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Research Article

Plant Species Composition and Conservation Values at Dilla University Botanical and Ecotourism Garden, Dilla, Ethiopia

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Ethiopia has a diverse topography with higher plant species composition and estimated to the higher proportion of endemic plant species. Currently, several factors drive natural forest destruction in the country, extensive agricultural land expansion triggered by increasing human population is probably the dominant force. The Dilla University Botanical and Ecotourism Garden was established targeting to rescue threatened flora from extinction, contribute towards conservation, and research on biodiversity and sustainable education as well as ecotourism development. The study was aimed to generate basic scientific information by identifying and documenting the formerly available plant species in to the garden and provide information for farther plant collection planning and research. Systematic sampling method was used to collect the vegetation data from 52 plots of 20 m × 20 m (400 m^2) quadrats. To collect data for herbaceous plants, five 1 m × 1 m subplots were laid in each of the main plot, where four were at the corners and one at the centre. Vegetation classification was performed using R-programme version 3.6.1 software packages. Shannon–Wiener Diversity Index was used to calculate species diversity, richness, and evenness. A total of 408 plant species, including trees (30%), shrubs (25%), herb (30%), grass (6%), and 9% of other species, were collected. The identified species belong to 287 genera and 105 families. Out of this, 27 species of plants are endemic to Ethiopia and 72 plant species were screened as a medicinal plant used for the treatment of human diseases. Based on IUCN Red Data List, among the endemic plant species nineteen species were least concern; two were near threatened; two were endangered while four were vulnerable. Three vegetation community types were identified from the hierarchical clustering analysis. The result designates that Dilla University Botanical and Ecotourism Garden has high plant species composition and diversity with a good distribution. The higher composition of this ecologically, economically, and socially important plant species at its early stage makes the garden a unique garden in the country and realize to be a centre for research, education, and tourist destination.

1. Introduction

Ethiopia has a diverse topography with higher plant species composition, where 6,000–7,000 species of higher plants exist in the country of which about 780–840 (12-13%) plant species are estimated to be endemic [1, 2]. However, these biologically rich resources of Ethiopia are vanishing at an alarming rate due to monocropping and expansions of road construction through vegetation are becoming other causes of deforestation. Currently, increasing rate of drought, desertification, and shortage of food for both humans and animals are becoming serious problems that need attentions [3]. Although several factors drive natural forest destruction in Ethiopia, extensive agricultural land expansion triggered by increasing human population is probably the dominant force [4, 5]. The indigenous agroforestry systems in the southeastern Rift Valley escarpment of Ethiopia were shown to maintain a high proportion of native tree species (86%). This is considerably higher than reported for traditional tree-crop and Enset-coffee agroforestry systems in the eastern and southern parts of Ethiopia [6–8].

Today the forest cover in Ethiopia is less than 3% compared with an average of 20% for sub-Saharan Africa [9]. The need for fuel wood, Forest conversion to farmland,

seasonally set forest fires, and over grazing areas have been indicated as the main causes of forest degradation; frequently leading to loss of forest cover and biodiversity, erosion, desertification, and reduced water resources [10].

The destruction of vegetation and environmental degradation has become issues of national and global concern in recent years. This is because of the fact that declining vegetation cover and depletion of natural resources are closely associated with drought and food shortages that have become major threat affecting the life of millions of people. The depletion of the natural vegetation in many parts of the country has also led to the threat and decline in number and distribution of many plant species [11].

According to Kelbessa et al. [12], 120 threatened endemic plant species are known from Ethiopia. Thirty-five of these species were from the Dry Afromontane forests of the country. Therefore, there is a need to conserve the natural vegetation. This could be achieved by appropriate management and use plans that include ecologically sound restoration or rehabilitation measures. There are diverse approaches and techniques to restore land and vegetation. Maintaining the Floristic composition, natural regeneration species, and conservation of the forest are among the approaches which closely linked with low cost in the form of *in-situ* conservation system.

Thus, establishing Botanic Gardens have significant role to save plant resources of special value from the looming destruction and eventual extinction. Botanic Gardens play major roles in strengthening conservation and care for plant species, particularly rare, economically important, and endangered species under threat by natural and manmade factors, including *ex-situ* conservation and appropriate scientific protection and care. It is accepted worldwide that Botanic Gardens are institutions working on conservation, care and research, and education services. Moreover, it also provides ecotourism services of natural attractions and aesthetic value from flower, seedling shops, and restaurant services.

Botanic gardens are delineated as a living museum that holds individual specimens or collections of plants for scientific, educative, conservation and aesthetic purposes. So that it defined, "Botanic gardens are institutions holding documented collections of living plants for the purposes of scientific research, conservation, display, and education." [13]. The botanic gardens have worked to prioritise the plants facing threat, take conservation action both *in situ* and *ex situ*, tackle overexploitation of individual species, inform and educate visitors and the wider public, and champion plants. The recently established Dilla University Botanical and Ecotourism Garden is located in southern part of Ethiopia, Gedeo zone, which is located on the escarpments of the south eastern Ethiopian highlands overlooking the Rift Valley. The site has geographical, archaeological, biological, cultural, and political values. Geographically, the site has different types of rocks and very attractive landscape, archeologically it has different engravings and cave, and biologically it is rich both in plants and animals biodiversity. So, the significance of the garden for conservation of Ethiopian biodiversity especially for low land and mid land plant biodiversity is unquestionable. The aim of this study was to generate basic scientific information on plants by identifying and documenting the formerly available and introduced plant species and vegetation structures of the garden. It will be important for the future plant collection planning for conservation, research, and education activities.

2. Methods

2.1. Site Descriptions. Dilla University Botanical and Ecotourism Garden (DUBEG) is the conservation initiative established since 2017 G.C. on 130 hectares in Gedeo zone at the west corner of Dilla town, Sesa sub-City, Odaya Kebele between main and Odaya campus of Dilla University. The vision of the garden is to achieve internationally renowned botanic garden, witnessing Ethiopia's floral richness and its centre of origin for many economic plants. The mission of the garden is to rescue threatened flora from extinction, contribute towards conservation, and research on biodiversity and sustainable education as well as ecotourism development. The geographical co-ordinates of the garden lies between latitude $6^{\circ}25'55.66''$ N and $6^{\circ}26'$ $44.6''$N and longitudes $38^{\circ}16'05.12''$ E and $38^{\circ}17'25.56''$ E (Figure 1). The garden is located 1 km northeast of Dilla town and 1.5 km north to Dilla University main campus. The site is bordering with Laga Dara River (Sidama zone) to North, Don Bosco pig production to South, Mejege River (Abaya woreda) to Weast and Saron log and Odaya campus of Dilla University to East.

The site has geographical, archaeological, biological, cultural, and political values. Geographically, the site has different type of rocks and very attractive landscape, archeologically it has different engravings and cave, and biologically it is rich both in plants and animals biodiversity. Culturally, the local people were using the site for different ceremony like wedding and different concerts. Politically the site is also the borderline of three administrates zones (Gujje, Geodo, and Sidama). Therefore, the area gives great opportunity to strengthen the relationship between the three zones with Dilla University, the university with other stakeholders.

In addition, DUBEG is a potential area for education, conservation, research, and recreation. It also has an access for infrastructure, water (3 rivers), road, relatively fertile soil, geographically it is attractive (ranging from sheltered gullies and streams, rivers, valley, gorge, caves, escarpment, to steep hillsides, and exposed hilltops), and it is near to the Dilla university. Other than these the area has rich source of indigenous crops, wild animals, cultural heritages (engravings of wild animals expected to the age of antiquity), and cave.

The garden activities have currently started on land about 20.7 hectares at the subsite locally called Waleme. Don Bosco Catholic Church protected this area for the last 30 years. At this site, the garden has two separate parts nursery site (2.6 hectares) and the main garden (18.1 hectare). The internal parts of the main garden also have different components, which are uses for various

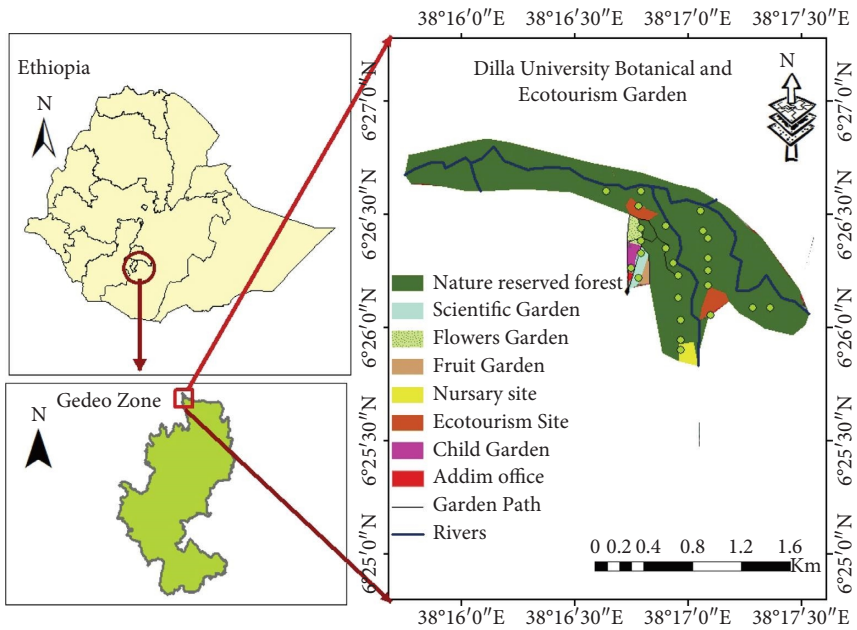

Figure 1: Map of the study DUBEG.

activities of the garden. Each of the garden components has a particular function. It has seven main components, such as Child Garden, Scientific Garden, Recreation site, Nursery site, Science Cafe, research and staff office, and Infrastructure which includes roads, irrigation system, store room, composite site, and compound (fence). The nature of these different components determines the primary opportunities for teaching and visiting.

2.2. Climatic Conditions. The analysis of Metrological data of monthly maximum and minimum temperature and monthly rain fall were taken from Addis Ababa National metrological Agency for the period 1988–2018. It showed that the mean annual temperature of the study area is ranging from a mean minimum of 8°c to mean maximum of 25.4°c. The mean annual rainfall of the area is 1,267 mm per year. The region indicates concentration of a bimodal pattern type of rain in the zone when long rain (mid-February to mid-may) and short rain (September to November) with in tiny and fine rain showers in June (Figure 2). The lowest mean temperature over 30 years was 8°c recorded in metrological data of Dilla station.

