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FARMERS' ATTITUDES TOWARDS LAND RESOURCE CONSERVATION AND ITS IMPLICATION FOR SUSTAINABLE LAND MANAGEMENT IN THE HIRMI WATERSHED, NORTHERN HIGHLANDS OF ETHIOPIA

Tsehaye Gebrelibanos[1], Mohammed Assen[2]

[1]Aksum University, Department of Geography and Environmental Studies, Aksum, Ethiopia

[2] Addis Ababa University ,Department of Geography and Environmental Studies, , Addis Ababa, Ethiopia

ABSTRACT

Developing favorable attitudes of local communities towards conservation of natural resources is an indispensable prerequisite for sustainable land management practices. In Ethiopia, however, analysis of farmers' attitudes before planning and implementation of conservation efforts has received little or no attention. This research examined farmers' attitudes towards conservation of natural resources in Hirmi watershed, Northern highlands of Ethiopia. For this purpose, data were collected by means of questionnaire with 0.89 reliability from a stratified random sample of 164 farm households during 2011and 2012. Likert- scaling method was employed to assess attitudes of farmers. Results revealed that nearly 62 percent of the participating farmers had high and very high attitudes. A multiple regression model indicated that, farming experience, household income, benefits gained, farmers' age extension contact, literacy and access to credit were found to be significant predictors of attitudes. In addition, the results of the study showed that there was statistically significant positive correlation between attitude and farming experience, household income, farmers' age, extension contact, benefits, land holding tenure and literacy. Land tenure security, extensive extension contacts, trainings and awareness creation among respective stakeholders need to be practiced to build favorable attitude of farmers for sustainable land resource conservation.

Keywords: Attitude, conservation, natural resources, sustainable land management, Northern highlands, Ethiopia.

INTRODUCTION

The destruction and mismanagement of land resources in countries like Ethiopia where a large proportion of the population depends on subsistence farming for livelihood requires an urgent consideration. Land degradation remains to be a serious threat in the highlands of Ethiopia (>1500 m a.s.l) where over 88 percent of the human and over 75 percent of the livestock populations reside (Hurni, 1988, Azene, 2001, Aklilu, 2006). As indicated by the high rate of soil erosion (Hurni, 1993), land degradation is the most threatening environmental problem in the highlands of Ethiopia.

Despite the fact, there is sever land degradation in the Ethiopian high lands, efforts undertaken so far to reverse the scenario have been minimal and mainly been in the form of campaigns and quite often farmers have not been involved in the planning process (Azene, 2001; Paulos, *et al*., 2004). Attitudes of local land users, such as farmers, are critical for sustainable conservation endeavors. For instance, in a research conducted by Hu, *et al*. (2006) on the Loess hilly area of China , the contribution of attitude in the conservation of natural resources was found to have a significant role in the successful implementation of soil conservation projects. In contrast, the unsustainability of the Ethiopian massive conservation efforts carried out following the 1973/74 terrible famine was partly attributed to the low attitude of the respective stakeholders particularly the farmers who were attracted only by the food donation incentives provided by the World Food Program without any consensus made between the two actors, especially on the techniques employed (Hoben, 1996; Azene, 1997; Shiferaw and Holden, 1998;Yeraswork, 2000). This led a large section of farmers to consider the food for work program as a short lived project with little or no contribution to a long lasting natural resources conservation (Yeraswork, 2000; Meijerink, 2002).

As Napier *et al.,* (2008) noted, unless the attitudes of all stakeholders in a concerned area are assessed and represented, conservation planning and program implementation efforts may not achieve its anticipated outcomes. This reflects environmental conservation efforts become seamless only whenever it gains social acceptance. Attitude implies that a person is no longer neutral towards referent objects or issues. The person is positively or negatively inclined towards the referents (Newcomb, 1966; Zanden, 1977). Attitude refers to a person's psychological stand about objects or issues. A number of socio economic characteristics influence farmers' attitudes towards conservation of natural resources. For instance, extension contacts and literacy have caused attitude differences among farmers in Iran (Sadit *et al*.,2010), training received and satisfaction with participation in Nepal(Barel,2005) and ,age ,level of literacy and economic activity in Kenya(Shibia,2010).

