Journal of Economics and Sustainable Development
ISSN 2222-1700 (Paper) ISSN 2222-2855 (Online)
Vol.9, No.1, 2018

Comparative Economic Analysis of Three Competing Land Use Types in Southern Ethiopia: Tools for Informed Decision-Making on Land Use Choices

Alemayehu N. Ayana[1*] Lemlem T. Lejissa[1*]

Abstract
Land is a scarce natural resource and increasingly being constrained by competition among mutually exclusive uses. Ethiopia has experienced serious challenges to allocate this limited resource to socio-economically efficient uses. By using economic performance indicators such as Net Present Value (NPV) and Benefit Cost Ratio (BCR), this paper compares the socio-economic value of three major competing land use types in southern Ethiopia over three investment time horizons (5, 10 and 15 years). The study aims to provide empirical evidences for rational decision-making in allocating scarce land resources. We applied descriptive statistics, ANOVA, and econometric model to analyze and present the results of these three land uses. Wood Based Mono-Cropping (WBMC), Tree Cereal Mixed Cropping (TCMC), and Cereal Based Mono-Cropping (CBMC). Our results reveal that the economic values of WBMC is significantly higher than CBMC and TCMC as shown by the two performance indictors (NPV and BCR). Our study also finds labor, product price, land, tenure security, and rainfall variability significant to explain factors that determine farmers' land use choice in the study area. The study concludes that WBMC is economically feasible compared to the two-competing land uses and is a lucrative enterprise in the study area. The outputs of this study can give useful insights for smallholder farmers and investors who like to engage in forestry enterprise; and assist decision-makers and practitioners to improve the current practices in land use planning.
Keywords: Net Present Value; Benefit Cost Ratio; WBMC; TCMC; CBMC; Southern Ethiopia.

1. INTRODUCTION

Over the past decades, land use pattern in developing countries has shown an unprecedented dynamic change, mainly because of demographic pressure and the growing demand for crop and livestock products. Similarly, in Ethiopia, the scale and pace of the ongoing land use changes are historically unprecedented, primarily due to the expansion of arable land by smallholders and large commercial farms. For instance, cultivated area in Ethiopia has increased from 9.44 to 15.4 million ha between 2001 and 2009 (Alemayehu, 2014). Franks *et al* (2017) also reported that crop production area has increased by 88 per cent between 1994 and 2014. It is projected that total cultivated area will reach 27 million hectares by 2030 with an annual growth rate of 3.9%, following the conventional agricultural development path (Melaku *et al*., 2015). The demand for spatial expansion of land to increase agricultural production often creates the conflict of interest between agriculture and other land use options, which put the different economic sectors in a state of competition rather than complementing one another. In addition to improving agricultural intensification and biotechnological innovation to meet the growing demand for food, natural resource management deserves significant focus in the face of growing competition for cultivable land.

In Ethiopia, lack of comprehensive information on socially, environmentally, and economically feasible land use options is often mentioned as a key problem for the inefficient allocation of scarce land resources. As the demand for land grows, efficient allocation of this scarce resource becomes more crucial than ever. Comparative economic analysis of the competing land uses can be a useful tool to understand the evolving patterns of land allocation in the country and eventually improve the current practices in land use planning. This study aimed to analyze the economic performances of three competing land use types and identify factors affecting land use choices in Southern Ethiopia. The outputs of this study provide concrete evidence for making rational decisions in allocating scarce land resources. The three competing land use types studied were Wood Based Mono-Cropping (WBMC), Tree Cereal Mixed Cropping (TCMC), and Cereal-Based Mono-Cropping (CBMC). The economic performances of the three land use types were compared across three-time horizons (5, 10 and 15 years) using economic performance indicators such as Net Present Value (NPV) and Benefit Cost Ratio (BCR). Data were collected from one hundred and twenty sample units through structured questionnaire and direct measurements of the farm plots in Gedeo zone of Southern Nations, Nationalities and Peoples Regional State.

