Use and management of homegarden plants in Zvishavane district, Zimbabwe

ALFRED MAROYI[*]

Biodiversity Department, School of Molecular and Life Sciences, University of Limpopo, Private Bag X1106, Sovenga 0727, South Africa

Abstract: This study was aimed at documenting use and management of plant species growing in homegardens in Zvishavane district, Zimbabwe. The findings of this study were derived from qualitative and quantitative data collected from 31 homegardens in Zvishavane district between March and December 2009. The study documented information on management of plants growing in homegardens; their numbers, composition and uses. Household interviews and homegarden surveys revealed that 73 species were important to local livelihoods. Vegetables, fruits, ornamentals and medicines were the most important use categories. Among 73 plant species growing in homegardens, 52 species were cultivated and the rest were non-crop species. Cultivated species were actively managed but the management of non-crop species was passive (i.e. were tolerated and protected). These results revealed that homegardens satisfy various household needs such as food, ornamentals, medicines, building materials, religious and ceremonial uses.

Resumen: El objetivo de este estudio fue documentar el uso y el manejo de especies vegetales que crecen en huertos familiares en el distrito Zvishavane, Zimbabue. Los hallazgos de este estudio se derivan de datos cualitativos y cuantitativos recolectados en 31 huertos familiares entre marzo y diciembre de 2009. El estudio documentó información sobre el manejo de plantas que crecen en huertos familiares, sus números, composición y usos. Las entrevistas en los núcleos familiares y la inspección de los huertos familiares mostraron que 73 especies fueron importantes para el sustento local. Las categorías de uso más importantes fueron verduras, frutas, ornamentales y medicinas. Entre 73 especies de plantas que crecen en huertos familiares, 52 especies fueron cultivadas y el resto fueron especies no cultivadas. Las especies cultivadas fueron manejadas activamente, mientras que el manejo de las especies no cultivadas fue pasivo (i.e. fueron toleradas y protegidas). Estos resultados mostraron que los huertos familiares satisfacen varias necesidades familiares tales como alimento, plantas ornamentales, medicinas, materiales de construcción, y para usos religiosos y ceremoniales.

Resumo: Este estudo teve por objectivo documentar o uso e gestão das espécies de plantas vegetando nos quintais de casa no distrito de Zvishavane, Zimbabwe. Os resultados deste estudo resultaram da informação qualitativa e quantitativa recolhida em 31 quintais de casa no distrito de Zvishavane entre Março e Dezembro de 2009. O estudo documenta a informação na gestão das plantas vegetando nos quintais de casa: os seus números, composição e usos. As entrevistas às unidades habitacionais revelaram que 73 espécies eram importantes para assegurar os meios de vida local. Vegetais, frutos, plantas ornamentais e medicinais eram as categorias de uso mais importantes. Entre as 73 espécies vegetando nos quintais de casa, 52 espécies eram cultivadas, sendo as restantes resto espécies não comestíveis. As espécies cultivadas eram ativamente manejadas mas a gestão das restantes espécies era passiva (i.e. eram toleradas e protegidas). Estes resultados revelaram que os quintais de casa satisfazem

[*]*Corresponding Author*; e-mail: alfred.maroyi@ul.ac.za

várias necessidades das unidades habitacionais como sejam a alimentação, ornamentais, medicinais, materiais de construção, religiosos e para usos cerimoniais.

Introduction

The uses of homegardens vary, as some are used for subsistence agriculture and others for commercial production of food crops (Vogl *et al.* 2004). In the rural homegarden, gardeners usually grow fruits, vegetables, medicinal, spiritual and ornamental plants (Kumar & Nair 2004; Lamont *et al.* 1999). Worldwide, homegardens are a community's most adaptable and accessible land resources and important components in reducing vulnerability and ensuring food security (Buchmann 2009). The features of homegardens are year-round production of food, decreased risks of production failure due to high diversity of species, increased resource productivity over time, expansion of the amount and quality of labour applied in the farm, provision of output flexibility and alternative production (Senanayake *et al.* 2009). Therefore, a homegarden can serve as an important source of both food and cash income for vulnerable households. Tropical homegardens may also harbour threatened plant species and serve as areas for experimentation and observation of recently acquired species (Kumar & Nair 2004). At the same time, homegardens are important social and cultural spaces where knowledge related to agricultural practices is transmitted (Blanckaert *et al.* 2004; Galluzzi *et al.* 2010). According to Kumar & Nair (2004), homegarden production is mostly supplementary to staple food production and mainly focuses on vegetables, fruits and condiments. Nevertheless, the wide range of products from trees, shrubs and herbaceous plants cultivated in homegardens offers diversity to the diet for rural households and also serves as an important source of cash income through sale of surplus produce and cash crops (High & Shackleton 2000).

Species composition, structure and function of homegardens may be influenced by ecological, socio-economic and cultural factors, such as distance from urban markets, household size and composition, environmental degradation and family tradition (Lamont *et al.* 1999). Abdoellah *et al.* (2006) pointed out that the introduction of cash crops in homegardens is accompanied by reduced species diversity. On the contrary, Trinh *et al.* (2003) argued that commercialization of homegardens does not lead to reduced diversity, but to more diversity in terms of total number of species. According to Galluzzi *et al.* (2010), homegardens, whether found in rural or urban areas, are characterized by a structural complexity and multifunctionality, which enables the provision of different benefits to ecosystems and people. Homegardens are fundamentally different from large-scale agricultural systems, mainly because they are small in size, intensively managed production systems and require low levels of agricultural inputs.

