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FARMERS' PERCEPTIONS OF EROSION HAZARDS AND ATTITUDES TOWARDS SOIL CONSERVATION IN GUNUNO, WOLAITA, SOUTHERN ETHIOPIA

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ABSTRACT: *The newly introduced structural conservation measures, i.e. the fanya juu and the normal bunds, did not manage to command widespread acceptance and adoption by Gununo farmers, despite the fact that the region experiences one of the very severe cropland erosion. The farmers were of the opinion that the conservation structures have very serious constraints and limitations. They reported that the conservation structures put large areas of land out of production, make oxen ploughing very difficult, harbor rodents that attack crops, and encourage running grass to grow and spread into the farms. A combination of these constraints, which severely affect crop production, have led to development of negative attitudes towards the soil conservation structures. The paper concludes that it is these negative attitudes, rather than improper perception of the erosion hazard and wrong conceptualization of the latter's threat to soil productivity, that have led to poor adoption of the conservation measures in the study area.*

INTRODUCTION

The average annual soil loss for cropland in the highlands of Ethiopia is estimated at 42 tons/ha [Hurni, 1988, p.127]. There are, however, very wide variations in rates of soil erosion among the different agroecological regions in the country. The net average soil loss rate estimated for cultivated fields at Gununo Soil Conservation Research Station, 'Wolaita', in the southern highlands, was 75 tons/ha which is equivalent to a soil depth loss of 7.5 mm/year [Belay, 1992, p.92]. The soil erosion in this region is so severe that the highest single year soil loss for

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Ethiopia, 296 tons/ha (a soil depth loss of about 3 cm), was recorded in this station [SCRP, 1983, p.16].

Soil erosion causes a considerable and, in most cases, an irreversible soil fertility and productivity decline. The effect of erosion on soil productivity is especially severe in the southern and southwestern highlands, where Nitosols are the predominant soil types, and most of the soil fertility is concentrated in the topsoil. In Gununo area, the loss of the top 80 cm soil, i.e., the topsoil, was estimated to cause a yield decline of more than 67 percent, and if erosion is to proceed at the estimated rate of 7.5 mm/yr on the least eroded fields, soil productivity would correspondingly decline by 7, 10, 20, and 26 percent, in the coming first, second, third, and fourth 20-year periods, respectively [Belay, 1992, p.91].

To control soil productivity decline, and to have sustainable agricultural development, soil erosion has to be stopped or at least reduced to a tolerable level, i.e., to a level below soil formation rate. There are several techniques of controlling erosion and these are broadly grouped under: (1) agronomic methods, which aim at controlling erosion by improving the vegetative cover of the soil;(2) soil management techniques, which try to control erosion by improving the aggregation of the soil particles; and (3) structural soil conservation methods, which control erosion by shortening the length and minimizing the gradient of the ground slope.

The conservation methods recently introduced in Ethiopia are of the structural type and, of these, the most common are the 'fanya juu' and the normal bunds. Both of these structures consist of narrow ridges and channels that are constructed parallel or at slight angle to the contour in order to control erosion and facilitate terrace development. In the case of the normal bunds the ridge or the bund is constructed by digging a ditch and throwing the soil downhill while in the case of the fanya juu the bund is constructed by throwing the soil uphill.

Hundreds of thousands of kilometers of fanya juu and normal bunds have been constructed over cropland in Ethiopia. However, reports indicate that these conservation structures have not been as successful as they could be, because the users (i.e., the farmers) were not enthusiastic enough in widely accepting and maintaining the new technology [Wood, 1990, p.195]. The failure of the conservation programs partly emerge from the fact that planners and implementing agencies ignore or fail to consider sociocultural factors as key determinants of the success or failure of conservation programs.[1] As Sanders [Sanders, 1992, p. 20-22] points out, effective and sustainable soil conservation programs can be designed and implemented only if (1) the causes of land degradation are properly identified; (2) the right conservation technologies are selected; and (3) the farmers are effectively involved in the planning and implementation of the conservation technology. Though socio-cultural factors are central in all of these, they are by far more crucial in deciding the involvement and participation of farmers in the conservation programs.

There is a general tendency, however, on the part of policy makers and planners to view the land degradation and conservation problems as functions of only physical and technical factors. This may have resulted from an underestimation of the role of the socio-cultural factors in the adoption and continued use of resource conservation practices, or from lack of appropriate information or both. Certainly, as Alemneh [1990, p.49] argues "there are few village level-data that identify the socioeconomic forces that fuel the processes of environmental degradation" in Ethiopia, and paucity of such data in this regard is one of the most important reasons for disregarding sociocultural factors in conservation planning.