2. METHODOLOGY

2.1. The study areas

This study was conducted in the Gedeo zone of the Southern Nations, Nationalities and Peoples' Regional (SNNPR)

[1]Ethiopian Environment and Forest Research Institute, P. O. Box 24536 code 1000, Addis Ababa, Ethiopia.
*Corresponding author at Ethiopian Environment and Forest Research Institute, P. O. Box 24536 code 1000, Addis Ababa, Ethiopia

State of Ethiopia (Figure 1). The total area of Gedeo zone is 134,700 ha, with a total population of 1,028,063 (513,113 men and 514,950 women) (CSA, 2013). Gedeo zone is one of the most densely populated areas in Ethiopia, averaging 627 persons per km^2 (Mesele, 2013). The topography of the zone is generally comprising hills and rolling plateaus, with elevation ranging from 1300 – 3064 m.a.s.l and the mean annual temperature varies from 12-28^{o}C. The mean annual rainfall of the zone ranges from 800mm to 1800mm per year. The dominant soils mainly developed from volcanic rock and classified as Nitosols. Gedeo zone has three agro-climatic zones namely: Lowland (areas below 1500 m), Midland (areas between 1500 and 2300 m), and Highland (areas between 2300 and 3100 m) (Mesele, 2013). The major annual crops grown in the area are: maize (Zea mays), teff (Eragrostis tef), wheat (Triticumae stivum), barely (Horgeum vulgare), bean (Phaseolus vulgaris), Sweet potato (Ipomoea batatas), Ginger (Zingiber officinale), Ethiopian Cabbage (Brassica oleracea), Beetroot (Beta vulgaris), Tomato (Solanum lycopersicum), Garlic (Allium sativum) and Chili (Capiscum annuum). The main perennial crops grown are Eucalyptus species, Enset (Ensete ventricosum), Coffee Arabica, K'hat (Catha edulis) and a variety of fruit crops such as Avocado, Annona, Banana, kazmir (Mexican apple), Lemon, Mango, and Papaya. The enset-coffee mixed farming system is a dominant and cereal farming is co-dominant land use types in the study area.

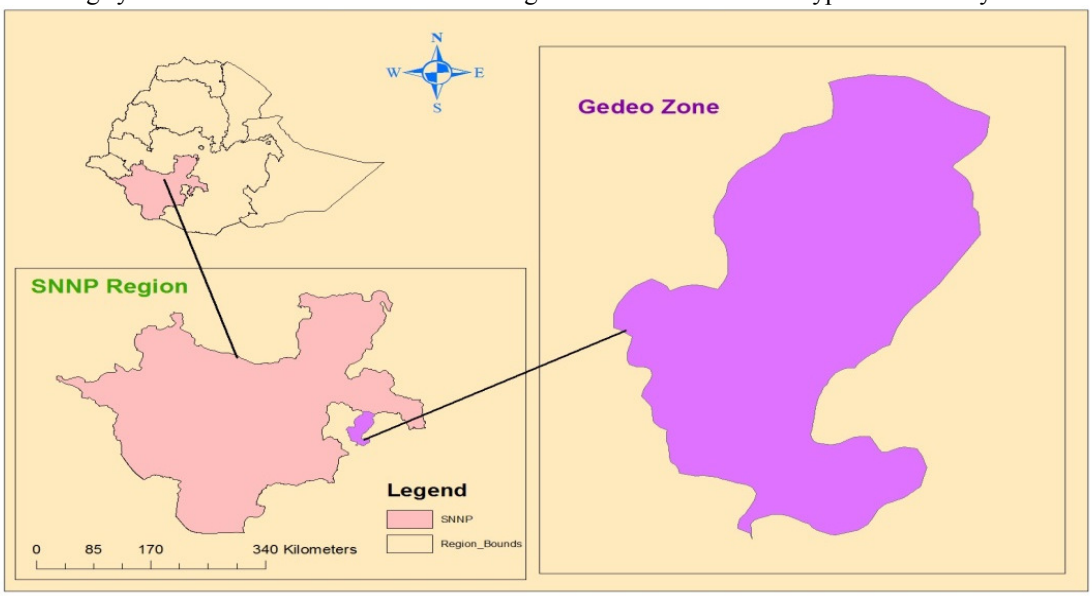

Figure 1 Map of the study area

2.2. Methods of Data Collection and Analysis

Three *Woredas*[1] namely *Wenago*, *Yirga cheffe*, and *Gedeb* were purposively selected based on their location in three agro-climatic zones. Hundred twenty sample units were selected based on multi-stage stratified random sampling techniques. Detailed interview using close-ended questioner was conducted with the owner of each farm plot to generate information on the socio-economic attributes, the major inputs, and produces from the plot understudy for fifteen years. Direct measurements and field observations were also made to estimate the size of the plot, stock density, major crops and tree species grown and the different assortment of products from the plot and to corroborate with the interview data.

