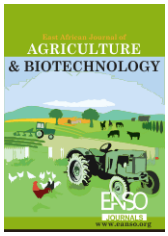

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Original Article

Local Farmers' Perception towards Eucalyptus Woodlot: Lesson Drawn from the Jamma District, Northeastern Ethiopia

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ABSTRACT

Eucalyptus woodlots are the most economically important and extensively planted exotic tree species in Ethiopia. However, there are different arguments on Eucalyptus's contribution and its effect on the environment from scholars and communities as a whole. Hence, this study investigates farmers' perceptions and factors affecting their perception of *Eucalyptus* woodlot plantation. The sample size of respondents was 150 farmers who were selected randomly, and data were collected using semi-structured questionnaires, focus group discussions and key informant interviews. The collected data were analysed through descriptive statistics and a binary logistic regression model. The result revealed that 65.3% of farmers had a positive perception, but they perceived negative effects like Nutrient competition of *Eucalyptus* on crops, effect on water resources, drying out of other plant species, shading effect, and causing soil infertility. *Eucalyptus* contributed 41.6% to the total household income, next to agriculture (54.2%). Degraded land, roadsides, and farm boundary were the common niches of *Eucalyptus* plantations. Furthermore, *Eucalyptus* wood products are the most preferable construction materials for local communities. The result shows that the majority of the farmers plant *Eucalyptus* on degraded land. The model result indicated that staying years in the area, farmers' experience, age, educational status, and distance to market had significant effects on farmers' perception towards *Eucalyptus* plantation. The findings recommended that different concerned bodies should work to address different socioeconomic and biophysical factors affecting farmers' perception towards *Eucalyptus* woodlot. The findings further suggest that experts and policy-makers should consider the interests and perceptions of farmers to make decisions regarding *Eucalyptus* woodlot plantations.

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INTRODUCTION

In Ethiopia, natural forests and woodlands are shrinking on the one hand, while population and wood demands are rapidly increasing on the other hand. The forest depletion and increasing population have resulted in a severe shortage of wood products, especially fuelwood and construction materials (Liang et al., 2016; Tadesse & Tafere, 2017). One of the most common solutions to the response of this problem has been the establishment of fast-growing tree species plantations. Plantation forests of exotic tree species are one form of forest in Ethiopia (Tesfaye et al., 2016; Dejene & Kidane Yilma, 2018). Plantation in the form of woodlot is important for meeting the increasing demand for forest products that supply from the plantation forest and able to reduce supplies from natural forests. One of the measures taken by the government to minimise the problem of scarcity of wood products was to introduce fast-growing exotic tree species (e.g., *Eucalyptus camaldulensis* and *Eucalyptus globulus*) and establish fuelwood projects near urban and peri-urban areas (Liang et al., 2016). This rapid growth and adaptability to a range of conditions have made it preferable to any other exotic species grown in the country (Bekele, 2015).

Some scholars argued about its negative impact on soil acidification, nutrient depletion, allelopathic effect, and excessive water utilisation (Liang et al., 2016; Negasa et al., 2017). However, the importance of the species because of its fast growth, high biomass production, coppicing ability, browsing, and disease resistance properties make it widely adopted and expanded tree species (Negasa et al., 2016). In northern Ethiopia, *Eucalyptus* is the most commonly grown tree species in the community and private woodlots (Tadesse & Tafere, 2017; Kebede, 2022). Currently, nearly all *Eucalyptus* woodlots are planted mostly on hilly patches, parts of farmlands that are not suitable for growing food crops, and around homesteads (Negasa et al., 2016; Negasa et al., 2017). The ongoing expansion of *Eucalyptus* plantations by farmers in Ethiopia has been the focus of two major debates on the environmental impact and the economic role of the species. The former debate was related to soil acidification, nutrient depletion, allelopathic effect, and excessive water utilisation by the species, especially when grown on previously cultivated farmlands (Liang et al., 2016; Janice et al., 2016; Alemu, 2016; Negasa et al., 2017). However, the later debate focuses on the importance of the species because of its fast growth, high biomass production, coppicing ability, browsing, and disease resistance (Negasa et al., 2016). Nowadays, in Ethiopia, the *Eucalyptus* plantation grown as a woodlot has been continuing and used by many farmers for construction materials, fuel wood, and related purposes (Daba, 2016).

Despite the potential importance of *Eucalyptus*, the associated environmental concerns, such as the impoverishment of soil fertility, depletion of groundwater, and soil acidification, are yet to be undermined by different scientists and communities for Ethiopian site-specific conditions associated with assumptions of its negative Effect (Daba, 2016; Liang et al., 2016; Negasa et al., 2017). This indicated that the demand for further investigation regarding the impacts of *Eucalyptus* is very high. With the

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expansion of woodlots in developing countries like Ethiopia, concerns are rising about relationships between woodlots and local farmers (Zerga, 2015; Deginet et al., 2022). Therefore, this study adds to the scant literature on relationships between farmers' perceptions and associated factors influencing their perception regarding *Eucalyptus* woodlot. Unlike previous studies that demonstrated the perception of farmers on the negative impact of *Eucalyptus* expansion related to crop, water, soil, environment, and related effects (Zerga, 2015; Negasa et al., 2016; Alemu, 2016; Zerga et al., 2021; Alemayehu & Melka, 2022), we use econometric model to examine factors influencing farmers' perception towards *Eucalyptus* woodlot.

