

Homestead Gardens Diversity of a Watershed Development Project area in Kamrup District, Assam

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Abstract

Homestead gardens are traditional agroforestry systems with complex structure and multiple functions. Watershed development approach also aims at development of homestead gardens with an objective to conserve the natural resources particularly for domestic consumption and income generation. To understand the system, the socio-economic aspects and species richness of homestead gardens at Tamholong, Dakhin Dimoria, Taloni, Dharbam, Uloni and Uttar Dimoria villages under Dimoria Development Block, Kamrup district, Assam, were studied. Since homestead gardens are also important sites for *in situ* conservation of different species, the role of the rural communities in the management and preservation of biodiversity in their traditional homestead garden was examined. The homestead garden size falls within the range of 0.02 to 0.53 ha, with an average of 0.20 ha. The total number of species encountered in the homestead gardens was 217, with vegetable as the dominant species. Out of 217 species, 70 species under vegetable, 15 species under major fruits, 32 species under minor fruits, 17 species under medicinal plants, 40 species under ornamental plants and 43 species under miscellaneous category. Out of 217 plant species in the homestead garden 72 species were herb, 39 species were shrub, 34 species were climber and 72 species were trees. The home stead gardens are the sites of conservation of a large diversity of plants both wild and domesticated, because of their uses to the households. Thus the home stead gardens were found to be complex systems with plant diversity conserved through their use.

Key words: Homestead garden, Species diversity, Watershed, Geohydrological unit

INTRODUCTION

Watershed is a geohydrological unit draining to a common point by a system of drains. Watershed is the land & water area, which contributes runoff to a common point. Watershed development refers to the conservation, regeneration & the judicious use of all the natural resources (land, water, plants, and animals) & human development within the watershed area. Watershed development aims at fulfilling the basic needs (water, food, fodder, fuel wood & livelihood) of the local community in a sustainable & socially justifiable manner along with conservation of the natural resources. Homestead gardens play an important role in fulfilling the basic needs and also conserving and maintaining the plant diversity in a sustainable and socially justifiable manner.

Homestead garden comprises of a wide range of natural resources including plants, animals and micro-organisms (Anonymous 2009a). Homestead garden are traditional agro forestry systems characterized by the complexity of their structure and multiple functions. Homestead gardens can be defined as 'land use system involving deliberate management of multipurpose trees and shrubs in intimate association with annual and perennial agricultural crops and invariably livestock within the compounds of individual houses, the whole tree-crop animal unit being intensively managed by family labour (Fernandez & Nair 1986). Homegardens have attracted considerable research attention during the past three decades (Wojtkowski 1993) mainly due to the following reasons: (i) they contain characteristics which make them an interesting model for research and the design of sustainable agro ecosystems, including efficient nutrient cycling, high biodiversity, low use of external inputs and soil conservation potential (Torquebiau 1992; Jose 1993) and (ii) home stead gardens

have been shown to provide a diverse and stable supply of socio-economic products and benefits to the families that maintain them (Christanty 1990). Home stead gardens also have distinct horizontal structure which together help in the efficient utilization of water, light and space, and support diverse wildlife species besides meeting various social and basic needs of families. Home stead gardens are important *in situ* conservation sites.

The wealth of genetic diversity presently available in the State in the form of domesticated crops with their wild relatives is not fully documented. In Assam, there exists two unique systems for conservation of biodiversity in general, and specifically domesticated biodiversity, in the form of homestead gardens and sacred groves, even though so far no scientific attempt has been made to understand the inter-dependence of different components of these two systems and the human beings.

In order to understand the structure and function of homestead gardens, it is necessary to analyze both socio-economic and biophysical aspects of these systems. A number of studies on the complete inventory of home gardens have been done, including the structure, species composition (Fernandez & Nair 1986), socioeconomic aspects and management zones (Mendez *et al* 2001). In India most of the inventory of homestead gardens has been concentrated in Kerala (Kumar *et al* 1994; Santhakumar 1996). Another study in Karnataka by Shastri *et al* 2002, highlighted the importance of trees in village ecosystem. However in North East India, except for studies by Ramakrishnan *et al* 1996; Ramakrishnan 2001; Godbole 1998; Sinha & Das 2000 and Das & Das 2005 no data are available on the inventory of traditional home gardening systems. As a step in this direction, an attempt is made in this article to analyze the structure of the traditional home stead gardens in Dimoria Block, Kamrup district, Assam.

The study was conducted in a watershed area covering six revenue villages under Dimoria Development Block, Kamrup district, Assam. Assam is the second largest state in Northeast India next to Arunachal Pradesh, covers with an area of 78,438 sq km. The state lies between 24° 44' N to 27° 45' N latitude and 89° 41' and 96° 02' E longitudes (Guha 2002). Kamrup Metropolitan district of Assam, occupying an area of about 216.79 sq km, is located between 26° 00' N to 26° 15' N latitude and 91° 30' and 92° 15' E longitudes and is bounded in the North by Darrang district and Kamrup district, South by the state of Meghalaya and Kamrup district, East by the District of Morigaon and West by Kamrup district. The population of the district is 10,62,771 as per 2001 census (Anonymous 2009b). The district has an undulating topography characterized by hillocks, plains and low-lying waterlogged areas. The area experiences a warm, humid climate. Maximum temperature of the district recorded 38.0° C (August) and minimum temperature recorded 10° C (January).

The main objective of this study is to understand the diversity in homestead garden of a watershed area as practiced by rural communities and to provide a base for further scientific studies.

