

CHAPTER V

HOMEGARDEN:

STRUCTURE AND USES

5.1 Homegarden and its components

In the North Central Coast of Vietnam, the popular homegarden system includes four components known by the name R.V.A.C.. These are the first letters of forest (*Rừng*), garden (*Vườn*), fishpond (*Ao cá*) and animal pen including poultry (*Chuồng*). However, it does not mean that all household homegardens have all four components, but is dependent on landscape, capital, labour, power, experience, and the needs of the household as well as the local market. The main focus of the study is on the garden component. The other three elements are presented below.

5.1.1 Fishponds

Fishponds in homegarden studied sites had been developed based on water resources, experience and knowledge of aquaculture and, the need for fish food in the local market. A Vietnamese idiom has a sentence “the most benefit comes from pond cultivation, the second from the homegarden, and the third, from the crop field” (*Thứ nhất canh trì, thứ nhì canh viên thứ ba canh điền*). However, only 30% of households in the upland area of Northern part of Vietnam possess one in their homegardens (Cuc *et al.*, 1996). The proportion of households with fishponds could explain the need for aqua products (in this case, fish) in the community as well as the aquaculture

development in each sub-zone. The results of the survey from the four study communes are showed in Table 8.

Table 8. Percentage of households with fish cultivation in the homegardens

Commune	Hongha	Hongtien	Binhthanh	Huongho
% of HH with fish cultivation	37.4	37.4	25	12.5

Source: Field study, 1998.

At Hongha and Hongtien communes, 37.4% of households had fishponds while at Binhthanh and Huongho the amount was lower. This was because Huongho and Binhthanh were communes in the lower area of the upland, where fish cultivation would carry high risks because of flood and typhoon in the fall season. At Hongha and Hongtien commune, this number has been increased each year as the demand of local people for fresh water fish increased. Whilst the wild resource from streams and springlets has been exhausted to date, fishponds in the homegarden could provide directly instead of wild fish from the streams. Moreover, as market activities expanded to meet the needs of people for aqua products, fishponds would bring increased benefits to the household.

Binhthanh and Huongho communes are nearer to the central market than the others communes in this study, and the transport communication system is better such that, the need for fresh aqua products can be satisfied. However, the proportion of households cultivating fish are lower than in Hongha and Hongtien communes.

Freshwater fish cultivated in the fishponds of households in the North Central Coast were grass carp (*Trắm cỏ*: *Ctenopharyngodon idellus*), bighead carp (*Mè hoa*: *Aristichthys nobilis*) silver carp (*Mè trắng*: *Hypophthalmichthys molitris*), Indian carp (*Rô hu*: *Labeo rohita*), and Java tilapia (*Rô phi*: *Tilapia mossambica*). In households the common carp (*Chép*: *Cyprinus carpio*) was found where fishponds were situated near rivers, and climbing perch (*Rô đồng*: *Anabas testudineus*) and snakehead (*Lóc bô ng*: *Ophiocephalus micropeltes* and *Lóc*: *Ophiocephalus striatus*) in cases where the fishponds were near to paddy fields.

Fish were fed with animal manure, green manure, grass, banana leaves and the other vegetable product in the homegarden. Most of the fishpond owners were retired officers and people with secondary school education. They acquired fish culture technology from agricultural extension agents and from other Kinh people districts where they had visited. However, 40% of fish keeping households got low benefit from their fishponds because of low yield (lower than 1 ton/ha/year). According to Trang (1996), low yields of fresh water fish in the upland area were due to high fish density, low quality of water and shortage of food.

Most gardens with fishponds did not have a problem of water for the irrigation of crops and trees in their garden land. Water was irrigated from streams to the fishpond and the overflow was used to irrigate the garden.

Setting up the fishpond was done by men but maintaining by women. Local government had encouraged local people, especially upland people at Hongha and

Hongtien, to expand fishpond water surface area in order to increase output for local and lowland markets.

5.1.2 Poultry and domestic animals

Poultry and domestic animals were the second component of homegarden systems, which significantly contributed to household income. Most households in the upland areas raised ducks, chicken, pigs and some other. These poultry and domestic animals were fed by-products from the homegarden and their manure applied to trees in the garden and fishpond. Because of a shortage of market activities and also trade in the rural upland area, these products used to be consumed by the household or exchanged with neighbours in the villages at Hongtien and Hongha communes. In this study, income from this component will be calculated from the fodder values from homegarden products.

5.1.3 Forestry

Forestry in homegarden systems could be seen best in the new economic zone in which new households opened large areas of land and planted forest trees in the garden. Forest trees were planted on the steep, hillsides in areas of about 700 to 1000m². Small woods played a role in conserving water resources and solved the needs of the household for wood for domestic construction, fuelwood and cash. In contrast to the dispersed trees, forestry in the system consisted of a concentration of small woods in the garden planted with forest trees. Woods in the homegarden complex could develop microclimates and give benefit to the surrounding environment. Dispersed trees were forest trees but they were dispersedly planted

around the garden. Most homegardens at Hongha and Hongtien communes are planted with forest trees in the garden but forest trees were seen at only 60% of the gardens of Binhthanh and 10% of Huongho. Forest trees were planted to satisfy the needs for fuelwood and construction but also for the benefits of land-use management. In the garden of Huongho commune, fruit trees provided more benefit than forest trees, so although Huongho people also needed fuelwood, forest trees were rare at this commune.

5.1.4 Garden land

Homegarden area consisted of homestead and homegarden cultivating areas. All the products from gardening, animal husbandry and aquaculture were used to fulfil household objectives, and the residues from gardening were used for cattle rearing and fish farming, those from animal husbandry rearing after recycling could be used for tree planting, vegetables from gardening for fish, and water from ponds for irrigation.

5.2 Structure of flora system in the homegarden

5.2.1 Species component

5.2.1.1 Number of species in the homegarden

There are differences in the number of species in the homegardens at four studied communes as presented in Table 9. The main market strongly influenced the number of species in the homegardens at Hongha, which is 60 km from the central market, and where no local markets were available. Local farmers' consumption was

based on products from the homegarden, milpa, paddy and crop fields and forest. Seventy-seven species were found at Hongha and 73 at Hongtien, which were higher than Binhthanh and Huongho. The number was higher for several reasons. Firstly, because there were no local markets and the main market was so far away, Hongha and Hongtien people planted more vegetables, food and fruit for themselves. In contrast, Huongho and Binhthanh people had a local market and could easily go to Hue market (30 Km) to buy and sell a greater variety of products. Secondly, the low income of people in remote areas meant they had less to spend on market products and therefore plant more products in their own gardens to reduce their expenditure. The last reason was outlets for products. At greater distances from the main market, and with bad infrastructure, products from their homegardens were not easy to sell or might fetch low prices.