Homegarden owners use various forms of plant management strategies in home gardening activities. On the basis of previous studies (e.g. Bennet 1992; Blanckaert *et al.* 2004; Thomas & Van Damme 2010; Van den Eynden 2004), plant management in homegardens can be categorized into two main groups: cultivated or tolerated. Cultivated or planted species are managed and cared for by people during their entire life cycle (Van den Eynden 2004). They are sown as seed, multiplied vegetatively by means of stem, root or other cuttings, or transplanted from natural habitats (Thomas & Van Damme 2010). Tolerated plant species are those species that are deliberately spared during digging, weeding and land clearing activities for the benefits or usefulness they provide to households (Thomas & Van Damme 2010). Tolerated species are maintained and protected in homegardens, and are also found growing naturally in the wild.

Little is known about homegarden variation in Zimbabwe, including factors that influence species selection and management. Homegardens in Zimbabwe are poorly known and have not been well researched. Maroyi (2009) documented the contribution of homegardens to the livelihoods of rural people while other few attempts to document uses of trees in homegardens include Gumbo *et al.* (1989), Campbell *et al.* (1991), Musvoto & Campbell (1995), Price & Campbell (1998), and Chivaura-Mususa *et al.* (2000). In this context, a study was, therefore, undertaken aimed at documenting use and management of plant species
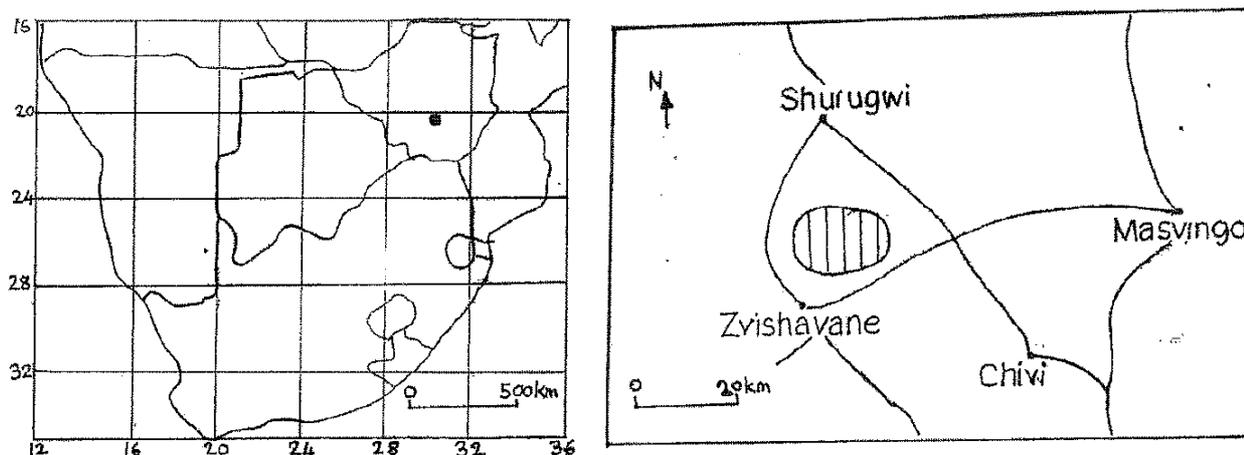
Fig. 1. Geographical location of the study area. Left: map of southern Africa illustrating position of Zvishavane district. Right: detailed map of study area.

growing in homegardens in Zvishavane district, Zimbabwe. The current study focused on home-gardens adjacent to the homestead (Campbell *et al.* 1991; Price & Campbell 1998) or homegardens in a river floodplain or wetland. Both types of homegardens are clearly demarcated and protected from animals by brushwood fences, mersh or barbed-wire fences, and sometimes by live fencing.

Materials and methods

Study area

The study was conducted in Zvishavane district (Fig. 1), a semi-extensive agro-ecological region (Vincent & Thomas 1961). Zvishavane town receives an average of about 570 mm of rainfall per annum. Most of the rainfall is received in summer that stretches from November to March. The mean annual temperature is 20 °C although high temperatures of up to 30 °C have been recorded during the hot months of October to December. Winters can also be extreme in some years reaching 5 °C in winter between May and July. Zvishavane district experiences periodic seasonal droughts and severe dry spells in some cases. Crop production is, therefore, risky except in certain very favourable localities, where limited drought resistant crops are grown as a sideline (Vincent & Thomas 1961). The soils are sandy loam, predominantly derived from granite charac-terized by low agricultural potential due to low nutrient content, particularly nitrogen and phos-phorous (Nyamapfene 1991).

Subsistence agriculture is the mainstay livelihood of the population in Zvishavane district.

Maize cultivation is the main activity, with other grains such as sorghum [*Sorghum bicolor* (L.) Moench] and millet [*Pennisetum glaucum* (L.) R. Br.] being planted by most households as insurance against poor rains, which in some years are inadequate to produce a good maize crop. Subsistence grain crops are supplemented by household vegetable production e.g., pumpkins (*Cucurbita maxima* Duchesne ex Lam.), covo (*Brassica carinata* A. Braun), rape (*Brassica rapa* L.), cabbage (*Brassica oleracea* L.) and beans (*Phaseolus vulgaris* L.), much of this being from small garden tracts along Musavezi and Runde floodplain, cultivated during the dry winter season. Residents of Zvishavane district use cattle and donkeys to plough their fields, and as a means of transporting people and goods to and from the local markets. Cattle, goats, sheep and chicken are an important source of proteins (mainly meat) and cash. Residents also use cow, goat and sheep dung as manure. The area is characterized by savanna grassland and savanna woodland types of vege-tation with dry deciduous thickets in some parts. The woodlands and grasslands provide building poles, fuelwood, edible fruits, tubers and thatching grass. The dominant plant species are *Bra-chystegia spiciformis* Benth., *Julbernardia globi-flora* (Benth.) Troupin, *Colophospermum mopane* (J. Kirk ex Benth.) J. Kirk ex J. Léonard, *Acacia* spp., *Combretum* spp. and dense riverine thickets of mixed species along the major rivers.

Data collection

Information on homegardens was collected from Zvishavane district represented by Mabasa,

Table 1. Homegarden and household characteristics in Zvishavane district, Zimbabwe.