Evidently farmers' involvement in the conservation of natural resources is largely governed by their awareness of the problems, attitudes and apparent benefits of conservation practices (Ahnstrom et *al*. 2008). Thus, while conservation efforts are attempted, the attitude of the concerned stakeholders needs consideration because people's attitudes highly influence program implementation especially when the program is sustainably required (Richards, 1996).

Farmers with positive attitudes towards conservation efforts are excited on the activities and maintenance of the conservation structures (Bekele and Holden, 1998; Hu *et al.*, 2006). This implies it is useless to compel people into accepting systems of

conservation that they do not appreciate. In addition, land resources conservation would be sustainable whenever it becomes biophysically appropriate, economically viable and socially endurable (Graaf, 1993; Herweg and Ludi, 1999; Hu, *et al*. 2006).

Understanding farmers' environmental attitudes has important contributions for selecting viable land resources management options as it can serve as a basis to assess the effectiveness of introduced conservation/management methods by avoiding potential conflicts (Hu, *et al*. 2006). It is, therefore, indicative that any approach to the conservation of natural resources cannot be effective unless the human dimension, especially attitude is considered (Graaf, 1993, Barel, 2006).

The study area is selected as it is a dry land in northern highlands of Ethiopia and has experienced land degradation and endeavors of soil and water conservation practice through a household level labour quota system. This labour quota is a system of labour supply from land user households where every adult household member is compelled to contribute 20 adult person days per year. Labour mobilization is seasonal and takes place in January/February and July. However, complains are common in the rules regarding the distribution of benefits from plantations and area closures as there is no significant economic benefit realized from collective management of commons at household level(Gebremedhin *et al*., 2003).

The objective of this paper was to investigate attitudes of farmers towards conservation of land resources in the Hirmi watershed and its adjacent agro-ecosystem, Northern Highlands of Ethiopia.

MATERIALS AND METHODS

Study area

The Hirmi watershed **and its adjacent agro- ecosystem** is located in the highlands of northern Ethiopia and forms part of the Tekeze River basin. It is located between 140^0 0' -14^0 9'N, and 38^0 14'-38^0 25'E. It covers 23,984 ha of land and has a population of about 69,705 in 11,617 households with a population density of 290/km^2 (CSA, 2007; Tahtay Koraro Office of Agriculture, 2011). In Administrative terms, the watershed lies within the North West Zone of Tigray, National State (Figure1). A wide range of elevation characterizes the study area, and governs its climatic characteristics. On the basis of the traditional agro climatic classification system, which considers temperature and elevation, Hirmi watershed falls within *Weinadega* (subtropical) agro-climatic zone with an altitudinal range between 1800 to over 2400 meters above sea level. Metrological records from *Indaselassie* town which lies within the heart of the watershed suggest the mean annual temperature of 20.3^0c with small monthly variation. The annual rainfall averages 987mm (1971 -2007) with a maximum of 1380.2mm in 1975 and a minimum of 679.7mm in 1971. Rainfall shows unimodal pattern and mainly occurs between June and September. The occurrence of rain fall is not dependable.