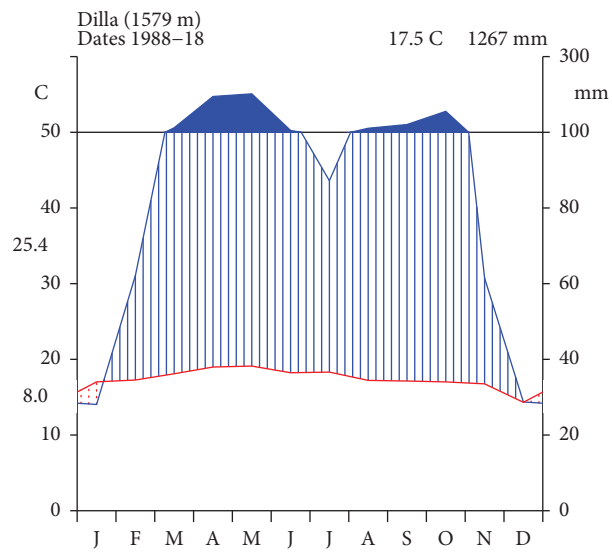

Figure 2: Map of climatic diagram of the district (Source: National Metrological Agency A.A).

2.3. Data Collection and Analysis

2.3.1. Sampling Methods. The vegetation data were collected from 52 plots of 20 m × 20 m (400 m^2) quadrats laid at every 50 meters along seven transect lines from south-north direction using compass. The distance between each transect line was 70 m laid in a zigzag form of starting point of laying plot. To collect data for herbaceous plants, five 1 m × 1 m subplots were laid in each of the main plot, where four were at the corners and one at the center. Plant species in each plot was counted and recorded at individual level; voucher specimens were collected, numbered, and pressed for further identification by using checklists and flora Ethiopia and Eretria [14]. Additional plant species occurring outside the quadrats, but inside the forest within 10 m distance, were also recorded only as "present" for floristic composition, but they were not used in the subsequent vegetation data analysis [15, 16]. The vernacular (local) names were used when available. Finally, socioeconomically important plant species and their status were screened based on the previous literatures.

2.3.2. Plant Community Determination. The vegetation data analysis was made based on species absence presence data. The diversity of voucher plant species were estimated by

using the Shannon–Wiener index (H′) and Simpson's dominance index (1-D) [17]. The computer R-programme version 3.6.1 Vegan package was used to analyze the vegetation data through Agglomerative Hierarchical Classification technique. The Euclidean distance and Ward's method were used for clustering the vegetation data. Its classification was made using cover abundance values as class labels. The clusters were assigned in number to indicate the individual communities' number.

3. Results

3.1. Floristic Composition. A total of 408 specimens of plants (herbs, shrubs, trees, shrubs/trees, climbers, and tree/climbers) were identified and documented from Dilla University Botanical and Ecotourism Garden. Oof them, 131 were introduced from a different area for the purposes of conservation and garden beautfication. Three species, *Ziziphus spina-christi, Ilex mitis, Eucalyptus citriodora, and Opuntia ficus indica,* and some annual plant species were collected outside the sampling plots for the purpose of documentation of available plant species. Those plant species was not incorporated in statistical data analysis. The collected species were composed of 32% trees, 32% herbs, 24% shrubs, 4% grass, 4% climbers, 1% liana, and 1% Fern and Epiphytes species (Figure 3).

The identified species belong to 287 genera and 105 families. The major families were Fabaceae represented by 44 species (10.81%), Poaceae and Euphorbiaceae each with 22 species (5.41% each), Asteraceae by 20 species (4.91%), and the remaining (48%) families were represented by one species (Table 1).

3.2. Plant Community Classification. The abundance data of a species were used for the analysis. R program Version 4.2.2 software (Vegan and labdsv package) was used to perform a hierarchical cluster dendrogram, which depicted the vegetation community of plant species. Three communities (clusters) were identified as a result of grouping of quadrates and designated as communities 1, 2, and 3 shown in the dendrogram (Figure 4).

The results of Sorensen's Similarity Index indicate the vegetative community similarity in species composition is slightly varied among communities. The highest similarity was observed between communities II and I (27.7%). The least similarity was observed between community II and III (18.1%) and relatively shares less species within the community. Overall similarity coefficient ranges from 18 to 28% among all the communities. Thus, species composition dissimilarities account for 72% for the most similar communities and 82% for those that share least similarity (community II and III).

Generally, the clusters represent the actual DUBEG components, community number one represents the nursery site and the protected forests along the river, community number two represents scientific garden and child garden sites, community number three represents recreation site and science cafe.

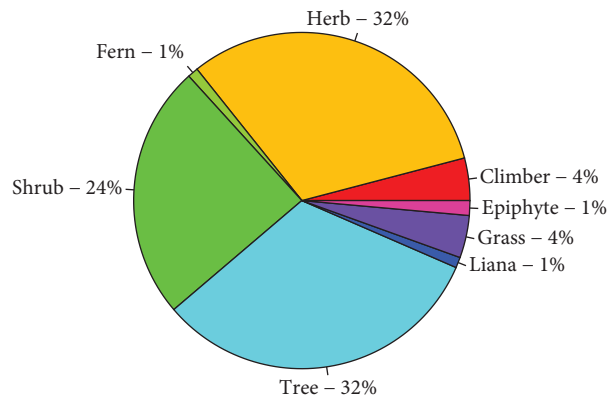

Figure 3: Proportion of life form of plant species collected from DUBEG.

3.3. Species Diversity. The Shannon–wiener index (*H*) for the communities reflect the deference in their species richness and evenness. Species diversity among the Community types is categorised from highest to lowest as Community-II > Community-I > Community-III and species evenness Community-II > Community-I > Community-III has the highest species richness and highest *H*'max. Community III has the least even distribution, the least diversity, the least species richness, and the least equitability. Generally, the three communities have almost the same species distribution (equitability or evenness) but comparatively community III has the least species evenness (Table 2).

Among the identified plants of the study area, 27 species (6.61%) were endemic plant species to Ethiopia. According to the IUCN Red Data List, one species was categorized as Nearly Threatened (*Maytenus addat* (Loes.) Sebsebe), one species as Vulnerable (*Echinops kebericho* Mesfin), and the others 25 of them are Least Concern (Table 3). These endemic species were composed of herbs, shrubs, trees, liana, and grass constitute 33.33%, 25.93%, 18.51%, 11.11%, and 3.70%, respectively.

Following a desk study to review the literature on ethnobotanical uses of plants, it was found that 72 plant species belonging to 38 families were screened as a medicinal plant used for the treatment of human diseases (Table 4). Accordingly, the life forms of medicinal plants reviewed belongs to 28 trees (38.89%), 17 shrubs (23.61), 21 herbs (29.17%), two climbers (3.81%), two liana (2.78%), and one grass (1.39%). As the referenced authers indicated, the traditional healers have harvested these medicinal plant leaves, roots, barks, seeds, fruits, stems, flowers, barks, seeds, or latex for treatment of human diseases.

For the documentation purpose, 408 plant species are listed by their botanical name following the Flora of Ethiopia and Eritrea Volume 1–8 and Natural Database for Africa (NDA). On CD-ROM Version 2 (Table 5). The higher plant species composition at its early stage rank Dilla University Botanical and Ecotourism Garden at the second level among the botanic garden (Gullale botanic garden) and other protected field Gen banks and make it a unique garden to the country.

Table 1: The number of families, genera, and species of plants in DUBEG (RF = relative frequency).

Family	Genera	Species	RF (%)
Acanthaceae	3	3	0.74
Acoraceae	1	1	0.25
Adiantaceae	2	2	0.49
Aizoaceae	1	1	0.25
Aloaceae	1	3	0.74
Amaranthaceae	2	4	0.98
Amaryllidaceae	2	3	0.74
Anacardiaceae	4	6	1.47
Annonaceae	2	2	0.49
Apiaceae	3	3	0.74
Apocynaceae	8	9	2.21
Aquifoliaceae	1	1	0.25
Araceae	8	8	1.97
Araliaceae	3	4	0.98
Araucariaceae	1	1	0.25
Arecaceae	2	2	0.49
Asparagaceae	7	6	1.47
Asphodelaceae	1	1	0.25
Asteraceae	11	20	4.91
Balsaminaceae	2	2	0.49
Bignoniaceae	4	4	0.98
Bombacaceae	1	1	0.25
Boraginaceae	3	3	0.74
Brassicaceae	2	2	0.49
Bromeliaceae	1	1	0.25
Burseraceae	1	2	0.49
Cactaceae	3	5	1.23
Cannabaceae	1	1	0.25
Cannaceae	1	1	0.25
Capparidaceae	2	3	0.74
Caricaceae	1	1	0.25
Caryophyllaceae	1	1	0.25
Casuarinaceae	1	1	0.25
Celestraceae	1	4	0.98
Combretaceae	2	12	2.95
Commelinaceae	2	4	0.98
Convolvulaceae	1	1	0.25
Crassulaceae	6	9	2.21
Cucurbitaceae	4	5	1.23
Cupressaceae	3	4	0.98
Cyperaceae	1	7	1.72
Dioscoreaceae	1	2	0.49
Dracaenaceae	1	3	0.74
Drynariaceae	1	3	0.74
Ebenaceae	2	2	0.49
Euphorbiaceae	11	22	5.41
Fabaceae	24	44	10.8
Flacourtiaceae	1	1	0.25
Geraniaceae	1	3	0.74
Hypericaceae	1	1	0.25
Labiatae	1	1	0.25
Lamiaceae	14	20	4.91
Lauraceae	1	1	0.25
Loganiaceae	3	3	0.74
Loranthaceae	4	4	0.98
Malvaceae	3	3	0.74
Marantaceae	2	2	0.49
Meliaceae	3	3	0.74
Melianthaceae	1	1	0.25
Menispermaceae	1	1	0.25

Table 1: Continued.