	Mean	S. D.	Range
Size of garden (m²)	1294	677	178-2764
Size of cultivated area (m²)	280	110	154-540
Forms of irrigation used in homegardens			
	No. of homegardens		%
Bucket	28		90.3
Drip irrigation	3		9.7
Head of household			
Female	55.6 %		
Male	44.4 %		
Age (years)	41[a] (21-72)		
Education of household head			
Illiterate	4.5%		
Educated up to primary level	13.6%		
Educated up to secondary level	68.2%		
Educated up to tertiary level	9.1%		
Number of adults in a household	4[a] (1-6)		
Number of children in a household	4[a] (0-11)		

[a]Values are medians unless otherwise indicated, figures in brackets are ranges.

Matenda and Shiku villages (Fig. 1). The final choice of the study areas depended on guidance and advice from the District Agricultural Extension Officer based on farming systems and the existence of homegardens. Prior to any contact with the local people, the study and its objectives were introduced to the local traditional leaders. Once the traditional leaders granted permission to proceed, I approached individuals for participation. The individuals were selected using wealth ranking (Grandin 1988) to ensure that different wealth categories were represented in the study. Data collection involved field observations and interviews conducted with 31 households between March and December 2009 (Table 1). Verbal informal consent was obtained from each individual who participated in the study. The interviews were conducted in Shona, the local language since the author is a native speaker of the language. Basic information was gathered on the demographic composition of the household, agricultural output and sale of output. Household information gathered included household size, age and education of the household head, benefits and constraints encountered in homegarden activities. In the homegarden survey, garden size was measured; information on the local (vernacular) name of each plant species in the homegarden, major plant uses (building, timber, firewood and construction material; cereal; fruit; medicine; oil crop; ornamental, hedge and shade, and vegetable) and the period of the year (pre-rainy season, rainy season, harvest season and dry season or all year round) when each crop product was available for harvesting were obtained. Species were differentiated into indigenous (native), naturalized alien or cultivated alien species. The management status of the plants in homegardens was characterized as cultivated or tolerated. The Statistical Package for the Social Sciences (SPSS) was used to aid in the analysis of primary data.

The importance of each plant species in homegardens was assessed using its use-value (UV) as defined by Lucena *et al.* (2008):

i. $UV = \sum U_i/n$

ii. $UV_f = \sum UV/n_f$

iii. $UV_c = \sum UV/n_c$

where, U_i = number of uses mentioned by each informant;

n = total number of informants;

UV_f = use value for each species in the plant family;

n_f = number of species in the family;

UV_c = use value of each species in the category;

n_c = number of species in the category.

Only current uses were included in the calculation of the use values to reflect the realized value. The use-value technique was chosen as it is considered objective, reproducible and appropriate for statistical analyses (Lucena *et al.* 2008).

Plant collection and identification

Plants growing and cultivated in homegardens were identified in the field by the participants. Voucher specimens were collected during walks with participants when encountered for the first time and again when they were flowering or fruiting, for easy identification. Specimens were processed using standard taxonomic procedures (Bridson & Forman 1998; Victor *et al.* 2004). Each specimen included important parts such as leaves, stems, flowers and fruits where available. For small herbaceous plants, the whole plants were

Table 2. Inventory of crop species identified in homegardens of Zvishavane District, Zimbabwe; their scientific and vernacular names, and main uses. Species marked with an asterisk (*) are indigenous. ᵃManagement status, C = cultivated, T = tolerated. Abbreviations (main uses): B= Building, timber, firewood and construction material, C = Cereal, F = Fruit, M = Medicinal, Oi = Oil crop, Or = Ornamental, hedge and shade, Ot = Other uses, V= Vegetable, V^t = Edible tuber. UV = Overall use value.

