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Contribution of Traditional Agroforestry Practices for Rural Household Livelihoods in Libo Kemkem District, South Gondar Zone, Amhara Region, Ethiopia

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Abstract

Traditional agroforestry practices have been practiced for centuries in different parts of Ethiopia as a livelihood strategy of smallholder farmers. As a result, farmers are well habituated with this practice so as to improve their livelihood. The main objective of this paper was to identify the major types of agroforestry practices and its contribution to rural household livelihoods in Libo Kemekem district, South Gondar Zone, Amhara region, Ethiopia. For this study, socio-economic data were collected from 112 household heads by using semi-structured questionnaires. A random selection procedure was used to obtain samples of individual households from the three sampled kebeles. The responses of sample households were analyzed statistically using recent SPSS version 20. Home garden, parkland, woodlot, live fences, farm boundary planting, trees on pasture land, roadside tree planting and tree planted for soil conservation were found to be the most common types of agroforestry practices in the study area. These agro-forestry practices which integrate trees and shrubs as a major component play an important role in the daily lives and livelihoods of the farmers. Moreover, the tree components were not only important sources of their livelihood but also contribute for the improvement of crop productivity and livestock performance as a source of feed and shade. Some of the main socio-economic benefits derived for the practice include provision of tree products like timber, firewood, construction materials, medicines and fruit for food either for home consumption or surplus products for sale in the market as a means for income generation. Despite the all rounded livelihood benefit derived from the agroforestry practices noted in this study area, its development and expansion were constrained by various factors. Major constraints mentioned by the respondents towards tending of trees includes: termite damage at the early stage of seedling establishment, land shortage, lack of technical assistance (such as lack of required species and amount of seedlings), free grazing and pests especially on fruit trees like Mangifera indica. Generally the findings revealed that agroforestry practice play a

significant role in supplying different livelihood benefits, which enhance household incomes and sources of wood products. Therefore, research and development efforts towards the improvement of agroforestry practice should be done by introducing new technologies so as to further improve the livelihoods of farmer and smoothly address their constraints.

Keywords: 1. Agroforestry 2. Livelihood 3. Practice 4. Ethiopia.

Introduction

Ethiopia is a country with diverse landscapes and culture in eastern Africa [1]. More than 90 million inhabitants [2], living in rural areas of Ethiopia is primarily an agrarian. Peoples who are living in mountainous areas depend heavily on forest resources for their livelihood and welfare [3]. In Ethiopia, many rural communities have for centuries lived in and around vegetation areas and they make use of timber and non-timber forest products for their livelihoods [4]. A livelihood comprises the capabilities, assets (including both material and immaterial resources) and activities for a means of living. Sustainable rural livelihoods have received high priority recently [5]. Agricultural Development Leading Industrialization has been launched in Ethiopia to enhance an agriculture-led growth strategy for sustainable economic development, reducing poverty and increasing the level of food security [6]. 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 [7]. According to World Agroforestry Center, agroforestry is a dynamic, ecological based natural resources management system through integration of trees into rangeland and farmland to diversify and sustain production for the increasing socio-economic and environmental benefits for all land users at all levels [8]. Agroforestry has been a traditional agricultural practice sustainable for thousands of years and an important element of the cultural rural landscape in tropical and temperate regions around the world including Ethiopia [9]. More than hundred different agroforestry practices have been identified in tropical and temperate regions [8]. A number of research works has been conducted focused on its implication on biodiversity, sustainability, national and regional environment but with limited consideration of its social dimensions [10]. Consequently, there is limited knowledge on the contribution of traditional agroforestry practices on food and livelihood security of rural households who depend on and make their livings from subsistence farming. Therefore, this study was intended to assess and describe the existing types of agroforestry practices and its contribution to rural household livelihoods in Libo Kemekem district, Amhara region of Ethiopia.

Materials and Methods

Description of the Study Area

The study was conducted in Libo Kemkem district, South Gondar Zone, Amhara Region, Ethiopia. (Figure 1). This district is situated between 12^0 39' 66" and 12^0 42' 45" N latitudes and 37^0 26' 99" and 37^0 28'42" E longitudes. The district is located 645 and 70 kilometers away from Addis Abeba and the Reginal city of Bahar Dar respectively. It covers an area of 1,560 km^2 and comprises 33 rural and 2 urban Kebeles. The total population of the district is 198, 951 of which 100,951 are males and 97,423 are females. The altitude of the district ranges from 1,800 to 3,000 meters above sea level and the temperature ranges from 18 ºC to 25 ºC. The area receives an average annual rain fall ranging from 900 to 1400 mm. From the total area of land, 51% is cultivable, 8.3% pasture, 5.9% forest or shrub land, 17.98% % is considered degraded or other**.** The livestock populations of the district are estimated to be 115,453 cattle, 36,448 goats, 17,939 sheep, 371 horses, 461 mules; 1,220 donkeys; 75,972 hens and 10,337 bee hives [11].

