

## Research Article

# Assessment of agroforestry practices in Buno Bedele and Ilu Abba Bora zones of Oromia region, Ethiopia

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### Abstract

Agroforestry practices are considered as one of the major sources of food and income to meet the needs and the wellbeing of the rural communities. This study was conducted in Buno Bedele and Ilu Abba Bora zones, with the objective to identify and assess agroforestry practices, importance, constraints and farmers' perception on the existing agroforestry practices in study area. Accordingly, 3 districts from each zone and a total of 12 Kebeles (2 Kebeles each from 6 districts) were selected purposely. A total of 299 household were selected for the survey. Semi-structured questionnaire data was generated by conducting household survey, key informant interviews, and direct field observations were applied. Based on the respondent's response across both zones, the results of this study have shown that there were existing agroforestry practices covering Homegardens (96 %), Coffee based agroforestry practice (91.3), Fruit trees based agroforestry practice (86.6%), woodlots (65.6%), windbreak/shelterbelts (62.5%), Trees on rangeland (57.2%), Life fencing (53.8%), Parkland agroforestry (43.1%), Taungya (26.4%) and Alley cropping (16.7%) in the study area. The major Importance of agroforestry practices were income generation, regulation of climate effects, soil improvements, used for shade, food human and livestock feed, proper land use, wood for construction, fuel wood and timber. Impacts on wild animals, insect pest and diseases, competition of trees with crop (i.e. shading effect), shortage of land for tree planting, lack of capital, lack of knowledge, taking long time for profit, lack of seed accessibility and shortage of labor were the major constraints recorded in the study areas. Majority of respondents have strongly agreed with the benefits of the existing agroforestry practices such as increased farm income, improved soil fertility and conserved soil and water, saved time on collecting fodder and fuel wood from the forest and improved the environmental conditions. The respondents in study area have shown positive attitude towards the existing agroforestry practices such as planting of trees like *Albizia gummifera* (78.2 %), *Cordia africana* (67.9%) and *Croton macrostachyus* (63.2%) were the most common trees that dominated the study areas. *Albizia gummifera* (67.2%) and *Cordia africana* (61.9%) also were most preferred trees by farmers in field. Avocado (91.3%), Banana (79.6%) and Mango (61.9%) were the most dominant fruit trees/shrubs, while Maize (95%), Coffee (91.3%), Teff (76.6%), Chat (65.9%) and Sorghum (52.8%) were the most dominant crops. Cows, Oxen, Calves, Chicken were the most dominant livestock categories. The study recommends further studies have to be made on positive trees/shrubs selection, management and introducing new agroforestry practices and manage the exist agroforestry practice in the study areas.

**Keywords:** Onno Biosphere, Diameter Distribution, Parameter estimation

### Article Info

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# 1 Introduction

Agroforestry is a form of sustainable land use systems that integrates trees with crops or animal husbandry to initiate an agro ecological succession (FAO, 2013). Agroforestry provides various ecosystem services through providing diversified household needs including cultural services such as agro-tourism, beautiful fascinations, demonstration, and education. Principally, agroforestry affords amendable services such as soil conservation, watershed management, pest control and sinks for carbon. In so doing, it contributes to the mitigation of global climate change (Jose and Bardhan, 2012).

In Africa, rapid population growth, decline of per capita food production and environmental degradation are the main problems. Consequently, the need for intensification of agricultural production coupled with population growth forces poor farmers to expand their cultivation to hilly and marginal areas. This process aggravates the degradation of natural resources. In relation to this, agroforestry practice can be one of the superior options to reduce pressure on remaining natural forests and sustain biodiversity (Kang, Akinnifesib, 2000; Gustavo, et al., 2004).

