SINET: Ethiop. J. Sci., 34(1): 1–16, 2011
 ISSN: 0379–2897

HOMEGARDENS AND AGROBIODIVERSITY CONSERVATION IN SABATA TOWN, OROMIA REGIONAL STATE, ETHIOPIA

Habtamu Hailu [1] and Zemede Asfaw [2]

[1] Environmental Science Programme, College of Natural Sciences, Addis Ababa University PO Box 23031, Addis Ababa, Ethiopia. E-mail:habtamu.ss@gmail.com
[2] Plant Biology and Biodiversity Management Programme Unit, College of Natural Sciences, Addis Ababa University, PO Box 3434, Addis Ababa, Ethiopia. E-mail: zemede@bio.aau.edu.et

ABSTRACT: Homegardens are repositories of biocultural assets of communities, the hub of plant-based resources and the microcosms of agrobiodiversity hotspots. The homegardens of Sabata, a peri-urban town located in the tepid-humid mid highland agroecological zone of southwest Shewa of Oromia Regional State (Ethiopia), were investigated using standard methods of ethnobotany with the aim of elucidating their diagnostic features and significance in agrobiodiversity conservation. Semi-structured interviews, observations, discussion with key informants and guided garden tour with plant specimen collection and identification constituted the main study methods. The resulting data were subjected to matrix ranking, descriptive statistical analysis and calculations of diversity and similarity indices. One hundred thirty-five plant species of different use categories and life forms, distributed in 110 genera and 58 families were recorded. Each homegarden had an average of 33 species. *Ensete ventricosum,* represented by 18 locally identified landrace clones, was the most frequent (91.60%) species. Among 240 randomly sampled households, 78% had attached homegardens. These homegardens provide sizeable returns in terms of plant material for home use and income generation on top of their ecological and aesthetic values. *Cupressus lusitanica* had the highest relative density (0.02%) among the tree species. An average Shannon-Wiener diversity index of 4.301 indicated the richness of Sabata homegardens in plant agrobiodiversity. These homegardens represent rich compositional, structural and functional diversity playing key roles for on-farm conservation and ensuring environmental well-being while contributing to livelihood support. This rich agrobiodiversity together with the local biocultural knowledge and management skills, backed by household decision-making and information networks of the multiethnic communities are the regulators of the homegarden dynamics. Key desirable actions relevant to Sabata homegardens include enhancement and development programmes that would facilitate climate adaptation efforts and optimize provision of resources with conservation of agrobiodiversity while preserving the local biocultural knowledge.

Key words/phrases: Agrobiodiversity, homegardens, local knowledge, Sabata

INTRODUCION

Environmental crisis manifests itself in various ways including global warming, desertification and loss of biodiversity, which constrain human livelihoods. The current threats facing biological diversity call for investigations on the aspects of conservation of the natural resources of an environment (FAO, 1983) and in this, agrobio-diversity has a great significance. The term agrobiodiversity specifies the variety and vari-ability of plants, animals and microorganisms that are indispensable for sustaining key functions of the agroecosystem, comprising of its structure and processes for, and in support of food production and security (FAO, 2004). The term homegarden refers to the traditional land use system around a homestead, where several species of plants are grown and maintained by household members and their products are primarily intended for consumption by the family (Shrestha *et al*., 2002). The last couple of decades have testified an increasing worldwide interest in homegardens, bringing to light their potential for sustained subsistence farming and biodiversity conservation (Christanty, 1990). At present, homegardens are wide-spread in the tropical and subtropical regions of Asia (Godbole, 1998), Africa (Okigbo, 1990) and Central and South America (Padoch and De Jong, 1991).

In parts of Ethiopia, homegardens and other traditional agroforestry systems are found in a complex state like in the enset-based homegar-

dens (Zemede Asfaw, 2004) and the homegarden agroforestry systems of southern and south-western Ethiopia (Tesfaye Abebe, 2005; Tesfaye Abebe *et al.,* 2010). One of the most vital functions that homegardens serve is intergenerational preservation and perpetuation of agrobiodiversity and indigenous knowledge on farming and useful plants (Zemede Asfaw and Zerihun Woldu, 1997). The pivotal role of indigenous knowledge in the management of agrobiodiversity (Martin, 1995; Grenier, 1998) has brought about the realization that conservation of agrobiodiversity leads to preservation of indigenous knowledge promoting the well-being of indigenous local communities (Martinet and McNeely, 1992).

The homegardens in Ethiopia were earlier covered in studies of agricultural systems (Westphal, 1975), which alluded to their contributions to food production and maintenance of species. Limited studies are available that directly focus on Ethiopian homegardens (e.g. Zemede Asfaw and Ayele Nigatu, 1995; Zemede Asfaw, 1997, 2001a, b) and their specific aspects in certain localities of the country viz., Wolaita and Gurage (Zemede Asfaw and Zerihun Woldu, 1997), Bonga (Feleke Woldyes, 2000), Arbaminch area (Belachew Wassihun *et al*., 2003), Sidama (Tesfaye Abebe, 2005) and Wolaita (Talemos Seta, 2007). Zemede Asfaw and Ayele Nigatu (1995) elaborated that traditional homegardens of Ethiopia demonstrate a sustainable agricultural practice that is environmentally friendly and allows the harvesting of diverse products in response to the needs of farming families and urban dwellers. Various researches have shown that homegardens and other traditional agroforestry systems share similar attributes and can best be studied through application of qualitative and quantitative ethnobotanical research approaches. The homegardens of Sabata have not been ethnobotanically investigated. The general trend in the loss of and threat to agrobiodiversity in Ethiopia and the prevailing research gaps were the driving factors that initiated this study on plant diversity and conservation practices in Sabata town. The study was particularly designed to make inventory of the various plant species in the homegardens, and to see how households conserve agricultural biodiversity in this farming system.

MATERIALS AND METHODS

The study area

The study was conducted between November 2007 and March 2008 in Sabata, a peri-urban township and the capital of Sabata Awas District (formerly called Alamganaa District) in South-west Shewa Zone, Oromia Regional State, Ethiopia (Fig.1). It is located within the geographic co-ordinates of 08°41'54''N (961500 m N) to 09°1'9''N (997000 m N) latitude and 038°27'15''E (440000 m E) to 038°43'38''E (470000 m E) longitude and at a distance of 24 km southwest of Addis Ababa between the altitudinal ranges of 2195 and 2300 m.a.s.l. The town is posited within the range of the afromontane forest and the tepid-humid mid highland agro-ecological zone (MOA, 2002) with a mean annual rainfall of 955 mm, the highest and lowest records being in July and November, respectively. The mean maximum and minimum temperatures are 22°C and 10°C, respectively. The soils of the study area, as reported in OUPI (2008), are basically derived from Mesozoic sedimentary and Cenozoic volcanic rocks; the major soil types are Chromic and Pellic Vertisols (76.1%) and Chromic and Orthic Luvisols (23.9%). Elements of the natural vegetation are merely noticeable from the limited remnant trees of *Ficus* spp. and *Olea europaea* ssp. *cuspidata* left for shade, on fences and in some secluded places. *Eucalyptus* trees/plantations are observed on hilly areas, in open spaces and in homestead compounds as also reported by OUPI (2008). Sparsely scattered naturally growing vegetation consisting of shrubs, bushes, woody riverine species are found along with planted trees and protected government and community forests in the Sabata Awas District (RSIC, 2006).

