Farmers' investments in land management practices in the CRV of Ethiopia

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ABSTRACT

In order to combat land degradation in the form of water erosion and fertility depletion in the Central Rift Valley (CRV) of Ethiopia farmers are of crucial importance. If they perceive land degradation as a problem they will be more willing to invest in land management measures. This study presents farmers' perceptions of land degradation, respective investments, and factors influencing their investments in land. In this study, water erosion and fertility depletion are taken as main indicators of land degradation. Results show that farmers perceive water erosion and soil fertility depletion as problems that have intensified over the last decade. However, despite awareness of these problems, farmers' investments to control soil erosion and soil fertility depletion are very limited. This study shows that the major factors that positively influence farmers' investments in land management practices are *households' resource endowments, access to information, social capital* and *availability of family labor*. For sustainable land management strategies this implies that these should (i) be integrated within a comprehensive rural development strategy that generates improvements of farmers' livelihoods and their financial capacity, (ii) trigger social capital and create enabling conditions for farmers to participate in different groups, cross site visits and farmer-to-farmer experience sharing, and (iii) stimulate collective action within the villages in order to enhance access to labor which is crucial for carrying out land management practices.

Key words: Land degradation, farmers' investments, sustainable land management, socioeconomic factors, factor analysis

INTRODUCTION

The production of food to satisfy the basic needs of the population of Ethiopia is crucial to overall socio-economic well-being. However, there is increasing concern that land degradation in the form of soil erosion and soil fertility depletion will seriously limit food security and sustainable agricultural production in Ethiopia (Shiferaw and Holden 2000; Bewket and Sterk 2002). A national level soil erosion assessment in the 1980s showed that some 20,000–30,000 ha of croplands become out of production annually (FAO 1986). Plot level measurements also show the severity of the problem, with soil losses ranging from 42 t $ha^{-1}yr^{-1}$ (Hurni 1993) to 179 t ha^{-1} yr^{-1} (Shiferaw and Holden 1999) on cultivated lands. Such losses heavily reduce the production potential of agricultural land (Sonneveld and Keyzer 2003).

Nevertheless, farmers' investments in land management measures are still limited in Ethiopia (Shiferaw and Holden 1998; Descheemaeker 2006). Farmers generally begin investing in land management when they perceive that there is water erosion and soil fertility depletion (Desbiez *et al*. 2004). But farmers often underestimate or do not perceive land degradation, while also other factors often play an important role in the decision to invest or not on more sustainable practices.

Several studies on these aspects have been carried out in the Ethiopian highlands (Amsalu and de Graaff 2006; Deininger and Jin 2006). Results show that farmers often do actually perceive land degradation as a problem (Bewket and Sterk 2002; Shiferaw *et al*. 2007), but that there is no consistent association between this perception and investments in land management. For example, Shiferaw and Holden (1998) reported that if farmers perceive land degradation as a problem they invest more in their land, while other authors reported a lack of association between both factors (Ndiaye and Sofranko 1994; Mbaga-Semgalawe and Folmer 2000). Other personal, social, cultural, economic, institutional and biophysical factors were found to be of more influence than perception of the problem alone (Bekele and Drake 2003; Kessler 2006).

In Ethiopia, studies related to land degradation and land management investments have been mainly concentrated in the highlands (Herweg and Ludi 1999; Nyssen *et al*. 2009; Descheemaeker *et al.* 2006). Consequently, research related to farmers' perceptions of land degradation, investments in land management and factors influencing farmers' investments is scanty in other parts of the country, such as in the Central Rift Valley (CRV). In addition, farmers' perceptions and their reaction as well as factors influencing investments in land management vary from place to place and from household to household due to variations in socio-cultural, economic and biophysical conditions (Payton et al. 2003; Amsalu and de Graaff 2007).

It is questionable if results from elsewhere are applicable to the Ethiopian CRV. This study is therefore carried out in the CRV and aims to: (i) explore farmers' perceptions of land degradation (water erosion and fertility depletion), (ii) assess farmers' investments in land management, and (iii) identify factors that determine farmers' decisions concerning *how much* to invest in land management practices.