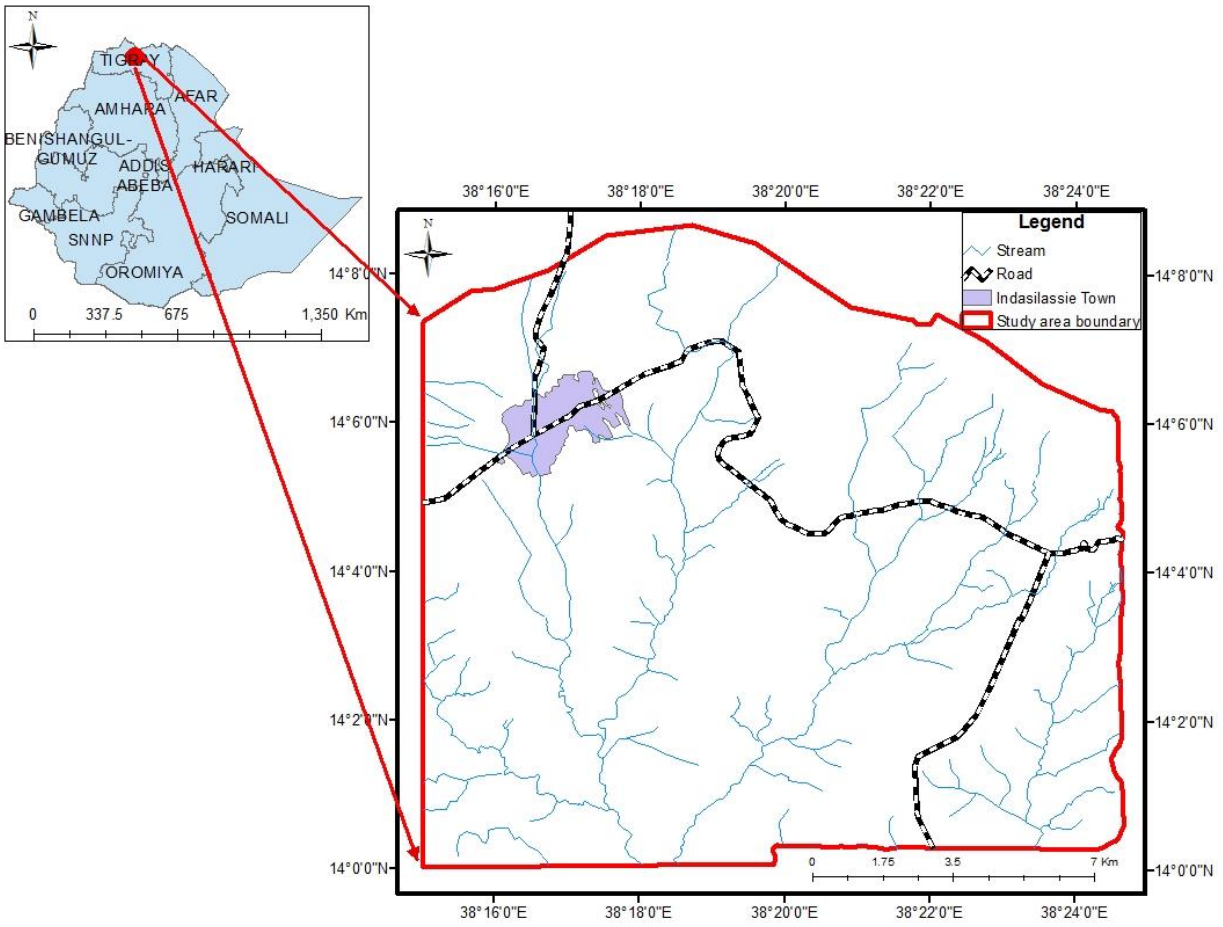

Figure1: Location Map of the Study Area

The major land use/cover types prevailing in the area include cultivated and rural settlement lands, grass lands; shrub lands, and forest areas. Rain fed crop production is the main economic activity and the important crop production systems in the area are *Eragrostis tef* (Teff), *Sorghum bicolour (Sorghum)*, *Zea mays* L. (Maize) *Pennisetum glaucum* (Millet), *Cicer arietinum* (chick pea) and *Vicia faba* (horse bean). On average the families in the study area use two or three parcel of crop land with a combined average land holding size of 0.7 ha.

Cattle, donkeys, goats, bees and poultry are the common types of livestock raised in the area. Farming is exclusively rain-fed and is dependent on weather conditions. Farmers sell a portion of their produce (crops and livestock) to earn cash income for covering household expenses.

Data source and analysis

Data were obtained from a survey undertaken from December 2011 to February 2012 with the help of structured questionnaire and discussions with key informants. The structured questionnaire was used to interview household heads. As final decisions on conservation of resources are made by household heads, they are taken as a unit of analysis. The data included socio-economic characteristics and attitudes of land users towards land resources conservation. The attitudinal data contained 29 items. Each farmer responded to the 29 items on a five-point Likert scale ranging from strongly agree to strongly disagree. Simple weightings (1 to 5) were assigned to the response categories on the basis of favour and disfavour for the items. The strongly agree response with a weight of 5 was given for the most favorable statements; the agree,

undecided, disagree and strongly disagree were given values of 4, 3, 2 and 1, respectively. The maximum weight was given for strongly agree in the case of positive statements. Thus, the maximum total score would be 145 if the respondent scores 5 for each of the 29 items and the minimum total score would be 29, if a respondent scores 1 point for each of the 29 statements. Higher values for positive statements indicate positive attitudes toward conservation of natural resources.

