

Research Article

Characterization of Agroforestry Practices and their Socioeconomic Role in Guji Zone, Oromia, Southern Ethiopia

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Abstract

Agroforestry offers a potential solution to the problem of declining rural agricultural production. The study was conducted in Guji zone southern Ethiopia to characterize the existing agro forestry practice at study area. Accordingly, districts were stratified based on agroecology of study area. Based on these two districts from highland and two districts from midland were selected and two PA from each district were selected based on purposive sampling. 15 farmers from each PA, totally 120 farmers selected from both agro ecologies. To collect data, semi-structured questionnaire was used for household survey, key informant interview and field observation. As a result, home garden agroforestry practices dominate study area (17.5%) which followed by coffee-based agroforestry practice (13.3%), the least distributed agroforestry practice in the study area was alley cropping which shows 3.3%. The major importance of agroforestry practices was for income generation, climate regulation, soil fertility improvement, shade, food and feed, proper land management, construction, fuelwood and timber. Majority of the respondents were strongly agreed with the agroforestry practices; increase income, improve soil fertility and conserve soil and water, replace collecting fodder and fuelwood from natural forest, and improve microclimate regulations. The respondents in the study area have positive attitude with existing agroforestry practices. *Cordia africana* (54.3%), *Hagenia abyssinica* (33.8) and *Grevillea robusta* (22.5%) were the most common trees that dominated in agroforestry practices of the study area. *Cordia africana* and *Hagenia abyssinica* also were most preferred trees by farmers in field. *Percia americana*, *Mangifera indica*, *Musa paradisiaca* L. were most dominated fruit trees at study area. so Further research should be done to diversify least distributed agroforestry practice, minimize negative attitude toward farmers and maximize extension work to adopt agroforestry practices.

Keywords: Agroforestry; Home garden; Respondents; Income

Introduction

The land use system in Ethiopia is associated with the decrease in the size of holding both for arable and grazing lands [1]. Thus, there is continued trend toward the conversion of forested and marginal lands to agricultural lands, resulting in massive environmental degradation and a serious threat to sustainable agriculture and forestry [2]. The decreasing in the size of land holding is related to population explosion [3]. Agro forestry offers a potential solution to the problem of declining rural agricultural production in the tropics. Cultivating trees, agricultural crops and pastures and/or animals in intimate combination with one another spatially or temporally is an ancient practice that farmers have used throughout the world [4]. Agro forestry (AF) is a relatively new name for a set of old practices. There are several types of traditional systems exist in different parts of Ethiopia, and there are new technologies started by several institutions at a national level across different land use systems (Abebe Yadesa et al., 2001). The authors identified major agro forestry system in Nigeria as including shifting cultivation: home garden, Taungya, Shelter Belts Alley

Cropping; bounding trees, dune fixation, and Aqua forestry; shifting cultivation according to Adedire [5]. Agro-forestry had been claimed, to have the potential of improving agricultural land use systems and providing lasting benefits and alleviating adverse environmental effects at local and global levels. The aim and rationale of agro forestry lies in optimizing production based on the interactions between the components and their physical environment. This will lead to higher sum total and a more diversified and /or sustainable production than from a monoculture of agriculture or forestry alone. Agro forestry provides a wider range of products, more secure subsistence or more cash income from wood products to enable the farmer to buy food. Nair [6,7] indicated that the combination of several types of products which are both subsistence and income generating, helps farmers to meet their basic needs and minimizes the risk of the production system's total failure. The integration of trees into the farming system could go a long way to help ameliorate environmental problems. Specifically, by creating microclimates favorable for crop growth and

enhancing the recycling of materials to provide a more complete ground cover which could help to protect the soil from erosion and moderate extreme temperatures [5].