Respondents were asked for the prevailing market prices of goods traded in the common marketplaces, such as the current market price of grains, straw, forage, vegetables, fruits, fuelwood, construction wood, house utensils, farm implements etc. and triangulated with the nearby marketing price through the market survey. Similarly, quantity and the market prices of different input associated with the specific plot were also obtained from the owner. Current market price method was used to calculate direct economic benefit for the given land use type.

Economic performance indicators such as Net Present Value (NPV) and Benefit Cost Ratio (BCR) of the three land use types were calculated and compared. The NPV determines the net returns by discounting the streams of benefits and costs back to the beginning of the base year using appropriate discount rate over the lifetime (analysis period) of the production system. NPV is calculated using the following formula:

$$NPV = \sum_{t=0}^{n} (Bt - Ct)/(1+r)^t \qquad > 0$$

Where Bt are benefits flow at time t, C_t is costs of production at time t, t is a year, and r is the discount rate.

[1] *Woreda* (similar to district or county) is the third tier after 'zone' in the administrative structure of Ethiopia and it is composed of a number of *kebeles* (the smallest administration structure).

The BCR compares the discounted benefits to discounted costs. Among the three alternatives compared, the land use with higher BCR is taken as a better economic option and it is computed using the following formula.

$$BCR = \frac{\sum_{t=0}^{n} Bt/(1+r)^t}{\sum_{t=0}^{n} Ct/(1+r)^t} > 1$$

To facilitate comparison between the three land use types, all direct benefits and costs were quantified across the study years. After collecting, compiling and classifying of costs and benefits flows from each land use, the net present value of each option for the selected time period was calculated by adopting the current discount rate.

To address the objectives of the study, descriptive statistics, ANOVA, and econometric analysis were employed. We interpreted the data using mean, percentage, frequency, and standard deviation; LSD-test and Multinomial Logistic Regression. The data was analyzed using Statistical Package for Social Sciences (SPSS) version 20 and Microsoft Office Excel 2007.

2.3. Model Specification

A multinomial Logistic regression model was used to answer the question of the possible constraints in farming activities. The model used to describe the relationship between dependent variable and a set of independent variables. The dependent variables have three groups: the choice of an individual farmer to practice cereal based mono-cropping and/or wood-based mono-cropping and/or tree-cereal mixed cropping whereas, the explanatory variables could be continuous, categorical or dummy. The probability of a land user to be constrained in their farming activities is:

$$P_i = \frac{1}{1+e^{-Z_i}} = \frac{e^{Z_i}}{1+e^{Zi}} \quad \text{..... (1)}$$

Where in the notation P_i represents the probability that an individual will be constrained by various factors. Moreover, e denotes the base of natural logarithms which is approximated at 2.718. Z_i is a function of m explanatory variables (X_i), and expressed as:

$$Z_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \ldots + \beta_m X_{mi} \quad \text{..... (2)}$$

If P_i, is the probability of the i^{th} farmer to be constrained by choosing the specific land use type by various factors, as given by (equa. 1), then ($1 - P_i$), is the probability of the i^{th} farmer to not be constrained by practicing the specific land use types.

$$1 - P_i = \frac{1}{1 + e^{Z_i}} \quad \text{..... (3)}$$

Dividing [1] by [3], we get

$$\frac{P_i}{1 - P_i} = \frac{1 + e^{Z_i}}{1 + e^{-Z_i}} = e^{Z_i} \quad \text{..... (4)}$$

$\frac{P_i}{1 - P_i}$ is simply the odds ratio in favor of the i^{th} farmer to be constrained to the probability to not be constrained by practicing the specific land use types.

