Assessment on the socioeconomic aspect of area enclosure in North Shewa Zone: The case of Kewote and Basona Worena districts

Solomon Bizuayehu[1] and Beneberu Tefera[2]
Debre Birhan Agricultural Research Centre, P.O.Box 112, Debre Birhan, Ethiopia.
[1]sbizuayehu@gmail.com and [2] beneberu2001@gmail.com

Abstract

The general objective for undertaking this research was to identify the contribution of area enclosure for household income and assess socioeconomic factors that contribute for better use and management of area enclosure. The study was done in two districts of North Shewa zone, Kewote and Basona Worena. Both probability and non-probability sampling techniques were employed in the study. Accordingly, two kebeles (Yelen and Karajejeba) from Kewote and one kebele (Gudoberhet) from Basona Worena districts were selected purposively and samples of 95 farmers participating in area enclosure were selected randomly. Primary data were collected using structured questionnaires. Focus group discussions were also held to supplement data collected using questionnaires. Data were analyzed using descriptive statistics and econometric model using STATA version 8 software. The cost-benefit analysis result showed that besides its ecological benefit, area enclosure has a net benefit of ETB 3272.33 ha^{-1} per year per household. Farmers on average have incurred a cost of ETB 1399 ha^{-1} per year. The regression result indicated that education status of the household head, number of male family members, grazing land problem and experience in participation of area enclosure use and management affected income from area enclosure positively and significantly. But sorghum production affected income from area enclosure negatively.

Key words: Cost-benefit, ecological benefit, enclosure.

Introduction

The establishment of area enclosures (AE) has been one of the strategies for rehabilitating degraded hillsides within a catchment. The inception of area enclosure in Ethiopia dates back to the early 1980s, which coincides with the beginning of large-scale land rehabilitation and soil and water conservation programs in the country (Betru *et al.*, 2005). Area enclosure in the Ethiopian context is defined as a degraded land that has been excluded from human and livestock interference for rehabilitation (Tefera *et al.,* 2005). In principle, human and animal interference is restricted in the AE to encourage natural regeneration. In practice, however,

cattle are allowed to free graze in several of the AE. Cutting grass and collection of fuel wood and bee keeping is also practiced. In some areas besides enclosing the area soil and water conservation structures are also implemented. The AE and community woodlots were established by the government primarily for ecological regeneration and biodiversity conservation. The concept of economic benefits was not often explicitly addressed in the early years of their establishment. But, since few years there is a huge interest from participants in using AE and community woodlots as source of income.

It is believed that the socioeconomic situation of specific area affects the sustainable and effective management of resources. Even though there are limited works done on the socioeconomic aspects of AE in different areas of the country, there is no similar work done in the study areas. Therefore this study was conducted with the overall objective of examining the contribution of AE for household income and assessing the socioeconomic factors that contribute to the better management of AE. The finding of this research will complement the study done by the Forestry and Agro-forestry program of Debre Birhan Agricultural Research Centre (DBARC) about area enclosure, since the research was limited only to the ecological aspects of AE.

Methodology

Study area

The study was conducted in Kewote and Basona Worena districts of North Shewa zone. Out of the total area coverage in North Shewa zone (15954 km^2) Kewote and Basona Worena districts share 715.85 and 1301.78 km^2, respectively. The total population is 118,333 and 120,879, respectively (CSA, 2007). Kewote district is mostly lowland, while Basona Worena is generally highland. The share of the different land use patterns in North Shewa is about 11.5% farmland, 10.8% grassland, 21.5% natural forest, 17.1% plantation forest, and 39.1% others. The land covered by AE in North Shewa zone is 15,265 ha out of which 1,500 ha and 1,805 ha are in Kewote and Basona Worena districts, respectively (NSZoA, 2007).

Sampling procedure and data analysis

A combination of probability and non-probability sampling techniques were employed. A multistage sampling method was implemented to identify sample farmers. Initially, Basona Worena and Kewote districts were selected purposively on the basis of their area enclosure coverage and representing the highland and lowland areas in the zone. Then, two kebeles (Yelen and Karajejeba) form Kewote and one kebele (Gudoberhet) from Basona Worena districts were selected purposively again based on the coverage and long year experience in area enclosure. Finally, 65 farmers from Kewote and 30 farmers from Basona Worena (a toal of 95 sample farmers) who participated in AE were selected using random sampling procedure. Primary data were collected using questionnaires that were pre-tested and modified accordingly in 2007/2008. Secondary data were collected from the central statistical authority and respective district agriculture and rural development offices. Focal group discussions were also held to strengthen the quantitative data collected. The data were analyzed using descriptive statistics and econometric method using STATA Version 8 software.

