

# Ethnobotanical study of multipurpose plants in ENSET-based home gardens of Angecha District, Southern Ethiopia

## Abstract

Although home gardens are important for sustainable agriculture and resilience building in the face of climate change, recent development initiatives failed to include them as a viable option. This ethnobotanical study was conducted to document the role of home gardens for food security, conservation and sustainable use of medicinal and other multipurpose species in Angecha District, Southern Ethiopia. Data were collected from owner of home garden using semi-structured interview, discussions, observations and market survey. Vegetation data was collected from 75 home gardens which were selected randomly. Descriptive statistics was used for data analysis. Food plants were dominant in the home gardens followed by medicinal plants. A total of 44 food plants belonging to 38 genera and 18 families were documented from the surveyed home gardens. *Ensete ventricosum* was the most frequent and widely used multipurpose plant and women play a significant role its production cycle from propagation to harvesting. Women were empowered to manage home gardens and sell products in markets. Medicinal plants managed by the farmers 22 (belonging to 21 genera and 17 families). Herbs were the most commonly used growth forms and leaves were the most frequently used parts in traditional medicine. Home gardens were important for enhancing food and nutritional security, promoting ecosystem services and contributing to improving family income. It was concluded that there was high need to promote home gardens as part of sustainable farming system for food security and nutritional requirements, and for sustainable use of plants for diverse needs of communities.

**Keywords:** food plants, fruits and vegetables, indigenous knowledge, medicinal plants

Volume 4 Issue 1 - 2020

**Dawit Daba, Gemedo Dalle**

Centre for Environmental Science, College of Natural and Computational Sciences, Addis Ababa University, Ethiopia

**Correspondence:** Gemedo Dalle, Centre for Environmental Science, College of Natural and Computational Sciences, Addis Ababa University, Mailing Address: P. O. Box 80119, Addis Ababa, Ethiopia, Tel 251911887041, Email gemedo.dall@aau.edu.et

**Received:** December 11, 2019 | **Published:** January 28, 2020

## Introduction

Home gardens have been common practices for indigenous communities in many developing countries such as Ethiopia. It started with the domestication of edible plants and can be described as a mixed cropping system that encompasses vegetables, fruits, plantation crops, spices, herbs, ornamental and medicinal plants.<sup>1</sup> Home gardens have been closely associated with cultural practices of local communities where domesticated species are used for food, medicinal and other purposes. Farmers in developing countries manage these plants used for their food, medicine, spices, shade and other family needs in their home gardens. Review of studies from around the world suggests that home gardens can be a versatile option to address food insecurity in various challenging situations.<sup>1</sup> Home gardens are important for the conservation of useful plant species since they contain many and diverse species which may be absent from other production systems.<sup>2</sup> Home gardens also provide a wide range of ecological benefits and services and valuable set of products for the rural including food, fuel and fodder.<sup>2,3</sup> They are used to grow medicinal, spice, ornamental and stimulant plants.<sup>4</sup>

Enset (*Ensete ventricosum*, family Musaceae) is one of the root crops commonly cultivated in southern and southwestern part of Ethiopia. Enset has been cultivated in Ethiopia since ancient times. It is part of a sustainable production system.<sup>5</sup> The genus enset is close to, but distinctly separate from the genus musa, the common banana. Enset has been cultivated in Ethiopia since ancient times. It is part of

a sustainable production system<sup>5</sup> and many communities. The genus enset is close to, but distinctly separate from the genus musa, the common banana. The vegetative growth habit of enset is similar to banana plants, but *Ensete ventricosum* doesn't spontaneously produce suckers and is not grown for fruits, these contains mostly large and very hard seeds and plants are usually harvested at onset of flowering.<sup>6</sup>

Enset is a multi-purpose and drought tolerant crop. There are several hundred landraces (clones) having different characteristics and enset is used for food, fodder, fibre and traditional medicine.<sup>7</sup> The vegetative growth habit of enset is similar to banana plants, but *Ensete ventricosum* doesn't spontaneously produce suckers and is not grown for fruits, these contains mostly large and very hard seeds and plants are usually harvested at onset of flowering.<sup>6</sup> The nutritive value of the food is similar to potato and the fodder composition is suitable for ruminants. Enset is most commonly grown in home gardens frequently intercropped with peas and beans which is suitable to compensate the low protein level in enset foods.<sup>8</sup>

The enset farming system where enset is cultivated as perennial plantation is homestead ring is association with other companion crop species growing in main agricultural land is rich in both interspecific and intraspecific diversity.<sup>6</sup> Being a long-leaved monocarp, enset improve local climate and soil condition when cultivated especially the deep roots are important in preventing nitrogen loss and environmental pollution.<sup>9</sup>

Home based medical plant use relies on plants of the home garden crops, weeds that grow wild around human habitation. The cultivated medicinal plants are mostly produced in home garden either for medicinal or other primary purposes.<sup>10</sup> Medicinal plants are grown in home gardens all over the world and in developing countries nearly 80% of the people use them to treat various illness, diseases, and also to improve their health conditions.<sup>11</sup>

Local communities have developed indigenous knowledge for the sustainable management of home gardens and had been using and transferring this knowledge to the next generations for the betterment of their life. Indigenous knowledge is used to sustain the community's culture, religion and environment and also for conservation and sustainable use of local biodiversity.<sup>12</sup>

Indigenous knowledge has been the basis for agriculture, health care, food preparation, education, environmental conservation and other activities.<sup>13</sup> Therefore, there is a need for systematic documentation of such a useful knowledge through ethnobotanical research.<sup>14</sup> Zemede Asfaw<sup>10</sup> reported that in Ethiopia, the selection plant species for live fence is related to multiple uses like produce edible fruits and having spines and have traditional ways of restricting the uncontrolled transfer of planting materials (germplasm) from home gardens.