Agroforestry has been practiced by many farmers in different corners of the Guji zone by traditional and cultural way of cultivation. But no scholars have been carried out researches on existing agro forestry practices in Guji zone and there is no compiled information is available on potential agro forestry practices and their role to generate livelihood alternatives in rural communities to the stakeholders at different levels. So, this study intends to characterize the existing agro forestry practice in the study area while evaluating the contribution of these practices to rural livelihood and assessing perception of farmers towards management and problems of agro forestry practices and available management options in the selected district.

Materials and Methods

Description of the Study Area

Astronomically, Guji zone is located between 4°30'-6°25'N latitudes and 38°16'-41°34'E longitudes. It is located in the southern central portion of Oromia Region. The total area of the zone is 33,364.51km². Bore and Uraga Districts have similar agro ecology where have similar agro ecology where diverse crops such as bread wheat, food barley, horticultural crops (mostly potato, Enset, garlic and head cabbage) and highland pulse crops (Faba bean and field pea) were largely produced in each district. These districts are also known for rearing of livestock. White honey is produced in each district from natural vegetation found. Adola Rede and Oddo Shakiso District are characterized by three agro-climatic zones namely humid, sub humid and dry arid zones. Traditional farming system of these both districts are: Teff, Haricot bean, sweet potato, coffee and maize.

Sampling Method and Sample Size Determination

At first stage, discussion was made with Zonal agricultural office to get districts with agro forestry potential. Also, at district stage, discussion occurred with agricultural experts to get potential kebeles with agro forestry practices. So, to contact respondents, structured questionnaire was prepared and survey of the agro forestry practices was undertaken by using purposive sampling methods to select districts and kebeles depend on the potential of agro forestry practices.

From Guji zone, two districts from each Agroecology (high land, midland) totally four districts were selected. Namely from highland agroecology: - Bore and Uraga districts and from midland Adola Rede and Oddo Shakiso Districts were selected. Then, from each district by purposive method, two kebeles (PA) were selected. Totally 120 respondents were interviewed for this study and 15 respondents from each kebele for both agro ecology. So, data were collected through face-to-face interview using a pre-prepared questionnaire and types of agroforestry practices exist were identified with the help of farmer's indigenous knowledge on component, arrangement of agro forestry practice and direct field observation.

Data Analysis Method

The data collected were analyzed by using statistic package for social science (SPSS version 20). Descriptive analysis was employed to the tools such as percentage, and frequency distribution.

Result and Discussion

Socio Economic Characteristics of Respondents

This research revealed that the sex ratio of household respondents engaged in agroforestry was 70% men and 30% women that show male respondents more participate in agro forestry practice and agriculture. About 37.5% of the respondents were aged between 30 and 40 years (Table 1). Those in the age class 50–60 was 31.7% while the third largest class was 40–50 years with 15.8%. The remaining 15% were in the ages 20–30 years (Table 1). Therefore, this study revealed that most of the respondents are in a condition of ability to participate in any agroforestry practices and economic activities. Regarding the marital status, 77.5% of the respondents are married and about 20.9% are single while about 1.6% were divorced (Table 1). Regarding family size largest percentage (60.8%) hold by 5-8 number of family followed by 1-4 (19.1%) number of family and the smallest range number of family shows as it is >8 (17.5%). The education level of respondent's shows that the largest number was educated (79.9%) and 20.1% was uneducated (Table 1, Figure 1). From educated respondents 23.3% educated up to grade four and 56.66% educated more than grade eight.

Table 1: Socioeconomic description of sample respondents.