To address the mentioned gaps, the main objective of this study was to investigate local farmers' perceptions and determinants influencing their perception regarding *Eucalyptus* woodlot plantation as well as its contribution to the total household income compared to other income sources. Accordingly, we hypothesised that local households' perception of *Eucalyptus* woodlot growing in the Jamma district is affected by different socioeconomic and demographic variables. Hence, this study aims to answer the following three key research questions; i) What do the local farmers perceive about the *Eucalyptus* woodlot plantation? ii) What factors affect the local farmers' perception regarding *Eucalyptus* woodlot? iii) What *Eucalyptus* woodlot contributes to the households' total income? The findings of this study will help to address the needs and demands of smallholder farmers who are engaged and not engaged in *Eucalyptus* woodlot.

MATERIAL AND METHODS

Study Area

The study was conducted in Jamma district, South Wollo zone, Amhara region, Northeastern Ethiopia. Geographically the district is located within the coordinates of 10◦09′ 33" - 10◦35′ 45" N and 39◦03′ 24" - 39◦29′ 1" E (Figure. 1). It covers an area of 1,052 km^2. According to Ethiopian Central Statistical Agency (CSA), the district has a total population of 144,038, of whom 71,339 were males and 72,699 were females (CSA, 2007). The district has a total household of 32,163 and a population density of 121 people per km^2. Jamma district has a mean annual temperature of 18◦C and annual rainfall ranging from 500 to 3600 mm. The altitude of the district ranges from 1400 to 2900 m.a.s.l. 77% of the Jamma district lies in Woyna Dega or mid-land agroecologies. However, the remaining 23% of the distinct has lowland (kola) and high-land (dega) agro-ecologies (Teshome, 2019).

Sampling Technique and Data Collection Method

A total of 3 *Eucalyptus* potential Kebeles[1] were selected using information from the Jamma district report. From sample Kebeles, a total of 150 randomly selected farmers were used through a random number based on the list of farmers obtained from the Kebele administration.

The total sample size was determined according to Israel (1992) by using the following formula (Equation 1).

$$n = \frac{N}{1+N(e)^2} = \frac{240}{1+240(0.05)^2} = 150 \qquad (1)$$

Where; n = sample size; N = total population of household; e = precision level

Before final data collection, a preliminary survey was conducted to get better information about the study area and the kind of data to be collected. Both quantitative and qualitative data were collected from primary and secondary sources. To collect data, a household survey, key informant interview (KII), and focus group discussion (FGD) was employed. They mainly conducted to obtain quantitative data, while KII and FGD conducted to obtain qualitative data. A household survey was conducted through a semi-structured questionnaire, while KII and FGD were conducted through a checklist.