In 2007 the population of the town was 56,131 (49.64% male, 50.36% female) belonging to different ethno-linguistic groups including the Oromo, Amhara, Gurage, Silte, Tigrie, Wolaita, Dorzie, Gamo, Goffa, Konta, Dawro and others (CSA, 1994; 2008). In this relatively small town, such diverse groups are living together in harmony under dynamic transfer and mix of local knowledge and traditional practices relevant for maintenance of homegarden agrobiodiversity.

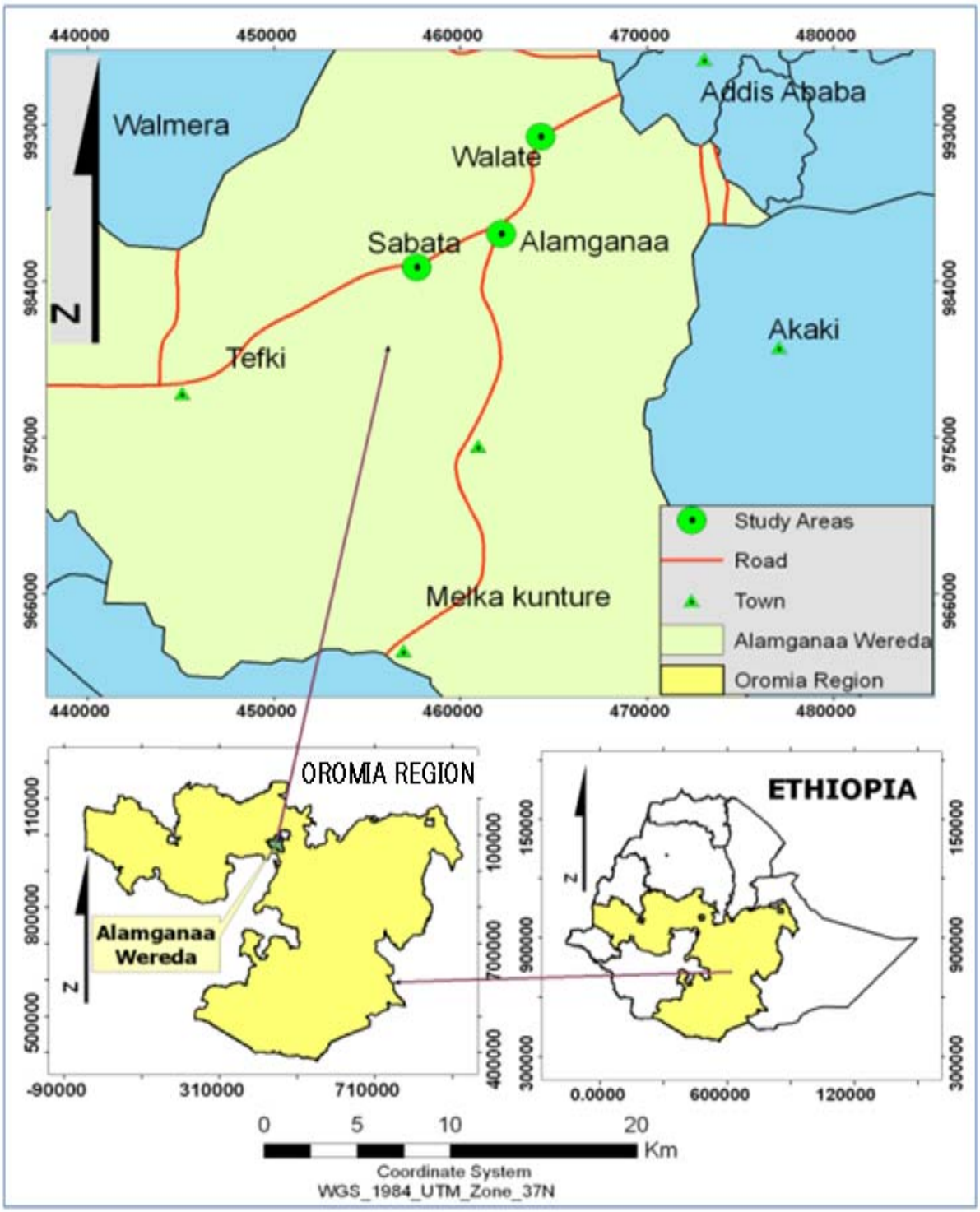

Fig. 1. Location map of the study area (drawn from Ethio GIS Data).

Selection of homegardens

A reconnaissance survey was undertaken in Sabata town during which six research sites were identified in three Kebeles namely, Kebele-01, Kebele-02 and Kebele-03. This was followed by observation of randomly picked households and scoring 240 (80 houses in each Kebele) for presence or absence of associated gardens. Based on a preliminary survey of the homegardens, which indicated that 78% of the households practiced homegardening, 24 well-managed homegardens (eight in each Kebele, four each

from the north-western and south-eastern parts of the town crossing the Addis Ababa-Jimma highway) were preferentially selected for detailed study. Permission of the owners of homegardens was secured after explaining the purpose of the study and assuring them of the ethical use of the results for academic matters.

Sampling and data collection

Sample plots of 10 m x 10 m (100 m^2) were delimited in the study area giving a total of 24 quadrats (2400 m^2). Plant specimens collected from the homegardens were identified with reference to the volumes of the "Flora of Ethiopia and Eritrea" and by comparing them with the authenticated specimens housed at the National Herbarium (ETH), Addis Ababa University (AAU) and further confirmation by taxonomic experts. Ethnobotanical techniques were employed for data gathering using semi-structured interviews, observations, discussion, guided garden tour with key informants, informants' consensus and direct matrix ranking following standard ethnobotanical methods (Martin, 1995; Alexiades, 1996; Phillips, 1996). Ten key informants were asked to prioritize six tree species based on six use criteria applying the procedure for direct matrix ranking.

