

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

Mosisa Mezgebu (✉ [mosisamez17@gmail.com](mailto:mosisamez17@gmail.com))

Oromia Agricultural Research Institute Bedele Agricultural Research Center

---

## Research Article

**Keywords:** Agroforestry practice, Taungya, alley cropping

**Posted Date:** May 3rd, 2023

**DOI:** <https://doi.org/10.21203/rs.3.rs-2841634/v1>

**License:** © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

---

# Abstract

*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. This study was conducted in Buno Bedele and Ilu Abba Bora zone, with the aim to identify and assess agroforestry practice, constraints and Importance and farmers' perception on the existing agroforestry practice in study area. Accordingly 3 districts from each zone and 12 Kebele in 6 districts were selected by purposely sampling methods and similarly 299 household were selected. Semi-structured questionnaire data was generated by conducting household survey interview, key informant, and direct field observation were applied. Based on the respondent's idea across the both zones, the results of this study have shown that ,Homesteads (96%), Coffee based agroforestry practice (91.3) ,Fruit trees based agroforestry practice (86.6%), woodlot (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%) are the exist agroforestry practices in the study area. The major Importance of agroforestry practices were for income, regulated climates, soil improvement, used for shade, food and livestock feed, properly using the land, construction, fuel wood and timber. On the other hand, 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, lack of seed accessibility and Shortage of labor the major constraints recorded in the study areas. Majority of respondents were strongly agreed with the agroforestry practices; increase farm income, improve soil fertility and conserved soil and water, saved time on collecting fodder and fuel wood from the forest and improve the natural condition. Those show that the respondents in study area have positive attitude with existing agroforestry practices. Albizia gummifera (78.2%), Cordia africana (67.9%) and Croton macrostachyus (63.2%) were the most common trees that dominated in the study area. 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 and Cow, Oxen, Calve, Chicken were the most dominant livestock. The study recommends further studies have to be done on positive interaction trees/shrubs selection in component, management and introducing new agroforestry practices and manage the exist agroforestry practice at study area.*

## 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).Worldwide believes that agroforestry gives various ecosystem services through providing diversification of household needs in addition to cultural services such as agro-tourism, aesthetic values, demonstration and education. Principally, agroforestry affords amendable services such as soil conservation, watershed management, pest control and sinks for carbon. In so doing that, it gives contributing to the mitigation of global climate change (Jose and Bardhan, 2012).

In developing countries especially Africa, rapid population growth, decline in 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 aggravates the degradation of natural resource and unsustainability. In relation to this,

agroforestry practice can be the only option to condense pressure on leftover natural forests as of deforestation 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 in the country followed the human settlement times past and thus is much older in northern Ethiopia than the other parts. The Current agricultural land coverage in Ethiopia is estimated 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 agroforestry systems is the retention of scattered trees (*Faidherbia albida*) on farmlands 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 these smallholders for monetary, material, environmental, and cultural uses (Jamala et al., 2013; Iiyama et al., 2017). However, the practice of farmland agroforestry is declining in many agricultural landscapes in Ethiopia due to increase in fuel wood demand 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.

Generally, integration of trees in to the farms have to be adapted as biological soil and water conservation for livelihood diversification to meet multiple demands of farmer through agro-forestry practice thereby to mitigate global climate change (Pandey, 2002).

In Ilu abba bora and Buno bedele zones, many agroforestry practices in farmlands for value of indigenous conservation measures. However the existing farmers' agroforestry practices and systems are not assessed, identifying by research to documented and characterize the existing farm land agroforestry practice and also to share best practice agroforestry existing at study area.

So the study was initiated with the aim to identify and assess Agroforestry practice, constraints and opportunities and farmers' perception on the existing agro-forestry practice in study area.

## Research Methodology

### Description of study areas

The study was conducted in Bacho, Alle and Darimu districts of Ilu Abba Bora zone and Gechi, Chora and Bedele districts of Buno Bedele zone of the Oromia Regional state, South Western Ethiopia. Buno Bedele and Ilu Abba bora Zones are located between the distances 474-600km, south western of Addis Ababa, the capital city of the country. Both zones located at latitude and longitude lies between 8° 27' – 8° 45'N and 36° 21' – 36° 35' E, respectively. The zones contain highland (10%), midland (67%) and lowland (23%) agro-ecologies; and located at altitude ranges 500- 2575m a.s.l. The annual precipitation ranges from 1500-2200mm with 6 to 9 months of rain fall (MOA, 2010). The farming system of the zones are characterized by mixed farming system comprising both cropping and livestock production (Fig. 1).

# Sample size and sampling technique

Firstly the discussion was made with two zones (Buno Bedele and Ilu Abba Bora) in order to isolate the most potential districts by agroforestry practice for studies. Then three districts were selected from each zone and by same procedure. The discussion was made with all selected districts and identified the potential kebele by agroforestry practice.