Table 9. Number of observed species in homegarden systems

Commune	N ₀ . of species	Rice crop	Annual crop	Perennial spp	Forest spp	Average spp/homegarden
Hongha	77	1	41	26	9	32
Hongtien	73	-	41	27	5	36
Binhthanh	67	-	33	29	5	24
Huongho	63	-	27	32	4	22

Source: Field survey, 1998.

Table 9 also presents the number of species per homegarden on average. Annual crops in the homegardens at Hongha and Hongtien were more than annual crops at Binhthanh and Huongho. In contrast, numbers of perennial species in the homegardens in the studied sites were not significant difference. Forest species at

Hongha was more than in the lower altitude areas. The greater the distance to the central market the greater the number of species. At Huongho and Binhthanh communes, the number of species were 22 and 24 but there are 32 and 35 at Hongtien and Hongha.

5.2.1.2 Common tree and crop species

In the remote communes the land was used to cultivate everything for the needs of the farmers such as food, vegetables, medicine, fuelwood, with low input. At shorter distances from the centre, there was high intensity cultivation, providing not only for household needs but also for cash income. Their products such as fruit coffee, tea and pepper could sell and became the main source of income for the family.

Hongha, the most remote commune of Thuathien-Hue province without a market, and with a low level of business activities, generated a large diversity of products from its homegardens. Food crops such as rice, sticky rice, arrowroot, cassava and sweet potato were planted in homegardens, in addition to other species arranged for foodstuff with other purposes. At Hongtien, some food crops were moved to crop land instead of garden land for other species such as ornamental and fruit species. At Huongho, the number of vegetable species reduced and there was no food crop.

Table 10. The most common species in the studied communes

Commune	Common name	Scientific name	Percent of gardens
Hongha			
	Pineapple	<i>Ananas comosus</i> (L.) Merr.	100
	Jack fruit	<i>Artocarpus heterophyllus</i> Lamk.	87.5
	Pumpkin	<i>Cucurbita maxima</i> Duch. ex. Lam.	87.5
	Gourd	<i>Lagenaria siceraria</i> (Molina) Standl.	87.5
	Cassava	<i>Manihot esculenta</i> Crantz	87.5
	Banana	<i>Musa paradisiaca</i> L.	87.5
Hongtien			
	Mulga	<i>Acacia auriculiformis</i> A.Cunn.ex. Benth	100
	Pineapple	<i>Ananas comosus</i> (L.) Merr.	100
	Pumpkin	<i>Cucurbita maxima</i> Duch. ex. Lam.	100
	Gourd	<i>Lagenaria siceraria</i> (Molina) Standl.	100
	Banana	<i>Musa paradisiaca</i> L.	100
	Taro	<i>Alocasia odora</i> (Roxb.) C. Kock	87.5
	Tea	<i>Camellia sinensis</i> Kuntze	87.5
	Coconut	<i>Cocos nucifera</i> L.	87.5
	Eucalyptus	<i>Eucalyptus camaldulensis</i> Dehnh.	87.5
	Cassava	<i>Manihot esculenta</i> Crantz	87.5
Binhthanh			
	Sapodilla	<i>Manilk arazapota</i> (L.) Van Royen	87.5
Huongho			
	Pineapple	<i>Ananas comosus</i> (L.) Merr.	100
	Grape fruit	<i>Citrus grandis</i> (L.) Osbeck	100

Source: Field survey, 1998.

The main species of homegardens changed with distance from the main market (Table 10).

Table 11 presents the number of observed species in the gardens of the four study communes by percentage ranges. There were 6 species at Hongha, 10 species at Hongtien but 1 and 2 species at Binhthanh and Huongho planted in most (75%-100%) gardens. This result illustrated specific selection of main species at each sub-zone. In the remote area, where lack of markets was a problem, there were more common species than in nearer city areas where founded local markets and near the central market. Hongtien commune had 10 main observed species of which two were Acacia and Eucalyptus. At Hongtien, the proportion of forest area to total land area was low. Thus, fuelwood and wood for construction were the main problem for local people of this commune. Therefore, at shorter distance to the main central market, the common tree species were focused on this use, thus, the number of common species was smaller.

Table 11. Flora species distribution at homegardens by percentage ranges

Commune	Number of species			
	Common 100-76	Less common 75-51	Uncommon 50-26	Rare 25-1
Hongha	6	16	21	36
Hongtien	10	12	30	21
Binhthanh	1	15	15	36
Huongho	2	8	24	29

5.2.1.3 Species 's diversity indices at commune level

Productivity has usually been the first criterion used to evaluate the performance of a farming system (McConnell, 1992) but the first element of productivity is the amount of a species grown on a given space. Species diversity and population density belongs to this element. In the other words, developing biodiversity in agricultural land and homegardens is the best way of rural development because mono-cropping cultivation in food crop can not improve people living in that area (Diem, 1997). According to Ludwig and Reynolds (1988), diversity is composed of two distinct components: (1) the total number of species and (2) evenness (how the abundance data are distributed among the species).

The study analysed the diversity index based on S , the number of species in a community and N_0 , the number of observed individual. The number of species in the community refers to the species richness, evenness refers to the species abundance. Diversity indices incorporate both species richness and evenness into a single value (Ludwig and Reynolds, 1988).

One dimension of homegarden production is the number of different activities (species), which contribute different products of total output. Results of the study illustrated in Table 12 showed that in remote areas, the richness index was high. Hongha and Hongtien communes had richness index higher than at Huongho and Binhthanh communes. These figures also explained that garden production in remote areas was more diverse than in the other studies areas.

Species diversity maybe thought of as the number of species in the community, which ecologists often refer to as species richness. Margalef index (R_1) presented in Table 12 measures species richness that are independent of the sample size. They were based on the relationship between S and N_0 . Species richness of Binhthanh commune was highest (6.953) because S was very high but the number of observed individuals is lowest (13,253). However, in general richness indices in remote areas was high.