Data analysis

Data analysis followed descriptive statistical methods, frequencies, relative frequencies, densities, relative densities, Shannon and Wiener (1949) index of species diversity, and Sørensen's similarity coefficients (Kent and Coker, 1992). Shannon and Wiener (1949) index was applied to quantify species diversity and richness using the formula: $H' = -\Sigma (Pi \ lnPi)$, where "H" is the Shannon-Wiener Diversity Index, "Pi" is the ratio of a species average to the total species average and "ln" is the natural logarithm. The diversity of each cluster was calculated using this index based on the frequency of species as input source. Sørensen's coefficient of similarity (S_S) is defined using the formula: $S_S = 2a / 2a + b + c$, where S_S = Sørensen's similarity coefficient, a = number of species common to quadrats, b = number of species in quadrats 1 and c = number of species in quadrat 2. This similarity index was used to measure the degree to which the species composition of quadrats in a cluster of homegardens are alike. The possible coefficient values range from 0 (complete dissimilarity) to 1 (total similarity) (Kent and Coker, 1992).

RESULTS AND DISCUSSION

Agrobiodiversty of Sabata homegardens

A total of 135 plant species belonging to 110 genera and 58 families were recorded from homegardens of the study area. In terms of the number of plant species that homegardens contain, the Fabaceae constituted the largest number with 13 species (Appendix 1); the Lamiaceae and Asteraceae had 9 each, Rutaceae, Rosaceae and Solanaceae 6 each, and Moraceae and Myrtaceae 5 each ranking second, third and fourth respectively. The data on plant composition of homegardens indicated that the area has floristic richness and included plant species from diverse genera and families. This fits well with the assertion that homegardens are valuable sources of plant agrobiodiversity (Brookfield, 2001).

Plant species with the highest relative frequencies of occurrence included *Ensete ventricosum* followed by *Rosa hybrida* and *Vernonia amygdalina* (Table 1). The sustainable use of plant genetic resources in agriculture is inseparable from agrobiodiversity conservation. Homegardens are vivid examples of production systems with rich diversity that serves both development and conservation functions (Eyzaguirre and Watson, 2002). Das and Das (2005) further advocated that homegardens are the sites of conservation of a large diversity of plants both wild and domesticated, because of their uses to the households. *Ensete ventricosum* is an indigenous root crop cultivated and processed for human food as a principal carbohydrate source only in Ethiopia (Brandt, 1996); it has key position in some homegardens in the country as a dominant species (Tesfaye Abebe, 2005). It is the most frequently maintained crop in the homegardens of the study area for being culturally popular as food source. Other than cultivating crops for their food values, homegarden owners also grow ornamental plants like *Rosa hybrida* for their recreational and aesthetic uses and utility plants such as *Vernonia amygdalina* for household services. Such miscellaneous uses of homegarden plants have positive implications for maintaining the agrobiodiversity of the area.

Table 1. Plant species with the highest frequencies of occurrence in the homegardens of Sabata.

Scientific name	% Frequency	Relative frequency (%)
Ensete ventricosum	91.60	2.71
Rosa hybrida	87.50	2.59
Vernonia amygdalina	87.50	2.59
Cupressus lusitanica	75.00	2.22
Cyperus alternifolius	70.83	2.09
Nephrolepis undulata	70.83	2.09
Ruta chalepensis	70.83	2.09
Dovyalis caffra	66.60	1.97
Lippia adoënsis var koseret	66.60	1.97
Persea americana	62.50	1.85
Rhamnus prinoides	62.50	1.85

From the total of 39 tree species identified in this study from 24 sample quadrats (2400 m^2), *Cupressus lusitanica* came out as the most represented with 1500 individuals (1.6 plants per m^2) and has the highest relative density (0.02) followed by *Eucalyptus camaldulensis* with a total number of 1125 individuals and relative density of 0.01. *Cupressus lusitanica* is the most represented, but it is not placed in farmers ranking because of minimal relative benefits obtained from it. The reasons behind its being frequent could be related to availability of free or cheap seedlings for planting in addition to promotion by agricultural development agents. The species is one of the most widely propagated exotic trees in government forestry research during the past years. Some tree species had high number of individuals (Table 2) while the others had from 1–34 individuals.

Computation of homegarden species diversity revealed a Shannon-Wiener diversity index greater than 4.00 in the six sites. Sites S_1 and A_4 are the most diversified with diversity indices of 4.357 next to site W_5 (H'= 4.394). Relatively smaller diversity indices were found in the cases of S_2 and W_6 sites with H'= 4.290 and H'=4.234, respectively, the lowest of all being in A_3 (H'=4.174). Sites W_5 and A_3 have the highest and smallest number of species, respectively (Table 3). In addition, the results show very little (<50%) floristic similarity coefficients (Table 4).

Table 2. Tree species with the highest number of individuals, densities and relative densities of occurrence in Sabata homegardens.

Scientific name	Number individuals	Density	Relative Density (%)
Cupressus lusitanica	1500.000	0.625	0.019
Eucalyptus camaldulensis	1125.000	0.469	0.014
Persea americana	63.000	0.026	0.001
Eucalyptus globulus	58.000	0.024	0.001
Casimiroa edulis	53.000	0.022	0.001
Juniperus procera	41.000	0.017	0.001

Table 3. Shannon-Wiener Diversity Index (H′) for the six study sites in Sabata town.

Research sites	Species richness	Shannon's index (H′)
S_1	78	4.357
S_2	73	4.290
A_3	65	4.174
A_4	78	4.357
W_5	81	4.394
W_6	69	4.234
Mean	74	4.301

S_1 and S_2 are study sites in Kebele 01, A_3 and A_4 in Kebele 02 and W_5 and W_6 in Kebele 03.

Table 4. Sørensen's similarity index for plant species composition in the cluster of homegardens.

Cluster of homegardens	S_1	S_2	A_3	A_4	W_5	W_6
S_1	1.00					
S_2	0.40	1.00				
A_3	0.38	0.39	1.00			
A_4	0.40	0.41	0.41	1.00		
W_5	0.38	0.40	0.38	0.43	1.00	
W_6	0.35	0.38	0.37	0.40	0.42	1.00

S_1 and S_2 are study sites in Kebele 01, A_3 and A_4 in Kebele 02 and W_5 and W_6 in Kebele 03.

According to Shaw (2003), the first and most obvious measurement to make is the species richness (*i.e.,* the count of the total number of species within the sample) which is a valid index of diversity in its own right. The lower species diversity indices that were recorded at sites S_2, A_3 and W_6 may be related to the on-going trend of shifting the polycultural gardening practices towards few income generating food crops including cabbage, carrot, lettuce, garlic, onion and tomato. Similarity values above 0.40 may indicate slight similarity in agroeccology and transfer of knowledge while lower values indicate uniqueness and localized identities among gardens and households.

Factors that influence plant composition in Sabata homegardens

The composition of plant species in the homegardens of the study area is affected by different factors. The seven major ones are given in Table 5 along with the frequencies for 51 homegarden owners who identified on average more than two factors, which they considered relevant in affecting plant composition in their gardens. The results also show that availability of water, socio-economic conditions and home-garden size are the top three factors. The low availability of water or a decreasing rainfall pattern during the dry spell is the major factor affecting off-season production of their garden crops and for the reduction of plant diversity in general. This finding directly corroborates with those of Padoch and de Jong (1991), Zemede Asfaw (1997) and Talemos Seta (2007) who found that the diversity of plant species in home-gardens and in many environments is limited by the availability of adequate water.

