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Biodiversity in Agroforestry Systems: A Case Study in Homegardens of Gulmi and Palpa Districts, Western Nepal

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ABSTRACT

Homegardens are important part of an agroecosystem, which has long been practiced in Nepalese farming systems but poorly studied. This study identified the diversity of plant species of 73 homegardens of Hastichaur Village Development Committee (VDC), Gulmi district and 43 homegardens of Siddheshwor VDC, Palpa district. A total of 110 different plant species were recorded within three layers *i.e.* top layer (3-15m), middle layer (1-3 m) and ground layer (up to 1m). Species richness in the Hastichaur was higher (90) than Siddheshwor (73) VDC; in contrast species evenness was higher in Siddheshwor than Hastichaur. The bigger sized homegardens (average size was 250 m²) belong to Brahmin and Chhetri and recorded the highest plant species diversity (1.791) and species richness (90). In contrast, smaller sized homegardens (average size was 80 m²) belong to Dalit community and recorded the lowest diversity (1.696) and species richness (60) of the plants. The presence of the vegetable species, *Zingiber officinale* and *Capsicum annuum* was highest (95%) in Siddheswor VDC and *annuum* (85%) was highest in Hastichaur VDC. The presence of medicinal plants was very low in both VDCs. The trend of plant species richness showed was as Brahmin/Chettri > Magar > Kumal > Dalit in Hastichaur and as Brahmin/Chettri > Kumal > Magar > Dalit in Siddheshwor VDCs.

Keywords: Agroforestry, homegarden, biodiversity, species richness, mid hill, Nepal

INTRODUCTION

A homegarden is a clearly bounded piece of land cultivated with a diverse mixture of annual and perennial crops and on which a house is built (Karyono 1990). In general, homegardens are characterized by different vegetation strata composed of trees, shrubs and herbs in association with annual and perennial agriculture crops and small livestock within house compounds (Fernandez & Nair 1986). Rural homegardens contain local as well as improved verities of plants viz. vegetables, fruits, spices and animals *viz*. livestock and fish. Traditionally managed homegarden has small scale sustainable farming system and is the source of supply for the family requirements, and also helps to reduce environmental pollution, soil erosion and enhance agrobiodiversity conservation (Pulami & Paudel 2004). The homegarden links social and biological aspects of cultivated species and natural ecosystems, and conserving species diversity and genetic diversity (Eyzaguirre & Linares 2004).

Homegarden systems, literally known in Nepali as Ghar Bagaincha or Ghar Bari, provide an additional food supply for many rural people in Nepal, particularly the mid hill region, which is rich in natural resources and fulfill the locals' daily needs (Shrish *et al.* 2011a). Several species of plants are grown and maintained by household members and their products are primarily intended for consumption (Shrestha *et al.* 2002, Shrish *et al.* 2011b). Traditionally, homestead farming comprises vegetables, medicinal crops, ornamental crops, livestock, fishery, agro-forestry and home-building materials producing crops such as bamboo and others that fulfill home requirements (Upadhyay 2004).

The crops, vegetables, trees, fruits found in homegardens can play a crucial role in improving food security and nutrition at household level of poor and non-poor families in mid hill Nepal. Many cultivated, as well as neglected and underutilized species could make an important contribution to the dietary diversity of local communities (Gautam *et al.* 2004, Khanal *et al.* 2014). Homegardens contribute to food security in various ways by providing source of nutrition such as vegetable, fruits, seeds and mushrooms, as well as products from small livestock. Typically in Nepalese context, homegardens are valued for food security, nutrition, fodder, firewood and timber, spices, herbs and medicinal plants, green manures and pesticide crops, cultural-religious uses and source of cash income (Shrestha *et al.* 2002). Homegarden systems are also important contribution to sustainable agricultural production, because of their potential to meet several economic, social, ecological and institutional conditions for sustainability (Torquebiau

1992, Nair 2001). There is ample evidence to show that the expansion of homegardens to improve the health and nutrition of women and children (Abebe *et al.* 2010, Ebert 2014), improve food security/family income (Regmi *et al.* 2004). They are also important centers of experimentation, species domestication, important for the *in situ* conservation of a wide range of unique genetic resources for food and agriculture (Subedi *et al.* 2004).

