



Indigenous Knowledge On Management Of Home Gardens And Plants In Loma And Gena Bosa Districts (Weredas) Of Dawro Zone, Southern Ethiopia: Plant Biodiversity Conservation, Sustainable Utilization And Environmental Protection

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Abstract

The home garden is a small-scale traditional agricultural ecosystem and is locally known by the name Daaddaa/Emeriyaa in Dawro language and has played an important role in conservation and sustainable utilization of plant biodiversity as well as in adaptation to the changes in climatic conditions of the environment. The information was gathered through semi-structured interview conducted with 100 home garden owners. Samples of 100 home gardens (HGs) were considered and data on 214 plant species distributed in 174 genera and 63 families were collected from 300 plots of 5m x 10m each. The data were analyzed using SPSS computer software. The procedure for preference ranking and Shannon diversity index were also applied.

The study found out that *Fabaceae* stood first containing 21 (12.07 %) genera and 24 (11.21 %) species, *Asteraceae* 18 (10.34 %) and 29 (13.55 %), and *Poaceae* 17 (9.77 %) and 17 (7.94 %) respectively. The average record of species per home garden in 100 HGs was 33 and the species diversity was not significantly different ($p = 0.239$). The HGs had high diversity of plant species as indicated by Shannon diversity index of 3.8. *Ensete ventricosum* came out as the dominant species being found in 95 HGs followed by *Solanum capsicoides* (86) and *Coffea arabica* (84). The upper layer was dominated by *Carica papaya-Persea americana* Complex, the middle layer by *Ensete ventricosum* Complex and the lower layer by Spice-vegetable Complex. There were about 66 general use reports on plants of the study area. One hundred thirty species were recorded in the plots of sampled home gardens as plants that have medicinal values while 33 species were recorded as plants that used as spices.

Keywords: Conservation, Dawro, Ethnobotany, Environment protection, Home garden, Indigenous Knowledge, Plant Biodiversity, Sustainable Utilization

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1. Introduction

Biodiversity encompasses all species of plants, animals, microorganisms, and ecosystems and ecological processes. Increasing awareness about the progressive deterioration of plant biodiversity has triggered a number of conferences, reports and books, but insignificant attention has been given to the basic scientific work required for efficient conservation [26]. The diversity of plant and animal resources as well as the complex cultural diversity including indigenous knowledge of the local communities in Ethiopia needs to be conserved and preserved [22]. In Ethiopia, traditional agriculture is based on the local varieties/ landraces and variable plant populations adapted to local agronomic conditions and meet economic, social, cultural and ecological needs.

The home garden is the result of accumulated knowledge practiced and managed over generations [25, 34]. According to [16], the evolution of home gardens possibly started from shifting cultivation practices that were used to overcome problems of resources and to ascertain rights to land resources. The collection of useful plants and animals from the wild has gradually led to small-scale plant and animal husbandry and the continued intensification resulted in the emergence of full-scale agriculture in gardens and fields [6, 33] and still currently taking place in some traditional agricultural systems as observations show. It does function to hold food plants like vegetables and fruits and medicinal plants [8], spices, condiments, and dyes [33] and for adaptation of changing climate [7]. It has also lately become an important strategy for production wood for fuel, timber, and for introduction and adaptation of new species, and for conservation of germplasm, ecosystem, agricultural practices and know-how of indigenous people and other necessities.

The presence of home gardens in different areas of Ethiopia is indicated by different names applied in different cultures of Ethiopia. They are referred to as 'Daaddaa/Emeriyaa' in Dawro language investigated in this study and elsewhere as 'Yeguaro ersha' in Amharic and 'Eddo' in the Oromo language [10], 'Daddeegoyo' in Kefa language [34], 'Daniio gade' in Gamo language [33] and Darkwa in Welayta [30]. Home gardens have been described as 'living gene banks' in which a variety of germplasm, in the form of indigenous varieties, landraces and rare species thrive side by side and has been preserved through generations [19]. Hence, [15] described it as microcosm that has all features and qualities of environment and [28] generally as multi-storied and multi-purpose. This heterogeneous environment of home gardens provides favourable growing conditions for a wide diversity of useful plants.

The special arrangement of the crops in home gardens may be related to the various uses of the crops micro-environmental adaptation and their habit. The management home gardens contain some food crops showing that the most important function of the home garden is food production [9, 12, 16, 21, 36]. The heterogeneity of ecology and know-how of people caused the diversity of home gardens and farm lands [25]. Various authors pointed that a special focus has to be given to developing home gardens so that, indigenous and exotic useful plants could be

maintained for the benefit of present and future generations [11]. Biodiversity maintenance must be integrated with agricultural practices that can have multiple ecological and socioeconomic benefits, particularly to ensure food security. Agrobiodiversity through traditional farming systems contributes to rural livelihoods based on subsistence agriculture mainly built with food security targets [20, 23, and 27].

Indigenous knowledge (IK) is the knowledge accumulated during the historic experiences of a group of people that adapted to social, economic, environmental, spiritual and political changes through generations. Indigenous peoples of different localities have developed their own specific knowledge on plant resources, use, management and conservation [14]. According to [37], indigenous knowledge refers to the complex set of knowledge developed around specific conditions existing with indigenous populations and communities of a particular geographic area. It differs among community members according to their gender, age, social standing, profession and intellectual capabilities.

The ethnobotanical knowledge of farmers is an important resource for the development of sustainable agriculture and the conservation of genetic material [11]. It is in this sense that indigenous knowledge is said to be at the hands of farmers and which is important for sustainable use of resources and sustainable development of livelihoods in particular and society in general. Recent studies on home gardens indicate that culturally diverse ethnic groups in Ethiopia have their own unique lifestyle and perception of their surroundings for developing, maintaining, conserving and utilizing biological resources. The study was conducted with the aim to identify the major plant species, to see their diversity and use categories as well as to document the traditional management and the associated indigenous knowledge for conservation and sustainable utilization of plants in and around the home gardens in Loma and Gena Bosa districts of Dawro Zone, Southern Ethiopia.

2. Materials and Methods

2.1 Description of the Study Area

Dawro Zone is one of the 14 Zones in Southern Nations, Nationalities and Peoples Region (SNNPR) of Ethiopia. This study covered two drought stressed districts, Loma and Gena Bosa of the 5 districts that constituted the zone (Fig.1). The study area consists of sub-humid types of agroecological zones containing deciduous wood land ranging in elevation from 550– 2600m distinguished by the presence of the dominant tree species including *Boswellia papyrifera*, *Combretum mole*, *Terminalia brownii*, *Acacia senegal*, *Piliostigma thonningii*, *Balanites aegyptiaca*, *Lannea fruticosa*, *Syzygium guineense subsp. guineense* and others along the Omo and Gojeb river valleys. The vegetation varies from semi-desert type in lowland areas to broad-leaved evergreen forest types in the highlands. In addition, *Ensete ventricosum*, source of the staple food in the area, provides vegetation cover and creates green scenery.

The soil in the study area has good physical properties and uniform profile, porous from clay to clay loam in texture and low base saturation less than 5.5P^H Values which have agricultural potentialities (Anon, 2004).The annual rainfall of Loma district ranges from 1401mm to 1800 mm but it is from 1201-1600 mm in Gena Bosa district. The mean annual temperature in the study area ranges between 15.1°C-27.5°C in both districts.

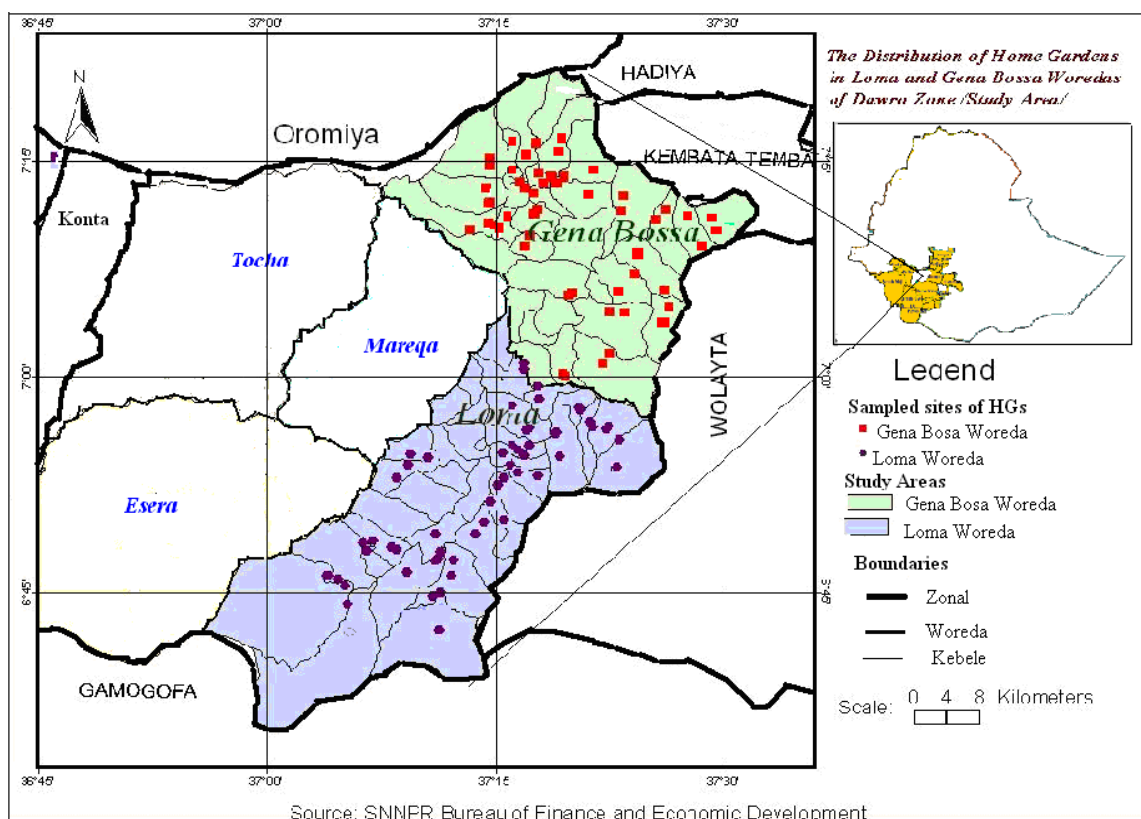


Figure 1. Location of the study area in Dawro Zne and the sampling sites

2.2 Data Collection

Qualitative and quantitative approaches were applied using the research techniques known as guided field walk/guided garden tour, use value matrix, free listing, priority ranking and preference-ranking [14, 17] to gather datasets. The ethnobotanical information was collected from a randomly sampled 100 households (home garden owners); from 112 traditional healers as informants on medicinal plants and from 32 vendors of spices, condiments and medicinal plants selected systematically and conveniently from the two study sites based on their availability, willingness and practical knowledge. Informant selection was made with the help of local administrators, local people including elderly persons and Non-Governmental Organization (NGO). Semi-structured interviews were administered in local dialects to each of the respondents according to techniques described by [17].