In contrast to the polycultural cropping nature of homegardens, the emphasis being given by some households to the production of income generating sole vegetable crops could be the second major factor (socio-economic factor) for waning plant diversity in some homegardens of the area. This finding agrees with an earlier report by Talemos Seta (2007) who indicated that homegarden plants/crops were being replaced by some cash crops in order to get better cash income in return. As Sabata is a peri-urban town situated near a cosmopolitan centre with very large population (Addis Ababa), the demand for fresh vegetables is very high and the sizes of most gardens are relatively large but production is concentrating on few cash crops. However, some gardeners complained about the smaller sizes of their gardens that limit cultivation of diverse taxa of food and non-food crops. Moreover, there is a declining trend in garden size as land is taken for construction of additional houses for renting. The demand for houses is increasing because of population growth, urbanization and intensification of investment activities and this could be another constraint on the richness of plant diversity. In this regard, Zemede Asfaw (1997) described that garden space tends to reduce due to urbanization and population growth.

Table 5. Factors that affect homegarden plant diversity as reported by homegarden owners in Sabata town.

Factors	Frequency	% of respondents
Water availability	31	60.8
Socio-economic condition	22	43.1
Homegarden size	19	37.3
Agricultural input support (seed/seedling provision)	15	29.4
Homegarden handling	11	21.6
Crop pests	8	15.7
Lack of awareness	3	5.9

Even though there are some efforts being undertaken in promoting homegardening in the area, the agricultural input support (seed/-seedling provision) dispensed by governmental or non-governmental sectors is minimal. These agencies provide some indigenous and alien

plant species, which would enrich the diversity of homegarden plants. Though dependence on donations from the government and NGOs is not a viable and sustainable solution, intermediate forms such as the purchase of inputs (high quality vegetable seed, fencing material) at subsidized prices from government agencies may be preferable (Frankenberger *et al.,* 1989). The occurrence of pests, which destroy the seedlings of edible and non-edible plant species that are used for market and home consumption, is also another detrimental factor. Since chemical pest control is not a viable alternative in smallholder cropping systems (homegardens), information is required on crop and species combinations with a greater potential to reduce pests, diseases and weeds. Investigation of the effectiveness of the plant species with anti-pest properties used by the Chagga people in Tanzania (Fernandes *et al*., 1984) showed that they were used as a first step protection, indicating potential uses of indigenous knowledge. Households in Sabata and beyond can apply plants such as *Croton macrostachyus* used in traditional protection against insects, mites, ticks, and nematodes.

Local homegarden management practices

A number of local management practices are carried out in the homegardens of the study area and the maintenance of diverse taxa of plants is one among the major endeavours. From a total of 135 species identified in the present study, the maximum number of species per garden was 57, the minimum 13, and the average 33 (23.61 %). Rich diversity of plant species in the homegardens has been made possible by cultivating and protecting a mixture of herbs, lianas, shrubs and trees based on the need and decision of the family members. Belachew Wassihun *et al.* (2003) reported similar findings. Management activities are carried out with minimal ecological cost due to the low utilization of chemical inputs. Soil enrichment is maintained by including leguminous species among the crops cultivated and by incorporating organic fertilizers such as house refuses, animal manures and crop residue. This observation goes in line with findings reported by previous researchers (Zemede Asfaw, 1997; Belachew Wassihun *et al*., 2003; Talemos Seta, 2007). Garden pests like termites that damage tuber crops such as *Solanum tuberosum* are controlled by the application of wood ash to the soil according to garden owners. Sprinkling a little wood ash around the base of young plants, and also lightly on new leaf growth is known to deter insects and fungi (FAO, 2001). Seed selection is also carried out by homegarden owners based on the colour of seeds, maturity, crop yield, quality, disease and drought resistance.

Indigenous knowledge on homegarden plant use

Some homegarden owners of the study area have a profound local knowledge on the classification scheme and processing of *Ensete ventricosum*. They stated that the plant is a multipurpose crop that is used for food, medication, cordage and wrapping of materials. Talemos Seta (2007) captured similar perception with regards to the functions of this valuable crop. The corm (the swollen underground stem base) of a mature plant is chopped, cooked and eaten. Leaf sheaths (pseudostems) are scraped by skilled women and are used for Bulla porridge; the chopped and grated pulp of the corms and leaf sheaths is fermented and used as flour in making Kocho bread (as baked flat cake). Some gardeners of the area, particularly those of the Gurage community, suggested that there are about 70 landrace varieties (clones) of *Ensete ventricosum*. Eighteen landrace clones (farmers' varieties) of this nutritionally and culturally valued crop plant identified by the owners of homegardens are given in Table 6 along with their uses.

Table 6. Landraces (farmers' varieties/clones) of *Ensete ventricosum* recognized by the households interviewed in Sabata town, Walate 03 Kebele.

Local variety name in Ežhe (Gurage) language	Use
Agadie	Food, Fibre, Fodder
Ankefye	Food, Fibre, Fodder
Astara	Food, Fibre, Fodder, Medicinal
Badediet	Food, Fibre, Fodder
Beneshe	Food, Fibre, Fodder
Chehuye	Food, Fibre, Fodder
Cheswe	Food, Fibre, Fodder
Deriye	Food, Fibre, Fodder, Medicinal
E'herye	Food, Fibre, Fodder
E'kuafye	Food, Fibre, Fodder
Fereziye	Food, Fibre, Fodder
Guariye	Food, Fibre, Fodder, Medicinal
K'ebbena	Food, Fibre, Fodder, Medicinal
Kembat	Food, Fibre, Fodder
Netch'we	Food, Fibre, Fodder
Shertye	Food, Fibre, Fodder, Medicinal (for cattle)
Yehereye	Food, Fibre, Fodder
Yehirafereye	Food, Fibre, Fodder

Ežhe is the language spoken by the Sebatbet Gurage ethnolinguistic community of the Gurage people in Ethiopia.

Households in Sabata reported using all these clones for human food, fibre source and as fodder for domestic animals while using five of these additionally as traditional medicines (Table 6). Some of these varieties are included in the list of clones from Sodo and Butajira Districts in the paper by Asnaketch Woldetensaye and Linden (1997).