Family	Genera	Species	RF (%)
Mimosaceae	1	1	0.25
Moraceae	1	7	1.72
Moringaceae	1	2	0.49
Musaceae	2	2	0.49
Myrsinaceae	3	3	0.74
Myrtaceae	5	6	1.47
Nyctaginaceae	2	3	0.74
Oleaceae	3	4	0.98
Oxalidaceae	1	1	0.25
Papilionaceae	1	1	0.25
Passifloraceae	1	1	0.25
Phytolaccaceae	1	1	0.25
Pinaceae	1	1	0.25
Piperaceae	1	1	0.25
Pittosporaceae	1	1	0.25
Plantaginaceae	1	1	0.25
Poaceae	14	22	5.41
Podocarpaceae	1	1	0.25
Polygonaceae	4	5	1.23
Proteaceae	2	2	0.49
Pteridaceae	1	1	0.25
Punicaceae	1	1	0.25
Ranunculaceae	1	3	0.74
Rhamnaceae	3	5	1.23
Rosaceae	4	7	1.72
Rubiaceae	6	6	1.47
Rutaceae	6	6	1.47
Salicaceae	2	3	0.74
Santalaceae	1	1	0.25
Sapindaceae	1	1	0.25
Sapotaceae	2	2	0.49
Scrophulariaceae	1	1	0.25
Simaroubaceae	1	1	0.25
Smilacaceae	1	1	0.25
Solanaceae	6	9	2.21
Tiliaceae	2	2	0.49
Tropaeolaceae	1	1	0.25
Urticaceae	2	2	0.49
Verbenaceae	5	5	1.23
Violaceae	1	1	0.25
Vitaceae	3	3	0.74
Woodsiaceae	1	1	0.25
Zingiberaceae	4	4	0.98
Zygophyllaceae	1	1	0.25
Total	287	408	100

3.4. Discussions

3.4.1. Floristic Compostion. In this study, a total of 408 plant species, including shrubs, trees, shrubs/trees, herbs, epiphyte, liana, and grass, were recorded. Out of this, 27 species of plants are endemic to Ethiopia and 72 of plant species also have a medicinal value that is used for the treatment of human diseases. According to IUCN [24] Red Data List, 19 species were least concern, two were near threatened, and two were endangered, while four were vulnerable. Overall diversity and evenness were 1.79 and 0.09, respectively. According to Kent M. et al. [25], the Shannon–Weiner diversity index normally varies between 1.5 and 3.5 and rarely exceeds 4.5. In our study area, however, there is high diversity and evenness showing more or less even representation of individuals of most plant species in the sampled quadrats.

Vegetation classification is a powerful tool employed for several purposes, including efficient communication, data reduction, and synthesis, interpretation, and land management and planning. It also provides one way of summarizing our knowledge of vegetation patterns [26]. Hence, three plant community types were identified at the Dilla University Botanical and Ecotourism Garden. These three communities also represents the actual garden

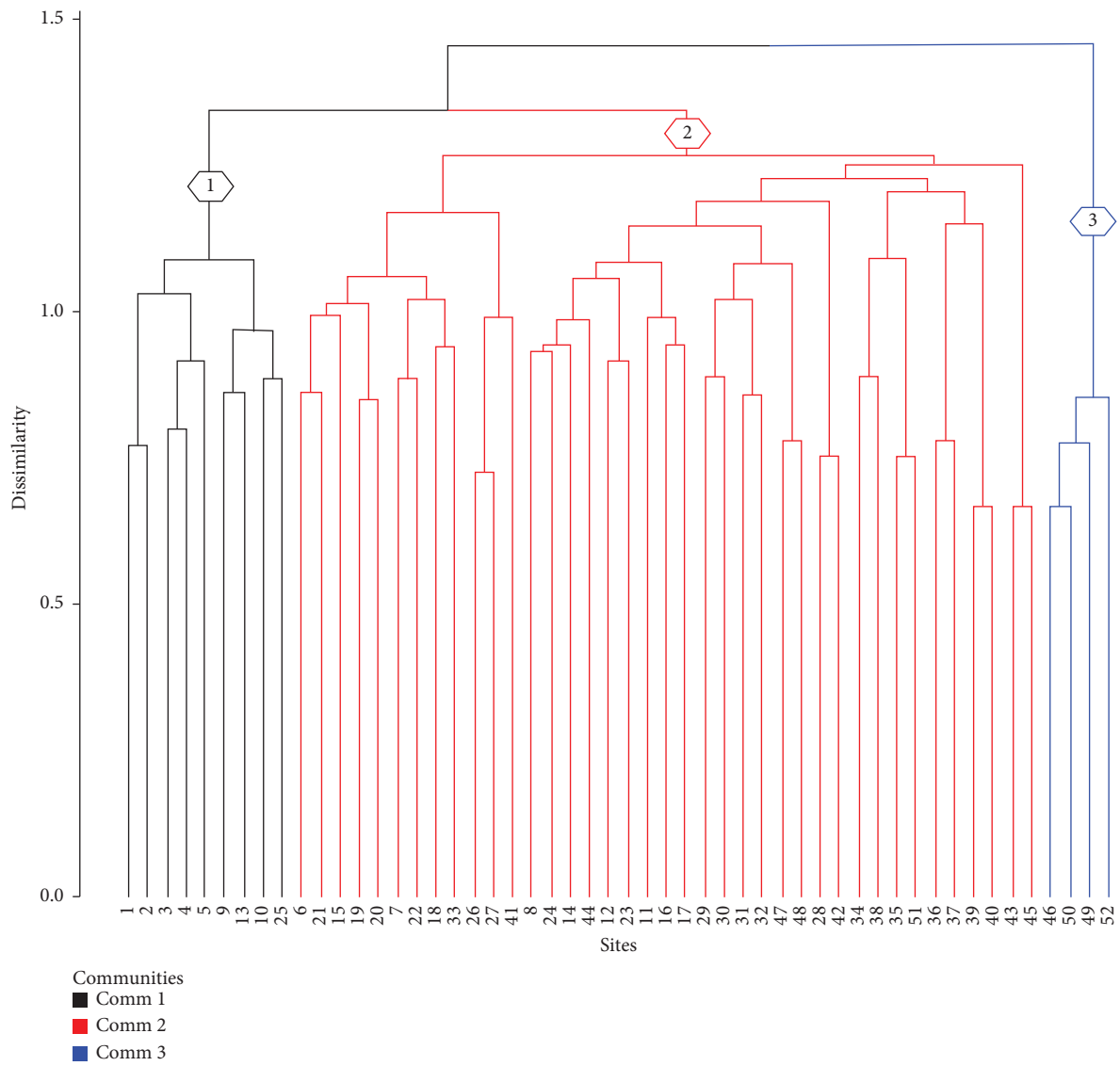

Figure 4: Dendrogram showing the plant community types of DUBEG.

Table 2: Species richness, evenness, and Shannon–Wiener diversity index of the plant community types.

Community types	Species richness (S)	Diversity index (H)	Simpson	Shannon evenness	Simpson evenness
Community 1	195	5.13	140.27	0.97	0.72
Community 2	232	5.31	170.91	0.98	0.74
Community 3	8	1.89	5.26	0.91	0.66

compartments. Community number three represents the scientific garden and child garden areas of the garden. This area is where high plant collection and plantation have been engaged. That is why this community was represented only by two plots. Species richness (number of species) was determined by summing up the number of species identified [27]. The diversity index [28] was computed for the three communities from the study garden. The different values of H' for the communities reflect the difference in their species richness and evenness. The minimum value of H' is zero, which a value for a community with a single species and increases as species richness and evenness increases. The variation in species richness and diversity may be attributed to varation in altitude, latitude, and soil gradient and disturbance factors [29]. The relatively higher similarities between community types IV and I is probably due to the similar environmental conditions and their similar altitudinal range.

Table 3: List of endemic species of DUBEG, their habit, and IUCN red list categories.

Scientific names	Family	Habit	IUCN red list category [18]
Acacia negrii Pic.-Serm.	Fabaceae	T	VU
Aloe gilbertii Sebsebe & Brandham	Aloaceae	Sh	LC
Bidens ghedoensis Mesfin	Asteraceae	H	LC
Clematis longicauda Steud. ex A. Rich.	Ranunculaceae	L	LC
Clematis hirsuta L.	Ranunculaceae	L	LC
Crotalaria awasensis Thulin	Fabaceae	Sh	LC
Daucus hochstetteri (wild carrot)	Apiaceae	H	LC
Echinops kebericho Mesfin	Asteraceae	H	VU
Erythrina brucei Schweinf	Papilionaceae	T	LU
Euphorbia bittataensis M. Gilbert	Euphorbiaceae	Sh	LC
Euphorbia uniglans M. Gilbert	Euphorbiaceae	T	EN
Ficus ruspolii Warb	Moraceae	T	VU
Kalanchoe laciniata L.	Crassulaceae	H	LC
Kalanchoe lanceolata (Forssk.) Pers.	Crassulaceae	H	LC
Kalanchoe schimperiana A. Rich	Crassulaceae	H	LC
Lippia adoensis Hochst. ex Walp	Verbenaceae	Sh	LC
Maytenus addat (Loes.) Sebsebe	Celestraceae	T	NT
Millettia ferruginea (Hochst) Bak.	Fabaceae	T	NT
Pelargonium boranense I. Friis & M.G. Gilbert.	Poaceae	G	LC
Rubus aethiopicus R. A. Graham	Rosaceae	L	EN
Solanecio gigas (Vatke) C. Jeffrey	Asteraceae	Sh	LC
Solanum marginatum L. f.	Solanaceae	Sh	LC
Thymus schimperi Ronnigeer	Lamiaceae	H	LC
Urtica simensis Steudel	Urticaceae	H	LC
Vepris dainellii (Pichi-Serm.) Kokwaro	Rubiaceae	Sh	LC
Verbascum stelarum Murbeck	Scrophulariaceae	H	LC

T = tree, Sh = shrub, H = herb, C = climber, NT = nearly threatened, L = liana, LC = least concern, and VU = vulnerable.

As reported by Dereje D. et al. [30], in addition to altitudinal gradient, other environmental factors such as aspect, slope, and soil physical and chemical properties have sound effects on patterns of vegetation in communities. The study conducted in a similar method at different areas of catchiment indicates 213 plant species were collected from Chilimo forest [31] and 80 woody species from Gamo Gofa Zone [32]. Although, a total of 155 socioeconomical important plant species were collected from natural forest and 65 plant species from home garden at Gedeo Zone, Wonago Woreda [33]. Comparatively, DUBEG is composed of higher ecologically and socioculturally important plant species. The accessible plantation of collected plant species from various areas for the purpose of conservation, research, and education in DUBEG at the site of scientific garden and child garden has a great role for the existed variation among the communities. The existence of higher plant species on these selected areas is also very important to make plant conservation awareness, education, and demonstration for peoples visiting the site. It is also important to enhance and increase awareness of cultural diversity as part of the conservation mission [34].

Table 4: Ethnobotanical uses of plants collected from DUBEG that used for the treatment of human diseases.

