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Assessment of Usage Diversity of Agroforestry Tree Species in Hadiya Zone, Southern Ethiopia

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Abstract: Diversification of products and services from agroforestry trees of Ethiopia becomeimportant for sustainable farming systems. This study was conducted with the aim to investigate usagediversity of tree species. At farm level different tree species were counted, listedand recoded. The DBH of all trees and shrubs ≥5cm was measured. The average basal area per farm was 11 m^2 (12 m^2 per ha), with a range between 0.74 –59 m^2 per farm (2.3–35.8 m^2 per ha).Sixteen different usage typeswere identified, of which fuel wood holds the largest percent followed by both pole and medicinal use.Different 65 species of trees were recordedin terms of the mean important Value Index (IVI), of which Eucalyptus species ranked first (57), followed by Cordiaafricana (50.4), Croton macrostachyus (33),Erythrinaabyssinica (31.4), and Cupressuslusitanica (19). The IVI of these five species accounted for more than 30% of the total IVI. Usage diversity is well recognized in the study area but further studies of trees and use diversity in relation to soil fertility in particular and environmental Management in general seems important.

Key words: Diversity • Farm • Trees • Types • Usage

Introduction

Historically many traditional farming systems consisted of an integration of agricultural and tree crop production. Sometimes animal husbandry was also included. These systems provide not only final production for human usage, but also the inputs for further production. According to various evidence, such combined agricultural and forestry activities were practiced both in temperate and tropical regions for many countries(Murthy 2017, Wari et al 2019). Population pressure with other supplementary factors increased pressure on the land that resulted in diminishing forest areas in many parts of the tropics. Additional factors to be considered as contributing agents in the decreasing of forest areas are: Competition for land between agriculture and forestry, various time scales in production cycle, the benefits of forests are often dispersed, many occur outside the direct forest area and Insufficient knowledge of the possibilities of forestry (UAS 2017).

Thus, gradually it appeared that due to several factors, the recognition of agroforestry took place. Improved systems have been started in more recent times thatare in 1975 by the international development research center of Canada. Consequently, ICRAF was established (1977)with main objective of promoting national agroforestry technologies/practices launched rapidly since the early 19780's and has resulted in greater understanding of the science of agroforestry. According toSharma and Vetaas (2015)much of these understanding have come from conservation of existing practices and system.

In most parts of the developing world, rural people recognize the role of trees in providing a number of important goods and services (Jara et al 2017, Verheyen et al 2013). Farmers actively plant or protect trees on their farms can be seen as an indicator of the fact that they appreciate trees in their farming systems (Endale et al 2017). Farmers in many situations have historically taken up the planting and management of trees on their lands, to provide the needed outputs (Arya and Sunny 2016).Increasing environmental degradation, particularly deforestation, thus calls urgently for increasing tree planting of the right species at the right place for the right purpose (Fischer et al 2019)or for improvement of the management system of existing tree resources on farmlands, rangelands and other areas. Diversification of construction-wood and timber production may be more relevant.

Studies in several other areas showed that farmers are using their lands for planting tree species of economic value on the farm, usually around the houses, working out overtime the most efficient and sound mixture and structure of different species(Amare 2018).To investigate the distribution of tree species on farmlands for various products and services, it may be beneficial to investigate the relationships of some farm and household characteristics with tree species richness and use-diversity(Derero et al 2020, Anglaaere et al 2011). This general issue, in Hadiya zone where information on the relationships of farm characteristics with on-farm usage diversity of tree species is not studied. Only a number of studies, however, have been conducted on the agroforestry landuse systems of homegarden species diversity (Eshete et al 2016, Kewessa et al 2015) and other studies at farm-level tree-species diversity (Mengistu and Asfaw 2016) However, none of them have conducted their studies in on how usage diversity of tree species. Thus, the focus of this study is therefore to understand the usage diversity ofagroforestry treespecies on farms.

Materials and methods

Description of the study area

The study area is geographically located in $7^{0}07'$- $7^{0}92'$N Latitude and $37^{0}29'$-38^{0} 13'E Longitude. Topography of the study area is rugged high land and hilly areas with range of slope from 2-35 percent. Generally the terrain is mountainous, undulating and broken type that is very much prone to soil erosion. The town of Hadiya is Hosanna, the capital of the zone. It is situated North of Hawassa (capital city of South Nations Nationalities Regional State) and 198 km away from it.