METHODOLOGY

Sixty (60) homestead garden units were selected from the six revenue village (10 homestead gardens from each village) viz., Tamholong (26°0'14.1" N, 92°07'04.6" E), Dakhin Dimoria (N 26°06'03.7", E 92°07'03.8"), Taloni (26°06'11.9" N, 92°05'48.5" E), Dharbam (26°06'15.0" N, 92°06'29.7" E), Uloni (26°06'44.4" N, 92°06'33.7" E) and Uttar Dimoria (26°07'27.1" N, 92°07'33.6" E). The latitude, longitude and altitude of each village were recorded. The altitude of the study villages ranges from 67 m to 107 m. Selection of homestead was based on the size (< 0.66 ha). The size of the homestead gardens sampled ranged from 0.02 to 0.53 ha, with an average of 0.20 ha. Since the land holding pattern of majority of the villagers falls in the category of either marginal

or small holders and large farmer category represent only a small fraction of the village, therefore, in the present study, sampling was done mostly from the marginal and small farmers' category. Each household from the sampling category was surveyed by administering a semi structured questionnaire for socio-economic factors and information on homestead garden size, and management practices, species richness etc. Plant uses defined by villagers were documented and each plant was allotted a use category according to its main use like vegetable, medicine, ornamental, timber, fruits etc. Plant specimens collected were identified with the help of literature of Santapau *et al* 1998 and Kanjilal *et al* 1934 – 1940 and matched at ASSAM.

RESULTS

A total of 217 plant species have been recorded in the homestead gardens of the study villages and out of 217 species, 70 species under vegetable (Table 1), 15 species under major fruits (Table 2), 32 species under minor fruits (Table 3), 17 species under medicinal plants (Table 4), 40 species under ornamental plants (Table 5) and 43 species under miscellaneous category (Table 6). Out of 217 plant species in the homestead garden 72 species were herb, 39 species were shrub, 34 species were climber and 72 species were trees (Fig 1). Average number of species per homestead garden varies with the size of the homestead gardens. In smaller homestead gardens, the lowest numbers of twelve species were recorded, with dominance of fruit trees (*Areca catechu*, *Artocarpus heterophyllus*, *Mangifera indica*, *Musa balbisiana*. etc), which has multiple uses. In larger homestead gardens, a maximum number of 66 species were recorded and these gardens are the important sites for conservation of wild/rare species like *Averrhoa bilimbi*, *Elaeagnus latifolia*, *Pandanus amaryllifolius*, *Baccaurea sapida* etc. A number of factors such as socio-economic status, market linkage, domestic demand, own consumption, land-holding pattern etc. normally affect the diversity in homestead gardens. On an average it was observed that most of the homestead gardens have wider species diversity.

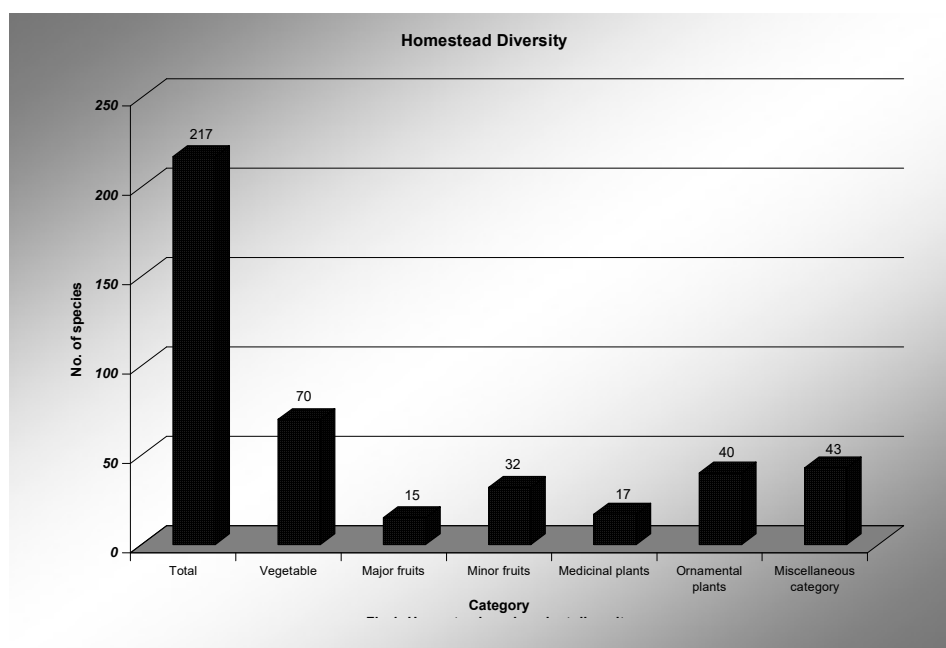


Figure 1: Plant diversity in homestead gardens of a watershed development area in Kamrup district of Assam