Category	Variables	Frequency	Percent
Age class	20-30	18	15
	30-40	45	37.5
	40-50	19	15.8
	50-60	38	31.7
	Total	120	100
Sex	Male	84	70
	Female	36	30
Marital status	Single	24	20.9
	Married	93	77.5
	Divorced	3	1.6
	Total	120	100
Family size	4-Jan	23	17.5
	8-May	73	60.8
	>8	24	19.1
	Total	120	100
Level of education	Uneducated	24	20
	Grade 1-4	28	23.3
	Grade 5-8	39	32.5
	>9-12	29	24.16
	Total	120	100

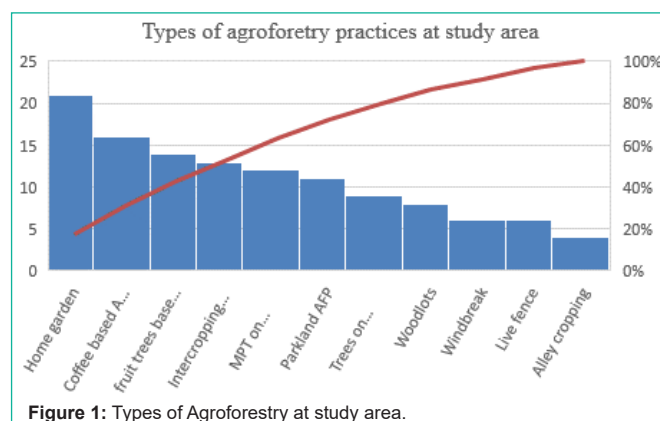


Figure 1: Types of Agroforestry at study area.

Types of Agroforestry Practices at Study Area

The result shows that eleven types of agroforestry practices were identified for the study area. As of other part of our country, farmer's community of Guji zone practices different types of agro forestry practices for different socio-economic services. So, depending on result analysis, home garden agro forestry practices were the most practices dominates (17.5%) the study area for both agro ecology (Highland and Midland) followed by coffee based agro forestry practice (13.3%) and fruit trees-based agroforestry practices (11.6%) (Table 2). The least agroforestry practice exists in the study area was alley cropping. In line with this study, report that home garden and coffee based agro forestry practices are the types of agroforestry practice mostly practiced by farmers at Ilu Ababor Zone of Oromia region south western Ethiopia [8].

Home Garden Agro Forestry Practices of Study Area: The concept of home gardening involves cultivating a small piece of land nearby the family home or nearby a walking distance. It can be seen as a mixed cropping system consisting of vegetables, fruits, plantations, spices, herbs, ornamental and medicinal plants and livestock that can serve as a source of food and income. Table below shows list of plants cultivated by farmers at both agro ecologies at their homestead. Farmer's uses home garden Agro forestry practices for dietary services and generate cash income.

The Total number of plants species identified under home garden agroforestry practice at both agroecologies was 23 (6 woody and 17 herbaceous). Most plants managed in home garden agroforestry practice at both agro ecologies were Herbs (13) followed by trees which is 6 and climber 2 as of shrubs (Table 2,3).

Table 2: List of plants in the Homestead at Highland of study area.

Highland Agro ecology					
Scientific Name	Vernacular Name (Afaan Oromo)	Amharic Name	Family Name	Parts Used	Habit
<i>Allium cepa</i> L.	Shinkurti Baalaa	Baro Shinkurti	Alliaceae	Steam and leaf	Herbs
<i>Brassica carinata</i> A.Br.	Shaanaa/Rafu	Gomen	Cabombaceae	Leaf	Herbs
<i>Capsicum annum</i>	Qaaraa	Qariya	Solanaceae	Fruit	Herbs
<i>Cymbopogon martini</i> (Roxb.) Wats.	Marga Cita	Tej sar	Poaceae	Leaf	Herbs
<i>Enset ventricosum</i> (Welw.) cheesman.	Weesii	Enset	Musaceae	Leaf, Steam and Root	Herbs
<i>Liphia adoensis</i>	Uddoo	Koseret	Verbenaceae	Leaf	Herbs
<i>Ocimum basilicum</i> L.	Bassobila	Bassobila	Lamiaceae	Leaf	Herbs
<i>Ruta chalepensis</i> L.	Sukutte	Tenadami	Rutaceae	Leaf and Seed	Herbs

Source: Household survey, 2022-2023.

Table 3: list of plants as homestead at Midland of Study area.

