Innovations

Determinants of the Adoption of Rural Land Management Practices: The Case of North Achefer District, North West Ethiopia

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Abstract **:** *Despite the practices of the introduced land management measures, the study district was prone to serious land degradation. The need for identifying the key determinant factors for adopting rural land management technologies for better impact often was not communicated. Accordingly, the present study intended to investigate determinant factors for adopting the rural land management practices in north Achefer district.The study employed a cross-sectional research design composed of both quantitative and qualitative research approaches.It used random,Purposive and stratified sampling techniques to select sample households. Household surveys, key informant interviews, and focused group discussions were conducted to collect primary data. A total of 132 households were covered by the questionnaire survey.Thedata were analyzed using descriptive and inferential statistics. The major findings confirmed that the practices of land management were stone bund, soil bund, stone faced soil bund, hill side terrace, cut-off drain, stone gabion and check dam. The binary logistic regression results showed six out of thirteen explanatory variables: Educational status, extension services, awareness, farm size, labor availability and involvement in off-farm activities were among the determinants for adopting rural land management technologies in the study area.In conclusion, the determinants of rural land management practices are complex and call for multifaceted interventions.So, there is a need to consider those physical, institutional, economic, and social factors in the practice of rural land management.*

Key words: *determinants, adoption, land degradation, land management*

Introduction

Land degradation is a decline in land quality caused by human activities, has been a major global issue during the 20th century and will remain high on the international agenda in 21st century (Asnake,2024). It affects a large number of people over a significant portion of the earth's surface which has led to extreme poverty and hanger (Taffa, 2009). Around the world, land degradation can be viewed as any change or disturbance to land perceived to be undesirable that affect human activities like agriculture and settlements (Ademe *et al*, 2017). Not all countries of the world have similar environmental challenges. The policy also differs among countries, for example in developed countries environmental problems are the result of industrialization. On the other hand in developing countries of the world major environmental problems are deforestation, soil degradation, and wild life destruction and misused of water resources (Eswaran *et al,*2019). Therefore environmental policies and practices of the developing countries should focus on in solving such problems.

Land degradation has been the serious challenge for different countries. The causes of land degradation are complex and be different from place to place. The major drivers of land degradation are proximate and underlying causes; the proximate causes are more or less natural factors such as biophysical conditions, topographic and climatic conditions, whereas the underlying factors are mostly anthropogenic, which include population growth, land tenure and other socio-economic and policy related factors (Alemu*et al*, 2023). Different factors those make worse land degradations such as over grazing, plowing steep slopes, damaged conservation structures, continues cultivation, deforestation and limited use of land management activities (Safriel, 2017).These all natural and human made factors are main causes to decline land productivity.

Ethiopia is one of the sub-Saharan Africa countries endowed with natural resources (Gebreselassie, 2016). However land degradation is one of the serious problems in Ethiopia persisting for a long period of time. About 85% of the population of Ethiopia is highly depending on agriculture to sustaintheir lives. Accordingly, the land sizes used by each farmer are reduced from time to time. These situations forced the farmers to use the land intensively throughout the year that has resulted in land degradation. Land degradation in turn encompasses mineral depilation, poor physical(low water retaining capacity) and biological condition of soil (Yimer, and Tekalign, 2016).

Land degradation is a disturbing problem in *Amhara* region where soil erosion leaving 20,000 and 30,000 hectares of the land unproductive (Meseret, 2016).*Abay* riverbasin is the largest basin in *Amhara* region where land degradation affects its inhabitants, due to agricultural land expansion, high population growth, deforestation, continues cultivation, free grazing and dependency of the rural population on crop cultivation and other factors which aggravate the problem in the basin (Mengistu, Bewket, 2015).

So far, various studies have been conducted on rural land management practices in different parts of Ethiopia (Abera, & Wana, 2023, Etsay, Negash, Aregay, 2019,Arega, Temesgen, & Mansingh, 2018, Desta, Tamene, Abera, Amede & Whitbread, 2021).But the findings have been mixed and conflicting. So, this study makes an important addition to the existing literature.In order for land management practices to be effective, base-line information on their potential users is essential, as well as guidance on what land management activities should be promoted or discouraged.Accordingly, the present study was motivated by the desire to fill this gap in investigating factors affecting land management, and to provide local policy makers with information so that they can assess their options for land management. Thus, the study examines determinants of rural land management practices in north Achefer district.