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 purposively based on representative of agroforestry practice. Two kebeles also were selected purposively from each district. Accordingly 150 household from Buno Bedele zone, 149 from Ilu Abba Bora zone and totally 299 household were participated.

## Methods of data collection and analysis

The data was collected in each zone at kebele level through interview using questionnaires, key informant and direct field observation. The types of agroforestry practices exist were identified based on linked with farmer's indigenous knowledge on component, arrangement of agroforestry practice and direct field observation. The data collected from samples household responses were analyzed by using statistic, package for social science (SPSS version 20). Descriptive analysis employed the tools such, percentage, and frequency distribution.

## Results and Discussion

### Characteristics of respondents

The general characteristics related with agroforestry practice of household respondents distributed by Sex, Age, Marital status, Family size education status and experience of farming system were stated (Table 1).

A total of 299 households including, the majority respondents about 91.6% were male whereas 8.4% were Female. This implies that majority of household head in agroforestry practice in zones were male and low number of females observed at studies.

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 result conclude that, the household interviewed about agroforestry practice were dominated by working group and the farmers in study area were comparatively medium age group. The smallest portion of age group was above 63 years old.

The marital status of the household head shows 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 range between 5–8 members of families while, 30.1% respondents had range between 1–4 members of families and remain respondents (14%) had above 8 family members.

Concerning to education status, the higher (76.9%) respondents are educated while, 23.1% of respondents were uneducated. From educated respondents 56.6% of respondents educated levels were above grade four

(4). The majority of the respondents (57.9%) had above 24 years' experience farming system (Table 1).

Table 1  
Characteristics of the sample household at study area

| Category                               | Variables   | Buno Bedele Zone<br>N (%) | Ilu Abba Bora Zone<br>N (%) | Overall<br>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)           |
| Education                              | 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     | 1(0.7)                    | 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)        |
| Source: Households survey; April, 2021 |             |                           |                             |                  |

## Agroforestry practice in study area

Based on the results of study ten (10) agroforestry practices were identified, and documented for study area. Like ways, in Ethiopia, smallholder farmers practice various agroforestry practices depending on the

socioeconomic and biophysical conditions were explained (Jamala et al., 2013; Abrham et al., 2016; liyama et al., 2017). The result showed that, among the identified agroforestry practice homegardens, is the most dominated (96%) agroforestry practice followed, by Coffee based agroforestry practice (91.3%), fruit trees based agroforestry practice (86.6%), Woodlot (65.6%), windbreak/Shelterbelts (62.5%), trees on rangelands (57.2%), life fencing(53.8%), parkland agroforestry(43.1%), taungya(26.4%), and alley (16.7%) cropping respectively (Table 2). The identified agroforestry practice in both zones (Buno Bedele and Ilu Abba Bora) almost in similar status.

As the respondent's reason out why the homegardens agroforestry practice widely practiced in study area is because of this practice simplicity for management, especially for keeping from wild animals and it consists of multipurpose trees, fruit trees and livestock in around home of households and get diversity outputs from it.

The second major respondents (91.3%) were participated in Coffee based agroforestry practice because the area is suitable for coffee production and households get most income from it.

From exist agroforestry practice at study area Alley cropping is the least percentage (16.7%) at both zone. In contrast in East Hararghe parkland agroforestry (58%), followed by alley cropping as hedge row intercropping (33%), homegardens (22%), multipurpose trees on farmland (19%), live fence/boundary tree planting (18%), and wind breaks (4%) were identified (Musa et al., 2022). In this report alley cropping the second dominant agroforestry practice. In similarly based on the findings of the study in Arba Minch Zuriya district of Gamo Gofa Zone, homegardens, intercropping and livestock production were identified to be the major agroforestry practices of the area, the dominant being the homegardens practice (Alemu, 2016). In these finding similar with study area home garden agroforestry practice the dominated one.

Table 2  
Types of existing agroforestry practice in study area

| Agroforestry practice                   | Respondents % |               |         |
|-----------------------------------------|---------------|---------------|---------|
|                                         | Buno Bedele   | Ilu Abba Bora | Overall |
| Homegardens                             | 98            | 94            | 96      |
| Coffee based agroforestry practice      | 87.3          | 95.3          | 91.3    |
| Fruit trees based agroforestry Practice | 76.7          | 96.6          | 86.6    |
| Woodlot                                 | 66            | 65.1          | 65.6    |
| Windbreak/Shelterbelts                  | 76.7          | 48.3          | 62.5    |
| Trees on Rang land                      | 60.7          | 53.7          | 57.2    |
| Life Fencing                            | 38            | 69.8          | 53.8    |
| Parkland agroforestry practice          | 40            | 46.3          | 43.1    |
| Taungya                                 | 28            | 24.8          | 26.4    |
| Alley cropping                          | 13.3          | 20.1          | 16.7    |
| Source: Households survey; April, 2021  |               |               |         |