Local perception and uses of trees around homesteads

In addition, people of the study area have the tradition of using various tree species found in their homegardens for different purposes viz., construction, implements, firewood, shade, compound enclosures and for their therapeutic use. The results of 10 key informants direct matrix ranking for six tree species based on six use criteria is given in Table 7. Accordingly, *Eucalyptus globulus* with a total score of 240 (19.05%) ranked first. *Acacia abyssinica* and *Juniperus procera* with 233 (18.49%) and 226 (17.94 %) constituted the second and third positions, in that order. The maximum scores per use criterion were given to *Eucalyptus globulus* and *Cordia africana* (59 each) concerning their uses for construction and implements, respectively followed by *Croton macrostachyus* with the score of 58 for its medicinal use. Indigenous trees ranked at the top except *Eucalyptus globulus,* which is an introduced but very useful tree species, albeit claims that it exerts negative ecological impacts on the undergrowth of other plant species and on soil water availability, especially in dry areas (Poore and Fries, 1985). Regardless of this, it is a widely used tree in the study area as well as in many parts of the country for construction since it is a fast growing tree with desirable bole. Moreover, *Cordia africana* is also the most preferred tree species for implements/tools as it can be shaped and carved easily into different forms.

Environmental contributions of Sabata homegardens

Observations made in the area during the fieldwork brought up the tremendous environmental contributions of the homegardens. They render the environment suitable for life by reducing the deleterious effects of extreme wind, temperature, dust and improving the quality of life in general. Trees in the homesteads also provide good services by intercepting dust and other undesirable visitors. The contributions of homegardens of the study area to the sustenance of the general environment cannot be overemphasized. In this connection, Kuchelmeister and Braatz (1993) underlined that garden plants help to remove pollutants from the air through absorption by the leaves or the soil surface, deposition of particulates and aerosols on leaf surfaces and fallout of particulates on the leeward (downwind) side of the vegetation because of the slowing of air movement. Parallel to this assertion, the homegardens of Sabata are offering and will continue to offer relevant environmental services on top of their values in the provision of needed resources and aesthetic values. Homegardening deserves encouraging and promoting in Sabata and beyond.

Table 7. Results of ten key informants' direct matrix ranking for six tree species encountered in homegardens (6, best; 1, least).

Use criteria	Tree species					
	Cordia africana	*Croton macrostachyus*	*Eucalyptus globulus*	*Juniperus procera*	*Acacia abyssinica*	*Acacia mearnsii*
Construction	32	15	59	49	21	34
Implements	59	30	18	37	45	21
Fuel wood	30	18	48	17	55	42
Shade	50	31	14	30	53	32
Live fence	27	20	49	53	30	31
Medicine	19	58	52	40	29	12
Total score	217	172	240	226	233	172
Rank	4	5	1	3	2	5

CONCLUSION

The floristic composition of Sabata homegardens showed that the homegardens are rich (135 species) in plant diversity. Local management practices are customarily performed in the homegardens where households endeavour to maintain diverse plant taxa. They cultivate and protect a mixture of herbs, lianas, shrubs and trees depending on the need and decision of households. Different factors including availability of water, socio-economic conditions and homegarden size affect plant composition of Sabata homegardens. A deep-rooted local knowledge is also apparent from the practices of homegarden owners on taxonomic schemes applied to *Ensete ventricosum and* processing of its products. The local knowledge and management practices shaped over centuries can be lost unless thoughtful attention is given and proper documentation is put in place. Homegarden system, as practiced traditionally, is organic in nature and its environmental soundness is well recognized. However, to safeguard agricultural biodiversity of Sabata and beyond a timely intervention should be undertaken against the threat of commercialization and the trend in pondering on high value crops utilizing high chemical inputs (fertilizers and pesticides). There is a clear need for drawing attention to the biodiversity resources of the area and the maintenance and enhancement of homegardens.

ACKNOWLEDGEMENTS

We are grateful to the homegarden owners and the local administration in Sabata for their kind support and their traditional ethical clearance through their blessings and acquiescence that facilitated working on the homegardens of the area. The senior author acknowledges the Addis Ababa University (AAU) for the provision of financial assistance and the Environmental Science Programme, Faculty of Science (AAU), now the College of Natural Sciences for immensely contributing to the success of this work.

REFERENCES

1. Alexiades, M. (1996). Collecting ethnobotanical data: an introduction to basic concepts and techniques. **In**: *Selected Guidelines for Ethnobotanical Research: A Field Manual,* pp. 53–94, (Alexiades, M.N. and Sheldon, J.W., eds). The New York Botanical Garden, Bronx, New York, U.S.A.
2. Asnaketch Woldetensaye and Linden, B. (1997). Cultivation and utilization of *Ensete ventricosum* in two regions of Ethiopia. **In**: *The Ecology and Production of Ensete ventricosum in Ethiopia*, pp. 1–45, PhD Dissertation, Swedish University of Agricultural Science. PhD Thesis, Swedish University of Agricultural Sciences, Uppsala.
3. Belachew Wassihun, Zemede Asfaw and Sebsebe Demissiew (2003). Ethnobotanical study of useful plants in Daniio Gade (Homegardens) in Southern Ethiopia. *Ethiop. J. Biol. Sci*. **2**(2):119–141.
4. Brandt, S.A. (1996). A model for the origin and evolution of enset food production. **In**: *Enset-based Sustainable Agriculture in Ethiopia. Proceedings of the International Workshop on Enset* (1993), pp. 36–46, (Tsedeke Abate, Steven, C.H., Brandt, A. and Seifu Gebremariam, eds). Addis Ababa, Ethiopia.
5. Brookfield, H. (2001). *Exploring Agrobiodiversity*. Columbia University Press, New York.
6. Christanty, L. (1990). Homegardens in tropical Asia, with special reference to Indonesia. **In:** *Tropical Home-Gardens*, pp. 9–20, (Landauer, K. and Brazil, M., eds). United Nations University Press, Tokyo.
7. CSA (1994). The population and housing census of Ethiopia, results for Oromia Region.Volume I: Part VI. Central Statistics Agency, Addis Ababa, Ethiopia.
8. CSA (2008). The 2007 population and housing census results of Ethiopia. Central Statistics Agency. Addis Ababa, Ethiopia.
9. Das, T. and Das, A.K. (2005). Inventorying plant biodiversity in homegardens: A case study in Barak Valley, Assam, North East India. *Current Science* **89**(1):155–163.
10. Eyzaguirre, P. and Watson, J. (2002). Homegardens and agrobiodiversity: an overview across regions. **In:** *Omegardens and In situ Conservation of Plant Genetic Resources in Farming Systems. Proceedings of the Second International Homegardens Workshop*, pp. 10–18, (Watson, J.W. and Eyzaguirre, P.B., eds), 17–19 July 2001, Witzenhausen, Federal Republic of Germany. International Plant Genetic Resources Institute, Rome, Italy.
11. FAO (1983). *Selected Medicinal Plants*. In FAO plant production and protection paper **53**(1):1–94.
12. FAO (2001). *Improving Nutrition Through Homegardening: A Training Package for Preparing Field Workers in Africa*. FAO, Rome.
13. FAO (2004). *Building on Gender, Agrobiodiversity and Local Knowledge*. FAO, Rome, 18 pp.
14. Feleke Woldyes (2000). A study on biodiversity management in Daddegoyo (Traditional Homegardens) by Kaficho people of Bonga Area (Southwestern Ethiopia): An ethnobotanical approach. MSc Thesis, Addis Ababa University, 89 pp.
15. Fernandes, E.C.M., Oktingati, A. and Maghembe, J. (1984). The Chagga homegardens: A multistoried agroforestry cropping systems on mount Kilimanjaro (Tanzania). *Agroforestry Systems* **2**:73–86.