[1] Kebele is the smallest administrative units of Ethiopia

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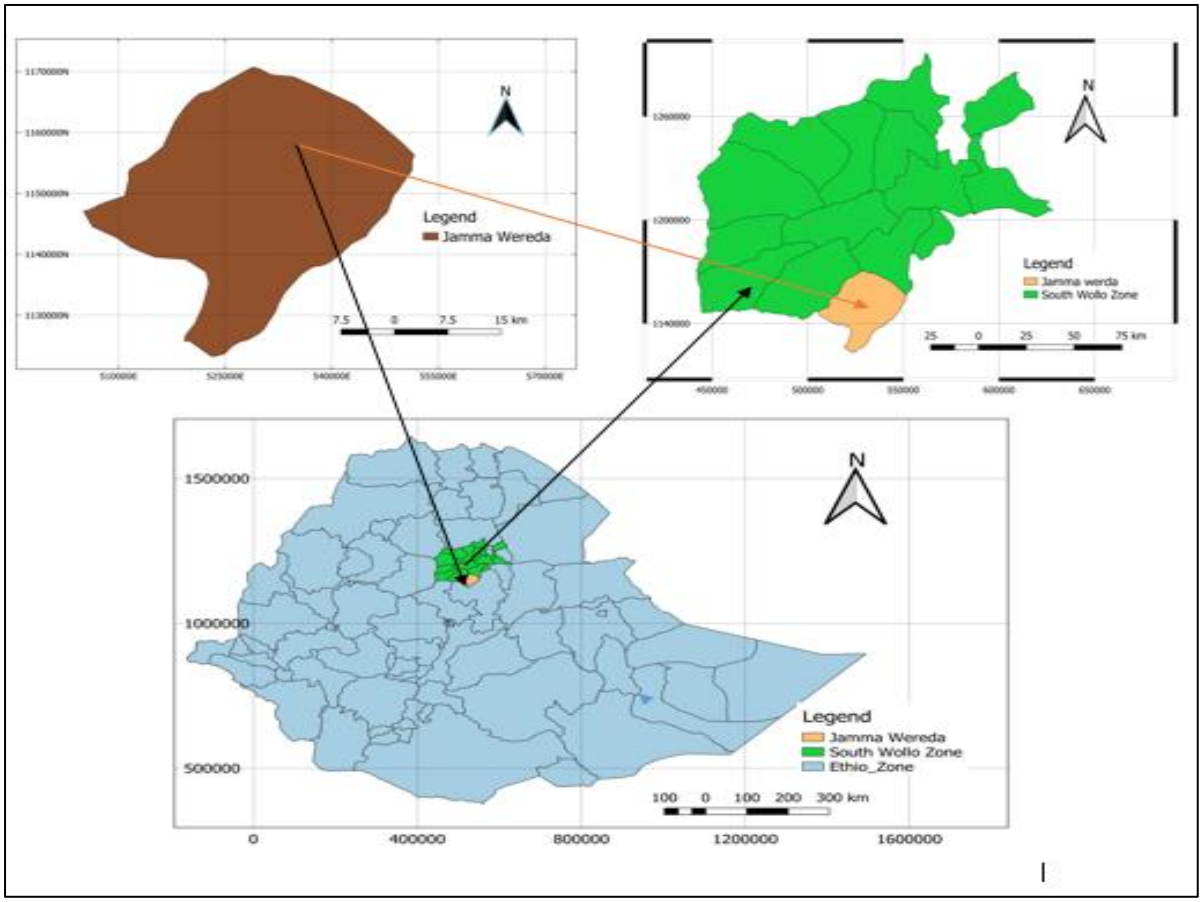
The data collection tools were conducted by considering various socioeconomic characteristics, income sources, perceptions regarding niches and effects of *Eucalyptus*, and cognitive (e.g., knowledge, beliefs, and experience) variables (Tadesse & Kotler, 2016; Tadesse & Teketay, 2017). Selected farmers were involved in data collection related to 15 major explanatory variables supposed to affect farmers' perception of the *Eucalyptus* woodlot (Table 1). Those explanatory variables were selected following the previous studies. A total of three FGDs was conducted from three sampled kebeles (one FGD from each kebele) as well as nine KII were selected (three KIIs per Kebele) in the interview with the developmental agent to obtain the general information of *Eucalyptus* woodlot.

Figure 1: Map of the study area



Method of Data Analysis

The collected data were analysed using descriptive statistics and binary logistic regression model and summarised into tabular and graph format through the help of STATA version 17. Descriptive statistics, such as percentage, frequency, graphs, means, and standard deviation, were used to analyse descriptive variables. A binary logit regression model was used to analyse factors affecting local farmers' perception of the *Eucalyptus* plantation. The logit model was selected in this study because the distribution of the data followed the logistic distribution function. The qualitative data obtained from the FGD and KII was summarised using texts and contexts.

Binary logit regression analysis was applied to identify the factor that influences the farmer's perception to establish and allocate the land for the *Eucalyptus* woodlot. Demographic, institutional, socioeconomic, and biophysical factors which affect the farmers' perception were examined using binary logistic regression. In the logit model, farmers who have a positive

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perception of the *Eucalyptus* woodlot take the value of 1, and the farmers who have a negative perception of the *Eucalyptus* woodlot take the value of 0. The dependent variable is a categorical dichotomy (i.e., positive/ negative), while the independent variables include a mix of continuous and nominal variables. According to Gujarati (2004), the functional form of the logit model is presented as follows:

$$Li=\ln\left(\frac{pi}{1-pi}\right) = Zi = \beta0 + \beta1x1 + \beta2x2 + \beta3x3 + \beta4x4 \ldots \beta nxn \quad (2)$$

Where: Pi = the probability of perception of farmers on *Eucalyptus* woodlot ranges from 0 to 1.

L= the natural log of the odds ratio or logit.

$$Zi = \beta0 + \beta1x1 + \beta2x2 + \beta3x3 + \beta4x4 \ldots \beta nxn \quad (3)$$

β0 = the intercept. It is the value of the log odd ratio $(\frac{pi}{1-pi})$ when X is zero.

β = β1+ β2+ β3+ β4… βn the slope, measures the change in L for a unit change in X; Thus, if the stochastic disturbance term (Ui) is taken into consideration, the logit model becomes

Li = β0 +β1 Xi +Ui.