Econometric model specification

Generally, the following multiple linear regression model was used following Gujarati (2004):

$Y_i = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + E_i$

Where, i=1, 2, 3……n, and n= total number of respondent farmers

Y = Dependent variable, income from AE in Ethiopian Birr per year

k = Number of explanatory variables

X = Explanatory variables

β s are coefficients of the explanatory variables, and

E_i is residual term

Before running the model all the hypothesized explanatory variables were tested for the existence of multicollinearity and Hetroskedasticity problem using Variance Inflation Factor (VIF) and Breusch-Pagan/Cook-Weisberg tests, respectively. The dependent and explanatory variables employed and the hypothetical relationships are indicated in Table 1.

Table 1. Variable definition and hypothetical relationship.

Variables	Code	Hypothetical relationship
Income from AE in ETB year^{-1} (Dependent)	IncomeAE	---
Education level of the household head	Educhh	+
Number of male members of the household head	Malfamsz	+
Production of teff (Quintal = 100 kg)	Pteff	-
Production of Sorghum (Quintal = 100 kg)	Psorghum	-
Grazing land problem (1 = yes, 0 = No)	Grazlndpro	+
Distance of AE from home (minute by foot)	Farenclos	-
Feeling of ownership (1 = yes , 0 = No)	Felurs	+
Extension service (1 = yes , 0 = No)	Extserev	+
Experience in AE (years)	Whenenclo	+

Cost benefit analysis

The cost benefit analysis simply took both benefits and costs that could be estimated in monetary terms. In the benefit side both the grass used for home and sold grass was considered. Costs associated with management and use of area enclosure were considered. The total cost for guard was estimated by dividing the total salary paid for a year by the total members/participants of AE. Other costs are estimated by using the market values for labor (wage rate) both for hired and family labor.

Results and discussion

General household and farm characteristics

Out of the total sample households the majority (87%) were male headed. The average age of the household head in the study areas is 43 years. Total landholding per household head varies from 1 to 11.5 *timad* (1 *timad* = 0.25 ha), with an average holding of 4.82 *timad*. The average family size is five where three of them are male. Households own oxen in the ranges of zero to four oxen per household, with an average of one ox (Table 2).

Table 2. Household (HH) characteristics in Kewote and Basona Worena districts.

Variable description	N	Minimum	Maximum	Mean	Std. Dev
Age of the household head	89	18	86	43.2	14.82
Number of male family members	92	0	7	2.76	1.57
Total number of family members	92	1	11	5.10	2.14
Total landholding per HH (*timad*)	90	1	11.5	4.82	2.40
Total farmland per HH (*timad*)	85	0.5	8	3.68	1.81
Total number of oxen per household	89	0	4	1.44	0.90

Note: One *timad* is 0.25 hectare.

Area enclosure use and management

It is expected that area enclosure will have its own implication on availability of grazing land. The study result confirmed that farmers face grazing land problem due to enclosure and other associated reasons. Out of the total respondents about 81.4% reported grazing land shortage (Table 3). However, on the other hand enclosing the area has enhanced the productivity of the land, especially of grass, which in turn could solve feed shortage in the area.

The other basic problem in managing common property is lack of sense of ownership. In terms of ownership, from the total sample households about 83% of the respondents gave area enclosure an equivalent weight to their private land (Table 3). Factors that improved sense of ownership are: farmers are using and managing the resource by themselves, farmers are getting short term benefit out of AE (in case of Kewote), and some farmers formed a cooperative and got ownership license. Majority (nearly 80%) of the respondents have had contact with extension agents and take lessons/advices about area enclosure management. Similar study conducted by Tefera *et al.* (2005) also confirmed positive sense of ownership by farmers where 93% of the respondents showed positive attitude to AE and indicated that the value of the land had increased due to enclosures.

from erosion. In both districts, farmers hire guards and pay a monthly salary ranging from ETB 120 to 150 for each guard.