16. Frankenberger, T.R., Stone, M.P. and Tejada, S.S. (1989). Household vegetable gardens in Africa: Case studies from Mauritania and Lesotho. *Arid Lands Newsletter* **29**:21–24, University of Arizona, USA.
17. Godbole, A. (1998). Maintenance of biodiversity. **In:** *Applied Ethnobotany in Natural Resource Management*, pp. 9–12, (Rastogi, A., Godbole, A. and shengii, P., eds). International Center for Integrated Mountain Development, Nepal.
18. Grenier, L. (1998). *Working with Indigenous Knowledge: A Guide for Researchers*. The International Development Research Centre (IDRC), Ottawa, Canada, 100 pp.
19. Kent, M. and Coker, P. (1992). *Vegetation Description and Analysis: A Practical Approach*. Belhaven Press, London.
20. Kuchelmeister, G. and Braatz, S. (1993). Urban forestry revisited. *International journal of the forestry and food Industries* **44**:13–18.
21. Martin, G.J. (1995). *Ethnobotany: A Method Manual*. Chapman and Hall, London.
22. Martinet, C. and McNeely, J. (1992). Managing parks for the 21 century. A device from the parks congress. *Parks* **3**:13–21.
23. MOA (2002). The Agroecological zones of Ethiopia (AEZE). Natural Resource Management and Regulatory Department, Ministry of Agriculture, Addis Ababa.
24. Okigbo, N.B. (1990). Homegardens in tropical Africa. **In:** *Tropical Homegardens*, pp. 21–40, (Landauer, K. and Brazil, M., eds). United Nations University Press, Tokyo.
25. OUPI (2008). Physical and socioeconomic study of Sabata Town. Oromia Urban Planning Institute, Finfinne, Ethiopia.
26. Padoch, C. and De Jong, W. (1991). The house garden of Santa Rosa: Diversity and variability in an Amazonian agricultural system. *Econ. Bot*. **45**(2):166–175.
27. Phillips, O.L. (1996). Some quantitative methods for analyzing ethnobotanical knowledge. **In**: *Selected Guidelines for Ethnobotanical Research*: *A Field Manual*, pp. 171–197, (Alexiades, M. and Sheldon, J.W., eds). New York Botanical Garden Press, Bronx, New York.
28. Poore, M.E.D. and Fries, C. (1985). *The Ecological Effects of* Eucalyptus. FAO Forestry paper 59, Rome.
29. RSIC (2006). Physical and socio-economic profile of Alamganaa of south west Shewa Zone (Draft). Regional Statistics and Information Center, Finfine, Ethiopia.
30. Shannon, C.E. and Wiener, W. (1949). *The Mathematical Theory of Communication*. University of Illinois, Chicago, USA.
31. Shaw, P.J.A. (2003). *Multivariate Statistics for the Environmental Sciences*. Arnold: London, 228 pp.
32. Shrestha, D.P., Margate, D.E., Anh, H.V. and Van der Meer, F.D. (2002). Spectral unmixing versus spectral angle mapper for land degradation assessment: a case study in southern Spain. **In:** *17th World Congress of Soil Science CD-ROM Proceedings: Confronting New Realities in the 21st Century*, 14–21 August, 2002, Bangkok, Thailand**.** Kasetsart University, pp. 1141–1 – 1141–10.
33. Talemos Seta (2007). Diversity in enset-based homegardens and its significance to household supply in Wolayita (Southern Ethiopia): An Ethnobotanic approach. MSc Thesis, Addis Ababa University, pp. 105.
34. Tesfaye Abebe (2005). Diversity in homegarden agroforestry systems of Southern Ethiopia. PhD Dissertation, Wageningen University, Netherlands.
35. Tesfaye Abebe, Wiersum, K.F. and Bongers, F. (2010). Spatial and temporal variation in crop diversity in agroforestry homegardens of southern Ethiopia. *Agroforestry Systems* **78**:309–322.
36. Westphal, E. (1975). Agricultural systems in Ethiopia. Agricultural Research Report No. 826, College of Agriculture, Haileselassie I Univ., Addis Ababa and Agricultural Univ. of Wageningen, Wageningen.
37. Zemede Asfaw (1997). *Survey of Food Crops, their Preparations and Homegardens in Ethiopia: Indigenous African Food Crops and Useful Plants*. United Nations University/Institute of Natural Resources in Africa No. B_6, ICIPE. Science Press, Nairobi, 65 pp.
38. Zemede Asfaw (2001a). The role of homegardens in the production and conservation of medicinal plants. **In:** *Conservation and Sustainable use of Medicinal plants in Ethiopia. Proceedings of the National Workshop on Biodiversity Conservation and Sustainable Use of Medicinal Plants in Ethiopia (*28 April - 1 May, 1998), pp. 76–91, (Medhin Zewdu and Abebe Demissie, eds). Institute of Biodiversity Conservation and Research, Addis Ababa, Ethiopia.
39. Zemede Asfaw (2001b). Origin and evolution of rural homegardens in Ethiopia. **In:** *Biodiversity Research in the Horn of Africa Region. Proceedings of the Third International Symposium on the Flora of Ethiopia and Eritrea* (August 25–27, 1999), pp. 273–286, (Friis, I. and Ryding, O., eds) at the Carlsberg Academy, Copenhagen.
40. Zemede Asfaw 2004. The enset-based homegardens of Ethiopia. In:, *Home Garden and Agrobiodiversity,* pp. 123-147, (Eyzaguirre, P.B. and Linares, O.F., eds). Smithsonian Institution, Washington.
41. Zemede Asfaw and Ayele Nigatu (1995). Homegardens in Ethiopia: Characteristics and plant diversity. *SINET: Ethiop. J. Sci*. **18**(2):235–266.
42. Zemede Asfaw and Zerihun Woldu (1997). Crop association of homegardens in Welayta and Gurage in Southern Ethiopia. *SINET: Ethiop. J. Sci*. **20**(1):73–90.