Ethiopia has diverse agroecology with many ethnic groups practicing different home gardens management cultures. Many plant species were conserved and used in the different cultures in diverse

home gardens in the Country. However, with increasing human population and land degradation, both the size and number of home gardens and species in them have been decreasing over time. Studies showed that problems such as genetic erosion, loss of indigenous knowledge of cropping patterns and management practices, human induced habit changes (change in land use) and drought had threatened home gardens and agrobiodiversity in them.<sup>15</sup>

Data on ethnobotanical study of home garden species in Angecha district were limited. Therefore, this study was conducted to document home garden plants, their use categories, to identify multipurpose and marketed species and to document indigenous knowledge of local communities on the uses and conservation practices of home garden species.

## Materials and methods

### Description of the study area

The study was conducted in Angecha District located in Southern Nations, Nationalities and Peoples Region (SNNPR) at a distance of 260 km south of Addis Ababa (Figure 1). The district has an area of 17754.31 hectares. The exact location of the study sites were Amberitcho Wasera, Gerba Fendide and JobaDodoba with the latitude and longitude of E 0806627/ 37N 0372367, E 0808021/37N0369579 and E 0815875/37N0371306, respectively.

The soil type of the area is 85% loam soil, 10% clay soil and 5% Red soil.<sup>16</sup>

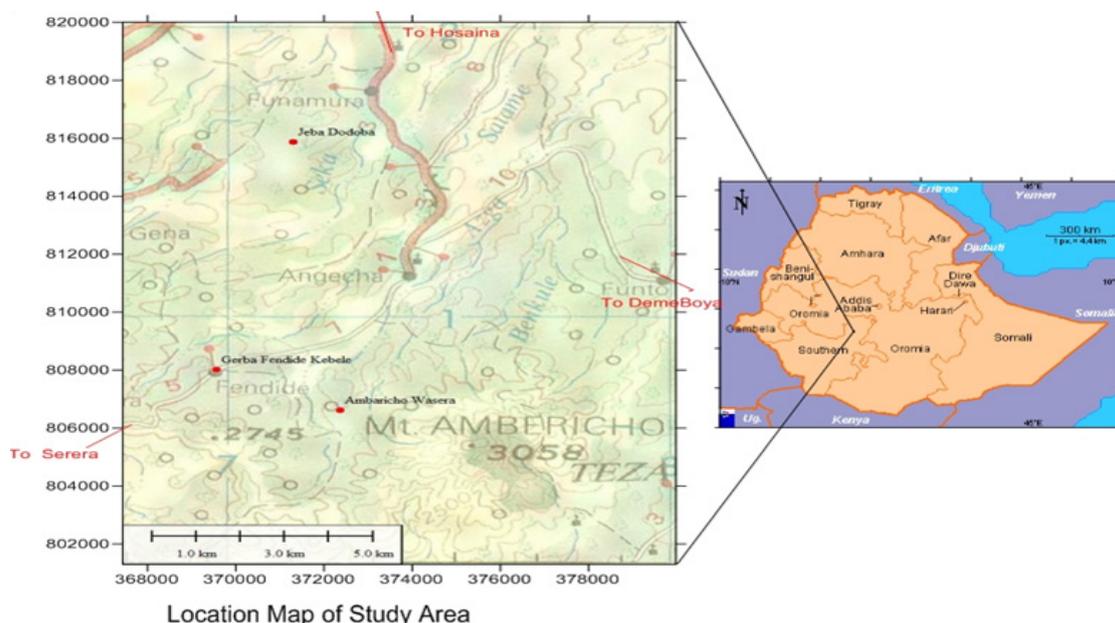


Figure 1 Location map of study area.

### Climate

Angecha District had two agro- ecological Zones locally called Hanisewa (35%) and Hanisewa Kalea (65%) which means highland (Dega) and midland (Woyinedega), respectively.<sup>16</sup> The study area had alternating wet and dry season. Based on last ten years data from 2006-2015 climate data obtained from the National meteorological

Service Agency of Ethiopia, the annual mean maximum and minimum temperature were 24.3°C and 12.8°C, respectively. The total mean annual rainfall from 2006 to 2015 was 112 mm.

### Population and livelihoods

According to AWLEAD<sup>16</sup> data, the total population size of Angecha District was 107565. The District was dominated by Kembata people

ethnic group. The livelihood of local communities was mainly dependent on small scale subsistence agriculture. Enset cultivation in home gardens was common practice in the area.

## Data collection

### Ethnobotanical data collection

Ethnobotanical techniques were applied to collect data on perception and management of enset based home garden plants used by people in Angecha district. Group discussion, semi- structured interview, field observation, preference ranking, direct matrix ranking and paired comparison were used for data collection.<sup>12,14</sup> The interview and discussion were conducted in Kembata language using translator and in Amharic language (whenever possible).

### Market survey

A market survey was conducted to record the variety and amount of food and other products that have market values in Angecha District. There four market centers in the District: Angecha town big market, Gojame market around Ambericho Wasera study sites, Fendide market in Gerba Fendide site and Utuge market around Joba Dodoba study site. Survey was done in all of these markets by interacting with sellers, producers and consumers using semi-structured questionnaires.

### Preference ranking

Preference ranking was done following Martin.<sup>14</sup> Each rank was given a value 1, 2, 3, 4, etc. with the most important item given the highest value while the least assigned the smallest value. This method was applied to rank selected enset based home garden species according to their function. Fifteen key informants were given six food crops that frequently occurred in their home garden and asked to rank them based on their personal preference. A pre- prepared interview questions were used during data collection that included the management and conservation practices of enset based home garden plant species, to what extent conservation practices were undertaken by the people in enset based home garden and uses of enset based home garden by the local people etc.