Table 1: Diversity of vegetables in the homestead garden with their parts used

Species	Family	Local name	Parts used
<i>Abelmoschus esculentus</i> (Linnaeus) Moench	Malvaceae	<i>Bhendi</i>	Immature fruit
<i>Alocasia indica</i> (Roxburgh) Schott	Araceae	<i>Man Kochu</i>	Leaves
<i>Alocasia cucullata</i> (Loureiro) Schott	Araceae	<i>Mukhi kochu</i>	Tuber
<i>Amaranthus gangeticus</i> Linnaeus	Amaranthaceae	<i>Morisa sak</i>	Leaves
<i>Amorphophallus campanulatus</i> (Roxburgh) Blume <i>ex</i> Decaisne	Araceae	<i>Ol-kochu</i>	Tuber, tender leaves
<i>Basella alba</i> Linnaeus	Basellaceae	<i>Seujia puroi</i>	Twig
<i>Basella rubra</i> Linnaeus	Basellaceae	<i>Ronga puroi</i>	Twig
<i>Brassica juncea</i> (Linnaeus) Czernjaev	Brassicaceae	<i>Soriho</i>	Leaves
<i>Brassica oleracea</i> var. <i>capitata</i> Linnaeus	Brassicaceae	<i>Bondha kobi</i>	Leaves
<i>Brassica oleracea</i> var. <i>botrytis</i> Linnaeus	Brassicaceae	<i>Phul kobi</i>	Yellow curd (head) of aborted floral meristem
<i>Brassica oleracea</i> var. <i>gongylodes</i> Linnaeus	Brassicaceae	<i>Ol kobi</i>	Tuber
<i>Brassica rugosa</i> (Roxburgh) L.H.Bailey	Brassicaceae	<i>Lai</i>	Leaf
<i>Brassica rapa</i> var. <i>rapa</i> Linnaeus	Brassicaceae	<i>Shalgom</i>	Root
<i>Benincasa hispida</i> (Thunb.) Cogniaux	Cucurbitaceae	<i>Kumora</i>	Fruit
<i>Beta vulgaris</i> Linnaeus	Chenopodiaceae	<i>Beet</i>	Tuber
<i>Beta vulgaris</i> Linnaeus var. <i>bengalensis</i> Roxburgh	Chenopodiaceae	<i>Perali paleng</i>	Leaves
<i>Blumea balsamifera</i> (Linnaeus) DC.	Asteraceae	<i>Kachi doria</i>	Leaves
<i>Cajanus cajan</i> (Linnaeus) Miller	Fabaceae	<i>Rohor dali</i>	Seeds
<i>Canavalia gladiata</i> (Jacquin) DC.	Fabaceae	<i>Kantal urohi</i>	Immature fruit
<i>Centella asiatica</i> (Linnaeus) Urban	Apiaceae	<i>Bor manimuni</i>	Leaves
<i>Chenopodium album</i> Linnaeus	Chenopodiaceae	<i>Buthua</i>	Leaves
<i>Cissus quadrangularis</i> Linnaeus	Vitaceae	<i>Harjora</i>	Stem
<i>Clerodendrum colebrookianum</i> Walpers	Verbenaceae	<i>Nephaphu</i>	Tender shoot
<i>Coccinia grandis</i> (Linnaeus) Voigt	Cucurbitaceae	<i>Kundoli</i>	Fruit
<i>Corchorus capsularis</i> Linnaeus	Tiliaceae	<i>Mora pat</i>	Leaves
<i>Cucumis melo</i> var. <i>utilissimus</i> (Roxburgh) Duthie & J.B. Fuller	Cucurbitaceae	<i>Kakri</i>	Fruit
<i>Cucumis sativus</i> Linnaeus	Cucurbitaceae	<i>Teo</i>	Fruit
<i>Cucurbita moschata</i> Duchesne	Cucurbitaceae	<i>Ronga lau</i>	Fruit & twigs
<i>Daucus carota</i> Linnaeus var. <i>sativa</i> . DC.	Apiaceae	<i>Gajor</i>	Root
<i>Dioscorea alata</i> Linnaeus	Dioscoreaceae	<i>Kath alu</i>	Tuber
<i>Dioscorea bulbifera</i> Linnaeus	Dioscoreaceae	<i>Gothia alu</i>	Tuber
<i>Dioscorea esculenta</i> (Loureiro) Schott	Dioscoreaceae	<i>Moa alu</i>	Tuber
<i>Dolichos lablab</i> Linnaeus	Fabaceae	<i>Urohi</i>	Fruit
<i>Gymnopetalum cochinchinense</i> (Loureiro) Kurz	Cucurbitaceae	<i>Kauri patal</i>	Fruit
<i>Hibiscus cannabinus</i> Linnaeus	Malvaceae	<i>Mesta tenga</i>	Leaf and calyx
<i>Homalomena aromatica</i> (Roxburgh) Schott	Araceae	<i>Gon kochu</i>	Petiole
<i>Houttuynia cordata</i> Thunberg	Saururaceae	<i>Mosundori</i>	Leaves
<i>Hydrocotyle sibthorpioides</i> Lamarck	Apiaceae	<i>Soru manimoni</i>	Whole plant
<i>Ipomoea batatas</i> (Linnaeus) Lamarck	Convolvulaceae	<i>Mitha alu</i>	Tuber
<i>Lagenaria siceraria</i> (Molina) Standley	Cucurbitaceae	<i>Jati lau / Pani lau</i>	Fruit
<i>Luffa cylindrica</i> (Linnaeus) M.J. Roemer	Cucurbitaceae	<i>Bhol</i>	Fruit
<i>Luffa acutangula</i> Roxburgh	Cucurbitaceae	<i>Jika</i>	Fruit
<i>Lycopersicon esculentum</i> Linnaeus	Solanaceae	<i>Belahi</i>	Fruit
<i>Lycopersicon pimpinifolia</i> Linnaeus	Solanaceae	<i>Kon belahi</i>	Fruit
<i>Malva verticillata</i> Linnaeus	Malvaceae	<i>Lofa</i>	Leaves
<i>Manihot esculenta</i> Crantz	Euphorbiaceae	<i>Simolu alu</i>	Tuber
<i>Momordica charantia</i> Linnaeus	Cucurbitaceae	<i>Tita kerela</i>	Fruit
<i>Momordica dioica</i> Roxburgh <i>ex</i> Willdenow	Cucurbitaceae	<i>Soru bhat kerela</i>	Fruit