THE ROLE AND SIGNIFICANCE OF FARMERS'PERCEPTIONS AND ATTITUDES IN SOIL CONSERVATION PLANNING

Among the many sociocultural factors influencing the use and management of land, some of the most important are the farmers' perceptions, attitudes and knowledge. In the present study, perception refers to an individual's awareness of objects, events, relationships and processes in the environment [Hall, 1983, pp. 103 & 583]. Knowledge is what the individual is familiar with, takes as fact or for granted, and also to his long standing information and recently learned sets of skills and resource management practices. Attitude refers to the individuals "general and enduring positive or negative feeling about some person, object or issue" [Petty and Cacioppo, 1981, p.7].

Farmers' perceptions of processes such as erosion and resource degradation and his knowledge of, and attitudes towards, resource management and conservation technologies are factors that strongly influence his decisions with regard to resource conservation. The role and importance of these factors in an individual's decision making process are also strongly emphasized in Beal and Sibley's conceptual framework (Fig 1).

The model is represented by a series of concentric circles that depict the group of factors and components that are involved in the individuals' decision making process. The inner circle represents the predispositional variables, i.e., personal characteristics (age, sex, education, etc), attitudes, knowledge, past behavior and goals that predispose a farmer to act in a certain way. It is believed that if one understands these predispositional variables properly, he would be able to predict the individual's behavior. Thus appropriate information on these variables would enable land use planners to predict whether the farmer would accept or reject recommended conservation measures. The second circle represents the farm firm characteristics that relate to land management, cropping

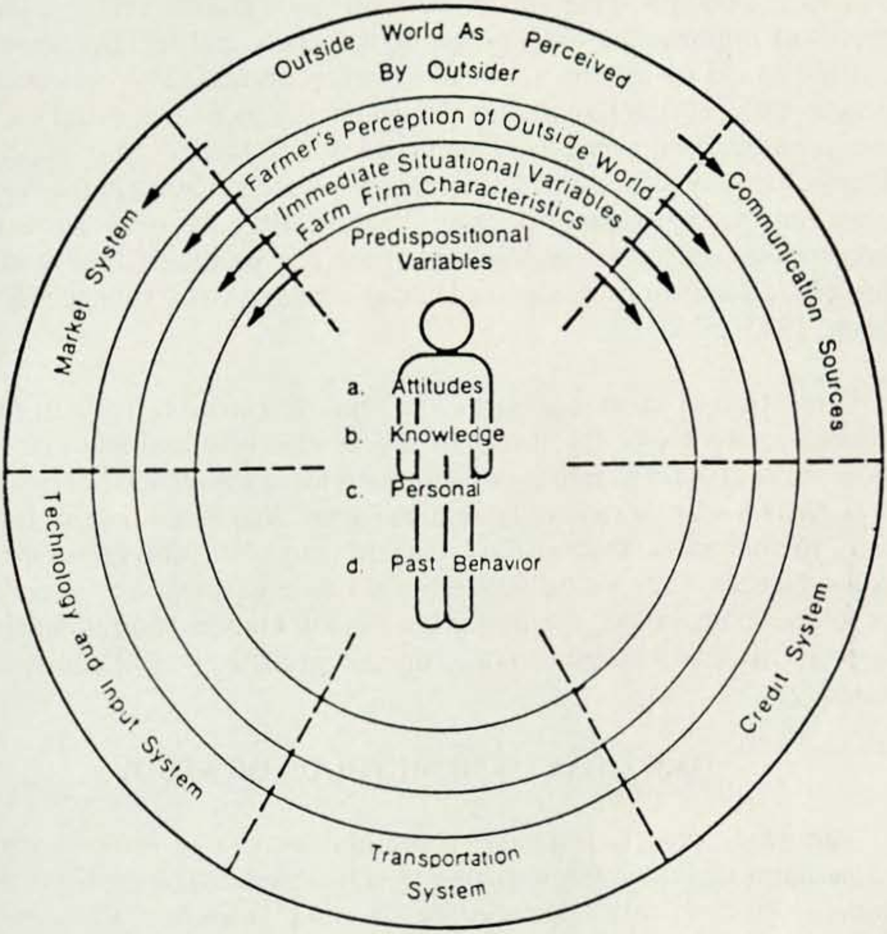

Figure 1. Beal and Sibley's (1967) Conceptual Framework for Analysis Individual Behavior [Shaner,1982, et. al., p. 263]