Table 12. Species diversity indice for the four homegarden sampling communities

Indices	Hongha	Hongtien	Binhthanh	Huongho
S	77	73	67	63
Richness				
N_0	178,997	105,193	13,253	29,451
R_1	6.284	6.226	6.953	6.025
Evenness				
$E5$	0.656	0.451	0.485	0.265
Diversity				
λ	0.124	0.222	0.110	0.689
H'	2.467	2.170	2.872	0.993
$N1$	11.789	8.758	17.674	2.700

Richness index at Hongha commune (6.284) was higher than Hongtien commune (6.226) and also at Huongho (6.025). The species evenness or equability refers to how the species abundance are distributed among the species (Ludwig and Reynolds, 1988). Table 12 shows the evenness index at Hongha commune that was highest. This means that, the species abundance of observed species at Hongha

commune were high in all species. Meanwhile, at Huongho commune, where 63 species were observed, it was narrow in the number of individual species in the homegardens. This result explained the concentration of observed individuals as unequity. Homegarden farmers at Huongho commune focused on some economic species than on others. The evenness index at Hongtien and Binhthanh communes was similar to Hongha but was lower due to the history of these two communes. These two communes were concentrating on certain economic and useful species for their gardens but evenness indexes are not as low as Huongho because they were not as well established. Indices that attempted to combine both species richness and evenness into a single value were diversity indices. According to James and Rathbun, 1981 (cited in Ludwig and Reynolds, 1988), the major criticism of all diversity indices is that they attempt to combine and, hence, compound a number of variables that characterise community structure: (1) the number of species, (2) relative species abundance (evenness), and (3) the homogeneity and size of the area sampled. The diversity index presented at Table 12 indicates the characteristic diversity of the homegardens at the four studied communes. The unexpected result came from Binhthanh commune with low observed individuals but high species. This was because Binhthanh homegardens were in a period of change from mixed garden to concentrated garden. Farmers concentrated on some species to meet the needs of the market hence many useless species in the garden were replaced. It was easier to explain in the other three communes. As the most remote commune, Hongha gardens had more diversity than Hongtien. In contrast Huongho garden had the lowest diversity.

To sum up, based on the number of species and diversity indices at the studied sub-zones, the longer the distance from the central market, the greater the homegarden diversity and richness.

5.2.1.4. Homegarden sizes in relation to average number of species grown

The number of species in the homegarden did not have any relationship to the size of the garden. This agreed with McConnell's research on Kandy gardens in Sri Lanka, where there was also no apparent relationship between farm size and number of species grown (McConnell, 1992). See Figure 14A.

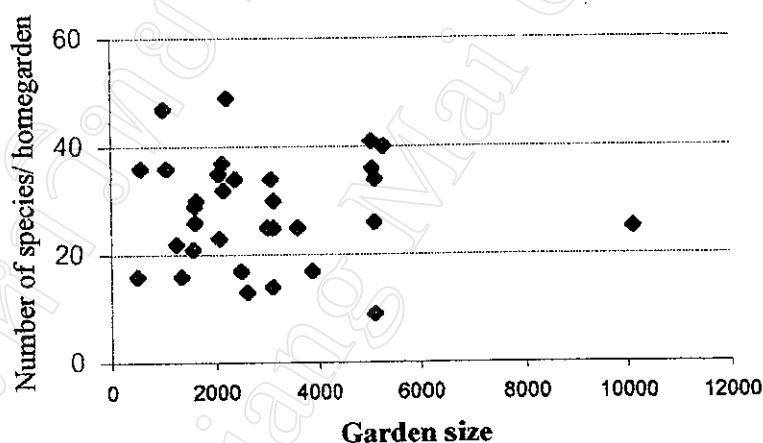


Figure 14A. The correlation of number of species and homegarden sizes

A large garden is likely to be diverse and carry as many species as small size garden. This was illustrated by the following distribution of gardens of various sizes in relation to the average number of species grown in the garden of each size. This means that a greater diversity of species per unit land area occurs on smaller gardens.

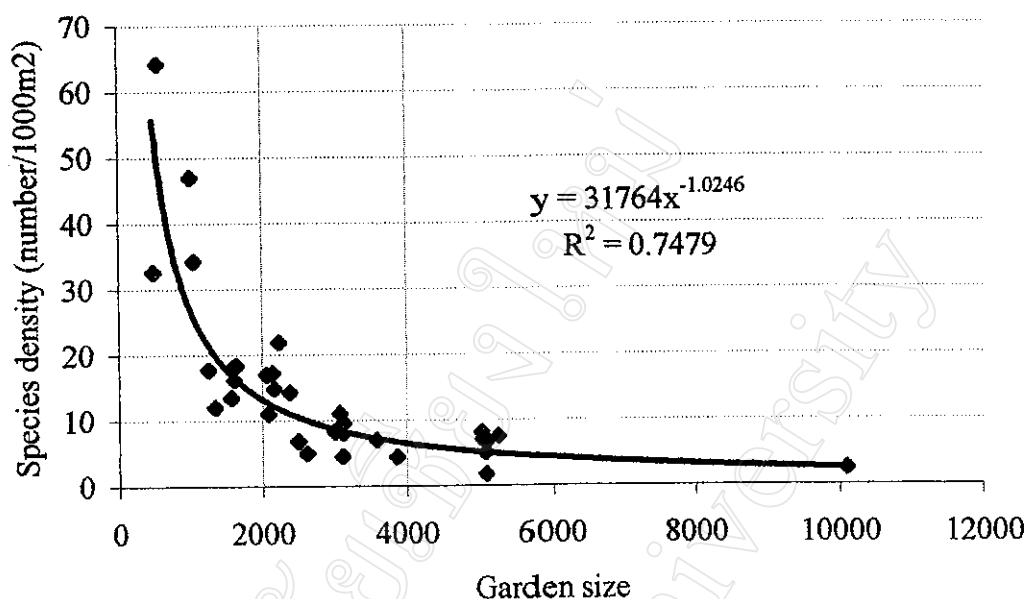


Figure 14B. Correlation of species density (number/100m²) and homegarden sizes

Figure 14B presents the correlation of the number of species per 1,000m² and the garden size for all the studied sites. There was a significant correlation of these two variables ($R^2 = 0.7479$).

5.2.2 Layer structure

Although tree species in homegardens were not planted at the same time, its vertical structure developed about 3 layers in which light demand intolerant tree species took possession of the highest layer and covered most of the garden. These were jackfruit, mangosteen, pomelo, bamboo, and other forest tree species. They became the main species and controlled the microclimate of the whole garden. Under this layer, shade tolerant tree species were planted and their canopy arranged at 3-8 m high. There were many species in this layer, some of them were lemon, banana,

papaya, tea, coffee, and cinnamon. The third layer included species that could grow well under the shade of other species, such as pineapple, arrowroot and taro, as well as species that were used for animal feed and spice. This layer played an important role in the homegarden, as it retained the tree litter and covers most of the land surface of the garden, and with the big amount of products, it also provided the main products from the garden. In the research areas, pineapple was one of the most popular products of homegarden cultivation.

The 3 layers at Hongha and Hongtien were easy to see. Acacia, jackfruit, star apple and sometimes eucalyptus as the first layer covered 40-60 % of the area. The popular species that were planted as a second layer were cinnamon, tea, tamarind, pouteria zapota, soursop, custard apple tree and sapodilla. The third layer was covered by pineapple, arrowroot, *Houttuynia cordata*, and lolot. Taro and other shade tolerant tree and crop species were planted around the house, near small streams, or around the fishpond. Vertical structure was not so clear at Binhthanh and Huongho. The first and second layers were not easy to separate because the tree species of these homegardens were simpler than at Hongha and Hongtien. With high intensity and low density, the main tree species were arranged over 80 to 90 % of the area. The tree species that were found at Huongho are pomelo, jackfruit, star apple and rose apple. These tree species were about 6-8m high and were cut at this height for ease in fruit collection. Pineapple was used as the second layer, covering 80 % of the area. Lemon and orange were arranged at about 4-6m and sometimes close to the first layer.