In Ethiopia, the integration of trees and shrubs into agriculture emerged many years ago (Edmond et al., 2000). The historical development of farming practices in the country followed by the human settlement in the past impacted the agricultural production in northern part than the other parts of Ethiopia. The current agricultural land coverage in Ethiopia is estimated to be about 46% by supporting 83% livelihoods of the population, 80% of export earnings and 73% of the raw materials in agro-based industries (Brown et al., 2012; Bishaw et al., 2013). Various agroforestry systems are practiced in different parts of the country. One of the oldest indigenous parkland agroforestry systems characterized by retention of scattered tree such as *Faidherbia albida* on crop land of rift valley and highlands of eastern Ethiopia (Abebe, 2005; Asfaw and Ågren, 2007). The deliberate retaining of naturally occurring trees on farmlands is a common land use practice carried out by smallholders for monetary, construction and fuel wood materials, environmental, and cultural uses (Jamala et al., 2013; Iiyama et al., 2017). However, parkland agroforestry practices are declining from agricultural landscapes due to increased demands for fuel wood and degradation of nearby forests (Onyekwelu et al., 2015). Agricultural intensification, the increasing popularity of exotic tree species which generate larger economic benefits for farmers (Teshome, 2009), and the fact that land proclamations do not specify clear instructions for farmers on how to manage and conserve indigenous trees. Several Agroforestry practice can be relevant for different agro-ecological zones, and many systems with a range of different composition can fulfill essentially the same function for livelihoods and landscapes.

In Ilu Abba Bora and Buno Bedele zones, there are many agroforestry practices in farmlands for value of indigenous conservation measures. However, the existing agroforestry practices and systems are not assessed, identifying by research to documented and characterize the existing farmland agroforestry practices and to share best practices of agroforestry existing at study area.

Therefore, study was initiated with the objective to identify and assess the existing Agroforestry practices, analyse constraints, opportunities and farmers' perception of these practices in study area.

## 2 Research Methodology

### 2.1 Description of study areas

The study was conducted in the six districts of Ilu Abba Bora and Buno Bedele zones of the Oromia Regional State, Southwestern Ethiopia. Three districts from each zone, namely, Bacho, Alle and Darinu and Gechi, Chora and Bedele districts, respectively were purposely selected (Figure 1).

Ilu Abba Bora is in the Southwestern part of the regional state of Oromia, Ethiopia. The capital town of the zone is Mattu, which is located at distances 600km, southwestern of Addis Ababa. It lies between 34°52'30"E - 36°53'0"E longitudes and 7°27'30"N - 8°49'30"N latitudes. The zone is surrounded by two Regional States and three zones of Oromia National Region. The zones and regions bordering the Zone are in the West by Gambela Region, in East and Southeast by SNNPS, in the North and West Wollega, in the North-East by East Buno Bedele zone and in the South by SNNPS. The areal coverage of the Ilubabor zone is estimated to be 10,920 KM<sup>2</sup> or (1,092,000 hectares). The zones consist of highland (17%), midland (62%) and lowland (21%) agro-ecologies; and temperature ranges from 16c° to 26c° (Zone Physical and Socio-Economic Profile, 2021-2022). The farming systems of the zones are characterized by mixed farming system comprising both cropping and livestock production.

Buno Bedele Zone is one of the Zones of Oromia National Regional State in Ethiopia and bordered in the south by Southern Nations, Nationalities, and Peoples Region, in the west by the Ilu Aba Bora Zone, in the north by the East Wollega Zone and West Wollega Zone and in the east by the Jimma Zone. The capital town of the zone is Bedele, which is located at the distance 480km, southwestern of Addis Ababa, the capital city of the country.

### 2.2 Sample size and sampling technique

Firstly, meetings were made with two Agricultural offices of the zones (Buno Bedele and Ilu Abba Bora) in order to identify the most potential districts where agroforestry practices are carried out. Then three districts were selected purposely from each zone. Totally six districts, three from Buno Bedele zone (Bedele, Gechi and Chora districts) and three from Ilu Abba Bora zone (Bacho, Alle and Darimu districts) were selected. Two kebeles also were selected purposely from each district. A total of 12 kebeles six from Buno Bedele zone (Obolo Bechara and Sidisa Kebeles from Bedele district, Gito and Chara kebeles from Gechi district and Hawa Yember