### Paired comparison

This method was used to rank five selected food crops that had market utility based on the list given by 15 key informants. A list of the pairs of selected item with all possible combinations was made and sequence of the pairs and the order within each pair was randomized before every pair was presented to selected informants and their responses recorded and total value was summarized. The total number of possible pairs was calculated by  $n(n-2)/2$  where n, is the number of the items being compared.

### Direct matrix ranking

Direct matrix ranking is one of the tools which involve asking people to order their much favored enset based home garden plants by taking into account several characteristics (food, medicinal, timber, fire wood, fodder etc) following Martin.<sup>14</sup> Based on information gathered from key informants, six multipurpose tree species were selected and asked to assign value (5=best, 4=very good, 3= good 2= less used, 1= least used and 0= not used. Finally the results of fifteen respondents were added to get matrix that represent the views of the entire community.

## Vegetation data collection and identification

During field data collection with the help of selected knowledgeable elders, owner of home garden and developmental agents of agricultural sector, plant specimens were collected. Local names and habits of each plant were recorded, numbered, pressed and dried. All plant specimens collected were taken to Addis Ababa University National Herbarium for identification. Taxonomic identifications were undertaken using taxonomic keys and published volumes of the Flora of Ethiopia and Eritrea. The identified specimens with labels were deposited at the National Herbarium.

## Results

### Food plants in home gardens

This study documented a total of 44 food plants belonging to 38 genera and 18 families were documented from the surveyed home gardens (Table 1). Poaceae, Fabaceae, Lamiaceae, Solanaceae and Rutaceae were important families. Poaceae was most dominant family represented by 6 genera and 6 species followed by Fabaceae, Lamiaceae and Solanaceae (each represented by 4 genera and 4 species). The highest number of food plants was fruits (represented by 10 species) followed by vegetables (represented by 10 species). Cereals and pulses were represented by 9 species (Table 1).

**Table 1** List of Food Plant Species documented from Home Gardens in Angecha District, Southern Ethiopia

Species	Family	Remarks
<i>Allium cepa</i>	Alliaceae	Vegetable
<i>Allium porrum</i>	Alliaceae	Vegetable
<i>Allium sativum</i>	Alliaceae	Vegetable
<i>Ananas comosus</i>	Bromeliaceae	Fruit
<i>Avena fatua</i>	Poaceae	Cereal
<i>Beta vulgaris</i>	Amaranthaceae	Root Tuber
<i>Brassica carinath</i>	Brassicaceae	Vegetable
<i>Brassica integrifolia</i>	Brassicaceae	Vegetable
<i>Canavalia africana</i>	Fabaceae	Pulse
<i>Capsicum annum</i>	Solanaceae	Vegetable
<i>Capsicum frutescens</i>	Solanaceae	Vegetable
<i>Carica papaya</i>	Caricaceae	Fruit
<i>Casimiroa edulis</i>	Rutaceae	Fruit
<i>Citrus aurantifolia</i>	Rutaceae	Fruit
<i>Citrus sinensis</i>	Rutaceae	Fruit
<i>Coccinia abyssinica</i>	Cucurbitaceae	Root Tuber
<i>Colocasia esculenta</i>	Araceae	Root Tuber
<i>Cucurbita pepo</i>	Cucurbitaceae	Vegetable
<i>Daucus carota</i>	Apiaceae	Root Tuber
<i>Ensete ventricosum</i>	Musaceae	Root Tuber

Table continue

Species	Family	Remarks
<i>Eragrostis tef</i>	Poaceae	Cereal
<i>Hordeum vulgare</i>	Poaceae	Cereal
<i>Ipomoea batatas</i>	Convolvulaceae	Root Tuber
<i>Lactuca sativa</i>	Asteraceae	Vegetable
<i>Lepidium sativum</i>	Brassicaceae	Spice
<i>Lycopersicon esculentum</i>	Solanaceae	Vegetable
<i>Malus sylvestris</i>	Rosaceae	Fruit
<i>Mangifera indica</i>	Anacardiaceae	Fruit
<i>Mentha spicata</i>	Lamiaceae	Spice
<i>Musa x paradisiaca</i>	Musaceae	Fruit
<i>Ocimum basilicum</i>	Lamiaceae	Spice
<i>Persea americana</i>	Lauraceae	Fruit
<i>Pisum sativum</i>	Fabaceae	Pulse
<i>Prunus domestica</i>	Rosaceae	Fruit
<i>Prunus persica</i>	Rosaceae	Fruit
<i>Rosmarinus officinalis</i>	Lamiaceae	Spice
<i>Ruta chalepensis</i>	Rutaceae	Spices
<i>Saccharum officinarum</i>	Poaceae	
<i>Solanum tuberosum</i>	Solanaceae	Root Tuber
<i>Thymus schimperi</i>	Lamiaceae	Spices
<i>Trigorella foenum-graecum</i>	Fabaceae	Pulse
<i>Triticum aestivum</i>	Poaceae	Cereal
<i>Vicia faba</i>	Fabaceae	Pulse
<i>Zea mays</i>	Poaceae	Cereal

According to the perception of farmers, having diverse food crops on their home gardens was important to increase nutritional requirements for their family and also to increase income directly contributing to ensuring local food security. Key informants ranked *Ensete ventricosum* and *Solanum tuberosum* as the most important food crops preferred by the local community in their area (Table 2).

### Medicinal plants

A total of 22 medicinal plants belonging to 21 genera and 17 families were identified from home gardens managed by the farmers (Table 3). These medicinal plants were used to treat both human and domestic animals ailments. Herbs were the most common (77.3%) medicinal plants followed by shrubs (18.2%). Regarding parts used, leaf was the most frequently used (81.8%) in traditional medicine (Table 3).

### Other uses of plants on home gardens

Table 4 summarizes home garden plants used for other uses such as fodder, construction, live fences, etc. Relatively, high number of plants (9 trees and shrubs) used for construction and building were managed on home gardens.