Species	Family	Local name	Parts used
<i>Moringa oleifera</i> Lamarck	Moringaceae	<i>Sajina</i>	Fruit, leaves, flower
<i>Musa paradisiaca</i> Linnaeus	Musaceae	<i>Kach kol</i>	Flower
<i>Myriactis nepalensis</i> Lessing	Asteraceae	<i>Babori</i>	Leaves
<i>Paederia foetida</i> Linnaeus	Rubiaceae	<i>Bhedai lota</i>	Leaves
<i>Phaseolus vulgaris</i> Linnaeus	Fabaceae	<i>French bean (urohi)</i>	Fruit
<i>Phlogacanthus thyrsoiflorus</i> (Roxburgh) Nees	Acanthaceae	<i>Ronga bahok</i>	Flower
<i>Pisum sativum</i> Linnaeus	Fabaceae	<i>Motor</i>	Seeds
<i>Pogostemon benghalense</i> (Burmans) O. Kuntze	Lamiaceae	<i>Hook loti</i>	Leaves
<i>Polygonum microcephallum</i> D. Don	Polygonaceae	<i>Madhusuleng</i>	Leaves
<i>Portulaca oleracea</i> Linnaeus	Portulacaceae	<i>Malbhog sak</i>	Twig
<i>Raphanus sativus</i> Linnaeus	Brassicaceae	<i>Mula</i>	Root
<i>Rumex acetocella</i> Linnaeus	Polygonaceae	<i>Chuka sak</i>	Leaves
<i>Sesbania grandiflora</i> (Linnaeus) Poiret	Fabaceae	<i>Bokphul</i>	Flower
<i>Solanum melongena</i> Linnaeus	Solanaceae	<i>Bengna</i>	Fruit
<i>Solanum torvum</i> Linnaeus	Solanaceae	<i>Hati bhekuri</i>	Fruit
<i>Solanum indicum</i> Linnaeus	Solanaceae	<i>Tita bhekuri</i>	Fruit
<i>Spinacia oleracea</i> Linnaeus	Chenopodiaceae	<i>Paleng</i>	Leaves
<i>Trichosanthes dioica</i> Roxburgh	Cucurbitaceae	<i>Potol</i>	Fruit
<i>Trichosanthes cucumerina</i> var. <i>anguina</i> Linnaeus	Cucurbitaceae	<i>Dhunduli</i>	Fruit
<i>Trigonella foenum-graecum</i> Linnaeus	Fabaceae	<i>Methi sak</i>	Leaves
<i>Typhonium trilobatum</i> (Linnaeus) Schott	Araceae	<i>Cham kochu</i>	Leaves
<i>Vigna unguiculata</i> (Linnaeus) Walpers	Fabaceae	<i>Danguti</i>	Immature fruit

Table 2: Major fruit plants diversity in the homestead garden with their parts used

Species	Family	Local name	Parts used
<i>Achras zapota</i> Linnaeus	Sapotaceae	<i>Sapota</i>	Mesocarp
<i>Ananas comosus</i> (Linnaeus) Merrill	Bromeliaceae	<i>Mati kothal</i>	Fleshy and juicy part
<i>Artocarpus heterophylla</i> Lamarck	Moraceae	<i>Kothal</i>	Fleshy sacs, seeds
<i>Areca catechu</i> Linnaeus	Arecaceae	<i>Tambul</i>	Nut
<i>Cucumis melo</i> Linnaeus	Cucurbitaceae	<i>Bangi</i>	Fleshy part
<i>Carica papaya</i> Linnaeus	Caricaceae	<i>Amita</i>	Fleshy part
<i>Citrullus lanatus</i> (Thunberg) Matsum. & Nakai	Cucurbitaceae	<i>Tarmuj</i>	Watery, fleshy part
<i>Citrus aurantifolia</i> (Christmann) Swingle	Rutaceae	<i>Kaji nemu</i>	Juicy sacs
<i>Citrus limon</i> Linnaeus	Rutaceae	<i>Bor nemu</i>	Juicy sacs
<i>Cocos nucifera</i> Linnaeus	Arecaceae	<i>Narikol</i>	Endosperm
<i>Litchi chinensis</i> (Gaertner) Sonner	Sapindaceae	<i>Lichu</i>	Aril
<i>Mangifera indica</i> Linnaeus	Anacardiaceae	<i>Aam</i>	Mesocarp
<i>Musa sapientum</i> Linnaeus	Musaceae	<i>Cheni champa</i>	Fleshy part
<i>Psidium guajava</i> Linnaeus	Myrtaceae	<i>Madhuriam</i>	Fleshy part
<i>Punica granatum</i> Linnaeus	Punicaceae	<i>Dalim</i>	Juicy aril

Table 3: Minor fruit plants diversity in the homestead garden with their parts used

Species	Family	Local name	Parts used
<i>Aegle marmelos</i> (Linnaeus) Correa	Rutaceae	<i>Bael</i>	Pulp
<i>Anona reticulata</i> Linnaeus	Annonaceae	<i>Atlas</i>	Pulp
<i>Anona squamosa</i> Linnaeus	Annonaceae	<i>Sita phal</i>	Pulp
<i>Artocarpus lacucha</i> Buchanon-Hamilton	Moraceae	<i>Cham kothal</i>	Flesh, seed
<i>Averrhoa carambola</i> Linnaeus	Averrhoaceae	<i>Kordo</i>	Whole fruit