Appendix 1. List of plant species of Sabata homegardens. (Note: O=Afan Oromo, A=Amharic, G=Gurage, T=Tigrie, NLN=No local name)

Scientific name	Family	Vernacular Name (Language)	Habit	Number of individuals of tree species
Acacia abyssinica Hochst.ex Benth.	Fabaceae	Lafto (O)	Tree	15
Acacia mearnsii De Willd.	Fabaceae	Yetmnja-zaf (A)	Tree	12
Acacia melanoxylon R.Br.	Fabaceae	Omedlla (A)	Tree	1
Agave americana L.	Agavaceae	Qacha (A)	Herb	
Ajuga integrifolia Buch.- Ham. ex D. Don	Lamiaceae	Armaguusaa (O, A)	Herb	
Albizia schimperiana Oliv. var. *schimperiana*	Fabaceae	Mukka-arba (O)	Tree	1
Allium cepa L.	Alliaceae	Qullubbii-diimaa (O)	Herb	
Allium sativum L.	Alliaceae	Quulubii-adii (O)	Herb	
Aloe pubescens Reynolds	Aloaceae	E'ret (A)	Herb	
Annona cherimola Mill.	Annonaceae	Gishta (A)	Tree	10
Artemisia absinthium L.	Asteraceae	Arrittii (O)	Herb	
Artemisia afra Jacq. ex Willd.	Asteraceae	Jukunn (O)	Herb	
Arundo donax L.	Poaceae	Shambako (O)	Herb	
Asparagus africanus Lam.	Asparagaceae	Seriti (A)	Herb	
Begonia cucullata Willd.	Begoniaceae	NLN	Herb	
Begonia rex-cultorum Hort.	Begoniaceae	NLN	Herb	
Beta vulgaris L.	Chenopodiaceae	Qosta (A)	Herb	
Bidens rueppellii (Sch. Bip. ex Walp.) Sherff	Asteraceae	Kello (O), Adey-abeba (A)	Herb	
Bougainvillea x buttiana Holtum and Standl.	Nyctaginaceae	Bugambe (A)	Liana	
Bougainvillea glabra Choisy	Nyctaginaceae	Bugambe (A)	Liana	
Brassica carinata A. Br.	Brassicaceae	Yeguragie gomen (A)	Herb	

Appendix 1 (continued)

Scientific name	Family	Vernacular Name (Language)	Habit	Number of individuals of tree species
Brassica oleracea L.	Brassicaceae	Goommana (O)	Herb	
Brassica oleracea L. var. *capitata*	Brassicaceae	Tql-gomen (A)	Herb	
Buddleja davidii Franch.	Longaniaceae	Necho (A)	Shrub	
Caesalpinia decapetala (Roth) Alston	Fabaceae	Arangamaa (O)	Liana	
Callistemon citrinus (Curtis) Skeels	Myrtaceae	NLN	Tree	
*Calpurnea aure*a (Ait.) Benth.	Fabaceae	Ceekaa (O)	Shrub	
Canna indica L.	Cannaceae	Siet-akuri (A)	Herb	
Capsicum annuum L.	Solanaceae	Barbaree (O)	Herb	
Carissa spinarum L.	Apocynaceae	Hagamsa (O)	Liana	
Casimiroa edulis La Llave	Rutaceae	Shasho (A), Kazmir (O, A)	Tree	53
Catha edulis (Vahl) Forssk. ex Endl.	Celastraceae	Cati (O)	Shrub	
Catharanthus roseus (L.) G. Don	Apocynaceae	NLN	Shrub	
Citrus aurantifolia (Christm.) Swingle	Rutaceae	Lomii(O)	Shrub	
Citrus aurantium L.	Rutaceae	Komtatie (A)	Shrub	
Citrus medica L.	Rutaceae	Trngo (A)	Shrub	
Citrus sinensis (L.) Osb.	Rutaceae	Burtukana (O)	Shrub	
Coffea arabica L.	Rubiaceae	Buna (O, A, G)	Shrub	
Colocasia esculenta (L.) Schott	Araceae	Godaaree (O)	Herb	
Commelina sp.	Commelinaceae	Hoolaa-gabbis (O)	Herb	
Cordia africana Lam.	Boraginaceae	Wedecha (O)	Tree	12
Crinum abyssinicum Hochst. ex A. Rich.	Amaryllidaceae	Yejb-shnkurt (A)	Herb	
Croton macrostachyus Del.	Euphorbiaceae	Bakkannisa (O)	Tree	14
Cucurbita pepo L.	Cucurbitaceae	Dabaaqula (O)	Climber	
Cupressus lusitanica Mill.	Cupressaceae	Gatira (O)	Tree	1500

Appendix 1 (continued)

Scientific name	Family	Vernacular Name (Language)	Habit	Number of individuals of tree species
Cymbopogon citratus (Dc.) Stapf	Poaceae	Tej-sar (A)	Herb	
Cyperus alternifolius L.	Cyperaceae	Quietema (A)	Herb	
Cyperus sp.	Cyperaceae	Qunnii (O)	Herb	
Dahlia pinnata Cav.	Asteraceae	NLN	Herb	
Datura stramonium L.	Solanaceae	Asangiraa (O)	Herb	
Daucus carota L.	Apiaceae	Kaarota (O)	Herb	
Dodonaea angustifolia L. f.	Sapindaceae	Ktktta (A, G)	Shrub	
Dovyalis caffra (Hook. f. and Harv.) Hook. f.	Flacourtiaceae	Koshommii (O)	Shrub	
Dracaena steudneri Engl.	Dracaenaceae	Yuka (A)	Yuka (A)	15
Ensete ventricosum (Welw.) Cheesman.	Musaceae	Kocho (A), Aset (G)	Herb	
Erythrina brucei Schweinf.	Fabaceae	Korch (A)	Tree	6
Eucalyptus camaldulensis Dehnh.	Myrtaceae	Baarzaafii diimaa (O)	Tree	1125
Eucalyptus globulus Labill.	Myrtaceae	Tree	Tree	58
Euphorbia inaequilatera Sond.	Euphorbiaceae	NLN	Herb	
Euphorbia milii Des Moulins	Euphorbiaceae	Ye' aklil-eshoh (A)	Shrub	
Ficus elastica Roxb.	Moraceae	Yegoma-zaf (A)	Tree	4
Ficus populifolia Vahl	Moraceae	Yekebrit-inchet (A)	Tree	4
Ficus sur Forsk.	Moraceae	Harbu (O)	Tree	2
Ficus thonningii Blume	Moraceae	Dembi (O)	Tree	2
Foeniculum vulgare Mill.	Apiaceae	Insilaala (O)	Herb	
Gomphocarpus fruticosus (L.) Ait. f.	Asclepiadaceae	NLN	Herb	
Grevillea robusta R.Br.	Proteaceae	Gravillia (O, A,G)	Tree	26

Appendix 1 (continued)