practices, labour, inputs, outputs, etc., and which articulate the farmer's behavior with regard to the farm practices. The third circle represents the factors that condition the farmers behavior and decision. Of these factors, the most important are his perceptions, beliefs and feelings about the outside world or the environment in which he acts. The outside circle depicts the real situation in the relevant environment. The latter includes the physical, biological, economic and social setting over which the farmer has very little control. Information on the situation in the relevant environment is necessary because "... the difference between farmers' perceptions and researchers' observations can be determined and used for educational purposes and planning strategies for change" [Shaner et.al., 1982, p.263].

Perception of erosion hazards and land degradation leads to proper conceptualization of the threat to soil productivity and soil resources. Where the erosion hazard is not perceived the resulting land degradation may also be seen as something remote rather than immediate. If farmers fail to perceive the erosion hazard, and to conceptualize the consequences, they would feel reluctant to take measures against the problem. Under these circumstances the soil conservation planner may need to run intensive education programs prior to the soil conservation activities.

OBJECTIVES AND METHODS OF STUDY

This study reports results of a preliminary village level survey and assessment of farmers' knowledge of soil resources, perceptions of the soil erosion hazard, knowledge of, and attitudes towards, soil conservation. It is believed that this study, which specifically relates to Gununo area, will contribute to the existing knowledge on the relationships between the physical environment and sociocultural factors in Ethiopia and add to the data base required for designing more sustainable land use and resource management plans.

Four small contiguous catchments (Lower 'Dombe', 'Zerwa', 'Goppo' and 'Kessiga' catchments), each about 70 to 100 ha, were selected for investigation. The catchments are located close to Gununo Soil Conservation Research Station and have similar topography, climate, soils, and farming system. Two of the catchments (Zerwa and Lower Dombe) were treated with fanya juu and normal bunds, while the other two were not.

A total of 39 farmers, 15 from the treated and 24 from the untreated catchments were selected randomly and each farmer, interviewed through an interpreter, was asked to respond to both open ended and closed type questions relating to his perception of the soil erosion hazard and attitudes towards the newly introduced structural soil conservation measures and alternative soil erosion controlling land management techniques. Wherever it was necessary the information obtained from the interviews were supplemented and verified through field observations. The interviewed farmers had at least one or two cultivated fields on slopes of above ten percent though in extreme cases slope gradients may exceed 30 percent. The interviewees have lived in the area since birth and some of basic data relating to these farmers is shown in Table 1.

THE STUDY AREA

The study area is located in Wolaita, about 16 km WNW of Soddo town, and though small is typical of the very extensive 'enset' (Inset ventricosum) and coffee (Coffee arabica) producing agro-ecological region of the southern and southwestern Ethiopian highlands. The catchments selected for the study lie at elevations of between 1800 and 2100 m, and form part of the Omo drainage basin. The landscape is characterized by undulating topography, a series of V-shaped valleys and relatively narrow interfluves with typical slope gradients of 10 to 20 percent. Climatic records at the site indicate mean annual temperature of 19.2°C and rainfall of 1335 mm [Belay, 1992, p. 5]. Rainfall occurs

Table 1
Basic data relating to the interviewed farmers

Attribute	Number	Attribute	Number
Age range (years)		Sex	
< 15	0	Male	47
		Female	0
15-25	5		
26-35	10	Martial Status	
		Unmarried	2
36-45	9	Married	47
46-55	7		
		No of children	0 -12
>55	8	Land holding (ha)	0.25-2.00

Source: Field Survey

over an extended period of eight months (March to October) and has a typical bimodal pattern with small break in May or June. Detailed survey (1:5,000) groups the soils in the area under the Eutric Nitosols of the FAO/UN classification system [Weigel, 1986]. Reconfirming this broad classification, Belay [1992, p.22] subdivides the soils into three erosion phases, i.e.slightly, moderately, and severely eroded soils (Table 2).It is argued that erosion induced property and productivity changes necessitates grouping of these soils into separate classes.