Scientific name	Plant family	Vernacular name	Habit	ᵃManag.	Main uses	UV
*Cleome gynandra L.	Capparaceae	Nyovhi	Herb	T	V	1.96
Cucurbita maxima Duchesne ex Lam.	Cucurbitaceae	Muboora	Vine	C	V	1.93
Ipomoea batatas (L.) Lam.	Convolvulaceae	Mbambaira	Vine	C	V^t	1.91
Mangifera indica L.	Anacardiaceae	Mumengo	Tree	C	F	1.90
Allium cepa L.	Alliaceae	Hanyanisi	Herb	C	V	1.89
Zea mays L.	Poaceae	Chibage	Herb	C	C	1.86
Brassica carinata A. Braun	Brassicaceae	Covo	Herb	C	V	1.85
Psidium guajava L.	Myrtaceae	Mugwava	Tree	C	F, M	1.84
Brassica rapa L.	Brassicaceae	Repi	Herb	C	V	1.84
Lycopersicum esculentum Mill.	Solanaceae	Matomatisi	Herb	C	V	1.83
*Corchorus tridens L.	Tiliaceae	Derere	Herb	T	V	1.82
Eucalyptus sp.	Myrtaceae	Mupuranga	Tree	C	B, M, Or	1.80
Brassica juncea (L.) Czern. & Cross.	Brassicaceae	Tsunga	Herb	C	V	1.70
Brassica oleracea L.	Brassicaceae	Kabegi	Herb	C	V	1.66
*Diospyros mespiliformis A. DC.	Ebenaceae	Musuma	Tree	T	B, F	1.63
Solanum tuberosum L.	Solanaceae	Mbatatisi	Herb	C	V^t	1.56
Capscum frutescens L.	Solanaceae	Mhiripiri	Shrub	C	V	1.52
Citrus sinensis (L.) Osbeck	Rutaceae	Muorengi	Tree	C	F	1.52
*Cleome monophylla L.	Capparaceae	Nyovhi	Herb	T	V	1.51
Saccharum officinarum L.	Poaceae	Nzimbe	Herb	C	Ot	1.51
*Parinari curatellifolia (Planch.) Benth.	Chrysobalanaceae	Muhacha	Tree	T	B, F, Or	1.42
Melia azedarach L.	Meliaceae	Musiringa	Tree	C	Or, Ot	1.36
Musa x paradisiaca L.	Musaceae	Mubhanana	Herb	C	F, M	1.31
Carica papaya L.	Caricaceae	Popo	Tree	C	F	1.28
Citrus limon Burm. f.	Rutaceae	Mulemoni	Tree	C	F, M	2.27
Citrillus lanatus (Thunb.) Mansf.	Cucurbitaceae	Vise	Vine	C	F	1.25
Vigna unguiculata (L.) Walp.	Fabaceae	Nyemba	Vine	C	V	1.25
Cucumis anguria L.	Cucurbitaceae	Muchacha	Vine	T	V	1.24
Sorghum bicolor (L.) Moench	Poaceae	Ipwa	Herb	C	Ot	1.24
Phaseolus vulgaris L.	Fabaceae	Binzi	Herb	C	V	1.22
*Sclerocarya birrea (A. Rich.) Hochst.	Anacardiaceae	Mupfura	Tree	T	F	1.22
*Kirkia acuminata Oliv.	Simaroubaceae	Mubvumira	Tree	T	M, Or, Ot	1.21
Amaranthus hybridus L.	Amaranthaceae	Mbuya	Herb	T	V	1.19
*Berchemia discolor (Klotzsch) Hemsl.	Rhamnaceae	Munyii	Tree	T	F	1.18
Prunus persica (L.) Batsch	Rosaceae	Mupichisi	Tree	C	F	1.16
*Amaranthus thunbergii Moq.	Amaranthaceae	Mbuya	Herb	T	V	1.12
*Azanza garckeana (F. Hoffm.) Exell & Hillcoat	Malvaceae	Mutohwe	Tree	T	F	1.11
Morus alba L.	Moraceae	Mumabhurosi	Tree	C	F	1.10
Arachis hypogea L.	Fabaceae	Nzungu	Herb	C	Oi	1.09
Lagenaria siceraria (Molina) Standl.	Cucurbitaceae	Makavhu	Vine	C	V	1.08
*Aloe chabaudii Schonl.	Asphodelaceae	Gavakava	Herb	C	M	1.05
*Strychnos cocculoides Bak.	Loganiaceae	Muzumwi	Tree	T	F	1.02
Catharanthus roseus (L.) G. Don.	Apocynacaeae	Guruva	Herb	C	M, Or	1.02

Table 2. Continued.

Scientific name	Plant family	Vernacular name	Habit	[a]Manag.	Main uses	UV
Agave americana L.	Agavaceae	Mufiba	Herb	C	Or, Ot	1.01
Brassica napus L.	Brassicaceae	Chemberedzagumana	Herb	C	V	0.96
Cucumis metuliferus Naud.	Cucurbitaceae	Gaka	Vine	C	V	0.93
Vangueria infausta Hochst.	Rubiaceae	Mudzvirin'ombe	Shrub	T	F	0.86
Vernonia amygdalina Del.	Asteraceae	Muzhozho	Shrub	T	M	0.85
Jatropha curcas L.	Euphorbiaceae	Mupfuta	Herb	C	Oi, Or	0.84
Opuntia ficus-indica (L.) Mill.	Cactaceae	Mudhorofiya	Shrub	C	F, Or	0.83
Vitex payos (Lour.) Merr.	Lamiaceae	Mutsvubvu	Tree	T	F	0.81
Ricinus communis L.	Euphorbiaceae	Mupfuta	Shrub	C	M, Oi	0.80
Persea americana Mill.	Lauraceae	Mukotopeya	Tree	C	F	0.76
Daucus carota L.	Apiaceae	Makerotsi	Herb	C	V	0.75
Lantana camara L.	Verbenaceae	Lantana	Shrub	C	Or	0.73
Oryza sativa L.	Poaceae	Mupunga	Herb	C	C	0.71
Solanum nigrum L.	Solanaceae	Musungusungu	Herb	C	V	0.70
Pennisetum glaucum (L.) R. Br.	Poaceae	Mhunga	Herb	C	C	0.63
Commiphora sp.	Burseraceae	Mudyaroro	Shrub	T	Or	0.62
Pisum sativum L.	Fabaceae	Pizi	Herb	C	V	0.61
Voandzeia subterranean Thouars	Fabaceae	Nyimo	Herb	C	Ot	0.60
Afzelia quanzensis Welw.	Fabaceae	Mukamba	Tree	T	B, Or	0.60
Physalis angulata L.	Solanaceae	Muguzubheri	Herb	T	F	0.57
Strychnos spinosa Lam.	Loganiaceae	Mutamba	Tree	T	F	0.56
Canna indica L.	Cannaceae	Kana	Herb	C	Or	0.52
Nerium oleander L.	Apocynaceae	Ruva	Shrub	C	Or	0.49
Abelmoschus esculentus(L.) Moench.	Malvaceae	Derere	Herb	C	V	0.46
Nicotiana tobacum L.	Solanaceae	Fodya	Herb	C	M, Ot	0.41
Triticum aestivum L.	Poaceae	Gorosi	Herb	C	C	0.30
Adansonia digitata L.	Bombacaceae	Muuyu	Tree	T	F, Or	0.25
Alocasia odora (Lindlb.) K. Koch	Araceae	Ruva	Herb	C	Or	0.21
Euphorbia tirucalii L.	Euphorbiaceae	Heji	Shrub	C	Or	0.16
Eleusine coracana (L.) Gaerten.	Poaceae	Rukweza	Herb	C	C	0.14

collected. Specimens were deposited for future reference at the National Herbarium, Harare, Zimbabwe.