Table 1: Summary of factor variables affecting farmers' perception of Eucalyptus woodlot

Variables	Types of variables	Measurements	Hypothesis
Farmers' perception of *Eucalyptus* woodlot	Dummy	1= positive, 0= negative	Dependent variable
Sex	Dummy	1= Male, 0= female	+
Educational status	Dummy	1= Literate, 0= Illiterate	+
Age	Continuous	Farmer's age in years	-
Family size	Continuous	Number of persons in the household	-
Farmers' experience in *Eucalyptus* production	Continuous	Number of years farmers engaged in *Eucalyptus* production	+
Length of residence in the area	Continuous	Length of years farmers lived in the area	+
Landholding size	Continuous	Landholding size in hectares	+
Livestock holding size (TLU)	Continuous	Number of livestock holding in tropical livestock unit (TLU)	-
Access to credit service	Dummy	1= Farmers have credit access, 0= no credit access	+
Distance from road access	Continuous	Distance between farmer's house and road access in hours	+
Distance from natural forest	Continuous	Distance between farmer's house and natural forest in hours	+
Distance from market to home	Continuous	Distance between farmer's house and marketplace in hours	+
Agricultural income	Continuous	Amount of income from agriculture in Ethiopian birr	-
Off-farm income	Continuous	Amount of income from off-farm sources in Ethiopian birr	-
Eucalyptus income	Continuous	Amount of income from *Eucalyptus* in Ethiopian birr	+

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RESULTS AND DISCUSSION

Socioeconomic Characteristics of Respondents

A total of 150 farmers responded to the questionnaire survey. The majority of the respondents (82.7%) were males, and the average age of the respondents was about 48 years, with a standard deviation of 10.34. On average, the respondents lived in the area for about 44.71 years. The average family size in a household was about 6.45 persons. Regarding the status of education, the vast majority of the respondents (71.3%) were illiterate. The average *Eucalyptus* production experience of farmers was about 23.61 years, with a standard deviation of 6.77. The average landholding size was about 2.51 ha as well as the average livestock holding was 14.88 animals. The majority of the respondents (74%) had access to credit services, and about 65.3% of farmers had a positive perception of *Eucalyptus* plantations. The average annual income of the farmers was about 55729.3200 in Ethiopian birr. The average distance between the houses of the respondents and the nearby forest was taken about 4 hours (*Table 2*). The average distance between the houses of the respondents and the nearby natural forest was about 5.37 hours as well as the average distance between the houses of the respondents, and the marketplace was about 3.7 hours.

Table 2: Summary of samples and descriptive results

Variables	Descriptive results	(%)
Total sample size(n)	150 respondents	
Sex	Female	17.3
	Male	82.7
Educational status	Illiterates	71.3
	Literate	28.7
Age	Mean = 48.0067 years; SD=10.34213	
Family size	Mean = 6.4533 years; SD=3.00690	
HH experience in *Eucalyptus* woodlot production	Mean= 23.61 years; SD =6.773	
Length of residence in the area	Mean = 44.7133 years; SD =9.69698	
Landholding size	Mean = 2.51 hectare; SD =.710	
Livestock holding size (TLU)	Mean = 14.8795 animals; SD =8.72256	
Access to credit service	Yes	74.0
	No	26.0
Farmers' perception of *Eucalyptus w*oodlot	Positive	65.3
	Negative	34.7
Annual income	Mean = 55729.3200 birr; SD= 14964.05807	
Distance from road access	Mean =4.0773 hours; SD= 4.15777	
Distance from natural forest	Mean =5.3679 hours; SD=4.37934	
Distance from market to home	Mean = 3.70975 hours; SD =2.64290	

Niches and Contribution of *Eucalyptus* Plantation

The survey result shows that about 66.1% of the farmers plant *Eucalyptus* on degraded land. This is because *Eucalyptus* is the farmers' most preferred tree type in the area to recover their income, maintain food security, and for mitigating rural poverty. Thus, degraded areas have been given priority for tree planting by households and the government afforestation program to prevent further loss of land. About 23.6% of the respondents have planted *Eucalyptus* on the farm boundaries of homesteads and around farmland. Small land holding size and fragmentation of lands, which will increase boundary areas and respond to the new tenure system, could explain the desire to plant trees on farmland boundaries. The other 8.7 % and 1.6% of *Eucalyptus* growers planted *Eucalyptus* along the roadside and on farmland with the crop, respectively. *Eucalyptus*