Preference ranking was included in pre-designed semi-structured interview items. Other criteria like local economic importance, species scarcity and cultural significance of the species importance in the community were asked to add descriptive information. Guided field walk technique was used after getting information through semi-structured

interview. Vital observations were made; species counted and recorded after laying quadrants at appropriate sites within the home garden. Occasional interaction was made by using unstructured interview, raising some questions and taking notes. Participant observation technique was used to add new information and strengthen information collected through interview, observation and discussion.

Botanical data were collected from September 2006 to March 2007. A 5 mx10m quadrant was made in three directions, left, right and hind sides around the house. A total of 300 quadrants were made in the randomly sampled 100 home gardens during the field study. Within each quadrant, the type of plant found with its local name, number of individuals of each type and habit of the plant was recorded and each given a collection number, pressed, dried and voucher specimens taken to Addis Ababa University, National Herbarium (ETH) for identification and documentation of the taxa using published volumes of Flora of Ethiopia and Eritrea and by comparing with authentic specimens; and specimens were deposited there.

2.3 Data Analysis

Ethnobotanical data were analyzed using both qualitative and quantitative methods as outlined by [14, 17], and the Statistical Program for Social Sciences (SPSS, 2003). Preference ranking was analyzed based on [17] by entering the responses of key group of informants in data matrix. Species diversity was determined using Shannon Diversity Index which is calculated as $H' = - \sum p_i \ln(p_i)$, $i = 1$; where: H' = Shannon Diversity Index, p_i = the proportion of individuals or the abundance of species i^{th} as a proportional of total cover in the sample, $\ln = \log \text{base}_e$ / Natural logarithm [1, 24].

3. Results and Discussion

A. 3.1 Emic Categorization Systems and Practices in the Study Area

Dawro people in the study area have their own emic categorization of the different abiotic factors (such as landscape, soil and seasons) in and around the home gardens based on various criteria (such as the slope, fertility and the amount of rain) in a similar way as reported for the Keficho people [34], Gamo people [33], Konso people [18] and Wolayta people [30].

The four categories of the soils in to 'Tue'sa', 'Ladasaa/shafesaa', 'Otsasaa' and 'Anc'c'osaa' occurring in and around home gardens was based on fertility, color, depth, erodibility, capacity to hold water and how easy they are to cultivate. In order to follow the fertility of soil they have indicators. When the fertility indicating plant species disappear or were no more seen in the farming field, their reappearance was waited and the field was left to recover from the degraded conditions. Hence, the farmers decided to fallow, rotate or shift cultivation based on assessment of the indicator plants. Otherwise, they planted the fertility adding plant species like *Manihot esculenta*, *Moringa stenopetala*, *Ipomoea batatas*, *Colocasia esculenta*, *Cordia africana*, *Ficus vasta*, *Tamarindus indica* and others.

Some of these are known to add a lot of litter from leaves, flowers and fruits and the leguminous species (e.g. *Tamarindus indica*) add nitrates to the soil.

They also followed some indicators of seasons for farming activities. They recognized flowering of *Erythrina brucei* and shedding of *Ficus* spp. leaves as Spring/‘Belg’ (‘Assuuraa’ or ‘Bad’d’eesaa’) was approaching. They also followed the destruction of the leaves of *Ficus* spp. by caterpillars at the end of sorghum sowing time. Maize was cultivated two times in a year in mid altitudes: as ‘Baassiyaa’ (in September and October) and ‘Shachchaa’ (in March and April). Sweet potato was grown throughout the year and harvested more than two times in a year. However, enset was harvested throughout the year. There was a similar report from Wolayta [30]. In order to show the activity from sowing to harvesting, according to elderly informants, there was popular saying: - “Laappuniyani-laalee, Hosppuniyani-hokkee, Udupuniyani-uttis’eellee, Tammiyani-tattafee and Tammanne-ittinniyaani-ililee”-the literal meaning of this is “sowing in March, weeding in April, resting in May, seeking for and touching in June and harvesting/ready for feeding and using in July”. Planting the drought tolerant and fertility adding plant species in ‘Ladasaa/shafesaa’ (leached soil) and following indicators of farming and edaphic factors were good practices in the study area. This practice allowed regeneration of certain plants and appearance of some soil microorganisms associated with soil fertility. However, conversions of ecosystems might appear due to various anthropogenic and natural phenomena than the usual time/season.

The indigenous knowledge of classifying plant biotic components into different aspects helped the people to manage biodiversity giving due attention to the structures of home gardens in limited plots of land. Their indigenous knowledge on classifying plants in to different aspects also helped the study and made the documentation of the information easier. About 62.15% herbs, 18.69% shrubs, 8.41% trees, 6.54% climbers and 4.21% creepers were documented in plots of sampled home gardens (See Appendix 1).

II. 3.2 The Spatial Arrangement of Plants in the Home Gardens (Daaddaa/Emeriyaa) of the Study Area

Structure and features of home garden systems in Dawro was not of a fixed nature. As it was observed, it varied according to the age, preference, need, economic conditions of the owner, environmental conditions, land availability, socio-cultural characteristics and education level of the owner. Similar observations were reported by [5, 6, and 33]. The feature of home gardens in Dawro was somewhat similar to those reported for the Konso (18), Gamo [33] and Keficho [34]. Home gardens were widely practiced with reference to their structural and functional components considering their characteristic features on the agricultural landscapes having been powered by the wealth of their indigenous knowledge as [7] reported. The type of home garden (Daaddaa/Emeriyaa) in relation to living house is predominantly backyard. As it was observed from sampled home gardens, it varies in size, structurally both vertically and horizontally. A cross-section from the back of the house to the end of the garden

shows typical zoning in the home garden. The clean circle, plantless surrounding the house, called 'kariyaa giichchaa', was left there for children play ground and protects from advancing of small dangerous animals like snakes. A small circle just behind the house after the clean area contains small sized but more species per unit area, including spices, medicinal plants and aromatic plants that provide good fragrance to the surroundings of the house. The next zone, which accounts for not less than 30% of the species in the entire HG, includes vegetables, fruits and coffee. Still, the next zone accounts for not less than 15% of the species including enset and coffee in the home gardens and the last circle have only a few species, but larger populations of each in a wider area. Farther out, diversity was lower at the extreme end of the garden (Fig. 2).

The diversity of important plant species in the 'Daaddaa/Emeriyaa' was high due to the activities of planting and protection of annual and perennial herbs, and woody perennials in combination. This is attributed to the priority given by the farmers to the plant species of their choice due to their usefulness for various purposes including income generation. They also recognized the layers of plants starting from land coverings to the large sized plants and allow the emergent to grow in the home gardens in order to get some benefits that are very critical in such drought stressed area.

Horizontally managed home gardens were also observed where there were no more spices and medicinal plants around the houses. The average size of home gardens inspected in the study area was more than half a hectare, which was different from that reported (less than half a hectare) for Arsi people around Dheerea Town [36]. This was because, most of the sampled home gardens were from mid-altitude and lowlands of the study area, which were with low population and consequently have larger sizes. The crop structure of the home garden could also be seen in temporal scales where households shift the location of some species seasonally or annually depending on the species. This has been reported in [5].

Home gardens also vary in composition or diversity of plants based on ecological, socio economic, personal preference, as well as the distance and availability of markets.

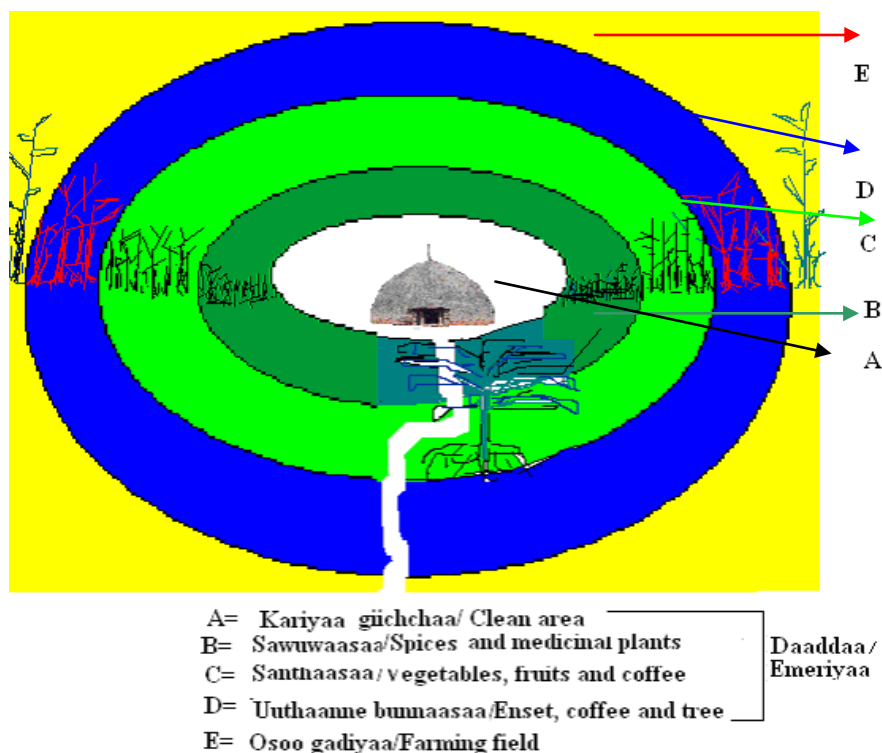


Figure 2 Model of a typical home garden (Daaddaa/Emeriyaa) in the study area

The horizontal arrangement of plants in the home garden (Daaddaa/Emeriyaa) followed a certain pattern with reference to the living houses. Cattle were penned on the down hillside of the house and a channel was cut in the ground to take the urine and droppings out and this part of the garden was called ‘Wooruwa’. Farmers use the open space at the front side (‘Kariyaa/Zaguuwa’) for important social events like ceremonial celebrations of life events as death, weddings and social assemblies especially under tree shades. The remaining home garden part where spices, condiments, medicinal plants, enset, coffee and other crops were grown was called ‘Daaddaa/Emeriyaa’ and the outfield of the garden where a few crops are cultivated in a wide area being less manured except weeding was called ‘Ooso gadiyaa’ or ‘Shoyk’aa’ (Fig. 2).