Results

Homegarden and household characteristics

The surveyed households in Zvishavane district possessed fenced homegardens adjacent to the homestead (71 %) or next to a river or shallow well in a wetland (29 %). Homegarden boundaries were clearly defined by wooden fence, mersh or barbed wire. Cultivation was mainly done in an area of about 154 - 540 m² (Table 1). The majority of households (90.3 %) relied on bucket irrigation while only three (9.7 %) households had drip irrigation as the source of water (Table 1). Rainfed

irrigation is still playing a pivotal role in homegarden irrigation. Surveyed households were predominantly headed by women (55.6 %) (Table 1). The average age of the majority of household heads was about 41 years. The sample population was relatively well-educated, with illiterate levels of less than 4.5 % (Table 1). The majority of household heads were educated up to secondary level (68.2 %). According to the participants, agriculture was the main source of income for most households, with only two (9.1 %) of the household heads educated up to tertiary level, and these were employed as teachers at local schools.

Plant use and taxonomic diversity

A total of 73 plant species were found in homegardens in Zvishavane district (Table 2). They
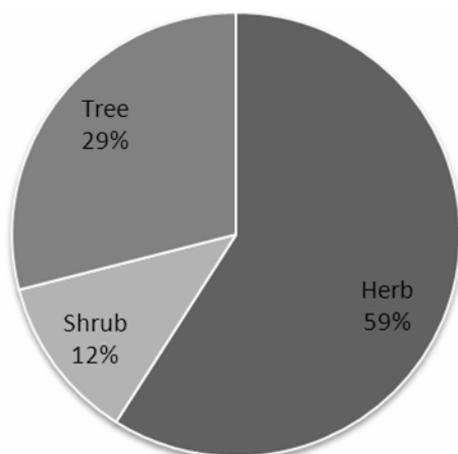
Fig. 2. Growth forms of plants growing in homegardens of Zvishavane district, Zimbabwe.

belong to 38 botanical families and 61 genera. The greatest number of species were in the families Poaceae (7 species), Fabaceae (6), Solanaceae (6), Brassicaceae (5), Cucurbitaceae (5) and Euphorbiaceae (3). The remainder of families were represented by between two and one species. 52 species (71.2 %) were cultivated, while 21 species (28.8 %) were not domesticated but tolerated or protected in homegardens. The majority of plant species growing in homegardens were exotics (51 cultivated and 3 tolerated species, 74 %) and only 19 species (26 %) were indigenous, occurring also in the wild but also tolerated or protected in homegardens. The majority of plants managed in homegardens were herbs (43 species, including 7 vines; 59 %), followed by trees (21 species; 29 %) and shrubs (9 species; 12 %) (Fig. 2). Ten most common species were: *Cleome gynandra* L. used as traditional vegetable; *Cucurbita maxima* Duchesne ex Lam. (traditional vegetable); *Ipomoea batatas* (L.) Lam. (edible tubers), *Mangifera indica* L. (edible fruits), *Allium cepa* L. (vegetable), *Zea mays* L. (cereal), *Brassica carinata* A. Braun (vegetable), *Psidium guajava* L. (edible fruits), *Brassica rapa* L. (vegetable) and *Solanum lycopersicum* Mill. (vegetable) (Table 2).

Eight different uses of homegarden plants were identified (Table 3): vegetables (25 species including *Ipomoea batatas* and *Solanum tuberosum* L. with edible tubers, 34.2 %), edible fruits (22 species, 30.1 %), medicinal plants (10 species, 13.7 %), ornamentals, hedging and shade plants (15 species, 20.5 %), cereals (5 species, 6.8 %), plants used for building, timber, firewood, and construction material (4 species, 5.5 %), oil crops (3 species, 4.1 % and others with miscellaneous uses (7

species, 9.6 %, including *Saccharum officinarum* L. and *Sorghum bicolor* (L.) Moench with edible stems). The majority of plants recorded in homegardens were cultivated or domesticated (52 species, 71.2 %), with all oil crops and cereal plants confined to homegardens (Fig. 3). Wild plants with edible fruits, those collected as traditional vegetables, ornamental, edging and shade plants, those used for building, timber, firewood and construction material, and as medicines were deliberately spared and tolerated in homegardens (Fig. 3). When clearing and weeding their homegardens, the households spared plant species used as traditional vegetables (*Amaranthus hybridus* L., *A. thunbergii* Moq., *Cleome gynandra, C. monophylla* L., *Corchorus tridens* L. and *Cucumis anguria* L.), edible fruits (*Adansonia digitata* L., *Azanza garckeana* (F. Hoffm.) Exell & Hillcoat, *Berchemia discolor* (Klotzsch) Hemsl., *Diospyros mespiliformis* A. DC., *Parinari curatellifolia* (Planch.) Benth., *Sclerocarya birrea* (A. Rich.) Hochst., *Strychnos cocculoides* Bak., *S. spinosa* Lam., *Vangueria infausta* Hochst. and *Vitex payos* (Lour.) Merr.). Other plant species generally protected or tolerated for various reasons included *Afzelia quanzensis* Welw., *Commiphora* sp. and *Kirkia acuminata* Oliv.

Interviews with household heads revealed that products derived from homegardens were used to improve family's food supply and nutrition and supplement income (Fig. 4). According to participants, homegardens serve more than one use category (Fig. 4), and are rarely used exclusively for one use category. Seven household heads (22.6 %) reportedly used their homegardens for food production only, while the majority (21 households, 67.8 %) used them for both food production and to generate household income (Fig. 4). Vegetables and maize (*Zea mays*) were the main products sold from homegardens (Table 4). Households sold their homegarden products from home, either to buyers who came to them or to neighbours. Some households donated homegarden produce to neighbours and relatives.

The edible plants were harvested from homegardens at different times of the year (Fig. 5). Sixteen plant species were harvested and consumed throughout the year (Fig. 5). The majority of them were vegetables, which included *Allium cepa, Brassica carinata, B. juncea* (L.) Czern. & Cross., *B. napus* L., *B. oleracea, B. rapa, Capsicum frutescens* L., *Daucus carota* L., *Phaseolus vulgaris, Pisum sativum* L., *Solanum lycopersicum* and *Solanum tuberosum*. Vegetables

Table 3. Summary of taxonomic rank and use categories of plant species in homegardens of Zvishavane district, Zimbabwe.