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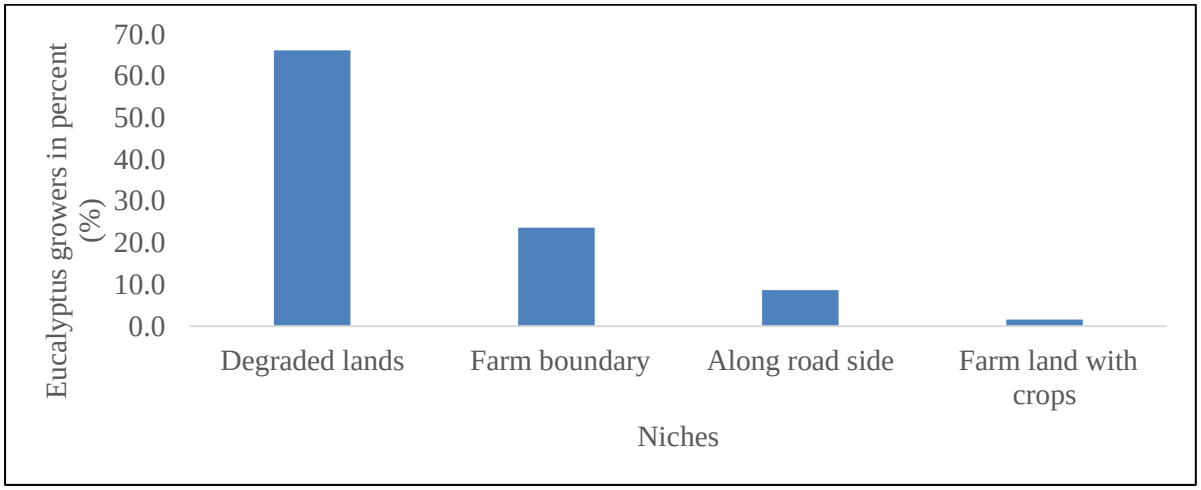
woodlot plantations on degraded land and roadside have to be encouraged when compared to farm boundaries and on farmland plantations with crops since their adverse effect on cereal crops are substantial (*Figure 2*).

Eucalyptus plantation in the study area has many patterns. Farmers plant *Eucalyptus* in different forms, such as woodlots around homestead areas, on degraded land or the land that declines in productivity of cereal crops, along the roadside, on-farm boundaries. Similar results were reported by (Zerga, 2015; Alemu, 2016; Tefera & Kassa, 2017; Gizachew, 2017).

Figure 2: Niches of Eucalyptus



Eucalyptus is the most commonly planted tree genera in the highland areas of Ethiopia due to its adaptability, fast growth, and not palatability for livestock. As presented in (*Table 3*), respondents indicate that about 78.95% of them respond that there is an increase in *Eucalyptus* woodlot plantations, followed by there is no change (14.04%), and the remaining think that there is decreasing in *Eucalyptus* woodlot plantations (7.01%) in the study area. This indicated that the majority of households highlighted that there is an increasing trend of *Eucalyptus* woodlot. Thus, the study is in line with Tefera and Kassa (2017) from Lake Tana Watershed, Derbe (2018) from north Gonder, Alemayehu *et al.* (2018) from Sidama, Edesa (2021) from Chelia district Tesfaw *et al.* (2021) from Blue Nile highland confirm the increasing trend of *Eucalyptus* planting in the respective study sites. Likewise, Taddesse *et al.* (2019) stated that the current trends show that smallholder farmers in Ethiopia have engaged in increasing tree planting, especially in fast-growing trees like *Eucalyptus*.

Table 3: Perception of farmers on the trends of Eucalyptus woodlot plantation

Trends of *Eucalyptus* woodlot plantation	Frequency	%
Increasing	1118	78.95
Remain the same	21	14.04
Decreasing	11	7.01

Eucalyptus in the study area has several contributions to the livelihood of the households. The key informants reported that *Eucalyptus* play an important role in reducing destruction from natural forests because farmers have their own *Eucalyptus* plantation; they don't need to go to the forest for construction materials and firewood. Farmers grow *Eucalyptus* for construction (38.7%), followed by fuelwood (35.3%) and income generation (26%), as shown in *Figure 3*. The KIIs and FGDs also pointed out that the variability of *Eucalyptus* growing niches was due to the availability of land, market availability, conservation of degraded lands, and road access.