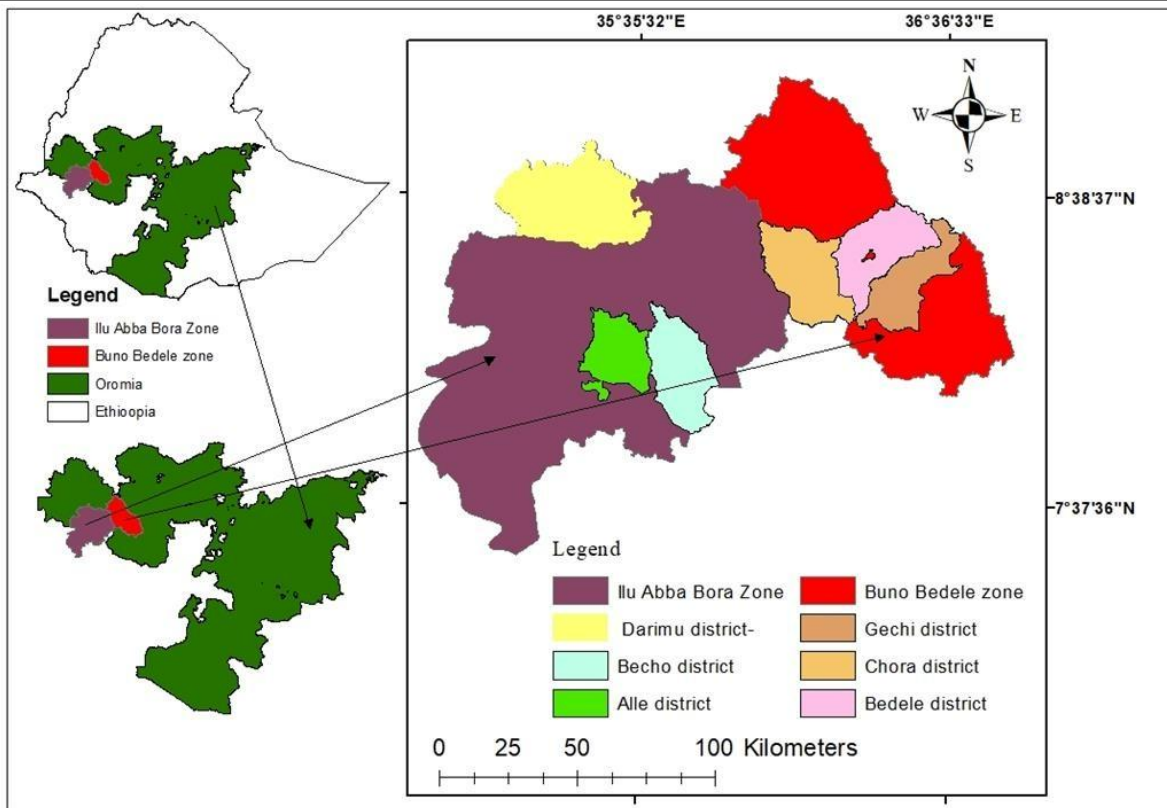


Figure 1: Map of study area

and Hawa Geba kebeles from Chora district) and six from Ilu Abba Bora zone (Kundi and Chatu Kebeles from Alle district, Fogo Sardo and Bake kebeles from Bacho district and Boto and Gobora kebeles from Darimu district) were selected.

Accordingly, 150 household were selected purposively from Buno Bedele zone (50 households from each district and from each Kebele 25 households were selected) and 151 household were selected from Ilu Abba Bora zone. 53 households from Alle district 25 household from Kundi kebele and 28 households from Chatu, 46 Households from Bacho district 25 Household from Fogo Sardo and 21 Household from Bake kebele and 52 Household from Darimu district 25 Household from Boto kebele and 27 household from Gobora kebele were selected. Totally 301 household were participated.

## 2.3 Methods of data collection and analysis

The data were collected in each zone at kebele level through questions using questionnaire, key informant interviews and direct field observations. The key informant interviews were conducted in the study areas with purposively selected community representatives such as elderly individuals who had ample knowledge about agroforestry practices in the study areas and Development Agents, natural resource experts to check the data collected from normal resources survey were correct and relevant. Accordingly, seven key formants have participated from each kebele. Direct field observations were carried out to identify component arrangements of agro-

forestry practices in the study areas.

The types of agroforestry practices existed in the study areas were identified based on farmer's indigenous knowledge through normal survey. The data collected from samples household responses were analyzed by using statistical package for social science (SPSS version 20). Descriptive analysis was employed using tools such as percentage and frequency distribution.

## 3 Results and Discussion

### 3.1 Characteristics of respondents

The general characteristics related with agroforestry practices as identified by household respondents are presented by sex, age, marital status, family size education status and experience of farming system stated (Table 1).

The majority of the respondents about 91.6% out of 301 households were male whereas 8.4% were female. This implies that majority of the household head in agroforestry practices in zones were male and low number of females were observed in the study sites.

The majority of the household heads were between 31-40 years age group (31.4%), followed by age group 20-30 years age group (23.7%) and 42-52, 53-63 and above 63 years which in percent



21.1%, 15.4% and 8.4%, respectively. From the above results, it can be deduced that the households surveyed on agroforestry practices were dominated by medium age group. The smallest portion of age group was above 63 years old.