Scientific names	Habit	Diseases treated	References
Ajuga integrifolia Buch. Ham.	Herb	Antihypotensive, elephantiasis, breast massage	[19]
Allium sativum L.	Herb	Abdominal pain, malaria, "Mitch"	[20]
Aloe sps	Herb	Skin disease, gastritis	[19]
Artemisia absinthium L.	Herb	Evil eye	[21]
Asparagus africanus Lam. (Sarittii)	Climber	Sexual impotency	[22]
Balanites aegyptiaca (L.) Delile	Tree	Stomachache, diarrhea, headache	[19]
Bersama abyssinica Fresen.	Tree	Antimalaria, taeniafuge, wound treatment	[14, 20–23]
Brucea antidysenterica J. F. Mill	Tree	Anticancer, antimalaria, external parasite, parasiticdisease in children	[18, 20, 22]
Calpurnia aurea (Ait.) Benth.	Shrub	Amoebic dysentery stomachache	[22]
Carissa spinarum L.	Shrub	Gonorrhea	[21]
Casimiroa edulis La Llave	Tree	Gastritis, stomachache	[19]
Catha edulis (Vahl) Forssk. ex Endl.	Shrub	Hypertension	[14, 21]
Citrus aurantiifolia (Christm.) Swingle	Shrub	Hypertension, skin cutting, cough, gastritis, low blood pressure, hypertension	[14, 21]
Clausena anisata (Willd). Benth.	Shrub	Skin irritation	[20]
Coffea arabica L.	Shrub	Gastritis, "fancho," worms, alleviate stress and headache	[19, 22]
Combretum collinum Fresen. subsp. binderianum (Kotschy) Okafor	Tree	Obstructed labour	[18]
Combretum molle R. Br. Ex G. Don	Tree	Malaria	[21]
Cordia africana Lam.	Tree	Malaria, diarrhea, dental problem, stomachache	[13, 21]
Croton macrostachyus Del	Tree	Malaria, diarrhea, chiffea, black leg, taenicide, haemostatic	[16, 21]
Cucurbita pepo L.	Herb	Gonorrhea	[20]
Cynodon dactylon (L.) pers.	Grass	Wound healing, snake bites	[22]
Datura stramonium L.	Herb	Skin wounds, toothache, malaria, dingetegna, wart	[20–22]
Dodonaea angustifolia L.f.	Shrub	Skin wounds, thyroid, snake bite	[21]
Echinops kebericho Mesfin	Herb	Cough, headache	[19, 21, 22]
Embelia schimperi Vatke	Liana	Taenicide	[22]
Ensete ventricosum Welw.	Herb	Amoebic dysentery, chiffea, placenta delay, weight gain	[19, 21]
Entada abyssinica Steud. ex A. Rich.	Tree	Treat children diarrhea	[18]
Erythrina abyssinica Lam. ex DC.	Tree	Abdominal distention, and cramp	[20]
Eucalyptus globulus Labill.	Tree	Headache, Mitch, stomach-ache, cough, common cold, influenza, allergic	[19, 20]
Euphorbia abyssinica Gmel.	Tree	Hemorrhoid, skin wounds, gastro-intestinal, ascaris, gonorrhea	[20–22]
Euphorbia tirucalli L.	Shrub	Evil eye, epilepsy	[21]
Ficus sur Forssk.	Tree	Stomach ache	[19]
Ficus sycomorus L.	Tree	Hepatitis	[20]
Ficus vasta Forssk.	Tree	Stomachache, bloody urine, toothache	[19]
Hagenia abyssinica (Bruce) J. F.Gmelin	Tree	Diarrhea, weight gain, cancer, taenifuge	[19, 22]
Justicia schimperiana (Hochst.ex Nees) T. Anders.	Shrub	Rabies	[20]
Kalanchoe lanceolata (Forssk.) Pers.	Herb	Epistaxis (nasal bleeding)	[22]
Lantana camara L.	Shrub	"Chirt"	[19]
Leonotis ocymifolia (Burm. f.) Iwarsson	Shrub	Ascaricide	[22]
Lepidium sativum L	Herb	Mich, malaria, cough	[21]
Lippia adoensis Hochst. ex Walp	Shrub	Stomachache	[19]
Maesa lanceolata Forssk.	Tree	Snake bite, eye disease, elephantiasis	[20–22]
Moringa stenopetala (Baker f.) Cufod	Tree	Amoeba, hypertension, malaria	[19]
Nicotiana tabacum L	Herb	Hemorrhoid, diarrhea, gonorrhea, toothache, snakebite, headache, tick	[21]

Table 4: Continued.

Scientific names	Habit	Diseases treated	References
Ocimum lamiifolium Hochst. Ex. Benth	Shrub	Mich, evil eye, cancer, anthelmintic	[21, 22]
Ocimum gratissimum L.	Herb	Allergic	[20]
Olea europaea L. subsp.cuspidata (Wall. ExG.Don) Cif.,L' Olivicoltore	Tree	Hemorrhoid, skin wounds, scabies	[21]
Osyris quadripartita Decn	Shrub	Stomachache, cough, swelling	[19]
Phytolacca dodecandra L'H' erit.	Liana	Sinus, anemia	[20]
Prunus africana (Hook.f.) Kalkm	Tree	Benign prostatic hyperplasia, prostate gland hypertrophy	[20]
Psidum guava L.	Tree	Eye disease, gastritis, worms, headache	[19]
Rhamnus prinoides L'Herit	Shrub	Chiffea, snakebiteQuaqucha, stom ach-ache,gastritis, wound, fever in children	[18, 19, 21]
Rhus natalensis Krauss	Tree	Malaria, cough	[21]
Rubus steudneri Schweinf.	Liana	Child cleaning, abortion	[19, 22]
Rumex abyssinicus Jacq.	Herb	Stomachache, kintarot, fever	[19, 22]
Rumex nepalensis Spreng.	Herb	Quaquchia, amoebic, dysentery, hypertension, hemorrhoid	[18, 21]
Ruta chalepensis L.	Herb	Stomachache, mich, malaria, evil eye, amoeba, headache, gonorrhea	[18, 19, 21]
Salix mucronata Thunb. (S. subserrata Willd)	Tree	Tooth abstraction	[22]
Salvia nilotica Jacq	Herb	Haemorrhoids, diarrhea	[21]
Schinus molle L.	Tree	Toothache, Mitch, housefly	[19]
Solanum incanum L.	Herb	Gonorrhoea, haemorrhoid, rabies, contraceptive, prenatal abortion	[21]
Stephania abyssinica (Dillon & N. Rich.) Walp	Climber	Stomach ache in children	[18]
Syzygium guineense (Willd.) DC.	Tree	Malaria, hemorrhoid, internal worms, snake bite, gonorrhoea	[21]
Terminalia brownii Fresen.	Tree	Anthrax, skin wounds	[21]
Thymus schimperi Ronnigeer	Herb	Cough medicine	[22]
Trigonella foenum-graecum L	Herb	Headache, stomach-ache	[22]
Verbena officinalis L.	Herb	Stomachache, amoeba, gonorrhoea, headache	[21, 22]
Vernonia amygdalina Del.	Tree	Anti-dysentery	[22]
Vernonia hymenolepis A. Rich.	Shrub	Antitumor	[22]
Xymenia americana L.	Shrub	Menstruation problem	[18]
Zingeber officinale Rosc	Herb	Eye disease, thermal burns, anthelmintic	[19, 22]
Ziziphus spina-christi L.	Tree	Haemorrhage	[18]

Table 5: List of plant species collected from Dilla University Botanical and Ecotourism Garden.

Scientific names	Family	Local name	Life forms
Acacia abyssinica Hochst.	Fabaceae		Tree
Acacia albida (Delile) A.Chev.	Fabaceae		Tree
Acacia ataxacantha DC.	Fabaceae		Tree
Acacia brevispica Harms	Fabaceae		Tree
Acacia decurrens Willd.	Fabaceae		Tree
Acacia melanoxylon R.Br	Fabaceae		Tree
Acacia nilotica L.	Fabaceae		Tree
Acacia negrii Pic.-Serm.	Fabaceae	Tedecca (Oro)	Tree
Acalypha volkensii Pax	Euphorbiaceae		Herb
Acalypha wilkesiana Müll.Arg.	Euphorbiaceae		Shrub
Acmella caulirhiza Del.	Asteraceae	Hajiloo	Herb
Acmella paniculata (Wall. ex DC.) R.K. Jansen	Asteraceae		Herb
Acorus calamus L.	Acoraceae		Herb
Adiantum capillus-veneris L.	Pteridaceae		Fern
Adiantum poiretii Wikstr.	Adiantaceae	Misira hantuuta (Oro)	Herb
Adiantum poiretii Wikstr.	Adiantaceae	Baala Handdaqqoo (Oro)	Fern
Aeonium leucoblepharum A. Rich.	Crassulaceae		Herb
Aframomum corrorima (A.Braun) P.C.M.Jansen	Zingiberaceae	Korarima	Herb
Agave attenuata Salm-Dyck	Asparagaceae		Herb
Aglaonema commutatum var. commutatum Schott	Araceae		Herb
Ajuga integrifolia Buch.Ham.	Lamiaceae	Anamuro/Akorarach	Herb
Albizia anthelmintica (A. Rich.) Brogn	Fabaceae		Tree
Albizia grandibracteata Taub.	Fabaceae	Kofale (Oro)	Tree
Albizia gummifera (J.F.Gmel.) C.A.Sm.	Mimosaceae	Sassa (Am & Oro)	Tree
Albizia julibrissin Durazz.	Fabaceae		Tree
Albizia lebbeck (L.) Benth.	Fabaceae		Tree
Allium sativum L.	Amaryllidaceae	Qullubi adii	Herb
Aloe macrocarpa Tod.	Aloaceae	Hargiisa	Herb
Aloe gilbertii Sebsebe & Brandham	Aloaceae		Shrub
Aloe sps	Aloaceae		Herb
Alocasia macrorrhizos (L.) G.Don	Araceae	Elephant ear	Herb
Amaranthus palmeri S.Wats.	Amaranthaceae	Laamoyii (Oro)	Herb
Amaranthus graecizans L.	Amaranthaceae	Laamoyii (Oro)	Herb
Ampelocissus bombycina (Bak.) Planch.	Vitaceae		Climber
Ananas comosus (L.) Merr.	Bromeliaceae	Pineapple	Herb
Annona reticulata L.	Annonaceae	Yebere Lib (Am)	Tree
Andropogon abyssinicus Fresen	Poaceae	Balamii (Oro)	Grass
Aptenia cordifolia (L.f.) N.E.Br.	Aizoaceae		Herb
Araucaria heterophylla (Salisb.) Franco	Araucariaceae		Tree
Arisaema flavum (Forssk.) Schott	Araceae		Herb
Arisaema schimperiana Schott.	Araceae	Qorcha budaa (Oro)	Herb
Artemisia absinthium L.	Asteraceae	Ariti	Herb
Artemisia afra.Jacq.ex wild	Asteraceae	Chi Gun	Herb
Arundo donax L.	Poaceae		Tree

