International Journal of Basic and Applied Sciences, 13 (2) (2024) 56-61

International Journal of Basic and Applied Sciences

Website: www.sciencepubco.com/index.php/IJBAS

Research paper

Socio-economic contribution of eucalyptus species on the livelihood of small-holder growers in horro buluk woreda, Oromia, Ethiopia

Sagni Takele *

Wollega University, Faculty of Natural Resource and Economics
**Corresponding author E-mail: sagnitakele5@gmail.com*

Abstract

Tree plantation practices in Ethiopia are dominated by exotic tree species, and Eucalyptus takes the lead in terms of coverage and purpose. Even though eucalyptus trees have several advantages over many other tree species, they are nonetheless criticized for their detrimental effects on the environment. There is a limitation of evidence on eucalyptus plantation practice and its economic contribution in the study area. The objective of the study was to socioeconomic contribution of eucalyptus species on the livelihood of small-holder growers in Horro buluk district, West Ethiopia. A total of 161 households were selected by systematic random sampling. Data were collected using key informant interviews, focus group discussions and household surveys. In addition, secondary data were collected from published and unpublished sources. The collected quantitative data were analyzed using percentage, mean, standard deviation, t-test chi-square-test and the qualitative data were analyzed using a summary of the text. Income from Eucalyptus accounts for 33.4 % of the total household income next to crop income which accounts for 39.6 %. Eucalyptus is also the main source of fuelwood and construction. According to the result, respondents chose eucalyptus over other tree species because of its high-income return, suitability for use as building and fuel which is raised in short rotation and need for minimal management. The outcome of the study also confirmed the local people's high reliance on eucalyptus-related activities, with eucalyptus-related income making up the majority of their sources of subsistence.

Keywords: *Eucalyptus Plantation; Socioeconomic Contribution; Livelihood; Small-Holder; Growers*

1. Introduction

1.1. Background and justification

Eucalyptus is an evergreen flowering tree and shrub which belongs to the family Myrtaceae and consists of about 800 species (Bayle, 2019). According to Khan et al., (2020), Eucalyptus is the most popular and fast-growing plant in the world. This tree is native to Australia and it was introduced to Ethiopia during the time of Emperor Menilik II; to be used for many purposes and to alleviate the shortage of fuelwood and construction wood in the capital Addis Ababa (Bayle, 2019). More specifically, the introduction and expansion of eucalyptus are due to the shrinking of natural forests and woodlands while population and wood demands are rapidly increasing. To curve the problem, the establishment of a fast-growing tree species plantation especially eucalyptus is a common strategy (Bongers, 2010).

In Ethiopia, about 70 species of Eucalyptus species exist and most of them are widely spread in many regions of the country, mainly in central highlands in which high population density exists. The most commonly existing Eucalyptus species are: Eucalyptus camaldulensis Dehnn., Eucalyptus tereticornis Sm., Eucalyptus grandis W.Hill ex Maid., Eucalyptus globulus Labill., and Eucalyptus saligna Sm.(Tsegaye Bekele, 2015). Eucalyptus globulus Labill. has been planted as the main tree species in the central highlands of Ethiopia since 1895 (Pohjonen, V. and Pukkala, T., 1990). It was planted on the hills of the central highlands of the country and it became expanded in Ethiopia. Its rapid growth and adaptability to a range of conditions have made it superior to any other exotic species grown in the country (Tsegaye Bekele, 2015).

Nowadays, forest plantation practices in Ethiopia are mainly exotic tree species, from this Eucalyptus takes the largest area of hardwood plantations. Growing eucalyptus on farmland in the form of woodlots has become a common practice among farmers in Ethiopia (Berihun Tefera and Habtemariam Kassa, 2017; Molla Mekonnen, 2016). According to Ketsela Hailemicael (2012), Eucalyptus tree gives multiple benefits compared to many other tree species since farmers often choose to plant eucalyptus, particularly smallholders in tropical and subtropical regions. According to Abebe Birara et al. (2019), the market demand and commercial value of Eucalyptus products such as firewood, pole, post, and charcoal were higher than the products that are from indigenous tree species like Cordia africana. As a result, many Ethiopian farmers use to plant eucalyptus on their farmland more than other indigenous trees.