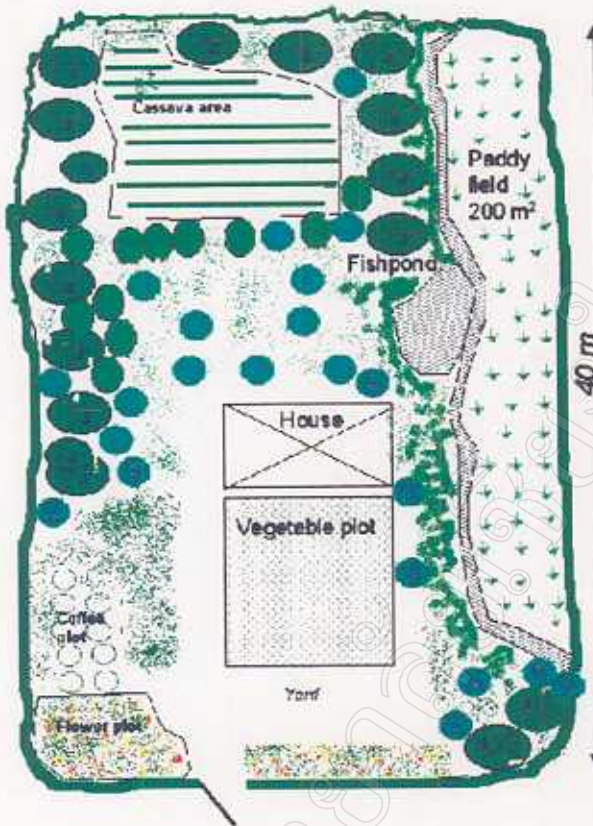


Figure 15A. Layer structure and horizontal structure in Hongha's homegarden.

Source: Field survey, 1998.

Homegarden data profile

Household: Kon Ha

ID: HH04

Village: Kongsam, Hongha.

Time: 22 year

Area: 1000 m²

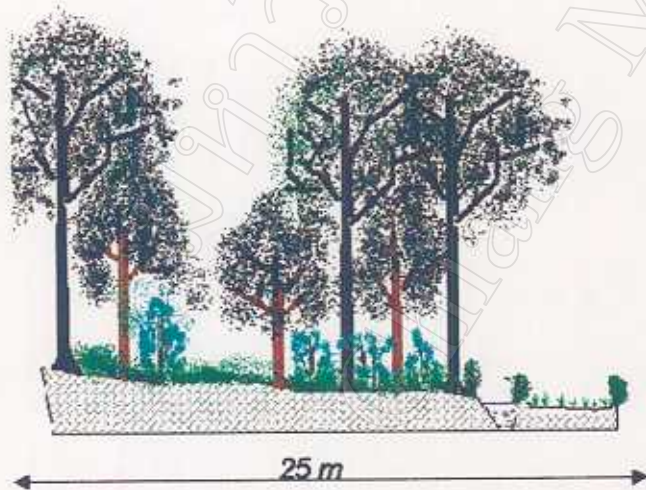
Distance to the main market: 60 km.

Number of species: 38

Main species: Jackfruit (J), cassava, banana, lemon, coffees.

Number of layers: 3 (Not clear)

Plant cover: 85%



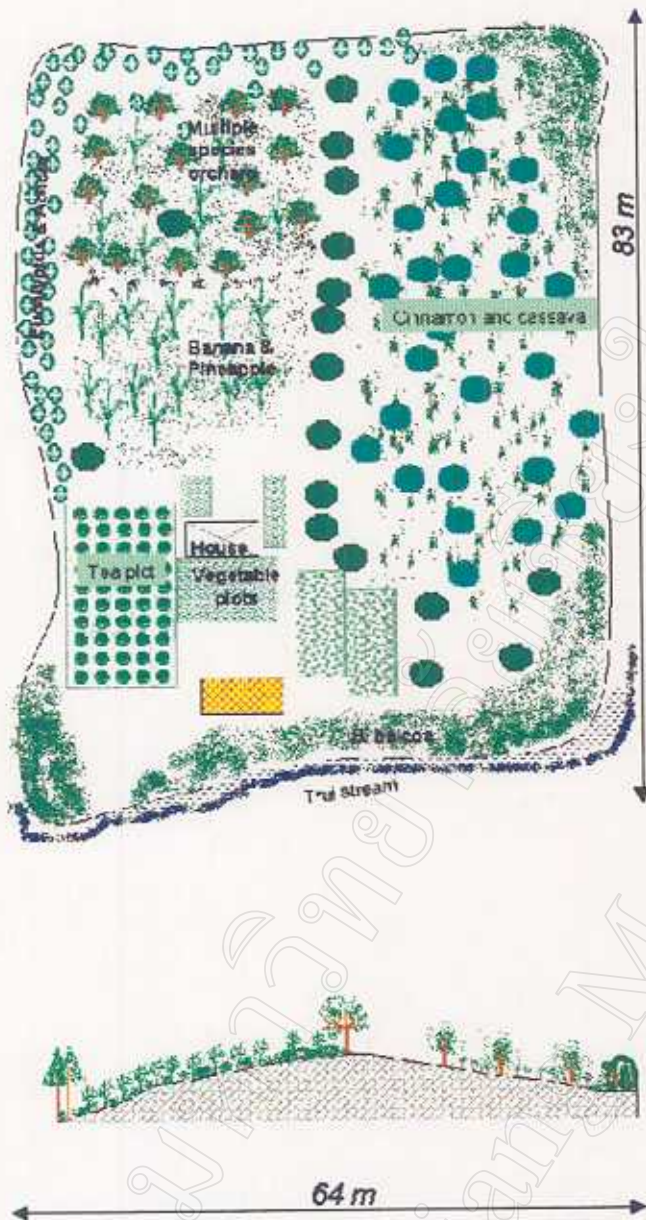


Figure 15B. Layer structure and horizontal structure in Hongtien's homegarden.

Source: Field survey, 1998.

Homegarden data profile

Household: Nguyen Van Tich (Cu Tich)

ID: HH04. Apr. 20, 1998.

Ethnic: Pahy

Village: Thonba, Hongtien.

Time structure: 6 year

Area: 5000 m²

Distance to the main market: 48 km.