The marital status of the household head showed that the married respondents share the majority percentage (96%), followed by a single and divorced constitute 2% and 2%, respectively.

About 55.9% household respondents had family members between 5-8 while 30.1 % respondents had range of 1-4 family members and remaining respondents (14%) had above 8 family members per household, respectively.

Concerning to education status, about 77 of % respondents were literate while 23.1% of the respondents were illiterate. From educated respondents 56.6% of respondents educated levels were above grade four. The majority of the respondents (57.9%) had above 24 years of experience in farming system (Table 1).

### 3.2 Agroforestry practices in study area

Based on the results of the study, 10 agroforestry practices were identified and documented in study areas. Smallholder agroforestry practices vary depending on the socioeconomic and biophysical conditions (Jamala et al., 2013; Abraham et al., 2016; Iiyama et al., 2017). The results of the study revealed that among the identified agroforestry practices, home garden is the most dominant (96%) of agroforestry practice followed by coffee based agroforestry practice (91.3%), fruit trees based agroforestry practice (86.6%), woodlots (65.6%), windbreak/shelterbelts (62.5%), trees on rangelands (57.2%), life fencing (53.8%), parkland agroforestry (43.1%), taungya (26.4%), and alley cropping (16.7%), respectively (Table 2). The identified agroforestry practice in both zones (Buno Bedele and Ilu Abba Bora) were almost of similar status.

The respondents have reasoned out why the home garden agroforestry practice was widely practiced in study area is because of its simplicity for management, especially for protecting home garden from attack of wild animals and it consists of multipurpose trees, fruit trees and livestock in and around of households and get diversified outputs from this practice.

The second dominant agroforestry practice was coffee responded by 91.3 % because the area is suitable for coffee production and the households obtain most income from this practice.

From existing agroforestry practices in the study areas, alley cropping was the least practiced component responded by 16.7% of respondents in both zones. In contrast, the study made by Musa et al., 2022, in East Hararge parkland agroforestry has been mentioned 58% of the respondents, followed by alley cropping as hedge row intercropping 33%, home garden 22%, multipurpose trees on farmland 19%, live fence/boundary tree planting 18%, and wind breaks 4% were identified. In this report, alley cropping was the second dominant agroforestry practice. Similarly, the findings of the study made in Arba Minch Zuriya district of Gamo Gofa Zone indicated

that homegardens, intercropping and livestock production were the major agroforestry practices of the area, respectively, the dominant being the homegardens practice (Alemu, 2016).

The homegarden is one of dominantly identified agroforestry practices in the study areas. Homegardens are practiced around home and composed of a high diversity of plants and an important source of diversified products used by the households. Products like avocado, banana, mango, orange, guava, apple and enset, maize, khat, coffee, cardamom, were cultivated in study areas. *Albizia gumifera*, *Cordia africana*, *Vernonia amygdalina* and *Ricinus communis* were the most available species in homegardens of study areas.

Coffee based agroforestry practice was the second major agroforestry practice identified at study areas. The farmers of study areas cultivate coffee under diverse shade trees like *Albizia gumifera*, *Acacia* spp, *Cordia africana*, *Croton macrostachyus* and *Sesbania sesban* in study areas.

Fruit trees-based agroforestry practice is widely used by farmers at study areas, and it has a role in providing multiple benefits to the households in the study areas. Fruit trees contribute towards income generation, food security and also used as a shade for coffee-based agroforestry practices. Avocado, Banana, Mango, Orange, Guava and Custard apple were the most dominant fruit trees dispersed through crop land, pasture and near home in study areas.

Woodlots are planted by farmers in study areas on a small-scale as one land use practices, for income generation, fuelwood and construction material production. *Eucalyptus* spp, *Grevillea robusta* and *Pinus patula* trees species were the most preferred tree species for woodlot agroforestry practice in study areas.

Windbreaks/Shelterbelts are lines of trees or shrubs which are used for the purpose of reduction of wind speed in the study areas. The tree species used for the windbreak in the study areas included *Eucalyptus* spp, *Grevillea robusta*, *Juniperus procera* and fruits like Avocado and Mango.

Trees on range land are scattered trees in rangelands and beneficial in providing shade for livestock. *Grevillea robusta* and *Pinus patula* trees species were planted dispersed on range land of study areas.