Despite its significant contribution in livelihood of rural communities and being in practice since long time, less attention has been given to homegardens which, in turn, is limited to their description and identification of plant species involved and location specific information on their yield and management (Nair 2001). Scientific investigations of the plant species diversity and their dynamics in homegardens are severely lacking (Subedi *et al.* 2004). Because of their small size, the homegardens remain neglected milieu despite their manifold significance. In this study, we compare species diversity and species richness of homegarden land use systems within different ethnic communities as well as at two different localities (VDCs) of two districts of the mid hill region of Nepal.

MATERIALS AND METHODS

Study Area

The study was conducted in Siddheshwor VDC (83º 22' 14.17" E to 27º 56' 33.9" N), Gulmi district and Hastichaur VDC (83º 14' 6.31" E to 28º 7' 52.93" N), Palpa district, Western Nepal (Fig. 1). There are mainly four ethnic communities viz. Brahmin/Chettri, Kumal, Magar and Dalit in both VDCs (Table 1). The average minimum and maximum temperatures varies from 23º C to 4.1ºC and mean annual rainfall is over 1900 mm.

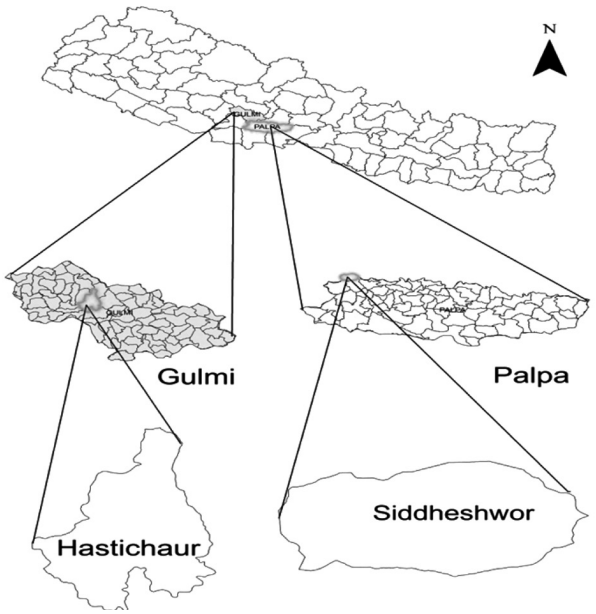

Fig. 1. Locations of the Study areas

Table 1. Basic description of the study sites.

Research Sites	Population*	Households*	Major Cast and ethnic people	Household taken for study
Siddheshwor VDC (Palpa)	2744	660	Brahmin, Chettri, Kumal, Magar and Dalit	43
Hastichaur VDC (Gulmi)	6901	1552	Brahmin, Chettri, Kumal, Magar and Dalit	73

**CBS, 2011*

Sampling

Homegardens of 116 households (43 households of Siddheshwor VDC and 73 households of Hastichaur VDC) were randomly selected. The size of homegardens (including home) ranged from 10 m x 5 m to 60 m x 50 m. The plants included in the study are vegetables, fruits, trees, fodder and medicinal excluding ornamental species. Homegardens were stratified into layers and plants were collected from three layers: top, middle and ground. The plants which could not be identified in the field were identified at Tribhuvan University Central Herbarium (TUCH), Kathmandu.

Data

The Shannon-Wiener index (Gurevitch *et al*. 2006) was calculated to analyze the diversity of different groups of plants as categorized above for each VDC and each ethnic group. Evenness as well as Simpson's index was calculated following Gurevitch *et al*. (2006). Sorensen coefficient of similarity was calculated by using formula: 2A/(B+C) X 100%, where A = total number of species common in two VDCs or in two ethnic communities. B = total number of species in VDC 1 or ethnic group 1, C = total number of species in VDC 2 or ethnic group 2.

RESULTS

A total of 110 different plant species of 52 families were categorized as vegetables, fruits, tree and fodder plants, and medicinal plants recorded from the Siddheshwor and Hastichaur VDCs of Gulmi and Palpa district respectively (Table 2).

Table 2. Plant species in homegardens of the studied VDCs.