### Marketed home garden plants

Survey of markets showed that *Brassica carinath*, *Brassica integrifolia*, *Solanum tuberosum*, *Ruta chalepensis*, *Rosmarinus officinarum*, *Allium sativum*, *Musa paradisiaca*, *Ensete ventricosum* products like Kocho and bulla etc. were dominant home garden products in the area commonly sold in markets. According to the traders and consumers suggestion, the abundance and diversity of plant species in markets vary with seasons. For example, fibre of enset dominates markets in December and January. Wheat, bean, potatoes, enset products such as “bulla”, “kocho” and “amicho” were dominant from February to May. The farmers pointed out that such supply variation was due to consumer need and water availability (rainfall). During the market survey and discussions with key informants, it was noted that most of these products were sold by women. Furthermore, women were active participants in the management of home gardens including planting, weeding, watering and evaluation of pests and diseases.

**Table 2** Preference Ranking for most widely used Food Crops in Home Gardens in Angecha District, Southern Ethiopia. NB. 10 for most valuable and 1 for least valuable

Scientific Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total score	Rank
<i>Solanum tuberosum</i>	8	10	10	9	8	9	9	9	8	10	8	8	9	9	9	133	2
<i>Triticum aestivum</i>	7	9	8	8	9	8	9	9	9	10	8	7	9	9	10	129	3
<i>Ensete ventricosum</i>	10	10	10	10	10	10	10	10	10	10	9	10	10	10	9	148	1
<i>Brassica carinath</i>	10	10	8	10	10	8	8	7	7	6	8	8	9	8	10	127	4
<i>Allium sativum</i>	6	9	5	7	6	8	8	7	9	9	7	7	7	6	9	110	5

Based on the pair wise comparison of five most commonly used food crops that have market utility, *Brassica integrifolia* (head cabbage) ranked first with score 38, *Allium sativum* (Garlic) second with score of 35 and *solanum tuberosum* (potato) was in the third

rank (Table 5). Total score was 38, 35, 20 and 13 for head cabbage, garlic, carrot and onion, respectively. Therefore, head cabbage and garlic were species with the highest market value.

**Table 3** Medicinal Plants Managed in Home Gardens, Parts Used and Ailments they were used for in Angecha District, Southern Ethiopia

No	Species name	Local name	Parts used	Used for/against	Habit
1	<i>Allium sativum</i>	Nech- shinkurt	Bulb	Head ache Abdominal crump	Herb
2	<i>Amaranthus caudatus</i>	Halibe (K)	Seeds	Common cold	Herb
3	<i>Catha edulis</i>	Chat (A)	Leaf	Tonsillitis	Shrub
4	<i>Clerodendrum myricoides</i>	Haniga (K)	Leaf	Evil eye	Herb
5	<i>Colocasia esculenta</i>	Godere (A)	Leaf	Sneezing (livestock)	Herb
6	<i>Coriandrum sativum</i>	Dinbilal (A)	Fruit	Stomachache human and livestock	Herb
7	<i>Croton macrostachyus</i>	Bisana (A)	Leaf sap	Skin wound	Tree
8	<i>Cymbopogo nctralus</i>	Tej-sar(A)	Leaf	Stomach ache	Herb
9	<i>Cyperus sp.</i>	Naka (K)	Leaf	Wash babies cloth (used as antiseptics)	Herb
10	<i>Dicliptera laxata</i>	Omorro (K)	Leaf	Evil eyes	Herb
11	<i>Eucalyptus camaldulensis</i>	Nech Barzaf (A)	Leaf	Common cold	Herb
12	<i>Fuerstia africana</i>	Anganbisha (K)	Leaf	Head ache	Herb
13	<i>Hagenia abyssinica</i>	Koso (A)	Flower	Tapeworm	Tree
14	<i>Lippiaa doensis var koseret</i>	Koseret (A)	Leaf	Common cold	Shrub
15	<i>Nicotiana tobacum</i>	Timbaho (A)	Leaf	Stomach ache ( livestock)	Herb
16	<i>Ocimum gratissimum</i>	Tuomo(k)	Leaf	Mouth ache	Herb
17	<i>Ocimum lamifolium</i>	Demakese (A)	Leaf	Common cold	Herb
18	<i>Ricinus communis</i>	Gulo (A)	Leaf	Prevent cold	Shrub
19	<i>Ruta chalepensis</i>	Tandam(A)	Leaf	Common cold	Shrub
20	<i>Senna septemtrionalis</i>	Checheyocho (K)	Leaf	Evil eye	Herb
21	<i>Solanum nigrum</i>	Migello (k)	Leaf	Toothache intestinal worms	Herb
22	<i>Thymus schimperii</i>	Tosign (A)	Leaf	Blood pressure	Herb

**Table 4** Home Garden Plants used for different purposes in Angecha District, Southern Ethiopia

Species	Fodder	Fragrant	Ornamental	Live fence	Construction	Utility plants	Shade plants	Miscellaneous
<i>Acacia abyssinica</i>						X		
<i>Arundo donax</i>					X			
<i>Asplenium acthiopicum</i>			X					
<i>Capparis deciduas</i>				X				
<i>Cordial africana</i>					X			
<i>Croton macrostachyus</i>					X			
<i>Cupressus insitanica</i>					X			
<i>Cymbupogon citralus</i>		X						
<i>Dovyalis caffra</i>				X				
<i>Erythrina brucei</i>							X	
<i>Eucalyptus camaldulensis</i>					X			
<i>Eucalyptus globules</i>					X			
<i>Ficus sur</i>							X	
<i>Juniperus procera</i>					X			
<i>Justicia shimperiana</i>				X				