Life fencing is widespread agroforestry practice trees/shrubs area established to border plots of home gardens and farmlands. It is used for protection of wild animals and cattle from crops. *Erythrina brucei* and *Capparis tomentosa* tree species are used as a live fence in study areas. *Erythrina brucei* is used for firewood, medicine, fodder, bee forage, mulch, nitrogen fixation, soil conservation and life fence, also *Capparis tomentosa* is also used for firewood, medicine, life fence and fencing material (Azene B.T, 2007).

Parkland agroforestry practice involves the growing of individual trees and shrubs scattered in the farmland, while field crops are grown under shade of the trees. Some of the naturally grown tree species include *Cordia africana*, *Acacia* spp, *Ficus vasta* and *Croton macrostachyus* *Syzygium guineense* *Albizia gumifera* and *Primus africana* and are mostly dispersed in the crop fields of maize and teff in the study areas.

Table 1: Characteristics of the sample household at study area

Category	Variables	Buno Bedele Zone N (%)	Ilu Abba Bora Zone N (%)	Overall N (%)
Sex	Male	141(94)	133(89.3)	274(91.6)
	Female	9(6)	16(10.7)	25(8.4)
Age class	20-30	35(23.3)	36(24.2)	71(23.7)
	31-40	46(30.7)	48(32.2)	94(31.4)
	42-52	36(24)	27(18.1)	63(21.1)
	53-63	25(16.7)	21(14.1)	46(15.4)
	≥63	8(5.3)	17(11.4)	25(8.4)
Marital status	Single	4(2.7)	2(1.3)	6(2)
	Married	144(96)	143(96)	287(96)
	Divorced	2(1.3)	4(2.7)	6(2)
Family size	1-4	48(32)	42(28.2)	90(30.1)
	5-8	83(55.3)	84(56.4)	167(55.9)
	≥8	19(12.7)	23(15.4)	42(14)
Educational	Illiterate	36(24)	33(22.1)	69(23.1)
	Grade 1-4	34(22.7)	27(18.1)	61(20.4)
	Grade 5-8	51(34)	61(40.9)	112(37.5)
	Grade 9-12	28(18.7)	26(17.4)	54(18.1)
	Diploma	10(7)	2(1.3)	3(1)
Experience of farming	1-5 years	3(2)	7(4.7)	10(3.3)
	6-14 years	22(14.7)	29(19.5)	51(17.1)
	15-24 years	39(26)	26(17.4)	65(21.7)
	≥24 years	86(57.3)	87(58.4)	173(57.9)

Taungya practice is trees planting; growing agricultural crops for 1-3 years until the shade of trees become denser or increase canopy cover. The farmers exercised this practice by using Cardamom crop under *Grevillea robusta* and *pinus patula* plantation and it's used to generate income. The majority of trees used in taungya practice tree are planted using spacing of 1m\*1m between trees.

Alley cropping is one of an important agroforestry practice in which legume trees species are planted in row and crops planted between of hedgerow trees. High organic biomass is produced from the pruning of hedgerows and accumulates soil organic matter and nutrients. From identified agroforestry practices in the study areas, this practice was the least used in both zones. Banana, mango and avocado are used around homestead as alley cropping plants with maize crop in the study areas.

Major common trees at study area *Albizia gummifera*, *Cordia africana*, *Croton macrostachyus*, *Eucalyptus spp*, *Grevillea robusta*, *Acacia spp*, *Sapium ellipticum* and *Varnonia amygdalina*, *Juniperus procera*, *Ficus vasta*, *Syzygium guineense*, *Podocarpus facaltus* and *Prunus africana* were the common trees found in the study areas (Table 3). According to the reply of respondents, *Cordia africana* is the best trees for timber production in the study areas.

### 3.3 Tree species most preferred in field by Farmers

*Albizia gummifera*, *Cordia africana*, *Grevillea robusta*, *Acacia spp*, *Eucalyptus spp*, *Croton macrostachyus*, and *Varnonia amygdalina* were most preferred trees by farmers in study areas (Figure 2). *Eucalyptus* tree species was planted on uncultivated land as woodland

used to obtain cash income for the household economy. This result is line with (Endale, 2017) who found that *Eucalyptus camaldulensis* and *Cupressus lustianica* tree species were the most preferred for woodlot purpose around Jimma town.