Historically, dense indigenous natural forests covered Hadiya, but the distribution of natural vegetation is declining from time to time, owing to human interference. Currently forest coverage of the study area is only 14% of the total land area (DAaNRD 2012). Tree species scattered on farms include, *Podocarpusfalcatus*, *Ekbergiacapensis*, *Hageniaabyssinica*, *Cordiaafricana*, *Millettiaferruginea*, *Croton macrstachyus*, *Scheffleraabyssinica*, *Ficussur*, *Prunusafricana* and *Erythrinaabyssinica* while *Eucalyptusspp* are grown around the boundaries, life fences and woodlots. Agriculture is the principal source of livelihood for the community. It is characterized by subsistence-level mixed farming of rain-fed crops, and livestock production together with trees planted for agroforestry. In the zone crops such as ‘’enset’’ (*Ensetvenrtricosum*), barley, maize, wheat and ‘’teff’’ are the most commonly cultivated crops in order of their importance. ‘’Enset’’ is the staple food crop for the majority while coffee (*Coffeaarabica*) and ‘’chat’’ (*Chataedulis*) are the dominant cash crops in some peasant associations. Climatically, the district is classified into mid-altitude and high-altitude, and the highland part holds more than 60% of the total land area. It has a bimodal rainfall distribution with a mean annual precipitation varies between 801 - 1400mm and a mean annual temperature of 10.54°C - 22.54°C (DAaNRD 2012).

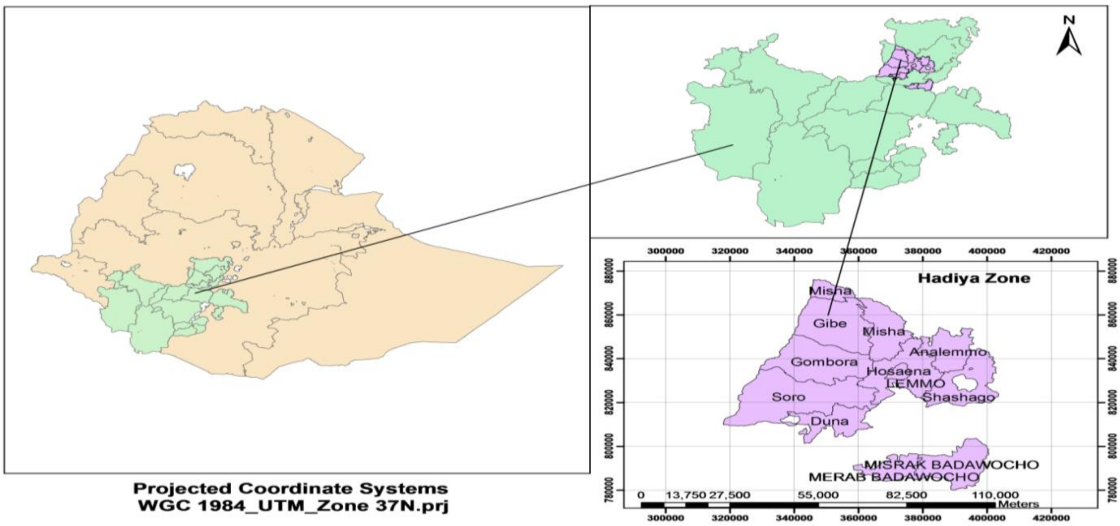

Figure 1: Map of the study area

Sampling techniques

In order to have a fair representation of sites, stratified purposive sampling procedure was used. From the zone, four representative Woredas namely Lemo, Sorro, Misha andDuna were selected. Main criterion used by the key informants (selection was done by adapting techniques used by(Tadesse et al 2019, Vargas-Larreta et al 2020).

Data collection

A complete on-farm tree inventory (trees defined as woody or ligneous plants including shrubs) was made on farms of 60 households by adapting technique of (Anglaaere et al 2011). At farm level, the total area of the farm and the area of each farm field were measured, and the different tree species grown on it were counted and listed, including local and scientific names. On individual fields, Diameter at Breast Height (DBH, 1.3 m) of all trees and shrubs ≥5 cm DBH was measured with a diameter tape and caliper. In identifying tree species occurring on farmers' fields, local names provided by the owners were identified in the herbarium named according to (Berihun and Molla 2017).Data were collected by the researcher and enumerators (agricultural technicians employed for the purpose of data collection).