## Homegardens

is one of dominant identified agroforestry practice in the study area. Homegardens are categorized by being practiced around home and composed of a high diversity of plants and an important source of diversified products used for household. Fruit (Avocado, Banana, Mango, Orange, Guava custard Apple and enset), Maize, Chat, Coffee Cardamom, livestock were cultivated in study area of homegardens practice. *Albizia gummifera*, *Cordia africana*, *Vernonia amygdalina* and *Ricinus communis* were the most exist trees species in homegardens at study areas.

## Coffee based agroforestry practice

It was second major agroforestry practice identified at study areas. The farmers of study areas were cultivated coffee under diverse shade trees. *Albizia gummifera*, *Acacia spp*, *Cordia africana*, *Croton macrostachyus* and *Sesbania sesban* were the most trees used for coffee shade in study area.

## Fruit trees based agroforestry Practice

This practice widely existing at farmers of at study areas and it has a role in household family by given multiple benefits. As respondents reply fruit trees had contribution for theirs live by provide income generation, reduce food security and also used for shade service. Avocado, Banana, Mango, Orange, Guava and Custard apple were the most dominate fruit trees dispersed through crop land, pasture and near home at study area.

## Woodlot

It was practiced by farmers at study area by planting tree on a small-scale as land use practices, for their income and construction service. *Eucalyptus spp*, *Grevillea robusta* and *Pinus patula* trees species were the most preferred for woodlot agroforestry practice at study area.

### **Windbreak/Shelterbelts**

its lines of trees or shrubs whose main aim is the reduction of wind speed and also this practice existing at study area. *Eucalyptus spp*, *Grevillea robusta*, *Juniperus procera* and *fruits* like Avocado and Mango species were planted in line and used as wind break at study area.

### **Trees on rang land**

is scattered trees in rangeland and beneficial in providing shade for livestock. At study area the trees/shrubs dispersed on grazing land mostly found in nature. *Grevillea robusta* and *Pinus patula* trees species were planted dispersed on range land at study area.

### **Life fencing**

is widespread agroforestry in practice trees/shrubs area established to determine of plot of land such as homegardens and farmland. It was served at study area for protection wild animals and cattle from crops and used for soil conservation. *Erythrina brucei* and *Capparis tomentosa* tree species were most used as a live fence at study area. Azena (2007) stated that, *Erythrina brucei* used for firewood, medicine, fodder, beforage, mulch, nitrogen fixation, soil conservation and life fence, also *Capparis tomentosa* used for firewood, medicine, life fence and fencing material.

### **Parkland agroforestry practice**

This practice involves the growing of individual trees and shrubs in scattered in the farmland, while field crops are grown under the trees/shrubs. Some of the naturally grown tree species includes *Cordia africana*, *Acacia spp*, *Ficus vasta* and *Croton macrostachyus* *Syzygium guineense* *Albezia gumufera* and *Prunus africana* were dispersed on farm land at study area.

**Taungya practice:** is trees planting; growing agricultural crops for 1–3 years, until the shade of trees become too dense. At study area the farmers exercised this practice by using Cardamom crop under *Grevillea robusta* and *pinus patula* plantation and it's used for purposely used land and rise income.

### **Alley cropping**

is one of an important agroforestry practice in which legumes trees species planted in row and crops again planted between of hedgerow trees species and high organic biomass produced from the pruning's of hedgerow species and build soil organic matter constituted with beneficial soil nutrients. From identified agroforestry practice at study area this practice was the least percentage at both zones. Banana Mango and avocado are use around home as alley cropping trees/shrubs with maize crop at study are.

## **Major common trees at study area**

In identified agroforestry practice or on farm land most trees are naturally exist and some of them are planted by farmers. *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* were most common trees at study area (Table 3). These common trees are multipurpose trees so its provide two or more benefits for farmers. All common trees exist at study area were used for improve soil fertility and for shade except *Eucalyptus spp* and *Juniperus procera* (Table 3). As response of respondents *Cordia africana* is the best trees for timber at the area. According to Ebisa and Abdela (2017), stated that *Albizia gummifera*, *Cordia africana*, *Croton macrostachyus* and *Vernonia amygdalina* are popular in smallholder coffee farms in Ethiopia for coffee shade.