METHODOLOGY

Study area

This study covered six *kebeles*[1] located in Meskan and Adamitulu Jido-Kombolcha (AJK) w*eredas*[2] of the CRV of Ethiopia (Figure 1). Four kebeles (Beressa, Drama, Dobi and Mikaelo) are found in Meskan wereda, located about 135 km to the south of Addis Ababa and part of the Southern Nations, Nationalities and People (SNNP) Region. The other two (Worja and Woyisso) kebeles are found in AJK wereda of the Oromia Region; about 160 km to the south of Addis Ababa. There are two major farming systems in the study areas: cereal-based and *enset*[3]-based (Adimassu *et al*. 2010). Cereals, mainly maize, teff and sorghum, dominate the cereal-based farming system, whereas *enset* (*Ensete ventricosum)* dominates the *enset*-based farming system. Farmers rotate cereals such as maize (*Zea mays*), sorghum (S*orghum bicolor*) and teff *(Eragrostis tef)* with pulses such as field pea (*Pisum sativum)*, faba bean (*Vicia faba)*, and haricot bean (*Phaseolus vulgaris*). Farmers in Meskan practice intercropping of these cereals with *chat (Catha edulis)*[4] and *enset*. They also plant trees around their homesteads (infields) and outfield areas for multiple purposes including construction, fuel wood, fruits and cash generation. The main tree species grown around Meskan homesteads are fruit (e.g., avocado and mango) and high-value cash crop trees (e.g. *chat*), whereas non-fruit trees (e.g., acacia) are grown in the outfields.

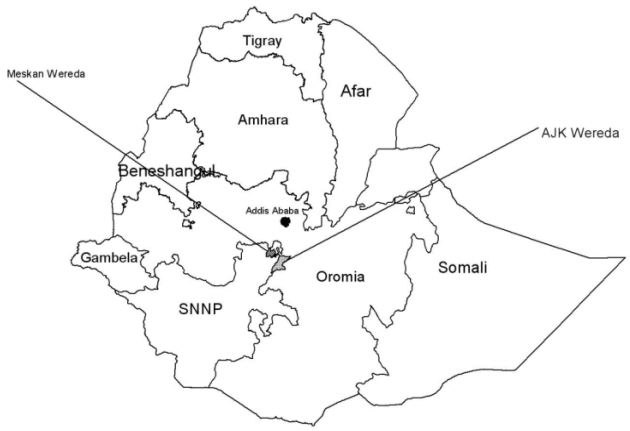

Figure 1. Map of Ethiopia showing the location of study areas

Data sources and analysis

Data for this study were collected in two sequential stages by using different techniques of data collection. In the first stage, data were collected through key informant interviews in the study kebeles. This first stage of data collection also included several focus group discussions, each of which consisted of 6-12 farmers representing a range of wealth, age and gender categories. In this first stage, farmers' perceptions were assessed concerning land degradation particularly water erosion and soil fertility depletion, and their respective land management investments were discussed. In the second stage of data collection, household surveys were carried out to generate detailed information concerning the perceptions of farmers towards water erosion and soil fertility depletion, their investments in land management practices and major factors influencing these investments. Accordingly, a total of 240 households were randomly selected from six kebeles and interviewed using a structured and pretested questionnaire. The major land management investments considered in this study are use of soil/stone bunds, application of animal manure, compost and inorganic fertilizers. Material, labor and money invested to construct or apply these measures were all converted into one monetary unit (the Ethiopian Birr, ETB) by using local labor and market prices. For the sake of data analysis, investments in land management were categorized into three levels (ranging from no investments made to considerable investments made).

Statistical Packages for Social Sciences (SPSS) software was used to analysis the data. Descriptive statistics primarily cross tabulation was employed to summarize the data. Chi-square analysis was undertaken to test the association between farmers' perceptions of land degradation and their actual investments in land management. Explanatory factor analysis was used to determine factors that affect farmers' investments in land management. Finally, Pearson correlation was employed to test the correlation between land management investments and the factors extracted using factor analysis.

RESULTS AND DISCUSSION

Household characteristics

More than 80% of households in the sample were male-headed. On average, about 50% of the respondents in the sample are literate (who can read and write). The average household size was 6.2 with 3.4 economically active members. The average livestock and land holdings were 3.7 Tropical Livestock Units (TLU) and 1.1 ha, respectively. The land size among the sample households is highly variable, ranging from 0.13 ha to 8 ha per household.