In the study area, farmers shift their agricultural land (cropland) to Eucalyptus plantation because it provides high income within a short time. Even if there is the expansion of eucalyptus in the study area, there is a limitation of information about livelihood contribution and

environmental issues regarding eucalyptus expansion. Thus, the study aimed to investigate the Socioeconomic contribution of eucalyptus species on the livelihood of small-holder growers in Horro buluk Woreda, west Ethiopia.

2. Research methodology

2.1. Description of the study area

The study was conducted in Horro buluk woreda, Horro Guduru Wollega Zone, and Oromia National Regional State. The district, Horro buluk is located at a distance of 17 km northwest of Shambu which is the capital of the Horro Guduru Wollega Zone and is located approximately 314 km west of Addis Ababa. The geographical location of Woreda ranges from 9° 37′ 0″N to 9° 52′ 3″N latitude and 36° 58′ 30″E to 37° 21′ 30″E longitude. The location map of the Horro buluk district is presented in Figure 1.

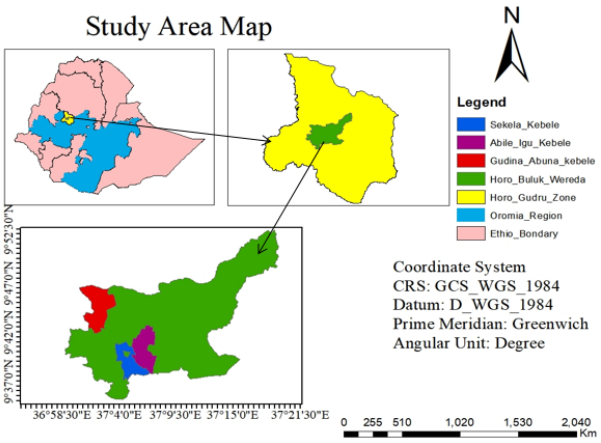

Fig. 1: Location Map of the Study Area (Horro Buluk Woreda).

2.2. Sampling method

A Multistage sampling procedure was used to sample households in the study district from potential eucalyptus Kebeles. First, potential and non-potential eucalyptus districts were identified. Second, one sample study district was purposively selected based on the growing potential (dominance) of Eucalyptus trees. Third, from the sampled district, three potential Kebeles were randomly selected for the detailed household survey. Farm households from selected Kebeles were categorized into eucalyptus planters and non-planters using a stratified random sampling method. Finally, sample households were selected using simple random sampling by the random numbering method from each group because the name of that the household heads in each sample Kebele were numbered. Therefore, the table of random numbers was used to select those that appeared in the sample.
A total of 161 household heads were selected using a systematic random sampling technique. The selection was made using proportional probability to size from the three sample Kebeles (Table 1). The sample size was determined by Kothari (2004) and the formula was used to determine the appropriate sample size for this study.

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

Where:
n= the required sample size
Z^2 = is the abscissa of the normal curve that cuts off area α at the tails (1- α equals the desired confidence level. The value of Z is found in statistical tables which contain the area under the normal curve. e.g., Z=1.812 at 93% confidence level; and Z^2 = 3.283).
N= the household size (3088)
P= the population proportion (assumed to be 0.5 since this would provide the maximum Sample size) q= 1-p
e = is the desired level of precision or margin of error (7% error or 0.07).

Thus; $n = \frac{3.283*0.5*(1-0.5)*3088}{(0.07^2(3088-1))+3.283*0.5*(1-0.5))} = 161$

Table 1: Sample Size and Sampling Distribution by Kebele

No	KPAs	Total population	No. of HHs planter	Non-planter	Proportional allocation of sample HHs planter	Non-planter	%
1	Sekela	6216	1074	230	56	12	42.2
2	Gudina Abuna	4310	748	153	39	8	29.2
3	Abille Iggu	4296	729	154	38	8	28.6
Total		14822	2551 3088	537	133 161	28	100

2.3. Sources and method of data collection

Data were collected from primary and secondary sources. Before main data collection, a reconnaissance survey was conducted about the site and a general overview of the study area using key informant interviews (KII) from Kebele leaders, development agents (DAs), rural

development agents, and agricultural and natural resource management experts. In this study, quantitative data were collected from the household survey as well as qualitative data were collected using KII and focus group discussion (FGD).

2.4. Method of data analysis

2.4.1. Descriptive statistics

Regarding the data analysis, both descriptive statistics and econometrics models were used. The collected data were analyzed using Statistical Package for Social Sciences (SPSS) version 25, STATA Statistical Software version 14 and Microsoft excel.

