



Species composition, utilization pattern, and socioeconomics of Chakma community home gardens in the southwestern part of Mizoram

C.Z. Lalmachhuani, Aruna Devi Angom, Chalak Onkar Chandrakant and Kalidas Upadhyaya*

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ABSTRACT: *The present study documented the species composition, utilization patterns, and socioeconomics of Chakma community home gardens in Mizoram. A total of 44 different species were identified in the studied area, of which 23 were trees, 3 were shrubs, and 18 were herb species belonging to 12 genera and 25 families. This distribution showed a relative prevalence of 52.27% for trees, 6.82% for shrubs, and 40.9% for herbs. The studied home gardens exhibited complex structure, both vertically and horizontally. Five vertical strata (emergent, canopy, understorey, shrub, and herb) were identified, with the highest percentage of species in the emergent stratum, 29.55%, followed by 13.64% in the canopy layer, 9.09% in the sub-canopy layer, 6.82% in the shrub layer, and 40.91% in the herb layer. Cultivated food crops and medicinal plants constituted 24.24% of the 50 surveyed gardens. About 21.21% constituted fruit trees in the studied homegardens. Timber and fuel wood species constituted 9.09% and 7.57%, respectively. Others (i.e., species which are used as fodder, charcoal, oil, etc.) constituted 13.63%. The net income from home garden productivity ranged from Rs 113586 to Rs 174511. These homegardens contribute significantly towards livelihood of Chakma community in the study area by catering subsistence needs of daily household needs and also supports agriculture in case of exigencies through diversified income. Choice of superior species with high market value, use of proper planting arrangement, use of high yielding varieties of crops, proper management of woody species, crop protection measures, proper post harvesting equipments, value addition of products and improved marketing and transportation facilities are some of the measures so as to make the existing homegardens highly productive and sustainable.*

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1. INTRODUCTION

The northeastern Indian state, Mizoram, home to various tribal groups, boasts abundant forests. The forest products and agricultural yields meet the basic energy requirements of the tribal people as well as their livestock. The village ecosystems function mainly by recycling resources within the system (Ulluwishewa, 2014). Indigenous agroecosystems are highly site-specific and differ from place to place, as they have evolved along divergent lines. In order to fulfil the food requirements, the farmers are struggling to compromise between small land holdings and better production. Traditional homegardens (HGs) are an important component of the indigenous village ecosystems, which are largely based on indigenous knowledge and species selection, where the farmers grow the plant species of the cultural patterns of the social and traditional significance. Furthermore, traditional ecological knowledge also strengthens

HGs by offering effective water and nutrient management that align with local environmental conditions (Kumar and Nair, 2004). The practice of indigenous agroforestry. With the popularization of economically important trees and crops the traditional form of HG for subsistence is now gradually changing to a market oriented commercial agriculture, which may not only be changing the HG structure and function, but also the intrahousehold dynamics of production, consumption and resource constraints that make HG part of a sustainable agricultural strategy. HG is an integral part of a typical Chakma homestead and has been playing a crucial role in supplying a variety of different food products to the household members. These HGs are important sources of food supply and are also important for their economic and social values, including reducing temperature and erosion, including enhanced well-being and cohesion, and economic benefits (Osei *et al.*, 2025).

“Chakma” or “Tsakma” means people of “Tsak” or “Thek clan” who are the progenitors of the Burmese race, and the Arakanese word ‘Khyeng-tha’ signifies people or nation living near water (Tiway, 2020).

✉ Kalidas Upadhyaya
kumzu70@gmail.com

Department of Forestry, Mizoram University,
Aizawl – 796004, Mizoram

Their economy is mainly based on home gardening, agriculture, and jhum cultivation. Manual labour is their main occupation (Bharbhuiya et al., 2016). Chakma farmers utilise three different microenvironments: (i) flat lands (which can be irrigated), (ii) slightly higher lands (which are not usually irrigated), and (iii) relatively steep highlands. In the irrigated lowlands, the Chakma grow wet rice, while slightly higher lands are used for cultivating varieties of crops including root crops such as taro, ginger, and turmeric; some vegetable crops, and pulses, chilies, garlic, and onions. In the hills, they cultivate mainly dry paddy, sesame, and cotton. These crops are grown by the traditional method of shifting cultivation (Ramakrishnan, 1992). Although the Chakma communities are strongly involved in home garden practices (Bharbhuiya et al., 2016), a lot of work on home gardens has been carried out elsewhere (Kumar & Nair, 2004; Pandey et al., 2006); however, little information is available on home gardens prevalent among Chakma communities. Therefore, the present investigation has been carried out with an aim to study the home garden characteristics with special reference to species composition and utilization pattern of predominantly Chakma-inhabited of Mizoram.