Data analysis

To examine the relationship between diversity indices and farm characteristics, farms were quantified and characterized in terms of their degree of diversity. Analysis of data was carried out using Statistical Package for Social Sciences (SPSS) Version 25. To assess the relationships between farm characteristics and tree diversity and number of trees on farm, Pearson Correlation with Tukey-test and (Sarkar et al 2020) indices were used (Danneyrolles) et al 2020)in consideration of Important Value Index (IVI) (Morandi et al 2020).

Measurement of diversity

The Shannon-Wiener function (commonly referred as Shannon diversity index) is the most widely used type of diversity index (Salami and Lawal 2018).It measures the uncertainty that, how difficult it would be to predict correctly the species of the next individual collected in the sample (Asigbaase et al 2019).Two components of diversity are combined in the Shannon diversity index: (1) the number of species and (2) equitability or evenness of allotment of individuals among the species (Asigbaase et al 2019). The Shannon diversity index is calculated as**:**

$$H' = - \sum p_i \ln p_i$$

where; H' = Shannon diversity index, P_i = proportion of individuals found in the i^{th}uses.

Values of the index (H') usually lie between 1.5 and 3.5, although in exceptional cases, the value can exceed 4.5 (Salami and Lawal 2018).Usually, Shannon diversity index place most weight on the rare species in the sample [23].

Equitability (evenness)

$$J = \frac{H'}{H'_{\max}} = \frac{\sum_{i=1}^{s} p_i \ln p_i}{\ln s}$$

where s = the number of species

H', and P_i = as above

The higher the value of J, the more even the species is in their distribution within the sample (Salami and Lawal 2018).

Results And Discussion

Wood production

The overall mean number of stems per farm and per ha was 724 and 705 respectively. Comparison of the number of stems at the Woreda level indicated a significantly higher value (P<0.05) of mean number of stems per farm and per ha at Sorroworeda(Table.3)

When comparing mean number of stems on farms of different wealth categories, highest number of stems per farm was from wealthier households due to their larger farm size than both medium and poor ones. However, higher number of stems per ha was observed on farms of poorer farmers due to the intensity of poor farmers to utilize their smaller plot of land.

Basal area

The average basal area on farms of the study sites was 11 m^2 per farm (12 m^2 per ha), having variations between sites, among Woredas and households. The mean basal area of trees per farm and per ha varied significantly between sites (P<0.05). Farms at the Ana-ballessa site had a higher mean basal area of 15.8 m^2 and 17.8 m^2 per farm and per ha, respectively (Table 1). The mean basal area per farm at the Ana-ballessa site was twice as high as that at the Wosheba site, while the mean basal area per ha was about three times higher than that at Wosheba, indicating that farms in Ana-ballessa site are rich in basal area.

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When the basal area per farm of different wealth categories at the site level is compared, farms of wealthy households had higher mean basal area per farm than both medium and poor households (P<0.01; Table 1). At the Ana-ballessa site, farms of all wealth categories had higher mean basal area per farm and per ha than their counterparts at Woseheba(Table 1).Mean basal area (m^2) of trees on farm at two study sites. In each site 30 farms were analyzed. Variation in mean basal area per farm and per ha was also detected at the Woreda level (F-test, P<0.05; Table 3). The lowest mean basal area of 4.7m^2 per farm (4.8m^2 per ha) was recorded at Misha Woreda. The largest basal areas (58.9m^2) per farm and per ha (35.8m^2) were recorded in Sorro Woreda while the smallest basal area (0.74 m^2) per farm was also at Misha Woreda. Comparison of mean basal area per farm and per ha of the three wealth categories at the Woreda level showed that wealthy households had higher mean basal per farm than other wealth categories at all Woredas. But the largest mean basal area per ha was recorded on farms of poor households at Ana-ballessasite (Table 2).

Table 1: ***Mean basal area***

Site	Basal area per farm		Basal area per ha	
	Mean	Std	Mean	Std
Wosheba	6.0b[1)]	5.0	5.9b	3.0
Ana-ballessa	15.8a	11.3	17.8a	7.2
Mean	11.0	10.0	12.0	8.1

1) Different letters following vertical mean values indicate significant difference (P<0.05) in mean basal area between sites.(Source: Survey result)