Number of species: 36

Main species: Jackfruit (J), cassava, banana, tea, longan, litchi, pineapple, gum, Cinnamon and mulga

Number of layers: 2-3

Plant cover: 75%

HT01. Apr 20, 98

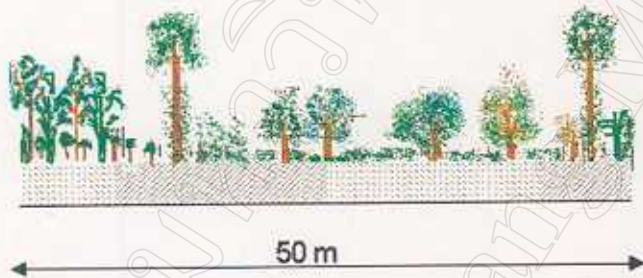
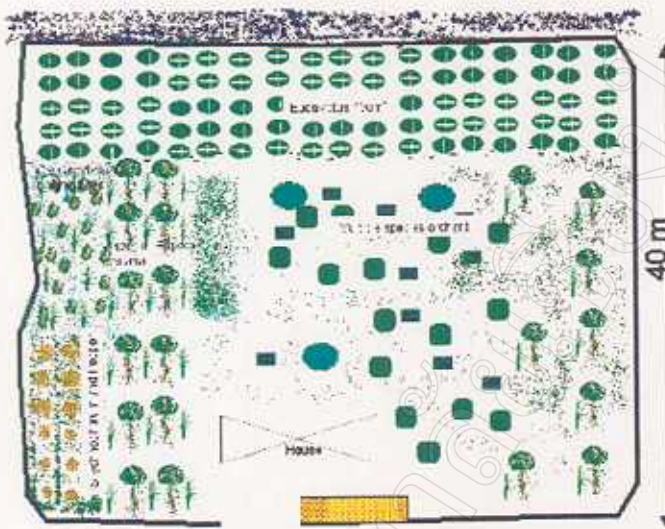


Figure 15C. Layer structure and horizontal structure in Binhthanh's homegarden.

Source: Field survey, 1998.

Homegarden data profile

Household: Pham Thi Mai

ID: HH04. May. 2, 1998.

Ethnic: Kinh

Village: Hoacat, Binhthanh.

Time structure: 6 year

Area: 2000 m²

Distance to the main market: 35 km.

Number of species: 35

Main species: Pineapple, pepper, banana, gum and fruits.

Number of layers: 2-3

Plant cover: 85%

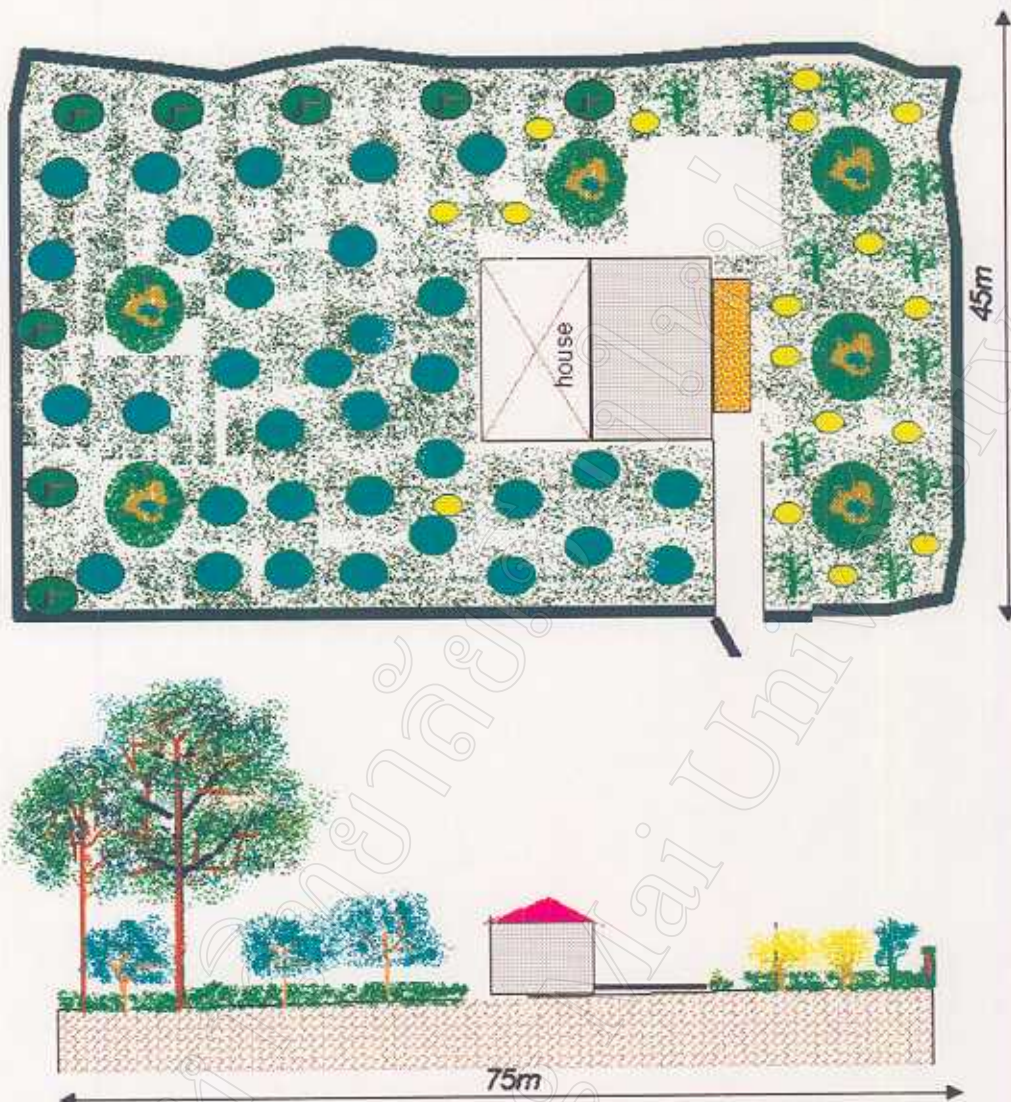


Figure 15D. Layer structure and horizontal structure in Huongho's homestead garden.

Source: Field survey, 1998.

Homegarden data profile

Household: Tran Thien Oanh

ID: HH04. May. 20, 1998.

Ethnic: Kinh

Village: Longho thuong, Huongho.

Time structure: >100 years

Area: 3375 m²

Distance to the main market: 15 km.

Number of species: 18

Main species: Pineapple, lemon, grapefruit, mangosteen.

Number of layers: 2 and 3

Plant cover: 90%

Epiphyte species do not belong to any particular layer but are non-layering plants. Pepper and dragon fruit were two examples of this group. These species are planted with a host. Hosts plants had strong and straight stem and were growing. Jackfruit, *Holarrhena pubescens* (Thùng mực) were usually selected for this purpose. Thus, epiphytes could grown to the highest layer.