Species	Family	Local name	Parts used
<i>Averrhoa bilimbi</i> Linnaeus	Averrhoaceae	<i>Bilimbi</i>	Whole fruit
<i>Baccaurea sapida</i> (Roxburgh) Mueller-Argoviensis	Euphorbiaceae	<i>Leteku</i>	Juicy aril
<i>Borassus flabellifer</i> Linnaeus	Arecaceae	<i>Tal</i>	Juicy hairs
<i>Carissa carandas</i> Linnaeus	Apocynaceae	<i>Korja tenga</i>	Whole fruit
<i>Citrus medica</i> Linnaeus	Rutaceae	<i>Jora tenga</i>	Juicy sacs
<i>Citrus grandis</i> (Linnaeus) Osbeck	Rutaceae	<i>Robab tenga</i>	Juicy sacs
<i>Citrus jambhiri</i> Lushington	Rutaceae	<i>Gol nemu</i>	Juicy sacs
<i>Dillenia indica</i> Linnaeus	Dilleniaceae	<i>Ou-tenga</i>	Calyx
<i>Diospyros lancaefolia</i> Roxburgh	Ebenaceae	<i>Kendu</i>	Mesocarp
<i>Elaeagnus latifolia</i> Linnaeus	Elaeagnaceae	<i>Mirika tenga</i>	Fleshy part
<i>Elaeocarpus floribundus</i> Blume	Elaeocarpaceae	<i>Jalpai</i>	Fleshy part
<i>Embllica officinalis</i> Gaertner	Euphorbiaceae	<i>Amla</i>	Fleshy part
<i>Flacourtia jangomas</i> (Loureiro) Raeschel	Flacourtiaceae	<i>Ponjol</i>	Fleshy part
<i>Garcinia pedunculata</i> Roxburgh	Clusiaceae	<i>Bor thekera</i>	Fleshy part
<i>Meyna laxiflora</i> Robyns	Rubiaceae	<i>Kotkora/ Mon tenga</i>	Fleshy part
<i>Phoenix sylvestris</i> (Linnaeus) Roxburgh	Arecaceae	<i>Khejur</i>	Fleshy part
<i>Phyllanthus acidus</i> (Linnaeus) Merrill	Euphorbiaceae	<i>Poramlakhi</i>	Fleshy part
<i>Psidium guineense</i> Swartz	Myrtaceae	<i>Ronga madhuriam</i>	Fleshy part
<i>Prunus domestica</i> Linnaeus	Rosaceae	<i>Nora bogori</i>	Fleshy part
<i>Prunus persica</i> (Linnaeus) Batsch	Rosaceae	<i>Ahom bogori</i>	Fleshy part
<i>Spondias pinnata</i> (Linnaeus f.) Kurz	Anacardiaceae	<i>Tepor tenga</i>	Fleshy part
<i>Syzygium cumini</i> (Linnaeus) Skeels	Myrtaceae	<i>Kola jamu</i>	Fleshy part
<i>Syzygium jambos</i> (Linnaeus) Alston	Myrtaceae	<i>Bogi jamu</i>	Fleshy part
<i>Tamarindus indica</i> Linnaeus	Fabaceae	<i>Teteli</i>	Pulp
<i>Terminalia bellerica</i> (Gaertner) Roxburgh	Myrtaceae	<i>Bhomora</i>	Kernel
<i>Terminalia chebula</i> Retzius	Myrtaceae	<i>Silika</i>	Fleshy part
<i>Zizyphus jujuba</i> Miller	Rhamnaceae	<i>Bogori</i>	Fleshy part

Table 4: Medicinal plants diversity in the homestead garden and their uses

Species	Family	Local name	Parts used	Uses
<i>Acorus calamus</i> Linnaeus	Araceae	<i>Boch</i>	Rhizome	Cough
<i>Adhatoda zeylanica</i> Nees	Acanthaceae	<i>Tita bahak</i>	Leaves	Bronchitis
<i>Aloe barbadensis</i> Miller	Liliaceae	<i>Chalkuwor</i>	Leaves	Dandruff
<i>Asparagus racemosus</i> Willdenow	Liliaceae	<i>Satmul</i>	Tuber	Appetizer
<i>Azadirachta indica</i> A. Jussieu	Meliaceae	<i>Maha neem</i>	Leaves	Skin disease
<i>Bacopa monnieri</i> (Linnaeus) Pennell	Scrophulariaceae	<i>Brahmmi</i>	Twig	Brain tonic
<i>Bryophyllum pinnatum</i> Salisbury	Crassulaceae	<i>Duportenga</i>	Leaves	Kidney stone
<i>Clerodendrum indicum</i> (Linnaeus) O. Kuntze	Verbenaceae	<i>Akalbih</i>	Root	Jaundice
<i>Kaempferia galanga</i> Linnaeus	Zingiberaceae	<i>Gathion/Bura ada</i>	Root	Root
<i>Mimusops elengi</i> Linnaeus	Sapotaceae	<i>Bakul</i>	Twig	Toothache
<i>Murraya koenigii</i> (Linnaeus) Sprengel	Rutaceae	<i>Narasingho</i>	Leaves	Anemia
<i>Ocimum sanctum</i> Linnaeus	Lamiaceae	<i>Tulosi</i>	Leaves	Cough
<i>Piper longum</i> Linnaeus	Piperaceae	<i>Pipoli</i>	Fruit	Cough
<i>Saraca asoca</i> (Roxburgh) De Wilde	Caesalpiniaceae	<i>Asok</i>	Stem bark	Gynecological problem

Species	Family	Local name	Parts used	Uses
<i>Terminalia arjuna</i> (Roxburgh ex DC.) Wight & Arnott	Myrtaceae	<i>Arjun</i>	Stem bark	Heart tonic
<i>Tinospora cordifolia</i> (Willdenow) Miers ex Hooker f. & Thomson	Menispermaceae	<i>Amar lota</i>	Stem mucilage	Typhoid
<i>Vitex negundo</i> Linnaeus	Verbenaceae	<i>Posotia</i>	Leaves	Skin disease