Table 2: ***Mean basal area at two study sites***

Site	Wealth status	Basal area per farm		Basal area (m^2) per ha	
		Mean	Std	Mean	Std
Wosheba	Poor	2.1c[1)]	1.4	6.0a[1)]	3.3
	Medium	6.3b	1.7	7.3a	3.2
	Rich	10.2a	6.6	4.3b	1.7
Ana-ballessa	Poor	7.5b	4.3	21.5ab	8.6
	Medium	15.0ac	5.4	19.5ab	5.0
	Rich	24.8ab	14.0	12.5ac	4.2

1) Different letters following vertical mean values indicate significant difference in mean basal area between wealth categories (P<0.05) at two study sites. (Source: Survey result)

Table 3: ***Mean basal area (m^2) at four study woredas***

Woredas	Basal area per farm			Basal area per ha		
	Mean	Min-max	Std	Mean	Min-max	Std
Misha	4.7b	0.74 - 9.2	2.7	4.8b	2.3 - 8.2	1.9
Duna	7.5b	1.0 - 22.2	6.5	7.1b	3.2 - 15.4	3.6
Sorro	17.7a	4.2 - 58. 9	14.8	19.6a	4.8 - 35.8	8.8
Lemo	13.8a	1.8 -22.7	6.1	16.0a	8.2 - 24.1	4.7
Total mean	11.0	0.74 - 58.9	10.0	12.0	2.3 -35.8	8.1

1) Different letters following vertical mean values indicate significant difference between Woredas (P<0.05). (Source: Survey result)

Usage diversity

Types of usage

A total of 16 use types were recognized each represented by 3 to 78 species of trees and shrubs (Table 4) and an average of 25 species (23 %) were found for each use type on each farm. This shows that most of the species recorded were represented in each use type. Of the average 29 tree species per farm identified, species for fuelwood accounted for 72% followed by poles, and medicines, and the shade.

The mean Shannon-Wiener index for the use types ranged between 0.19 - 3.0 with mean of 1.83 while the evenness values ranged between 0.17 - 0.75 with mean value of 0.60 (Table 4). Fuel wood with the largest number of tree species, had also the largest Shannon index value.

Wood production

The density of stems per ha ranged between 216 – 2038, with an average of 705. The high density of trees on these farms is in agreement with earlier reports of (Gamachu and Jegora 2019, Mekuria et al 2018) where the average density of trees per farm ranged between 86–1082, with an average of 475 trees per ha. It also agrees with the report of (Mengistu and Asfaw 2016) where the mean number of stems per ha ranged between 231–2477, with an average of 1610 trees per ha. Similarly, an average density range of 731–1669 trees per ha was also reported by (Bekele, 2018) from Ethiopia, where agro-ecological and demographic factors are similar to those in the present study area. The high density of trees (mainly, *Eucalyptus*spp, *Vernonia*sppand *Euphorbia abyssinica*), in some farms is attributed to trees planted at very high densities on woodlots and along boundaries. In some farms, dense live fences of *Euphorbia abyssinica* and *Eucalyptus* species were found. *Euphorbia abyssinica* is grown for its life fence and local construction purposes while *Eucalyptus*spp are grown densely for its long and slender poles. Trees dispersed on croplands have low density, to reduce competition with other agricultural crops. Such low density of trees on croplands for the purpose of minimizing competition with other agricultural crops was also reported by (Silva et al 2020).

The number of stems per farm ranged ''between'' 74 – 2086 with an average of 724. At the site level, Ana-ballessa, with less access to the forest, had a higher mean number of trees per farm and per ha than Wosheba, with 602 and 589 trees per farm and per ha, respectively. The high number of trees per farm and per ha at Ana-ballessa site with less access to the forest is in agreement with the conclusion of (Mgumia 2017).

At the Woreda level, the highest mean number of trees per farm and per ha was recorded at Sorroand LemoWoredas, respectively. The lowest mean number of trees per farm and per ha was observed at MishaWoreda, which is closer to the forest. Since they have more access to the forest, farmers at MishaWoreda take less attention to plant and diversify trees on their farms. Regarding wealth categories a greater number of stems per ha was found on farms of poor farmers indicating the intensity of poor farmers to utilize their smaller farms. The presence of a greater number of stems per ha on smaller farms was also reported by (Tafere and Nigussie 2018) from Ethiopia.

The wood resource was also estimated in terms of basal area per farm and per ha. The basal area of trees on sample farms ranged between 2.3–36 m^2 per ha with mean of 12 m^2. The mean basal area per ha obtained in the present study, is about twice higher than that reported by (Mengistu and Asfaw 2016). The low intensive exploitation of tree products due to low commercialization of wood products together with the poor road network infrastructure contributed for the presence of more number of stems on farms that resulted in more basal area per ha in the present study area.