Table 3  
Major common trees on the study area

| Tree species                           | Local name    | Uses of trees for:                          | Respondents % |               |       |
|----------------------------------------|---------------|---------------------------------------------|---------------|---------------|-------|
|                                        |               |                                             | Buno Bedele   | Ilu Abba Bora | Total |
| <i>Cordia africana</i>                 | Waddeessa     | Soil fertility/shade/construction/timber    | 64.7          | 71.1          | 67.9  |
| <i>Croton macrostachyus</i>            | Bakkannisa    | Soil fertility/shade/construction/medicinal | 54.7          | 71.8          | 63.2  |
| <i>Eucalyptus spp</i>                  | Bargamoo      | construction/income                         | 44.7          | 62.4          | 53.5  |
| <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>             | Birbirsaa     | 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>               | Bosoqa        | 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>Vernonia 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   | Soilfertility/shade/construction/medicinal  | 70.7          | 85.9          | 78.2  |
| Source: Households survey; April, 2021 |               |                                             |               |               |       |

## Tree species most preferred in field by Farmers

The farmers were not equal desired trees in the field, they preferred one rather than other based on the contribution of trees through their experience. This contribution defined by finding of this survey (Table 3). Based on these, *Albizia gummifera*, *Cordia africana*, *Grevillea robusta*, *Acacia* spp, *Eucalyptus* spp, *Croton macrostachyus*, and *Varnonia amygdalina* were most preferred trees by farmers in field at study area respectively (Fig. 2). *Eucalyptus* tree species was planted on uncultivated land as woodland used commercialized to extra cash income for the household economy. This same line with (Endale, 2017) *Eucalyptus camaldulensis* and *Cupressus lusitanica* tree species are the most trained tree, which more preferred for woodlot agroforestry practice around Jimma town.

## Trees planted by farmers at study area

As survey results the most common trees at study area were regenerated by nature and widely adopted by farmers as dominant on agricultural land and the farmers managed these trees within agroforestry practice. However some multipurpose trees were planted by farmers on their land and managed in different indigenous management within agroforestry practices. The result showed that, among the identified planted trees by farmers at study area are *Eucalyptus* spp and *Grevillea robusta*, are the most dominated one followed, by *Cordia africana*, *Juniperus procera*, *Albizia gummifera*, *Varnonia amygdalina*, *Sesbania sesban*, *Croton macrostachyus*, *Acacia* spp, *Ricinus communis* and *Pinus patula* respectively (Table 4).

Table 4  
List of some trees Planted by farmers on the area

| Tree species                           | Local Name      | Respondents % |                |          |
|----------------------------------------|-----------------|---------------|----------------|----------|
|                                        |                 | Buno Bedele   | Ilmu Abba Bora | Over all |
| <i>Cordia africana</i>                 | Waddeessa       | 30.7          | 20.1           | 25.4     |
| <i>Croton macrostachyus</i>            | Bakkannisa      | 3.3           | 4              | 3.7      |
| <i>Eucalyptus</i> spp                  | Baargamoo       | 56.7          | 75.2           | 65.9     |
| <i>Grevillea robusta</i>               | Giravila        | 64            | 59.1           | 61.5     |
| <i>Juniperus procera</i>               | Gaattiraa       | 24            | 26.2           | 25.1     |
| <i>Pinus patula</i>                    | Pachula         | 1.3           | 0.7            | 1        |
| <i>Ricinus communis</i>                | Qobboo          | 2,7           | nil            | 1.3      |
| <i>Sesbania sesban</i>                 | sasbaaniyaa     | 8             | 3.4            | 5.7      |
| <i>Varnonia amygdalina</i>             | Eebicha         | 7.3           | 7.4            | 7.4      |
| <i>Acacia</i> spp                      | Soondii/Laaftoo | 4.7           | 0.7            | 2.7      |
| <i>Albizia gummifera</i>               | Ambabbeessa     | 11.3          | 8.1            | 9.7      |
| Source: Households survey; April, 2021 |                 |               |                |          |

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

In the survey results the farmers at study area were participated in different agroforestry practice and fruit trees/shrubs, crops and livestock were the component of these practice. The results indicated that among the fruit trees/shrubs 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 and Cow ,Oxen, Calve, Chicken, sheep ,Goat, Donkey and Horse were the most dominant livestock at study area respectively (Table 5). Coffee and Chat were the major cash crops respectively for study area. Although, FAO (2013) mention that agroforestry is a form of sustainable land use systems that integrates trees with crops or animal husbandry to initiate an agro ecological succession.