	Species presence in %			
Plants	Siddheshwor n=43	Hastichaur n=73	Local name	Family
Vegetable, beans and others				
Abelmoschus esculentus (L.) Moench	67	51	Cipali bhindi	Malvaceae
Allium cepa L.	79	56	Pyaj	Amaryllidaceae
Allium sativum L.	79	67	Lasun	Amaryllidaceae
Amaranthus viridis L.		1	Latte Sag	Amaranthaceae
Artocarpus heterophyllus Lam.	28	18	Kathar	Moraceae
Brassica juncea (L.) Czem	74	62	Rayo	Cruciferae
Brassica oleracea var. *botrytis* L	60	42	Cauli	Cruciferae
Brassica oleracea L. var. cpitata L.	0	5	Bandagobi	Cruciferrae
Capsicum annuum L.	95	85	Khursani	Solanaceae
Chenopodium album L.	2	0	Betha	Chenopodiaceae
Colocasia antiquorum Schott. Var. esculenta	0	7	Karkalo	Araceae
Crateva unilocularis Buch. Ham.	0	1	Sipligan	Capparaceae
Cucumis sativus L.	86	73	Kakro	Cucurbitaceae
Cucurbita pepo L.	86	79	Pharsi	Cucurbitaceae
Curcuma angustifolia Roxb.	93	81	Besar	Zingiberaceae
Daucas carota L. var. *sativa* DC	40	18	Gajar	Umbelliferae
Dioscorea bulbifera L.	0	8	Gittha	Dioscoreaceae
Dioscorea sagittata Royle	2	11	Tarul	Dioscoreaceae
Dolichos lablab L.	70	64	Simi	Leguminosae
Ipomoea batatas (L.) Lam	0	1	Sakharakhand	Convolulaceae
Kydia calycina Roxb.	63	45	Kuvinde	Malvaceae
Lagnaria siceraria (Molina) Standl.	0	1	Lakua	Cucurbitaceae
Lathyrus aphaca L.	2	0	Jangali kerau	Leguminosae
Lycopersicum esculentum Mill	88	73	Golbheda	Solanaceae
Momordica charantia L.	84	77	Karela	Cucurbitaceae
Pisum sativum L.	70	60	Kerau	Leguminosae
Raphanus sativus L.	88	67	Mula	Curciferae
Sechium edule (Jacq.) Sw.	2	19	Skush	Cucurbitaceae
Solanum melongena L.	88	63	Bhenta	Solanaceae
Solanum tuberosum L	86	71	Aalu	Solanaceae
Trichosanthes anguina L.	81	66	Ghiraula	Cucurbitaceae
Trichosanthes anguina L.	9	38	Cicindo	Cucurbitaceae
Trichosanthes dioica Roxb.	14	4	Parval	Cucurbitaceae
Urtica dioca L.	0	1	Sisnu	Urticaceae
Vicia faba L.	33	32	Bakula	Leguminosae
Vigna unguiculata (L.) Walp.	0	15	Cow pea	Leguminosae
Zingiber officinale Rosc.	95	79	Aduwa	Zingiberaceae
Fruits				