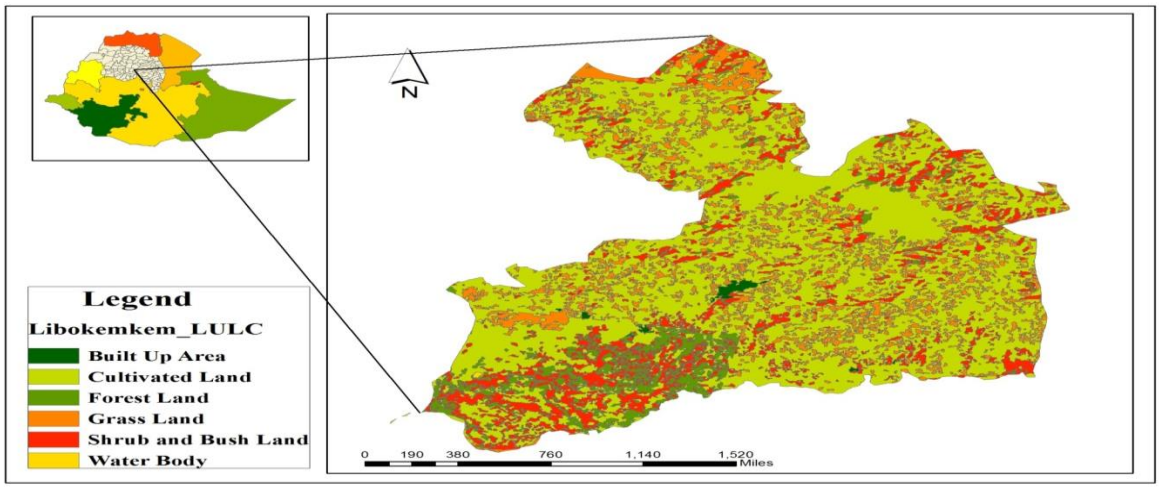


Figure 1. Map of the study area

The people of Libo Kemkem district are practicing diverse agricultural system which includes crop production and rearing of livestock as well as traditional agroforestry practices. Crop production is more dominant agricultural practices. In some areas where there are rivers, irrigation practice is common. The major types of crops grown in the area consist of cereals (wheat, teff, maize, barley, rice, and sorghum); pulses (beans, chickpeas, peas); oil seeds such as linseed, Niger seed. Moreover, Chat (Catha edulis), banana (Musa spp.), papaya (Carica papaya), lemon (Citrus aurantifolia), and gesho (Rhamnus prinides) are widely cultivated in the areas [12]

Research Methodology

Sample size and sampling technique: Both purposive and random sampling techniques were used; purposive sampling technique was used to select sampled kebeles based on agro-ecology and the existence of agroforestry practices while random sampling technique was used to select individual respondent households with in the sampled kebeles. A random sampling technique was used to get a more representative respondent from HHS with equal probability and thus improve efficiency. With the consultation of the Libo kemekem district Agricultural Office three kebeles were purposefully selected namely Mander Maraym and Asta Maryam from Dega, Derta from Weyna Dega and Shehoch Tara from kola kebeles based on agro-ecological zones and the existence of agroforestry practices. From each selected kebeles 112 respondents households were selected by using simple random sampling technique to identify the types of agroforestry practices and its contribution for household livelihoods as well as the challenges faced to do so in the district.

Method of data collection and analysis: The data was collected in each kebeles through interview using semi structured questionnaires, group discussions and direct observations. Both qualitative and quantitative data was collected and the responses of sampled households were analyzed by using statistical package for social science (SPSS version 20).