The survey site (and the awraja as a whole) constitutes one of the most densely populated areas of Ethiopia. The population density of Boloso Sori (i.e. the woreda to which the study area belongs) for the year 1987 was estimated at 399.1/km2 [CSA, 1988, p.28]. In the immediate environs of the study area,the population density for the same year was estimated

Table 2
Topsoil depth and areal coverage of erosion phases of Eutric Nitosolin Gununo area

Erosion Phase	Topsoil depth (cm)	Topsoil lost (%)	Area Coverage (%)
Slightly eroded	>60	<25	26.0
Moderately eroded	20-60	25-75	64.4
Severely eroded	<75	<75	9.6

Source: Belay, 1992, p.22.

at 523 persons/km2 and the average land holding was only 0.63 ha per household [Belay, 1987, p.16]. The traditional farming system which involved a subsistence crop and livestock production was, until recently, well adapted to this dense population. The land use pattern is characterized by semi-concentric belts of production around the homesteads. The houses are constructed at the lower edges of the interfluve crests while the tops, facing the homesteads, are left open for social activities. Down slope from the houses are the gardens, followed by the fields, the grazing land and finally the forests in the valleys.

The gardens, which are heavily manured, are the major suppliers of the food required for subsistence. Perennial crops such as 'enset', coffee, yams (Dioscorea spp.) and a variety of cabbages are planted here. The annual crops such as maize (Zea mays), sorghum (Sorghum bicolor), haricot beans (Phaseolus vulgaris), barley (Hordeum vulgare), 'teff' (Eragrostis teff), taro (Colocasia esculenta) and potatoes are planted in the fields. In the past crop cultivation on these fields made extensive use of fallowing to regenerate soil fertility. Presently, the practice of fallowing is very much minimized and fields are continuously cultivated using mineral fertilizers (di-ammonium phosphate and urea). Crop rotation, mixed cropping, intercropping, sequential cropping, and double cropping are also extensively utilized in the cultivated fields.

Normal bunds were introduced for the first time in Gununo area in 1980 by the Wolaita Agricultural Development Unit (WADU) for experimental purposes [WADU, 1981, p.2]. The treated site, i.e., the Zerwa catchment (upper part of the Dombe catchment) which largely constituted cropland, had a total area of about 68 ha. In 1987, the Soil Conservation Research Project (SCRP) treated, through food for work program, an additional area of about 100 ha in the Lower Dombe catchment. The conservation structures applied in this case were both the fanya juu and the normal bunds and were intended for demonstration purposes.

FARMERS' PERCEPTIONS OF THE EROSION HAZARD

It was earlier noted that, despite the accelerated soil erosion in the region, structural soil conservation measures, newly introduced in Gununo area, were not widely accepted and adopted by farmers outside demonstration and experiment sites. One of the suspected reasons for rejecting these conservation measures could be that the farmers are not aware of the soil erosion problem and its consequences on the soil productivity. Thus, it was necessary to elicit the farmers' perceptions of the erosion hazard on cultivated field in both conservation treated and untreated catchments of the study area.

The majority of the responses (88 percent of the total) indicated that farmers in the untreated catchments are indeed aware of the soil erosion hazard on their cultivated fields (Table 3). This perception rate, though much higher than those reported in some parts [Alemneh, 1990, p.50; Yeraswork et. al., p.40] is similar to what was registered for the whole of the country [FAO/MOA, 1986, p. 234]. The high level of perception in Gununo area is attributed primarily to the influence of the Gununo soil conservation research station which may have raised the community's

Table 3
Farmers' perceptions of soil erosion hazard in cultivated fields in Gununo Area

Farmers that perceive erosion as a problem			Farmers that did not perceive erosion as a problem	
Catchment	**Number**	**Percentage**	**Number**	**Percentage**
Treated	**8**	**53**	**7**	**47**
Untreated	**21**	**88**	**3**	**12**
Total	**29**	**74**	**10**	**26**

Source: Field Survey

awareness of the erosion hazard. The very intense soil erosion in the region also creates the conditions for a better perception of the problem.

Farmers in Gununo area were also very conscious of the intensity of soil erosion at different slope positions of the cropland in the untreated catchments. The farmers' reflections and our observations revealed that the fields most affected by erosion were those that occur at lower slope positions on longer slopes and higher gradients. As noted in a previous study [Belay, 1992, p.24], these slope arrangements allow runoff generated at higher slope positions to concentrate overland flow and build up energy and cause severe soil erosion. It was also noted that 53 percent of the farmers in the conservation treated catchments felt that erosion is still a problem even in the treated fields. This implies that the conservation structures already applied in the area are not sufficiently effective in controlling soil erosion. On the spot field observations in some of the conservation treated fields indicated that the causes of erosion in these fields are in most cases poor construction of the bunds, the abnormally wide inter-structure spacing and lack of maintenance.