Scientific name	Family	Vernacular Name (Language)	Habit	Number of individuals of tree species
Hibiscus rosa-sinensis L.	Malvaceae	NLN	Shrub	
Hagenia abyssinica (Bruce) J. F. Gmel.	Rosaceae	Heexoo (O)	Tree	5
Hyphaene thebaica (L.) Mart.	Arecaceae	Peakcock-zenbaba (A)	Tree	17
Iresine herbstii Hook. f.	Amaranthaceae	NLN	Herb	
Jacaranda mimosifolia D. Don.	Bignoniaceae	Yetemnja zaf (A)	Tree	20
Juniperus procera Hochst. ex Endl.	Cupresaceae	Gaattiraa (O), Ye' Abesha tsed (A)	Tree	41
Justicia schimperiana (Hochst. ex Nees) T. Anders.	Acanthaceae	Dhummuugaa (O)	Shrub	
Lactuca sativa L.	Asteraceae	Selata (A)	Herb	
Lepidium sativum L.	Brassicaceae	Feechoo (O)	Herb	
Leucanthemum vulgare Lam.	Asteraceae	NLN	Herb	
Lippia adoënsis Hochst. ex Walp. var. *koseret* Sebsebe	Verbenaceae	Kusaye (O), Koserete (A)	Shrub	
Liqustrum vulgare L.	Oleaceae	Yeterse-mefakia (A)	Shrub	
Lycopersicon esculentum Mill.	Solanaceae	Timatimi (O)	Herb	
Malus sylvestris Miller	Rosaceae	Applii / Pomii (O)	Tree	27
Mangifera indica L.	Anacardiaceae	Mango (O, A, G)	Tree	28
Melia azedarach L.	Meliaceae	Neem (A)	Tree	1
Mentha longifolia (L.) Hudson	Lamiaceae	Samhal (T)	Herb	
Mentha spicata L.	Lamiaceae	Nana (A)	Herb	
Millettia ferruginea (Hochst.) Bak.	Fabaceae	Hortessa (O)	Tree	1
Morus alba L.	Moraceae	Njorie (A)	Tree	5
Musa x paradisiaca L.	Musaceae	Muzii (A)	Herb	
Myrtus communis L.	Myrtaceae	Ades (A, G)	Shrub	
Nephrolepis undulata (Afz. ex SW.) J. SM.	Nephrolepidaceae	Zenbaba abeba (A)	Herb	

Appendix 1 (continued)

Scientific name	Family	Vernacular Name (Language)	Habit	Number of individuals of tree species
Nicotiana tabacum L.	Solanaceae	Timibo (O)	Herb	
Ocimum basilicum L.	Lamiaceae	Besobilla (A)	Herb	
Ocimum lamiifolium Hochst. ex Benth.	Lamiaceae	Koricha-michii(O), Yeken-damakese	Shrub	
Ocimum urticifolium Roth	Lamiaceae	Qoricha-michi (O), Yelelit-damakese	Shrub	
Olea europaea L. subsp. *cuspidata* (Wall. ex G. Don) Cif.	Oleaceae	Ejersa (O)	Tree	15
Opuntia cylindrica (Lam.) D. C.	Cactaceae	Qulqwal (A)	Shrub	
Opuntia stricta (Haworth) Haworth	Cactaceae	Qulqwal (A)	Shrub	
Passiflora edulis Sims	Passifloraceae	Yezenjero-Kolet (A)	Liana	
Pelargonium glechomoides Hochst. ex A. Rich.	Geraniaceae	NLN	Shrub	
Persea americana Mill.	Lauraceae	Abukado (O, A, G)	Tree	63
Phaseolus lunatus L.	Fabaceae	Adengwarrie (A)	Climber	
Phaseolus vulgaris L.	Fabaceae	Boloqqie (A)	Climber	
Phoenix reclinata Jacq.	Arecaceae	Zenbaba (A)	Tree	12
Phytolacca dodecandra L.	Phytolaccaceae	'Ndod (A)	Shrub	
Pinus patula L.	Pinaceae	Shew-shewwie (A)	Tree	34
Plectranthus sp.	Lamiaceae	NLN	Herb	
Podocarpus falcatus (Thunb.) Mirb.	Podocarpaceae	Birbirssa (O)	Tree	4
Prunus x domestica L.	Rosaceae	Prim (A)	Tree	7
Prunus persica (L.) Batsch	Rosaceae	Koki (O)	Tree	3
Psidium guajava L.	Myrtaceae	Zeyitunnaa (O)	Tree	26
Punica granatum L.	Punicaceae	Romaana (O)	Shrub	
Rhamnus prinoides L' Herit.	Rhamnaceae	Gesho (O, A)	Shrub	

Appendix 1 (continued)

Scientific name	Family	Vernacular Name (Language)	Habit	Number of individuals of tree species
Rhamnus stado A. Rich.	Rhamnace	Teddo (O)	Shrub	
Ricinus communis L.	Euphorbia	Qobboo (O)	Herb	
Rosa abyssinica Lindley	Rosaceae	Qega (O, A)	Shrub	
Rosa hybrida Hort.	Rosaceae	Tsgiereda (A)	Shrub	
Rosmarinus officinalis L.	Lamiaceae	Siga-metibesha (A)	Shrub	
Ruta chalepensis L.	Rutaceae	Ciraakkota (O)	Shrub	
Saccharum officinarum L.	Poaceae	Shenkora-ageda (A)	Herb	
Salvia microphylla Kunth.	Lamiaceae	NLN	Shrub	
Salix mucronata Thunb.	Salicaceae	Aleltu (O)	Shrub	
Schinus molle L.	Anacardiac	Kundo-berberie zaf (A)	Tree	12
Senna didymobotrya (Fresen.) Irwin and Barneby	Fabaceae	Akayi-warabessa (O)	Shrub	
*Sesbania sesba*n (L.) Merr.	Fabaceae	NLN	Shrub	
Solanum tuberosum L.	Solanaceae	Dinichaa (O)	Herb	
Spathodea campanulata P. Beauv. sub sp. nilotica (Seem.) Bidgood	Bignoniace	Espathoda (O,A) derived from its Latin name)	Tree	21
Tagetes patula L.	Asteraceae	Yeresa-abeba (A)	Herb	
Thuja orientalis L.	Cupresace	Shimelese tsed (A)	Tree	14
Verbena hybrida Voss.	Verbenace	NLN	Herb	
Vernonia amygdalina Del.	Asteraceae	Eebicha (O)	Shrub	
Vica faba L.	Fabaceae	Baqiela (A)	Herb	
Vitis vinifera L.	Vitaceae	Weyn (A)	Liana	
Withania somnifera (L.) Dunal in Dc.	Solanaceae	Gizawa (A)	Herb	
Xanthium strumarium L.	Asteraceae	Deha-nikel (A)	Herb	
Zantedeschia aethiopica (L.) K.P.J. Sprengel	Araceae	Yetrumba abeba (A)	Herb	