2. MATERIALS AND METHODS

The present study was carried out in the Chakma Autonomous District Council (CADC), situated in the south-western part of Mizoram, India (Fig. 1). For the purpose of the study, three villages viz., Tuichawng (92°31' to 92°53' E longitude and 22°55' to 22°19' N latitude; 135 m MSL), Belpei (Matisora) (92°31' to 92°55' E longitude and 22°56' to 22°20' N latitude; 75 m MSL), and Diblibagh village (92°29' to 92°36' E and 22°55' to 22°39' N latitude; 101 m MSL) were selected, which are predominantly inhabited by the Chakma community (Rocky & Sahoo, 2018). The study site falls under sub-tropical climatic conditions with short and dry winters. It is extremely warm during summer and moderately cold and dry during winter (Ralte et al., 2024). Pre-monsoon rain starts from late April with heavy rain during May to early July and continues till September. Thunderstorms with heavy downpours during April–May are common and continue up to August. The area receives an average rainfall of about 3400 mm a year. The temperature varies between 20°C and 30°C during summer and between 11°C and 21°C in winter, while the relative humidity ranges from 60 % to 95 % (Rocky & Sahoo, 2018; Ralte et al., 2024). Soils vary from sandy loam, loamy sand to silt loam, generally mature but dry due to the warm climate, and the pH shows acidic to neutral reaction (Manpoong & Tripathi, 2019).

The study was based on the primary survey and data collected through the PRA method and questionnaire. PRA techniques were used to collect information about the home-garden (HG) practices and their management by the village community (Chambers, 1994). Among the selected three villages, Tuichawng and Belpei were inhabited by both Chakma and Mizo communities, whereas Diblibagh village was inhabited only by Chakma people (Thangluah, 2025). To provide proportionate representation to every socio-economic segment, the community households were stratified based on landholding size, income status, socio-economic characteristics of the HG family members, number of livestock, and involvement in off-farm activities.

The area of each selected home garden was measured, and the different crops and trees grown were identified and enumerated following standard home-garden assessment procedures (Kumar & Nair, 2004). Information on the use, practice, pattern of extraction of products, and management of plant/crop species was recorded in the field itself. The species grown in the gardens were classified as herbs, shrubs, and trees according to standard botanical categories (Simpson, 2019). The frequency of a particular species was estimated by calculating the percentage of gardens in which the species occurred relative to the total number surveyed. Different uses of plants, extraction of home-garden products, their sales, and local market rates were collected from the farmers through semi-structured interviews (Alexiades, 1996). The collected data were tabulated and analyzed for further interpretation.

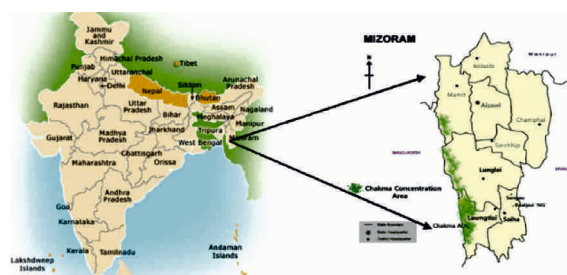


Fig. 1. Study site map (not to scale)

3. RESULTS AND DISCUSSION

Homegarden size and occupational pattern

The categorization of respondents based on home garden holding size revealed that the majority (45.23%) possessed small gardens ranging from 0 to 0.5 ha, followed by 40.47% who owned medium-sized gardens (>0.5–1.33 ha). Only 14.28% of the respondents had large home gardens measuring 1.33 ha or more. Home garden size classifications follow commonly applied agroforestry and home garden

typologies used in tropical regions (Kumar & Nair, 2004; Fernandes & Nair, 1986).