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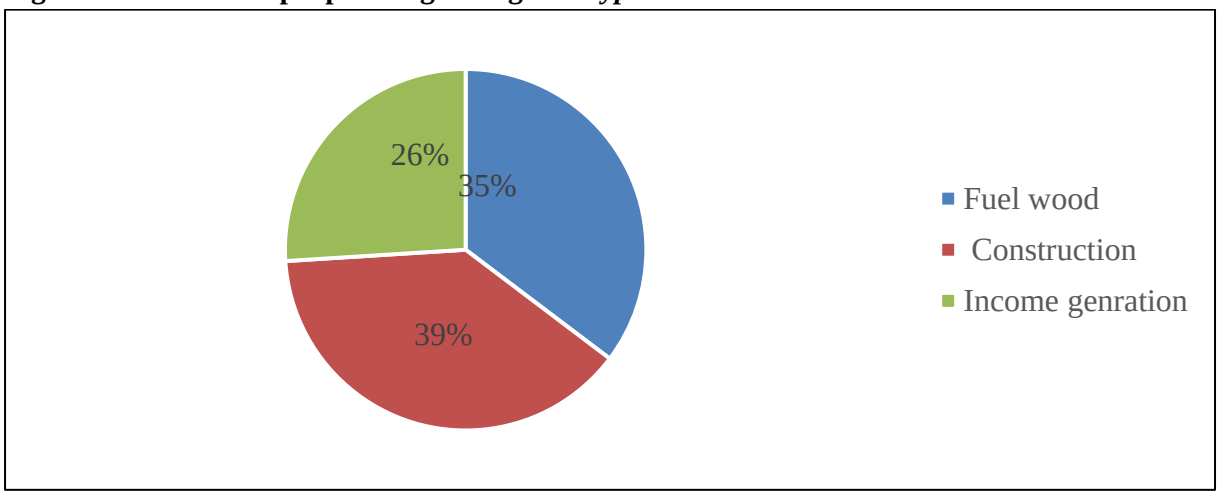
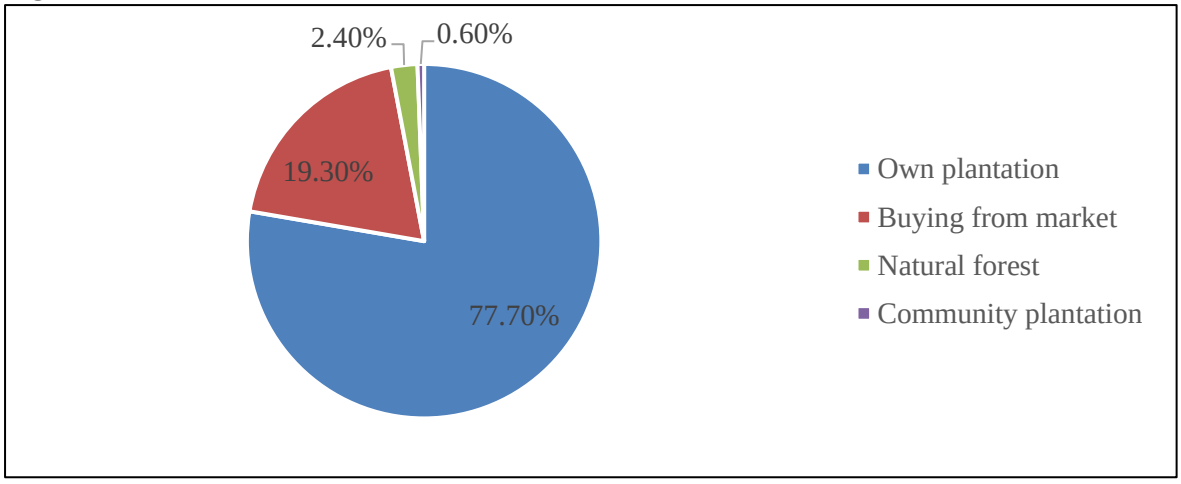
Previous pieces of the literature demonstrated that farmers grow *Eucalyptus* trees to fulfil the shortage of fuel wood, construction materials, and for income generation for livelihood (Birhanu & *Kumsa*., 2018; Alfred *et al.*, 2020; Alemayehu & Melka, 2022).

Figure 3: Households purpose of growing *Eucalyptus* tree



The survey result shows that the source of construction materials of the respondents are mainly wood products of *Eucalyptus* which are from their plantation (77.67%), buying from the market (19.25%), from the natural forest (2.48%), and community plantation (0.62%) (Figure 4). The decision to grow *Eucalyptus* is predominantly endangered by the need to meet household wood demand. Most household fuel and construction wood demands are met from their *Eucalyptus* plantation. *Eucalyptus* wood products are the most preferable construction materials for local communities particularly. The construction of many infrastructures such as health centres, schools, roads, water walls, and community halls, is largely dependent on *Eucalyptus* (Alfred *et al.*, 2020).

Figure 4: Household source of wood for construction



The household survey revealed that *Eucalyptus* has different products and contributes to the total household income. The result showed that *Eucalyptus* is the second income contributor (41.6%) to the total household income next to agriculture (Table 4). The finding of this study on the contribution of *Eucalyptus* to the total household income is higher than that of Alemayehu et al. (2018) who found that 35% in Sidama Zone, Southern Ethiopia, and Derbe (2018) found 29% in Wogera District Northern Ethiopia. However, the finding of this study is

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lower than Edesa (2021), who found that *Eucalyptus* contributes about 87% to the total household income in Chelia District, Oromia region. The result is also in line with Getnet et al. (2022), who indicated that the *Eucalyptus* woodlot contributes significantly to the household's total income. Among *Eucalyptus* products, income from stumpage price is the first (63.1%), followed by income from construction material (19%) and income from fuelwood (17.9%) regarding the contribution of the total income from *Eucalyptus* in the study area.

Table 4: Proportion of different income sources to the total household income

		N	Mean	Std. Dev	Max	Min	Share (%)
Income sources	Agricultural income	150	30186.80	12468.76	65000.00	4800.00	54.2
	Off-farm income	150	2382.52	6081.68	36100.00	.00	4.3
	Eucalyptus income	150	23160.00	6253.75	53000.00	12600.00	41.6
	Total income	150	55729.32	14964.06	109000.00	26860.00	100
Income from Eucalyptus products	Fuelwood income	150	4136.00	1875.14	900.00	18000.00	17.9
	Construction material income	150	4401.33	1265.71	1700.00	10000.00	19.0
	Stumpage price income	150	14622.67	4804.56	9000.00	33100.00	63.1
	Total income	150	23160.00	6253.75	12600.00	53000.00	100