Table continue

Species	Fodder	Fragrant	Ornamental	Live fence	Construction	Utility plants	Shade plants	Miscellaneous
<i>Ligustrum vulgare</i>			X					
<i>Lippia adonis var koseret</i>		X						
<i>Menthe spicata</i>		X						
<i>Millettia ferruginea</i>								X
<i>Pennisetum purpureum</i>	X							
<i>Phoenix reclinata</i>			X					
<i>Podocarpus falcatus</i>					X			
<i>Prunus africana</i>					X			
<i>Rhamnus prinoides</i>								X
<i>Ricinus communis</i>						X		
<i>Rosa hybrid</i>			X					
<i>Sesbania sesban</i>	X							

Table 5 Pair-wise Comparisons Marketed Food Crops in Angecha District, Southern Ethiopia

Pair	Order	Item	Respondents														
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
7	1,3	Head Cabbage and Potatoes	1	1	1	1	1	2	1	1	2	2	1	1	2	1	1
6	2,3	Garlic and Potatoes	1	1	1	1	1	2	1	1	1	1	2	2	1	1	1
3	3,5	Potatoes and Onion	1	1	2	2	1	2	2	2	1	1	1	2	1	1	1
8	1,4	Head Cabbage and Carrot	1	1	2	2	2	1	1	1	2	1	1	1	2	2	1
1	3,4	Potatoes and Carrot	1	1	1	1	1	1	1	2	2	1	2	1	1	1	2
2	1,5	Head Cabbage and Onion	1	1	1	1	2	2	1	2	2	2	2	1	1	1	1
5	2,4	Garlic and Carrot	1	1	1	1	1	1	1	1	2	1	1	2	2	1	1
10	4,5	Carrot and Onion	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1
4	2,5	Garlic and Onion	1	1	1	1	2	1	1	2	2	1	1	1	1	1	1
9	1,2	Head cabbage and Garlic	1	1	1	1	2	1	1	1	1	2	2	2	2	2	1

### Tree species with multiple uses in home garden of Angecha District

Owners of home garden and other people in Angecha district used different tree species found in their home garden for various purposes such as firewood, shades, medicine, building material, house furniture,

etc. The direct matrix ranking result of 15 key informants from the three study sites indicated that trees were used for diverse uses but there were preferences for some over others (Table 6). *Juniperus procera* with a total score of 382 ranked first followed by *Podocarpus falcatus* (score of 379) and *Cordia africana* (score of 374).

Table 6 Multipurpose Trees in Home Gardens of Angecha District, Southern Ethiopia. Based on use criteria (5= best, 4= very good, 3= good, 2= less used, 1= least used and 0= no value)

Scientific Name	Attributes and scores							Total	Rank
	Fuel wood	Shade	Construction	Live fence	Timber	For sale			
<i>Podocarpus falcatus</i>	47	69	68	63	68	63	378	2	
<i>Eucalyptus camaldulensis</i>	64	53	71	67	38	39	362	4	
<i>Cordia africana</i>	46	70	60	49	72	71	368	3	
<i>Juniperus procera</i>	54	57	69	65	69	68	382	1	
<i>Erythrina brucei</i>	54	52	53	68	56	52	335	5	

A number of Indigenous management practices were performed in the home gardens of Kembata people which helped the community to conserve and sustainably use multi-purpose species in their gardens. Some selected plants were grown at the home gardens because these plants were perceived to be important in increasing soil fertility and conserving soil moisture. In Angecha district, the management of home gardens was done by division of labor among family. Members During field work and discussions made with key informants it was observed that females take more active role in managing vegetables, enset and medicinal plants which included weeding, watering and selling while males participate in planting cash crop.

### Indigenous uses of Enset in Angecha District

The cultivation of enset has a cultural symbol for the Kembata communities and it is an expression of their identity. As key informants and owners of home gardens explained, enset is an old crop that has

been under cultivation since time immemorial. The majority of the farming households surveyed started farming and growing enset crop on their plot of land with a set of varieties inherited from their fathers at adulthood. Local communities believed that offering a plot of land with a mixture of varieties of enset to an adult son is an old tradition transferred from one generation to next in Kembata community. Every owner of home garden in Kembata community grew some enset and maintained two or more varieties in its home garden. As key informants explained, Enset being highly valued as a status symbol, people appreciate enset around it and give special respect and name for a man (ogojicho) owing a large number of growing enset plants in his home garden. The Kembata people show the cultural uses of enset, its status symbol role and the strong tie the crop has with their life from birth to death using their traditional folklores. Women did play a significant role in the production of enset foods (Figure 2).



**Figure 2** Woman decorticating pseudo stem of enset using a bamboo scrapper, Angecha District, Southern Ethiopia.

Enset foods are served both as staple daily diet as well as in occasions of cultural festivals; hence enset foods have both nutritional and cultural values for the society. As discussed between key informants especially women, we identified 8 recipes of dishes derived from 3 primary enset products called Kocho (*wasa*), Bulla and Amicho: As summarized in Table 7 Kocho and Bulla are obtained after processing, whereas the Amicho, or corm is cooking types boiled and eaten directly just like potatoes without any processing Kocho (*Wasa*) is a fermented pulp of the enset pseudostem derived by scraping the individual pieces excluding the fibrous remain, whereas Bulla is the small amount of water insoluble starchy product that may be separated from Kocho during the processing phase by squeezing and decanting the liquid. Some of the recipes from primary products such as *Atakana* and *mucho* are considered a speciality food and served during festive occasions. The community indicates that enset foods are traditionally incorporated in to cultural events such as birth, death and festivals. During births, a postnatal mother eats *Hozo* which is a special kind of porridge prepared from *wasa* and Bulla by mixing it with butter and spices.