Many writers have reported that farmers in many parts of Ethiopia have very good knowledge of the soils they use. For example, regarding the knowledge of peasants of 'Wello' and Northern 'Shewa', Mesfin [1991, p.87] states "... The information collected on soil types from peasants is extremely interesting. Evidently the peasants make very refined distinction between various types of soils and their characteristics. The types of soils identified are quite considerable....". Farmers in the studied catchments of Gununo were also found to have very good working knowledge of the characteristics and fertility of their soils. The indigenous knowledge of different soil characteristics and properties was effectively utilized in the assessment of the community's awareness of the effects of erosion. It would be recalled that the soils in the study area are Nitosols and that these soils are strongly differentiated into various erosion phases. Hence, it was one of the intentions of this study to find out if farmers are aware of the erosion-induced property changes in the soil erosion phases.

In view of this, farmers were asked if there are differences in the fertility and productivity of cultivated soils in their respective catchments and if they thought these differences were attributable to erosion. First and foremost, all farmers agreed that there are major differences in the fertility and productivity of soils in their respective catchments. However, these farmers managed to consistently classify the soils only into two groups, i.e., poor and fertile soils. The fertile fields were described by the farmers to have soft dark reddish brown thick surface soils, excellent tilth and higher water holding capacity (Table 4). On the other hand the poor soils were identified as reddish brown compact materials with characteristic poor tilth and low water holding capacity.

Farmers also reported that crop yields on the fertile soils are very much higher than those on the poorer ones. They also indicated that while almost all the crop types cultivated in the area can be grown in the fertile fields only a few of these can be produced on the poor soils. It is also pointed out that the poor soils need frequent following as it is impossible to cultivate them continuously.

Furthermore, the majority (64 percent) of the farmers expressed the view that the cause for soil fertility and productivity variations in their catchments are the different degrees of erosion (Table 5). These farmers feel that erosion brings about the degeneration of soil fertility and productivity by removing the fertile topsoil and exposing the very poor subsoil material. Others (31 percent) related poor fertility and productivity to the combined effects of both soil erosion and lack of stable yard manure. A few of them (5 percent) attributed the low fertility and productivity of the poor soils to only lack of stable yard manure.

Field observations of a number of plots described and classified by the farmers as fertileor poor confirmed that the two groups of soils are distinctly different erosion phases of Nitosols. The soil properties identified by the farmers to characterize the fertile and poor soil groups, respectively, were found to coincide very well with the characteristics of the slightly and severely eroded soils earlier identified and described by Belay [1992, p.22]. The dark surface soils identified in the fertile fields constituted the topsoil while the reddish surface soils of the poor fields consisted of mixtures of surface materials derived from the topsoil and erosion exposed subsoil. These responses suggest that the local farmers very well perceive not only the erosion process but also the effects of erosion i.e. the erosion hazard.

Farmers were also asked to estimate the thickness of the dark soil layer (i.e., the topsoil) in the two soil groups they identified. These facts were needed to find out if farmers properly perceive the effects of erosion on the topsoil, i.e., the darker and the most productive part of the soil profile. It was also believed that the estimated top soil depth can be used as an indirect measure of the perception of the erosion intensity. If farmers manage to relate these factors to soil erosion it may further

Table 4
Characteristics of fertile and poor soils as identified by farmers in Gununo Area

Identified soil characteristics	Farmers that identified the characteristics			
	Percentile soils		Poor soils	
	Number	(%)	Number	(%)
Darker surface soil	39	100		
Soft surface soil	33	85		
Easily ploughed (good tilth)	34	87		
Deeply penetrated by the plough	23	59		
Needs less intensive ploughing & seedbed preparation	1	3		
Holds more water	1	3		
Reddish surface soil			39	100
Compact and heavy surface soil				
Difficult to plough			31	80
Deep penetration by the plough difficult			30	77
			24	62
Needs intensive ploughing for seedbed preparation			2	5
Hold less water			1	3

Source: Field Work

Table 5

Principal causes of productivity differences as identified by local farmers

Identified Cause	Respondents	
	Number	Percentage
Erosion	25	64
Erosion & absence of stable yard manure	12	31
Absence of stable yard manure	2	5

Source: Feild Survey

indicate that they have a good knowledge of the effects of erosion on the soil fertility and productivity. The responses to the question are presented in Table 6.