Small-sized home gardens consist of more of vertically structured plants around the house and less space was left in front of the house for ceremonial and other purposes. In contrast, the large sized home gardens contain more of horizontally structured aggregations of plants and more space. In small sized home gardens, plants that need large space for their growth and perennials were grown in less number. In order to compensate for land shortage, they plant annuals and vines (climbers) to hang up on live fences for immediate access (Fig. 3). This in turn has biodiversity conservation value.



Figure 3. small-sized home garden (daaddaa/emeriya) structure and its features

Home gardens with small size, both in urbanized and rural areas have more diversity of plant species around than large sized ones. Vertical structure was focused in small sized (less than half ha) home gardens in the study area due to various reasons: plants were managed close to the house for ease of managing and immediate access of products, wind breaks, shade, canopy for weak plants that do not resist high solar radiation, need adding manure frequently and to compensate land for shortages (as seen in the highlands and midlands). Increasing vertical layer of home gardens has more of ecosystem benefit in that it traps moisture, breaks wind, attracts different seed and fruit dispersing animals (including their wastes and add manure to the soil); and benefit small-sized plant species by its canopy. For example, allowing the growth of *Tamarindus indica* and *Ficus vasta* in the home gardens attracted a lot of fauna that may leave their wastes for soil fertility, work through the solid aerating it and other opportunistic seeds and fruits for dispersal of wild and cultivated plants. Apart from this, they have benefit of storing/hipping and hanging maize and other crops temporarily, and for honey bee hive hanging and management. Hence, vertical structure was preferred in small-sized home gardens rather than horizontal one as the same was reported for Ghana [28].

Some of the indigenous crops in and around home gardens were enset, sorghum and teff, and important cash crops such as coffee and ginger. The most important spices, condiments and medicinal plants grown in and around home gardens include pepper (*Capsicum annum*), rue (*Ruta chalepensis*), sweet basil (*Ocimum basilicum*), thyme (*Thymus schimperi*), ginger (*Zingiber officinale*), and wormwood (*Artemisia absinthium*). Some spices were intercropped among other crops. In the gardens they grow perennial trees and shrub crops (such as mango and orange) as fresh food sources. The major food crops were the cereals (teff, maize and sorghum), root (enset, sweet potato, taro, yam and cassava), and fruits (Papaya, avocado, banana, mango and orange). In their home gardens, some spices, condiments and fragrance (*Lippia adeonsis* var. *koseret*, *Foeniculum vulgare* and rue) and taller in size were planted in the lower side of house in order to protect individuals from urine odour from domestic animals. Other spices, condiments and medicinal plants with relatively small height (*Thymus schimperi*) were planted on the front or in the upper side of the house.

Based on observation on physiognomic structure of home gardens, it was possible to have clear structural description of vegetation (concerning height categories) of home gardens. The vertical structure of home gardens can be classified as: the upper layer, middle layer and as the lower layer. As it was seen, the upper layer consists of the most frequently occurring species including *Carica papaya* (61), *Cordia africana* (60), *Persea americana* (54), *Moringa stenopetala* (40), *Mangifera indica* (27) and *Ficus vasta* (15). The middle layer consists of *Ensete ventricosum* (95), *Coffea arabica* (84), *Citrus sinensis* (20), *Citrus aurantifolia* (14), *Zea mays* (12) and *Sorghum bicolor* (10). The lower layer consisted of some vegetables, spices and medicinal plants those that were cultivated for immediate access or use. The upper layer was dominated by four species giving the *Carica papaya*-*Persea americana* Complex, the middle layer consisted of few species, about 12 and described as the *Ensete ventricosum* Complex and the lower layer consisted of 31 species of Spice-vegetable Complex (Fig.4).

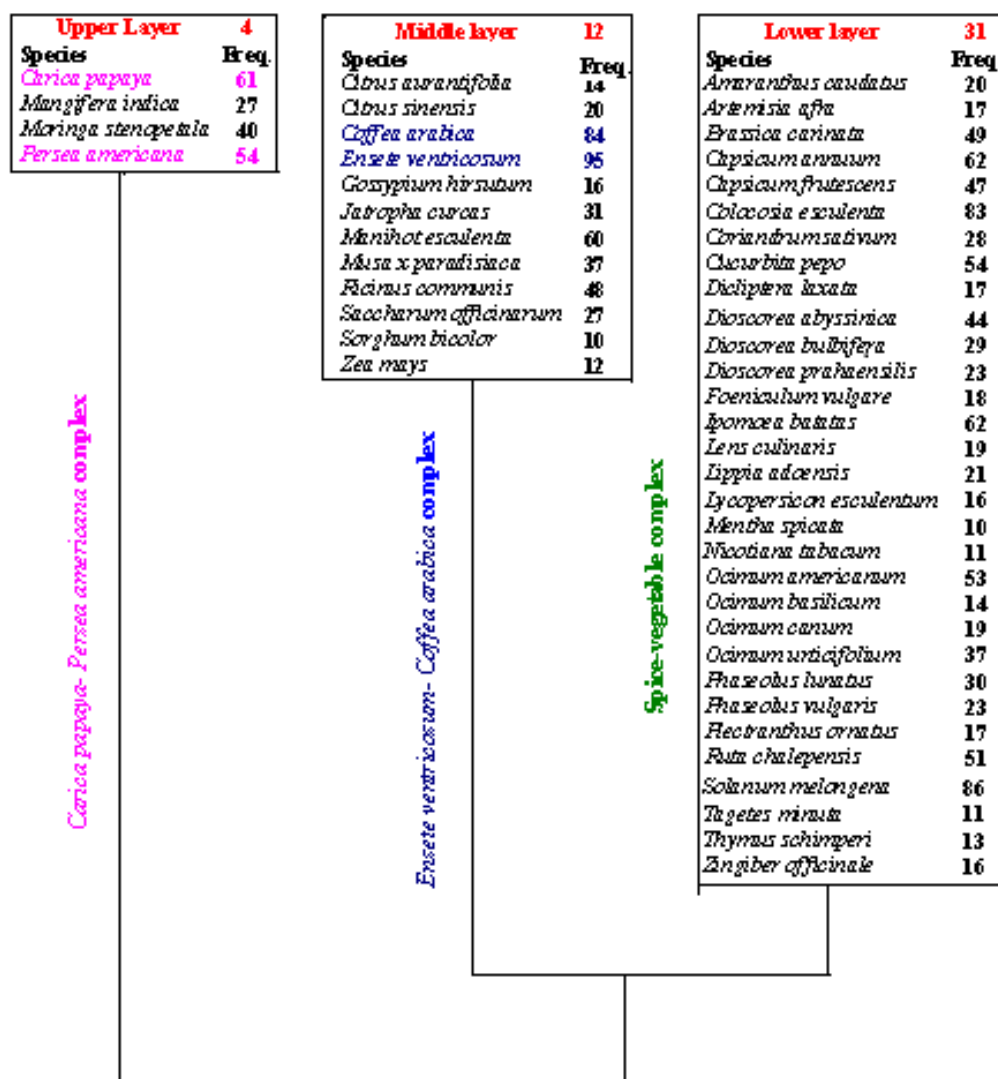


Figure 4. The etic categorization of home gardens based on the vertical HG structure

1.3. . Plant Diversity in Home Gardens ('Daaddaa/Emeriyaa')

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2) 1.3.1. Plant diversity in the plots of sampled home gardens (daaddaa/emeriya)

Two hundred fourteen plant species were recorded in the plots of the sampled home gardens and these are distributed in 174 genera and 63 families. *Fabaceae* stood first containing 21(12.07 %) genera and 24 (11.21 %) species, *Asteraceae* came in the second place with 18 (10.34 %) genera and 29 (13.55 %) species, and *Poaceae* in the third with 17 (9.77 %) genera and 17 (7.94 %) species. The families *Fabaceae*, *Asteraceae* and *Poaceae* were among the plants that are frequently used by the Dawro people. A similar report from Wolayta [30] indicated that they use more of *Fabaceae* (12.96%) and *Poaceae* (11.11%).

Plant species diversity means were computed by independent samples T test using SPSS computer software and the output showed that there was no significant difference in species diversity between the two districts because $P > 0.05$ ($P = 0.239$). The average record of species per home garden in 100 HGs was 33. About 53% of HGs were composed of the highest number of species ranging from 27-36; 26% of the HGs came with the record of 17-26 species; 18% of the HGs with 37-46 species; 2% of the HGs with 47-57 species and only one (1%) HG had 68 species. Of the most important home garden plants, *Ensete ventricosum* was widely distributed almost in all HGs (95%) followed by *Solanum capsicoides* (86%) and *Coffea arabica* (84%).

Plant diversity in and around home gardens was managed through horizontal and vertical arrangement of crop species in regular pattern, patches or near random structures. In the hierarchical arrangement of species in height from home to outwards, the lower layer was rich in species diversity than the middle and the upper layers. Similarly, the sides close to the home in the horizontal arrangements were rich in species diversity than the middle and hind sides. The spices and medicinal plants were usually with small heights and since they need relatively less manure they were grown in the plots close to the house. This was realized from documenting plants in the three plots around the house. Household wastes were hipped and spread near the house in suitable sites considering crop requirements and human comfort. Therefore, both cultivated and non-cultivated plants that need manure for their growth including those that grow from seeds from animal excrements tend to appear around the manure hips. The general pattern within the mature home gardens of the study area showed that diversity was highest near homes and plant size increases with distance from the house. Thus, species number generally decreases away from the house, while number of individuals of a single species increases in the same direction. A similar pattern was reported in Kefa [10].

In closely planted enset farms/HGs, it was observed that plants grow poorly either growing thin, tall, weak and / or undersized which in turn decreases plant biodiversity in home gardens. This indicates that close spacing affects the growth of plants beside individual preference, soil and temperature or environmental factor. Hence, the small

households plant less number of enset and other huge sized multipurpose plants and instead, they grow biennials and annuals like spices in their small sized plots of land as [35] reported the same effect of closely planting.