Table 5  
Major fruit trees/shrubs, crops and livestock at study area

| Category                  | Respondents % |               |         |
|---------------------------|---------------|---------------|---------|
|                           | Buno Bedele   | Ilu Abba Bora | Overall |
| <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    |
| Fingermilet               | 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     |

Source: Households survey; April, 2021

| Category                               | Respondents % |               |         |
|----------------------------------------|---------------|---------------|---------|
|                                        | Buno Bedele   | Ilu Abba Bora | Overall |
| <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    |
| Source: Households survey; April, 2021 |               |               |         |

## Farmer's perceptions about agroforestry

The result showed that farmers in study area widely participated in agroforestry on their farmland and around home. Majority of respondents were strongly agreed with the agroforestry practices on; increase farm income, improve soil fertility and conserved soil and water, saved time on collecting fodder and fuel wood from the forest and improve the natural condition (Table 6). This response revealed that agroforestry helps the farmers in increasing farm income and reduce the risk regarding to food and fodder, fuel wood and climate change. Based on respondent's reply most household had good perceptions and approach for agroforestry practice at study area. The results of this study similar with the finding of Alemayehu et al. (2021), the farmers had positive perception on agroforestry practices and they know very well on its utilities for income diversification, improvement of soil quality, fuel, construction materials, food, and feed, provision of shade, accessibility and ecological value could be understood from the given inquiry parameters.

Table 6  
Farmer's perception about agroforestry practice at study area

|                                                                                                                     |                                                               | Respondents % |      |     |     |   |
|---------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|---------------|------|-----|-----|---|
| Statements                                                                                                          |                                                               | 1             | 2    | 3   | 4   | 5 |
| Agroforestry practices                                                                                              | 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 |
| Source: Households survey; April, 2021, 1 = strongly agree, 2 = Agree, Neutral, 4 = Disagree, 5 = strongly Disagree |                                                               |               |      |     |     |   |

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

Survey results showed that the study area was potential of agroforestry practices. 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 7). 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 8).

Table 7  
Major importance to agroforestry practice at study area

| Importance                             | Respondents % |               |
|----------------------------------------|---------------|---------------|
|                                        | Buno Bedele   | Ilu Abba Bora |
| 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           |
| Source: Households survey; April, 2022 |               |               |

Table 8  
Major constraints to agroforestry practice at study area

| Constraints                                       | Respondents % |               |
|---------------------------------------------------|---------------|---------------|
|                                                   | Buno Bedele   | Ilu Abba Bora |
| 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          |
| Source: Households survey; April, 2021            |               |               |

## Trends of each value over last ten years

The result showed that fruit trees and agroforestry practice were increase at study area over last ten years. As the respondent's reason out why it's increased the farmers get awareness about tree planting and maintains of natural resource. Whereas Honey production, Animal husbandry and crop production were decreased respectively (Fig. 3). The crop production was decrease because shortage of agricultural land, lack of oxen for plough farm land and increasing agricultural input costs. Therefore the farmers practically participated in planting Coffee, fruit trees and Eucalyptus instead of crops production.

## Conclusion and Recommendation

As a result of Assessment existing agroforestry practices on study areas indicates; home garden, Coffee-based AF practice ,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 area. These practices had components of common trees *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 are; Avocado, Banana and Mango with Major crops Maize, coffee, Teff, Chat and sorghum. The agroforestry practice at study area were played for household importance in; 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. The respondents in study area had positive attitude with existing agroforestry practices. Major constraints to the consideration of agroforestry practice mentioned by the respondents included: 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, lack of seed accessibility and shortage of labor. Generally the study results indicated that, home garden the dominant and alley cropping the least agroforestry practice and impacts of wild animal is the main constraint in agroforestry practice at study area.

So, further studies for the improvement of agroforestry practice should be done on positive interaction trees/shrubs selection in component, and with best management, to improve the livelihoods of farmer by reducing the exist constraints. In the present studies, Alley cropping agroforestry practice showed the least exercised by respondents at study area. Therefore the research should be done on this practice to be introduces widely on famers land.

## References

1. Abebe T, 2005.Diversity in home garden agroforestry systems in Southern Ethiopia PhD thesis Wageningen University, Wageningen.
2. Abraham, A., Demel, T., Georg, G., Maru, S., 2016. Tree planting by smallholder farmers in the upper catchment of lake Tana Watershed, Northwest Ethiopia. *Small-scale Forest*. 15, 199–212.
3. Alemayehu. D., Shimalis.D, and wasihun, G., (2021). Assessment of Existing Agroforestry Practices in West Hararghe Zone of Oromia Region, Ethiopia. *International Journal of Research GRANTHAALAYAH*, 9(12), 286-302. doi:10.29121/granthaalayah.v9.i12.2021.4436