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Asparagus africanus Lam. (Sarittii)	Asparagaceae	Sarittii (Oro)	Climber
Athyrium schimperi Moug. ex Fee	Woodsiaceae		Fern
Azadirachta indica A.Juss.	Meliaceae	Neem	Tree
Balanites aegyptiaca (L.) Delile	Zygophyllaceae	Bedeno/Kudkuda (Oro)	Tree
Barleria grandicalyx Lindau	Acanthaceae		Herb
Berchemia discolor (Klotzsch) Hemsl.	Rhamnaceae	Jejeba (Am & Oro)	Tree
Bersama abyssinica Fresen.	Melianthaceae	Xiibroo (Oro)	Tree
Biancaea decapetala (Roth) O. Deg.	Fabaceae		Shrub
Bidens ghedoensis Mesfin	Asteraceae	Keelloo (Oro)Adey Abeba (Am)	Herb
Bidens prestinaria (Sch. Bip.) Cufod	Asteraceae	ADAA (Oro)	Herb
Borassus aethiopum Mart.	Arecaceae	Zembebe (Am)	Tree
Bougainvillea glabra Choisy	Nyctaginaceae		Shrub
Bougainvillea spectabilis Willd	Nyctaginaceae		Shrub
Brassica carinata A.Br	Brassicaceae	Kale/Delo (Gedf)	Herb
Breonadia salicina (Vahl) Hepper & wood	Rubiaceae		Tree
Brucea antidysenterica J.F.Mill	Simaroubaceae	Gudubaa lafaa	Tree
Brugmansia suaveolens (Humb. & Bonpl. ex Willd.) Bercht. & J.Presl	Solanaceae	Angel Trumpet (Eng)	Shrub
Buddleja davidii Franch.	Loganiaceae	Adittii (Oro)	Herb
*Caesalpinia decapeta*la (Roth) Alston	Fabaceae		Climber
Cactus grandiflorus L.	Cactaceae		Shrub
Cajanus cajan (L.) Millsp	Fabaceae	Yewof Ater (Am)	Shrub
Calathea zebrina (Sims) Lindl.	Marantaceae		Herb
Calpurnia aurea (Ait.) Benth	Marantaceae		Shrub
Callistemon citrinus (Curtis) Seekls	Myrtaceae		Tree
Canna indica L.	Cannaceae		Herb
Capparis tomentosa Lam	Capparaceae	Arrangamaa (Oro)	Shrub
Capparis flexuosa L.	Capparaceae		Shrub
Carica papaya L.	Caricaceae	Papaya	Tree
Carissa spinarum L.	Apocynaceae	Agamsaa (Oro)	Shrub
Carthamus tinctorius L.	Asteraceae	Safflower	Herb
Cascabela thevetia (L.) Lippold	Apocynaceae		Tree
Casimiroa edulis La Llave	Rutaceae	Kazmier (Am)	Tree
Cassia siamea Lam.	Fabaceae		Shrub
Casuarina equisetifolia L.	Casuarinaceae		Tree
Catha edulis (Vahl) Forssk. ex Endl.	Rutaceae	Chat (Ah)	Shrub
Catharanthus roseus (L.) G.Don	Apocynaceae		Herb
Ceiba pentandra (L.)	Bombacaceae	Yetit Zaf (Am)	Tree
Celtis africana Burm. f.	Cannabaceae	Matekomaa	Tree
Chamaecytisus proliferus (L.f.) Link	Fabaceae		Shrub
Cipadessa baccifera (Roth) Mi	Meliaceae		Tree
Citrus aurantiifolia (Christm.) Swingle	Rutaceae	Lomi(Am)	Shrub
Clausena anisata (Willd). Benth.	Rutaceae	Ulmaayi (Oro)	Shrub
Clematis longicauda Steud. ex A. Rich.	Ranunculaceae	Hida Fitii (Oro)	Liana
Clematis simensis Fresen.	Ranunculaceae	Ye Azo Hareg (Am)	Liana

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Clematis hirsuta L.	Ranunculaceae		Liana
Clerodendrum myricoides (Hochst.) Vatke	Lamiaceae	Mardhisiisaa (Oro)	Shrub
Clutia lanceolata Forssk.subsp. Lanceolata	Euphorbiaceae	Kutadhigaa (Oro)	Shrub
Coccinia abyssinica (Lam.) Cogn.	Cucurbitaceae	Anchote	Climber
Codiaeum variegatum (L.) A.Juss.	Euphorbiaceae	"Gold Dust"	Shrub
Coffea arabica L.	Rubiaceae	Buna	Shrub
Coleus blumei hybrids	Lamiaceae		Herb
Colocasia esculenta (L.) Schott	Araceae	Godaree	Herb
Combretum adengonium Steud. ex A.Rich.	Combretaceae	Rukkenssa nadhe: Looloni	Tree
Combretum collinum Fresen. subsp.binderianum (Kotschy) Okafor	Combretaceae	Dhandhallee/Dhandhaasa	Tree
Combretum contractum Engl.& Diels	Combretaceae	Lo'oo (Oro)	Tree
Combretum glutinosum Perr.	Combretaceae	Bikaa	Tree
Combretum hereroense Schinz.	Combretaceae	Keenno	Shrub
Combretum molle R. Br. Ex G. Don	Combretaceae	Looli/Rukkessa (oro)	Tree
Combretum nigricans Lepr. ex Guill. & Perr	Combretaceae		Tree
Commelina diffusa Burm.f.	Commelinaceae	Karxobi (Oro)	Herb
Commelina latifolia Hochst.ex A.Rich	Commelinaceae	Lalimichaa (Oro)/Yewef Enkur (Am)	Herb
Commiphora habessinica (O.Berg) Engl	Burseraceae	Chlanka (Oro)	Tree
Commiphora marchandii Engl.	Burseraceae		Shrub
Cordia africana Lam.	Boraginaceae	Wanza (Ah)	Tree
Cordyline fruticosa (L.) A.Chev.	Asparagaceae		Herb
Cordyline terminalis Kunth	Asparagaceae		Herb
Coriandrum sativum L.	Apiaceae	Coriander/Dinbilela	Herb
Cosmos bipinnatus Cav.	Asteraceae		Herb
Crassula ovata (Miller) Druce	Crassulaceae		Herb
Crinum abyssinicum Hochst. ex A. Rich	Amaryllidaceae	Shunkurtii warabessa	Herb
Crinum ornatum (Ait.) Bury	Amaryllidaceae	YejB Shnkurt (Am)	Herb
Crotalaria awasensis Thulin	Fabaceae		Shrub
Crotalaria incana L.	Fabaceae		Shrub
Crotalaria pallida Ait.	Fabaceae		Shrub
Croton macrostachyus Del	Euphorbiaceae	Mokonnisa (Oro)/Bsana (Am)	Tree
Croton schimperianus Muell. Arg.	Euphorbiaceae		Shrub
Croton variegatum L.	Euphorbiaceae		Shrub
Cucurbita pepo L.	Cucurbitaceae	Duba (Am)	Herb
Cucumis africanus L.f.	Cucurbitaceae	Wild cucumber (Eng)	Herb
Cupressus lusitanica Mill	Cupressaceae	Yeferenji-tid (Ahm)	Tree
Cupressus sempervirens Pyramidalis (C. s. Stricta)	Cupressaceae		Tree
Curcuma longa L.	Zingiberaceae	Turmeric/Erdi (Ahm)	Herb
Cussonia arborea Hochst. ex A.Rich	Araliaceae	Baragata (Oro)	Tree
Cymbopogon nardus (L.) Rendle	Poaceae	Nardos	Grass
Cymbopogon citratus (DC.) stapf	Poaceae	Tej sar	Grass
Cynodon dactylon (L.) pers.	Poaceae	Coqorsaa	Grass
Cynoglossum lanceolatum Forssk.	Boraginaceae	Saam'ee	Herb
Cyperus alternifolius subsp. flabelliformis Kük.	Cyperaceae		Grass

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Cyperus aterrimus Steud.	Cyperaceae	Ingicha (Am)	Grass
Cyperus bulbosus Vahl.	Cyperaceae	Kunti (Am)	Grass
Cyperus brevifolius (Rottb.) Hassk.	Cyperaceae		Grass
Cyperus niveus Retz.	Cyperaceae	Qunnii (Oro)	Grass
Cyperus rotundus L.	Cyperaceae		Grass
Cyperus trachysanthos Hook. & Arn	Cyperaceae		Grass
Dalbergia ecastaphyllum L.	Fabaceae		Shrub
Dalbergia lactea Vatke	Fabaceae	Sarxee	Shrub
Datura stramonium L.	Solanaceae	Asangira (Oro)/Atse Faris (Am)	Herb
Daucus hochstetteri (wild carrot)	Apiaceae		Herb
Delonix regia (Boj.ex Hook.) RaJ.	Fabaceae	Deridowa zef (Ah)	Tree
Dendrophthoe pentandra (L.) Miq.	Loranthaceae		Parasite plant
Dianthus barbatus L.	Caryophyllaceae		Herb
Dichrostachys cinerea L.	Fabaceae	Garme (Oro)	Tree
Dieffenbachia amoena W.Bull	Araceae	Dumb cane	Herb
Dioscorea abyssinica Hochst. ex Kunth	Dioscoreaceae	Yam/boyina	Climber
Dioscorea transversa R.Br.	Dioscoreaceae	Pencil yam	Climber
Diospyros abyssinica (Hiern) F. White	Ebenaceae	Loko	Tree
Discopodium penninervium Hochst	Solanaceae	Maraaroo	Herb
Dodonaea angustifolia L.f.	Sapindaceae	Hitacha (Orro)	Shrub
Dovyalis abyssinica (A.Rich.) Warb.	Salicaceae	Koshommii (Oro)	Shrub
Dovyalis caffra (Hook. F. & Herv.) Warb	Salicaceae		Shrub
Dracaena afromontana Mildbr.	Dracaenaceae	Motta zaf (Am)/Alghe (Or)	Tree
Dracaena Reflexa 'Lam.	Dracaenaceae		Shrub
Dracaena steudneri Engl.	Dracaenaceae		Tree
Drynaria laurentii (Christ) Hieron.	Drynariaceae		Fern
Drynaria rigidula (Sw.) Bedd.	Drynariaceae		Fern
Drynaria volkensii Hieron.	Drynariaceae		Fern
Duranta erecta L.	Verbenaceae	"Golden Edge"	Shrub
Duranta goldiana Linn	Verbenaceae		Shrub
Echeveria elegans Rose	Crassulaceae		Herb
Echinochloa colona (L.) Link	Poaceae		Grass
Echinops amplexicaulis Oliv.	Asteraceae	Duku (Orm)	Herb
Echinops kebericho Mesfin	Asteraceae	Qarabichoo (Oro)	Herb
Echinopsis chamaecereus H. Friedrich & Glaetzle	Cactaceae	Peanut Cactus	Herb
Echinopsis oxygona (Link) Zucc. ex Pfeiff. & Otto	Cactaceae	Golden ball cactus	Herb
Echinops pappii Chiov.	Asteraceae	Kushale (Am)	Shrub
Echinopsis spachiana (Lem.)H. Friedrich & G.D. Rowley	Cactaceae		Herb
Ehretia cymosa Thonn.	Boraginaceae	Huragaa	Shrub
Elettaria cardamomum (L.) Maton	Zingiberaceae	Cardamom	Herb
Embelia schimperi Vatke	Myrsinaceae	Aanquu (Oro)	Epiphyte
Englerina woodfordioides (Schweinf.) M.Gilbert	Loranthaceae	Digaaluu (Oro)/Enkoko (Am)	Climber
Ensete ventricosum (Welw.) Cheesman	Musaceae	Enset (Am)/qochoo (Oro & Ged)	Herb
Entada abyssinica Steud. ex A.Rich.	Fabaceae		Tree