The local people managed and arranged diversified plants in both vertically and horizontally in their home gardens in order to get different benefits. They cultivated diverse plant species in their home gardens (Daaddaa/Emeriyaa) to satisfy their subsistence needs. The main role of home gardens was for production of diversified food crops and in so doing they include high species diversity when compared with monoculture production systems. For example, among the most important multipurpose edible plants frequently recorded in 95%, 86% and 84% of home gardens in the study area were *Ensete ventricosum*, *Solanum capsicoides* and *Coffea arabica* respectively. These and other plants in the home gardens provided a number of services to the local people by adapting to the different conditions of the area. Therefore, home gardens in the study sites provided a number of services to the local people: in nutritional aspect (for food variability or to get balanced diet, flavouring), medicinal aspect (to treat the day to day illness of their health, their domestic animals, repelling dangerous animals), economic aspect (income generation, for local market and for their subsistence life), ecological aspect (for soil fertility, to prevent the degradation of soil, to protect wind and others), social aspect (traditional, religious, social and recreational) and husbandry of some important wild plants for multipurpose benefit. A similar observation for the first three uses was reported by [33] for Gamo home gardens.

The two districts were rich in species diversity. This is because in both the people are Dawro ethnic groups and have almost the same management and conservation strategy and household requirements of food plants, spices and other plant species, traditional agricultural systems, culture and indigenous knowledge. And also have almost similar climatic conditions, topography and other environmental factors. This was confirmed using the quantitative analysis from the outputs of SPSS computer software. The Shannon diversity index for the log value 1.5-4.5 became 3.8. The Simpson similarity index for the value between 0 and 1 is 0.73 and this approached 1. However, there were few differences in plant species diversity in and around each home garden (the highest 68 sp. /HG and the lowest 17sp. /HG were recorded). These variations came from different sources: individual preference and management system, size of home garden (annuals and biennials of different species were cultivated in small sized HGs), socio-economic background (the poor cultivated edible plants than income generating types), altitude (diversity increased with elevation), soil fertility status (fertile soil was more conducive for the growth of plants), rainfall pattern (highly diversified plants were observed i where there was more water availability), distance from house (highly diversified plants were observed near the house), proximity to market and road (less diversified plants were observed), invaded cultures and religious factors (did not allow to grow some stimulants like tobacco, buck thorn, chat, etc).

The advantage of the management of home gardens and agroforestry was that they improve microclimates by sustaining permanent plant cover, improving soil, water and other resources, reducing carbon emissions and increasing sequestration and storing it above and below ground, decline in reducing vulnerability and ensuring food security wherever they occur [7]. Therefore, up-scaling the value of home gardens and agroforestry systems can help create ecologically balanced environments (environmental protection) to improve agricultural production and better livelihood support (economic gains) [7].

3)

4) 1.3.2. Multipurpose plant species in and around home gardens of the study area

Some individuals of the study area practiced growing multipurpose trees, shrubs and grasses on the front or either sides of their houses. The most frequently encountered multipurpose plants during the study period in the order of importance were *Ensete ventricosum*, *Ficus vasta*, *Cordia africana*, *Croton macrostachyus*, *Arundo donax*, *Jatropha curcas*, *Maerua oblongifolia*, *Moringa stenopetala*, *Tamarindus indica* and *Terminalia brownii*.

Local people cultivated the most important ones with varied uses. For example, *Ficus vasta* was used for timber, medicinal, shade, indicator, furniture, soil fertility, building and other cultural ceremonies and takes the top rank followed by *Cordia africana* with seven uses. The result of seven multipurpose species direct matrix ranking confirmed that the local people were using *Cordia africana*, *Ficus vasta* and *Croton macrostachyus* for more of building and firewood followed by medicinal and furniture purposes. *Ficus vasta*, *Cordia africana* and *Arundo donax* were also well-known multipurpose species. *Croton macrostachyus* and *Moringa stenopetala* were the known medicinal plants used against many diseases. Enset was not included in this use matrix because the attributes selected were more of trees and shrubs. However, it was recorded with 15 uses: as food, medicinal, as feeding of cattle, wrapping material, as umbrella, as lentil material, as bedding material, making bags and ropes and for basketry, for tightening materials, house construction, mat making, for soil fertility and canopy for other small species.

The more the multiple uses for local people, the more conservation of that plant resource through cultivation and protection in and around home gardens. However, the size of home garden, the agroecology and the type of soil it needs for its growth and individual needs determined the number and type of each species grown in the home gardens. Plant species with many uses were observed scarcely distributed in nearby forests of the study area. For example, *Maerua oblongifolia* and *Lannea fruticosa* were more threatened because of their scarcely due to growing in limited places (only in lowland riverine vegetation) and being used as medicine intensively (especially their bark and roots respectively) by local people in addition to their multipurpose values (especially *Maerua oblongifolia* whose root was being used as detergent/as soap in the area).

Since home gardens consist of some gigantic trees for fruits production, hive hanging, soil fertility, shade provision, storing harvested crops temporarily, etc (agroforestry/agrobiodiversity system), they were considered as very responsive system while adaptation was taken as an appropriate measure and could be used for designing of the way forward to climate adaptation drives in Ethiopia and elsewhere [7]. The advantage of the management of home gardens with its agrobiodiversity improving microclimates by sustaining permanent plant cover, improving soil, water and other resources, reducing carbon emissions and increasing sequestration and storing it above and below ground, reducing vulnerability and ensuring food security wherever they occur in the study area was unquestionable.

5) 1.3.3. The use values of plants in and around home gardens

There were about 66 use reports on plants of the study area. Of the recorded plant species (214) in the plots of the sampled home gardens, 86 plants that occurred in the home gardens with various uses took the top position (40.19%) of the plant categories followed by 77 food plants (35.98%) and 25 plants for miscellaneous uses (11.68) (Fig.5). Out of the recorded 77 food plant species, 33 (42.86%) spice species stood first, followed by 13 (16.88%)fruits, 10 (12.99%)vegetables, pulses and roots/tubers accounted for 7 (9.09%) species each, and cereals and oils 4(5.19%) each from second to last positions in that order. About 130 species were recorded in the plots of sampled home gardens as plants that have medicinal values. Thirty three spices were recorded with 13 uses in and around home gardens. Miscellaneous uses were minor uses in which plant and plant products were used in smaller quantities, but they form a significant role [13]. For example, *Terminalia brownii*, *Maerua oblongifolia*, *Leucas stachydiformis*, *Kosteletzkyia adoensis*, *Balanites aegyptiaca*, *Ensete ventricosum*, *Agapanthus paraecox* and *Phytolacca dodecandra* were used as soap for washing purposes. Only one informant (traditional healer) was seen cultivating *Maerua oblongifolia* in the home garden for both medicinal, detergent service and for other purposes.

Plant resources served as live shade and /or live fence, fumigant, beehive hanging, washing, cleaning and soon. Trees and shrubs were mentioned as valuable sources of animal fodder, fuel wood, shelter, timber, herbal medicines and food for people. Major plant use categories recorded in each study site were shown in Fig. 5 where each category denoted as food plants (FP); fodder (AF/Fd); life fence (Lf); medicinal plants (MP); miscellaneous-timber, pole, equipment, handles, construction, soil fertility and others (Mi); important plants with various (combination of above) uses (NC); ornamentals (O), and stimulants (St).

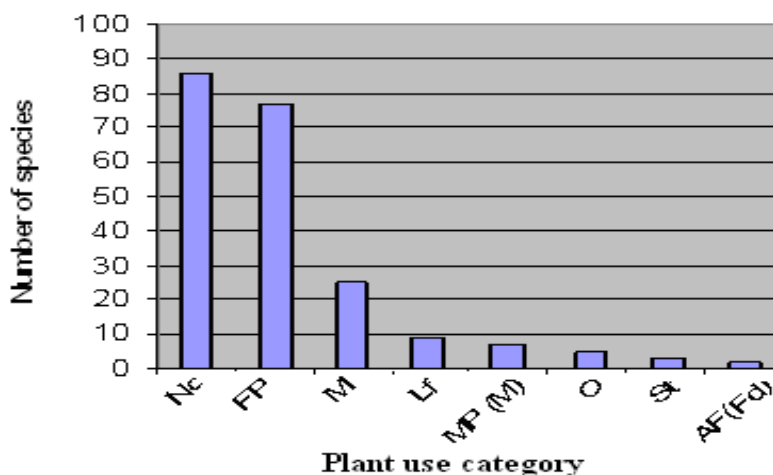


Fig.1. The use categories of plant species and their frequencies in home gardens of the study area

More use reports (66) have been recorded from the people of the study area when compared with other studies carried out for the Berta and Gumuz (18) [4] people of Benishangul-Gumuz Region. This might be related to experiences and culture of peoples in the study area, the size of home gardens, the number of samples, the area covered, and the agroclimatic conditions.

Species of some emergent important plants were recorded in the home gardens because farmers allowed them to grow there in order to get benefits like indicating of the conditions of soil fertility for farmers, medicine, as detergent/soap, repelling harmful insects and small animals, as food in the dry seasons, animal feed and the combination of two or more of the above and other uses. People in the study area practiced growing more of food and miscellaneous plants in their home gardens that contribute to the economy of the local population. The indigenous knowledge of using spices to flavour food, treat illness and for other purposes helped to conserve and compose these plant resources in the home gardens for centuries.

The perennial crops such as *Ensete ventricosum* and *Coffea arabica* were among the dominant plant species existing in almost all sampled home gardens. This was because; these plant species serve as the main economic and food source of the livelihood of the farmers. In addition to these food crops, *Colocasia esculenta*, *Ipomoea batatas*, *Zea mays*, *Phaseolus vulgaris* and *Brassica spp.* that contribute to the daily diet of the family were also common. *Solanum capsicoides* was a widely cultivated plant in the home gardens. It is a drought tolerant plant whose leaves were used as cabbage for food and fruits and leaves were for medicine. Other crops that were widely grown in the area include mango, avocado, banana and ginger. There were similar reports about the widely grown fruits for Gamo [33] and Wolayta people [30]. From production and continuous cultivation of these plant species, the study area is expected to be a centre for exporting of fruit and root crops in the near future.

B. 1.4. Management Practices Related to Spices, Condiments and Medicinal plants in and around Home Gardens of the Study Area

1.4.1. Intercropping

The intermixing of multipurpose plants in home gardens and in the farm field benefited the indigenous people. The same was reported for Ghana [28]. Men were more knowledgeable than women regarding the use of trees and shrubs that were collected from the wild and planted in the home gardens. On the other hand, women were more knowledgeable than men regarding the use of herbaceous species grown in home gardens. Women also cultivated and managed root and tuber, vegetable crops, spices, condiments and medicinal plants. For example, taking of fresh products of these plants to the market was carried out only by women otherwise by children. Such activity is expected to conserve the plants of medicinal value with the indigenous practices.