Materials and Methods

Description of the Study Area

The study was carried out in north *Achefer* district which is located in the North Gojjam Zone of Amhara region of Ethiopia.Astronomical and Relative location:- The study area is astronomically located between $11^0$15'00''N -$11^0$55'00''N and $36^0$30'00''E-$37^0$15'00''E and relatively Achefer district is located North of Dangla district, North west of Mecha district, West of Bahir Dar, South west of Lake Tana, South & SouthEast of Alefa district.Based on the 2007 national census conducted by the Central Statistical Agency of Ethiopia (CSA), this district has a total population of 189,716, of whom 96,856 are men and 92,860 women; 15,583 or 8.21% are urban inhabitants. The majority of the inhabitants practiced Ethiopian Orthodox Tewahido Christianity.

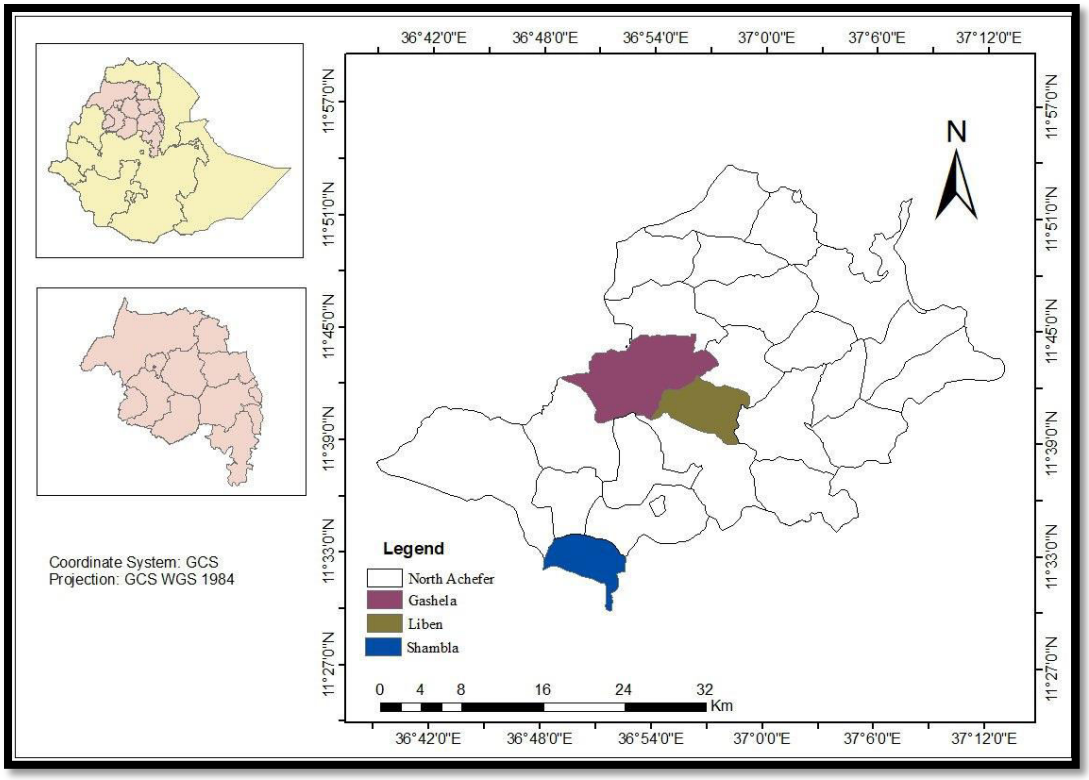

Fig 1. Map of the study area

Study Design, Sample Size Determination and Sampling Techniques

The study employed a cross-sectional research design and followed both quantitative and qualitative research approaches. This is because using both qualitative and quantitative approaches can avoid the limitation of using a single approach (Slee, 2006).The studydistrict was selected purposefullyfor the study because of the researchers' prior knowledge of the area. First to make the size of the sample manageable and to get a representative sample from27 rural Kebeles, all the *Kebeles* were stratified based on their agro-ecological zone (*Kolla,Dega* and Woyna-Dega), from which one *Kebele* was randomly selected from eachagro-ecological zone. The assumption is that in similar agro-ecological zones householdsshare similar experiences about land management practices.

For sampling, Kothari's (2004) sample size determination formula was employed.

$$n=\frac{z^2.p.q.N}{e^2(N-1)+z^2.p.q}$$

n= Sample size

z= standard variation of 95% confidence interval (1.96)

p= sample proportion in the target population estimated to have the characteristics being measured (10%) =0.1

q= 1-p=0.9

N= size of the target population

e= the estimate should be within 5% of the true value (0.05)

Finally, a total of 132 households were sampled for a questionnaire survey from the threerural kebeles using a proportional stratified random sampling technique based on thesampling frames obtained from the rural kebele offices: Shambela (Dega) (48), Liben(Woyna-Dega) (54), Gashola (Kolla) (30).