To conclude, the higher elevation communes such as Hongha to the lower communes, such as Huongho, there was a similar two to three-layer structure. Many species were arranged on the same land, not only to provide a good soil cover using dropped litter but also to prevent diseases and pests and to provide protection during difficult climate conditions such as typhoons, monsoons and floods.

5.2.3 Horizontal structure

Tree and crop species in the homegardens at the studied sites followed the same rule in general. Plots of flowers and allotment gardens were allocated near the dwellings for protection and gardening. The main parts of the garden were food and fruit fields, set beside or behind the house. Hydrophilous species such as taro, *Houttuynia cordata* and lolot were planted near streams, or small canals around the house, in areas under the shade of other higher tree species. Commonly, bamboo clusters were planted in the far corners of garden land, near rivers or streams for land protection. Hedgerows around the homegardens were built with forest trees such as eucalyptus, acacia, margose (*Melia azedrach*). Trees planted to remark the boundary of the homegardens were generally perennial forest tree species. Hedgerow trees were

used for fuelwoods and domestic construction, but were also planted for leaf vegetables, medicinal herbs and crop shadowing and fodder.

At three of the investigated communes: Hongha, Hongtien and Binhthanh, cereal foods were cultivated in the land set behind the dwellings. Cereal cultivation areas are large in the garden land at Hongha (60% of the total garden land) but less at Hongtien (25%) and Binhthanh (10%). In addition, paddy fields were also found in the garden land at Hongha commune. There were no cases of cereal food planted in garden land at Huongho.

In brief, horizontal structures in the homegardens of the four research areas followed the traditional rule of incorporating special plots. Because of the differences of the gardeners' needs and the gardening skill in different sub-zones, tree and crop species groups were not similar. The remote areas preferred paddy rice, cassava and other cereal crops. In contrast, the nearer areas preferred cash trees and crops. Food plots in the homegarden in remote areas had the same role to the fruit plots, but in the lower land, fruit plots for cash played a stronger role in homegarden management.

5.2.4 Density structure

Although plant population on a unit area played an important role in the evaluation of the production of the homegarden, there was no easy general index of density structure for all the flora in homegarden for a number of reasons. Firstly, layer structure was too complex with two to three indistinct layers. Secondly, time structure was different for tree and crop species. The density of plants in the homegardens depended on species, perennial or seasonal crops and trees, size of plants and type of

plants. Native wood perennials played an importance role in structure of homegardens as well as its income pattern. They were the frames of the homegardens. Under their canopies the other seasonal crops could be arranged and maybe changed every cultivated year. There were differences in density structure at Hongha, Hongtien, Binhthanh and Huongho communities. Density in the homegardens at Hongha was highest, then reduces with the distances of the studied sites to the central market. Densities of the large size homegardens were lower than the smaller homegardens. This results were similar to McConnell's report in 1992 on the Kandy gardens in Sri Lanka.

5.2.5 Time structure

Trees and crops in the homegarden are a combination of plants, which are different species and ages. The time structure of the homegardens depend on time of settlement, time of garden establishment, gardener's needs, market demands, and social effects. Except for annual crops species, in order to maintain a stable income throughout the year, trees in homegardens have to replant every year. Time structure management in homegarden is also dependent upon the latest market demands and the needs of homegarden household. Most gardeners in Huongho and Binhthanh could manage time structure in their homegardens. However, this skill was not found at any homegarden in Hongtien and in particular in Hongha commune. To sum up, in order to maintain sustainable income over time, homegardeners in nearer studied sites were better managed than those in the remote areas. Applying homegarden time

structure management at remote areas can improve income and stabilize homegarden production.

5.3 Function of the flora system in the homegardens

5.3.1 Grouping function of flora

Most of the tree and crop species in homegardens were multi-purpose plants. In this study, flora systems in the homegarden had 15 different uses. They were cereals, fruits, vegetables, spices, beverages, medicinal herbs, ornamental, hedgerows, host (crop shade), tools and utensils, fuelwoods, soil conservation, construction and others which are also enumerated in Table 13.

5.3.2 Uses of homegarden products

Cereal and starch crops in the homegardens such as rice, cassava, sweet potato and arrowroot were used for the main daily meal of the local people. Table 13 reports that, there were 7 species that provided cereal and tuber crops at Hongha homegarden, 4 species at Hongtien while there were 3 species at Binhthanh. Huongho commune did not have any species of cereal and starch crops in its homegarden.

At longer distances from the central market, homegardens provided cereal and starch crops as the main products for local farmers. The first reason was shortage of paddy land in upland areas and second, the lack of knowledge of land management.

Table 13. Number of species and their uses in the studied sites

Uses	Commune			
	Hongha	Hongtien	Binhthanh	Huongho
Cereal and tuber crops	7	4	3	0
Fruit	22	23	20	21
Vegetable	26	19	18	15
Spice	10	8	5	4
Ornamental	5	13	21	28
Medicinal herb	28	18	19	15
Hedgerow	10	6	8	5
Beverage	4	4	3	2
Soil cover	15	3	4	3
Host	18	12	14	10
Tools and utensils	13	10	9	6
Ritual	17	10	16	23
Fuelwood	18	6	3	2
Animal feed	4	6	3	3
Construction	11	8	3	4
Other	1	1	8	10

Source: Field survey, 1998.

People in Hongha and Hongtien communes had a real shortage of paddy lands yet they could not open up new lands. Homegardens were therefore used as the fields for cereal and starch crops supply. Most households at Hongha and Hongtien and 62% households at Binhthanh planted starch crops in their homegardens. However, there were differences in cereal and starch species.

Table 14. Cereal and starch crop species in the homegardens

Scientific name	Common name	Hong ha	Hong tien	Binh thanh	Huong ho
<i>Canna edulis</i> Ker Gawl.	-	+	-	-	-
<i>Colocasia esculenta</i> (L.) Scholt	Taro	+	-	-	-
<i>Impomoea batatas</i> (L.) Lam.	Sweet potato	++	++	+	-
<i>Manihot esculenta</i> Crantz	Cassava	++	++	+	-
<i>Maranta arundinacea</i>	Arrowroot	-	+	+	-
<i>Oryza sativa</i> L	Rice	++	-	-	-
<i>Pueraria lobata</i> (Willd.) Ohwi.	Kudzu	++	-	-	-
<i>Zea mays</i> L.	Corn	++	++	-	-

Note: ++ large area; + small area; - None

At the longest distance, Hongha people planted rice in their homegardens but at Hongtien and Binhthanh, arrowroot, cassava and sweet potato were planted. At Huongho commune, cereal and starch crops were planted in agricultural fields but not in the garden where products other than cereal food were planted. Table 14 reports cereal and starch crops found in the homegarden of the study areas. The number of tree species for fruit in the studied sites was the same (from 20 to 23 species). More than 80% of the fruit species were found at most of the homegardens in the studied sites. Nearly all the fruit species had been planted and improved over a long time. Diversity of fruit species was one of the potential homegarden developments. Table 15 presents a list of tree and crop species used for fruit in the homegarden.

