.28
	44-54	10	.6.41
Farm size	<0.5	98	62.82
	0.5-1	49	31.41
	>1	3	1.92
Extension Service	Access	102	65.38
	No access	54	34.61
Credit service	Access	62	39.75
	No access	94	60.25
Land holding ownership certificate	Certified	109	69.87
	Not Certified	47	30.13
Participation in public conservation campaigns	Involved in public campaigns	41	26.29
	Not involved in public campaigns	115	73.71
Slope of the plots	Steep slope	97	62.17
	Flat/plain	59	37.83

The average age of household head was about 42 years old. This shows that a majority of the sampled farmers fell in the adult category, that is, 44.2 percent of the sampled farmers were aged between 35 and 56 years old. In terms of the level of education attained by the household head, it was found that the average level of education attained was about 3 years of schooling, that is, on average; the household head spent about 8 years in school. It was further found that male headed households were more educated than female headed households. The sampled households own an average of 0.526 hectares of land with an average of about 2 plots per household. This goes to show that most households do not have adequate land on which to

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farm. In addition, it was found that the farmers had used the land they own for about 33years. This gives an indication that these farmers had used these lands for quite a number of years. Also, it was found that the farmers had an average of 27 years' experience in farming. The experience of 27 years is long enough for one to adapt to the new land management practices used in the area. It was also found that a majority of the households owned livestock. That is, 82 percent of the sampled households owned livestock while 18 percent did not own livestock. Out of the total sample respondents 54.68 and 55.32 % respondents reported that the status of their farm land is steep sloped and flat/plain respectively.

Farmers' Perceived Causes of Land Degradation

The farmers' perceived various causes of land degradation in their farmland and surrounding landscapes. Overwhelming majority of farmers' in the study areas were aware that land degradation in various forms and levels was happening on their farm lands as well as in the surrounding landscapes. Table 3 presents the locally perceived causes that were mentioned by the respondents as being the contribution of the farming practices to the observed land/soil degradation in the study areas. About 21.15 % of the respondents associated land degradation to cultivation of marginal areas while 17.95 % considered lack of conservation measures to be responsible for the diminishing soil quality. The overuse of the soil in continuous tillage without fertilizer supplementation, coupled by grazing on plant residues, weeds and crop stubble, has deprived the soils of both nutrients and organic matter.

Table3: Farmers' Perceived Causes of Land Degradation in the study area

Farmers' perceived causes land degradation	Frequency (n=156)	Percentages
Overgrazing and continuous cropping	21	13.46
Deforestation	24	15.38
Cultivation of marginal areas	33	21.15
Inappropriate tillage practice	26	16.67
Lack of conservation measures	28	17.95
Torrential rains	24	15.38
Total		100%

Farmers' Perceived Indicators of Land Degradation

Result from this study reveals that there are numerous long-established traditions communities use to estimate and to elucidate the condition of the land and the soils they are cultivating. A healthy and vigorous crop growth, reflected by a good crop stand in the field, was used as an important indicator that the soil is fertile enough, if moisture and other factors are not limiting. Under such circumstances, even if the weather conditions worsen during the growing season such that final yields are poor, the farmer would have realized the potential fertility of a certain piece of land. A stunted crop with less vigorous growth in the field when other factors such as moisture are considered not limiting was locally perceived to indicate a high probability that soils on which the crop is growing are of low quality and infertile. Majority of respondents (25%) considered crop yields as the best measure to comprehend land/soil status. It was noted

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

that declining crop productivity could be a clear indicator of declining soil fertility, and hence soil degradation and land degradation.

Table4: Farmers' Perceived Indicators of Land Degradation

Farmers' Perceived Indicators	Frequency (n=156)	Percentages
Declining crop yield and productivity	39	25
Spreading out of certain vegetation species/weeds	37	23.72
Gullies and rills formation	22	14.10
Change in the colour of the soil	16	10.26
Sedimentation of sandy materials	17	10.9
Decline in soil fertility	18	11.54
Changes in colour of rivers and streams	7	4.48

The existence of these indicators could confirm that rural people are aware of their environment and its related problems, and particularly so with those which affect the farm productivity and/or those that resulted into more visible landscape changes such as soil erosion. However, some of the respondents argued that soils are inherently infertile suggests that productivity has declined significantly within living memory and that people were unaware that their yields were probably rather low from the outset.

Farmers' Perception on Severity of Land Degradation and Its consequences on land productivity

From the total respondents their perception on land degradation problem were assessed and about 57.5 % of the sampled households perceived it as severe, 29.67% as moderate or medium and 13.17% as low. The farm households were also asked their perception about the consequences of land degradation 88%, 7%, and 5% mentioned yield decline, reduced farm plot and both respectively. This might lead the farmers towards the perception of underlying and proximate causes of soil fertility decline and at the end to the adoption decision on various options of fertility enhancing technologies of physical soil and water conservation practices. This perception may be influenced by differences in socio-economic characteristics inherent among the local people. Socio-economic characteristics such as endowment of livelihood assets by households determine the ability of a household to use, for example, agricultural inputs like fertilizers or manure as a way of improving soil productivity.

Table5: Farmers' Perception on Severity of Land Degradation and Its consequences on land productivity

Extent of land degradation & Productivity Effects	Names of Kebeles		
	Seriti (n=52)	Kolu Gelan(n=52)	Chilanko(n=55)
Severe	62.5	57	53
Moderate	25	32	32
Slight/minor	13.5	11	15

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

In the study area, for instance, wealthy farmers who could afford using fertilizers and/or manure did not perceive soil fertility as a major issue. Although yield decline through time cannot be attributed to soil erosion problem alone, farmers felt it and repeatedly mentioned that soil fertility decline due to erosion has played a considerable role. From the sample households, 88% mentioned soil erosion as the underlying cause for productivity deterioration of their farmland. Farmers pointed out that the yield of their fields is declining from year to year. Farmers were asked to compare their current yield with that of the last 20 years ago and 98% indicated that the yield for major crops is severely declining. Farmers reported that they are in persistent food shortages in now days because of significant decline in productivity of their farmlands. Particularly, in the months between April through June they face shortage of food. The results of the survey revealed that 33% of the sample farmers have faced shortage of food during the last 12 months.