Data Sources and Data Collection Techniques

In this study, both primary and secondary sources were used. The primary data were generated by employinghousehold surveys, focus group discussions, interviews, observations and review documents.

Household surveys were conducted to collect primary data from the sample household heads by using closed and open ended questions. First questions were prepared in English and it was translated in to the local language. Before the survey there was a pretest to check the validity of the questions.A focus group discussion (FGDs) was also held with the selected farmers based on age, knowledge and long living time in the area.Key informant interviews (KIIs) were also held with differentexperts; one agronomist, one natural resource expert, one land management expert and one animal sciences expert and one *kebele* manager.

Data Analysis

Based on the nature of the variables measured to analyze the collected data, both descriptiveand inferential statistics were employed. The data gathered through the surveyquestionnaire was coded, edited and entered into a statistical package for social science(SPSS 20.0 for windows) software. Accordingly, frequency distribution, percentage, meanand standard deviation were used to describe the household characteristics.For this study the chi-square test was used to see the level of significance for explanatory variables and binary logistic regressionwas used to identify the determinant variables which can affect the adoption of rural land management in the selected study area. Basic parametric assumptions (normality, homogeneity, multi-culinary) were applied.

Variables andmodel specification

The dependent variable of the model: the logistic analysis has dichotomous nature representing the observed status of the farmer in land management activities. Therefore, it was representing in the model by 1 if household head adopt land management activities and 0 if not.

It was assumed that the adoptions of land management practices were affected by different factors and the decision of households want to adopt land management activities subject to different relevant constraints which are explained from the next table.

Table 1. Description and measurement of explanatory variables

variables	Variable nature	Measurement of variables
Dependent variable		
Adoption of land management activities	Categorical/dummy	yes=1, no=0
Independent variables		
Labor availability	Continues	Numbers of labor
Sex of HH heads	Dummy	Male=1, female=0
Age of HH heads	Continues	Age of HH heads in years
Farm size	Continues	Cultivated area in hectare
Education HH heads	Dummy	Literate=1, illiterate=0
Income	Continues	Number(ETH Birr)
Off-farm activities	Dummy	Yes=1,no=0
Farming experience	Continues	No years a HH heads involved in farming activities
Extension services	Dummy	Yes=1, no=0
awareness of HH heads	Dummy	Yes=1, no=0
Livestock holding	Continues	Total livestock holding in number
Land tenure	Dummy	Yes=1, no=0
Family size	Continues	Number

Results and Discussion

The study result in table 2 describes the overall demographic characteristics of sampled household heads. From the total sample household heads about 63.6% were adopters of rural land management practices (RLMP)and 36.4% were non-adopters.Majority (92.7%) of the sample household heads were male headed household heads, while the remaining 7.3% of respondents were female headed. The focus group discussants confirmed that male headed households were more

practiced rural land management activities than female headed households. So, rural land management demands high amount of energy and time for construction and maintenance and done by male headed households. The result is consistent with the works of Wegayehu (2003).

Table 2.Socio-economic and household characteristics of sampled households

Household family size category	Level of adoption of RLMP					
	Adopter		Non-adopter		Total	
	No	%	No	%	No	%
1-4	31	36.9	28	58.3	47	35.6
5-7	34	40.5	12	25	60	45.5
8-11	19	22.6	8	16.7	25	18.9
Total	84	100	48	100	132	100
	Mean	SD	Mean	SD	Mean	SD
Total household size	6.2	1.96	5.38	1.89	5.8	1.98
Farm experience of sampled household heads	Adopter		Non-adopter		Total	
	N	%	N	%	N	%
15-25	31	36.9	15	31.3	49	37.1
26-35	42	50	21	43.8	58	43.9
36-45	9	10.7	10	20.8	21	15.9
46-60	2	2.4	2	4.2	4	3.1
Total	84	100	48	100	132	100
	Mean	SD	Mean	SD	Mean	SD
Farm experiences of sampled household	28.19	8.05	31.17	8.79	29.31	8.43
Sex of sampled household heads	Level of adoption of RLMP					
	Adopter		Non-adopter		Total	
	N	%	N	%	N	%
Yes	77	91.7	45	93.8	122	92.4
No	7	8.3	3	6.2	10	7.6
Total	84	100	48	100	132	100
Age of sampled household heads	Level of adoption of land management activities					
	Adopter		Non-adopter		Total	
	N	%	N	%	N	%
22-40	9	10.7	1	2	25	18.9
41-64	73	86.9	39	81.3	95	72

>64	2	2.4	8	16.7	12	9.1
Total	84	100	48	100	132	100

Regarding number of family members the majority (26.5%) of family size were 4, the largest number of family size is 11 and the smallest is 2. The mean family size of the sample households, non-adopter and adopters of rural land management practices were 5.8, 5.38 and 6.2 persons with a standard deviation of 1.98, 1.89 and 1.96 respectively.