Farmers' Perception of the Effects of *Eucalyptus* Woodlot

Table 5 indicates the perception of farmers (multiple responses) about the effects of *Eucalyptus* woodlot plantation on crops and related components. The result shows that *Eucalyptus* woodlots have effects in terms of shading effect (91.3%), nutrient competition (96.7%), and moisture competition (91.3%). Farmers also perceived that *Eucalyptu*s affected the property of soil by causing infertility (91.3%) and drying of other plant species (94.7%), and most of the farmers assumed that *Eucalyptus* has an effect on water resources regarding drying out of streams (96%). This result is supported by previous findings which reported that more water is consumed by *Eucalyptus* than by any other tree species or crops (Liang et al., 2016; Feyisa *et al*., 2018; Bayle, 2019; Xu et al., 2020;). Thus, the plantation expansion of *Eucalyptus* could affect the future food security of the farmers because of its adverse effect and competition on soil nutrients, affecting food crops.

Table 5: Farmers' perception of the effects of *Eucalyptus* plantation expansion

Perceived effects of *Eucalyptus* plantation	Frequency	The proportion of responses (%)
Shading effect on crop	137	91.3
Nutrient competition of *Eucalyptus* on crop	145	96.7
Moisture competition	137	91.3
Causing soil infertility	137	91.3
Changing soil colour	15	10.0
Drying out of other plant species	142	94.7
Effect on water resource	144	96.0

Determinants of Farmers' Perception Towards *Eucalyptus* Woodlot Plantation

Results from the binary logit model indicated that the age of the farm household heads negatively and significantly influenced the perception of farmers on *Eucalyptus* plantations at less than a 1% significance level. The estimated coefficient and the odds ratio of the variable were -0.2378 and 0.78839, respectively. This means as the age of farmers increases by one year, the tendency of farmers' perception to be negative on *Eucalyptus*

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woodlot plantation would lead to an increase in their negative perception by the odds of 0.78839, keeping other variables constant. This may be because younger farmers are often better disposed to devote themselves to long-term investments like *Eucalyptus* and have lower risk aversion and longer planning horizons to justify investments in *Eucalyptus*-based technologies. It is probable that with increased age, as a factor of experience and observed changes in the *Eucalyptus* woodlot plantation over a longer period of time, older farmers oppose the planting of *Eucalyptus* in their land, unlike the younger farmers. On the other hand, this finding is opposed to other findings; the positive impact of age and farm-accumulated experience in favour of trees on the farm has been reported (Gebreegziabher *et al.*, 2020).

The binary logit model result revealed that educational status was negatively correlated with farmers' perception of *Eucalyptus* woodlot plantation (*Table 6*). The result shows that the educational status of the farmer influences negatively and significantly on *Eucalyptus* plantation at a 1% significance level. The odds ratio shows that keeping other variables constant, being a farmer is educated probability of their positive perception of *Eucalyptus* woodlot plantation decrease by the odds of 0.17183. The plausible reason could be when the farmer is educated; they might be well aware of how to manage any impacts of *Eucalyptus* plantation. Therefore, as compared to illiterate farmers, more educated farmers would likely minimise the potential negative impacts of *Eucalyptus* plantations. Previous studies stated that perception of *Eucalyptus* plantation plays a key and central role in *Eucalyptus* plantation management and development (e.g., Bekele, 2015; Negasa et al., 2016).

Table 6: Binary logistic regression model to predict the perception of farmers to *Eucalyptus* woodlot plantation

Variables	Coef.	Std. Err.	z	Odds Ratio	P>z
Sex	0.7407	0.6769	1.09	2.09738	0.274
Age	-0.2378	0.0896	2.65	0.78839	0.008***
Educational status	-1.7612	0.6669	2.64	0.17183	0.008***
Family size	0.0480	0.1011	0.47	1.04914	0.635
Length of residence in the area	0.2708	0.0928	2.92	1.31095	0.004***
Farmers' experience in *Eucalyptus* production	0.3406	0.0695	4.90	1.40582	0.000***
Landholding size	0.2504	0.4364	0.57	1.28450	0.566
Livestock holding (TLU)	-0.0190	0.0304	0.62	0.98119	0.533
Agricultural income	0.0000	0.0000	0.94	1.00002	0.349
Off-farm	0.0000	0.0000	0.93	0.99996	0.350
Eucalyptus income	0.0001	0.0001	1.14	1.00009	0.256
Credit access	-1.0121	0.6550	1.55	0.36345	0.122
Distance to road access	-0.2555	0.1018	2.51	0.77453	0.012**
Distance to forest	0.0137	0.1095	0.13	1.01381	0.900
Distance to market	-0.2630	0.1012	2.60	1.30082	0.009***
_cons	-10.7616	3.7472	2.87	0.00002	0.004***
Number of observations	150				
LR $chi^2(15)$	86.66				
Prob > chi2	0.0000				
Pseudo R2	0.4476				

Length of residence in the area was positively correlated with farmers' positive perception of *Eucalyptus* plantation (*Table 6*). One of the possible reasons could be that farmers who have a residence in the area will have ample information on the history of their settlement in the area and

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might be more interested in planting and growing *Eucalyptus* woodlot. As a result, they may develop a positive perception towards growing *Eucalyptus* woodlot because they may expect high economic returns derived from *Eucalyptus*, including financial profits obtained from the sale of poles, construction materials, and fuelwood (Bekele, 2015; Liang et al., 2016; Negasa et al., 2016).