The study sites' occupational pattern revealed that the majority of residents primarily relied on agricultural activities for their income. This is consistent with earlier observations that rural households in Northeast India, including Mizoram, rely heavily on agriculture and allied activities for livelihood. In addition to farming, some family members were involved in small-scale businesses, government or private services, and daily wage labour, which contributed to their household earnings.

The land-use pattern revealed that home gardens (HGs) formed an integral component of the village landscape across all three study sites. Home gardens are widely recognized as multifunctional land-use systems that support household food security, NTFP cultivation, and biodiversity conservation (Galluzzi *et al.*, 2010). Most HGs were situated adjacent to houses and were used for cultivating non-timber forest products (NTFPs), agricultural crops, and horticultural species, similar to patterns documented in other tropical home-garden systems (Sunwar *et al.*, 2006).

3.2 Plant Species Composition

A total of 44 different species were identified in the studied area, of which 23 were trees, 3 were shrubs, and 18 were herb species belonging to 12 genera and 25 families (Table 1; Fig 2), which showed the relative prevalent percentage of trees (52.27%), shrubs (6.82%), and herbs (40.9%). HG exhibited complex structure, both vertically and horizontally. Five vertical strata (emergent, canopy, understorey, shrub and herb) were identified, with the highest percentage of species in the emergent stratum (29.55%), followed by 13.64% in the canopy layer, 9.09% in the sub-canopy layer, 6.82% in the shrub layer and 40.91% in the herb layer.

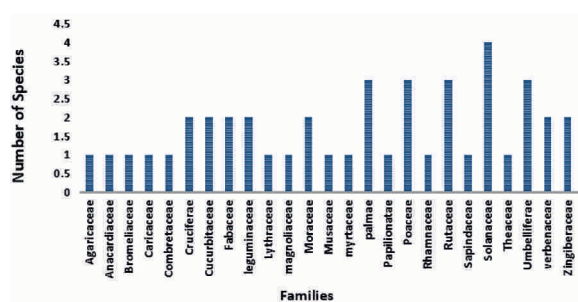


Fig 2. Number of species with respect to their family.

3.3. Homegarden Structure (Vertical Stratification)

Homegardens typically exhibit a distinct multi-tiered vertical structure composed of five major vegetation layers *viz.* emergent, canopy, sub-canopy, shrub, and herbaceous strata each contributing to

species diversity and ecological functioning (Appendix 1). The emergent layer generally consists of tall, long-lived tree species that form the uppermost stratum and play a crucial role in shading, habitat provision, and microclimatic regulation (Nair, 1993). The canopy layer is usually dominated by medium- to tall-growing fruit and timber species that form the primary productive and protective layer of the system (Fernandes & Nair, 1986). The sub-canopy stratum commonly contains fruit trees, spice crops, and perennial species that thrive under partial shade and contribute to continuous household supply (Kehlenbeck & Maass, 2004). The shrub layer predominantly comprises smaller fruiting shrubs, vegetables, and medicinal plants, which occupy the lower woody zones and enhance the structural complexity of the garden (Galluzzi *et al.*, 2010). The herb layer includes various annuals, tuber crops, and herbaceous plants that utilize ground-level light and space efficiently (Torquebiau, 1992). Such vertical stratification demonstrates the complex ecological design and multifunctional nature of homegardens, enabling optimal use of space, nutrient cycling, light capture, and year-round production for both subsistence and commercial purposes (Nair, 2006).

3.4 Uses pattern of the homegarden species

In the studied homegardens, ten major use categories of plants were recorded, and although several species had multiple uses, only their primary functions were considered for classification, which is consistent with approaches used in previous homegarden studies (Das & Das, 2005). A total of 44 plant species were documented from 50 homegardens in Tuichawng, Diblibagh, and Belpi villages, and the overall species richness did not vary substantially between villages, a trend also reported in other rural agroforestry landscapes (Kumar & Nair, 2004). Cultivated food crops and medicinal plants constituted approximately 24.24% of the total flora, reflecting the multifunctional and subsistence-oriented nature of homegardens (Fernandes & Nair, 1986). Common medicinal species such as *Solanum anguivi*, *Curcuma longa*, *Zingiber officinale*, *Benincasa hispida*, and *Psidium guajava* are widely grown in tropical homegardens due to their ethnomedicinal value (Kehlenbeck & Maass, 2004). The dominant food crops—including *Oryza sativa*, *Zea mays*, *Lycopersicon esculentum*, *Cucurbita pepo*, *Solanum melongena*, *Capsicum* spp., *Vigna sinensis*, *Brassica campestris*, radish, red gram, and beans are typical components of mixed homegarden agroecosystems in South and Southeast Asia (Abdoellah *et al.*, 2002).