1.4.2. Tradition of diversifying plants in home gardens

The study area people (Dawro) have tradition of diversifying their home gardens at least with enset, coffee, spices, vegetables, medicinal plants and fruits with other multipurpose plants, and at least a head of cattle (a cow and /or an ox). The people have a tradition of not let their daughters to be married to a person with less diversified home garden. There was a tradition of scolding such a person with the hope of to encouraging him to diversify his home garden. They knew that diversified home gardens provide balanced diet, medicine and income; the owner could not be affected by starvation, disease and poverty. Parents make sure that their daughter is going to a person that has a diversified home garden and a cow or an ox before they agree to give her and send her out of their home in order to reduce the risks of hardship in her future life. There was also a tradition of diversifying diets, the wife/woman who

provided only one or two dishes of food during meals was likewise advised to diversify it. In case where one or two were presented for meals, that lady was scolded by saying ‘Gutuma’ meaning this is a dry meal that cannot be eaten. There should be boiled coffee leaf, milk, other diversified food source and this must be obtained from the home garden. The link between a diversified home garden and variety of food on the dining table is well established in Dawro society. A lot of spices, condiments, vegetables, roots and tubers including enset, fruits, coffee and others were grown in the home garden for immediate access. Food diversification will naturally be embedded in the systems positive outcomes of mixed cropping and integrating farming coupled with introduction of new crops and underutilized adapted species [7]. Such tradition of respecting and encouraging individuals with diverse plant species in and around their home gardens contributed to having the diverse flora for all year round in home gardens in the study area. This consequently has multiple advantages such as an effect on the conservation strategy for food plants, traditional agricultural systems, species and the indigenous knowledge for generations in the study area.

1.4.3. Selective harvesting

Medicinal plants in the study area were collected in the morning not at midday, as they say, in order to protect themselves from evil spirits that may be hiding in the plant. While this has a conservation value by limiting the time of collecting, there may also be scientific merit of discouraging during hot hours not to compromise the chemical composition of the plant. A similar observation was reported from Chifra District [31]. There are also claims that traditional plant medicines are effective only if the plants were collected at certain time of the day as reported in Dar es Salaam and on the main island of Ukerewe, Tanzania (Gessler *et al.*, 1995 cited in [31]). Medicinal plant collection and provision was also done in holidays (including Sunday, Wednesday and Friday as these are culturally considered God’s days) as reported in Ejaji area (Chelya Wereda) in West Shoa [2] and Gimbi area, in western Wellega [32]. They think that it was effective especially on Sunday because it was their cultural belief and religious outlook. The selective harvesting of spices and herbs by women rather than men, and collecting or cutting trees for construction purpose (pole) by households were also some of the conservative practices.

1.4.4. Planting in graveyards and cemeteries

It was observed that the graves and tombs were planted with at least two to three trees. Spices, condiments and medicinal plants were also found on the tombs of woman symbolizing the effort made by women to grow spices in home gardens. Plants on graves and tombs were never cut for usage. Relatives and families visit the graves and weed them to make sure of their growth and survival (Fig. 6). The rituals and spiritually protected areas used for celebrations probably contain more plant diversity and have contribution to conservation activities in the area similar to the report from Ejaji area (Chelya Wereda) [2] and Gimbi area people in western Wellega [32].



Figure .6. 14 species of Spices (Basil), condiments (Wormwood) and medicinal plants (Lemon grass) in the grave and on the tombs in the Baza Koyisa kebele

1.4.5. Traditional ceremonies

According to elderly informants, 'Geyuwa' and 'Ocha Kasha' ceremonies in the study area were the conservative traditions for spices, condiments and medicinal plants. 'Geyuwa' was the ceremony in which women/wives aged over 40 years went to ceremonies far away from their residence with spices, medicinal plants, fragrances and perfume plants. They planted them there around small hut constructed in the forest (away from the residence) for this purpose. It was celebrated there in the forest whenever unusual things/features (including signs of mutation) were seen on the newly born human baby or in the young of their domestic animals. In the day of the celebration, they took similar plant species that they planted around the hut before (including rue, sweet basil and wormwood) and grasses from thatch of the roof as a sample. After the completion of dancing and singing procedures, they throw downhill the piece that they took with them, thinking that the evil thing will be thrown far away from their houses. 'Ocha Kasha' was another ceremony at which women in the neighbourhood and relatives come together to the home of a newborn child. It was the ceremony in which the mother sat on wooden frame made from *Syzygium guineense* and leaves of enset (*Ensete ventricosum*). They wash the mother three to four days after the child was born. They wash her after letting for an hour in the steam bath of spices and *Syzygium guineense*. According to this tradition, for this purpose, the spices used for the washing should be those cultivated around the house, in the home garden. However, the practices became diminished because of different factors like expansion of primary health services, education, invasion of different cultures and religions.

4. Conclusion and Recommendations

In conclusion, communities living in the study area practiced home gardening and took care of the home garden primarily as a means of satisfying their needs for ensuring food security or home consumption (for quick and easy access to foodstuffs including for use as spice and condiment) and as a means for income generation beside other miscellaneous usage. Home gardens were the most adaptable and accessible land resource that could reduce vulnerability to climate change, i.e. continuous adaptation to changes in environmental and living conditions, encountering the potential impacts of climate change. Home gardens have played and continue to play a prominent role in providing medicines used to treat illnesses of their children. The structure of home gardens and the farming practices allowed the maintenance of a considerable number and variety of useful species actively or passively. This whole thing has also aesthetic and cultural values.

The gene flow within the home garden system is obvious because it served as both in- and ex-situ conservation sites for indigenous crops and local varieties/landraces. The home gardens served as sites for domestication of wild varieties of some species and for trial of new varieties of crops. In other word, plant species with many uses have become scarce in the nearby forests of the study area, being threatened and there should be bylaws to regulate the communal resource use system.

There were well-established traditional home gardens with ornamentals, spices, condiments, medicinal plants, roots and tubers, vegetables, fruits and other collection of plants both horizontally and vertically arranged.

People in the study area adapted to use different plants. From production and continuous cultivation of these plant species, the study area was expected to be the centre for exporting fruits and root crops as well as spices, condiments and medicinal plants in the near future. The selection of wild plants used for food, medicine, construction, ritual and for other purposes, and growing them in the garden and planting two or more species in graveyards and other traditional ceremonial places showed how the Dawro people used and protected their biodiversity and their environment.

It appeared that there was a loss of plant biodiversity due to agricultural expansion and other factors such as selective cutting for timber, construction and other demands, bushfire and overgrazing. Traditional agricultural activities currently have been affected by the shift to improved seeds that are commercially important. Due to the increasing human population and the subsequent agricultural expansion, spices and medicinal plants in the wild were under threat. Thus, home gardens provided opportunities for the growth of wild plants in and around them.

Based on the results of the study the following recommendations were given:

- Before cultural transformation destroys the traditional system, greater effort should be devoted to surveys, documentation and conservation of the agrobiodiversity and the associated indigenous knowledge in the remaining weredas of Dawro Zone and other areas to have a better understanding of the wealth of the information available;
- Encourage home gardening for plant biodiversity conservation and management as well as for ecological interventions (for cultivation of spices, medicinal plants and other multipurpose species);
- Pharmacological and biological activity testing of most popularly used traditional medicinal plants that were considered as backbone of the health life for both human and the domestic animals such as *Becium ellenbeckii*, *Maytenus senegalensis*, *Stephenia abyssinica*, *Pentas schimperiana*, *Mucuna melanocarpa*, *Lannea fruticosa* and *Maerua oblongifolia* is important;
- Establish a field gene bank for crops like *Plectranthus edulis*, *Vigna radiata* and *Triticum polonicum*, some wild edible plants like *Dioscorea schimperiana*, some medicinal plants like *Maerua oblongifolia*, *Lannea fruticosa*, *Acacia seyal*, *Balanites aegyptiaca*, *Boswellia papyrifera*, *Cordia africana*, *Croton macrostachyus*, *Ficus sycomorus* and *Tamarindus indica*, and for other multipurpose plants;
- Awareness raising of the local population and training on the sustainable utilization and management of plant resources needs to be taken up seriously;
- Research directed towards alleviating bacterial wilt of enset and the wilting and berry attack of coffee by fungi and bacteria are mandatory for enset-coffee based gardens as well as those containing spices and medicinal plants. It is advisable to scale-up the indigenous way of protecting from such diseases by encouraging and assisting the knowledgeable persons to innovate;

➤ Find regional, national and international markets for those producers already organized and encourage the potential producers and traditional healers to form local cooperative associations as one of the strategies to alleviate subsistence life and take the people out of the food aid vicious cycle.