Usage diversity

The number of tree species grown in different farm fields is an important indicator of diversity. However, from the utility point of view, it is not only the number that matters, but also the diversity in the uses of trees. Diversity is a strategy through which small-scale, resource-poor farmers, sustain the production of a variety of goods(Balcha 2016, Nero et al 2018).By growing different foods and non-food plants, farmers meet the household food necessities, including food, fodder for livestock, fuel-wood, poles, timber, medicine, farm tools and fibers for making clothes. While on-farm trees are important in providing both ecological and economic benefits, they are also very important for the provision of social and cultural benefits to the individual farmer and to the community. Trees are cultivated and retained on farms for ornamental and medicinal uses. It is also important to consider the importance of shade in the lives of the farmers.

In the present study, about 16 major use types were identified on the basis of interviews with farmers. On average 25 species were found for each use type ranging ''between'' 3 to 78 species. The average number of species per use type in the present study exceeds a similar study reported by (Gachuri et al 2017from central Kenyaand (Desalegn and Jagiso 2020) fromEthiopia,where the number of species per use type ranged ''between'' 9.4 to 10.1 with an average of 9.7 species per use type. The presence of many species of trees contributes to the diversification of tree products. The highest number of tree species (72%) on farms of the present study was used as source of fuel-wood. Poles and medicines each accounted for about 40% of the total number of tree species.

On farm trees are also used as source of food. More than 20% of trees and shrub species in the present study were used to provide food. Apart from the specific products for which trees are planted, farmers also use trees in maintaining soil fertility and for soil conservation. Twenty-seven per cent of the species identified were used for maintaining soil fertility. Fiber and basketry were use types with the lowest number of tree species. The tradition of using ''enset'' leaf sheaths as the main source of fiber and basketry could be the probable reason for the very few or no tree species that are used as a source of fiber and basketry. Many species of trees and shrubs had several uses. Therefore the sum of total richness of individual uses exceeds overall species richness. Such method of putting greater diversity of tree species in to uses is a method of increasing farmer benefits and to conserve tree diversity on farms as reported by(Samuel et al 2019).The many products and services, and roles the tree species provides cannot be delivered by a few species only. As a result farmers have a wide variety of tree species on their farms. Furthermore with decreasing of off-farm tree resources, a use-base conservation of tree species on farms is increasingly important.

The accumulated knowledge of farmers helps them to integrate trees on their farms for various uses. According to(Kobayashi and Mori 2017) suchusage diversity of tree species could be an important insurance policy for farmers, a typical feature of subsistence farming communities in the tropics. The availability of tree species on farms with different uses also saves time and energy spent in collecting these products from distance forests and reduces threats to trees off-farms.

To evaluate the importance of individual trees at the farm level, the IVI of individual tree species was estimated. The higher IVI value for individual tree species in farms of all wealth categories most likely explained a better contribution of tree species to wealth categories. *Eucalyptus* species ranked first in terms of the mean IVI (57), followed by *Cordiaafricana*(50.4), *Croton macrostachyus*(33),*Erythrinaabyssinica* (31.4), and *Cupressuslusitanica* (19). The IVI of these five species accounted for more than 30% of the total IVI. These tree species have higher economical or ecological value to the farmers is similar to that of (Pahon et al 2016, Uthappa et al 2016).*Croton macrostachyus*is a fast growing indigenous tree species common in the study area. It is an important shade tree on farms where it provides mulch and protection to the understory. It produces poles for local construction and for the manufacture of tool handles. The wood is also used as a source of fuel.

With regard to species occurrences*Croton macrostachyus* which is the most frequently occurring tree species in 97% of the farms and used to provide fuel-wood, poles, medicine, bee forage, soil fertility, farm tools and shade. *Cordiaafricana* is one of the multipurpose tree species that provides multiple benefits. It provides shade and mulch in coffee and it increases the soil fertility. The wood produces durable quality timber that is used for the manufacture of furniture, doors, beehives and farm tools. It is also used to provide fuel wood. *Perseaamericana*, which has a high economic value in the study area, ranked first in its IVI among the tree species used for fruits. It provides medicine, bee forage, fodder, and shade and cash income to the farmers in harmony with(Felix and Nasution 2017, Sen 2018, Fichtner et al 2017).