Table 5: Ornamental plants diversity in the homestead garden

Species	Family	Local name	Ornamental parts
<i>Amaryllis belladonna</i> Linnaeus	Amaryllidaceae	<i>Bon nahoru</i>	Leaf & flower
<i>Bauhinia variegata</i> Linnaeus	Caesalpiniaceae	<i>Kanchan</i>	Flower
<i>Crinum asiaticum</i> Linnaeus	Amaryllidaceae	<i>Boga bon nahoru</i>	Leaf & flower
<i>Callistemon viminalis</i> (Soland ex Gaertner) G. Don	Myrtaceae	<i>Bottle brush</i>	Flower
<i>Canna indica</i> var. <i>indica</i> Linnaeus	Cannaceae	<i>Parijat</i>	Flower
<i>Canna indica</i> var. <i>maculata</i> (Hooker) Nb. Tanaka	Cannaceae	<i>Parijat</i>	Flower
<i>Catharanthus roseus</i> (Linnaeus) G. Don	Apocynaceae	<i>Nayantora</i>	Flower
<i>Clitoria ternatea</i> Linnaeus	Fabaceae	<i>Aparajita</i>	Blue flower
<i>Dahlia pinnata</i> Cavan	Asteraceae	<i>Dalia</i>	Flower
<i>Datura metel</i> Linnaeus	Solanaceae	<i>Datura</i>	Flower
<i>Euphorbia pulcherrima</i> Willdenow	Euphorbiaceae	<i>Lal pat</i>	Flower
<i>Gardenia jasminoides</i> J. Ellis	Rubiaceae	<i>Gandharaj</i>	Flower for fragrance
<i>Helianthus annuus</i> Linnaeus	Asteraceae	<i>Beli phul</i>	Flower
<i>Hibiscus rosa-sinensis</i> Linnaeus	Malvaceae	<i>Joba</i>	Flower
<i>Hiptage benghalensis</i> Kurz	Malpighiaceae	<i>Madhui maloti</i>	Flower
<i>Impatiens balsamina</i> Linnaeus	Balsaminaceae	<i>Demdewka</i>	Flower
<i>Ixora coccinea</i> Linnaeus	Rubiaceae	<i>Rangial/ Rongon</i>	Flower
<i>Jasminum grandiflorum</i> Linnaeus	Oleaceae	<i>Songkhomala</i>	Flower
<i>Jasminum sambac</i> (Linnaeus) Aiton	Oleaceae	<i>Chandrika/Duamali</i>	Flower
<i>Malvaviscus arboreus</i> Cavan	Malvaceae	<i>Pahimuja</i>	Flower
<i>Mirabilis jalapa</i> Linnaeus	Nyctaginaceae	<i>Gudhali gopal</i>	Flower
<i>Murraya paniculata</i> (Linnaeus) Jack	Rutaceae	<i>Kamini</i>	Flower
<i>Nyctanthes arbortristis</i> Linnaeus	Nyctaginaceae	<i>Sewali</i>	Flower
<i>Plumeria rubra</i> Linnaeus	Apocynaceae	<i>Gulanha</i>	Flower
<i>Plumeria acuminata</i> Aiton	Apocynaceae	<i>Shun champa</i>	Flower
<i>Polianthes tuberosa</i> Linnaeus	Amaryllidaceae	<i>Rojonigondha</i>	Flower
<i>Polyalthia longifolia</i> (Sonnerat) Thwaites	Annonaceae	<i>Debadaru</i>	Leaves
<i>Portulaca grandiflora</i> Hooker	Portulacaceae	<i>Office phul</i>	Flower
<i>Putranjiva roxburghii</i> Wallich	Euphorbiaceae	<i>Putranjiva</i>	Leaves
<i>Ipomoea quamoclit</i> Linnaeus	Convolvulaceae	<i>Tarulota</i>	Leaves
<i>Rhynchosstylis retusa</i> (Linnaeus) Blume	Orchidaceae	<i>Kopou phul</i>	Flower
<i>Rosa alba</i> Linnaeus	Rosaceae	<i>Gulab</i>	Flower
<i>Tabernaemontana divaricata</i> (Linnaeus) R. Brown ex Roemer & Schultes	Apocynaceae	<i>Kothona</i>	Flower
<i>Tagetes erecta</i> Linnaeus	Asteraceae	<i>Narji phul</i>	Flower
<i>Tecoma stans</i> (Linnaeus) H.B.K.	Bignoniaceae	<i>Tecoma</i>	Flower
<i>Thespesia populnea</i> (Linnaeus) Solander ex Correa	Malvaceae	<i>Paras/Bon kopah</i>	Flower

Species	Family	Local name	Ornamental parts
<i>Thevetia peruviana</i> (Persoon) K. Schumann	Apocynaceae	<i>Karabi phul</i>	Flower
<i>Thuja orientalis</i> Linnaeus	Cupressaceae	<i>Jhau</i>	Leaves
<i>Thunbergia coccinea</i> Wallich	Acanthaceae	<i>Chungalota</i>	Flower

Table 6: Plants for miscellaneous uses in the homestead garden

Species	Family	Local name	Parts used	Uses
<i>Allium cepa</i> Linnaeus	Liliaceae	<i>Pyaj</i>	Tuber	Condiment
<i>Allium sativum</i> Linnaeus	Liliaceae	<i>Naharu</i>	Tuber	Condiment
<i>Bambusa balcooa</i> Roxburgh	Poaceae	<i>Bhaluka bah</i>	Culm	Building material
<i>Bambusa polymorpha</i> Munro	Poaceae	<i>Betua bah</i>	Culm	Building material
<i>Bambusa pallida</i> Munro	Poaceae	<i>Bah</i>	Culm	Building material
<i>Bixa orellana</i> Linnaeus	Bixaceae	<i>Joroth</i>	Seed	Dye
<i>Cassia fistula</i> Linnaeus	Caesalpiniaceae	<i>Sunaru</i>	Stem	Timber
<i>Cinnamomum tamala</i> (Buch.-Hamilton) Nees & Ebermaier	Lauraceae	<i>Tejpat</i>	Leaf	Condiment
<i>Clerodendrum serratum</i> (Linnaeus) Sprengel	Verbenaceae	<i>Nangal bhonga</i>	Leaf	Local liquor
<i>Coriandrum sativum</i> Linnaeus	Apiaceae	<i>Dhania</i>	Leaf	Condiment
<i>Curcuma domestica</i> Valetton	Zingiberaceae	<i>Haludi</i>	Rhizome	Spice
<i>Dendrocalamus hamiltonii</i> Nees & Arnott ex Munro	Poaceae	<i>Kako bah</i>	Culm	Building material
<i>Eryngium foetidum</i> Linnaeus	Apiaceae	<i>Man dhania</i>	Leaf	Flavouring agent
<i>Flemingia strobilifera</i> (Linnaeus) W.T. Aiton	Fabaceae	<i>Makhioti</i>	Flowering twig	Cultural significance
<i>Garuga pinnata</i> Roxburgh	Burseraceae	<i>Jia</i>	Stem	Timber
<i>Gmelina arborea</i> Linnaeus	Verbenaceae	<i>Gomari</i>	Stem	Timber
<i>Gossypium herbaceum</i> Linnaeus	Malvaceae	<i>Kopah</i>	Cotton ball	Make thread
<i>Grevillea robusta</i> A. Cunningham	Proteaceae	<i>Silver oak</i>	Stem	Timber
<i>Jatropha curcus</i> Linnaeus	Euphorbiaceae	<i>Bhotera</i>	Plant	Bio fencing
<i>Justicia gendarussa</i> Linnaeus	Acanthaceae	<i>Bakhor</i>	Plant	Bio fencing
<i>Lagerstroemia speciosa</i> (Linnaeus) Persoon	Lythraceae	<i>Ajar</i>	Stem	Timber, make boat
<i>Lawsonia inermis</i> Linnaeus	Lythraceae	<i>Jetuka</i>	Leaf	Dye
<i>Mentha arvensis</i> Linnaeus	Lamiaceae	<i>Pudina</i>	Leaf	Flavouring agent
<i>Mesua ferrea</i> Linnaeus	Clusiaceae	<i>Nahor</i>	Leaf	Cultural significance
<i>Morus alba</i> Linnaeus	Moraceae	<i>Noni</i>	Leaf	Silk worm food
<i>Opuntia vulgaris</i> Miller	Cactaceae	<i>Sagar phena</i>	Plant	Bio fencing
<i>Oroxylum indicum</i> (Linnaeus) Ventenat	Bignoniaceae	<i>Bhatghila</i>	Twig	Cultural significance
<i>Piper betel</i> Linnaeus	Piperaceae	<i>Pan</i>	Leaf	Edible
<i>Piper nigrum</i> Linnaeus	Piperaceae	<i>Jaluk</i>	Fruit	Spice
<i>Pongamia pinnata</i> (Linnaeus) Pierre	Fabaceae	<i>Koroch</i>	Stem	Timber