Aegle marmelos (L.) Corr.	40	8	Bel	Rutaceae
Ananas comosus (L.) Merr.	16	16	Bhui katar	Bromeliaceae
Annona squamosa L.	0	4	Saripha	Annoneceae
Artocarpus lakoocha Wall.	0	25	Badahar	Moraceae
Carica papaya L.	88	70	Meva	Caricaceae
Citrus aurantifolia (Christ.) Swingle	81	64	Kagati	Rutaceae
Citrus aurantium L.	65	55	Suntola	Rutaceae
Citrus maxima (Burm.) Herr.	44	26	Vogate	Rutaceae
Citrus sinensis (L.) Osbeck	12	3	Mausami	Rutaceae
Citrus sinensis (L.) Osbeck. var. *jungar*	0	1	Junar	Rutaceae
Coffea arabica L.	5	8	Kaphi	Rubiaceae
Litchi chinensis Sonner	7	8	Litchi	Sapindaceae
Mangifera indica L.	88	45	Aap	Anacardiaceae
Musa paradisiaca L.	91	71	Kera	Musaceae
Prunus persica (L.) Batsch	84	62	Aru	Rosaceae
Psidium guajava L.	84	66	Amba	Myrtaceae
Punica granatum L.	7	5	Anar	Punicaceae
Purnus domestica L.	0	1	Aru bakhara	Rosaceae
Pyrus communis L.	72	34	Naspati	Rosaceae
Pyrus malus L.	5	1	Syau	Rosaceae
Saccharum officinarum L.	79	40	Ukhu	Gramineae
Syzygium cumini (L.) Skeels	63	10	Jaamun	Myrtaceae
Tamarindus indica L.	2	0	Imili	Leguminosae
Vitis vinifera L.	5	5	Angur	Vitaceae
Zizyphus mauritiana Lam.	21	8	Bayar	Rhamnaceae
Trees and fodder plants				
Acacia catechu (L.f.) Wild.	5	4	Khayar	Leguminosae
Alnus nepalensis D. Don	0	1	Utis	Betulaceae
Bambusa vulgare Schrad.	23	14	Tama bans	Gramineae
Bauhinia vahlii Wight & Am.	0	1	Bhorla	Leguminosae
Bombax ceiba L.	56	18	Simal	Bombacaceae
Castanopsis indica (Roxb.) Miq.	0	10	Katus	Fagaceae
Euphorbia hispida L.f.	0	1	Tote	Moraceae
Ficus benghalensis L.	37	10	Bar	Moraceae
Ficus glaberrima Blume	0	4	Pakhuri	Moraceae
Ficus lacor Buch-Ham	0	11	Kabhro	Moraceae
Ficus neriifolia Sm.	0	4	Dudhilo	Moraceae
Ficus religiosa L.	42	12	Pipal	Moraceae
Ficus semicordata Buch. Ham ex Sm	5	30	Khanyu	Moraceae
Gossypium arboreum L.	2	1	Kapas	Malvaceae
Lagerstroemia parviflora Roxb.	2	0	Bot Dhayaro	Lythraceae
Lannea coromandelica (Houtt.) Merr.	21	51	Dabdabe	Anacardiaceae

Litsea monopelata (Roxb.) Pers.	7	18	Kutmero	Lauraceae
Melia azederach L.	60	7	Bakenu	Meliacee
Morus bombycis Koidzumi.	2	11	Kimbu	Moraceae
Persea odoratissima (Ness) Kosterm.	0	1	Kaulo	Lauraceae
Pinus roxburghii Sargent	16	12	Salla	Pinaceae
Quercus semecarpifolia J.E. Smith	7	0	Khasru	Fagaceae
Sapindus mukorossi Gaertn.	2	0	Rittha	Sapindaceae
Schima wallichii (DC.) Korth.	37	62	Cilaune	Theaceae
Shorea robusta Gaertn.	16	12	Sal	Dipterocarpaceae
Streblus asper Lour.	7	36	Bedula	Moraceae
Thysanolaena maxima (Roxb.) O. Kuntze	0	3	Amriso	Gramineae
Woodfordia fruticosa (L.) Kurz.	2	0	Dhaiyaro	Lythraceae
Medicinal plants				
Acorus calamus L.	42	25	Bojho	Araceae
Allium wallichii Kunth.	9	7	Van lasun	Amaryllidaceae
Aloe vera (L.) Burm. f.	21	7	Ghui kumari	Liliaceae
Artemesia indica Willd.	77	67	Titepati	Compositae
Azadirachta indica A. Juss.	21	0	Nim	Meliaceae
Bunium persicum (Boiss.fedts)	0	1	Kalo jero	Umbelliferae
Calotropis gigantea (L.) Dryand.	2	1	Ank	Asclepiadaceae
Cannabis sativa L.	2	1	Ganja	Cannabaceae
Centella asiatica L. Urban	0	60	Ghod tapre	Umbelliferae
Jatropa curcas L.	0	3	Sajiyon	Euphorbiaceae
Justicia adhathoda L.	9	1	Asuro	Acanthaceae
Mentha arvensis L.	81	62	Pudina	Cucurbitaceae
Ocimum sanctum L.	47	55	Tulasi	Labiateae
Perilla frutescens (L.) Britton	0	3	Silam	Labiatae
Phyllanthus emblica L.	72	27	Amala	Euphorbiaceae
Sesamum orientale L.	0	1	Til	Pedaliaceae
Spilanthes paniculata Wall. ex. DC	5	3	Marati	Compositae
Terminalia bellirica (Gaertn.) Roxb.	26	19	Barro	Combretaceae
Terminalia chebula Retz.	35	23	Harro	Combretaceae
Zanthoxylum armatum DC.	12	1	Timur	Rutaceae