Result and Discussion

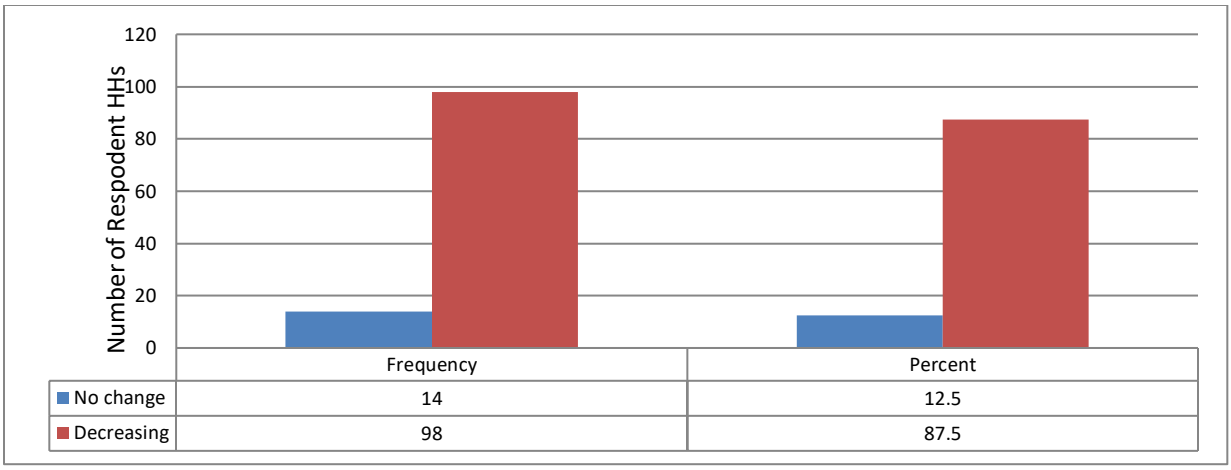
General Socio-economic Characteristics of Respondent Households:

The male and female households accounted for 92 % and 8 %, respectively. There is a high level of illiteracy (63%). This might be a factor for the poor adoption of new and improved technology. Education and age of farmers were found to be significant factors influencing decisions of farmers in the adoption pattern of improved varieties [13]. About 47.3 % respondents' household had land between 0.5-1 ha while 36.6 % of them had land < 0.5 ha (Table 1). Land holding size was reported by many households as the most important limiting production factor in the study area and the landholding per household was small. The shortage of land is likely to become escalating as the population continues to grow in an area [14]. Agriculture was identified as the mainstay of the livelihood of the people in the survey area. All of the respondent household (100%) depend on agriculture, either as a sole occupation or as major part of their livelihood occupations. 49% of the respondent households were engaged in mixed agricultural practice (Agroforestry). Agriculture being the major livelihood strategy, crop production specifically (26.8 %) does not pay to the satisfaction of the substantial households. When they were asked about recent crop production, 41.1% of the respondents reported that the produce from crop-farming no longer sufficed even for household consumption. Off-farm job opportunities, such as daily wages and small-scale trading were indicated as a means of filling gaps in household heads income and livelihood shortfalls.

Table 1: Qualitative socio-economic characteristics of the respondent households.

Variable	Category	Frequency (N=112)	Percentage
Sex	Male	103	92
	Female	9	8
Age	30-45	38	34
	45-60	46	41
	>60	28	25
Educational background	Illiterate Attend elementary school	71 26	63.25 23.21
	Attend secondary school	15	13.39
Engagement in agriculture Land holding	Livestock production only Crop production only tree production only Mixed (agroforestry) < 0.5 ha 0.5-1ha > 1ha	18 30 9 55 41 53 18	16.1 26.8 8.1 49 36.6 47.3 16.1

The majority of the respondents had witnessed considerable changes in the natural vegetation cover of the surveyed area. (87.5%) of respondents indicated that a decrease in the vegetation cover had taken place, while the rest (12.5 %) of the respondents reported either no change or an increase (Figure 1). Several multiple factors indicated as drivers of vegetation cover changes in the area include: Numerous respondents attributed the causes of the reduction in vegetation cover were expansion of agricultural land, wood-harvesting for construction and fuel wood purpose (79%) while (21%) respondents indicated that the expansion of agricultural land alone had caused the reduction in natural vegetation cover.



	Frequency	Percent
No change	14	12.5
Decreasing	98	87.5

Figure 1. Natural Vegetation Cover Status as Viewed by Respondents

Evolution of Agroforestry Practices, and Its Potentials

When a formal survey was conducted to assess the types of agroforestry practices, eight agroforestry practices and their combinations were mainly reported by the respondents. These identified agroforestry practices were home garden, parkland (scattered trees on croplands), woodlot, live fences, farm boundary planting, trees on pasture land, roadside tree planting and tree planted for soil conservation. The following section considers the evolution and performance of each agroforestry practice reported by farmers in the study area.