3. Results and discussion

3.1. Characteristics, access and resources of respondents

3.1.1. Household characteristics and access

The demographic characteristics of the respondents such as sex of household, educational status, marital status and access to credit are presented in Table 2 below.

Table 2: Summary of Categorical Household's Socio-Economic Characteristics

Variables	Indicators	non planter(N=28)		Planter(N=133)		Total(N=161)		$\chi 2$	P-value
		F	%	F	%	F	%		
sex	Female	10	35.7	20	15.0	30	18.6	6.522	0.011
	Male	18	64.3	113	85.0	131	81.4		
Education status	Illiterate	16	57.1	31	23.3	47	29.2	12.810	0.000
	Literate	12	42.9	102	76.7	114	70.8		
Credit access	No	6	21.4	34	25.6	40	24.8	0.212	0.645
	Yes	22	78.6	99	74.4	121	75.2		
Marital status	Married	20	71.4	119	89.5	139	86.3	20.403	0.000
	Unmarried	0	0	5	3.8	5	3.1		
	Divorced	0	0	4	3.0	4	2.5		
	Widowed	8	28.6	5	3.8	13	8.1		

The gender distribution of respondents shows that 18.6 % of females and 81.4 % of males. According to the findings of the study, the male household proportion is high, which may contribute to the expansion of eucalypts. This could be because men are more likely than women to plant eucalyptus trees and because female-headed households were less involved in tree-growing than male-headed households. The chi-square test shows there is a statistically significant difference at 5% level of significance regarding sex (Table 2). Furthermore, About 86.3 % of respondents were married while the rest 3.1%, 2.5%, and 8.1% were single, divorced, and widowed, respectively. The chi-square test shows there is a statistically significant difference at 1% level of significance regarding marital status (Table 2). Regarding education level, 29.2% of them did not attend any education, while 70.8% attended different education levels. The chi-square test shows there is a statistically significant difference at 1% level of significance regarding education status (Table 2). The credit access result also shows that about 24.2% of households did not get any credit access, while 75.8% of them got credit access but there is no statistically significant difference between eucalyptus planters and non-planters (Table 2).

Table 3: Continuous Socio-Economic Characteristics of Households

Variables	Non-Planter(N=28)		Planter(N=133)		Pooled data		t	p-value
	Mean	SD.	Mean	SD.	Mean	SD.		
Age	47.96	7.87	46.69	12.81	46.91	12.08	-.505	.614
Family size	6.89	2.96	6.86	2.85	6.86	2.86	-.060	.952
Livestock owned(TLU)	15.52	7.50	14.82	8.98	14.94	8.72	-.383	.702
Land holding size	1.62	1.16	2.28	0.89	2.16	0.97	3.360	.001
Distance from road	8.78	5.47	3.06	2.93	4.06	4.10	-7.868	.000
Distance from forest	1.70	1.07	4.04	2.64	3.64	2.60	4.601	.000
Distance from market	10.73	4.88	4.38	3.39	5.48	4.40	-8.287	.000
Eucalyptus income	0.00	0.00	43855.44	46964.31	9,355.03	9,427.31	4.929	.000
Crop income	67118.18	40294.58	48114.59	41312.35	10,751.36	8,214.90	-2.222	.028
Livestock income	38933.32	29253.90	43840.40	29832.29	4,990.45	3,718.38	.087	.931
Off-farm income	7073.93	10529.13	7650.33	53026.74	2,337.62	2,315.85	.057	.955

The different continuous socio-economic characteristics of the respondents are presented in Table 3. The average age and family size of the households were 46.91 and 6.86, respectively. The age is also appropriate for long-term exposure. As a result, many of them appear to have a good awareness of the many characteristics of eucalypts in their respective areas in land use practice. The average numbers of livestock holding within households were 14.94 in terms of tropical livestock unit (TLU) as indicated in Table 3. The mean landholding size and distance from the access road, natural forest and marketplace were 2.16, 4.06, 3.64, and 5.48, respectively. According to the respondent's explanation and response, the shortage of land limited the preference of farmers to expand eucalyptus and to obtain benefits. The income diversification of households they earn per year in birr was also presented in table 3, the average income from crop, eucalyptus, livestock and off-farm were 10751.36, 9355.03, 4990.44 and 2337.62, respectively. The t-test result shows that land holding, distance from the main road, distance from the forest, and distance from the market are statistically significant differences at 1% level of significance between eucalyptus planters and non-planters. In addition, crop income shows a significant difference between eucalyptus planters and non-planter at 5% level of significance.