The vegetation contained three layers: the top layer (3-15 m high trees, fodder plants and fruits) comprised of tree species *viz*. *S. wallichii, M. azederach, B. ceiba, L. coromandelica,* and *S. asper*; fruits *viz*. *C. aurantium, P. communis, M. indica, P. guajav*a. The middle layer (1-3 m high, mostly vegetables and medicinal plants) comprised of plant species such as *A. indica, C. maxima, C. aurantifolia, C. papaya, M. paradisiaca,* and *L. esculentum*. The ground layer was up to 1 m, and mostly comprised of vegetables and medicinal plants. The plant species of this layer were *O. sanctum, M. arvensis, C. asiatica, B. juncea, R. sativus, A. cepa, A. sativum, C. angustifolia,* and *Z. officinale*. The climbers were *M. chrantia, T. anguina, D. lablab, C. sativus, C. peop, D. sagittata*. The vegetables and medicinal plants species were found mixed with cereal crops like maize, the cereals were not documented.

The size of homegardens in both VDCs were biggest in Brahmin/Chettri community (average size was 250 m²) and the smallest size was in Dalit community (average size was 80 m²). The size of homegardens in Kumal and

Magar communities were similar (average size was 235 m^2) in both VDCs. The highest species diversity was found within Brahmin/Chettri community and the least diversity was found within Dalit community in both VDCs (Table 3). Species richness was also highest in Brahmin/Chettri (90) and least in Dalit community (60). Hastichaur has higher species diversity than Siddheshwor, but species evenness was more in Siddheshwor than Hastichaur Moreover, Simpson's index was similar in both VDCs. Species were evenly distributed in relation with Dalit in Hastichaur and with Kumal in Siddheshwor but species were less evenly distributed within Brahmin/ Chettri families. Homegardens of Magar of both VDCs have similar type of species distribution patterns. Simpson's index was found to be similar in all ethnic groups in both VDCs.

Table 3. Diversity indices of plants within different ethnic groups.

	Richness		Shannon-Wiener Index		Evenness		Simpson Index	
	I	II	I	II	I	II	I	II
Brahmin/Chhetri (n = 15)								
Vegetable beans and others	24	31	1.344	1.399	55.73	50.98	0.046	0.043
Fruits	18	24	1.153	1.190	52.75	49.48	0.074	0.076
Trees and fodders	17	21	1.048	1.166	58.02	54.05	0.114	0.084
Medicinal	14	14	0.974	0.950	51.07	42.81	0.127	0.133
All species	73	90	1.745	1.791	63.42	58.74	0.020	0.018
Kumal (n = 7)								
Vegetable beans and others	28	28	1.376	1.382	65.21	64.06	0.045	0.044
Fruits	16	18	1.151	1.146	63.53	65.86	0.076	0.829
Tree and fodders	12	12	1.057	0.979	75.65	66.31	0.091	0.122
Medicinal	11	11	1.013	0.894	79.24	64.80	0.102	0.163
All species	67	69	1.741	1.727	73.26	71.88	0.020	0.021
Magar (n = 12)								
Vegetable beans and others	23	26	1.341	1.372	57.61	57.33	0.046	0.044
Fruits	20	18	1.174	1.133	57.19	54.89	0.074	0.084
Trees and fodders	11	15	0.948	1.004	59.60	59.42	0.129	0.133
Medicinal	11	11	0.891	0.938	49.55	52.76	0.141	0.130
All species	65	70	1.716	1.733	65.21	64.80	0.020	0.020
Dalit (n = 9)								
Vegetable beans and others	25	27	1.328	1.347	63.79	66.80	0.050	0.050
Fruits	13	14	1.080	1.053	59.36	65.29	0.082	0.101
Trees and fodders	11	12	0.96	0.963	68.67	72.87	0.126	0.142
Medicinal	11	6	0.939	0.682	61.89	53.35	0.136	0.240
All species	60	59	1.696	1.664	70.68	73.47	0.022	0.025

Note: (I= Siddheshwor VDC, II= Hastichaur VDC).