### 3.4 Major fruit trees/shrubs, crops and livestock at study area

The farmers in the study area use different agroforestry practices such as production of fruit trees, crops and livestock. The results of the study indicated that among the fruit trees, avocado (91.3%), banana (79.6%) and mango (61.9%) were the most dominant, while maize (95%), coffee (91.3%), teff (76.6%), khat (65.9%) and sorghum (52.8%) were the commonly used crops. Cows, oxen, calves, chicken, sheep, goat, donkey, and horse were the most dominant livestock found in the study areas (Table 4). Coffee and khat were the major cash crops in the study areas. FAO (2013) mentioned that agroforestry is a form of sustainable land use systems that integrates trees with crops or animal husbandry to initiate an agro ecological succession.

### 3.5 Farmer's perceptions on agroforestry practices

The results of the investigation showed that farmers in study areas widely participated in agroforestry practices on their farmlands and around homesteads. The majorities of respondents have benefited from the existing agroforestry practices in various forms such as increased farm income, improved soil fertility and conserved soil and

Table 2: Types of existing agroforestry practice in study area

Agroforestry practice	Buno Bedele zone n=150			Ilu Abba Bora zone n=151			Overall n=301
	Bedele district n=50	Gechi district n=50	Chora district n=50	Alle district n=53	Bacho district n=46	Darimu district n=52	
	Obolo Bechara kebele n=25	Sidisa kebele n=25	Gito Kebele n=25	Chara Kebele n=25	Hawa Yember kebele n=28	Kundi Gaba kebele n=21	
Homegardens	100	100	100	96	96	96	96
Coffee based	84	100	84	60	100	96	91.3
Fruit trees based	84	76	72	76	64	88	86.6
Woodlot	60	68	80	52	64	72	65.6
Windbreak/Shelterbelts	96	72	72	84	64	72	62.5
Trees on Rang land	64	68	44	72	48	68	57.2
Life Fencing	52	36	52	24	40	24	53.8
Parkland agroforestry	44	44	52	40	28	32	43.1
Taungya	12	20	20	44	28	44	26.4
Alley cropping	8	8	4	36	12	12	16.7

Table 3: Major common trees at the study area

Tree species	Local name	Uses of trees for:	Buno Bedele N (%)	Ilu Abba Bora N (%)	Total N (%)
<i>Croton macrostachyus</i>	Bakkannisa	Soil fertility/shade/construction/medicinal	64.7	71.1	67.9
<i>Eucalyptus spp</i>	Bargamoo	construction/income	54.7	71.8	63.2
<i>Ficus vasta</i>	Qiltuu	Soil fertility/shade	6	22.1	14
<i>Grevillea robusta</i>	Giravilaa	Soil fertility/shade/construction/timber	44.7	39.6	42.1
<i>Juniperus procera</i>	Gaattiraa	Timber	16.7	12.1	14.4
<i>Podocarpus facaltus</i>	Birbinsa	Soil fertility/shade/construction/timber	14	0.7	7.4
<i>Prunus africana</i>	Hoomii	Soil fertility/shade/medicinal/timber	8.7	6	7.4
<i>Sapium ellipticum</i>	Bosoga	Soil fertility/shade/construction/timber	3.3	26.2	14.7
<i>Syzygium guineense</i>	Baddeessa	Soil fertility/shade/construction/timber	12.7	4.7	8.7
<i>Varmonia amygdalina</i>	Eebicha	Soil fertility/shade/medicinal	12.7	16.8	14.7
<i>Acacia spp</i>	Laaftoo/Sondi	Soil fertility/shade/construction	41.3	24.2	32.8
<i>Albizia gummifera</i>	Ambabbeessa	Soil fertility/shade/construction/medicinal	70.7	85.9	78.2

water, saved time on collecting fodder and fuel wood from the forest and improved the natural condition (Table 5). Based on respondent's reply most households had good perceptions and faithfulness for agroforestry practices in the study areas. The results of this study are similar to the finding of Alemayehu et al. (2021), the farmers had positive perception on agroforestry practices, and they knew very well its utilities for income diversification, improvement of soil quality, fuel, construction materials, food, and feed, provision of shade, accessibility and ecological values that could be understood from the given inquiry parameters.