Midland Agro ecology					
Scientific Name	Vernacular Name (Afaan Oromo)	Amharic Name	Family Name	Parts Used	Habit
<i>Carica papaya</i> L. Ca	Papaya	Papaya	Caricaceae	Fruit	Tree
<i>Catha edulis</i> (vahl.) Forssk.ex. Endl. Endl.	Caatii	Chat	Celastraceae	Leaf	Shrub
<i>Coffea arabica</i> L.	Buna	Buna	Rubiaceae	Seed	Tree
<i>Mangifera indica</i> L.	Maangoo	Mango	Anacardiaceae	Fruit	Tree
<i>Musa x paradisiaca</i> L.	Muuzii	Muz	Musaceae	Fruit	Herbs
<i>Persea americana</i> Mill.	Abukaatoo	Avokado	Lauraceae	Tree	Tree
<i>Phaseolus lunatus</i> L.	Boloqqee	Boloke	Fabaceae	Seed	Climber
<i>Ricinus communis</i> L.	Qobboo	Gulo	Euphorbiaceae	Leaf and Seed	Shrub
<i>Saccharum officinarum</i> L.	Shankoraa	Shenkora	Poaceae	Steam	Herbs
<i>Zea mays</i> L.*	Boqqolloo	Boqolo	Poaceae	Seed	Herbs
<i>Annona senegalensis</i> Pers.	Giishxaa	Gishta	Annonaceae	Fruit	Tree

Source: Household survey, 2022-2023.

Coffee Based Agro Forestry Practice

At both agro ecologies of the study area, coffee-based agroforestry practice was the second one at which farmers grow trees such as *Polysias ferruginea* (Tala), *Croton mycrostachya* (Bakkanisa), *Cordia africana* (Waddessa), *Persia americana* (abukato) and *Albizia gummifera* (Garbi) for coffee shade (Table 4,5).

Mostly at midland agro ecology of study area, sampled respondents described as they use *Cordia africana* firstly, followed by *Militia ferruginous* and *Albizia gummifera* as third priority for their coffee shade. The finding of these result also supported with Aschalew and Zebene (2018) [9] reported that *Cordia africana*, *Militia ferruginous* and *Albizia gummifera* are the most preferred trees used by farmers of study area as coffee shade.

Fruit Tree Based Agroforestry Practice

The third and the most important agroforestry practices at study area is fruit tree-based agroforestry practice which farmers use it in their daily life. In the study area household used fruits for household consumption and for income generation. As of respondents, they have good farming practice to cultivate fruit trees. Fruit tree-based agroforestry practice those farmers cultivate at study area are: *Percia Americana* (Avocado), *Mangifera indica* (Mango), *Musa paradisiaca* L. (Muuzii), mostly. They also cultivate *Anona Senegalese pers.* (Gishxa) and *Malus pumila* (Apple). In contrast to this finding, at Dale District, Sidama Zone, Southern Ethiopia, Avocado, Mango and Banana are the most fruit tree-based agroforestry practices cultivated (Figure 2) [10].

Intercropping Agroforestry Practices

Farmers of study area practice intercropping agroforestry to save

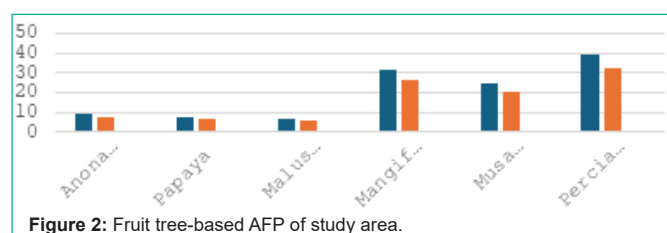


Figure 2: Fruit tree-based AFP of study area.