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Scientific name	Family name	Local name	Habit /Life form	LOMA		GENA BOSA		Total		
				species	Frequ	species	Frequ	Species	Frequ	Use
<i>Abrus precatorius</i>	<i>Fabaceae</i>	Badalluwa	C	3	2	215	1	218	3	NC; MP
<i>Acalypha psilostachya</i>	<i>Euphorbiaceae</i>	Shakintaa	S	2	1	0	0	2	1	NC; MP
<i>Acanthus polystachius</i>	<i>Acanthaceae</i>	Ookaa	S	0	0	5	3	5	3	NC; MP
<i>Achyranthes aspera</i>	<i>Amaranthaceae</i>	Oodaa/Goodaa	H	162	7	921	18	1083	25	NC; Fd
<i>Agave sisalana</i>	<i>Agavaceae</i>	K'anc'c'aa	H	0	0	2	1	2	1	Lf; MP
<i>Ageratum conyzoides</i>	<i>Asteraceae</i>	Zeei'saa	H	2962	48	3028	47	5990	95	NC
<i>Allium cepa</i>	<i>Alliaceae</i>	Sunk'k'uruutuwa	H	0	0	3	1	3	1	S; MP
<i>Allium sativum</i>	<i>Alliaceae</i>	Tuumuwa	H	0	0	23	1	23	1	S, MP
<i>Aloe otallensis</i>	<i>Aloaceae</i>	Godare Utsa	H	1	1	0	0	1	1	MP; Lf
<i>Amaranthus caudatus</i>	<i>Amaranthaceae</i>	Gaggabba	H	102	11	25	9	127	20	E-OI; MP
<i>Amaranthus graecizans</i>	<i>Amaranthaceae</i>	C'umad'iyaya	H	121	6	50	8	171	14	We
<i>Amaranthus hybridus</i>	<i>Amaranthaceae</i>	Fara c'umad'iyaya	H	148	12	207	17	355	29	We
<i>Ananas comosus</i>	<i>Bromeliaceae</i>	Anaanaasiya	H	1	1	0	0	1	1	F
<i>Andropogon gayanus</i>	<i>Poaceae</i>	Gataa (K'ac'a Gata)	H	2	1	2	2	4	3	Mi; MP

<i>Arthraxon micans</i>	<i>Poaceae</i>	Huwachiya	H	1563	29	412	14	1975	43	NC; Fd
<i>Artemisia absinthium</i>	<i>Asteraceae</i>	Naatiruwaa	H	40	8	0	0	40	8	S,M P,O
<i>Artemisia abyssinica</i>	<i>Asteraceae</i>	Faraaguppiya	H	0	0	35	3	35	3	S,M P
<i>Artemisia afra</i>	<i>Asteraceae</i>	Aguppiya	H	70	6	72	11	142	17	S,M P
<i>Artemisia annua</i>	<i>Asteraceae</i>	Faranjjiya aguppiya / Artemisiya	H	15	2	0	0	15	2	S,M P
<i>Azadirachta indica</i>	<i>Meliaceae</i>	Nimiitiirya	S	129	7	2	2	131	9	MP, Mi
<i>Bidens biternata</i>	<i>Asteraceae</i>	Hans's'ikaluwa	H	991	39	663	39	1654	78	NC; MP
<i>Bidens prestinaria</i>	<i>Asteraceae</i>	Addilya	H	56	8	161	8	217	16	NC; Fd; O
<i>Biophytum umbraculum</i>	<i>Oxalidaceae</i>	Dango	H	2	1	27	2	29	3	NC; MP
<i>Brassica oleracea</i>	<i>Brassicaceae</i>	Asotiya santsa	H	13	2	36	5	49	7	V; E-OI
<i>Brassica carinata</i>	<i>Brassicaceae</i>	Kanak'aa /Dank'aa	H	232	33	295	16	527	49	V
<i>Caesalpinia decapetala</i>	<i>Fabaceae</i>	Doyiyya/ Faranjjiya gom'o'Oriya/S'un dduk'iya	S	0	0	2	2	2	2	Lf; Mi
<i>Calpurnia aurea</i>	<i>Fabaceae</i>	Maylluwaa	S	0	0	1	1	1	1	Lf; MP
<i>Canthium</i>	<i>Rubiaceae</i>	Genie'-	C	3	1	0	0	3	1	NC;

<i>schimperianum</i>	<i>e</i>	shaya								
<i>Capsicum annum</i>	<i>Solanaceae</i>	Bambbariya	H	203	33	347	29	550	62	S,M P;V
<i>Capsicum frutescens</i>	<i>Solanaceae</i>	Mis'imis'uwa	H	156	31	110	16	266	47	S,M P;V
<i>Carduus schimperi</i>	<i>Asteraceae</i>	Kashiya (Geziyawa)	H	9	2	0	0	9	2	NC; MP
<i>Carica papaya</i>	<i>Caricaceae</i>	Paappa	S	87	36	70	25	157	61	F; MP
<i>Casimiroa edulis</i>	<i>Rutaceae</i>	Kasmiriya	S	0	0	1	1	1	1	F
<i>Catharanthus roseus</i>	<i>Apocynaceae</i>	Wulawuha (Bootsa c'iishiiyawa)	H	5	1	0	0	5	1	NC; MP
<i>Catha edulis</i>	<i>Celastraceae</i>	Jimaa	S	2	1	2	1	4	2	St; MP; Mi
<i>Celosia trigyna</i>	<i>Amaranthaceae</i>	Majoliya /Zarggula	H	133	9	358	13	491	22	NC; MP
<i>Chamaecrista mimosoides</i>	<i>Fabaceae</i>	Deesha Halakuwaa	H	2	1	0	0	2	1	NC; Fd
<i>Chenopodium ambrosioides</i>	<i>Chenopodiaceae</i>	Gonssiidaa Konsiris'iyaa	H	0	0	116	4	116	4	S,M P
<i>Citrus aurantifolia</i>	<i>Rutaceae</i>	Loomiya	S	0	0	15	14	15	14	F; MP
<i>Citrus sinensis</i>	<i>Rutaceae</i>	Birttukaniya	S	39	17	6	3	45	20	F
<i>Clusia abyssinica</i>	<i>Euphorbiaceae</i>	Caccaawuwa	T	1	1	2	1	3	2	Mi; MP
<i>Coccinia grandis</i>	<i>Cucurbit</i>	Wololuw	C	1	1	2	1	3	2	O;

	<i>aceae</i>	a								MP
<i>Coffea Arabica</i>	<i>Rubiaceae</i>	Bunaa/T ukkiyaa	S	641	41	747	43	1388	84	St; MP; Mi
<i>Colocasia esculenta</i>	<i>Araceae</i>	Boyina	H	880	42	1173	41	2053	83	R
<i>Commelina africana</i>	<i>Commeli naceae</i>	Gulbbati ya	H	951	17	312	17	1263	34	NC; MP; Fd
<i>Commelinia latifolia</i>	<i>Commeli naceae</i>	Dal77ish a/Gassaa	H	1229	46	2355	36	3584	82	NC; MP; Mi ; Fd
<i>Conyza bonariensis</i>	<i>Asterace ae</i>	Woyaniy a/Puluma /Toora	H	16	3	736	1	752	4	NC
<i>Corchorus olitorius</i>	<i>Tiliaceae</i>	Shooshaa ayfiya	H	0	0	10	6	10	6	O; MP
<i>Cordia africana</i>	<i>Boragina ceae</i>	Mok'otsa a	T	51	27	76	33	127	60	Mi; MP; We
<i>Coriandrum sativum</i>	<i>Apiaceae</i>	Deebbuw a	H	159	16	167	12	326	28	S; MP
<i>Coronopus didymus</i>	<i>Brassica ceae</i>	Faranjiya Shipa/Si bikaa	H	53	2	0	0	53	2	S; MP
<i>Crambe hispanica</i>	<i>Brassica ceae</i>	Doriganj iya	H	6	1	0	0	6	1	We
<i>Crassocephalum macropappum</i>	<i>Asterace ae</i>	Gammaa maataa	H	0	0	7	2	7	2	NC; Fd; Mi
<i>Crepis rueppellii</i>	<i>Asterace ae</i>	Mas's'u wa	H	19	6	26	5	45	11	Lf; MP
<i>Crotalaria rosenii</i>	<i>Fabacea e</i>	Kishikish o	H	0	0	2	1	2	1	NC; MP
<i>Croton</i>	<i>Euphorbi</i>	Anka	T	0	0	5	2	5	2	Mi;

<i>macrostachyus</i>	<i>aceae</i>									MP
<i>Cucumis sativus</i>	<i>Cucurbitaceae</i>	Gosiya/b accaa	Cr	11	7	4	3	15	10	Mi
<i>Cucurbita pepo</i>	<i>Cucurbitaceae</i>	Leekiya	Cr	74	34	41	20	115	54	V
<i>Curuma domestica</i>	<i>Zingiberaceae</i>	Erddiya	H	13	3	6	1	19	4	S; MP
<i>Cyathula cylindrica</i>	<i>Amaranthaceae</i>	Dorssa k'arccoc ha/Shid' o	H	15	1	118	12	133	13	NC
<i>Cymbopogon citratus</i>	<i>Poaceae</i>	Bunc'c'e cha	H	25	3	10	6	35	9	S,O
<i>Cynodon dactylon</i>	<i>Poaceae</i>	Sura (miyiiya s'ap'uwa wa)	H	1068	20	2263	25	3331	45	NC; MP; Fd
<i>Cyperus rigidifolius</i>	<i>Cyperaceae</i>	S'atha	H	1803	25	1686	18	3489	43	NC
<i>Cyphostemma adenocaula</i>	<i>Vitaceae</i>	Shorttiya tura	C	3	1	5	2	8	3	NC; MP
<i>Cyperus articulata</i>	<i>Cyperaceae</i>	Biddaara a	H	3	2	29	7	32	9	S; MP
<i>Datura stramonium</i>	<i>Solanaceae</i>	Laflafuw a/Mac'c' arak'a	H	18	3	43	11	61	14	NC; MP
<i>Dichondra repens</i>	<i>Convolvulaceae</i>	Ec'c'ere- haytsa	C	1559	31	1528	30	3087	61	NC; MP; Fd
<i>Dicliptera laxata</i>	<i>Acanthaceae</i>	Tooguuw a (Michiya D'aliya)	H	20	7	248	10	268	17	MP
<i>Digitaria abyssinica</i>	<i>Poaceae</i>	Worppad uwa	H	1100	14	226	7	1326	21	NC
<i>Dioscorea</i>	<i>Dioscoreaceae</i>	Boyiiya	C	69	30	56	14	125	44	R

<i>abyssinica</i>	<i>aceae</i>									
<i>Dioscorea bulbifera</i>	<i>Dioscoreaceae</i>	Bola boyiyya/ Bukuchiya/ unkurbbuwa	C	77	21	15	8	92	29	R
<i>Dioscorea praehensilis</i>	<i>Dioscoreaceae</i>	Wuc'c'ariya/ Shank'k'ila boyiyya	C	614	14	448	9	1062	23	NC; Fd
<i>Discopodium penninervum</i>	<i>Solanaceae</i>	C'oyd'a Ai'naa	S	5	1	0	0	5	1	NC; MP
<i>Dissotis canescens</i>	<i>Melastomataceae</i>	Siiroriya/ Biitaa tusa	H	0	0	2	1	2	1	NC; MP
<i>Drymaria cordata</i>	<i>Caryophyllaceae</i>	Hurs's'us'uma/ Moc'c'iya	H	153	2	0	0	153	2	NC; MP
<i>Echinochloa pyramidalis</i>	<i>Poaceae</i>	Doginya/ Gic'oliya /kana dupa	H	239	3	2	1	241	4	Mi; MP; Fd
<i>Echinops amplexicaulis</i>	<i>Asteraceae</i>	Kashiya (Zou'wa gad'aawa)	H	0	0	2	1	2	1	NC; MP
<i>Echinops kebericho</i>	<i>Asteraceae</i>	Bursa	H	0	0	2	1	2	1	MP
<i>Ehretia cymosa</i>	<i>Boraginaceae</i>	Etrriwanj jiya	T	0	0	3	2	3	2	Mi; MP
<i>Eleusine indica</i>	<i>Poaceae</i>	His's'iya maataa	H	92	9	64	5	156	14	NC
<i>Ensete ventricosum</i>	<i>Musaceae</i>	Utsa	H	954	48	2007	47	2961	95	R
<i>Entada abyssinica</i>	<i>Fabaceae</i>	Gelc'c'e c'c'a	T	1	1	0	0	1	1	Mi; MP
<i>Eragrostis tef</i>	<i>Poaceae</i>	Gaashiya	H	0	0	1200	1	1200	1	C