Taxonomic rank	Vegetable	Fruit	Ornamental	Medicine	Cereal	Building material	Oil crop	Others
Species	25	22	16	10	5	4	3	7
Genus	17	20	15	10	5	4	3	7
Family	11	18	14	9	1	4	2	6
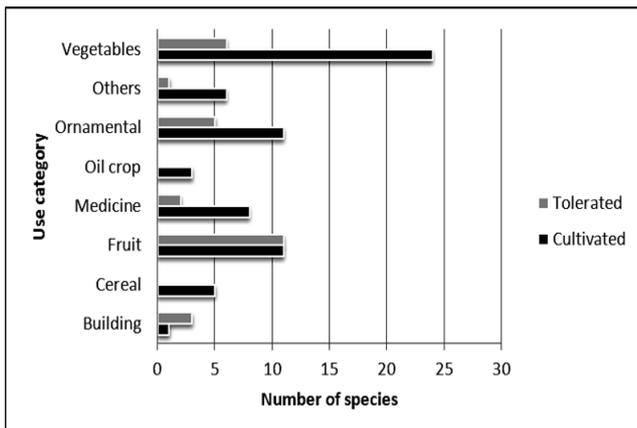
Fig. 3. The use categories of cultivated and tolerated plants in homegardens of Zvishavane district, Zimbabwe.
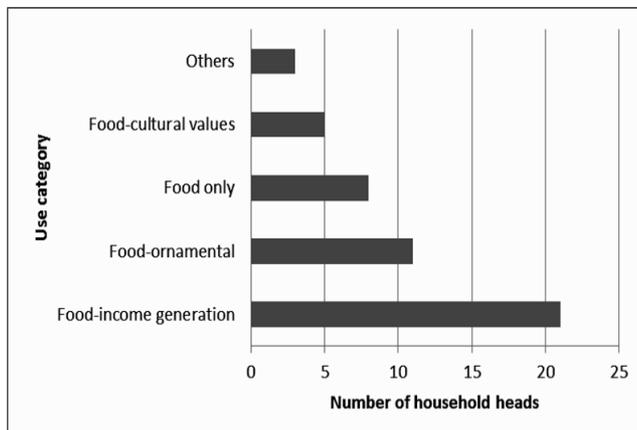
Fig. 4. Uses of homegarden plants in Zvishavane district, Zimbabwe.

tend to grow and mature within a short time and households quickly realized the outputs compared to other crops such as maize, which take a couple of months to mature. Some plants (e.g. *Adansonia digitata*, *Ipomoea batatas*, *Saccharum officinarum*, *Strychnos cocculoides* and *Strychnos spinosa*) were consumed during the dry season and pre-rainy season (Fig. 5). Twenty five species were harvesting during rainy and harvest seasons (mainly between October and May, see Fig. 5).

Table 4. Income earned by households in Zvishavane district, Zimbabwe, based on crops grown in homegardens.

Crops grown	Income earned on a regular basis			
	Daily	Weekly	Monthly	Seasonally
Leaf vegetables (mainly *Brassica carinata*, *Brassica juncea*, *Brassica oleracea* and *Brassica rapa*)	$5-20	$20-100	$100-200	
Solanum lycopersicum (tomato)	$5-20	$50-150	$100-300	
Allium cepa (onion)	$5-20	$5-30	$50-100	
Ipomoea batatas (Sweet potato)	$5-10	$5-20	$30-50	
Zea mays (Maize)				$50-200

Management of homegardens

When participants were asked about challenges being faced in home gardening activities, 24 (77.4 %) household heads indicated water scarcity as a major problem, followed by pests and diseases (61.3 %) and lack of inputs (48.4 %). Lack of labour and capital were cited by 29 and 25.8 % household heads, respectively (Fig. 6). Fence maintenance, soil fertility, lack of markets and extension services were mentioned as problems by between seven and three household heads (Fig. 6). Children, men and women played important roles in homegarden activities in Zvishavane district. It was found that labour-intensive activities like digging and land clearance were done by men, while watering and weeding were mainly done by women and children (Fig. 7). According to participants, women on average spent between six to eight hours per week on homegarden activities, while men spent three to five hours a week.

Plant species	Pre-rainy season	Rainy season	Harvest season	Dry season
Abelmoschus esculentus			■	■
Adansonia digitata	■			■
Allium cepa	■	■	■	■
Amaranthus hybridus		■	■	
Amaranthus thunbergii		■	■	
Arachis hypogea			■	
Azanza garckeana				■
Berchemia discolor				■
Brassica carinata	■	■	■	■
Brassica juncea	■	■	■	■
Brassica napus	■	■	■	■
Brassica oleracea	■	■	■	■
Brassica rapa	■	■	■	■
Capscum frutescens	■	■	■	■
Carica papaya	■	■	■	■
Citrillus lanatus			■	■
Citrus limon		■	■	
Citrus sinensis		■	■	
Cleome gynandra		■	■	
Cleome monophylla		■	■	
Corchorus tridens		■	■	
Cucumis anguria		■	■	
Cucumis metuliferus		■	■	
Cucurbita maxima		■	■	
Daucus carota	■	■	■	■
Diospyros mespiliformis			■	■
Eleusine coracana			■	■
Ipomoea batatas	■		■	■
Lagenaria siceraria		■	■	■
Lantana camara	■	■	■	■
Mangifera indica		■	■	
Morus alba		■	■	
Musa x paradisiaca		■	■	
Opuntia ficus-indica		■	■	
Oryza sativa		■	■	
Parinari curatellifolia (fruit/kernel)	■	■	■	■
Pennisetum glaucum		■	■	
Persea americana		■	■	
Phaseolus vulgaris	■	■	■	■
Physalis angulata		■	■	
Pisum sativum	■	■	■	
Prunus persica		■	■	
Psidium guajava		■	■	
Saccharum officinarum	■		■	■
Sclerocarya birrea (fruit/kernel)	■	■	■	■
Solanum lycopersicum	■	■	■	■
Solanum nigrum		■	■	
Solanum tuberosum	■	■	■	■
Sorghum bicolor			■	
Strychnos cocculoides	■			■
Strychnos spinosa	■			■
Triticum aestivum			■	
Vangueria infausta		■	■	
Vigna unguiculata			■	
Vitex payos		■	■	
Voandzeia subterranean			■	
Zea mays	■	■	■	