Fruit trees accounted for 21.21% of the species, with commonly cultivated species such as *Mangifera indica*,

Tamarindus indica, *Psidium guajava*, *Artocarpus heterophyllus*, *Citrus medica*, *C. macroptera*, *C.*

Table 1. Checklist of Plant species documented from the home gardens of selected study area.

	Common name	Vernacular name	Scientific name	Family	Uses	Relative frequency (%)
TREE	Teak	Teak	<i>Tectona grandis</i> L.f.	Verbenaceae	T	37.75
	Lampati	Zuang	<i>Duabanga grandiflora</i> (DC.) Walp.	Lythraceae	T, FW	23.41
	Champa	Ngiau	<i>Michelia champaca</i> L.	Magnoliaceae	T	20.43
	East Indian Almond	Char	<i>Terminalia myriocarpa</i>	Combretaceae	T	18.76
	Needlewood tree	Khiang	<i>Schima wallichii</i>	Theaceae	FW, Ch	15.42
	Wild Jack	Tat-kawng	<i>Artocarpus chaplasha</i> Roxb.	Moraceae	FW, Ch	24.81
	Jackfruit	Lamkhuang	<i>Artocarpus heterophyllus</i> Lam.	Moraceae	F, FD	27.63
	Tree bean	Zawng-tah	<i>Parkia timoriana</i> (DC.) Merr.	Leguminosae	FW, V	24.12
	Gurjan	Lawng thing	<i>Dipterocarpus indicus</i> Bedd.	Dipterocarpaceae	T, Ch	19.57
	White Teak	Thlanvawng	<i>Gmelina arborea</i> Roxb.	Verbenaceae	T, Ch, FW	14.54
	Tamarind	Tengtere	<i>Tamarindus indica</i> L.	Leguminosae	F, M	21.24
	Betel nut palm	Kuhva	<i>Areca catechu</i> L.	Palmae	F	39.56
	Coconut	Coconut	<i>Cocos nucifera</i> L.	Palmae	F	30.32
	Guava	Kawlthei	<i>Psidium guajava</i> L.	Myrtaceae	F, M	14.71
	Mango	Theihai	<i>Mangifera indica</i> L.	Anacardiaceae	F, M	35.96
	Ber	Borai	<i>Ziziphus mauritiana</i>	Rhamnaceae	F	20.57
	Wild orange	Hatkora	<i>Citrus macroptera</i> Mont.	Rutaceae	F, M	41.29
	Citron	Nimbu	<i>Citrus medica</i> L.	Rutaceae	F, M	5.23
	Pomelo	Ser-tawk	<i>Citrus grandis</i> (L.)	Rutaceae	F, M	7.21
	Banana	Balhlha	<i>Musa paradisiaca</i> L.	Musaceae	F, M	41.29
	Litchi	Litchi	<i>Euphoria longan</i> (Lour.) Steud	Sapindaceae	F	17.83
	Oil palm	Oil palm	<i>Elaeis guineensis</i> Jacq.	Palmae	O	4.79
	Papaya	Thingfangh-ma	<i>Carica papaya</i> L.	Caricaceae	F, M	26.47
SHRUB	Eggplant/Brinjal	Bawkbawn	<i>Solanum melongena</i> L.	Solanaceae	V	28.46
	Pepper	Hmarcha	<i>Capsicum annum</i> Linn.	Solanaceae	V, Sp	25.72
	Forest bitterberry	Samtawkte	<i>Solanum anguivi</i> Lam.	Solanaceae	M, V	21.70
HERB	Radish	Mula	<i>Raphanus sativus</i> Linn.	Cruciferae	V	38.80
	Mustard	Antam	<i>Brassica campestris</i> Linn.	Cruciferae	V	39.79
	Chickpea	Chana	<i>Cicer arietinum</i> Linn. Vern.	Papilionatae	V	30.73
	Pumpkin	Mai	<i>Cucurbita pepo</i> L.	Cucurbitaceae	V, M	20.46
	Maize	Vaimim	<i>Zea mays</i> L.	Poaceae	FO	23.65
	Ash gound	Maipawl	<i>Benincasa hispida</i> (Thunb.) Cogn.	Cucurbitaceae	V, M	13.27
	Cowpea	Be-hlawi	<i>Vigna sinensis</i> (L.) Savi ex Hausskn.	Fabaceae	V	20.73
	Bean	Bean	<i>Vicia feba</i> Spreng.	Fabaceae	V	35.92
	Mushroom	Maupa	<i>Agaricus campestris</i> L.	Agaricaceae	V	10.73
	Pineapple	La-khuih-thei	<i>Ananus comosus</i> (L.) Merr.	Bromeliaceae	F, M	19.35
	Ginger	Sawhthing	<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Sp, M	17.46
	Turmeric	Ai-eng	<i>Cucurma longa</i> Linn.	Zingiberaceae	S, M	16.79
	Tomato	Tomato	<i>Lypersicon esculentum</i> Mill.	Solanaceae	V	5.23
	Sorghum	Chhawhchhi	<i>Sorghum cernum</i> (Ard.) Host.	Poaceae	O, Sp	14.81
	Carrot	Carrot	<i>Daucus carota</i> L.	Umbelliferae	V	9.73
	Long coriander	Bahkhawr	<i>Eryngium foetidum</i> L.	Umbelliferae	Sp, M	25.19
	Coriander	Dhania	<i>Coriandrum sativum</i> L.	Umbelliferae	Sp, M	16.46
	Rice	Dhan	<i>Oryza sativa</i> Linn. Sp. Pl.	Poaceae	Fo	21.11