### 3.6 Major constraints and importance to agroforestry practices at study area

The finding revealed that, among the identified importance of agroforestry at study area increasing income of household, regulate climate of the area, shading importance, add soil fertility, purpose for food and fodder, properly using the land, for construction, fuel wood and timber were the major opportunities of agroforestry respectively (Table 6). In similarly agroforestry practices are considered as one

of the major source of food and income to meet the needs and the wellbeing of the rural community (Galhena et al., 2013).

On other side, impacts of wild animals, Insect pest and disease, competition trees with crop (i.e. shading effect), shortage of land for tree planting, lack of capital, lack of knowledge, taking long time for profit and lack of seed accessibility and shortage of labor are the main constraints in agroforestry practices respectively at study area (Table 7).

### 3.7 Trends of each value over last ten years

The results of the study showed that fruit trees planting, and agroforestry practices have increased in study areas over last ten years. The reasons of increasing of these practices in the study areas were awareness creation on management and management of the natural resources. Generally, honey, crop production and animal husbandry have been through time (Figure 3). The crop production was decrease because shortage of agricultural land, lack of oxen for ploughing the farmlands and increasing agricultural input costs.

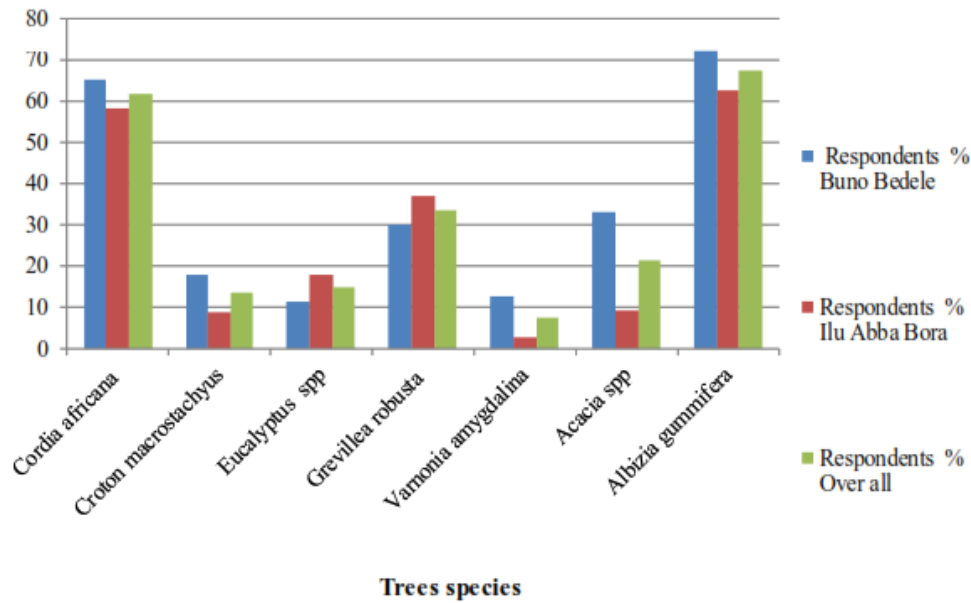


Figure 2: Tree species most preferred in field by Farmers

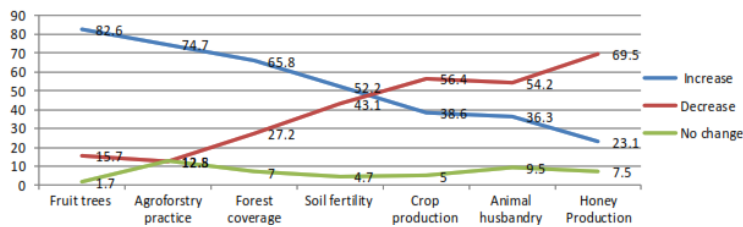


Figure 3: Response of respondents in percentage on trends of each value over ten years

Therefore, the farmers practically participated in planting coffee, fruit and Eucalyptus trees instead of crop production.

## 4 Conclusion

The study of the existing agroforestry practices revealed that home garden, coffee-based agroforestry, fruit trees based agroforestry, woodlot, windbreak/shelterbelts, trees on rangelands, life fencing, parkland agroforestry, taungya, and alley cropping were the most common types of agroforestry practices identified in the study areas. These practices had components of common trees like *Albizia gummifera*, *Cordia africana*, *Croton macrostachyus*, *Eucalyptus spp*, *Grevillea robusta*, *Acacia spp*, *Sapium ellipticum* and *Vernonia amygdalina*, *Juniperus procera*, *Ficus vasta*, *Syzygium guineense*, *Podocarpus facaltus* and *Prunus africana*. The major fruit trees species in the study areas were avocado, banana and mango mixed major crops like maize, coffee, teff, khat and sorghum. The agroforestry practices in study areas have played important role in increasing income of households, regulate climate of the areas, shading effect, increase soil fertility, proper use of available land, produce food and fodder, construction materials, fuel wood and timber. Major constraints of the existing agroforestry practices men-