Open ended questions were used to solicit information on land resources use and land management practices. Discussions were also held with key informants, such as local peasant association chairpersons, elderly community members, extension workers, and other administrative units.

A two stage sampling technique was employed to select sample households. In the first stage, three villages (Koyesta, Beles and Kelakl) were purposively selected to cover the upstream, midstream and downstream reach of the watershed. Table 1 presents characteristics of the villages and sample households. Following this, list of households of each village was collected from the respective administrative units and then 164 sample households were selected following systematic random sampling technique. Questionnaire reliability was estimated by calculating cronbach's alpha, which was 0.89.

Farmers' attitude was tested using a ranking method. A likert scale was used to give marks to each respondent. Then mean and standard deviation of marks were used to separate participants into low, moderate, high and very high attitude.

$A = very\ high : Mean + St.D \le A \le Max$

$B = High : Mean \le B < Mean + St.D$

$C = Moderate : Mean - St.D \le C < Mean$

$D = Low : Min \le D < Mean - St.D$

Table 1: Main features of households in three villages

Main features	Koyetsa	Beles	Kelakl
Total HH size	1103	1520	1208
Sample HH size	47	65	52
Area (ha)	4135	10803	7146
Mean Alt (m)	2200	1960	1840
Mean slope (%)	17.4	12.3	6.3

The data were analyzed using the Statistical Package for Social Sciences (SPSS, Version17). Appropriate descriptive statistics such as frequencies, percentage scores, mean scores, standard deviations and correlation and multiple regression were used to analyze the data.

RESULTS AND DISCUSSIONS

Classification of farmers according to their attitudes towards conservation of land resources

Table 2 presents the results of sample household heads classification according to their attitudes towards land resources conservation. Of the total interviewed farmers, 102 (62.2 percent) had very high and high attitude to the conservation of natural resources while 54(32.9 percent) had low attitudes and only 8(4.88%) had moderate attitude. The observed favorable response towards the conservation of natural resources is attributed to farming experience, farmers' age and extension contacts and household income of the farming communities. As confirmed by results of correlation coefficient, farming experience farmers' age and household income are among the most important socio –economic factors that influence attitude(r=0.76, 0.73 and 0.71) respectively. This reflects age and experience of farmers had governing role in shaping their attitudes towards conservation. Over 50 percent of the farmers believe on the importance of conservation of natural resources and this was endorsed by their response to participate voluntarily in conservation efforts (Table3). Farmers were not in favour of unlimited access to enclosures from where they collect fire wood and graze their animals. Moreover, most farmers agreed that it was their responsibility to protect the environment from damage. In addition, large proportion of the farmers (Over 51 percent) supported afforestation of hill sides and tree plantation on homesteads and farm plots. Volunteer participation in the campaigns to reverse land degradation was also supported by a significant proportion of farmers. This conforms to previous researches that indicated volunteer participation is determined by demographic variables including age and sex (Manzo and Weintein, 1987; Smith, 1994).

Table 2: Classification of farmers according to their attitude towards the conservation of natural resource in three villages

Attitude	Frequency	%
Very High	26	15.85
High	76	46.34
Moderate	8	4.88
Low	54	32.93
Total	164	100

The view of farmers regarding the need for the conservation of wild plants and animals across the three villages was also high. This was manifested by their response to provide equal attention to the preservation of wild lives with other human needs. Moreover, a significant proportion of farmers across the three villages agreed on the idea that soil fertility can be improved through improved land management practices.