Home-gardens: Home garden is one of the identified agroforestry practice in the study area. Home-gardens are characterized by being practiced near residence, composed of a high diversity of plants and an important source of diversified products used for household subsistence and cash income. Maize, Coffee, pepper, and numerous kinds of vegetables are the dominant components of home garden in the study area. Mangifera indica, Musa, Carica papaya, coffee arabica, Rhamnus prinoides, Catha edulis, Citrus sinensis, Citrus aurantifolia, and Citrus reticulata species were cultivated in home-garden agroforestry practice (Figure 2). Multi-purpose horticultural trees were most favored by rural house hold in the study area for home gardening. Cordina africana, Croton macrostachyus, Acacia species were found to be a shade trees. The products of home garden practice currently continue to serve household for home consumption as well as surplus products for sale in the market. The result of this study agrees with [15] who reported that home gardens are believed to provide a number of benefits to families, regarding from improving nutrition and providing a source for additional house hold income. Seedlings produced by government nurseries do not provide the multi-purpose trees required by household farmers.

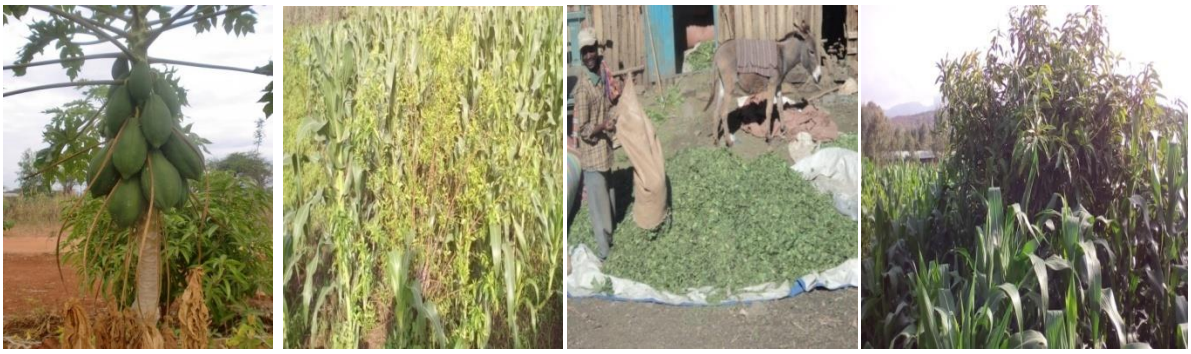


Figure 2.Home-garden Agrofrestry practice

Parkland Agroforestry Practice: This practice involves the growing of individual trees and shrubs in wide spaces in the farmland, while field crops are grown in the understory. Indigenous multi-purpose trees are maintained on farmland for various uses. Farmers apply their own selection criteria for leaving a tree on their farmland. Some of these criteria concern compatibility with crops (i.e. those trees that do not shade crops much, those that do not compete for growth resources) and provision of shade were worth mentioning. The practice of maintaining dispersed trees on cropland were based on protection and careful management of naturally regenerated trees, and it also involves planting new trees. Dispersed trees grown naturally in farmlands characterize a large part of the study areas compared to the planted ones. This could possibly due to the free grazing system being adopted in the area. Some of the naturally grown tree species includes Cordia africana, Acacia albida, Acacia abyssinica, Olea europae, Ficus vasta and Croton macrostachys and Albezia gumufera. This practice benefits farmers in many aspects like source of fodder, fuel wood, constructional material and agricultural implement tools. Similarly, [16] also reported that trees growing on farmland provide various benefits such as fodder, fuel wood, and building equipment. Therefore, household source of energy is one advantage of tree-based agroforestry products, which save several farmers from the problems that arise from shortages of energy; because, there may not be an alternative energy sources.

Figure 3. Parkland agroforestry practice

Trees on Woodlots, Live Fences, and Road Sides: Established woodlots were also noted by the respondent farmers in the study area. The main purpose of establishing woodlots was for the production of construction and fuel wood materials. Eucalyptus and Acacia decurrens species were found to be the dominant species planted as a woodlot. Typical biological attributes that attract farmers to Eucalyptus species include fast growth, coppicing ability, ease of management (such as non-palatability to cattle), established market demand for its wood, its ability to grow well even on degraded landscapes and its better growth performance than most indigenous tree species [17]). However, respondents responded that its establishment was hampered by termite damage as the major constraint of tree-planting in the in the study area during its early establishment period. Trees grown as live fences were multi-purpose and at the same times are used as a source of feed for animals. Ficus thonnigii were a good example tree species used as a live face providing fodder for livestock feed. This species is most preferred by many farmers since it can be fast established by cuttings. Trees are also planted on roadsides, where its purpose was mainly for the provision of shade. Given the harshness of the environment (very hot in the day), and the fact that trees totally shed their leaves in the dry season, trees which do not shed their leaves in the dry season are planted on roadsides in villages e.g. Melia azandracta. Such trees also have an ornamental purpose, giving villages a greener view, in addition to the main purpose of providing shade.