Similarities of different plant groups between VDCs and among ethnic groups are given in Tables 4 and 5. In between two VDCs, similarity in vegetables, fruits and medicinal species is high but trees and fodder species is low as compared to other groups of plants. Vegetables species are more similar between all ethnic groups in both VDCs while medicinal species are less similar than other groups of plants. In all plant groups, Siddheshwor VDC has highest similarity between Kumal and Dalit groups while least similarity between Kumal and Magar. But in case of Hastichaur VDC highest similarity was found between Brahmin/Chettri and Magar while least similarity was between Brahmin/Chettri and Dalit. Similarity between all ethnic groups was higher in Siddheshwor than that in Hastichaur VDC. However, similarity between all ethnic groups was more than 47%.

Table 4. Sorensen coefficient of similarity of plant groups in different ethnic groups

	Brahmin/ Chettri –Kumal		Brahmin/ Chettri- Magar		Brahmin/ Chettri- Dalit		Kumal-Magar		Kumal-Dalit		Magar- Dalit	
	I	II	I	II	I	II	I	II	I	II	I	II
Vegetables	92.30	88.13	93.61	87.71	89.79	89.65	90.19	88.88	94.33	87.27	87.5	90.65
Fruits	88.23	85.71	89.47	85.71	83.87	73.68	83.33	88.88	89.65	87.5	78.78	87.5
Trees & Fodder	82.75	66.66	71.42	83.33	71.42	54.54	86.95	74.07	86.95	66.66	81.81	51.85
Medicinal	88	64	75	80	88	50	66.66	54.54	81.81	58.82	72.72	47.05
All Species	88.57	79.24	84.05	85	84.21	72.48	80.30	80.57	89.79	79.68	81.6	75.96

Note: I = Siddheshwor, II = Hastichaur).

Gender wise, mostly females were more active in management of homegardens, although males also contribute significantly in management of homegardens. The irrigation facilities in homegardens were minimum in both VDCs. Most of the people in both VDCs are farmer though some have few side occupations. The production from homegarden was just for their household use and the occasional surplus was used to be shared among the neighbours too. Education among Brahmin/Chettri was high and lowest was in Dalit groups.

Table 5. Sorensen coefficient of similarity of plant groups in the same ethnic groups between Siddheshwor and Hastichaur VDCs

	Brahmin/ Chettri - Brahmin/ Chettri	Kumal – Kumal	Magar - Magar	Dalit – Dalit
Vegetables	83.63	89.28	93.87	88.46
Fruits	85.71	94.11	86.48	81.48
Trees & Fodder	73.68	66.66	69.23	60.86
Medicinal	71.42	72.72	76.19	35.29
All Species	80.98	83.82	84.1	73.94

Some species like *A. vera* and *O. sanctum* were planted separately with ornamental plants. The majority of the species in homegardens were *C. annuum, C. pepo, Z. officinale, C. angustifolia, A. sativum,* and *C. sativus.* Some species of religious values reported were *O. sanctum, A. marmelos, F. religiosa,* and *F. benghalensis*. These species were more abundant in Brahmin/Chettri ethnic group than others.

DISCUSSION

Most of the plants in the homegardens of the studied VDCs were common plants of mid-hill and Terai region of Nepal. They were vegetables: *S. tuberosum, L. esculentum, B. oleracea* var. *botrytis, S. melongena, M. charantia, T. anguina, B. juncea, R. sativus* and *D. lablab;* fruits: *L. chinensis, P. communis, M. paradisiaca, P. guajava, C. papaya, M. indica, S. cumini, A. marmelos* and *C, aurantifolia.* They play important role in food self sufficiency of the households in the study area (Khanal *et al.* 2014). In the case where the agriculture is substantial, these species also play important role in the improvement of farmers' economic condition.