Table 4: ***Species richness and usagediversity of trees and shrubs*** *(n=108)*

S No.	Use type	Species Richness	Species Percent	Shannon index (H^1)	Evenness (E)
1	Timber	29	27	2.1	0.60
2	Fuel-wood	78	72	3.0	0.70
3	Pole	43	40	2.7	0.71
4	Food	23	21	2.0	0.62
5	Medicine	43	40	2.8	0.74
6	Bee forage	30	28	1.9	0.57
7	Soil fertility	29	27	2.5	0.73
8	Farm tools	29	27	2.4	0.72
9	Fodder	21	19	2.0	0.65
10	Shade	34	31	2.6	0.74
11	Beehive	4	4.0	0.52	0.37
12	Life fence	14	13	1.43	0.54
13	Cash	14	13	2.0	0.75
14	Ornamental	4	4.0	0.83	0.60
15	Fiber	3	3.0	0.19	0.17
16	Basketry	3	3.0	0.25	0.23
	Mean	25	23.0	1.83	0.60

(Source: Survey result)

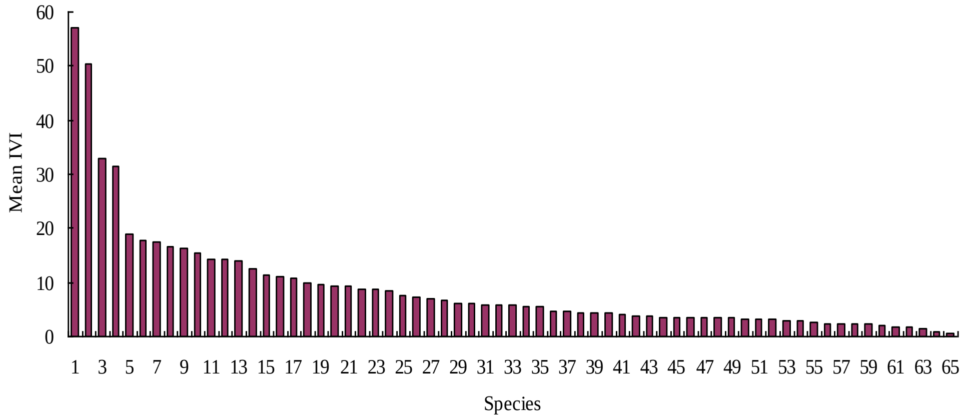

Figure 2: Mean important value index (IVI)

Important value index (IVI)

IVI indicates the importance of individual tree species at farm level and helps in assessing the contributions of each tree species. In all sample farms assessed *Eucalyptus spp* which is densely planted and used for timber, fuel-wood, poles and cash income ranked first with mean IVI of 57(Turkis and Elmas 2018, Koda et al 2020) followed by *Cordiaafricana*, *Croton macrostachys*, *Erythrinaabyssinica*and

Cupressuslusitanica(Figure 2). The IVI also vary with the wealth status of the sampled households. Farms of wealthy households had higher mean IVI than those farms of medium and poor households. But the higher mean IVI of fruit-tree species from *Perseaamericana*, *Citrus sinensis*, and *Psidiumguajava* from farms of poor households were higher than those from medium and wealthy households. The mean IVI of *Cordiaafricana* was higher than those tree species which were officially declared endangered at the national level.

There was also variation in mean IVI of tree and shrub species among the Woredas. For instance the highest mean IVI of *Eucalyptus spp* was recorded on wealthy farmers' farms at LemoWoreda. Most of the tree species with higher IVI were indigenous although *Eucalyptus* species ranked first which is similar to the study of(Zafriakma et al 2020, Jegora et al 2019).Mean IVI of trees and shrub (≥5cm dbh) species in ranking order recorded on farms of the study sites were indicated (Figure 2).