3.2. Conversion of other land use to the eucalyptus plantation

According to focus group discussants, the majority of households transform the other land-use type to eucalyptus plantation for different reasons; when crop productivity of the land decline, due to the influence of neighbor households who have eucalyptus, when cereal crops fail to give reasonable yield as expected due to pest and disease and to meet their fuelwood and construction materials demand.
The survey result showed that the respondents converted a higher percentage of cereal crops to eucalyptus plantations followed by grazing land; this is due to declining in land productivity to give the desired product of cereal crops. About 49.6%, 30.8%, and 12.8% of households established eucalyptus by converting croplands, grazing land and homestead area, respectively (Table 4).

Table 4: Number of Households Converted Other Land Use Types to the Eucalyptus Plantation

	Number of respondents	
Converted land use type	Frequency	percentage%
Crop land	66	49.6
Homestead area	17	12.8
Grazing land	41	30.8
Others	9	6.8
Total	133	100.0

Source (field survey, 2022).

Eucalyptus expanded at the expense of others by the transformation of other land use types. Farmers allocate a large proportion of their farmland to eucalyptus plantations. This is due to farmers' expectations of a higher return from eucalyptus growing than from crop production. According to all of the respondents who converted cropland to eucalyptus, the two main drivers of conversion were higher income from eucalypts versus annual crops and lower crop yields due to soil fertility reduction. Focus group discussion revealed that the expansion of eucalyptus in the area is competing for land for the production of food crops. The higher return on Eucalyptus production than other alternatives is one of the reasons for the conversion of profitable land to Eucalyptus woodlot (Dereje Jenbere, 2012; Berihun Tefera and Habtemariam Kassa, 2017; Asabeneh Alemayehu, 2018; Asabeneh Alemayehu and Yoseph Melka, 2022). The farmers promptly decide to convert the land to eucalyptus when the land declined in food crop productivity as expected. Also, the key informants mentioned that, when the owners of land passed away, their land is transferred to their children or relatives (living in urban areas or other places). Ultimately they convert the land into an eucalyptus plantation to generate continuous cash without the need for closer management. Similar findings were reported by Kebede Gizachew (2017) and Belay Zerga et al. (2021). Therefore, if it is not handled appropriately, this replacement could result in a drop in crop fields and a decline in food crops, affecting food production and security (Asabeneh Alemayehu and Yoseph Melka, 2022).

Fig. 2: Different Land Uses Converted to Eucalyptus Plantations.

Source; (own field photo, 2022).

3.3. Socio-economic impact of eucalyptus on the livelihood

3.3.1. Households income sources and their relative contribution

The survey result shows that the major household income sources were cereal crops, livestock, Eucalyptus and other off-farm activities. The major cereal crops grown in both agroecological zones are wheat, maize, barley, noug, teff, pea, bean and potato. Livestock production in horro buluk Woreda includes rearing cattle (cow and oxen), small ruminants (goats and sheep), Equines (donkeys, horses and mules) and poultry. Off-farm activities are also other important livelihood strategies in the study area. The most common of-farm activities in the study areas are petty trading and handicrafts. At the study site, different income groups of household income were compared. From the survey result, eucalyptus makes up 33.4% of the household's total income next to income from cereal crops which accounts for 39.6%. The livelihood of households largely depends on the cultivation of cereal crops (Table 8). Similarly, livestock and off-farm activities contribute 18.4% and 8.6% of total household income, respectively.

Table 8: Mean Household Income (in ETB) and Income Share by Income Source (Multiple Responses) Per Year

Source of income	N	Min	Max	Mean	Std. Deviation	Income share (%)
Cereal crops	154	740	50210	10751.4	8214.9	39.6
Eucalyptus	130	336.7	37000	9058.2	9375.9	33.4
Livestock	139	2466.7	33720	4990.4	3718.4	18.4
Off-farm	52	200	10000	2337.6	2315.8	8.6
Sum (%)						100

Source (field survey, 2021).

Dese Yadeta (2021) reported that eucalyptus income shares up 87% of the total household income and accounted for the largest share. Biruk Ketsela (2012) also revealed that the additional money from eucalyptus can help to improve the food security of farmers. In Ethiopia's highlands, eucalyptus can start providing income at the age of 3-4, excluding in-between benefits. Belay Zerga and Muluneh Woldetsadik

(2016) stated that Eucalyptus production was the second most important source of income in Eza Woreda of the Gurage zone. This finding also shows that Eucalyptus' income contribution is next to cereal crop production contributes to the rural household's economy.