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Erianthemum aethiopicum Wiens & Polhill	Loranthaceae		Epiphyte
Erythrina brucei Schweinf	Papilionaceae	Walensuu (Oro)/Korch (Am)	Tree
Erythrina abyssinica Lam. ex DC	Fabaceae		Tree
Eucalyptus citriodora Hook.	Myrtaceae	Shto Bahr Zaf (Am)	Tree
Eucalyptus globulus Labill.	Myrtaceae	Nech berzaf (Am)	Tree
Euclea divinorum Hiern	Ebenaceae	Mi'eessaa (Oro)	Tree
Euphorbia abyssinica Gmel	Euphorbiaceae	Adaami (Oro)	Tree
Euphorbia ampliphylla Pax	Euphorbiaceae	Adaami (Oro)	Tree
Euphorbia bittataensis M. Gilbert	Euphorbiaceae		Shrub
Euphorbia bicompacta var. rubra	Euphorbiaceae	Red Milk Bush	Tree
Euphorbia candelabrum Kotchy	Euphorbiaceae		Shrub
Euphorbia cotinifolia L	Euphorbiaceae	Tropical smoke bush	Shrub
Euphorbia pulcherrima Klotzsch	Euphorbiaceae		Shrub
Euphorbia tirucalli L	Euphorbiaceae		Shrub
Euphorbia trigona Mill	Euphorbiaceae		Shrub
Euphorbia uniglans M. Gilbert	Euphorbiaceae		Tree
Faurea speciosa Welw	Proteaceae	Daanisa (Oro)	Tree
Ficus benjamina L	Moraceae		Shrub
Ficus elastica Roxb. ex Hornem	Moraceae	yegoma zef	Tree
Ficus ruspolii Warb	Moraceae		Tree
Ficus sur Forssk	Moraceae	Harbuu (Oro)	Tree
Ficus sycomorus L	Moraceae	Odaa (Oro)	Tree
Ficus thonningii Blume	Moraceae	Denbigh (Oro)	Tree
Ficus vasta Forssk	Moraceae	Qilxuu (Oro)	Tree
Foeniculum vulgare Miller	Apiaceae	In selale	Herb
Galium spurium L	Rubiaceae	Saam'ee (Oro)	Herb
Gardenia ternifolia Schumach. & Thonn	Rubiaceae	Gambella	Tree
Girardinia bullosa (Steud.)Wedd	Urticaceae	Doobi (Oro)	Herb
Gomphocarpus fruticosus (L.) W.T.Aiton	Apocynaceae		Shrub
Graptophyllum pictum (L.) Griff	Acanthaceae		Shrub
Grevillea robusta A.Cunn. ex R.Br	Proteaceae		Tree
Grewia bicolor Juss	Malvaceae	Harooressa (oro)	Tree
Grewia ferruginea Hochst ex A.Rich	Tiliaceae	Harooressa (oro)	Tree
*Hagenia abyssinic*a (Bruce) J.F.Gmelin	Rosaceae	Eto (Oro)	Tree
Haworthia coarctata Haw	Asphodelaceae		Herb
Hibiscus acetosella Welw. ex Hiern	Malvaceae		Shrub
Hosta hybrid	Asparagaceae		Herb
Hybanthus puberulus M.G.Gilbert	Violaceae		Herb
Hyparrhenia cymosa (L.) Stapef	Poaceae	Margaa (Oro)	Grass
Hyparrhenia multiplex (Nees) Stent	Poaceae	Sambaleena (Oro)	Grass
Hypericum revolutum Vahl	Hypericaceae		Tree
Ilex mitis (L.) Radlk	Aquifoliaceae	Macheessaa (Oro)	Tree
Impatiens tinctoria subsp. Abyssinica	Balsaminaceae		Herb
Impatiens walleriana Hook.f	Balsaminaceae		Herb

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Indigofera tinctoria L	Fabaceae		Shrub
Ipomoea purpurea (*L.)Roth*	Convolvulaceae		Climber
Iresine herbstii aureoreticulata	Amaranthaceae		Herb
Iresine herbstii Lindl	Amaranthaceae	Blood leaf	Herb
Jacaranda mimosifolia D.Don	Bignoniaceae	Yetemenja zef (Ah)	Tree
Jasminum abyssinicum Hochst.ex DC	Oleaceae	Hidda ichilbe (Oro)	Climber
Jasminum bignoniaceum Wall. & G.Don	Oleaceae	Qacama waraabessa (Oro)	Shrub
Jatropha gossypiifolia L.	Euphorbiaceae		Shrub
Juniperus procera Hochst. ex Endl	Cupressaceae	Tid (Ahm)	Tree
Justicia schimperiana (Hochst.ex Nees) T.Anders.	Acanthaceae	Sansalli (Oro)	Shrub
Kalanchoe delagoensis Eckl. & Zeyh.	Crassulaceae		Herb
Kalanchoe lanceolata (Forssk.) Pers.	Crassulaceae		Herb
Kalanchoe laciniata L.	Crassulaceae		Herb
Kalanchoe marmorata Baker	Crassulaceae	Endehuahula (Am)	Herb
Kalanchoe schimperiana A.Rich	Crassulaceae	Bosque (Oro)	Herb
Lagenaria abyssinica (Hook.f.) C. Jeffrey	Cucurbitaceae	Buque sexana (Oro)	Climber
Lagenaria siceraria (Molina) Standl.	Cucurbitaceae	Buque (Oro) Kill (Am)	Climber
Lantana camara L.	Verbenaceae		Shrub
*Leonotis nepetifoli*a (L.) R.Br.	Lamiaceae	Balawarantii (oro)	Shrub
Leonotis ocymifolia (Burm. f.) Iwarsson	Lamiaceae	Yeferes Zeng (Am)	Shrub
Lepidium sativum L	Brassicaceae	Feto (Oro)	Herb
Leucaena leucocephala (Lam.) de Wit	Fabaceae		Tree
Leucas martinicensis (Jacq.) R.Br.	Lamiaceae		Herb
Leucas stachydiformis (Benth.) Hochst. ex Briq.	Lamiaceae		Shrub
Lippia adoensis Hochst. ex Walp	Verbenaceae	Kusayee (Oro)	Shrub
Maesa lanceolata Forssk.	Myrsinaceae	Abbayyii (Oro)	Tree
Maerua aethiopica (Fenzl) Oliv.	Capparidaceae	Qontir (Am)	Shrub
Malvaviscus penduliflorus DC.	Malvaceae		Shrub
Mangifera indica L.	Anacardiaceae	Mango	Tree
Manihot esculenta Crantz	Euphorbiaceae	Cassava (Eng)	Shrub
Markhamia lutea (Benth.) K.Schum	Bignoniaceae	Twriare	Tree
Martinov Leucas R. Br.	Lamiaceae		Herb
Maytenus addat (*Loes.*) Sebsebe	Celastraceae	Biitee (Oro)	Tree
Maytenus heterophylla (Ecki. & zeyh) Robson	Celastraceae	Kombolcha (Oro)	Tree
Maytenus parviflora (Vahl) Sebsebe subsp. eritreana (Sebsebe)	Celastraceae		Shrub
Maytenus buchananii (Loes.) Wilczek	Celastraceae		Shrub
Mentha spicata L.	Lamiaceae	Shay qemem	Herb
Millettia ferruginea (Hochst) Bak.	Fabaceae	Berbera (Ahm)	Tree
Mimusops kummel Bruce. ex A. DC.	Sapotaceae	Shee (Am)	Shrub
Mirabilis jalapa L.	Nyctaginaceae		Herb
Moringa oleifera Lam	Moringaceae		Tree
Moringa stenopetala (Baker f.) Cufod	Moringaceae	Shiferaw (Am)	Tree
Musa X paradisiaca L.	Musaceae	Muz	Herb
Myrsine africana L.	Myrsinaceae	Qacama (Oro)	Shrub