Table 5: ***List of trees and shrubs species identified in the study area***

No	Woody Species	IVI	No	Woody Species	IVI	No	Woody Species	IVI
1	*Eucalyptus spp*	57	23	*Podocarpusfalcatus*	10	45	*Acokantheraschemperiana*	5.7
2	*Cordiaafricana*	50.4	24	*Erythrinabrucei*	9.8	46	*Hypericumrevoltum*	5.7
3	*Croton macrostachyus*	33	25	*Dracaena steudneri*	9.5	47	*Aninigeriaaltissima*	5.7
4	*Erythrinaabyssinica*	31.5	26	*Oleaafricana*	9.4	48	*Sesbaniasesban*	5.7
5	*Cupressuslusitanica*	19	27	*Pinuspatula*	9.3	49	*Citrus sinensis*	5.7
6	*Coffeaarabica*	17.8	28	*Juniperusprocera*	9.1	50	*Cassia didmobotrya*	4
7	*Prunusafricana*	17.5	29	*Syzygiumguineense*	8.9	51	*Psidiumguajava*	4
8	*Syzygiumguineense*	17.2	30	*Perseaamericana*	8.8	52	*Annonareticulata*	4
9	*Millettiaferruginea*	17	31	*Ricinuscommunis*	8.5	53	*Mimusops kummel*	3.6
10	*Euphorbia abyssinica*	16.9	32	*Lepidotrichiliavolkensis*	8.5	54	*Maytenusarbutifolia*	3.6
11	*Vernoniaauriculifera*	16.5	33	*Hageniaabyssinica*	8.4	55	*Morus alba*	3.4
12	*Vernoniaamygdalina*	16.5	34	*Carica papaya*	8.4	56	*Flacourtiaindica*	3
13	*Grevillearobusta*	16.3	35	*Calpurnia aurea*	8.4	57	*Acacia decurrens*	3
14	*Ficussur*	14.2	36	*Acacia saligna*	8.2	58	*Acacia abyssinica*	3
15	*Bersamaabyssinica*	13.3	37	*Oleacapensis*	8.1	59	*Sapiumellipticum*	3
16	*Polyciasfulva*	12.2	38	*Celtisafricana*	8	60	*Dodoneaangusitifolia*	2.8
17	*Apodytesdimidiata*	12.1	39	*Casimiroaedulis*	8	61	*Embeliaschimperi*	2.5
18	*Ekbergiacapensis*	11.5	40	*Ehretiacymosa*	8	62	*Acacia melanoxylon*	2.5
19	*Albizziagummifera*	11.3	41	*Scheffleraabyssinica*	6.3	63	*Euphorbia pulcherrima*	2
20	*Celtisafricana*	10.2	42	*Tecleanobilis*	6	64	*Buddlejapolystachya*	1.5
21	*Maesalanceolata*	10.2	43	*Chataedulis*	6	65	*Dovyalisabyssinica*	1.3
22	*Fagaropsisangolensis*	10	44	*Pinusradiata*	5.7			

Conclusion And Recommendations

Conclusion

A complete assessment of agroforestry farm trees is mainly important for achievement of the prevailing situation of tree species richness and use diversity. By observing different use-related factors of the trees, and the number and the type of tree species grown on the farm and its uses, it is possible to achieve a better appreciative of existing tree-species and use diversity. Use diversity indices provide a summary statistic of diversity of tree species. Use diversity indices also provide important information on the commonness and rarity of species on farms. A total of 65 species of trees and shrubs were found on farms. Species-richness increased with increasing farm size. The density of trees largely depended on the planting pattern and composition of trees. Differences exist in the used diversity and composition of tree species among the sites, Woredas and households.

About 16 different usage types were identified, of which fuel-wood accounted for the largest number of species, followed by poles and medicine. Many species of indigenous trees, such as *Cordiaafricana*, *Croton machrostacyus*, *Erythrinaabyssinica*, *Milletiaferruginea*, *Albizziagummifera*, *etc*., are grown extensively in different fields because of their roles in providing shade and soil fertility, wood and other products. Tree species in different fields vary in their contribution of wood productivity. The mean basal area varied among villages and households due to some socio-economic factors, in particular, farm size and wealth status of the households. On average, 705 trees were grown per ha (724 per farm) of landholding. In terms of the mean IVI of individual tree species on farmlands, Eucalyptus species which is used for timber, fuel wood, poles and cash income ranked first, followed by *Cordia Africana*,*Croton macrostachyus*, and *Erythrinaabyssinica*.

Recommendations

Most of the studies so far highly focused on the diversity of tree species in natural forests. But there is limitation of study on use diversity of tree species at farm. Few studies so far conducted also focused on species diversity without taking in to consideration usage diversity.

Based on the findings of this study, the forwarded recommendations were, The study shown that extension efforts should be made to promote at introducing and expansion of multiuse trees on farms that help in improving the economic as well as ecological value of the farms. Hence, diversification of farms with multiuse tree species with the aim of enhancing productivity of individual farms becoming an important priority. Due to the wide range of farm variables that may impact tree and usage diversity at farm levels, studies that simulate or directly measure variations are useful.

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