Table 3: Attitude statements

Statements	Mean	SD	Variance
1. Soil, vegetation and water resources are the basis of life so that should be strictly conserved	3.98	1.270	1.613
2.Trees should be planted on closed and hill sides not on the farm*	4.05	1.092	1.193
3.Plantation of trees on garden, plot or hill side prevents soil erosion	4.05	1.092	1.193
4.It is the responsibility of local people to protect natural resources from damage	3.88	.936	.876
5.Mulching prevents loss of soil and moisture from the land	3.66	1.064	1.132
6.Green manuring, minimum tillage and improved fallows enhance soil fertility	3.79	1.082	1.171
7.Minimum tillage prevents soil erosion	3.66	1.174	1.378
8.Manuring improves water conservation in the soil	3.87	.982	.963
9.Regeneration of plants has increased in recent years in this watershed	3.82	1.064	1.132
10. Now there are more wild lives on protected areas of Hirmi than some years ago	3.71	1.003	1.006
11.Only land owners should plant trees*	3.43	1.273	1.621
12.If there is unlimited access for fuel wood in the protected areas, the natural vegetation would diminish soon	4.00	1.051	1.104
13.Drainage prevents water logging in the soil	3.57	1.125	1.265
14.Proper land management is important for the benefit of future generation	3.90	.954	.911
15.Agricultural chemicals pollute the environment*	3.40	1.138	1.296
16.The need of people is more important than conserving the wild lives	3.55	1.169	1.366
17.Degradation declines productivity so that it should be reversed soon	4.23	1.054	1.112
18.We should worry about the future of land resources	4.14	1.033	1.066
19.It makes me sad to see environments destroyed	4.22	1.057	1.117
20.Soil,water and vegetation conservation provides sustainable benefits	4.10	1.034	1.070
21.Steep slopes need to be prohibited from crop cultivation	3.82	1.272	1.619
22.Application of green manure is necessary though chemical fertilizers exist	4.02	1.056	1.116
23.Improvement of biological, chemical and physical properties of soils is possible through improved land management	3.96	1.029	1.060
24.There is equitable distribution of common pool resources and benefits	3.27	1.142	1.305
25.Sustainable development is important to prevent the environment	4.04	1.023	1.047
26.I am volunteer to participate in conservation activities	4.04	1.134	1.287
27.I respect the local law to protect the environment	3.67	1.086	1.179
28.I have sufficient knowledge regarding conservation activities and land management	3.82	1.129	1.275
29.Stream discharge increased since the establishment of enclosures	3.48	.969	.938

*Negative statements

Determinants of local farmers' attitude for conservation of land resources

To identify factors that influence farmers' attitudes for the conservation of land resources, multiple regression analysis was carried out. Table 4 presents the selected variables that influence attitude of farmers across the three villages. Among 10 variables considered in the model, only 7 variables were found to have significant influence on attitude. These variables together explained 79.7 percent of the variance in attitude.

Table 4: Results of multiple regression (Only significant predictors are included)

Variable	Adjusted R Square	R Square Change	F Change	df1	df2	Sig. F Change
Farming exp	0.614	0.616	259.869	1	162	0.000
HH Income	0.710	0.098	55.079	1	161	0.000
Benefits	0.752	0.043	28.268	1	160	0.000
Farmer's age	0.773	0.022	15.474	1	159	0.000
Extension contact	0.786	0.014	10.423	1	158	0.002
Access to credit	0.793	0.008	6.351	1	157	0.013
Literacy	0.797	0.005	4.285	1	156	0.040

In the step wise multiple regression, farming experience was entered first and explained 61.4 percent of the variance in attitude ($F_{1, 162}=259.87$, $p<0.001$). Over half of the respondents had more than 25 years farming experience in the area. Therefore, it can be said that, the experience of farmers in farming activity was at high level and was influential in building positive attitude. Household income was entered second and explained a further 9.8 percent ($F_{1, 161}=55.08$, $p<0.001$). The overall view of household income of the interviewed farmers was significant in explaining attitude variations.

The mean annual households income which is the sum of crop and non- crop income source of the study villages at the time of data collection for this study was 9026 Ethiopian birr which is nearly$500. There was variation in annual income of the households participated. This annual household income highly varies from less than 490 to more than 888 dollars. Household income is also related to livestock possession. A large section of the interviewed farmers raised livestock of one type or another. The mean livestock holding across the study area was 4.6 Tropical livestock unit (TLU) but discrepancies in the distribution of livestock ownership varied among the farmers.