Taking the natural logarithm of the odds ratio in both sides of [4] will result in what is known as the Multinomial Logistic Regression model as indicated below:

$$\ln\left(\frac{P_i}{1-P_i}\right) = \ln\left(\frac{1+e^{Z_i}}{1+e^{-Z_i}}\right) = \ln\left(e^{Z_i}\right) \quad \text{... (5)}$$

$$\ln\left(\frac{P_i}{1-P_i}\right)=\beta_0+\beta_1X_{1i}+\beta_2X_{2i}+\ldots+\beta_mX_{mi} \text{ .... (6)}$$

$$\ln\left(\frac{P_i}{1-P_i}\right)=\beta_0+\beta_1 LandShortage+\beta_2 LandTenure+\beta 3 Poorsoilfertility+\beta 4 Ra\inf all\ \text{var}\ iablity+\beta 5 WeakExtension$$
$$+\beta_6 LaborShortage+\beta_7 LackofCredit+\beta 8 Lowproduct\ \Pr ice$$

3. RESULTS AND DISCUSSION

3.1. Demographic and socio-economic characteristics of households

The average age of the sampled household heads was 44.5 years and the average age of farmers who cultivated CBMC, WBMC and TCMC are found to be 41, 37 and 42 years, respectively (Table 1). As clearly stated in the table below, the clear majority of CBMC cultivators were at the age range of 46-65, WBMC and TCMC cultivators were at the age range of 36-45. This implied that elderly farmers based their life in the traditional way i.e. monocrop agriculture as compared toS. the fellow WBMC and TCMC cultivators.

Table 1 Distribution of sampled household heads by age group for the comparative economic analysis study

	CBMC Cultivators (n = 41)		WBMC Cultivators (n = 37)		TCMC Cultivators (n =42)		Total (n= 120)	
Age category	N	%	N	%	n	%	N	%
20-35	8	6.67	7	5.83	4	3.33	19	15.83
36-45	14	11.67	14	11.67	21	17.50	49	40.83
46-65	19	15.83	11	9.17	15	12.50	45	37.50
>66	0	0.00	5	4.17	2	1.67	7	5.83
Chi-square = 134.056***								

*** significant at 1% significance level

The average family size of the respondents was 10 per household. About 14.17 per cent of the respondents were illiterates, 63 per cent attend primary school, the rest 19 per cent attend secondary school and about 3 per cent are above secondary school. The average educational level of the respondents was grade 2 (Table 2).

Table 2 Distribution of sampled household heads by educational level in the comparative economic analysis study

Land Use Type		Educational status of the respondent				
		Illiterate	Primary	Secondary	Above	Total
CBMC	Count	0	30	11	0	41
	% within Land use types considered	0.0%	73.2%	26.8%	0.0%	100.0%
	% within Educational status of the respondent	0.0%	39.5%	47.8%	0.0%	33.6%
	% of Total	0.0%	24.6%	9.0%	0.0%	33.6%
WBMC	Count	7	28	2	0	37
	% within Land use types considered	18.9%	75.7%	5.4%	0.0%	100.0%
	% within Educational status of the respondent	36.8%	36.8%	8.7%	0.0%	30.3%
	% of Total	5.7%	23.0%	1.6%	0.0%	30.3%
TCMC	Count	12	18	10	4	44
	% within Land use types considered	27.3%	40.9%	22.7%	9.1%	100.0%
	% within Educational status of the respondent	63.2%	23.7%	43.5%	100.0%	36.1%
	% of Total	9.8%	14.8%	8.2%	3.3%	36.1%
	Count	19	76	23	4	122
	% within Land use types considered	15.6%	62.3%	18.9%	3.3%	100.0%
	% within Educational status of the respondent	100.0%	100.0%	100.0%	100.0%	100.0%
	% of Total	15.6%	62.3%	18.9%	3.3%	100.0%
Chi – Square = 27.964* **						

The mean total cultivated land of CBMC, WBMC and TCMC cultivators was 3.22, 4.97 and 2.17 hectare, WBMC cultivators were largest than the CBMC and TCMC. In the study areas, farmers obtained diversified benefits from the three land use types. For instance, straw, forage and other by-products from CBMC land use.