Farmers' perceptions could also be influenced by the experience of farmers on *Eucalyptus* production. Experience in the farming of *Eucalyptus* was a significant positive impression on farmers regarding *Eucalyptus* plantation. With the assumption of citrus paribus condition, the odds ratio indicates that a unit change of household experience on farming of *Eucalyptus* increases the probability of positive perception by 11.40582. The result may be interpreted as experience on an *Eucalyptus* woodlot plantation significantly increasing the probability of a farmer considering a positive perception about the species. This implies that with increased experience in *Eucalyptus* woodlot plantation, it was more likely for a person to observe the positive effect of species and have a positive perception of it. The finding of this study opposed the previous findings (Dessie et al., 2019), which found that farmers' experience was significantly and negatively associated with *Eucalyptus* woodlot production.

The market distance was significant for positive correlation with a negative perception of *Eucalyptus* woodlot plantation. The odds ratio indicates that the probability of farmers perceiving the *Eucalyptus* woodlot plantation as not good increases with market distance by the odds of 1.30082, with the assumption of citrus paribus condition. This result may suggest that the favourable condition of market facilities in farmer residences may enable farmers to participate in the plantation of *Eucalyptus*, but the low transportation service and poor market access discourage farmers' engagement in the market of *Eucalyptus* products. As a result of more money and time being spent on the distant market, farmers might perceive the *Eucalyptus* plantation as unlikely/negative. The finding agrees with Dessie et al. (2019), who demonstrated that access to the market to the nearest distance of farmers' residences positively and significantly correlated with *Eucalyptus* woodlot due to easily availability of *Eucalyptus* inputs and outputs to farmers.

Distance of farmers from the nearest accessible road was associated negatively with a household positive perception of *Eucalyptus* plantation at less than a 5 % level of significance. The model result indicated that the farmers who are far away from the nearest road have a negative perception of *Eucalyptus* woodlot. The odds ratio shows that keeping other variables constant, as the distance of households from accessible road increase by one kilometre, the probability of farmers' perception towards the plant *Eucalyptus* decreases by the odds of 0.77453. This is probably due to *Eucalyptus* sellers and buyers mostly choosing roadside plantations to buy for their ease of transportation, which influences the decision of farmers to plant *Eucalyptus* nearest to accessible roads. This is in line with Gizachew (2017), who indicated that a household's proximity to accessible roads makes it easier to obtain seedlings and sell woodlot products without incurring a high transaction cost. People can readily move *Eucalyptus* wood items such as poles, construction materials, and fuelwood to the market area as the distance between their homes and the neighbouring access road lowers. Tadesse & Tafere (2017), Nigussie *et al.* (2017), and Derbe *(*2018) also stated that road distance from the stand is one of the institutional factors found to influence *Eucalyptus* planting decisions.

CONCLUSION

Perceptions of local farmers towards *Eucalyptus* woodlot plantation depend on the level of socioeconomic and biophysical conditions. Furthermore, the perceptions towards *Eucalyptus* plantation were mostly positive, meaning that farmers associated more positive than negative outcomes of *Eucalyptus* woodlot plantation. Degraded land, roadsides, farm boundary, and cropland were the common niches of *Eucalyptus* woodlot plantation. The local farmers perceived

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that *Eucalyptus* plantations have effects in terms of shading, nutrient competition, moisture competition, causing soil infertility, drying of other plant species, and drying out of streams. Evidence from the finding of this research revealed that *Eucalyptus* is the second contributor to households' total income next to agriculture. Further, the finding suggests that stumpage price income is the first income contributor among *Eucalyptus* products.

In the present study, the binary logistic regression model revealed that different socioeconomic and biophysical variables significantly affected farmers' perceptions either positively or negatively of *Eucalyptus* woodlot. The findings of the study revealed that local farmers' perception of the plantation of *Eucalyptus* was positively correlated with the length of residence in the area and farmers' experience in *Eucalyptus* production. But it was negatively correlated with the age of the farmer, educational status, distance to access the road, and distance to the market. The findings recommended that different concerned bodies should work together to address different socioeconomic and biophysical factors affecting farmers' perception towards *Eucalyptus* woodlot. Further research on the prioritisation of tree species mixing with *Eucalyptus* tree plantation should be recommended.

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Authors Contribution

KTA designed and performed the surveys, analysed the data, and wrote, reviewed and edited the manuscript. CX designed the research, and reviewed, edited and revised the manuscript.

Competing Interest

The authors declare that they have no competing interests

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