Fig. 5. Seasonality of edible plants growing in homegardens in Zvishavane district, Zimbabwe. Availability for harvesting is indicated by solid black fill.
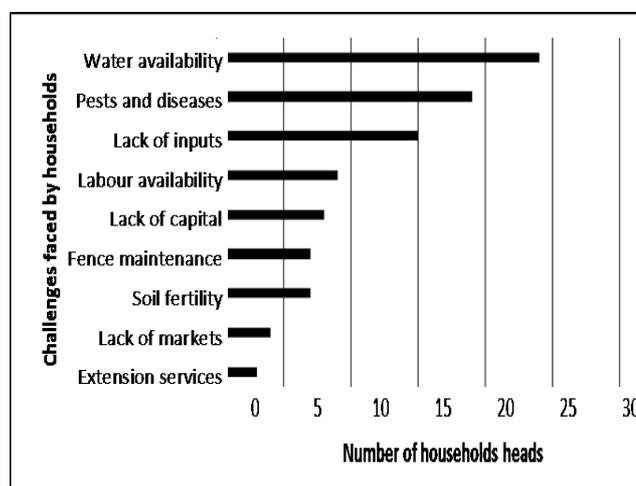

Fig. 6. Major challenges faced by households in homegardens in Zvishavane district, Zimbabwe.

Discussion

This study provides a detailed analysis of homegarden plants in terms of their numbers, composition, main uses and management in Zvishavane district, Zimbabwe. The study also documented demographic composition of the house-holds, their agricultural output and constraints encountered by households involved in home-gardening activities. It builds on previous work done by Gumbo *et al.* (1989), Campbell *et al.* (1991), Musvoto & Campbell (1995), Price & Campbell (1998), Chivaura-Mususa *et al.* (2000) and Maroyi (2009). The major difference between previous studies and the current work is the focus on both the uses of homegarden plants and how they are managed. Much of existing literature on homegardens in Zimbabwe is descriptive in nature, with species lists and their uses; often lacking detailed discussion on the socio-economic importance.
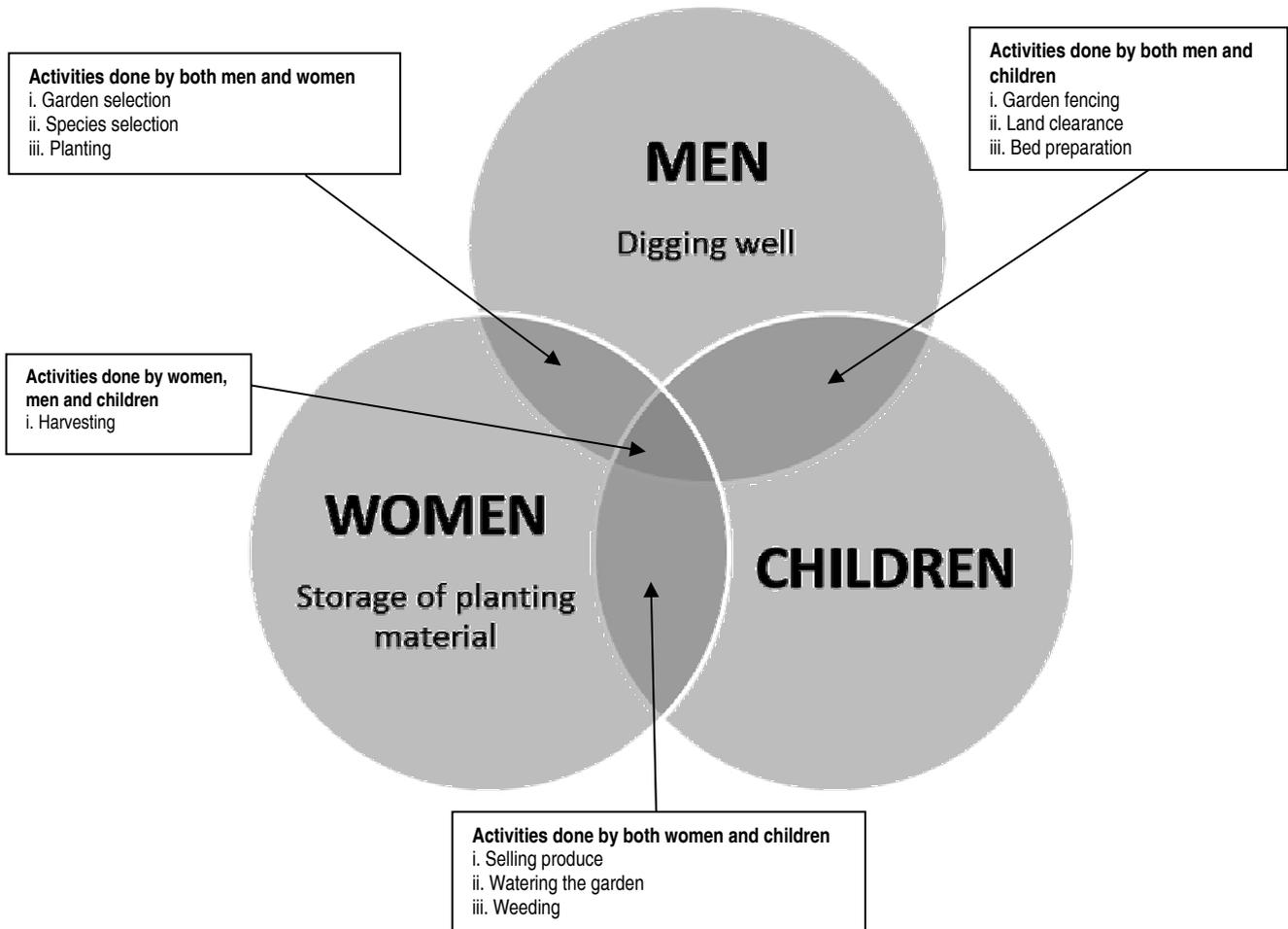
Activities done by both men and women
i. Garden selection
ii. Species selection
iii. Planting