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Myrtus communis subsp. Tarentina	Myrtaceae	Bersenet (Am)	Shrub
Nerium oleander L.	Apocynaceae		Shrub
Nicotiana tabacum L	Solanaceae	Tobacco (Eng)	Herb
Nuxia congesta R.Br. ex Fresen.	Loganiaceae	Qawwisa (Oro)	Tree
Ocimum basilicum L.	Lamiaceae	Besobila (Am)	Herb
Ocimum lamiifolium Hochst. Ex. Benth	Lamiaceae	Hancabi (Oro) Demekase (Am)	Shrub
Ocimum gratissimum L.	Lamiaceae	Basobila	Herb
Olea europaea L. subsp.cuspidata (Wall. ExG.Don) Cif.,L' 'Olivicoltore	Oleaceae	Ejersa (Oro)	Tree
Oncoba spinosa Forssk.	Flacourtiaceae	Akukkuu (Oro)	Shrub
Opuntia ficus - indica (L.) Miller	Cactaceae	Adami (Oro)/Balas (Ahm)	Shrub
Osyris quadripartita Decn	Santalaceae	Waatoo (Oro)	Shrub
Oxalis corniculata L.	Oxalidaceae	Butiyyee (Oro)	Herb
Oxytenanthera abyssinica (A.Rich.) Munro	Poaceae	Kerkeha (Am)	Tree
Ozoroa insignis Del	Anacardiaceae	Garri (Oro)	Tree
Passiflora edulis (Aubl.) Schum.	Passifloraceae	Passion Fruit (Eng)	Climber
Pelargonium boranense I. Friis & M.G. Gilbert.	Poaceae		Grass
Pelargonium hortorum "Allure Hot Coral"	Geraniaceae		Herb
*Pelargonium peltatu*m (L.) L'Hér. ex Aiton	Geraniaceae		Herb
Pelargonium zonale (L.)L'He'r. ex Aiton	Geraniaceae		Herb
Plumeria rubra L.	Apocynaceae		Tree
*Pennisetum clandestinu*m Chiov.	Poaceae	Sardo (Oro)	Herb
Pennisetum purpureum Schumach.	Poaceae	Elephant grass (Eng)	Grass
Pennisetum alopecuroides "'Hameln"	Poaceae	Dwarf Fountain Grass	Grass
Persea americana Mill.	Lauraceae	Avocado	Tree
Persicaria glabra (Willd.) M.Gómez	Polygonaceae		Herb
Phalaris arundinacea L.	Poaceae	Ribbon Grass (Eng)	Grass
Phoenix reclinata Jacq.	Arecaceae	Meexii (Oro)	Tree
Phyllanthus boehmii Pax.	Euphorbiaceae	Guurrii (Oro)	Herb
Physalis peruviana L.	Solanaceae	Hawuxii (Oro)	Herb
Phytolacca dodecandra L'H' erit.	Phytolaccaceae	Indoodee (Oro)	Liana
Piliostigma reticulatum (DC.) Hochst.	Fabaceae		Tree
Piliostigma thonningii (Schumach.) Milne-Redh.	Fabaceae		Tree
Pinus patula L.	Pinaceae		Tree
Piper capense L. f.	Piperaceae	Timiz (Am)	Shrub
Pithecellobium dulce (Roxb.) Benth	Fabaceae		Shrub
Pittosporum viridiflorum Sims	Pittosporaceae	Soolee (Oro)	Tree
Plantago lanceolata L.	Plantaginaceae	Qorxobii (Oro)	Herb
Plectranthus scutellarioides (L.) R.Br	Lamiaceae	Coleus	Herb
Plumeria rubra L.	Apocynaceae		Shrub
Podocarpus falcatus (Thunb.) C.N.Page	Podocarpaceae	Birbirsa (Oro)	Tree
Polygonum aviculare L.	Polygonaceae		Herb
Polyscias fulva (Hiern) Harms	Araliaceae	Yezinjero Wenber (Am)	Tree
Pouteria adolfi-friederici (Eng.) Baehni	Sapotaceae	Qararoo (Oro)	Tree
Premna schimperi Engl	Labiatae	Urgeessaa (oro)	Shrub

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Prunus persica L	Rosaceae	Koki	Tree
Prunus africana (Hook.f.) Kalkm	Rosaceae	Tiqur Inchet (Am)	Tree
Psidum guava L.	Myrtaceae	Zeytun (Am)	Tree
Punica granatum L	Punicaceae	Roman (Am)	Shrub
Pyrostegia venusta (Ker Gawl.)Miers	Bignoniaceae	Golden Shower	Climber
Rhamnus prinoides L'Herit	Rhamnaceae	Geshoo (Oro)	Shrub
Rhamnus staddo A. Rich	Rhamnaceae	Qadidaa (Oro)	Tree
Rhoicissus tridentata (L.f.) Wild & R.B.Drumm.	Vitaceae	Laaluu (Oro)	Climber
Rhus natalensis Krauss	Anacardiaceae	Daboobessaa (Oro)	Tree
Rhus vulgaris Meikle	Anacardiaceae	Xaaxxessaa (Oro)	Shrub
Rhynchosia minima (L.) DC.	Fabaceae		Climber
Ricinus communis L	Euphorbiaceae	Qobboo (Oro)	Shrub
Rosa abyssinica Lindley	Rosaceae	Qegga (Am)/hanqoxo (Oro)	Shrub
Rosmarinus officinalis L.	Lamiaceae	Siga metibeshe	Herb
Rubus aethiopicus R.A.Graham	Rosaceae	Enjorie (Am)	Liana
Rubus apetalus Poir.	Rosaceae	Goraa (Oro)	Liana
Rubus steudneri Schweinf.	Rosaceae	Goraa (Oro)	Liana
Rumex abyssinicus Jacq.	Polygonaceae	Tultii adi (Oro)	Herb
Rumex nepalensis Spreng.	Polygonaceae	Tultii (Oro)	Herb
Ruta chalepensis L.	Rutaceae	Teinadam (Am)	Herb
Saccharum officinarum L.	Poaceae	Shenkora (Am)	Grass
Salix mucronata Thunb. (S. subserrata Willd)	Salicaceae	Alaltuu (Oro)	Tree
Salvia leucantha Cav.	Lamiaceae		Shrub
Salvia nilotica Jacq	Lamiaceae	Qorcha michi (Oro)	Herb
Sansevieria trifasciata hort. ex Prain	Asparagaceae	Snakeplant	Herb
Sapium ellipticum (Hochst.) Pax	Euphorbiaceae	Waagisa	Shrub
Sarcostemma viminale Lavranos	Apocynaceae		Shrub
Schefflera abyssinica (Hochst. ex A.Rich.) Harms	Araliaceae	Boto/Gatamaa (Oro)	Tree
Schefflera arboricola (Hayata) Kanehira	Araliaceae	Dwarf Umbrella Tree	Shrub
Schinus molle L.	Anacardiaceae	Qundo berbere (Am)	Tree
Sclerocarya birrea (A. Rich.) Hochst.	Anacardiaceae		Tree
Sedum morganianum E. Walther	Crassulaceae	Burro's tail or donkey's tail	Herb
Securidaca longipedunculata Fresen.	Polygalaceae		Tree
Senna alexandrina Mill.	Fabaceae		Shrub
Senna bicapsularis (L.) Roxb.	Fabaceae		Shrub
Senna didymobotrya (Fresen.) Irwin & Barneby	Fabaceae		Shrub
Senna occidentalis L.	Fabaceae		Shrub
Senna siamea (Lam.) Irwin et Barneby	Fabaceae		Shrub
Senna singueana (Del.) Lock	Fabaceae		Shrub
Senna spectabilis (DC.) H.S.Irwin & Barneby	Fabaceae		Shrub
Sesbania sesban (L.) Merr.	Fabaceae		Shrub
Setaria geniculata (Willd.) P. Beauv.	Poaceae		Grass
Setaria megaphylla (Steud.) Th.Dur. & Schinz.	Poaceae	Jajaba	Grass
Setaria verticillata (L.) P.Beauv.	Poaceae		Grass

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Setaria viridis (L.) P. Beauv	Poaceae		Grass
Setaria geniculata (Wild.) P. Beauv.	Poaceae		Grass
Smilax aspera L.	Smilacaceae	Butaa (Oro)	Liana
*Solanecio gi*gas (Vatke) C. Jeffrey	Asteraceae	Ginbodhaa	Shrub
Solanum incanum L.	Solanaceae	Hdi sare (oro)	Herb
Solanum marginatum L.f.	Solanaceae	Hidi looni (Oro)	Shrub
Solanum scabrum Mill.	Solanaceae		Herb
Solanum spp.	Solanaceae		Shrub
Spathoda campanulata P.Beauv	Bignoniaceae		Tree
Stenotaphrum glabrum Trin.	Poaceae		Grass
Stenotaphrum secundatum (Walt.) Kuntze	Poaceae		Grass
Stephania abyssinica (Dillon & N. Rich.) Walp	Menispermaceae	Hida Kalela (Oro)	Climber
Strychnos spinose Lam.	Loganiaceae	Dokma	Tree
Syngonium podophyllum Schott	Araceae	American evergreen	Shrub
*Syzygium guineens*e (Willd.) DC.	Myrtaceae	Gotu (Oro)	Tree
Tagetes erecta L.	Asteraceae		Herb
Tagetes minuta L.	Asteraceae	Gimee	Herb
Tagetes patula L.	Asteraceae		Herb
*Taxillus vestitu*s (Wall.) Danser	Loranthaceae		Parasite plant
Terminalia brownii Fresen.	Combretaceae	Helo	Tree
*Terminalia laxifl*ora Engl. & Diels	Combretaceae	Debeka	Tree
Terminalia macroptera Guill & Perr.	Combretaceae	Dabaqaa	Tree
Terminalia mantaly H.Perrier	Combretaceae		Tree
Terminalia schimperiana Hochst.	Combretaceae	Gaarrii	Tree
Thevetia peruviana (Pers.) K. Schum.	Apocynaceae		Shrub
Thuja orientalis L.	Cupressaceae		Tree
Thymus schimperi Ronnigeer	Lamiaceae	Tosegn (Am)	Herb
Toddalia asiatica (L.) Lam	Rutaceae	Harangamaa	Climber
Tradescantia pallida (Rose) D.R. Hunt	Commelinaceae		Herb
Tradescantia zebrina (Schinz) D. R. Hunt	Commelinaceae		Herb
Trichilia emetica Vahl	Meliaceae	Xirdhoo/Ununu (Oro)	Shrub
Trifolium schimperi A.Rich	Fabaceae	Sidisa (Oro)	Herb
Trifolium fragiferum L.	Fabaceae		Herb

Table 5: Continued.