tioned by the respondents included problems associated to negative impacts on wild animals, occurrence of insect pest and disease, competition trees with crop (i.e. shading effect), shortage of land for tree planting, lack of capital, lack of knowledge and improved seed accessibility. Generally, the study results indicated that home garden are the dominant and alley cropping the least agroforestry practice used. Impacts of wild animal were also found to be the one of the constraints of the existing agroforestry practices in study areas.

Further studies for the improvement of agroforestry practices in the study areas should be done on positive interaction trees/shrubs and management of different components of the existing agroforestry practices to improve the livelihoods of farmer to reduce the existing constraints.

## Acknowledgements

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Table 4: Major fruit trees/shrubs, crops and livestock at study area

Category	Buno Bedele N (%)	Ilu Abba Bora N (%)	Overall N (%)
<b>Fruit trees/shrubs</b>			
Mango	57.3	66	61.9
Banana	67.3	92	79.6
Orange	18	34	26.1
Lemon	8	15.3	11.7
Avocado	90.7	92	91.3
Papaya	20	16.7	18.4
Apple	13.3	9.3	11
Pineapple	5.3	10	7.4
Guava	21.3	17.3	19.1
Custard Apple	20.7	16	18.1
Citron	3.3	4.7	4
Cashmere	10	6	8
<b>Crops</b>			
Maize	90.7	99.3	95
Haricot bean	4.7	30.1	17.4
Teff	82	71.1	76.6
Fingermillet	19.3	22.8	21.1
Sorghum	31.3	74.8	52.8
Coffee	87.3	95.3	91.3
Chat	77.3	54.4	65.9
Hot pepper	2	14.1	8
Barely	24	6.7	15.4
Wheat	20.7	15.4	18.1
Fabien	9.3	10.7	10
Field pea	4.7	4	4.3
<b>Livestock</b>			
Oxen	83.3	79.9	81.6
Cow	86.7	83.2	84.9
Chicken	64.7	89.9	70.2
Sheep	38	51	44.5
Goat	34.7	12.8	23.7
Calve	75.3	65.8	70.6
Donkey	17.3	12.8	15.1
Horse	6.7	20.8	13.7

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## Competing Interest

No competing of interests associated with this publication.

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Table 5: Farmer’s perception about agroforestry practice at study area

Statements	1	2	3	4	5
Increased farm income	59.9	37.1	2.3	0.7	0
Increased soil fertility & conserved soil & water	69.2	30.8	0	0	0
Reduced chances of complete crop failure	43.1	48.2	7.4	1.3	0
Saved time on collecting fodder and fuel wood from the forest	64.2	33.1	2.3	0.3	0
Took a long time to get income	45.5	45.8	7.1	1.7	0
Sustain/improve the natural condition	65.6	33.1	0.7	0.7	0
Preferred trees in farmland increase crop productivity	49.8	45.2	5	0	0
Trees in farmland used as windbreak, &increase soil fertility & crop production.	64.4	34.6	1	0	0

Table 6: Major importance to agroforestry practice at study area

Importance	Buno Bedele N (%)	Ilu Abba Bora N (%)
Properly using the land	29.5	24.5
Add income	51.4	55.2
Shading importance	37.7	28.7
Regulated climates	48.6	52.4
Timber	9.6	14.7
Construction	28.1	16.8
Fuel wood	15.8	18.2
Add soil fertility	52.1	23.8
Food and livestock feed	24.7	37.1
Save time	3.4	nil

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Table 7: Major constraints to agroforestry practice at study area

Constraints	Buno Bedele N (%)	Ilu Abba Bora N (%)
Shortage of land for tree planting	4.4	9.9
Take long time for profit	9.7	nil
Lack of capital	6.2	4.4
Insect pest and disease	25.7	19.8
Impacts of arboreal animals	45.1	54.9
Lack of seed accessibility	9.7	Nil
Lack of knowledge	8.8	1.1
Shortage of labor	1.8	7.7
Competition trees with crop (i.e. shading effect)	19.5	11.0

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