Abbreviation: T-Tiber; FW-Fuelwood; Ch-Charcoal; FD-Fodder; V-vegetables; M-Medicinal; FO-Food; Sp-Species; O-Oil

grandis, *Ananas comosus*, *Ziziphus mauritiana*, *Cocos nucifera*, *Musa paradisiaca*, and *Euphoria longan*, which are also frequently reported in traditional homegardens of the Indo-Malayan region (Kehlenbeck & Maass, 2004; Kumar & Nair, 2006). Timber and fuelwood species made up 9.09% and 7.57% of the flora (Fig. 3), respectively, with commonly cultivated timber species including *Tectona grandis*, *Duabanga grandiflora*, *Michelia champaca*, *Terminalia myriocarpa*, *Gmelina arborea*, and *Dipterocarpus indicus*, all of which are well-known agroforestry tree species in tropical Asia (Fernandes & Nair, 1986). Frequently cultivated spice plants such as *Curcuma longa*, *Zingiber officinale*, *Eryngium foetidum*, *Coriandrum sativum*, and *Sorghum cernuum* are also typical components of homegardens across India and Southeast Asia (Galluzzi *et al.*, 2010). Other species grown for fodder, oil, charcoal, and miscellaneous uses accounted for 13.63%, reflecting the multipurpose character of homegarden agroecosystems (Torquebiau, 1992). Fuelwood species such as *Artocarpus chaplasha* and *Schima wallichii* were the most commonly harvested for firewood and charcoal production, aligning with reports from other tropical regions where local tree varieties dominate household energy sources (Kumar & Nair, 2004). Notably, nearly all cultivated species in the studied homegardens were of local varieties, a characteristic also documented in traditional community-managed agroforestry systems (Galluzzi *et al.*, 2010).

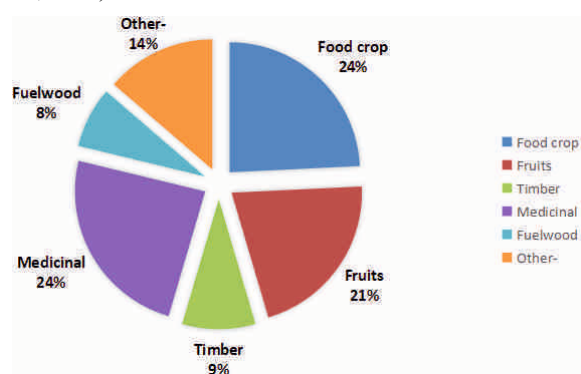


Fig 3. Proportion of functional groups (%) of crops.