3.3.2. Trends of different income sources

In the study area, the main source of support for household livelihood including, food consumption is cereal crops currently, and this may remain the same in the future. Crop production is integrated with livestock raising and other off-farm work. However, each source of income has its contribution to the livelihood of the household, respective of the food security situation of household's crop production has irreplaceable value. Livestock contribution is also important, for social security, as ingredients in farm inputs and for transport in addition to the source of food. However, eucalyptus income has similar value and in some cases, more than other income sources like, crop income, livestock income, and off-farm income. As shown in Figure 3 income of eucalyptus in 2009 and 2013 is high when compared to others. This may be a failure of crop production by a different factor, pest, disease and climate and a rotation period of harvest.

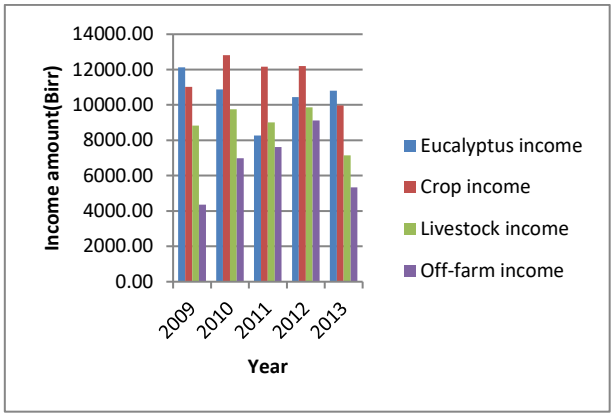

Fig. 3: Trends of Different Income Sources for Five Consecutive Years (2009_2013 E.C).

3.3.3. Contribution of eucalyptus products to the livelihood of households

Eucalyptus in the study area has several contributions to the livelihood of the households. The key informants reported that eucalyptus play important role in reducing destruction from natural forests, because they have their eucalyptus plantation the farmers don't need to go to the forest for construction materials and firewood. Farmers grow eucalyptus for fuelwood and construction (100%), income generation (79.75) and soil and water conservation (66.9%) as shown in Figure 4.

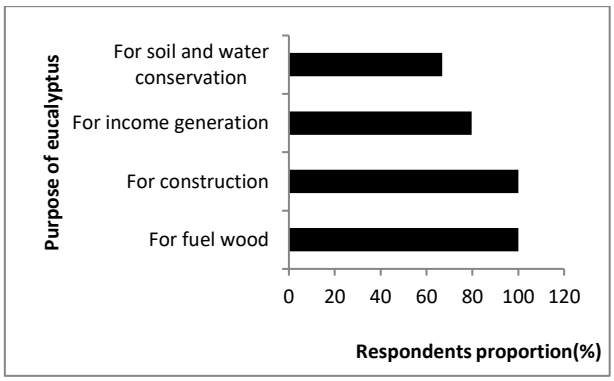

Fig. 4: Household's Purpose of Growing Eucalyptus Tree (Multiple Responses).

Source (field survey, 2021).

Eucalyptus has received much attention recently for its multi-function providing a potential socio-economic contribution to communities. Eucalyptus is the most dominant plantation species in the country widely used contributing to the national consumption of construction poles (92%), farm implements wood sources(91%), firewood (85%), posts (83%), timber (74%) and charcoal(40%) (Zenebe Mekonnen et al., 2007). Eucalyptus plantation plays an important role in both social and economic values because it provides a high-income return, creates job opportunities, improves food security and poverty reduction, for building and firewood, and produces a high rate of biomass and eucalyptus products can be a valuable source of revenue, for both sustenance and cash for local communities and the impoverished income (Dese Yadeta, 2021). Eucalyptus-producing jobs include growing seedlings, digging holes, weeding, planting, hoeing, watering, thinning, pruning, and gardening in rural regions, as well as timber processing, woodworking, and charcoal making and also in urban areas commercial operations such as fuelwood retailing, charcoal and pole sales, and wood processing are mostly done by women (Asabeneh Alemayehu, 2018; Asabeneh Alemayehu and Yoseph Melka, 2022). Eucalyptus has significant socio-economic impacts on the livelihood of the local community. Eucalyptus significantly contributes to household income improvement which leads to poverty reduction. Farmers grow eucalyptus trees to fulfill the shortage of fuel wood, and construction materials for income generation for livelihood (Silenat Birhanu et al., 2018; Alfred et al., 2020).