Pearson's correlation analysis confirmed high and positive association between attitude and household income ($r=+0.7$, $p<0.001$).

The third variable entered was benefits gained from natural resources and explained additional 4.3 percent of the variance in the dependent variable ($F_{1, 160}$, $p<0.001$). The fourth variable entered the model was farmers' age, this variable explained 2.2 percent of the variance in conservational attitude ($F_{1, 159}$, $p<0.001$). About 31 percent of the respondents were between the age of 50 and 59 years and 27 percent were below the age of 40. This is a reflection of a balanced distribution of young

and old age groups in the area. Pearson's correlation analysis indicted strong and positive association between farmers' age and attitude($r=+.728$, $p<0.001$).

Table 5: Step wise multiple regression of predictors for conservation attitude.

Variable	B	Standard error b	Beta	T	Significance of t
Farming experience	4.80	1.27	.22	3.77	0.001
HH income	6.39	1.00	.31	6.39	0.001
Benefits gain	5.61	1.65	.16	3.39	0.001
Farmers' Age	5.13	1.28	.21	4.01	0.001
Extension contact	3.86	1.05	.17	3.67	0.001
Access to credit	7.19	2.69	.10	2.67	0.05
Literacy	2.86	1.38	.08	2.07	0.05

The B-values in Table 5 indicate that the probability of good level of attitude is estimated to increase with access to credit and household income. The results are a bit surprising since the effects are high (B- values, 7.19 and 6.39) for access to credit and household income respectively. The level of significance is also high ($P<0.001$). This reveals the fact that access to credit and household income support the efforts in building up farmers' attitudes to the conservation of resources. When access to credit and level of household income are maximized, the probability of good attitude development increases among farmers. Estimated benefits gained, farmers' age and farming experience also had significant positive impact in building favorable attitudes (Table5). This implies that the probability of favorable attitude building is likely to increase with increasing benefits, farmers' age as well as farming experience. In addition, attitude is found to increase with farmers literacy rate. About 57 percent of the household heads could read and write but only 12 percent obtained formal education (Table 7). The high rate of literacy in the study area might be due to expansion of modern government and traditional church schools where most respondents had close attachment. This might have contributed to the favorable attitude of most farmers. Analysis of Pearson's correlation also indicated positive association between literacy rate and attitude($r=+0.438$, $P<0.001$). Moreover, although weak($r=+0.479$), positive and significant correlation was identified between attitude and land tenure (Table 6). All respondents possessed cultivable lands through one or the other means of existing land holding systems even though the question of tenure security is not totally resolved. The recent change in the land tenure system of Ethiopia was introduced in the early 1990s following a regime change in 1991. The 1994 constitution of Ethiopia declared land to be owned publically, so that it is not freely tradable. In the Tigray Regional State, where the study area is found, the rural land policy was improved in 1997. In contrast to the 1975 land reform, the recent policy allows unlimited periods of use rights for title holders as far as they maintain their residency in the village. In addition, the policy allows temporary land transfer rights in a form of contract arrangement with restrictions on the duration of contract (*Negarit Gazeta* Number23/1989, issued in March1997). Farmers can rent, lend and share their personal land holdings for a definite period of time but they are not allowed to sell it. On this basis, land holding status is classified in the study area as privately registered, inherited, rented, borrowed and gifted. About 60 percent of the farmers had privately registered plots for farming while 40 percent did not. This reflects a large number of the farmers were living under insecure land tenure system. Farmers land holding under insecure

tenure negatively affects land management and thereby creates unfavorable attitude. Insecure land tenure has remained to be a major factor restricting farmer investments on conservation in Ethiopia (Alemu ,1998; Gebremedhin and Swinton, 2003).

The average land holding size of the participants was 0.7 ha, which is slightly greater than the regional average and less than the national average which are 0.5ha and 1.29 ha respectively.