**Table 7** Cultural Food prepared from Enset in Kembata Community, Angecha District, Southern Ethiopia

Name of Cultural Food	Enset product used to prepare Cultural Food
<i>Wasa</i>	<i>Wasa</i>
<i>Mucho</i>	Bulla
<i>Mulla</i>	<i>Wasa</i> , Bulla
<i>Besheko</i>	<i>Wasa</i>
<i>Bilabilo</i>	<i>Wasa</i> , Pumpkin, cabbage
<i>Tumesso</i>	Amicho, <i>wasa</i>
<i>Atakana</i>	<i>Wasa</i> , Bulla, Butter, Milk
<i>Amicho</i>	<i>Amicho</i>

In funeral days, relatives and other neighboring people bring *murtewasa* a processed product from enset in addition there is cabbage and potatoes with it. In Meskel celebration (Mesala) in September, the Kembata community are eating the special foods *Atakana* on the eve and throughout the celebration week.

### Enset as multipurpose cultural crop

According to results from the discussion and interview made with key informants and owner of home garden, every part of enset plant has some sort of use in material culture of the Kembata Community. The green enset leaf *Habera* is used as traditional plate to serve food or as wrapping material for different products and baking breads. Dried leave and other pseudostem parts are also collected for making traditional seats (*Borkicho*) and mattress (*Endivero*). The outer most dried leaf- sheath of pseudostem (*oficoho*) often harvested while the tree is steel growing is used as seal (*mera*) of traditional milk processing pot and for handing butter for construction of fences and traditional houses only dried, water soaked and strong lamina is used. The fibre of enset(*kacha*) produced as side product during food

processing (*zugu*) Is a very strong and high quality fibre. It is used for making ropes, baskets, sacks, house flour carpets, utensils.

As developmental agents of agriculture, key informants and growers explained in the study area, most domestic animals specially cattle, were commonly practiced to eat leaf sheath of enset. In this regard enset is considered a safety cattle feed (*Lali*) because it is available during the drought prevalent season of the year, when most other feed sources dry out. Enset agriculture uses organic farming system using only farmyard manures, with no external chemical fertilizers. Enset farming fulfills aesthetic requirements for the home garden through colorful ornamental varieties. If there is more plantation of enset it generates income for the Kembata community.

### Medicinal uses of Enset Plants

The enset plant and its parts were used in indigenous ethnomedicinal services. All the respondents in the study area knew and believed that enset had medicinal value and important for their family healthcare. There were 11 medicinal (*Zebo*) varieties of enset plants identified from the study sites with their function (Table 8).

**Table 8** Some Medicinal Varieties of Enset, widely used in Angecha District, Southern Ethiopia

Local (Kembata) Name of Enset variety	Parts used	Used for/against
Sebera	Amicho Leaf	Heal fracture body of human and other animal
Gishira	Amicho	Heal fracture body of human and other animal
Lekaka	Amicho	Fractured body
Tes	Amicho	Inured and fractured body
Seskella	Kocho	Fracture body
Dentiche	Leafs	Urination problem in livestock
Kegile	Amicho Leaf	Liver disease
Etine		Aborts placenta of cattle after delivery
Cherkuwa	Amicho	Abortion Swelling of the body
Ageno	Leaf	Aborts placenta of cattle after delivery
Oniya	Leaf	Water released from leaf sheath cure allergy

### Propagation and harvesting of Enset Plants

The survey result showed that propagating mixtures of enset varieties were practiced in the area. Farmers maintain on farm enset diversity using this approach. The enset cycle managed by each household from propagation to harvesting involved four different stages locally called *Dubo*, *Mono*, *Sima* and *Era*. According to key informants, the enset cycle starts with the propagation of selected enset plants. Suckers were initiated from the selected enset plants by burring the corms in 1m deep pit after tipping the central shoot and removing apical dominance. The multiple suckers rising from the buried corm (locally called *Dubo*) are separated from the mother corm and replanted in well manured nurseries. Replanted *Dubo* grow in the nursery for another year after which they are called *Mono*. In this stage the enset plants grow near each other and get enough warmth and prepare itself for the next stage. After 1 year, the enset plant at the *Mono* is changed in to *Sima* because the plant is transferred from nursery to other place and re- planted far away. After 1 year again, the enset plant in the *Sima* stage finally changed into *Era* because it was enough to become matured and replaced.

Propagation is a cultural practice carried out every year- from January to March using a mixture of varieties of enset. Farmers select a mixture of varieties for propagation. Multipurpose varieties of enset high food and non- food uses such as *Siskella*, *Dirbo*, *Sheleke*, *Sorphe*, *Merza*, *Sebera* et are most frequently propagated varieties every year.

## Discussions

### Contributions of home gardens to food security

A total of 45 food plants comprising of fruits, vegetables, pulses and cereals were conserved and sustainably used by farmers in the study area. Food production is the primary role of most home gardens in many developing countries.<sup>17</sup> Home gardens are important to enhance household food security and nutrition.<sup>1</sup> Home gardens in Angecha district were dominated by food species in agreement with report from other part of Ethiopia and Uganda.<sup>18-20</sup> The home gardens were noted to be important in providing diverse food items.<sup>1,21</sup> Their importance on providing sustained subsistence on farming and biodiversity conservation are getting attention recently. Home gardening practice

in Ethiopia were to be as old as agriculture<sup>21</sup> directly contributing to ensuring food security in smallholder farming communities in rural areas. Galhena et al.,<sup>1</sup> pointed out that home gardens are an integral part of local food systems and the agricultural landscape of developing countries all over the world.