The survey result shows that the source of construction materials of the respondents are mainly wood products of eucalyptus which are from own plantation (77.67%), buying from the market (19.25%), from the natural forest (2.48%) and community plantation (0.62%). The decision to grow eucalyptus is predominantly endangered by the need to meet household wood demand. Most of the household fuel and construction wood demand is met from its eucalyptus plantation.

As the population is dramatically increasing the demand for construction materials is also increasing as well. Eucalyptus wood products are the most preferable construction materials for local communities particularly. The construction of many infrastructures such as health

centers, schools, roads, water walls and community halls is largely dependent on eucalyptus (Alfred, K et al., 2020). This is also true in the study area, where most of the households used eucalyptus for whole-house construction, farm implements, and fencing materials that require an extensive amount of wood. Biruk Ketsela (2012) also stated that, Except for leaves used for fuel wood (baking injera and roasting grains), all of the assortments are used for house construction, either directly or indirectly (by splitting into pieces), and fencing of residential areas (boundaries) to prevent illegal animal entry (including wild animals, like a hyena that eat their domestic animals).

The survey result shows that the energy consumption of households is largely dependent on eucalyptus products. In the study area, the farmer who does not have eucalyptus woodlot has also used eucalyptus wood products as the main source of energy, buying from the market or local community having eucalyptus plantation. In the study area, Eucalyptus firewood is a primary source of energy as well, which accounts for 81.3%. The other energy sources of households are crop residue (10.6%), firewood collected from the natural forest (7.5%) and Animal dung (0.63%).

Farmers in rural areas are mostly used biofuel as their source of energy for cooking, heating and occasionally for lighting purposes. The sources of these energies are mainly fuelwood, animal dung and crop residues. This result agrees with Belay Zerga (2015) who noticed that eucalyptus is the fuelwood source of all rural households. Resulting natural forest degradation, the farmers used fuelwood from natural forests rarely. Thus, the degradation of natural forests persuades farmers to plant eucalyptus as an optional fuelwood source. As a result, the total consumption of eucalyptus in reducing pressure from the natural forest is substantial in the study area. In many sections of the country, crop wastes and cow dung are used as firewood replacements. The use of Eucalyptus wood for energy reduces the usage of cow dung and crop leftovers, increasing its availability as fertilizers for crop production (Zenebe Mekonnen et al., 2007).

4. Conclusions

The main purpose of this study was to analyze the socio-economic and environmental implications of eucalyptus species spread on livelihood in the Horrobuluk district of West Ethiopia. Planting eucalyptus in rural areas was seen as a type of financial assurance against any unexpected financial issues. Eucalyptus tree cultivation is becoming a popular agricultural practice in the study area, alongside cereal crops such as teff, maize, wheat, barley, noug, pea, and bean. Farmers plant eucalyptus trees by converting different land use types i.e., grassland, cropland, and homestead are among land use types converted to eucalyptus. This is because farmers expect a higher return from eucalyptus growing than from crop farming. Due to the fall in cereal crop yields, degraded lands are usually turned into eucalyptus plantations. This rapid development of eucalyptus is displacing the production of cereal crops (food crops) on land, putting farmers' food security in danger. The most important reason fueling the spread of eucalyptus trees is the economic aspect, which includes a lack of fuelwood, construction materials, and financial issues

Furthermore, the income generated from eucalyptus was used for household expenditures such as; sending their children to higher education (college and university), to purchase materials (food, cloth and home equipment). The farmers in the study area considered eucalyptus as an emergent source of income for all expenses. Also, the major source of fuelwood and construction materials in the study area is eucalyptus wood products. As long as eucalyptus is a potential income source and significantly contributes to the livelihood of households, banning growing of eucalyptus without considering its socioeconomic and ecological roles should be shunned. Therefore, policymakers should take the right decision concerning eucalyptus plantation by assessing the overall benefit of eucalyptus considering the need of the community.

References

[1] Alfred, K., Zaiton, S. And Norzanalia, S., 2020. A Review on The Potential Socio-Economic Impact of Eucalyptus Plantation On Local Community. *The Malaysian Forester, 83*(2), Pp.322-339.