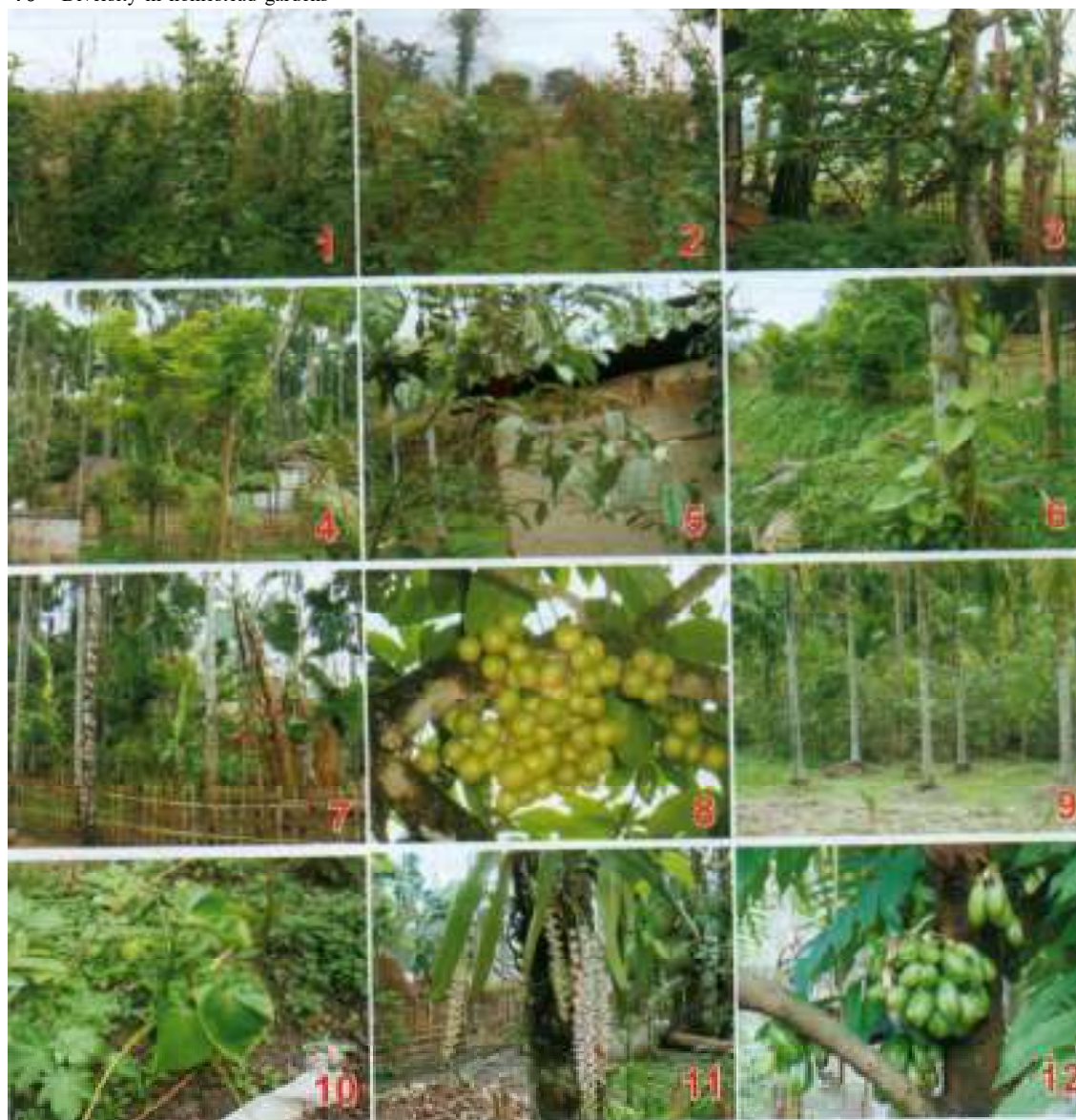


Table I. Figs. 1 – 12: 1. Vegetable based Homestead Garden, 2. Vegetable and herb based Homestead garden, 3. *Phyllanthus acidus* in Homestead garden, 4. Minor fruits in Homestead garden, 5. *Elaeagnus latifolia*-very rare fruit plant in the homestead garden, 6. *Tinospora cordifolia* (Medicinal plant in the Homestead garden, 7. Mixed Homestead garden, 8. *Baccaurea sapida* in the homestead garden, 9. Arecanut and Assam lemon based Homestead garden, 10. *Homolomena aromatica* in the Homestead garden, 11. *Rhyncostylis retusa* in Homestead garden, 12. *Averrhoa bilimbi* in the Homestead garden