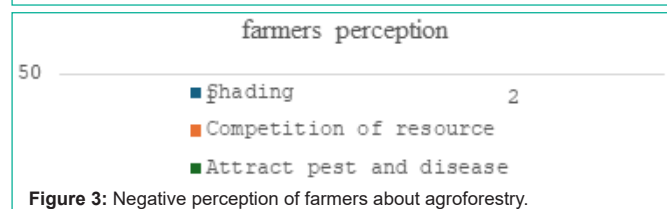


Figure 3: Negative perception of farmers about agroforestry.

space and resources, to get better yields and to reduce weeds from crops which can harm productivity of their farm. As respondent's idea intercropping can provide nutrient for neighbor plants. At midland agro ecology of study area were: - Coffee with Ginger; at highland agro ecology of study area, inset with maize, Apple based agroforestry practice with Onion, Maize with lettuce, Fababean with Maize and Fababean with field pea are the common intercropping agroforestry practice those farmers cultivate on their farmland. Similar to this study finding result, Hailu *et al.*, [11] reported the same finding of farming system at west Wollega zone Oromia regional state of Ethiopia.

Multipurpose Trees on Farmland

Farmers at study area use multipurpose trees for the purpose of fuel wood, construction material, as wind break and for logging.

Table 4: List of Trees Used by farmers for coffee shade at study area.

Scientific name	Vernacular Name (Afaan Oromo)	Family Name
<i>Cordia africana</i> Lam	Waddessa	Boraginaceae
<i>Croton macrostachyus</i> Del	Bakkanisa	Euphorbiaceae
<i>Ficus sur</i> Forssk	Harbuu	Moraceae
<i>Syzygium guineense</i> (Wild.) DC. subsp. <i>Guineense</i>	Badessa	Myrtaceae
<i>Persea americana</i> Mill.	Abukato	Lauraceae
<i>Albizia gummifera</i> (J.F.Gmel.)	Garbii	Fabaceae
<i>Vernonia amygdalina</i> Del.	Ebicha	Asteraceae

Source: Household survey, 2022-2023.

Table 5: Common Trees and their Importance at study area.

Tree species	Local Name	Its importance	Respondents%
Hagenia abyssinica	Heexoo	Timber/soil fertility/medicine	33.8
Cordia africana	Waddessa	Soil fertility/shade/construction/timber	54.3
Crotonmycrostacha	Mokkonnisa	soil fertility/shade/construction/medicinal	12.1
Eucalyptus spp.	Baarzaafii	Timber/Construction	9.5
Podocarpus falcatus	Birbira	soil fertility/shade/construction/timber	8.1
Prunus africana	Sukkee	soil fertility/shade/medicinal/timber	7.4
Albizia gummifera	Garbii	soil fertility/shade/construction/medicinal	11.1
Pinus patula	Shuwashuwe	Timber/Construction	37.7
Strichynos spinosa	Baddeessaa	Soil fertility/timber	3.2
Polysias ferruginous	Tala	Shade/ Soil fertility	17.1
Ekerbegia capensis	Anoonuu	Timber	8.6

Source: Household survey, 2022-2023.

At both agro ecology of the study area, multipurpose trees on farmland agroforestry practice were applied as exotic and indigenous multipurpose trees by farmers. *Grevilia robusta*, *Pinus patula*, *Acacia saligna*, *Cordia africana*, *Sesbania sesban*, *Lucenea leucocephala* and *Cupresses lustanica* were those plantations by private individuals and government on farmland and around home for their multiple benefits. Also, there were indigenous multipurpose trees such as *Hagenia abyssinica*, *polysias ferruginous* and *Croton mycrostachya* used by farmers of study area.

Major Common Trees and their Importance at Study Area

At study area, many of plants were indigenous and some of them are exotic trees. Farmers at study area plant trees naturally based on their experience. *Hagenia abyssinica*, *Cordia africana*, *Croton mycrostachya*, *Aningeria adolfereidrin*, *Strichynos spinosa*, *Polysias ferruginous*, *Albizia gummifera* and *Ekerbegia capensis* are indigenous common trees those serve farmers with different benefits such as shade, for construction and for fuel wood. Also, there are exotic common trees such as *Eucalyptus* species, *Pinus patula*, and *Gravilia robusta* where common trees exist at study area (Table 5).