Those who cultivate WBMC obtained all wood materials that can be used for construction, house utensils, farm implements, and energy source. Both wood and non-wood products are obtained from TCMC. These included fuelwood, fodder, construction material, and coffee. Coffee was primarily used as the source of income (cash crop). The shade trees (pruned branches and pollarded stem) are used for home consumption (fodder, fuelwood, and building materials) and income generation (pole, timber).

3.2. Economic Performance Evaluation of the three land use types

The study results showed that the aggregate economic return of WBMC over fifteen years is significantly higher as compared to CBMC and TCMC land use types (Table 4). The mean comparative economic return of WBMC is about 13.21 fold of the TCMC and 32.16 fold of the CBMC land use types. Thus, from the economic analysis point of view, WBMC is the most feasible economic alternative among the three land use type.

Table 3 Post-Hoc-test LSD of Total NPV (ETB/ha) for three land use types at major town price (5 years, 10 years, and 15 years)

Dependent Variable	(I) Land use types considered	(J) Land use types considered	Mean Difference (I-J)	Sig.
Total NPV year 5	CBMC	WBMC	561.25	0.662
		TCMC	-729.715	0.557
	WBMC	CBMC	-561.25	0.662
		TCMC	-1290.96	0.313
	TCMC	CBMC	729.71	0.557
		WBMC	1290.96	0.313
Total NPV year 10	CBMC	WBMC	-12762.98***	0.000
		TCMC	-3046.29	0.202
	WBMC	CBMC	12762.98***	0.000
		TCMC	9716.69***	0.000
	TCMC	CBMC	3046.29	0.202
		WBMC	-9716.69***	0.000
Total NPV year 15	CBMC	WBMC	-101403.19***	0.000
		TCMC	-4667.64	0.698
	WBMC	CBMC	101403.19***	0.000
		TCMC	96735.55***	0.000
	TCMC	CBMC	4667.64	0.698
		WBMC	-96735.55***	0.000

***. The mean difference is significant at the 0.01 level.

Using the major town market price, the BCR of WBMC practice is 97.4 and 504.5 times higher than CBMC and TCMC practices respectively.

Table 4 Post-Hoc-Test of Total BCR (ETB/ha) for three land use types at major town price (15 years)

(I) Land use types considered	(J) Land use types considered	Mean Difference (I-J)	Sig.
CBMC	WBMC	-24791.64**	0.031
	TCMC	207.41	0.985
WBMC	CBMC	24791.64**	0.031
	TCMC	24999.05**	0.029
TCMC	CBMC	-207.41	0.985
	WBMC	-24999.05**	0.029

*. The mean difference is significant at the 0.05 level.

During the first five years, the financial return from WBMC is relatively lower due to the high initial investment required for the establishment of this land use type. However, the outputs have increased positively after the first five years making the investment economically attractive afterward as compared to the TCMC and CBMC land use types (Table 3). The economic significance of *Eucalyptus* plantation is also indicated in the study by Belay and Muluneh (2016). Similarly, a study conducted in Goro Woreda of Bale zone, Ethiopia by Zenebe (2013) revealed that Eucalyptus plantation was found to be more profitable land use option as compared to wheat (*Triticumae stivum*), barley (*Hordeum vulgare*), sorghum (*Sorghum bicolor*), and tef (*Eragros tistef*) at 10% discount rate.

3.3. Input Costs

The total input costs of a given land use type comprise both establishment and management costs. Establishment costs are costs incurred during the beginning of the practice, while management costs are life-cycle costs of each practice. Our study revealed that the mean establishment and management cost of TCMC was 1.03 and 1.3 times

higher than CBMC and WBMC land use types respectively (Table 5). WBMC is the least input requiring land use type. This is mainly because of the minimum management cost requirement for this land use type, for example, eucalyptus woodlot, despite the relatively high input cost at the beginning of establishing the plot. Thus, as indicated in table 3, the input requirement of WBMC significantly decreases across time.