Table 1. Major household characteristics

Characteristics	Average
Men headed households (%)	80.5
Literate respondents (%)	51.1
Age of household heads (years)	45
Number of households size	6.2
Number of economically active family members	3.4
Livestock holding (TLU)	3.7
Land holding (ha)	1.1

Farmers' perceptions of land degradation

1 *Kebele* is the lowest level administrative unit in Ethiopia

2 *Wereda* is the local administrative unit above the *kebele*

3 The *Enset* plant, also called 'false banana', is a giant herbaceous tree which may grow up to 13 m high and a diameter of 2 m or more. It is a single-stemmed tree consisting of an above-ground pseudo stem made from overlapping leaf sheaths, a short, compact and fleshy underground stem called a 'corm,' and conspicuously large leaves.

4 *Chat* is an evergreen tree cultivated for the production of fresh leaves that are chewed for their stimulant properties.

Water erosion (soil erosion caused by water) and soil fertility depletion are considered as main indicators of land degradation. Accordingly, farmers were asked two main questions to gauge their perceptions of land degradation: (i) Is soil erosion a problem in your fields? (ii) Is soil fertility depletion a problem in your fields? Figure 2 presents farmers' responses on these two questions. The results show that a highly significant (χ^2 = 21.32, p=0.001) proportion of the respondents (92%) noted the problem of soil erosion on their land. Similarly, a majority (84%) of the farmers (χ^2 = 19.73, p = 0.001) reported soil fertility depletion to be a problem. Most farmers affirmed the view that soil erosion and soil fertility depletion have intensified over the last decade due to the increased frequency of plowing and overgrazing (i.e. removal of crop residues). Studies elsewhere in Ethiopia also found farmers to believe that soil erosion (Amsalu and Graaff 2006) and nutrient depletion (Stoorvogel *et al*. 1993; Haileselassie *et al.* 2005) are serious and increasing problems on their plots.

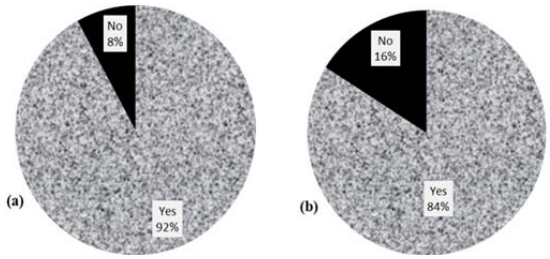

Figure 2. Farmers' perception of land degradation: (a) soil erosion and (b) soil fertility depletion in the CRV of Ethiopia

Farmers' investments in land management

Soil and stone bunds are the two main land management practices to control soil erosion. Similarly, farmers apply animal manure, compost and inorganic fertilizers to control soil fertility depletion.

Concerning these practices, again farmers were asked two questions: (i) Do you construct soil or stone bunds in at least one of your plots? (ii) Do you apply soil fertility practices in at least one of your plots? The results show that about one-third of the households (38%) construct either stone or soil bunds in at least one of their plots to counter water erosion (Figure 3). This is a very small proportion as compared to the proportion of farmers who perceive soil erosion as a problem in their fields.

The study furthermore shows that a significant majority of households (83%) applies at least one soil fertility practice in one of their plots. This large proportion (as compared to farmers applying water erosion control measures) is explained by the fact that soil fertility measures have immediate yield effects. Moreover, these measures are easier to apply and they are common practices that all farmers apply over years.

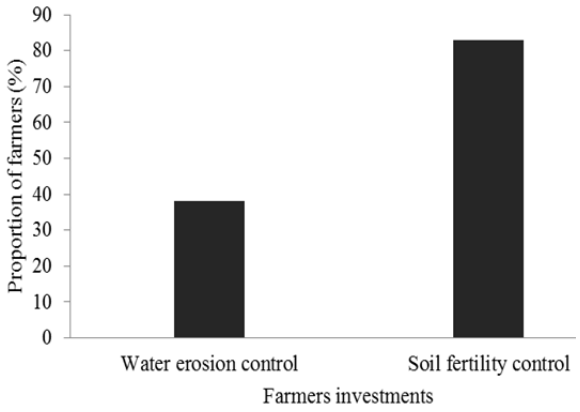

Figure 3. Percentage of farmers that invested in soil erosion and fertility control measures

Chi-square analysis of these data showed no association between perception and investments in land management practices; even not for soil fertility control measures, which is quite surprising considering the high rates of perception of soil fertility depletion (Figure 2b) and investments in control measures. Hence, the often heard hypothesis that farmers' perception of land degradation as a problem affects farmers' investments in land management (Mbaga-Semgalawe and Folmer 2000) is rejected by this study. Neither investment in water erosion control nor in soil fertility control is associated with farmers' perceptions of soil erosion or soil fertility depletion. This result is in agreement with findings in the Blue Nile basin of Ethiopia (Bewket and Sterk 2002) and leads to the conclusion that in the CRV apparently other (socioeconomic) factors determine farmers' decisions to invest in sustainable land management.