Several stakeholders were involved in the use and management of AE both at Kewote and Basona Worena (Table 4). The responsibility of the kebele goes up to penalizing those who act out of the agreed bylaws. The practices in the two districts vary slightly; unlike in Basona Worena, farmers at Kewote are getting short term benefit from selling grass out of the AE. At Karajejeba kebele of Kewote there is also an experience that involved farmers organized themselves and received ownership license, which created strong sense of ownership.

Table 4. Role of different stakeholders in the use and management of area enclosure at Kewet and Basona Worena districts.

Stakeholders	District	Task/responsibility	Remark
Research	Kewote	Research was done and demonstrated to familiarize the community at Karajejeba kebele	DBARC
	Basona Worena	Taking the initiation and giving training for farmers.	Forestry Research Centre
Agricultural offices	Kewote and Basona Worena	Follow up and giving technical assistance and providing seedlings.	Kebele and woreda experts
NGOs	Kewote	Adopt the success in Karajejeba in Yelen kebele by taking the initiation and giving training for farmers.	'Mulu wongeale church'
	Basona Worena	Giving training and financial assistance for farmers.	SUNARMA, CCF
Community/ Kebeles	Kewote and Basona Worena	Form bylaw and do for its practicality	
Farmers	Kewote and Basona Worena	Get organized and do all necessary tasks in group and individually.	

Problems and opportunities of AE

Major reasons for failure and success of area enclosures

Reason for failure (problems)

- AE are often

Table 5. Cost benefit analysis of an individual farmer participating in AE use and management in Kewote district.

Items	Description	Value (ETB ha^{-1} $year^{-1}$)
Benefit	Sale of grass	399.33
	Grass for home consumption	4272.00
	Total benefit per year	4671.33
Cost	Salary for guard	67.94
	Plantation (digging and planting)	47.66
	Harvesting and transportation	512.51
	Household labor value	333.90
	Terrace construction	384.49
	Others	52.50
	Total cost per year	1399.00
Net		**3272.33**

Note: The price for home consumption is estimated by the market value of the grass at time of harvest. The cost for family labor was calculated by changing the hours spent on AE to man-days since the farmers do these activities when they are free from their major agricultural activities and not full day.

Farmers use both family and hired labor for the different activities done in managing and utilizing the area enclosure. The study prevailed that the major share of the total labor is invested for harvesting and transportation grass followed by plantation (Table 6). Generally, a family will invest more than 33 man-days per ha per year for area enclosure use and management (Table 6).

Table 6. Labor used for the use and management of a hectare of AE.

Activities	Man day ha^{-1} $year^{-1}$
Plantation (digging and planting)	11.47
Harvesting and transportation	29.85
Terrace construction	26.40
Others	4.96
Total labor used for AE	33.39

Factors affecting income from area enclosure

A total of 67 respondents from Kewote district have been taken for the analysis. Basona Worena district was not taken into consideration for this analysis since the experience in these

two areas is different. At Basona Worena district the existing situation does not yet allow participants to get income/return out of the area enclosure, because their expectation is to get income from sell of trees which demand relatively longer time.

Income from area enclosure (basically from sell of grass) can be affected by many socioeconomic factors. The dependent variable in the regression analysis is total income from area enclosure. It is calculated by the summation of revenue from sold grass and the opportunity cost of grass used for home consumption. Since there are rules and regulations on how and to what extent participants can use products of the enclosure, income from AE will be taken as a proxy variable for efficient and sustainable management of the resource. A total of nine variables were considered in the regression analysis, out of which five of them were found to be significant (Table 7). The R^2 value of 0.796 is interpreted as; 80% of the variation in income from area enclosure is explained by the variables in the model.

Table 7. Result of a regression analysis on factors affecting income from area enclosure.