Determinants of Farmer Perceptions of the Severity and effects of land degradation on productivity agriculture

Logistic regression model was used to analyze determinants of farmers' perception of the effects of land degradation risks on agricultural productivity. The success of the overall prediction by the regression model indicate that the variables sufficiently explained the perception of farmers on conservation practices, and there is a strong association between the perception and the group of the explanatory variables (R^2 = 0.802). A positive estimated coefficient in the model implies increase in the farmers' perception of soil erosion and conservation practices with increased in the value of the explanatory variable. Whereas negative estimated coefficient in the model implies decreasing perception with increase in the value of the explanatory variable.

Table6: Logistic regression result for perception of the effects of land degradation risks

Variables	β	SE	Z	Sig	Odds Ratio
Age of household head	0.037***	0.658	0.898	0.0890	0.040
Family Size	0.167	0.138	1. 230	0.272	0.023
Sex of household head	0.245**	0.006	1.980	0.0967	0.011
Education level of household head	0.0847**	0.726	2.500	0.048	0.131
Farming experience	0.208**	0.038	0.360	0.023	0.101
Tenure type	0.280*	0.657	1.980	0.662	0.34
Land certificate	0.078	1.872	1.160	0.723	0.162
Extension contact	0.876*	0.182	1.740	0.024	0.056
Participation in conservation campaigns	0.087**	0.086	1.420	0.0340	0.021
Availability of SLM project	0.062**	0.467	0.440	0.0876	0.031
Slope of the plot	2.286**	0.025	2.010	0.0965	0.023
Type of soil of the plot	0.834	0.100	1.070	0.0956	0.231
Distance from residence	0.147	0.064	1.600	0.782	0.031
Area of the plot	1.720	0.0676	0.240	0.345	0.045
Age of the plot	0.070**	0.078	0.340	0.024	0.021
Constant	-1.703***	.346	-1.690	0.114	

Model Chi-square 98.280
Log likelihood function 72.165
Nagelkerke (R^2) 0.802
Number of observation 156

***, **, ***significant at 10, 5 and 1% level of significance, respectively.**

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

Extension contact: As hypothesized, extension contact is found to have a significant positive

Influence on the perception of the severity and effects of land degradation on agricultural productivity. This may be explained by the fact that scientific information and research result reports that farmer gain from extension agents help them to aware and understand the severity and effects of land degradation on agricultural productivity. Therefore, Farmers who had frequent contact with extension agents perceived productivity decline associated with land degradation.

Availablity of SLM project in the village: implementation of SLM project in the village positively influences and aware farmers about the risk of decline in agricultural land productivity due to land degradation and soil erosion. This could justified by SLM projects effort of attempt to participate the farmers in processes and awareness creation and capacity building through experience sharing from other successful project areas. Participation/training on agricultural land management SWC measures and etc. has a positive and significant effect on conservation perceptions. Farmers who participated in training by development agents on SWC works were more aware of soil erosion and conservation than those who did not participated. In their finding, Nagassa *et al.* (1997) in Ethiopia reported that training of farmers and their participation in extension workshops improves their perception of soil degradation problem and facilitates the adoption of improved technologies.

Age oh household head: The finding of the study reveals that age of the household head has a negative influence on the perception of the risk of decline in agricultural land productivity due to land degradation and soil erosion. This means that aged farmers tended to perceive severe yield loss or productivity decline, in contradiction to other finding that younger farmers perceived higher erosion.

Educational level of household heads: Education of the head of the household significantly and positively determined farmers' perception of the risk of decline in agricultural land productivity due to land degradation and soil erosion. Possible explanation is that educated farmers tend to be better access to research output reports and generally to update information about the risks associated with land degradation and soil erosion and hence tend to spend more time and money on soil conservation. This is because literate farmers often serve as contact farmers for extension agents in disseminating information about agricultural technologies from government agencies. The odds ratio also suggests that if a farmer is educated, other factors held constant, the likelihood of awareness will be two times higher than an illiterate farmers.

However, the other variables, such as family size, tenure type, land certification, gender, family members in farm work, as well as physical factors, such as the slope of the terraces and altitude, did not significantly influence the perception of the risk severe yield loss or productivity decline and had only weak explanatory power in the model.

CONCLUSION AND POLICY IMPLICATION

Farmers in the study area were generally aware of and perceived soil erosion as a serious problem and its effect on agricultural land productivity. Their possibility of perceiving its effect on agricultural land productivity on agricultural land productivity as slight to severe was primarily determined by institutional and demographic factors as well as weakly by biophysical factors. The socio-institutional and demographic determinants of the effects of land

ISSN 2055-0197(Print), ISSN 2055-0200(Online)

degradation and soil erosion risks on agricultural productivity decline point to policy implications for public inclusive SLM practices and capacity building programs as well as bringing back and indigenous land management practices to research and learning platforms for sustainable and desirable societal betterment.

Acknowledgement

This study was undertaken with a financial support from Ambo University, is sincerely acknowledged. Many thanks are extended to the farmers in Jeldu District who are enthusiastically participated in this study and for their inspirations and willingness for the interview that paved a way towards completion of this work. The development workers of the Jeldu district are also sincerely thanked for their efforts to support the researcher by conducting questionnaire survey.

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