Table 2. Types of agroforestry tree species grown in different agroforestry practices in the study area

Type of agroforestry practices	**Types of Species grown**
Boundary Planting	Eucalyptus, Gravillea robusta, Acacia decurrens, Cauarina equsetifolia
Homestead	Cordina africana, Croton macrostachyus, Carissa spinarum, Mangufera indica, Papaya, Coffea arabica, Banana, Citerus spp, Rhamnus prinoides, Catha edulis
Life fence	Eucalyptus, Cupressus lusitanica, Olea africana, Acacia decurrens, Sesbania sesban
Wood lot	Eucalyptus spp, Vernonia amygdalina, Acacia decurrens
Parkland AF/Tree crop land	Corton macrostachyus, Acacia albida, Albezia gumufera, Cauarina equsetifolia,
Tree in the grazing land	Cordina africana, Acacia decurrens, Acacia saligna, Ficus thonnigii
Tree for soil conservation	Suspania susban, Vetiver, elephant grass
Alley cropping	Cordia africana, Acacia species, and Croton macrostachys

The contribution of agroforestry practices to rural livelihoods

Crop production, livestock rearing and forestry practices are the major sources of livelihood. The major sources of annual income of farmers were found to be crop production (53.57%) followed by livestock product (20.53%), agro-forestry products (18.75%), and off-farm activities (7.14%). The majority of respondents (54%) recognized that crop production and sale contributed to their household income (Figure 3). The major types of cereals crop produced for consumption and sale includes Zea mays, Sorghum, Eragrostis tef, Hordeum vulgare, Triticum sativum, Eleusin ecoracana. Pulse crops includes Faba beans (Vicia faba), field pea (Pisum sativum), and chickpea (Cicer arietinum). Cash crops include Rhamnu sprinoides (Gaso), Catha edulis (Chat) are cultivated in within the home-garden agroforestry practice.