Some tree species were found to be pruned at canopy to increase light for species in ground layer while species of more timber and fodder values were left. Respondents were not aware about medicinal value of some plants such as *B. persicum*, *A. wallichii* and *J. curcas*. The higher participation of females in managing homegardens is due primarily to the fact that there is issue of depopulation of males in rural mid hill of Nepal, as the case in Latin America (Howard 2006). Homegarden is claimed to be an efficient, highly rationale, ecologically and socioeconomically sustainable agroecosystem (Kehlenbeck & Maass 2004, Peyre *et al.* 2006) that can sustain basic community needs without environmental deterioration (Fernandes & Nair 1986). Home gardens are one of the oldest forms of managed land-use systems (Das & Das 2010) which are considered to be the richest in species diversity per unit area. Several landraces and cultivars, and rare and endangered species have been preserved in the home gardens (Watson & Eyzaguirre 2002, Kumar & Nair 2004). Size of homegardens affects the species richness there. In Nepal, mostly Brahmin/ Chettris have larger land size than others and therefore, their homegardens have higher number of species than Dalit communities. However, species richness of homegardens within a region is influenced by homestead size, structure, climatic conditions, market and socio-cultural forces too (Gajaseni & Gajaseni 1999, Trinh 2003). It was found that management practices also affect the diversity and species richness of homegardens.

The composition of plants in homegardens varies with ethnicity, food culture, religion and spirituality (Sthapit *et al.* 2004). Nepalese homegardens are largely vegetable based (37-48% of the total species planted) with fruits, fodder, medicinal and ornamental plants. Homegardens have their own management systems and their production systems are mostly organic-based, with the maximum utilization of locally available resources. Although homegardens occupy a very small proportion of the total land holdings of the family (2-11%), they are rich in biodiversity. Homegardens are a major source of vegetable and fruit supplies for the family; 60% of the requirements are fulfilled from homegardens (Pulami & Paudel 2004). In Nepalese homegardens, richness of homegarden species can be seen in the following order: vegetable, fruits, Tress and fodder, and medicinal (Subedi *et al.* 2004). In the same way, our finding on species richness resembles is in the same order in both VDCs as well as in all ethnic groups.

The Simpson index and Species Evenness between the two VDCs were similar, and this may be accounted for similar ecological zone and similar cultural and ethnic composition. Higher species richness of Brahmin/Chettri may be due large size of homegardens. Kumal and Magar have similar species richness due to similar size of homegardens. The high number of trees and fodder species in Brahmin/Chettri may be due to high number of cattle present in their households. Kumal, Magar and Dalit have comparatively less tress and fodder species as the number of cattle within these communities is also less. The richness of medicinal species seems to be similar in all ethnic groups in both VDCs except for the Dalit of Hastichaur, this may be due to same level of knowledge of medicinal plants in all groups. In all four ethnic groups high number of vegetables species indicate these species are important in daily needs and had helped in self sufficiency of daily requirements of households. High similarity in plants species between two VDCs may be due to both being in same climatic zone and with similar composition of ethnic groups.

The homegarden is an important component of the rural ecosystem that has been adopted by farmers from immemorial period. Homegardens are often looked as an important source of food and nutrition, particularly in rural Nepal. For subsistence and poor farmers, crop varieties and cultivars adapted to particular micro-niches around homesteads are crucial and accessible resources available to provide a secure livelihood (Wezel & Bender 2003). For example, leaves of species like *Brassica juncea* and *Raphanus sativus* were stored for some days in compressed form so that its water losses and then were kept in sun for some days to make '*Gundurk*' (fermented vegetable) which was utilized when there is shortage of vegetables. Homegardens (and most other multistrata systems) that are primarily subsistence systems, fulfill the basic needs of farm families (mostly food), rank very low in the value premises and theoretical assumptions that underlie the neoclassical analysis (Current *et al.* 1995). Homegardens of studied VDCs plays important role in self-sufficiency of most of the households. Although diversity and species richness vary from one ethnic group to other, it was found that homegardens not only play important role in food security but it also help to maintain diversity of different plants.

In conclusion, homegardens are not only important sources of food, fodder, fuel, medicines, construction materials and income in many countries, they are also important for the *in situ* conservation of a wide range of unique genetic resources for food and agriculture (Subedi *et al.* 2004, Sahoo *et al.* 2010). Furthermore, a homegardens can play an important role in providing alternative livelihood opportunities for the people during periods of stress, such as a bad crop year (Kabir & Webb 2009). Some species are found to be grown naturally i.e. uncultivated. These neglected and underutilized species could also make an important contribution to the dietary diversity of local communities. Nepalese homegardens are dynamic in their evolution, composition and uses. Their structure, functions, and both inter- and intra-specific genetic diversity have been influenced by changes in socioeconomic circumstances and the cultural values of users of these land use systems.

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