With regard to the educational status, 56.1% of the sample household heads were literate, while the remaining 43.9 % were illiterate. The KID reviled that literate household heads were accepted and applied introduced rural land management practices than illiterate household heads. So education status were highly affected the adoption of rural land management activities which is in line with the finds of Tedla (2003).

Determinants of the adoption of land management activities

The assumptions (do not need to assume linearity or normality, does not assume a liner relationship between the dependent and independent variables, dependent variables must be a dichotomy, the category must be mutual exclusive and absence of multicollinearity) of binary logistic regression were tested before using the results of the binary logistic regression. As revealed by regression model test of coefficient table, the model was adequately fit the data, there were using several tests to determine goodness of fit for logistic regression including omnibus test, hosmer and lemeshow test, Pseudo $\mathbf{R}^2$ and classification table. The goodness of fit for logistic regression checked by omnibus tests of model coefficients were chi-square value was 36.885, df = 13, and p-value =0.00. A p-value (sig) of the model was <0.05. In this case is highly significant indicated the model was fitted. According to hosmer and lemeshow test the value of chi-square (4.559), df (8) and sign (0.803). If the p-value is above 0.05 (statistically not significant) the estimated model has adequately fitted and if the p-value is below 0.05 (statistically significant) the estimated model does not adequately fit the data. The result of hosmer and lemeshow test p-value (Sig) was 0.803. This suggested that the estimated model has best fitted. On the other hand, the model summery (Pseudo$\mathbf{R}^2$) value was that does range from 0 to 1 is a more reliable measure of relationship. The model summery shows that all independent variables explained the dependent variables by 33.4% of the total variation in the model. Based on classification table, in a perfect model, all cases were on the diagonal and the overall percent correct were 100%. Proportion of correctly predicted cases/events/adopter group was 72 (85.7%), correctly classified non-

case/ non-event/ non- adopter group were 29 (60.4%) and overall predicted (76.5%).

As a result, thirteen variables were hypothesized to have an effect on the adoption of land management practices and were entered to the model using version 20 SPSS computer software. Out of the variables analyzed, the coefficients of six variables, are namely involvement of off-farm activity, labor availability, awareness, extension service, farm size, and education status were found to be significant in predicting the dependent variable.

Farm size: farm size of the household heads is one of the physical factors affecting farmer's decision in adoption of rural land management activities. The relationship between farm size and adoption of land management activities, become negative and significant at 5% level of significance with odd ratio value 0.351. The odds ratio of farm size is 0.351, meaning that farm size is less likely to increase participation in land management activities as compared to farmer decided to participate in land management activity. For every one unit increase of farm size, decrease the decision on practicing land management activity by the odds of 0.351. It was also significant at $p<0.05$. An increase farm size decreases the decisions on practicing land management activities. This might be due to those household heads have large farm size are unable to protect and control their farm land using land management practices because adopting land management practices on large farm size holding takes time and resources, This finding is in harmony with the previous works ofHabtamu (2006).

Awareness of introduced land management practices: Awareness of introduced land management activities was significantly and positively associated with adoption of land management practices on cultivated owned land. This implies that the better the farmers aware the importance of land management activities, the more likely the farmers to adopt land management structures on their lands. Being other variables constant a unit increase of awareness level, increases households decision to participate in land management activities by the odds of 5.393 and significant at $p<0.05$. This means as the awareness level of a households increases, the farmers decision to participate in land management practices programs increase. It affects the decision of farmers by shaping opinion of farmers with regard to the management of land. The result is consistent with the works of Kumela (2007).

Extension services: extension services in Ethiopia are carried out at *kebele* level using extension officers. There are three extension officers, also known as development agents (DAs) in each *kebele* specializing in plant science, natural

resource management and livestock production. In this study, extension services are intended to educate farmers and assist in resolving their land management related problems, there by motivating them to decide to participate in land management problems. Contrary, to the expectations, the logistic regression analysis of this variable revealed that frequency of extension services is found to be statistically negative and significant at the 5% level of confidence. The odds ratio of extension services is 0.266, meaning that extension services are less likely to increase practice of land management activities as compared to households decided to participate in land management activity. It was also significant at $p<0.05$. This means that a unit increase of extension services, decrease farmers decision to practiced land management activities by the odds of 0.266 and significant at $p<0.05$. This means as the frequency of extension services received by a farmer increase, his/her decision to practice land management program decreases. This could be explained by the fact that the quality of services received may be affected with lack of appropriate knowledge and inadequate number of extension workers and inadequacy of working facility, lack of acceptance of extension workers by households and other related factors. This results is consistent with the study done in Ethiopia by Amsalu (2015). He stated that experiences with technology adoption in Ethiopia indicate that farmers are either unwilling to uptake external recommendations or take more time to know and implemented. Contrary, the study conducted by Birhan (2009), stated that increasing the number of visits made by the development agents have a positive relation with the adoption of land management practices which results from accelerated effective dissemination of land management activities information to the farmers.