Scientific names	Family	Local name	Life forms
Trigonella foenum-graecum L	Fabaceae	Fenugreek	Herb
Triumfetta tomentosa Boj.	Tiliaceae	Danigollaa (oro)	Herb
Tropaeolum majus L.	Tropaeolaceae		Herb
Urtica simensis Steudel	Urticaceae	Saammaa	Herb
Uvaria angolensis Welw. ex Oliv.	Annonaceae	Toxa muz (Ahm)	Climber
Vangueria apiculata K. Schum	Rubiaceae	Buruurii (Oro)	Tree
Vepris dainellii (Pichi-Serm.) Kokwaro	Rubiaceae	Maddesa	Shrub
Vepris lanceolata (Lam.) G.Don	Rutaceae		Shrub
Verbascum sinaiticum Benth.	Scrophulariaceae	Gurra harree	Herb
Verbascum stellarum Murbeck	Scrophulariaceae		Herb
Verbena officinalis L	Verbenaceae		Herb
Vernonia amygdalina Del	Asteraceae	Ebicha (Oro)/Grawa (Ah)	Tree
Vernonia hochstetteri Sch.Bip. ex Walp.	Asteraceae	Sooyyoma (Oro)	Shrub
Vernonia hymenolepis A. Rich.	Asteraceae	Sooyyoma (Oro)	Shrub
Vernonia myriantha Hook.f.	Asteraceae	Reejjii	Tree
Vitis vinifera L.	Vitaceae	Wine grape	Climber
Xanthium strumarium L.	Asteraceae	Dha Niqel (Am)	Herb
Xymenia americana L.	Oleaceae	Enkoy (Am)	Shrub
Zantedeschia aethiopica (L.) Spreng.	Araceae	Calla Lily	Herb
Zingeber officinale Rosc	Zingiberaceae	Ginger	Herb
Ziziphus abyssinica Hochst ex A. Rich.	Rhamnaceae	Huqunqura (Oro)	Tree
Ziziphus spina-christi L.	Rhamnaceae	Kurkura (Am)	Tree

4. Conclusions

The result of the study indicates that the Dilla University Botanical and Ecotourism Garden has high plant species composition and diversity with a good distribution. A total of 408 plant species were recorded from the garden; out of this, 27 plant species are endemic to Ethiopia and 72 of plant species have also a medicinal value that is used for the treatment of human diseases. Based on IUCN Red Data List, nineteen species were least concern; two were near threatened; four were vulnerable, while two were endangered. Three plant community types (cluster) and sample plots distribution were identified at DUBEG. These three communities are also representing the actual garden compartments and reflect their representative plant composition. The composition of this highly useful plant species compared to the surrounding catchiment and some protected forest at its early stage makes the Dilla University Botanical and Ecotourism Garden unique to the country and center for research, education, and tourist destination.

Finally, further studies on soil properties and detailed ethnobotanical studies are required to explore the wealth of indigenous knowledge on the diversity of plants and their implications in conservation are also recommended.

Abbreviations

A.A: Addis Ababa
DUBEG: Dilla University Botanical and Ecotourism Garden
sps: Species.

Data Availability

All data relating to plant species generated or analyzed during this study are included in this published article. The data that support the findings of this study are available from the author upon request.

Ethical Approval

Research and dissemination committee (RDC) of Dilla University Research and dissemination Office (RDO) approved the research work. Contacts to Dilla University Botanical and Ecotourism Garden Director's office were also made to make the agreement on about the purpose of the study, possible result and benefits of the study, and lastly to labor workers of the garden for plant sps identification in their local name. Finally, after the agreement was achieved and positive attitudes were developed, data collection was started.

Conflicts of Interest

The authors declare that they have no conflicts of interest.

Authors' Contributions

All authors have read and approved the manuscript.

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References

[1] D. Teketay, *Country Brief State of Forests and Forestry Research in Ethiopia. Indicators and Tools of Restoration and Sustainable Management of Forests in East Africa*, D. Teketay and T. Bekale, Eds., Working paper No. 1, Freiburg, 2002.

[2] B. Girma, "Biological diversity and current ex situ conservation practices in Ethiopia," *Institute of Biodiversity Conservation and Research*, Addis Ababa, Addis Ababa, Ethiopia, 2008.

[3] Y. Moges, Z. Eshetu, and S. Nune, "Ethiopian forest resources: current status and future management options in View of Access to Carbon Finances," *Ethiopian Climate Research and Networking with The United Nations Development Programme (UNDP)*, Addis Ababa, Addis Ababa, Ethiopia, 2010.

[4] L. Mulugeta and T. Demel, "Changes in soil seed bank composition and density following deforestation and subsequent cultivation of a tropical dry Afromontane forest in Ethiopia," *Tropical Ecology*, vol. 47, pp. 1–12, 2006.

[5] M. Didita, S. Nemomissa, and T. W. Gole, "Floristic and structural analysis of the woodland vegetation around Dello Menna, Southeast Ethiopia," *Journal of Forestry Research*, vol. 21, no. 4, pp. 395–408, 2010.

[6] D. Teketay, "Human impact on a natural montane forest in southeastern Ethiopia," *Mountain Research and Development*, vol. 12, no. 4, pp. 393–400, 1992.

[7] A. Abate, B. Tamrat, and D. Sebsebe, "The undifferentiated afromontane forest of Denkoro in the central highland of Ethiopia: a floristic and structural analysis SINET," *Journal of Science*, vol. 29, pp. 45–56, 2006.

[8] T. Awas, *Plant diversity in Western Ethiopia ecology ethnobotany and conservation*, PhD Thesis, University of Oslo, Oslo, Norway, 2007.

[9] T. Hunde, "Forest resource status of Ethiopia," in *Proceedings of the national policy on forest resource of Ethiopia*, Addis Ababa, Addis Ababa, Ethiopia, September 2007.

[10] E. Kelbessa and T. Soromessa, "Interfaces of regeneration, structure, diversity and use of some plant species in Bonga forest: a reservoir for wild coffee gene pool," *Sinet: Ethiopian Journal of Science: Ethiop. J. Sci*, vol. 31, no. 2, pp. 121–134, 2008.

[11] T. Bekele, *Plant Population Dynamic of Dodonaea Angustifolia and Olea Europaea ssp.Cuspidata in Dry Afromontane Forests of Ethiopia*, Actae University Upsaliensis Upsala, Uppsala, Sweden, 2000.

[12] E. Kelbessa, S. Demmissew, Z. Woldu, and S. Edwards, "Some threatened Endemic plants of Ethiopia," *NAPRECA Monograph, Sseries*, vol. 2, pp. 35–55, 1992.

[13] M. Dosmann and A. Groover, "The importance of living botanical collections for plant biology and the "next generation" of evo-devo research," *Frontiers of Plant Science*, vol. 3, p. 137, 2012.

[14] D. Bridson and L. Froman, *The Herbarium handbook*, Royal Botanical Gardens Kew, Richmond, England, 1992.
[15] T. Bekele, "Phytosociology and ecology of a humid Afromontane forest on the central plateau of Ethiopia," *Journal of Vegetation Science*, vol. 5, no. 1, pp. 87–98, 1994.
[16] E. Fikadu, M. Melesse, and A. Wendawek, "Floristic composition, diversity, and vegetation structure of woody plant communities in Boda dry evergreen montane forest, West Showa, Ethiopia," *International Journal of Biodiversity and Conservation*, vol. 6, no. 5, pp. 382–391, 2014.
[17] A. E. Magurran, *Ecological diversity and its measurement*, Springer science & business media, Berlin, Germany, 2013.
[18] L. J. Vivero, E. Kelbessa, and S. Demissew, *The red list of endemic trees and shrubs of Ethiopia and Eritrea*, Fauna and Flora international, Cambridge, UK, 2005.
[19] A. Tw, Y. Ba, T. Mekuannint, and Y. At, "Traditional medicinal plants used to treat maternal and child health illnesses in Ethiopia: an ethno-botanical approach," *J Tradit Med Clin Natur*, vol. 07, no. 3, p. 277, 2018.
[20] B. N. Tefera and Y. D. Kim, "Ethnobotanical study of medicinal plants in the hawassa zuria district, Sidama zone, southern Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 15, no. 1, p. 25, 2019.
[21] B. Abera, "Medicinal plants used in traditional medicine by Oromo people, Ghimbi District, Southwest Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 10, no. 1, p. 40, 2014.
[22] F. Mesfin, T. Seta, and A. Assefa, "An ethnobotanical study of medicinal plants in amaro woreda, Ethiopia," *Ethnobotany Research and Applications*, vol. 12, pp. 341–354, 2014.
[23] A. Balcha, "Medicinal plants used in traditional medicine in jimma zone, oromia, southwest Ethiopia," *Ethiop J Health Sci.*vol. 10, no. 40, 2003.
[24] IUCN, *Indigenous and community conserved areas*United Nations Environment Programme, Nairobi, Kenya, 2009.
[25] M. Kent and P. Coker, *Vegetation Description and Analysis. A Practical Approach*, John Wiley & Sons, Hoboken, NJ, USA, 1992.
[26] G. Dalle, B. Maas, and J. Isselstein, "Plant communities and their species diversity in the semi-arid rangelands of Borana lowlands, southern Oromia, Ethiopia," *Community Ecology*, vol. 6, no. 2, pp. 167–176, 2005.
[27] H. G. Whittaker, *Communities and Ecosystem*, Vol. 79, Macmillan Publishing Co Willey and Sons, Hoboken, NJ, USA, 2 edition, 1975.
[28] C. E. Shannon and W. Wiener, *The Mathematical Theory of Communication*, University of Illinois, Chicago, Illinois, 1949.
[29] F. Senbeta, T. Woldemariam, S. Demissew, and M. Denich, "Floristic diversity and composition of sheko forest, southwest Ethiopia," *Ethiopian Journal of Biological Sciences*, vol. 6, no. 1, pp. 11–42, 2009.
[30] D. Dereje, "Floristic compositioand ecological study of bibita forest (gura farda), southwest Ethiopia," M Sc Thesis, Addis Ababa University, Addis Ababa, 2007.
[31] T. Soromessa and E. Kelbessa, "Interplay of regeneration, structure and uses of some woody species in Chilimo forest, Central Ethiopia," *Science, Technology and Arts Research Journal*, vol. 3, no. 1, pp. 90–100, 2014.
[32] W. Getachew Andabo and W. Feleke, "Land use practices, woody plant species diversity and associated impacts in maze national park, Gamo Gofa zone, southwest Ethiopia," *Plant*, vol. 3, no. 6, pp. 64–74, 2015.
[33] F. Mesfin, S. Demissew, and T. Teklehaymanot, "An ethnobotanical study of medicinal plants in Wonago Woreda SNNPR Ethiopia," *Journal of Ethnobiology and Ethnomedicine*, vol. 5, no. 1, p. 28, 2009.
[34] C. P. Dunn, "Biological and cultural diversity in the context of botanic garden conservation strategies," *Plant Diversity*, vol. 39, no. 6, pp. 396–401, 2017.