[2] Alfred, K., Zaiton, S. And Norzanalia, S., 2020. A Review on The Potential Socio-Economic Impact of Eucalyptus Plantation On Local Community. *The Malaysian Forester, 83*(2), Pp.322-339.

[3] Asabeneh Alemayehu and Yoseph Melka, 2022. Small Scale Eucalyptus cultivation and its Socio-Economic Impacts in Ethiopia: A Review of Practices and Conditions. *trees, Forests and People*, P.100269. https://doi.org/10.1016/j.tfp.2022.100269.

[4] Asabeneh Alemayehu Munuyee, 2018. *Value Chain Analysis and Identification of Upgrading Options for Eucalyptus Poles and Fuel Wood in Sidama: The Case of Hawassa Zuria District, Souther Ethiopia* (Doctoral dissertation, Technische Universität Dresden).

[5] Bayle, G.K., 2019. Ecological and social impacts of eucalyptus tree plantation on the environment. *Journal of Biodiversity Conservation and Bioresource Management, 5*(1), pp.93-104. https://doi.org/10.3329/jbcbm.v5i1.42189.

[6] Belay Zerga and Muluneh Woldetsadik, 2016. Contribution of Eucalyptus tree farming for rural livelihood in Eza Wereda, Ethiopia. *Palgo J Agric, 3*(1), pp.111-117.

[7] Belay Zerga, 2015. Ecological impacts of Eucalyptus plantation in eza wereda, Ethiopia. *Int. Inv. J. Agric. Soil Sci, 3*(4), pp.47-51.

[8] Berihun Tefera And Habtemariam Kassa, 2017. Trends And Driving Forces of Eucalyptus Plantation By Smallholders In The Lake Tana Watershed Of Ethiopia. In *Social And Ecological System Dynamics* (Pp. 563-580). https://doi.org/10.1007/978-3-319-45755-0_31.

[9] Bongers F. 2010. Plantation forests in restoration ecology: some experiences from Africa. In: Bongers F, Tennigkeit T (eds) Degraded forests in Eastern Africa: management and restoration. Earthscan Publ, London, pp 171–220 https://doi.org/10.4324/9781849776400.

[10] Dereje Jenbere, Mulugeta Lemenih and Habtemariam Kassa, 2012. Expansion of eucalypt farm forestry and its determinants in Arsi Negelle District, South Central Ethiopia. *Small-Scale Forestry, 11*(3), pp.389-405. https://doi.org/10.1007/s11842-011-9191-x.

[11] Dese Yadeta Edesa, 2021. Economic Contribution of Eucalyptus globulus to the Livelihoods of Local Communities in Chelia District, Oromia, Ethiopia. *European Business & Management, 7*(6), p.159. https://doi.org/10.11648/j.ebm.20210706.11.

[12] Kebede Gizachew (2017). Expansion of eucalypt woodlot and its factors in Cheha District, Southern Ethiopia. *World Scientific News, 66*, 163-180.

[13] Khan, N., Fahad, S., Faisal, S., Akbar, A. and Naushad, M., 2020. Socio-Economic and Medicinal Review of Eucalyptus Tree in the World. *Available at SSRN 3644215*. https://doi.org/10.2139/ssrn.3644215.

[14] Molla Mekonnen Alemu, 2016. Eucalyptus Tree Production in Wolayita Sodo, Southern Ethiopia. *Open Access Library Journal, 3*(12), pp.1-10. https://doi.org/10.4236/oalib.1103280.

[15] Silenat Birhanu nd Fikadu Kumsa., 2018. Review on expansion of Eucalyptus, its economic value and related environmental issues in Ethiopia. *International Journal of Research in Environmental Science, 4*(3), pp.41-46.

[16] Tsegaye Bekele, 2015. Integrated Utilization of Eucalyptus globulus grown on the Ethiopian Highlands and its Contribution to Rural Livelihood: A Case Study of Oromia, Amhara and Southern Nations Nationalities and People's Regional State Ethiopia. *International Journal of Basic and Applied Sciences, 4*(2), pp.80-87.

[17] Zenebe Mekonnen, Habtemariam Kassa, Mulugeta Lemenh and Bruce Campbell, 2007. The role and management of eucalyptus in Lode Hetosa district, Central Ethiopia. *Forests, Trees and Livelihoods, 17*(4), pp.309-323. https://doi.org/10.1080/14728028.2007.9752606.