The majority (65 percent) of the farmers expressed the view that the depth of the topsoil is very thin (<25 cm) in the poor soils, i.e., the severely eroded soils, and very thick (50 to 150 cm) in the fertile soils, i.e., the slightly eroded soils. The estimated depths of the topsoils coincided very well with the measured values of less than 20 cm registered for severely eroded soils [Belay, 1992, p.22]. Farmers are very well aware of the topsoil depth in the severely eroded soils as it is very shallow (in many cases missing) and the subsoil materials are frequently exposed to the surface during ploughing.

However, the topsoil depth estimations made for the fertile fields were very much exaggerated. The majority (71 percent) of the farmers expected the topsoil depth to be between 50 and 149 cm. A considerable proportion (19 percent) also felt that it is above 149 cm. But earlier conducted field measurements indicated that the topsoil depth of even the slightly eroded soils rarely exceed 80 cm [Belay, 1992, p.22]. This writer feels that the reluctance of farmers to apply soil erosion control measures on fertile soils might be partly attributed to this wrong perception of topsoil depth.

Table 6
Depth of the dark soil layer (i.e., the topsoil) as perceived by the local farmers

Estimated topsoil depth (cm)	Respondents			
	Fertile soil Group		Poor soil group	
	Number	Percentage	Number	Percentage
< 25	0	0	22	65
25-49	4	10	7	20
50-99	15	41	5	15
100-149	11	30	0	0
> 149	7	19	0	0

NB: the farmers estimates made in cubits and spans were later converted to centimeters by the author.

Source: Field Survey

FARMERS' ATTITUDES TOWARDS SOIL CONSERVATION STRUCTURES

As observations indicate the magnitude of the erosion hazard is so great in some fields that an immediate action is badly needed. Moreover, as it is already pointed out the majority of farmers are very well aware of this erosion hazard. Hence one of the expected reactions of farmers to this menacing problem is soil conservation. But the conservation behavior of farmers is strongly influenced not only by the perceptions of the erosion hazard but also by their opinions and feelings of soil conservation mẹasures. Hence it was necessary to find out what the attitudes of the farmers were on issues relating to soil management and conservation. Thus, farmers in the treated catchments were asked if the conservation structures (the 'fanya juu' and normal bunds) in their fields are necessary.

Of the fifteen farmers interviewed, 80 percent (12 farmers) felt that these structures are necessary, while 20 percent (3 farmers) felt otherwise (Table 7). Farmers in the untreated catchments were also asked if it is necessary to control the soil erosion hazard in their fields. Surprisingly enough a large majority (83 percent) of them agreed that they want to have erosion control measures in their fields (Table 8). Only 17 percent of the farmers felt that they don't need soil conservation measures because they thought erosion is not a serious problem. This result in general suggests that most of the farmers have the desire to apply conservation measures in their cultivated fields if they are provided with the appropriate methods.[2]

Table 7
Farmers' attitudes towards soil conservation measures in the Treated Catchments

Farmers that want to retain the soil conservation structures in their fields	12	80
Farmers that do not want to retain the conservation structures in their fields	3	20

Source: Field Survey

It was also observed that all the farmers that rejected the necessity of soil conservation measures, in the treated and untreated catchments, were those that had farms with sizes of less than 0.33 ha, i.e. the lowest category of farm sizes (Table 9). It appears that farmers with smaller land holdings are more likely to reject conservation structures than those with larger ones. It must be noted, however, that with the limited number of samples considered in this paper, it is difficult to give a conclusive statement about the relationship between size of holding and attitude toward conservation structures.

Table 8
Farmers' attitudes towards soil conservation measures in the Untreated Catchments

	Respondents	
	Number	Percentage
Farmers that agreed to measures against soil erosion in their fields	20	83
Farmers that felt their is no need for soil conservation in their fields	4	17

Source: Field Survey

Those who agreed on the necessity of soil conservation measures in the untreated catchments were further asked if they have ever tried to control soil erosion in their respective fields. Of those who felt the necessity of soil conservation (i.e., of the 20 farmers) 80 percent indicated that they had tried to check soil erosion through various methods. According to the responses, about 60 percent of them applied field ditches while 10 percent tried to construct level bunds (Table 10). However, almost all those who applied field ditches pointed out that though the structures are very easy to construct (using oxen drawn

Table 9
Size of land holdings of interviewed farmers

Size of farms (ha)	Number of farmers
<0.33	11
0.34 - 1.66	14
0.67 - 1.25	10
1.25 - 2.00	3

N.B. The data in hectares was obtained from farmers' estimates made in 'timad'(4'timad' = 1 ha)

Source: Field Survey

ploughs) they are much inferior to the bunds and 'fanya juu' in arresting soil erosion. Other erosion control techniques applied by farmers included leaving soil clods along contours, contour planting of 'enset', mulching, and application of stable yard manure.