*Ensete ventricosum* was ranked as the most important food crop preferred by the local community. This could be the major reason why home gardens in Angecha were dominated by enset. Major garden types are distinguished based on the major crop types or the key species such as in the case of enset dominated home gardens in south and central Ethiopia. In such gardens enset occurs with many other crops in different combinations including a variety of root/ tuber crops coffee, chat and various vegetables and spices as was documented during this study and in agreement with previous reports.<sup>21</sup>

The Kembata communities had been using enset to meet their livelihoods improvements and also for diverse uses including medicinal purposes. Similar cases were reported by Brandt et al.,<sup>5</sup> showing how enset played a great role in the day to day life of local communities. The Kembata community considered enset as their symbolic cultural identity crop. There are 8 types of enset dishes known in Kembata People. The deep rooted culture of using enset in daily lives from birth to death ceremonies and festive was an important bio-cultural heritage which was similar to other enset growing areas of Southern Ethiopia.<sup>6</sup>

Farmers in the study area perceived that diverse food crops were important to increase nutritional requirements for their family and also to increase income. The variety of annual and perennial crops and vegetables grown in the home gardens provide a secure supply of fresh produce throughout the year<sup>22</sup> and thereby contributing to household food security by providing direct access to food and important nutrients that may not be readily available or within their economic reach.<sup>23</sup> Furthermore, home gardens may become the principal source of house hold food and income during period of stress.<sup>24</sup>

### Medicinal plants management in home gardens

A total of 22 medicinal plants were documented in the home gardens of Angecha District. Similar result was reported from Sebata District in Oromia.<sup>18</sup> It was noted that among the functional groups documented from the home gardens in the District, medicinal plants ranked top followed by vegetables and fruits in agreement with previous reports.<sup>25,26</sup>

Medicinal plants form the bases of traditional or indigenous health care systems used by the majority of the population of most developing nations including Ethiopia.<sup>27</sup> Even though there have been expansion of health care systems in the rural areas of Ethiopia, local communities still use herbal medicines to treat different ailments of both human and animals. Local communities grew medicinal plants in their home gardens and were noted using them to treat various illness in agreement with reported situations from somewhere else.<sup>10,11</sup>

Herbs were the most common medicinal plants used in the study area in agreement with the report from Ecuadorian Amazon Region.<sup>28,29</sup> In agreement with many previous reports<sup>28,30</sup> and unlike Ermias Lulekal et al.,<sup>31</sup> leaves were the most commonly (about 82 %) used plant parts for medicinal purposes.

### Other uses of home garden plants

Although food and medicinal plants were dominant in the studied home gardens, local farmers did benefit from the home gardens in many ways. *Brassica carinath*, *Brassica integrifolia*, *Solanum*

*tuberosum* *Ruta chalepensis*, *Rosmarinus officinarum*, *Allium sativum*, *Musax paradisiaca*, *Ensete ventricosum* were important home garden products sold in local markets. Home gardens are important for improving financial status of families<sup>32,33</sup> as they contribute to increasing income in several ways including selling home garden products such as fruits, vegetables, animal products.<sup>24</sup> In addition to direct earning from sale of home garden produce, products consumed by the household frees up household earning for other purchases.

Kembata People also used their indigenous knowledge for selecting and managing different multipurpose plant species in their home gardens. It was noted that the farmers these species for other uses such as fodder, construction, live fence, ornamental and shade. *Juniperus procera* was the most widely used multipurpose tree followed by *Podocarpus falcatus* and *Cordia africana*. These species were preferred for their multipurpose services for the local communities. They were used for shade, soil fertility improvement, construction and craft. Home gardens can be considered as land use system involving purposeful management of different trees and shrubs in close connection with annual and perennial agricultural crops.<sup>33</sup>

In the study sites the management of home garden was done by division of labour among family members. Females take more active role in managing home gardens while males participated in planting cash crops. The female participated in composting, watering, removing weeds from their respective home gardens, separating plants infected by pest and diseases and report to the male foe solution. The female manage the home garden until it reaches mature stage ready to be sued for household and also for sale. It was women who sale home garden products in the local markets in agreement with reports from other areas.<sup>19,25</sup> It was observed that women had a major share in home garden management. They were responsible for managing vegetables, spices, enset and medicinal plants. They also participated in collecting herbaceous forages and working towards improving soil fertility through manure addition in agreement with previous reports from other areas.<sup>19</sup> Excess produce from home gardens were sold on road sides or at nearby markets by women and sometimes children. The income generated from minor crops like Brassica species, spice goes to women again similar to report by Zemedede Asfaw.<sup>19</sup>

It was concluded that home gardens are important for cultivation of edibles, medicinal plants, cash crops and other important plant species which were used the subsistence to the local people. From home gardens, diverse food products such as pulses, vegetables, fruits were used which directly contribute to ensuring food security and reducing the negative impacts of malnutrition. Other benefits of these home gardens included improving family health, conserving and sustainably using agrobiodiversity, and preserving indigenous knowledge and culture. Therefore, it was recommended to consider home garden as part of sustainable farming system for food security and nutritional requirement of the local people. Local farmers should be supported in many ways including technical capacity development and awareness raising on sustainable utilization and management of plant resources. There was high need to promote conservation and sustainable use of multipurpose species on home gardens.

### Acknowledgments

We thank the Ethiopia Biodiversity Institute for financial support during this research work. We also thank local communities and administration of Angecha District for their support and warm hospitality.

## Conflicts of interest

The author declares there are no conflicts of interest.