<i>Erythrina abyssinica</i>	<i>Fabaceae</i>	Borttuwaa (Gad'aa wa)	T	1	1	0	0	1	1	Mi; MP
<i>Eucalyptus camaldulensis</i>	<i>Myrtaceae</i>	Barzzafiya (Karetsa)	T	5	2	7	2	12	4	Mi
<i>Eucalyptus globulus</i>	<i>Myrtaceae</i>	Barzzafiya (Bootsa)	T	40	1	0	0	40	1	Mi; MP
<i>Euphorbia hirta</i>	<i>Euphorbiaceae</i>	Shato maataa (Shank'k'ila d'aliya)	H	104	18	63	4	167	22	NC; MP
<i>Falkia canescens</i>	<i>Covolvulaceae</i>	Liichiiya	H	21	1	0	0	21	1	NC; Fd
<i>Ficus vasta</i>	<i>Moraceae</i>	Esaa/Etta	T	6	6	11	9	17	15	Mi; MP; We
<i>Foeniculum vulgare</i>	<i>Apiaceae</i>	Walaga/ Shilariya	H	178	15	49	3	227	18	SM
<i>Galinsoga parviflora</i>	<i>Asteraceae</i>	Ematsiya /Bizddiya	H	2447	37	1623	33	4070	70	NC
<i>Galium aparinoides</i>	<i>Rubiaceae</i>	Kanggad'a	H	1	1	0	0	1	1	NC
<i>Gardenia ternifolia</i>	<i>Rubiaceae</i>	Genbbela	T	0	0	1	1	1	1	Mi
<i>Girardinia diversifolia</i>	<i>Urticaceae</i>	Konaa (K'eri Konaa)	H	10	2	0	0	10	2	NC
<i>Guizotia abyssinica</i>	<i>Asteraceae</i>	Nuugiya	H	18	2	2	1	20	3	E- OI; MP
<i>Guizotia scabra</i>	<i>Asteraceae</i>	Tuufa	H	187	26	358	24	545	50	NC

<i>Guizotiaschimperi</i>	<i>Asteraceae</i>	Kod'uwa	H	730	28	31	8	761	36	NC
<i>Glycine max</i>	<i>Fabaceae</i>	Fafanjiiya atariya	S	9	2	49	7	58	9	P,Lf
<i>Glycine wightii var. longicauda</i>	<i>Fabaceae</i>	S'oka/S'i lke-d'aliya	C	0	0	5	4	5	4	NC; MP
<i>Gossypium hirsutum</i>	<i>Fabaceae</i>	Tooguwa tura	C	39	12	113	4	152	16	Mi; MP
<i>Grewia bicolor</i>	<i>Tiliaceae</i>	S'awayiya	S	2	1	5	4	7	5	MI
<i>Hackelochloa granularis</i>	<i>Poaceae</i>	-	H	3	1	0	0	3	1	NC
<i>Hibiscus cannabinus</i>	<i>Malvaceae</i>	Dans'a (Zo'o, Puutuwa a malaa)	S	0	0	5	1	5	1	O; MP
<i>Hygrophila schulli</i>	<i>Acanthaceae</i>	Fara aguntsa	H	10	2	0	0	10	2	NC
<i>Hypericum peplidifolium</i>	<i>Hypericaceae</i>	Maalima s'ino	H	20	1	0	0	20	1	NC; MP
<i>Impatiens tinctoria</i>	<i>Balsaminaceae</i>	Wosoluwa	H	3	1	118	2	121	3	NC; MP
<i>Indigofera arrecta</i>	<i>Fabaceae</i>	Wusiwusiya	S	9	3	10	2	19	5	NC; MP
<i>Indigofera spicata</i>	<i>Fabaceae</i>	Sheekaa/ K'uriya/ Dangarsa d'ure	H	97	13	84	36	181	49	NC; MP
<i>Ipomoea batatas</i>	<i>Convolvulaceae</i>	Shukariya	Cr	1160	35	298	27	1458	62	R
<i>Jasminum abyssinicum</i>	<i>Oleaceae</i>	JoliJoola a/Zinbala	H	4	2	0	0	4	2	NC; Fd
<i>Jatropha curcas</i>	<i>Euphorbiaceae</i>	Miimiiya /Atiiyaa/ Faranjjiy	S	74	15	177	16	251	31	Lf ;MP

		a s'eema								
<i>Juniperus procera</i>	<i>Cuperssa ceae</i>	S'iida (Abasha wa)	T	2	1	0	0	2	1	Mi; MP; O
<i>Justica diclipteroides</i>	<i>Acanthaceae</i>	-	H	1	1	0	0	1	1	NC
<i>Justicia schimperiana</i>	<i>Acanthaceae</i>	Santsaliya/Taadak'aa	H	0	0	4	1	4	1	Lf; MP
<i>Kosteletzkya adoensis</i>	<i>Malvaceae</i>	Med'eriyaa	H	15	3	6	2	21	5	NC; MP
<i>Lactuca paradoxa</i>	<i>Asteraceae</i>	Mas'oliyaa	C	0	0	2	1	2	1	NC; MP
<i>Laggera crispata</i>	<i>Asteraceae</i>	Seesa/Gelsho tambbuwaa	H	30	15	30	14	60	29	NC; MP; Mi
<i>Lantana trifolia</i>	<i>Verbenaceae</i>	Shankish aashaa	H	7	3	0	0	7	3	NC; MP
<i>Lens culinaris</i>	<i>Fabaceae</i>	Misiriya	H	44	8	25	11	69	19	P; MP
<i>Lepidium sativum</i>	<i>Brassicaceae</i>	Sibikkaa	H	16	4	84	3	100	7	S; MP
<i>Leucas abyssinica var. sidamoensis</i>	<i>Lamiaceae</i>	Kirikisa S'imbis'ora malatiyawa	H	3	1	0	0	3	1	NC; MP
<i>Leucas martinicensis</i>	<i>Lamiaceae</i>	K'umo'ti ya	H	170	27	189	21	359	48	MP, Mi
<i>Linum usitatissimum</i>	<i>Linaceae</i>	Talbba	H	3	1	2	1	5	2	E-Ol; MP
<i>Lippia adoensis var. adoensis</i>	<i>Verbenaceae</i>	Shaashaa	S	4	1	20	3	24	4	S; MP
<i>Lippia adoensis</i>	<i>Verbenaceae</i>	Kosoroti	H	55	8	32	13	87	21	Mi

<i>var. kosoret</i>	<i>eae</i>	yaa								
<i>Lycopersicon esculentum</i>	<i>Solanaceae</i>	Timatimi ya	H	26	9	30	7	56	16	V
<i>Maesa lanceolata</i>	<i>Myrsinaceae</i>	Gegec' u wa	T	2	1	2	2	4	3	Lf; MP; Mi
<i>Malus sylvestris</i>	<i>Rosaceae</i>	Appliya (ladiya mala)	S	12	2	0	0	12	2	F; MP
<i>Mangifera indica</i>	<i>Anacardiaceae</i>	Manguwa	T	39	19	15	8	54	27	F; MP
<i>Manihot esculenta</i>	<i>Euphorbiaceae</i>	Mitsa Boyiyya/ Pampa	S	593	39	166	21	759	60	R; MP
<i>Mentha spicata</i>	<i>Lamiaceae</i>	Masho/ Maatsa sawo	H	0	0	163	10	163	10	S
<i>Millettia ferruginea</i>	<i>Fabaceae</i>	Zaagiya	T	1	1	3	3	4	4	Mi; MP
<i>Moringa stenopetala</i>	<i>Moringaceae</i>	Halakuwa	T	143	30	38	10	181	40	V; MP
<i>Musa x paradisiaca</i>	<i>Musaceae</i>	Muuziyya	S	63	24	116	13	179	37	F
<i>Nephrolepis undulata</i>	<i>Oleandraceae</i>	Bisaa (Gad'aa wa)	H	4	1	0	0	4	1	NC; MP
<i>Nicandra physaloides</i>	<i>Solanaceae</i>	Puk'ak'ya (Laflafuwa malatiyawa)	H	0	0	86	8	86	8	NC
<i>Nicotiana tabacum</i>	<i>Solanaceae</i>	Tambuwa/Kaak oosa	H	28	5	31	6	59	11	St; MP
<i>Nigelia sativa</i>	<i>Ranunculaceae</i>	Karetsa sawuwa/ Karetsa	H	0	0	22	1	22	1	SM

		K'imami ya								
<i>Ocimum americanum</i>	<i>Lamiace ae</i>	Dunkkiy a (Bunaane K'umaw a)	H	249	31	449	22	698	53	S; MP
<i>Ocimum basilicum var.basilicum</i>	<i>Lamiace ae</i>	Dunkkiy a (Maatsaa waa)	H	2	1	0	0	2	1	S; MP
<i>Ocimum basilicum var. thyrsiflorum</i>	<i>Lamiace ae</i>	Hiran'uw a	H	20	7	72	7	92	14	S
<i>Ocimum americanum</i>	<i>Lamiace ae</i>	Zitiituw a	H	54	17	23	2	77	19	S
<i>Ocimum lamiifolium</i>	<i>Lamiace ae</i>	Dama kasiya	H	3	2	3	2	6	4	MP
<i>Ocimum urticifolium</i>	<i>Lamiace ae</i>	Guluuwa /Deesha dunkkiya	H	32	15	82	22	114	37	S; MP
<i>Olyra latifolia</i>	<i>Poaceae</i>	Woshiila ngiya	H	383	9	129	1	512	10	NC
<i>Opuntia ficus- indica</i>	<i>Cactacea e</i>	Baalasya	H	0	0	172	4	172	4	C
<i>Oxalis radicata</i>	<i>Oxalidac eae</i>	Zil'i- maataa/ Shuk'o/s humachi ya	H	120	16	1311	7	1431	23	NC; MP
<i>Passiflora edulis</i>	<i>Passiflor aceae</i>	Purunttus hya	H	2	1	3	2	5	3	F; MP; O
<i>Pelargonium whytei</i>	<i>Geraniac eae</i>	Zo'o C'iisha	H	2	1	0	0	2	1	O
<i>Pennisetum clandestinum</i>	<i>Poaceae</i>	Gors'aa	H	38	3	59	2	97	5	NC; Fd