Major Fruit Trees/Shrubs, Crops and Livestock at Study Area

Based on survey result, all component of agroforestry was recorded at study area. The desire of farmers regarding these components was different based on their experience of practicing agroforestry and the land they hold. Based on these, the most dominant fruit trees exist at study area were: - Apple, Mango, Banana and Avocado whereas Wheat, Barley, Potato, Onion, Faba bean, Maize and Enset are the most dominant crops farmers cultivate at study area. Also, Oxen, Calve, chicken, Sheep, Goat, Donkey and Horse are the most dominant livestock component practiced by farmers. This indicates agroforestry can be practiced for economic, social and environmental benefit. In line with this result, FAO (2013) [12] described as the collective term for land-use systems and technologies in which woody perennials (e.g. trees, shrubs, palms or bamboos) and agricultural crops or animals are used deliberately on the same parcel of land in some form of spatial and temporal arrangement.

Farmers Perception towards Agroforestry Practices

Survey result shows that there was high participation of farmers in agroforestry practices around farmland and home. They described as agroforestry was important economically and environmentally. Farmer's negative perception about agroforestry was they think as this practice take long time to generate income, competition of resources, shading effect, attract pest and disease and attract birds (Figure 3).

Positively farmers aware that agroforestry has benefit such as increased farm income, soil fertility, decreased complete crop failure and a potential of solving their fuel wood needs.

The results of this study similar with the finding of Alemayehu *et al.*, [13], 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.

Major Constraints and Opportunity of Agroforestry at Study

Area: As of respondent's study area has potential of agroforestry. But there was constraints and opportunity regarding agroforestry practice in the study area. Major opportunities are: improve soil fertility, source of income for household, regulate climate, use for food and fodder, for proper use of land, for construction and for fuel wood and timber production. As of respondents; there were also constraints such as: - competition for resources, shortage of land for tree planting, lack of knowledge, Insect pest and Disease. The trend of agroforestry practice at study area for the last ten year was increasing [14-20].

Conclusion and Recommendation

The study area has covered with different types of agroforestry practices. Home garden, coffee-based agroforestry practices, fruit tree-based agroforestry practices, intercropping, multipurpose tree on farm land, parkland agroforestry, Woodlots, wind break, live fence and Alley cropping agroforestry practices are those recorded at study area. These agroforestry practices distribution varies across agro ecology. Mainly home garden agroforestry practices, coffee-based agroforestry practice and fruit tree-based agroforestry practice were dominated the study area. This implies as the area was rich of agroforestry practices. As home garden agroforestry, farmers of study area cultivate vegetables, fruits, spices, herbs and medicinal plants for daily activities.

Farmers of study area used polysias ferruginea, Croton mycrostachya, Cordia africana and Albizia gummifera as coffee shade trees. Especially at midland agroecology of study area farmers used Cordia africana, Millettia ferruginea and Albizia gummifera for coffee shade. Home garden agroforestry practice dominates the study area and alley cropping shows the list domination. Generally, in the study area farmers practices different types of agroforestry activities for their livelihood.

Therefore, this study recommends that: at midland agroecology of the study area, there was low distribution of intercropping, wind break, trees on range land, woodlots and alley cropping agroforestry practices. So, it should be diversified through providing necessary inputs and materials for adoption of more agroforestry practice for farmers. so more research and extension service should be applied to maximize farmers benefit from agroforestry by minimizing constraints exist at study area. On the other hand, even if farmer's perceptions towards agroforestry practice are positive most of the farmers still not adopted agroforestry practice in the study area.

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Conflict of Interest

Authors Declares no conflict of interest on Manuscript

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