Table 6: Correlation between Attitude and farm characteristics

Variable	Correlation	P- Value
Farming experience	.785**	<0.001
Household income	.712**	<0.001
Farmers' Age	.728**	<0.001
Extension contact	.644**	<0.001
Benefit	.642**	<0.001
Land tenure	.479**	<0.001
Literacy	.438**	<0.001

Table: 7 Characteristics of respondents in Himi watershed

Characteristics	Mean
Mean Age(yr)	49.7
Sex %	
Male	68.3
Female	31.7
Education (%)	
Illiterate	43.7
Basic education	41.2
Elementary	12.7
Secondary& above	3.5
Mean family size	4.6
Mean land holding(ha)	0.71
Ave. annual income(Birr)	9026
Mean livestock number TLU)	4.6

IMPLICATIONS FOR LAND MANAGEMENT

The understanding and perception of local land users regarding land resources conservation is important when sustainable land management options are considered. The positive attitude of the local farmers towards land resources conservation is a favorable predictor for future prevention of land degradation. The positive attitudes of local farmers towards conservation of

land resources are increasing due to influence of some socioeconomic factors. Positive attitudes may lead to increased motivation and likelihood to successful conservation due to increased input. Education is necessary to create public awareness for land resources conservation. Levels of education or specific knowledge about farming are positively correlated with more favorable attitudes. Expansion of agricultural extension services also has positive impacts on the awareness of local farmers regarding current conservation issues. Apart from education and farming experience, economic factor is another aspect to support nature conservation. Household income of the farm community is positively correlated with favorable attitudes towards conservation of available land resources. Therefore, creating alternative income generating activities is an important element in land resources conservation efforts.

CONCLUSIONS

Natural resources conservation and sustainable land resources management in a way that would fit specific environmental and socio- economic condition is an issue recently rose in Ethiopia and many investigators have developed interests towards this method. Conservation practices of natural resources would be most effective when understood in the context of individual farmers so that analysis of farmers' attitude would have paramount importance not only in controlling potential conflicts but also examining policy efficiencies.

To implement desirable land management method in a more sustainable way, it is essential to generate viable changes in the attitude of farmers as initial step.

Therefore, exploring attitudes vis-à-vis the idea and principles of sustainable land management would serve as a corner stone for initiating appropriate planning and program implementation. Hence, the purpose of this study was appraisal of farmers' attitudes towards the conservation of land resources and identifies most important factors that influence it. A large section of the farmers were volunteers to participate in conservation efforts and supported the practice of tree plantation not only on farm plots but also hill sides.

Attitude of farmers was favorable towards the conservation of natural resources. Over 62 percent of the participants had very high and high attitudes to preserve soil, water and vegetation resources. The empirical results from a multiple regression model showed, farming experience, household income, benefits gaine, and farmers' age were significant predictors of conservation attitudes. Results of correlation analysis also showed farming experience, farmers' age, household income, extension contact and benefits gained had higher attitudes towards conservation efforts than their counter parts. A greater section of the research participants could read and write but only few had formal education. This might have contributed for building up of positive attitude across the study villages. Although the entire interviewed farmers acquired cultivable land, more than 40 percent had no privately registered plots for farming so that they were compelled to borrow or rent from others who were not able to cultivate the plots themselves for various reasons. This suggests that a significant section of the community had insecured land tenure. And this inturn affects attitudes of farmers towards land management negatively, because it may affect farmers' interest to invest in land improvements.

Therefore, government intervention is needed to make the land less farmers farm owners by dividing the hill sides of the watershed for grass and tree plantation. Extension contacts and trainings are urgently needed to maximize positive attitude and transform it into practical actions in sustainable manner. Information should also be made available to farmers especially about the impacts of the loss of natural resources through one or the other means on top of benefits of conservations. Finally, the conclusions drawn from this study raise policy issues that awareness creation among respective stakeholders would be important in the attempt to introduce or implement land management practices in sustainable way and this needs persistent debate across various sections of the concerned communities.

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ABOUT THE AUTHORS

Tsehaye Gebrelibanos: Aksum University, Department of Geography and Environmental Studies, Aksum**,** Ethiopia

Mohammed Assen: Department of Geography and Environmental Studies, Addis Ababa University, Addis Ababa, Ethiopia