Most respondents (84 percent) also expressed the view that among the conservation measures they know, the normal bunds and 'fanya juu' provide the most effective system of soil erosion control (Table 11). This suggests that most farmers in the untreated catchments are very much aware of the effectiveness of the structural conservation measures in controlling erosion. The finding agrees with an earlier study which concluded that farmers in Gununo have favorable attitudes towards soil conservation structures [Amare, 1988, p.83]. It appears that the constraints to the spontaneous adoption of the structural conservation measures should be sought in factors other than wrong perception of erosion and negative attitudes towards soil conservation.

Farmers in both treated and untreated catchments were also asked to state the advantages and disadvantages of the normal bunds and the fanya juu. Most farmers (>80 percent) feel that the normal bunds and fanya juu are advantageous in the sense that they control erosion and improve crop yield[3] (Table 12). Similar views were also reported by researchers in various parts of the country [Amare, 1988, p.84; Yeraswork et. al., 1983, pp.23-24; Mulugeta, 1992, p.82 & p.75].

The disadvantages of normal bunds and fanya juu are listed in Table 13. A good proportion of the farmers (55-66 percent) pointed out that the structures encourage the spread of running grass and provide breeding grounds for rodents that attack crops. The rodent problem is widely reported in conserved fields in various parts of the country [Yeraswork et. al., 1983; Yohannes, 1989; Dessalegn, 1991; Mulugeta, 1992]. In fact, Mulugeta [1992, p.62] reports that out of the 30 sample fields he examined in his study area (Western 'Cherake' catchment, Wolaita) half were inhabited by moles. Where the rodent problem is severe farmers dig the bunds, destroy the habitats and if possible kill the rodents. Similar actions are also taken against running grass. But, farmers rarely rebuild the bunds, and as a result, many of the structures are permanently destroyed.

Table 10

Farmers that attempted to apply conservation measures to control erosion in the untreated catchments

Types of conservation measures applied	Number of Farmers	Percent of total interviewed
Normal bunds & fanya juu	2	10
Field ditches	12	60
Mulching	1	5
Applying yard manure in rows	1	5
Planting 'enset' in rows	1	5
Leaving soil clods along contours	1	5
Attempted nothing	2	10
Total	20	100

Source: Field Survey

Some farmers also added that the fanya juu and normal bunds create serious difficulties during ploughing where the inter-structure spaces are too narrow to turn the oxen and to allow up- and down-slope ploughing. In some areas farmers respond to this problem by destroying alternate bunds and enlarging the inter-structure spaces.

Farmers also complained that a considerable proportion of their cultivated land is put out of production as it is occupied by the structures.

Table 11
Effectiveness of the more commonly applied soil erosion control measures as perceived by farmers

Conservation Measures	Number of Farmers responding		
	Effective	Not Effective	Dont't know
	Untreated catchments		
Field ditches	13	11	
Normal bunds & fanya juu	21	21	2
	Treated catchments		
Normal bunds & fanya juu	11	4	

Source: Field Survey

The Ethiopian Highland Reclamation Study has also identified loss of land as a major problem of most structural conservation measures and pointed out that these structures take up 2-5 percent of the land at slopes of up to 8 percent; 8-12 percent at slopes of 8-16 percent; 15-20 percent at slopes of 16-30 percent and over 25 percent at slopes of above 30 percent [FAO/MoA, 1986, p.49].

Amare [1988, p.84] argues that the majority of the farmers he interviewed felt that the production lost due to the space occupied by the conservation structures is compensated for by increased yield attained following treatments. But this report is contestable because measurements on many conserved fields and experimental plots did not

Table 12
Advantages of the fanya juu and normal bunds as perceived by the local farmers

Perceived advantages	Farmers reporting advantages			
	Treated Catchments		Untreated catchments	
	No.	%	No.	%
Erosion	13	86	23	96
Improved crop yield	12	80	20	83
Improved fodder grass	0	0	1	4

Source: Field Survey

indicate sufficient yield increments at least in the first five years of treatment, to fully compensate for the lost land [Belay, 1992, p.117]. Moreover, as already pointed above the cropland lost due to conservation increases with increasing slope and as a result it becomes literally impossible to compensate for the losses on the very steep slopes because these demand very large yield increments. For example an observation of a field on a slope of 30 to 45 percent, immediately after treatment, indicated that the conservation structures put about 45 percent of the cropland out of production [Belay, 1992, p.105]. To compensate for a loss of land of this magnitude a two fold increase in yield is required and this is impossible to attain by simply treating the fields with conservation structures alone.