Table 5 Total expenses/ha in 5 years, 10 years, and 15 years, for the three land use types

Dependent Variable	(I) Land use types considered	(J) Land use types considered	Mean Difference (I-J)	Sig.
Total discounted costs for 5 years	CBMC	WBMC	374.59	0.399
		TCMC	-285.49	0.506
	WBMC	CBMC	-374.59	0.399
		TCMC	-660.09	0.136
	TCMC	CBMC	285.49	0.506
		WBMC	660.09	0.136
Total discounted costs for 10 years	CBMC	WBMC	2278.89***	0.000
		TCMC	-409.67	0.495
	WBMC	CBMC	-2278.89***	0.000
		TCMC	-2688.55***	0.000
	TCMC	CBMC	409.67	0.495
		WBMC	2688.55***	0.000
Total discounted costs for 15 years	CBMC	WBMC	1876.69***	0.011
		TCMC	-266.26	0.707
	WBMC	CBMC	-1876.69***	0.011
		TCMC	-2142.95***	0.004
	TCMC	CBMC	266.25696	.707
		WBMC	2142.95211***	.004

***. The mean difference is significant at the 0.01 level.

The direct economic benefits from mixed cropping (TCMC) were positive across three-time horizons. On average, the NPV/ha of TCMC was superior to CBMC but significantly inferior to WBMC. This was mainly because of high-input cost and severe component competition that exists within the TCMC system. Moreover, on average the economic return of TCMC is not very much different from CBMC except for the contribution of products from perennial components. Despite its lower economic return, farmers attach higher overall importance to multiple cropping mainly because of the usability of the products at the household level (for subsistence). In the study area, a mixed farming system is clearly linked with the socio-cultural tradition of farm households. Thus, under the current prevailing farming conditions, farmers attempt to balance the economic drive of producing cash crop and maintaining multiple crops. In line with this study, Getahun (2015) studied the economic performance of agroforestry based systems versus mono-cropping systems using economic performance indicators at the household level in Wondo District. The results from the three economic performance indicators showed that the fruit-tree based agroforestry system has the highest NPV, BCR and expected annual income (AEV) followed by monocrop of sugarcane, sequential monocrop of tomato with maize, and sequential monocrop of potato with maize, respectively. He concluded that the agroforestry land use is the best land use practice with the highest financial return than that of the monocrop land use (Getahun, 2015).

Table 6. Various constraining factors in practicing the three land use systems

Land use types considered	Explanatory Variables	B	Std. Error	Wald	Sig.	e^{β}
CBMC	Land Shortage	-1.270**	.538	5.565	0.018	0.281
	Tenure	.857	.443	3.735	0.053	2.356
	Poor soil fertility	-1.034	.624	2.749	0.097	.356
	Low rainfall	1.809**	.657	7.580	0.006	.164
	Weakextension	.195	.411	.225	0.635	1.215
	Shortage of labor	1.949***	.455	18.388	0.000	7.023
	Lack of credit	.344	.713	.233	0.630	1.410
	Lowproduct price	1.983***	.742	7.149	0.008	7.265
WBMC	Land Shortage	-1.781***	.645	7.630	0.006	.168
	Tenure	1.578***	.530	8.858	0.003	4.847
	Poor soil fertility	.027	.700	.002	0.969	1.028
	Low rainfall	-1.634	.726	5.063	0.024	.195
	Weak extension	-.739	.470	2.466	0.116	.478
	Shortage of labor	1.965***	.537	13.379	0.000	7.133
	Lack of credit	1.247	.735	2.880	0.090	3.480
	Low product price	4.030***	.987	16.659	0.000	56.270

A reference category is Tree Cereal Mixed Cropping (TCMC)
Log-likelihood (X^2) = 93.39
Correctly predicted percent = 60.2
*, **, and *** represents statistically significant at 10, 5 and 1% level of significance, respectively

3.4. Constraints and choice of land use

Out of eight explanatory variables included in the model, five variables were found to be significant in explaining the constraining factors in practicing the three land use types. Taking TCMC as a reference category, land shortage (negatively); labor shortage, rainfall variability and low product price (positively) affects CBMC cultivators. Moreover, land shortage (negatively); labor shortage and low product price (positively) affects WBMC cultivators (Table 6).

Land Shortage: was the more serious constraining factor to TCMC than CBMC growers.