Table 15: List of tree and crop species used for fruit in the homegardens

Scientific name	Family name	Common name	Vietnamese name
<i>Allospondias lakonensis</i> (Pierre) Stapf.	Anacardiaceae		Dâu
<i>Ananas comosus</i> (L.) Merr.	Bromeliaceae	Pineapple	Dứa (Thom)
<i>Annona muricata</i> L.	Annonaceae	Soursop	Mãng cầu xiêm
<i>Annona squamosa</i> L.	Annonaceae	Custard apple	Mãng cầu ta
<i>Artocarpus heterophyllus</i> Lamk.	Moraceae	Jack-fruit	Mít
<i>Averrhoa carambola</i> L.	Oxalidaceae	Star-fruit	Khế
<i>Carica papaya</i> L.	Caricaceae	Papaya	Đu đủ
<i>Chrysophyllum cainito</i> L.	Scrophulariaceae	Star-apple	Vú sữa
<i>Citrus aurantiifolia</i> (Christm.) Sw.	Rutaceae	Lemon	Chanh
<i>Citrus maxima</i> (Burm.) Merr.	Rutaceae	Grape fruit	Bưởi
<i>Citrus grandis</i> (L.) Osbeck	Rutaceae		Thanh trà
<i>Citrus reticulata</i> Blanco	Rutaceae	Tangerine	Quýt
<i>Citrus sinensis</i> (L.) Osb.	Rutaceae	Orange	Cam
<i>Cocos nucifera</i> L.	Arecaceae	Coconut	Dừa
<i>Diospyros kaki</i> L.f	Ebenaceae	Persimmon	Hồng
<i>Garcinia mangostana</i> L.	Clusiaceae	Mangosteen	Mãng cụt
<i>Hylocereus undatus</i> (Haw.) Britt. et Rose	Cactaceae	Dragon fruit	Thanh long
<i>Lichi sinensis</i> Radlk.	Sapindaceae	Litchi	Vải
<i>Mangifera indica</i> L.	Anacardiaceae	Mango	Xoài
<i>Manilk arazapota</i> (L.) Van Royen	Scrophulariaceae	Sapodilla	Sapoche
<i>Musa paradisiaca</i> L.	Muraceae	Bananas	Chuối
<i>Pouteria zapota</i> (Jacq.) More et Steam.	Scrophulariaceae		Trứng gà
<i>Psidium cattleianum</i> Sabien	Myrtaceae	Purple guava	Ổi
<i>Syzygium samarangense</i> (Blume) Merr. et Perry	Myrtaceae	Rose apple	Đào mận
<i>Tamarindus indica</i> L.	Fabaceae	Tamarind	Me
<i>Ziziphus mauritiana</i> Lam.	Rhamnaceae	Jujube	Táo

Vegetables and spices were also the main products of the homegarden that meet the daily gardeners' needs. Market supply and homegarden consumptions were two main sources that provided vegetables and spices to households. In the remote areas, markets were only a concept. People at Hongha and Hongtien commune had not established markets in their communes. Homegardens became the main place to provide these foodstuffs for daily meals and other domestic consumption. In contrast, in lower communes, such as Binhthanh and Huongho founded local markets were located near good roads to the central market. Vegetables and spices became their agricultural goods that were cultivated in the fields (Huongho commune). Vegetable and spice richness was greatest in the remote sub-zones than at shorter distances. A list of vegetable and spice species is illustrated in Table 16.

Table 16. List of vegetables and spices in the homegardens

Scientific name	Family name	Common name	Vietnamese name
<i>Alocasia odora</i> (Roxb.) C. Kock	Araceae		Món Bạc hà
<i>Amaranthus tricolor</i> L.	Amaranthaceae		Rau dền
<i>Amorphophallus konjac</i> K. Kock	Araceae		Khoai nua
<i>Arachis hypogea</i> L.	Fabaceae	Ground nut	Đậu phụng
<i>Artocarpus heterophyllus</i> Lamk.	Moraceae	Jack-fruit	Mít
<i>Averrhoa carambola</i> L.	Oxalidaceae	Star-fruit	Khế
<i>Bambusa balcoa</i> Roxb.	Poaceae	Bamboo	Lô ô
<i>Bambusa blumeana</i> Schultes.	Poaceae	Spinout bamboo	Tre gai
<i>Basella alba</i> L. <i>B. rubra</i> L.	Basellaceae	Malabar night shade	Mồng tơi
<i>Brassica cernua</i> Forbes et Hemsl	Brassicaceae		Cải cay
<i>Brassica chinensis</i> L.	Brassicaceae		Cải thìa
<i>Carica papaya</i> L.	Caricaceae	Papaya	Đu đủ
<i>Cinnamomum cassia</i> Presl.	Lauraceae	Cinnamon	Quế

<i>Citrus aurantiifolia</i> (Chritn.) Sw.	Rutaceae	Lemon	Chanh
<i>Citrus maxima</i> (Burm.) Merr.	Rutaceae	Grape fruit	Bưởi
<i>Citrus grandis</i> (L.) Osbeck	Rutaceae	Pomelo	Thanh trà
<i>Colocasia esculenta</i> (L.) Scholt	Areaceae		Môn
<i>Cucurbita maxima</i> Duch. ex.Lam.	Cucurbitaceae	Pumpkin	Bí đỏ
<i>Eryngium foetidum</i> L.	Apiaceae	Eryngium	Mùi tàu
<i>Erythrina variegata</i> L.	Fabaceae		Vông nem
<i>Ficus auriculata</i> Lour.	Moraceae		Vả
<i>Houttuynia cordata</i> Thumb.	Saururaceae		Diếp cá
<i>Impomoea auquatica</i> Forssk.	Convolvulaceae	Morning Vegetable	Rau muống
<i>Impomoea batatas</i> (L.) Lam.	Convalvalaceae	Sweet potato	Khoai lang
<i>Lactica sativa</i> L.	Asteraceae	Lettuce	Sa lách xoong
<i>Lagenaria siceraria</i> (Molina) Standl.	Cucurbitaceae	Gourd	Bầu
<i>Luffa cylindrica</i> (L.) Roem.	Cucurbitaceae	Rag gourd	Mướp ngọt
<i>Lycopersion esculentum</i> (L.) Mill.	Solanaceae	Tomato	Cà chua
<i>Mormordica charantia</i> L.	Cucurbitaceae	Bitter gourd (La-kwa)	Mướp đắng
<i>Musa paradisiaca</i> L.	Muraceae	Bananas	Chuối
<i>Pandanus amaryllifolius</i> Roxb.	Pandanaceae	Fragrant Screw-pine	Lá dứa
<i>Piper lolot</i> C. DC.	Piperaceae	Lolot	Lá lốt
<i>Piper nigrum</i> L.	Piperaceae	Pepper	Tiêu
<i>Plantago major</i> L.	Plantaginaceae		Mã đề
<i>Raphanus sativus</i> L.	Brassicaceae	Daikon	Cải củ
<i>Sauropus androgynus</i> (L.) Merr.	Euphorbiaceae		Rau ngót
<i>Solanum melogena</i> L.	Solanaceae	Egg plant	Cà tím
<i>Solanum undatum</i> Poir.	Solanaceae		Cà pháo
<i>Tamarindus indica</i> L.	Fabaceae	Tamarind	Me