Species	Family	Local name	Parts used	Uses
<i>Ricinus communis</i> Linnaeus	Euphorbiaceae	<i>Era</i>	Leaf	Silk worm food
<i>Saccharum officinarum</i> Linnaeus	Poaceae	<i>Kuhiar</i>	Stem	Edible
<i>Sesamum indicum</i> Linnaeus	Pedaliaceae	<i>Til</i>	Seed	Yield oil
<i>Sesbania sesban</i> (Linnaeus) Merrill	Fabaceae	<i>Fabaceae</i>	Plant	Bio fertilizer

Species	Family	Local name	Parts used	Uses
<i>Shorea robusta</i> Gaertner f.	Dipterocarpaceae	<i>Sal</i>	Stem	Timber
<i>Sterculia urens</i> Roxburgh	Sterculiaceae	<i>Udal</i>	Stem	Fiber
<i>Streblus asper</i> Loureiro	Moraceae	<i>Shewra</i>	Stem	Timber
<i>Tectona grandis</i> Linnaeus f.	Verbenaceae	<i>Shegun</i>	Stem	Timber
<i>Thysanolaena maxima</i> (Roxburgh) O. Kuntze	Poaceae	<i>Phul jharu</i>	Inflorescence	Broom
<i>Toona ciliata</i> M.J. Roemer	Meliaceae	<i>Poma</i>	Stem	Timber
<i>Trewia nudiflora</i> Linnaeus	Euphorbiaceae	<i>Bhelkor</i>	Stem	Timber
<i>Zea mays</i> Linnaeus	Poaceae	<i>Makoi</i>	Seed	Edible
<i>Zingiber officinale</i> Roscoe	Zingiberaceae	<i>Ada</i>	Rhizome	Condiment

DISCUSSION

The above study clearly indicates that the homestead gardens of the study villages are rich in species diversity. The homestead garden size and thus the diversity were found to be related to the socio-economic conditions of the families.

Homestead gardens exhibit complex structure, both vertically and horizontally. In the present study, four to five vertical canopy layers have been identified in home gardens the emergent layer, the canopy, the under story, the shrub and the herb layer. The emergent layer had a height of 15 m or more and was composed of multipurpose tree species represented in the canopy layer. The shrub layer had the height of 1–5 m and was composed of shrubs like *Hibiscus rosa-sinensis*, *Nyctanthes arboritristis* and saplings of species forming the upper layers, whereas the herb layer was less than 1 m and was mainly composed of vegetables, ornamentals and medicinal plants species like *Centella asiatica*, *Canna indica* var. *indica* and *Acorus calamus*. All the five layers were not present in all the homestead gardens. The canopy, shrub and herb layers were common in all homestead gardens. In some homestead gardens certain tree species from the canopy layer rise up to a height of 15 m or more, forming a gap in the system otherwise continuous layer and thereby allowing light to pass through them to the layers below. The shade provided by the upper layers supports the homestead garden shade loving species. Homestead gardens are important sites for *in situ* conservation of plant diversity (Gajaseni 1999) and can also serve as gene pools for the eroding indigenous tree species. Many wild tree species like *Lagerstroemia speciosa*, *Trewia nudiflora*, *Cassia fistula* and *Garuga pinnata* are also conserved in homestead gardens because of their high commercial value. It was observed that there is an increasing interest towards the cultivation of *Tectona grandis*, *Shorea robusta* and *Gmelina arborea* plant among the villagers in the study area for their high commercial value. Plants like *Mesua ferrea*, *Flemingia strobilifera*, *Oroxylum indicum*, *Ficus racemosa* etc. were observed in most the homestead garden, which are being maintained by the villagers for cultural values.

The present study recorded seven major management zones in homestead gardens based on their function, location and species composition viz., (i) bamboo groves (*Bah bari*) (ii) betelnut groves (*Tambul bari*) (iii) banana groves (*Kol bari*) (iv) vegetable garden (*Sakoni dorai*), (v) ornamental garden (*Phulani*) (vi) herbal garden (*Ousudhi bagan*) (vii) dense or extended zones. The betel-nut, banana and bamboo groves are so named as they are usually dominated by or composed of pure stands of betel-nut, banana and bamboo. The dense or forest zones are usually composed of a mixture of trees, including wild or and rare trees. Such zones fulfill a number of needs of families, ranging from fodder, fuel wood, timber, etc. These zones are also equally important from conservation point of view.

The utilization of village bamboos, a keystone resource selected by the small-holder farmers for its socio-economic and ecological importance, needs to be strengthened for diversification of

products through value addition (Anonymous 2004). This would provide opportunities for development of small scale rural industries and create off-farm employment and marketing opportunities.

The major causes for the loss of homestead garden biodiversity in the study areas can be summarized as follows.

- Degradation of the native agro-ecosystems by introduction of exotic/improved varieties and application of chemical fertilizers, insecticides, pesticides, etc.
- Conversion of agricultural lands for non-agricultural activities.
- Introduction of exotic crops for economic gains, ignoring site suitability.
- Narrowing the genetic base of indigenous crops by encouraging cultivation of improved varieties.
- Lack of conservation and cultivation effort

The homestead gardens of the study area like other tropical home-gardens were found to be subsistence farming systems only except few home-gardens. The high diversity in the structure of the homestead gardens fulfills a range of social, economic and ecological functions. The technique of management and high diversity of homestead gardens reflect the wisdom of traditional culture and ecological knowledge that have evolved over the years. 'Conservation through use approach in homestead gardens is an element of a complementary conservation strategy. There is an urgent need to strengthen and document such traditional systems of natural resource management for economic viability, ecological sustainability and social acceptability (Eyzaquirre & Linares 2001).

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