3.5 Production and marketing pattern of homegarden products

The Chakma community relies extensively on the production from their homegardens (HGs) to meet daily household requirements, with most labour needs—especially in smaller Hgs, being fulfilled by family members themselves (Kumar & Nair 2004). Besides supporting subsistence needs, HGs also generate employment opportunities within the community, particularly during activities such as weeding and harvesting (Trinh *et al.*, 2003). The homegardens of the Chakma community supply multiple products of economic value, with timber species such as Teak (*Tectona grandis*), *Schima wallichii*, *Michelia champaca*, bamboo species, *Artocarpus heterophyllus*, *Artocarpus chaplasha*, *Duabanga grandiflora*, *Dipterocarpus indicus*, *Tamarindus indica*, and *Gmelina arborea* serving as significant sources of cash income for growers (Pandey *et al.*, 2007). In addition to timber, medicinal plants, fruits, vegetables—such as pumpkin, carrot, mango, banana, orange, coconut, rice, beans, jackfruit, cowpea, pineapple, mustard, radish, and guava—along with livestock components including cows, poultry, and pigs, form integral parts of the HGs in the study area (Table 3).

A stable equilibrium of organic matter and nutrient cycling within HGs is maintained through the continuous deposition and decomposition of leaf litter, which plays a key role in sustaining biodiversity and enhancing productivity per hectare (Mendez *et al.*, 2001). The variety of products generated from homegardens holds substantial market value contributing the net income from home garden which ranged from Rs 113586 to Rs 174511, providing farmers with a significant income source (Table 4). These products are utilized for household consumption and sold both locally and in district markets such as Lunglei (Fernandes & Nair 1986). Food products, especially fruits and vegetables, constitute the major items marketed from HGs (Wezel & Bender 2003). Notably, the average net income from HGs was found to be highest in Tuichawng village, indicating that a greater proportion of

Table 2: Livestock status in the study area

Sl.No.	Livestock category	Villages		
		Tuichawng	Belpei	Diblibagh
1	Cattle	4	2	5
2	Pig	15	14	11
3	Goat	17	61	12
4	Poultry	212	290	142
5	Duck	14	17	24
	Total	262	384	194

Table 3. Average yield and income from homegarden produce in the study area

Villages	Parameters*	Food items	NTFPs	Others (Excluding timber and fuelwood)
Tuichawng	Production (Kg fresh weight)/HH	849	70	85
	Consumption (Kg fresh weight)/HH	251	162.3	29
	Sold items (Kg fresh weight)/HH	597	542	56
	Net income (Rs.)	7900	2877	3687
Diblibagh	Production (Kg fresh weight)/HH	839	385	169
	Consumption (Kg fresh weight)/HH	248	95	34
	Sold items (Kg fresh weight)/HH	591	290	135
	Net income (Rs.)	1678	9200	2722
Belpei	Production (Kg fresh weight)/HH	651	163	273
	Consumption (Kg fresh weight)/HH	198	35	46
	Sold items (kg fresh weight)/HH	449	128	227
	Net income (Rs.)	1298	5863	5185

(Timber and fuelwood are excluded in production, consumption and sold item categories, whereas their values in monetary terms are included in net income.)

homegarden produce entering the market reflects an increasing trend toward commercialization of homegardening in the study area (Wezel & Bender 2003).

3.6 Homegarden management

The Chakma community manages their homegardens using traditional agricultural practices. Crops are generally sown with simple indigenous tools such as small hoes, through light tillage and dibbling, which is typical of traditional homegarden systems in tropical regions (Kumar & Nair 2004; Das & Das 2005). Seed sowing is usually carried out before the onset of the monsoon to ensure adequate moisture for early germination (Trinh *et al.* 2003). Manual weeding is performed multiple times during the cropping cycle, a practice commonly observed in labour-intensive home gardens across South and Southeast Asia (Sahoo *et al.* 2012). Most homegardens in the study area are rainfed, although a few farmers supplement water through simple pipelines, similar to patterns reported in other Indian home garden systems (Pandey *et al.* 2007). Livestock manure, particularly cow dung and poultry waste, contributes essential nutrients to the soil, thereby improving homegarden fertility and supporting enhanced plant growth reflecting the nutrient recycling characteristic of traditional agroforestry systems (Nair 1993; Mendez *et al.* 2001). A limited number of farmers also apply insecticides and weedicides when necessary. Harvesting times vary according to species, and almost all harvesting activities are performed manually, consistent with the labour-orientated management typical of tropical homegardens (Thomas *et al.* 1998).