One of the main constraints to practice TCMC land use type is the perception that trees compete with agricultural crops for land particularly when land size per household is small. This finding is corroborated by Balana *et al*. (2012) and they indicated that the land size is less relevant when farmers' holding is large enough to accommodate both agricultural crops and trees. Therefore, having large land holding may help households to allocate parts of it for crop production and animal grazing and the remaining for planting trees. It has been proposed as the solution to land shortage and productivity due to its great potential for both forestry and agricultural products.

Rainfall Variability: was a more serious constraining factor for CBMC practitioners than TCMC. As various research findings indicated, TCMC such as Agroforestry is the best solution for the problem of low rainfall. According to Mbow *et al.* (2014) Agroforestry contributes to ecosystem functions in water recycling by increased rainfall utilization compared to annual cropping systems. The results confirm that agroforestry systems may greatly increase rainfall utilization compared to annual cropping systems. This complementarity between trees and annual crops extends possibilities of soil moisture uptake, hence making soil resource utilization more efficient than in monoculture (Gebrehiwot, 2015; Balana *et al*., 2012).

Labor Shortage: was the more serious constraining factor for CBMC and WBMC practitioners than TCMC. This is due to the productive land holding equivalence of TCMC and mono-cropping (CBMC & WBMC). Through practicing TCMC farmers can be profitable using a small parcel of land and labor input as compared to mono-cropping. This finding is similar to various results that show the labor costs as determining the factor to the adoption of eucalyptus woodlots (Lalisa, 2012; Matthies and Karimov, 2014).

Low product price: was the more serious constraining factor for CBMC and WBMC cultivators than TCMC. Since TCMC is the integration of trees with annual crop cultivation, livestock production, and other farm activities is a series of land management approaches. According to Muhammed et al. (2011), the combination of trees with the annual crops increases the overall farm income of per unit land area of farmland and reduces the risks and broadens the spheres of alternatives. A study conducted by Matthies and Karimov (2014) to evaluate the financial drivers of woodlot production in Amhara regional state shows that limited knowledge about marketing and low bargaining power are constraints on absolute profitability for many smallholders. According to this study, the sale price is highly variable and dependent on various factors such as the strength of informal relationships between the buyers and sellers, access to transportation, and a farmer's level of awareness about marketing the wood.

Land Tenure is a constraining factor for WBMC cultivators than TCMC.Tenure insecurity is defined here as the

perceived probability of losing ownership of a part or the whole of one's land without his/her consent (Balana *et al*., 2012). Land ownership in agrarian societies is not only the main means of generating a livelihood, but it is often also the primary means for accumulating wealth. The current finding is in line with the finding of Matthies and Karimov (2014) in Amhara regional state. Although some households may plant some trees that are enough for household consumption irrespective of the risk, insecure land tenure is not expected to encourage tree planting in Ethiopia. In the absence of the above containing factors, farmers were asked to state their ideal land use practice. Thus, about 65% of the farmers ranked first TCMC, 34% ranked the second WBMC and 63% ranked in third place CBMC practices.

4. CONCLUSION

This paper analyzed the comparative economic performances of three competing land use types and identified constraining factors affecting land use choices in Southern Ethiopia. The three competing land use types studied were Wood Based Mono-Cropping (WBMC), Tree Cereal Mixed Cropping (TCMC), and Cereal-Based Mono-Cropping (CBMC). The economic performances of these three land use types were compared across three-time horizons (5, 10 and 15 years) using economic performance indicators such as Net Present Value (NPV) and Benefit Cost Ratio (BCR). The output of this study is aimed to provide empirical evidence for making rational decisions in allocating scarce land resources.

Farmers in the study area obtain diversified benefits from the three land use types. In case of CBMC farmers obtain direct benefits such as grain, straw, forage and other by-products. Farmers who practice WBMC obtain all wood materials that can be used for construction, house utensils, farm implements, and energy source. Both wood and non-wood products are obtained from TCMC. These included fuelwood, fodder, construction material, and coffee. Our results showed that the aggregate economic return of WBMC over fifteen years was significantly higher as compared to CBMC and TCMC land use types. The mean comparative economic return of WBMC was about 13.21 fold of the TCMC and 32.16 fold of the CBMC land use types. Thus, from the economic analysis point of view, WBMC is the most feasible economic alternative among the three land use type. Moreover, the BCR of WBMC was 97.4 and 504.5 times higher than CBMC and TCMC practices respectively. The financial return from WBMC is relatively lower during the first five years due to the high initial investment required for the establishment of this land use type. However, the outputs have increased positively after the first five years making the investment economically attractive afterward as compared to the TCMC and CBMC land use types.