Activities done by both men and children
i. Garden fencing
ii. Land clearance
iii. Bed preparation

Activities done by women, men and children
i. Harvesting

MEN
Digging well

WOMEN
Storage of planting material

CHILDREN

Activities done by both women and children
i. Selling produce
ii. Watering the garden
iii. Weeding

Fig. 7. Venn diagram showing homegarden activities done by children, men and women in Zvishavane district, Zimbabwe.

Homegardens are known to play an important role in the socio-economic structure of rural subsistence communities (High & Shackleton 2000; Méndez *et al.* 2001), and their diversified agricultural crops and trees fulfil many basic needs of local populations (Mohan *et al.* 2007). The new contribution of the current study is the provision of information and reasons behind the households' decisions to plant or retain certain plant species (Kumar & Nair 2004).

Homegardens in Zvishavane district are major sources of food plants, ornamentals, medicinal plants and plants used for building purposes. A trend that has also been observed in Bolivia (Thomas & Van Damme 2010), Costa Rica (Zaldivar *et al.* 2002), Cuba (Buchmann 2009; Wezel & Bender 2003), Ecuador (Van Den Eynden 2004), Iberian Peninsula (Agelet *et al.* 2000), India (Chandrashekara & Baiju 2010; Das & Das 2005), Indonesia (Kehlenbeck & Maass 2004), Mexico

(Aguilar-Støen *et al.* 2009; Blanckaert *et al.* 2004), Nicaragua (Méndez *et al.* 2001), Peru (Coomes & Ban 2004; Lamont *et al.* 1999) and South Africa (High & Shackleton 2000). These are probably the major reasons why people manage plant species in homegardens. This is not surprising as one would expect usefulness of a plant species to be the force that drives plant management (Thomas & Van Damme 2010). However, members of the community do not use or value all plant species equally, and in this study, it was observed that food plants, either traditional vegetables or edible fruits had the highest use value scores (Table 2). This study identified *Cleome gynandra, Cucurbita maxima, Ipomoea batatas, Mangifera indica* and *Allium cepa* as the top five species with high overall use values. Most traditional vegetables grow under the traditional system of agriculture where they appear in crop mixes and no specific inputs are applied (Machakaire *et al.* 2000).

Previous research in Zimbabwe showed that two or three leaves of pumpkin (*Cucurbita maxima*) were harvested per reaping, and the pumpkin leaves were consumed three to four times per week during the rainy season (Ndoro *et al.* 2007). Similarly, studies in South Africa showed that African leafy vegetables are commonly consumed mostly because they are a free source of nutritious food that can be easily accessed and regularly harvested during the growing season (Faber *et al.* 2010). Musvoto & Campbell (1995) investigated the role of mango (*Mangifera indica*) within agroforestry systems in northern Zimbabwe and showed that 82 % of households had mango trees in their homegardens. Households appear to selectively manage plant species that are important to them so as to ensure that such species are readily available on their land (Wiersum 1997).

The results of this study have shown that plants maintained in homegardens provide households with a diversity of foods and cash income. The diversified, year-round supply of edible products from gardens is often crucial for subsistence among the poorest and most marginalized groups in developing countries (Galluzzi *et al.* 2010). Home gardening has created a sense of food self-reliance in a number of households, which has gone a long way towards reducing the food insecurity of families. However, homegardens do not satisfy the demand for staple food crops such as maize and other cereals as they are grown on a small scale in these agroforestry systems. Cereals and maize planted in homegardens serve as a supplement to the main field crop planted at the beginning of the rainy season. According to Buchmann (2009), homegarden is the community's most adaptable and accessible land resource and an important component in reducing vulnerability and ensuring food security.

There is a clear sharing of tasks between women, men and children in the management of homegardens. According to Aguilar-Støen *et al.* (2009), both men and women participate in the establishment, care and management of homegardens, but are responsible for different plants and homegarden functions. Results from the current investigation confirm findings from other parts of the world that women play an important role in homegarden management and utilization of resources derived from homegardens (Agelet *et al.* 2000; Blanckaert *et al.* 2004; Galluzzi *et al.* 2010; Méndez *et al.* 2001). Home gardening was an important part of women's workload in Zvishavane district as they were responsible for a large part of homegarden production. In line with this, it was found that women also played a key role in the management of homegardens and processing of plant products for household usage as well as income generation to meet household needs. According to participants, households with skills, experience and labour input tended to produce more and, thus, realized more in terms of output. Home gardening is a physical job that requires digging, weeding and watering plants usually using buckets, and all these tasks are shared among household members.

In conclusion, homegardens in Zvishavane district appear to be supplementary agricultural production systems, which are managed and controlled by household members. The bulk of homegraden produce is used by the household and only a small produce is marketed to raise cash income for the household. Building and maintaining a household homegarden requires a lot of work and cooperation from all members of the household. Involvement of family members in home gardening activities empowers them to become self-reliant, and simultaneously making a contribution to household food security. At the same time, homegardens are also important social and cultural spaces where non-food plants are cultivated and managed. Therefore, the cultivation and management of plants used for food, ornamentals, medicines, building materials, religious and ceremonial uses should be promoted as part of local livelihoods intervention for rural communities.

Acknowledgements

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