4. Alemu, M. (2016) Indigenous Agroforestry Practices in Southern Ethiopia: The Case of Lante, Arba Minch. *Open Access Library Journal*, **3**, 1-12. doi: 10.4236/oalib.1103278
5. Agbogidi, O.M., Adolor, E.B., 2013. Home gardens in the maintenance of biological diversity. Department of Botany, Faculty of Science, Delta State University, Abraka, Delta State, Nigeria
6. Asfaw, Z. and Ågren, G.I. 2007. Farmers' local knowledge and topsoil properties of agroforestry
7. Bekele-Tesemma, A. 2007. Useful trees of Ethiopia: identification, propagation and management in 17 agro ecological zones. Nairobi: RELMA in ICRAF Project, 552p.
8. Bishaw, B, Neufeldt, H, Mowo, J, Abdelkadir, A, Muriuki, J, Dalle, G, Assefa, T, Guillozet, K, Kassa, H, Dawson, I.K, Luedeling, E. and Mbow, C, 2013. Farmers' strategies for adapting to and mitigating climate variability and change through agroforestry in Ethiopia and Kenya. In: Davis, C.M., Bernart, B. & Dmitriev, A. (Eds.) Forestry Communications Group, Oregon State University, Corvallis, Oregon.
9. Brown, S, Grais, A, Ambagis, S. and Pearson, T, 2012. Baseline GHG emissions from the agricultural sector and mitigation potential in countries of East and West Africa. CCAFS Working paper no. 13. CGIAR research program on climate change, agriculture and food security (CCAFS). Copenhagen, Denmark. Available online at: [www.ccafs.cgiar.org](http://www.ccafs.cgiar.org)
10. Duguma LA, Hager H (2009). Forest products scarcity perception and response by tree planting in the rural landscapes: farmers' views in central highlands of Ethiopia. *Ekológia*, **28** (2): 158.
11. Ebisa, L., Abdela, G., 2017. Diversity of shade tree species in smallholder coffee farms of western Oromia, Ethiopia. *Int. J. Agroforest. Silvicult.* **5**, 294–304.
12. Edmond, N, Yakam-Simen, F, Tadesse, K.K. & Romeij, P, 2000. Gedeo Zone Mapping Project. Phase 2. Final Report. Treemail, Heelsum, the Netherlands, Privateers N.V. and the Agricultural Bureau for Gedeo Zone. <http://www.treemail.nl/download>. Accessed 24 March, 2009.
13. Endale B (2017). Environmental Contribution of Agroforestry Systems to Smallholder Farmers around Jimma town, southwestern Ethiopia, unpublished MSc. Thesis.
14. FAO, 2013. Advancing agroforestry on the policy agenda: a guide for decision- makers. FAO, Rome. Agroforestry Working Paper No. 1. <http://www.fao.org/docrep/017/i3182e/i3182e00.pdf>. (Accessed 25 March 2021).
15. Galhena, D. H., Freed, R., and Maredia, K. M. (2013). Home gardens: a promising approach to enhance household food security and wellbeing. *Agriculture and Food security* **2**, 1-13.
16. Gustavo SG, Fonseca AB da, Harvey CA, Gascon C, Vasconcelos HL, 2004. Agroforestry and Biodiversity Conservation in Tropical Landscapes. Island Press, USA, pp. 537.
17. Iiyama M, Derero A, Kelemu K, Muthuri C, Kinuthia R, Ayenkulu E et al. (2017) Understanding patterns of tree adoption on farms in semi-arid and sub-humid Ethiopia. *Agrofor Syst* **91**(2):271–293. <https://doi.org/10.1007/s10457-016-9926-y>
18. Jamala GY, Shehu HE, Yidau JJ, Joel L (2013) Factors influencing adoption of agro-forestry factors influencing adoption of agro-forestry among smallholder farmers in Toungo, South-eastern, Adamawa State, Nigeria. *IOSR J Environ Sci Toxicol Food Technol (IOSR-JESTFT)* **6**(6):66–72
19. Jose, S. & Bardhan, S, 2012. Agroforestry for biomass production and carbon sequestration: an overview. *Agroforestry Systems* **86**:105–1

20. Kang BT, Akinnifesib, FK, 2000. Agroforestry as alternative land-use production systems for the tropics. *Natural Resources Forum* 24, pp. 137-151.
21. Kebebew Z, Ayele G (2010). Profitability and household income contribution of growing *Eucalyptus globulus* (Labill.) to smallholder farmers: The case of central highland of Oromia, Ethiopia. *European Journal of applied science*, 2 (1): 25-29.
22. Ministry of Agriculture (MOA), 2010. Livestock Services Project. Volume 1 (Credit application to the IDA). Livestock and Meat Board, Addis Ababa, Ethiopia, pp: 31
23. Musa .A, Bira . Ch, . Robe. E. Assessment of Existing Agroforestry Practices in East Hararghe Zone Oromia, Ethiopia. *International Journal of Natural Resource Ecology and Management*. Vol. 7, No. 1, 2022, pp. 29-41. doi: 10.11648/j.ijnrem.20220701.15
24. Onyekwelu JC, Olusola JA, Stimm B, Mosandl R, Agbelade AD (2015) Farm-level tree growth characteristics, fruit phenotypic variation and market potential assessment of three socio-economically important forest fruit tree species. *For Trees Livelihoods* 24(1):27–42. <https://doi.org/10.1080/14728028.2014.942386>
25. Pandey, D.N, 2002. Carbon sequestration in agroforestry systems. *Climate policy* 2: 367–377.
26. Teshome T (2009) Is eucalyptus ecologically hazardous tree species? *Ethiopian e-JResInnForesight* 1 (1), 128–134. Available online at [www.nesgl.org/eejri/f4/index.php?journal=admin&page=article&article\\_id=128](http://www.nesgl.org/eejri/f4/index.php?journal=admin&page=article&article_id=128)
27. Yemenezwork Endale, Abayneh Derero, Mekuria Argaw and Catherine Muthuri (2017). Farmland tree species diversity and spatial distribution pattern in semi-arid East Shewa, Ethiopia. *Forests, Trees and Livelihoods* 26: 199-214