4. CONCLUSION

The analysis of different parameters of the study revealed that the people of all the three villages relied on traditional HGs for their livelihood. From the HGs they fulfilled their need for food, fruits, fodder, timber, fuel wood, medicines, meats and many other non-timber forest products. All these resources and products were used not only for income generation but also for their domestic uses. A total of 44 plant species were identified in the HGs of the area, of which 16 were tree and 12 were shrub species. A variety of fruit and timber yielding trees and vegetable crops were found to be grown in the homegardens providing various products throughout different seasons of the year. Due to the poor road accessibility and uneasy transportation and communication, lack of post-harvest storage facilities, the Chakma people faced difficulty in selling their HGs products. The villages of the studied area have not received any fund from the state government for the management of HGs.

The HGs systems in the area can be one of the alternative land use systems to the age-old shifting agriculture practices. These traditionally managed HGs need proper attention from the policy makers in order to make them more productive and sustainable. Choice of superior species with high market value, use of proper planting arrangement, proper and timely management including management for woody species, timely and suitable plant protection measures, capacity building of the local communities for proper post-harvest handling, storage and value addition of the products and marketing and transporting facilities are some of the strategies that can be recommended for improving the existing homegardens in the study area so as to make them highly productive and sustainable.

Appendix 1. Homegarden structure (vertical stratification):

Emergent layer	Canopy layer	Sub-canopy layer	Shrubs layer	Herbs layer
<i>Areca catechu</i> L.	<i>Mangifera indica</i> L.	<i>Citrus macroptera</i> Mont.	<i>Solanum anguivi</i> Lam.	<i>Ananus comosus</i> (L.) Merr.
<i>Cocos nucifera</i> L.	<i>Euphorbia longan</i> (Lour.) Steud.	<i>Carica papaya</i> L.	<i>Solanum melongena</i> L.	<i>Zingiber officinale</i> Roscoe
<i>Tectona grandis</i> L.f.	<i>Psidium guajava</i> L.	<i>Musa paradisiaca</i> L.	<i>Capsicum annuum</i> Linn.	<i>Oryza sativa</i> Linn. Sp. Pl.
<i>Parkia timoriana</i> (DC.) Merr.	<i>Ziziphus mauritiana</i> Lam.	<i>Citrus medica</i> L.		<i>Zea mays</i> L.
<i>Michelia champaca</i> L.	<i>Elaeis guineensis</i> Jacq.	<i>Citrus grandis</i> (L.)		<i>Cucurma longa</i> Linn.
<i>Dipterocarpus indicus</i> Bedd.				<i>Raphanus sativus</i> Linn.
<i>Artocarpus heterophyllus</i> Lam.				<i>Vicia feba</i> Spreng
<i>Schima wallichii</i> Choisy				<i>Daucus carota</i> L.
<i>Duabanga grandiflora</i> (DC.) Walp.				<i>Brassica campestris</i> Linn.
<i>Gmelina arborea</i> Roxb.				<i>Cucurbita pepo</i> L.
<i>Artocarpus chaplasha</i> Roxb.				<i>Coriandrum sativum</i> L.
<i>Terminalia myriocarpa</i> Van Heurck & Mull. Arg.				<i>Eryngium foetidum</i> L.
<i>Tamarindus indica</i> L.				<i>Agaricus campestris</i> L.
				<i>Vigna sinensis</i> (L.) Savi ex Hausskn
				<i>Benincasa hispida</i> (Thumb.) Cogn.
				<i>Cicer arietinum</i> Linn. Vern.
				<i>Sorghum cernuum</i> (Ard.) Host.
				<i>Lycopersicon esculentum</i> Mill.

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