Involvement in off-farm activity: the model result confirmed that involvement of off-farm activities statistically negative and significantly determines the adoption of land management activities in the study area. The odds ratio of involvement of off-farm activities is 0.279, meaning that involvement of off-farm activities are less likely to increase practice of land management activities as compared to farmers decided to participate in land management activity. It was also significant at $p<0.05$. This means that a unit increase of involvement of off-farm activities, decrease farmers decision to practice land management activities by the odds of 0.279 and significant at $p<0.05$. This result is similar with the study conducted by Abera (2003), revealed that increasing involvement in off-farm activities for income generating, decrease the participation of farmers towards land management activities. Off- farm activities in the slack season overlap with time of construction and maintenance of land management activities. As a result, farmers who involve in off-farm income generating activities are likely to put less

effort in maintenance and construction and enhance on adoption of introduced land management activities.

Education status: Education of the household head was statistically positive and significant relationship at 5% level of confidence, which related to the adoption of introduced land management activities. The odds ratio for education level is 3.134, meaning that education level are more likely to increases households decision to practice land management activities. Being other variables constant a unit increase of education level, increases households decision to participate in land management activities by the odds of 3.134 and significant at $p<0.05$. This means as the education level of a households increases, the farmers decision to participate in land management practices programs increase. This could be because of the respondents' literate household heads were accept and applied introduced rural land management practices than illiterate household heads which is in line with the works ofRobert (2012).

Labor availability: The availability of family labor is one of the most important preconditions needed for successful implementation of the land management activities by farmers. The result of the regression analysis revealed that the labor availability is found to be statistically negative and significant at the 5% level of confidence. This means that being other variables constant a unit increase of labor availability, decrease households decision to participate in land management activities with odds of 0.257 and significant at $p<0.05$. This means as the number of the labor availability of a households increases, the farmers decision to participate in land management practices programs decreases. This could be because of the farmer's negative attitude towards the program and/or lack of information about the long term benefits of the program.

Table 3. Binary logistic regression resulton determinants of rural land management practices

Explanatory variables	Estimated coefficient (B)	Standard error (S.E)	Wald	Degree of freedom (df)	Significance level (sig)	Odds ratio Exp(B)
Education status	1.142	.504	5.134	1	.023**	3.134
Income	.749	.638	1.381	1	.240^{ns}	2.115
Off-farm activity	-1.276	.632	4.081	1	.043**	.279
Labor availability	-1.357	.585	5.387	1	.020**	.257
Livestock holding	-.107	.562	.036	1	.849 ^{ns}	.898
Sex	.431	.618	.485	1	.486 ^{ns}	1.538

Age	.666	.539	1.523	1	.217 ns	1.946
Family size	.026	.790	.001	1	.974 ns	1.026
Farm experience	-.007	.609	.000	1	.990 ns	.993
Extension services	-1.324	.534	6.140	1	.013**	.266
Awareness	1.685	.721	5.459	1	.019**	5.393
Land tenure	-.948	.518	3.358	1	.067 ns	.387
Farm size	-1.048	.492	4.535	1	.033**	.351
Constant	-.622	.981	.402	1	.526 ns	.537

**statistically significant at <0.05(95%), ns=not significant

Conclusion

This study aimed to assess determinates of the adoption of rural land management activities in *North Achefer* district. Understanding of the most important determinant factors that affect farmers' decision would contribute to the design of appropriate strategies by achieving technical change in land management process in the study area.The Binary logistic regression model analysis identified that the rural land management practices was affected positively and significantly by education status and awareness of introduced land management activities. On the other hand involvement of off-farm activities, labor availability, extension services and farm size have a negative and significant influence on the adoption of land management activities. Given the problem of land management practices in the study area, increasing the awareness of the community is crucial to addressing the issue. As a result national and regional governments, as well as non-governmental organizations (NGOs) have to work togetherto improve rural land management practice through strengthening skill training centers, expand extension services which can in turn improves the productivity of the land.

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