Variables	Coefficient	Std. error	t	P>|t|	VIF[1]
Educhh	1922.78	689.69	2.79	0.014**	1.30
Malfamsz	1025.81	286.33	3.58	0.003***	2.33
Pteff	155.64	95.83	1.62	0.125	1.22
Psorghum	-320.32	79.95	-4.01	0.001***	2.93
Grazlndpro	1660.90	937.90	1.77	0.097*	1.56
Farenclos	-41.23	35.01	-1.18	0.257	1.80
Felurs	-193.84	882.16	-0.22	0.829	1.16
Extserev	-3013.69	1835.99	-1.64	0.122	1.44
Whenenclo	643.81	364.64	1.77	0.098*	1.55
Constant	-2528.48	2149.75	-1.18	0.258*	-

Remark: R^2 = 79.63% and N = 67; * significant at 10%, ** significant at 5% and *** significant at 1%.

The VIF values in Table 7 indicated that there is no significant multicollinearity problem among explanatory variables. The Breusch-Pagan test (which assumes Ho: Constant variance)

[1] VIF is the variation inflation factor that is used to test for multicollinearity problem in the model.

result also confirmed as the model is free from Hetroskedasticity problem with 1% level of significance.

Education status of the household head (*Educhh*) affected gross income from AE positively and significantly (Table 7). The variable was a dummy variable with choices of literate or illiterate. The regression result confirmed that literate households earned ETB 1922 year^{-1} better than illiterate once. Education can also be seen as a proxy variable for level of awareness. Literate farmers do have better exposure to learn and easily understand new information and technology. Management of natural resources in general and AE in particular demands huge labor force. Major tasks of management and use of the AE are basically done by male. In line with this argument the number of male members of household (*Malfamsz*) significantly and positively affected the income from AE (Table 7). Hence, an increase in male family members will increase income from AE by ETB 1025.81 year^{-1} (Table 7).

In a situation where there is fixed amount of inputs, activities that use similar inputs will compete for the same resource. Agricultural production and management and use of AE compete for labor and other resources. Hence, 100 kg increase in the production of sorghum (*Psorghum*), which is the major crop in the study area, induced ETB 320 year^{-1} reduction on the income from AE (Table 7). Moreover, the result of the current study prevailed that those who have grazing land problem (*Grazlndpro*) got better benefit from AE than those who do not have

Conclusion and recommendations

Like other community resources, use and management of AE needs active participation of different stakeholders for common action. The experiences in the two districts showed that there is participation of stakeholders at different stages. There are success stories in many areas, but there is also failure in some areas. This failure is basically due to conflict and lack of cooperation in managing the resource and negligence of the community. The profitability analysis proved that investment in AE is profitable. On average every household got a net profit of ETB 3272.33 ha^{-1} $year^{-1}$. Basically farmers use family labor for managing and use of the AE, and on average a household contributes nearly 33 man-days ha^{-1} $year^{-1}$.

The multiple linear regression model prevailed that around 80% of the variation in the dependent variable was explained by explanatory variables included in the model. The model result indicated that educational level of the household head positively and significantly affected income from AE. Households with more number of male members got better income from AE. The basic rational for having positive and significant relation between number of male members in the family and income from AE can be attributed to the reason that the majority of the AE use and management tasks are done by male. The only variable that affected income from AE negatively is production of sorghum. This implies that those who focus on production of crop (sorghum) earn less return from AE. The other most important variables in explaining the variation in income from AE are grazing land problem and years of experience in AE use and management. Both the variables affected income from AE significantly and positively.

The basic problem in managing common property, like area enclosure, is conflict in sharing the benefit out of it. Hence, there should be a thorough planning work in harmonizing the benefit share among kebele, districts and regions adjacent to the area enclosures. Even though enclosing an area creates pressure on availability of grazing land, the cost benefit analysis showed that it is profitable. Usually this practice is done on degraded lands (hill sides), hence it will create an opportunity to produce more grass out of it than before and also have a rewarding potential to reduce erosion. Therefore, this practice should be replicated to other

similar areas too. Those who are educated have been seen to benefit more from AE. Therefore, there should be training and/or education to create awareness about area enclosure to better manage the resources in general and AE in particular.

Area enclosure plays a great role in protecting resource degradation. But, farmers will be convinced in managing AE when they get some practical benefit, hence such works should include short term benefits (like grass) to the participants. If there is no way that farmers would get short term benefit, there should be a support (technical and/or financial) from governmental and nongovernmental stakeholders at least in the early stages of formulation since benefit and better management of AE comes through experience.

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