## Figures

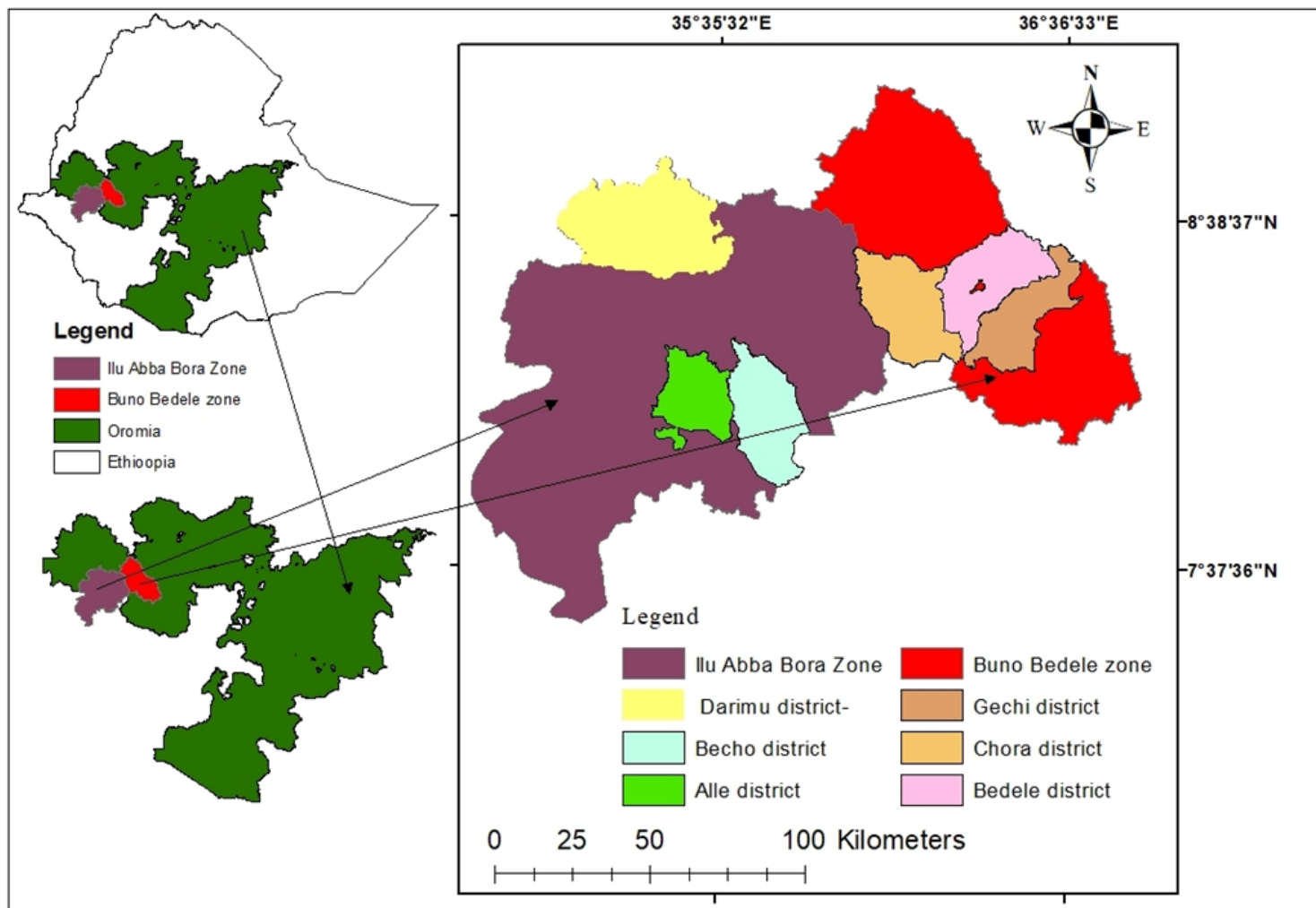


Figure 1

Map of study area

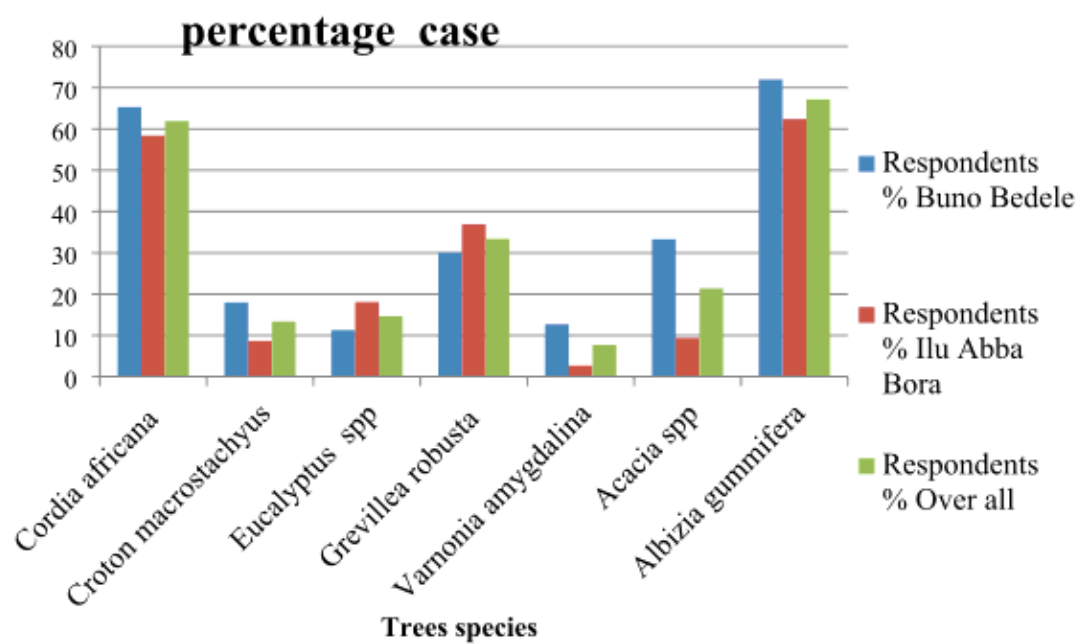


Figure 2

Tree species most preferred in field by Farmers