The direct economic benefits from mixed cropping (TCMC) were positive across three-time horizons. On average, the NPV/ha of TCMC was superior to CBMC but significantly inferior to WBMC. This was mainly because of high-input cost and severe component competition that exists within the TCMC system. Moreover, on average the economic return of TCMC is not very much different from CBMC except for the contribution of products from perennial components. Despite its moderate economic return, farmers attach higher overall importance to multiple cropping, i.e. TCMC, mainly because of the utility of many of the products from this land use at household level. In this study, we confirmed that mixed farming system is clearly linked with the socio-cultural tradition of farm households. Thus, under the current prevailing farming conditions, farmers attempt to balance the economic drive of producing cash crop such as *Chata edulis* and Eucalyptus in the form mono-cropping and maintaining the traditional multiple crops. In this regard, more than 65% of the farmers ranked TCMC as their priority land use type over WBMC (second) and CBMC (third) ranked land use types.

ACKNOWLEDGEMENT

The auteurs are thankful to Ethiopian Environment and Forest Research Institute (EEFRI) for the financial assistance given to accomplish this study. The cooperation received from farmers, administrative officials, development agents and GO's during data collection is highly appreciated.

REFERENCES

Alemayehu, N. 2014. Forest governance dynamics in Ethiopia: histories, arrangements, and practices. Ph.D. thesis. Wageningen University, Wageningen.

Balana, B., Haregeweyn, N., Muys, B., Descheemaeke, K., Decker, J., Poesen, J. Nyssen, J and Mathijs, E. 2012. Cost-benefit analysis of soil and water conservation measures: The case of exclosures in northern Ethiopia. Forest Policy and Economics, 15: 27-36.

Belay, Z. and Muluneh, W. 2016. The contribution of Eucalyptus Tree Farming for Rural Livelihood in Eza Woreda, Ethiopia. Palgo Journal of Agriculture.

CSA. 2013. Population Projection of Ethiopia for All Regions at Wereda Level from 2014 – 2017. Federal Democratic Republic of Ethiopia, Central Statistical Agency, Addis Ababa, Ethiopia.

Gebrehiwot, S. 2015. Forests, water and food security in the northwestern highlands of Ethiopia: Knowledge synthesis, Environmental Science and Policy 48: 128-136.

Getahun, K. 2015. Profitability analysis and determinants of fruit tree-based agroforestry system in Wondo District,

Ethiopia. African Journal of Agricultural Research. Vol.10 (11):1273-1280.

Lalisa, D. 2012. Financial analysis of agroforestry land uses and its implications for smallholder farmers' livelihood improvement in Ethiopia. Agrofor. Syst. 87 (1), 217–231.

Matthies, B., and Karimov, A. 2014. Financial drivers of land use decisions: The case of smallholder woodlots in Amhara, Ethiopia. Land Use Policy, 41 474–483.

Mbow, C., Smith, P., Skole, D., Duguma, L. and Bustamante M. 2014, Achieving mitigation and adaptation to climate change through sustainable agroforestry practices in Africa. Environmental sustainability6:8-14.

Melaku, B., Tesfaye, Y., Mohammed, Z., Zewdie, S., Tebikew, Y., Brockhaus, M. and Kassa, H. 2015. The context of REDD+ in Ethiopia: Drivers, agents, and institutions. Occasional Paper 127. Bogor, Indonesia: CIFOR.

Mesele N. 2013. The indigenous agroforestry systems of the south-eastern Rift Valley escarpment, Ethiopia: Their biodiversity, carbon stocks, and litterfall. Doctoral Dissertation, University of Helsinki, Faculty of Agriculture and Forestry, Department of Forest Sciences.

Zenebe, M. 2013. The productivity of Eucalyptus camaldulensis (Dehnh.) in GoroWoreda of Bale zone, Ethiopia.Research Journal of Agriculture and Environmental Management, 2(9): 252-260.