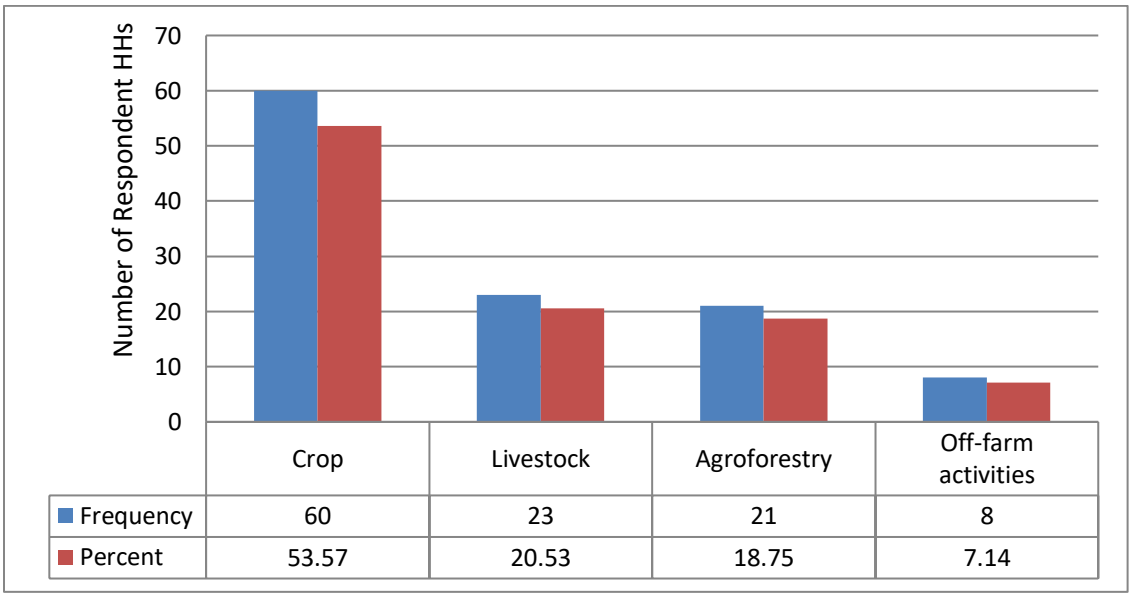


Figure 3. Major sources of rural household livelihood contribution

Agro-forestry practice which integrates trees and shrubs play an important role in the daily lives and livelihoods of the farmers. The tree component provides constructional materials, fuel wood, timber, agricultural tools, and fodder. Moreover, it can play a role for an improved yield of crops. The improvement of crop yield can also reduce the pressure on natural vegetation. The tree components are not only important sources of their livelihood but also contribute for the improvement and better productivity of livestock as a source of feed and shade. Tree species such as Ficus thonnigii, Ficus sur, Ficus vasta, Acacia abyssinica, Apodytes dimidiate, Maytenus arbutifolia and Sesbania sesbana were used mostly for livestock feed in the study area. Crop production accounted as a major source of income. The area is mostly known by cash crop production like catha edulis. This is in agreement with [18] who reported that catha edulis is a cash crop that generates cash income in Ethiopia. Respondents viewed that different agro-forestry product were

contributed much to their household income. In general, the results of this study showed that major sources of livelihood from agroforestry components were crop cultivation, animal rearing, and tree growing. The result also showed that the income they earned from agricultural crop products like cabbage, maize, teff; sorghum and Rhamnus prinoides (Gaso) were regular. Farmers mentioned that they accrued extra income from integrated tree-based agroforestry products. The dependency on tree-based products for cash income was higher from commercial trees such as Eucalyptus spps. A study conducted by [19] reported that more than 28% of the incomes of rural household in Oromia regional state, Lode Hetosa Woreda generate cash income from selling of cash crop of Eucalyptus tree. In addition in all study kebeles, cash crops like Rhamnus prinoides, Catha edulis (Chat) can easily be grown and attract good market. Hence, the income obtained from these products was helping farmers for enhancing the capacity to purchase household materials and inputs.

Tree Planting Practices and Constraints

Tree-planting was practiced by most of the respondents (74.1%), while the remaining surveyed households had not been involved in tree-planting at least within the past two years (24.9%). Among those households which did not practice tree-planting, 5.9 % respondents mentioned a lack of technical assistance (such as seedling shortage, and lack of preferred species for planting), while 19 % respondents mentioned reasons such as land shortage and insecure land tenure as reasons discouraging to the practice of tree-planting. Government nurseries were the main source of tree seedling according to (52.7%) respondents, while nurseries run by NGOs were mentioned by (7.5%) respondents as providing tree seedlings. A combination of private, community and government nurseries was mentioned by respondents (39.8%) as the source of tree seedlings. Nonetheless, a majority (86.6%) of the respondents engaged in tree-planting was not satisfied with the species and number of seedlings provided to them. Planted trees were mainly within home compounds (41.4%), and in the form of woodlots (21.2%), or as woodlots only (11.1%). The remaining trees were planted along roadsides (26.3%). Despite the all rounded benefit derived from the agroforestry practices noted in the study area, their development and expansion were constrained by various factors. Major constraints to the tending of trees, mentioned by the respondents included: termite damage at an early stage (seedling establishment), land shortage, lack of technical assistance (such as lack of required species and amount of seedlings), pests especially on fruit trees like Mangifera indica and free grazing system. Free grazing system has a negative effect on the conservation efforts, as trampling animals often damage planted seedlings in open fields as well as physical conservation structures such as stone terraces and soil bunds. Forest grazing clearly had a strong negative effect on germination, seedling survival and growth of seedlings although specie effects are different to some extent [20].

Conclusion

Home garden, parkland, woodlot, live fences, farm boundary planting, trees on pasture land, roadside tree planting and tree planted for soil conservation were the most common types of agroforestry practices identified in the study area. These practices were played an important means for human wellbeing and livelihood strategy which enhance household incomes and sources of wood products of the rural households. Regardless of the all rounded benefit derived from the agroforestry practices noted in the study area, their development and expansion were constrained by various factors. Major constraints to the tending of trees, mentioned by the respondents included: termite damage at an early stage of seedling establishment, land shortage, lack of technical assistance, free grazing and pests. Therefore, research and development efforts towards the improvement of agroforestry practice should be done by introducing new technologies so as to further improve the livelihoods of farmer and smoothly address their constraints.

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