Factors determining farmers' investments

In order to express *how much* farmers invest in land management practices, all investments were quantified and expressed in Ethiopian Birr. Next, factor analysis was applied on 30 household characteristics in order to extract those socioeconomic key factors at household level that are most determent for farmers' decision *how much* to invest. This resulted in five major household level factors which together explain most of the variance in the sample, i.e., resource endowments, access to information, social capital, availability of family labor and experience and knowledge. As a final step, correlation coefficients were determined between each of these five household level factors and farmers' investments in land management. Table 2 shows that all factors except *experience and knowledge* are significantly correlated with farmers' investments.

Table 2. Pearson correlation coefficients of household level factors with investments (in ETB) in land management

Factors	Coefficients
Resources endowment	0.216**
Access to information	0.154*
Social capital	0.156*
Family labor	0.239**
Experience and knowledge	0.026

** Correlation is significant at the 0.05 level (two-tailed)*
*** Correlation is significant at the 0.01 level (two-tailed)*

The first factor ("*resources endowment*"), which is composed of household characteristics related to land and livestock, shows a significant correlation with farmers' investments in land management. It implies that "richer" farmers, with more land and livestock available, invest more in land management, particularly because of having the financial means to purchase inorganic fertilizers. The factor *"access to information"* is also positively correlated with farmers' investment and this is explained by the fact that proximity and better access to information sources (such as extension workers or town centers) stimulate investments in land management. Similar findings have been reported for other areas of Ethiopia by Bekele and Drake (2003). The third factor that positively influences farmers' investments in land management is *"social capital"*. The result shows that farmers with a larger numbers of friends and relatives invest more in land management. This is mainly because social capital promotes cooperative behavior and facilitates flow of information that may be relevant to land management. Moreover, in the absence of formal credit markets, it facilitates informal credit exchange within social networks to smooth financial constraints related to land management. The fourth factor *"family labor"* is significantly correlated to investments in land, because most conservation practices require significant labor. This confirms what is often found in similar studies elsewhere in which availability of labor within a family determines farmers' investments in land management practices which require significant labor. In our case this particularly refers to the construction of water erosion control measures (soil and stone bunds), as well as to the preparation of compost and the collection and application of animal manure. The factor *"experience and knowledge"* shows no correlation with farmers' investments in this study, which leads to the conclusion that characteristics like age and education (proxies for experiences and knowledge) do not influence investments in land management. This is in line with our earlier observation that perception of land degradation phenomena is very high in the study area and therefore it is not influential with respect to investments in land.

CONCLUSIONS

This study assessed farmers' perceptions of land degradation and their investments in land management practices in the CRV of Ethiopia. It shows widespread awareness of land degradation in the form of water erosion and soil fertility decline. Nevertheless, the use of and investments in land management practices - particularly investments in water control are very low, as demonstrated by the small percentage of farmers who have constructed soil or stone bunds. In the CRV, four factors which are related to socioeconomic characteristics of the households significantly influence farmers' decisions *how much* to invest in land management. These factors include the households' resource endowments, access to information, social capital and availability of family labor. Of these factors, farmers' resources endowment is a major factor that determines investments in land management. Therefore, sustainable land management strategies should be integrated within a comprehensive rural development strategy that generates improvements of farmers' livelihoods and their financial capacity. Better market access and diversification of production are some examples of such an integrated approach to sustainable land management. Moreover, this study confirmed the contribution of social capital in land management, and hence creating enabling conditions for farmers to participate in different groups, cross site visits and farmer-to-farmer experience sharing which improves their social networks and access to information and credit facilities. Furthermore, more social capital will also trigger access to labor in the form of carrying out collective action within the villages. Availability of labor is a crucial factor in sustainable land management; if family labor is a limiting factor it can be replaced by collective action with social networks. Farmers in the area are used to collaborative work, but triggered from intrinsic motivation to work together is far more effective than the currently widely used safety net approach or the food-for-work projects used to mobilize people for conservation activities.

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