Farmers react to the abnormally high level of cropland loss by either severely narrowing the bunds or totally removing alternate structures or both. These kinds of reactions have also been reported from other parts of 'Wolaita'. Mulugeta [1992, p.63] reports that the width of bunds in the majority of the sample fields were reduced to about 26 to 75 cm from their original normal average dimensions of 150 cm. Though narrowing of bunds and ditches reduces the land put out of production it at the same time weakens the structures and increases the possibility of their breaching by runoff and raises the risk of rill and gully erosion on the cultivated fields.[4]

Table 13
Disadvantages of normal bunds as perceived by the local farmers

Disadvantages	Farmers reporting disadvantages			
	Treated catchments		Untreated catchments	
	No.	%	No.	%
Puts considerable land out of production	2	13	4	17
Encourages running grass	8	53	15	63
Provides breeding grounds for rodents	9	60	16	66
Does not allow up and down slope ploughing	3	20	10	42

N.B. In addition to the disadvantages listed here, the necessity of larger labor, better know-how and more advanced tools for the construction of bunds and 'fanya juu' impose serious constraints to the spontaneous adoption of the soil conservation structures.

Source: Field Survey

CONCLUSIONS

The paper at hand has clearly indicated that farmers in Gununo area have very good perception of the erosion hazard in the region. Furthermore, these farmers have very well conceptualized the effects of erosion and have clearly identified the major and visible characteristics of eroded and less eroded field. They are also aware of the fact that erosion results in severe decline in fertility and productivity of soils.

Most of the farmers have the willingness and desire to tackle the erosion problem and feel that the soil conservation structures applied in their environs, the 'fanya juu' and normal bunds, are effective in controlling soil loss. They have also pointed out that these structures improve soil productivity and crop yield. But at the same time, they have strongly complained that the soil conservation structures put large areas of land out of production, make oxen ploughing very difficult, harbor rodents and running grass and encourage crop losses.

It appears that the structural conservation measures bring about net production decline because the yield improvements resulting from soil conservation are not large enough to compensate for the losses resulting from the technical problems. Consequently, farmers have developed negative attitudes towards the structural conservation measures. The study suggests that it is these negative attitudes, rather than inadequate perceptions of the erosion hazard and poor conceptualization of the threat to soil productivity, that led to poor adoption of the structural conservation measures in the study area.

Fortunately, both the technical and economic problems can be tackled through increased research, training and skill development programs; widespread weed and rodent control measures; and crop production intensification on the cultivated land. If these are effectively realized there is a good chance that the conservation structures will command more widespread adoption and sustainable use in Wolaita and probably other parts of Ethiopia.

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Notes

1. *Three major groups of sociocultural factors are thought to strongly influence farmers' decisions to accept or reject new technologies (Shaner et. al., 1982), and these are (i) the farmers' goals and preferences; (ii) the community's social and cultural values, norms and customs; and (iii) the farmers' perceptions, beliefs, knowledge and attitudes. It is also argued that the sociopolitical environment, constituting the political instability, the exploitative marketing policies, the uncertainty of access to land, etc., have contributed to the failure of soil conservation programs in Ethiopia (Wood, 1990, p.194-195).*

2. *An appropriate soil conservation method is one that is technically effective (i.e., reduces soil loss to the tolerable rate), financially profitable (from the farmers point of view), and socially and culturally acceptable to the farming community, and can be easily integrated into the farming system.*

3. *Farmers in Gununo area rarely utilize the ridges and ditches of the structures for the production of fruit or fodder grass as advised by the Ministry of Agriculture.*

4. *In many of the humid areas of Ethiopia, fields treated with level 'fanya juu' and normal bunds are reported to induce serious drainage and waterlogging problems (Yeraswork, 1988). The farmers in Gununo area did not report this problem apparently because the excellent soil structure and high infiltration capacity of the Nitosols rarely allow water to collect on the fields and encourage waterlogging.*

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