Source: Households survey; April, 2021

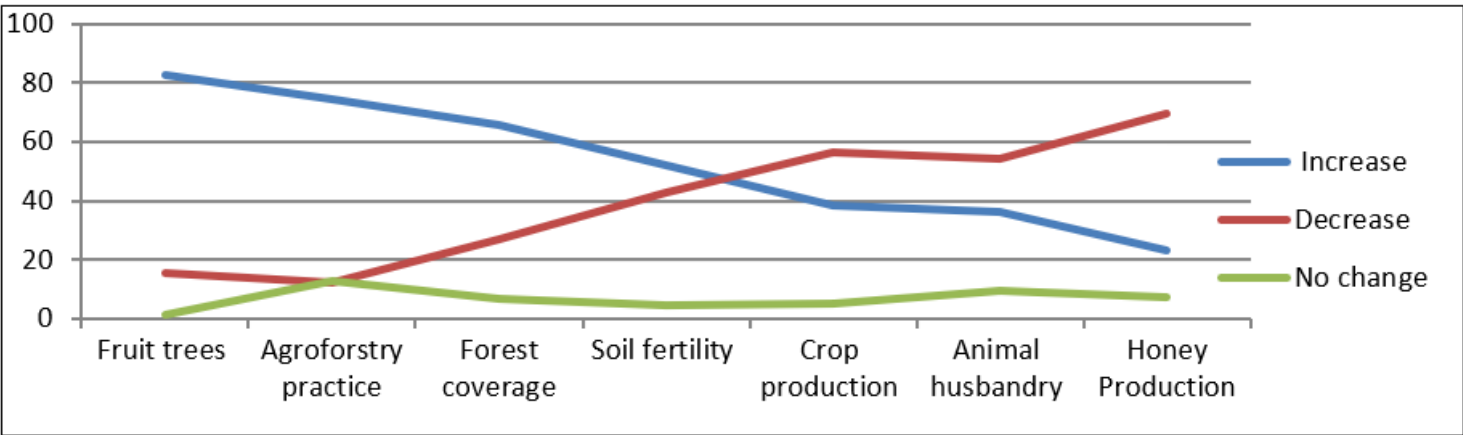


Figure 3

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

Source: Households survey; April, 2021