<i>Persea americana</i>	<i>Lauracea e</i>	Abokatuwa	T	39	22	72	32	111	54	F; MP
<i>Phaseolus lunatus</i>	<i>Fabacea e</i>	Bak'aliya Wohiya /Karpuwa	C	14	6	71	24	85	30	P
<i>Phaseolus vulgaris</i>	<i>Fabacea e</i>	Torggoniya/Sheed'iya	H	103	16	270	7	373	23	P
<i>Phaulopsis imbricata</i>	<i>Acanthaceae</i>	Umbaa	H	347	3	3120	25	3467	28	NC
<i>Phyllanthus pseudoniruri</i>	<i>Euphorbiaceae</i>	Higishshaa d'aliya	H	23	3	14	1	37	4	NC; Fd
<i>Phyllanthus sepialis</i>	<i>Euphorbiaceae</i>	-	H	3	1	0	0	3	1	NC
<i>Physalis peruviana</i>	<i>Solanaceae</i>	Pugul'iyaa	H	4	2	1	1	5	3	NC; MP
<i>Piliostigma thonningii</i>	<i>Fabacea e</i>	K'ank'k'aalaa	T	2	2	3	1	5	3	Mi; MP; We
<i>Piper nigrum</i>	<i>Piperaceae</i>	K'undobambbariyaa	T	7	4	2	1	9	5	SM
<i>Pisum sativum</i>	<i>Fabacea e</i>	Atariya	H	4	2	0	0	4	2	P
<i>Plantago palmata</i>	<i>Plantaginaceae</i>	Borodaa	H	2	1	2	1	4	2	NC
<i>Plectranthus edulis</i>	<i>Lamiaceae</i>	Kafudon uwa K'oli- donuwa	H	7	2	0	0	7	2	NC
<i>Plectranthus ornatus</i>	<i>Lamiaceae</i>	Dissa	H	24	7	36	10	60	17	S
<i>Plectranthus punctatus</i>	<i>Lamiaceae</i>	Donakiya/Kafudonuwa	H	3	1	0	0	3	1	NC

		malatiya wa								
<i>Portulaca oleracea</i>	<i>Portulac aceae</i>	Boodool aa/Margu daa	H	53	8	101	1	154	9	NC; Fd
<i>Prunus africana</i>	<i>Rosaceae</i>	Ontsa	T	1	1	0	0	1	1	Mi; MP
<i>Prunus persica</i>	<i>Rosaceae</i>	Kokiya	S	3	2	0	0	3	2	F
<i>Psidium guajava</i>	<i>Myrtacea e</i>	Zaytuuna a	T	1	1	6	4	7	5	F
<i>Pycnostachys abyssinica</i>	<i>Lamiace ae</i>	Olomuwa	S	0	0	12	2	12	2	Lf; MP
<i>Rhamnus prinoides</i>	<i>Rhamnac eae</i>	Geeshuwa	S	1	1	0	0	1	1	S; MP
<i>Ricinus communis</i>	<i>Euphorbi aceae</i>	S'eemaa	S	43	21	88	27	131	48	Mi; MP
<i>Rossmarinus officinalis</i>	<i>Lamiaca eae</i>	Ashuwa sawisiya maataa	H	29	4	0	0	29	4	S; NC
<i>Rumex abyssinicus</i>	<i>Polygona ceae</i>	C'ol'iya	H	18	3	1	1	19	4	NC; MP
<i>Rumex nepalensis</i>	<i>Polygona ceae</i>	Zans's'al aa	H	146	7	124	12	270	19	NC; MP; We; Mi
<i>Ruta chalepensis</i>	<i>Rutaceae</i>	S'alotiya	H	176	20	125	31	301	51	SM
<i>Saccharum offiicinarum</i>	<i>Poaceae</i>	Shonkora a	H	140	14	81	13	221	27	Mi
<i>Salvia nilotica</i>	<i>Lamiace ae</i>	Sa'a- okata	H	10	1	259	5	269	6	NC; MP
<i>Santolina chamaecyparissu s</i>	<i>Asterace ae</i>	Faranjiya Naatiruw a	H	13	2	0	0	13	2	S,O
<i>Satureja paradoxa</i>	<i>Lamiace ae</i>	Settuwaa	H	229	1	312	2	541	3	NC; Fd

<i>Senna petersiana</i>	<i>Fabaceae</i>	Shooshaa Ens'arsa a	S	11	4	0	0	11	4	NC; Fd
<i>Sesbania sesban var. nubica</i>	<i>Fabaceae</i>	Manuwa maataa	S	1	1	0	0	1	1	Fd
<i>Sida rhombifolia</i>	<i>Malvaceae</i>	Danduretsa	H	254	28	352	34	606	62	NC; MP; Fd
<i>Sida schimperiana</i>	<i>Malvaceae</i>	Kinddich uwa	H	61	2	2	1	63	3	NC; MP
<i>Snowdenia polystachya</i>	<i>Poaceae</i>	Maga	H	266	2	204	8	470	10	NC; MP; Fd
<i>Solanum americanum</i>	<i>Solanaceae</i>	Gaayeeta	H	49	12	46	7	95	19	We; MP
<i>Solanum capsicoides</i>	<i>Solanaceae</i>	Karetsa buluwa /meeteeti ya buluwa	H	382	44	423	42	805	86	We; MP
<i>Solanum incanum</i>	<i>Solanaceae</i>	Wora buluwa	H	11	2	39	7	50	9	NC; MP
<i>Solanum tuberosum</i>	<i>Solanaceae</i>	Dinichaa /Bul'u'u maa	H	33	4	17	1	50	5	R
<i>Sorghum bicolor</i>	<i>Poaceae</i>	Maldduwa a/Gembu wa	H	133	7	18	3	151	10	C
<i>Sparmannia ricinocarpa</i>	<i>Tiliaceae</i>	Karc'c'o cha/Bari bacho	H	152	24	157	15	309	39	NC
<i>Spilanthus mauritiana</i>	<i>Asteraceae</i>	Aydamy a	H	422	17	764	14	1186	31	NC; MP; Fd; Mi
<i>Sporobolus pyramidalis</i>	<i>Poaceae</i>	Gic'ariya	H	1	1	0	0	1	1	NC

<i>Stephenia abyssinica</i>	<i>Menispermaceae</i>	Adoturaa	C	0	0	20	3	20	3	NC; MP
<i>Syzygium guineense. subsp guineense</i>	<i>Myrtaceae</i>	Ocha	T	0	0	1	1	1	1	Mi; We; MP
<i>Tagetes erecta</i>	<i>Asteraceae</i>	Derek'aa /Wontak'ama	H	4	1	0	0	4	1	O; MP
<i>Tagetes minuta</i>	<i>Asteraceae</i>	Ululuwa	H	27	6	15	5	42	11	S; MP
<i>Tephrosia gracilipes</i>	<i>Fabaceae</i>	-	H	3	1	0	0	3	1	NC
<i>Terminalia brownii</i>	<i>Combretaceae</i>	Galal'u'uwa	T	2	2	2	1	4	3	Mi; MP
<i>Terminalia schimperiana</i>	<i>Combretaceae</i>	Ambbiya	T	2	2	3	3	5	5	Mi; MP
<i>Thunbergia ruspolii</i>	<i>Acanthaceae</i>	Mud'a/Hallo	H	0	0	14	2	14	2	NC
<i>Thymus schimperi</i>	<i>Lamiaceae</i>	Oysamaataa/Zinbanuwa	H	183	4	474	9	657	13	S; MP
<i>Tridax procumbens</i>	<i>Asteraceae</i>	Puuk'uutuwa	H	139	16	94	4	233	20	NC; MP
<i>Trifolium decorum</i>	<i>Fabaceae</i>	Azimiiya	H	19	1	28	3	47	4	NC; Fd
<i>Vernonia amygdalina</i>	<i>Asteraceae</i>	Garaa	T	13	4	25	11	38	15	Fd; MP; Mi
<i>Vernonia hochstetteri var. hochstetteri</i>	<i>Asteraceae</i>	Gigina	H	2	1	0	0	2	1	NC; MP
<i>Vernonia theophrastifolia</i>	<i>Asteraceae</i>	Buuzuwa	S	4	3	12	6	16	9	Lf; MP
<i>Vernonia</i>	<i>Asteraceae</i>	Zamuwa	S	0	0	5	2	5	2	NC;

<i>urticifolia</i>	<i>ae</i>									MP
<i>Vicia faba</i>	<i>Fabaceae</i>	Ba'e'elaa	H	42	3	20	1	62	4	P
<i>Vigna radiata</i>	<i>Fabaceae</i>	Gijjiya	H	4	1	0	0	4	1	P
<i>Vitis vinifera</i>	<i>Vitaceae</i>	Woyniia	H	15	1	0	0	15	1	F; MP
<i>Withania somnifera</i>	<i>Solanaceae</i>	S'emusha	S	21	11	8	1	29	12	MP; Fd
<i>Zea mays</i>	<i>Poaceae</i>	Badaalaa	H	152	4	294	8	446	12	C
<i>Zehneria scabra</i>	<i>Cucurbitaceae</i>	Ec'c'a	C	5	2	0	0	5	2	NC; MP
<i>Zingiber officinale</i>	<i>Zingiberaceae</i>	Yenjeel uwa	H	296	13	695	3	991	16	SMP
214				30675	1757	37650	1574	68325	3331	

Appendix 1

Distribution of plant species recorded in plots of sampled home gardens of the study area

Keys: * The right bolded ones show edible and some medicinal plants recorded in more than 9 HGs

Where: **Fd** for fodder;

FP for food plants (cereal, fruit, oil, pulse, root, spice, vegetable, wild edible);

Lf for life fence;

Mi for miscellaneous uses like timber, pole, equipment, handles, construction, soil fertility and others;

MP for medicinal plants

NC for important plants with various (combination of above) uses;

O for ornamentals, and

S for stimulants