## References

- Galhena DH, R Freed, KM Maredia. Home Gardens: a Promising Approach to enhance Household Food Security and Wellbeing. *Agriculture & Food Security*. 2013;2:8.
- Hodgkin T. Home Gardens and the Maintenance of Genetic Diversity. In: JW Watson, PB Eyzaguirre, et al. editors. *Contribution of Homegardens to in-situ Conservation of Plant Genetic Resources in Farming Systems*. 2001.
- Brownrigg L. Home Gardening in International Development: What the literature shows. 1985;32–41.
- Mathewos Gize, Sebsebe Demissew, Zemedede Asfaw. Indigenous Knowledge on Management of Home Gardens and Plants in Loma and Gena Bosa Districts (Weredas) of Dawuro Zone, Southern Ethiopia: Plant Biodiversity Conservation, Sustainable Utilization and Environmental Protection. *International Journal of Sciences: Basic and Applied Research*. 2013;10(1):63–99.
- Brandt SA, A Spring, C Hiebsch, et al. The Tree against Hunger. Enset-Based Agricultural Systems in Ethiopia. American Association for the advancement of science. 1997.
- Tsegaye A, PC Stuik. Analysis of Enset (*Ensete ventricosum*) Indigenous Production Methods and Farm based Biodiversity in Major Enset growing Regions of Southern Ethiopia. *Experimental Agriculture*. 2002;38(3):291–315.
- Bizuayehu Tadesse. On Sidama Folk Identification, Naming, and Classification of Cultivated enset (*Ensete ventricosum*) varieties. *Genet Resour Crop Evol*. 2008;55(8):1359–1370.
- Abebe Y, BJ Stoecker, MJ Hinds, et al. Nutritive Value and Sensory acceptability of corn- and kocho-based Foods Supplemented with Legumes for Infant Feeding in Southern Ethiopia. *Afr J Food Agric Nutr Dev*. 2006;6(1):1–19.
- Lekasi JK, MA Bekunda, PL Woome, et al. Decomposition of Crop Residues in Banana-Based Cropping Systems of Uganda. *Biological Agriculture & Horticulture*. 1999;17(1):1–10.
- Zemedede Asfaw. The Role of Home Gardens in the Production and Conservation of Medicinal Plants. 2001.
- Rao MR, BR Rajeswara Rao. Medicinal Plants in Tropical Home Gardens. *Tropical Home gardens*. 2006;205–232.
- Cotton CM. *Ethnobotany: Principles and Applications*. 1996.
- Alexiades M. Collecting Ethnobotanical Data: An Introduction to Basic Concepts and Techniques. In: M Alexiades, JW Sheldon, et al. editors. *Selected Guideline for Ethnobotanical Research*. A Field Manual. The New York Botanical Garden, U.S.A. 1996.
- Martin GJ. *Ethnobotany: A Methods Manual*. 1st edn. 2004.
- Kumar BM, PKR Nair. The Enigma of Tropical Homegardens. *Agroforestry systems*. 2004;61(1–3):135–152.
- AWLEAD. Angecha Woreda Land and Environment Administration Development. 2014.
- Nair PKR. *An Introduction to Agroforestry*. Kluwer Academic publisher London. 1993.
- Habtamu Hailu, Zemedede Asfaw. The Diversity of Food and Medicinal Plants in the Homegardens of Sabata Town, Oromia National Regional State, Ethiopia. *Ethiopian Journal of Biological Sciences*. 2009;8(1):31–51.
- Zemedede Asfaw. Home Gardens in Ethiopia: Some Observations and Generalizations. In: Watson JW, PB Eyzaguirre, editors. *Homegardens and in situ conservation of Plant Genetic Resource in Farming Systems*. Proceeding of the Second International Homegardens Workshop. 2002.
- Whitney CW, E Luedeling, JRS Tabuti, et al. Crop Diversity in Homegardens of Southwest Uganda and its Importance for Rural Livelihoods. *Agriculture and Human Values*. 2018;35(2):399–424.
- Zemedede Asfaw, Ayele Nigatu. Home Gardens in Ethiopia: Characteristics and plant Diversity. *SINET: Ethiopia J Sci*. 1995;18(2):235–266.
- Shreshta P, R Guatam, RB Rana, et al. Homegardens in Nepal: Status and Scope for Research and Development. In: Watson JW, Eyzaguirre PB, editors. *Homegardens and in situ conservation of Plant Genetic Resource in Farming Systems*. Proceeding of the Second International Homegardens Workshop. 2002.
- Talukder A, L Kiess, N Huq, et al. Increasing the Production and Consumption of Vitamin A—Rich Fruits and Vegetables: Lessons Learned in Taking the Bangladesh Homestead Gardening Programme to a National Scale. *Food and Nutrition Bulletin*. 2000;21(2):165–172.
- Marsh R. *Building on Traditional Gardening to improve House hold Food Security*. Food Nutrition and Agricultural 1998.
- Christanty L. Home Garden in Tropical Asia, with Special Reference to Indonesia. In: K Landauek, M Brazil, et al. editors. *Tropical Home Gardens*. 1990.
- Okigbo NB. Homegardens in Tropical Africa. In: K Landauer, M Brazil, editors. *Tropical Homegardens*. Tokyo. 1990.
- WHO. Planning for Cost Effective Traditional Health Services in the new Century. A discussion paper. 2001.
- Leul Kidane, G Gebremedhin, T Beyene. Ethnobotanical Study of Medicinal Plants in Ganta Afeshum District, Eastern Zone of Tigray, Northern Ethiopia. *J Ethnobiol Ethnomed*. 2018;14(1):64.
- Caballero Serrano V, B McLarenb, JC Carrascoc, et al. Traditional Ecological Knowledge and Medicinal Plant Diversity in Ecuadorian Amazon Home Gardens. *Global Ecology and Conservation*. 2019;17:00524.
- Marshet Gijjan Gemedo Dalle. Ethnobotanical Study of Medicinal Plants in Nagelle Arsi District, West Arsi Zone of Oromia, Ethiopia. *Journal of Natural Sciences Research*. 2019;9(13):1–19.
- Ermias Lulekal, Z Asfaw, E Kelbessa, et al. Ethnomedicinal Study of Plants used for Human Ailments in Ankober District, North Shewa Zone, Amhara Region, Ethiopia. *J Ethnobiol Ethnomed*. 2013;9:63.
- Hoogerbrugge I, LO Fresco. *Home Garden System: Agricultural Characteristics and Challenges*. 1993.
- Fernandez ECM, PKR Nair. An Evaluation of the Structure and Function of Tropical Home gardens. *Agricultural Systems*. 1986;21(4):279–310.