Coffee, tea, kuzud and the other traditional species, which were planted in the homegarden, were used as beverages. These species were planted for domestic use and for cash such as coffee and tea. About ten years ago, coffee and tea were planted

in most of the upland areas of the North Central Coast of Vietnam by the promotion of local Coffee and Tea Companies. Today, coffee and tea were replaced by other higher benefit fruit trees at Huongho and Binhthanh but still maintained in the homegardens in Hongtien and Hongha communes.

Medicinal herbs were popularly used in the rural upland areas of Vietnam. Normally, each village used to have one or two traditional physicians who used medicinal herbs to treat common diseases. However, in the homegardens, farmers also planted many medicinal herbs for household uses. At far distances from the central city, although there are commune health stations, people still customarily treated popular diseases by themselves with herbs from the homegardens and wild herbs. Twenty-eight species of medicinal herbs were found at Hongha, 18 species at Hongtien, 19 species at Binhthanh but only 15 species at Huongho (Table 17).

Table 17. Medicinal herbs in homegardens and their uses

Scientific name	Family name	Vietnamese name	Uses
<i>Canna generalis</i> Bail.	Cannaceae	Ngải hoa	Post natal complications
<i>Catharanthus roseus</i> (L.)G. Don	Apocynaceae	Dừa cạn	Dysentery, blood pressure, diabetes
<i>Cinnamomum cassia</i> Presl.	Lauraceae	Quế	Diarrhoea, digest
<i>Citrus aurantiifolia</i> (Chritm.)Sw.	Rutaceae	Chanh	Snake-bit, flu, hopping-cough
<i>Curcuma pierreana</i> Gagn.	Zingiberaceae	Nghệ	Stomach-ache
<i>Eleutherine bulbosa</i> (Mill.) Urb.	Iridaceae	Sâm đại hành	Anaemia, health-tonic
<i>Epiphyllum oxypetalum</i> (DC.) Haw.	Cactaceae	Quỳnh hoa	Uterus-hemorrhage Lung-tuberculosis
<i>Eucalyptus</i> sp.	Myrtaceae	Bạch đàn	Cold, flu
<i>Garcinia mangostana</i> L.	Clusiaceae	Mãng cụt	Diarrhoea, dysentery
<i>Hedychium coronarium</i> Koenig	Zingiberaceae	Ngải Tiên (Tabu)	Bitten-snake, abdomen-ache

<i>Hibiscus rosa-sinensis</i> L.	Malvaceae	Dâm bụt	Furuncle, Menses
<i>Houttuynia cordata</i> Thumb.	Saururaceae	Diếp cá	Constipation, measles, dysentery
<i>Ixora coccinea</i> L.	Rubiaceae	Trang đỏ	Dysentery, itch
<i>Kalanchoe pinnata</i> (Lam.) Pers	Crassulaceae	Thuốc bỏng	Burns and scolds, stanching
<i>Maranta arundinacea</i> L.	Marantaceae	Bình tinh	Kidney, digest
<i>Morus alba</i> L.	Moraceae	Dâu tằm	Cold, flu, eye-ache, asthma
<i>Pallopa multiflora</i> (Thumb.) Haraldon	Polygonaceae	Hà thủ ô	Declining kidney, hoary hair
<i>Piper betle</i> L.	Piperaceae	Trầu không	Infection, stomach-aches, asthma
<i>Piper nigrum</i> L.	Piperaceae	Tiêu	Digest, pain relief, rheumatism
<i>Plantago major</i> L.	Plantaginaceae	Mã đề	Flu, cough, cold, abscess
<i>Polyscias fruticosa</i> (L.) Harms	Araliaceae	Đinh lăng	Health-tonic, cough, rheumatism
<i>Psidium cattleianum</i> Sabien	Myrtaceae	Ổi	Diarrhoea, haemostasis
<i>Pueraria lobata</i> (Willd.) Ohwi.	Fabaceae	Sắn dây	Sunstroke, fever, measles
<i>Punica granatum</i> L.	Punicaceae	Lựu	Diarrhoea, blood -dysentery, helminthiasis
<i>Sauropus androgynus</i> (L.) Merr.	Euphorbiaceae	Rau ngót	Measles, antidote
<i>Zingiber officinale</i> Roscoe	Zingiberaceae	Gừng	Digest, cold, haemorrhagic

Medicinal herbs in homegardens of the studied sites were used to treat common diseases, such as stanching, fever, flu, cold, diarrhoea, stomach-aches, snake-bit, post natal complications. However, Hongha and Hongtien communes used herbs from their gardens more frequently than those at Huongho and Binhthanh. At longer distances from the centre, medicinal herbs in homegardens played a more important role than at shorter distances.

Tree species planted in homegardens for fuelwoods, tools and utensils, and construction needs were popularly found in the upland areas. Most households in Hongha, Hongtien and Binhthanh communes planted eucalyptus (gum) and acacia around the homegardens and steep land for construction materials and fuelwoods.

Trees were first planted in homegardens about 10 year ago since the government baned natural forest explosion. From results of participatory discussions in the four studied sites, 40% of Hongha's people used fuelwoods from homegardens but 60% at Hongtien and Binhthanh. However, there were not many homegardens planted with fuelwood trees in Huongho. The two main wood species are *Eucalyptus camaldulensis* and *Acacia auriculiformis* because of their fast growth. About 25% households planted those trees in their homegardens. The others species were also used to make utensils and tools. Bamboo groups were popularly planted in most homegardens for house making, garden frames and the other labour tools.

More ornamental tree species in the homegardens at shorter distances to the centre were found than at longer distances. In particular, the Kinh people planted these species for house decoration and rituals. Twenty-eight species were found at Huongho commune, 21 at Binhthanh, 13 at Hongtien but 5 at Hongha. See Table 18. Ornamental trees were planted in front of the house and normally in amongst the flower plots. Most homegardens in Huongho grew plots of flowers in their homegardens. Species of Asteraceae were popularly found at these communes. There were two main types of ornamental in the homegardens: perennial and seasonal. About 60% of the homegardens in Huongho and Binhthanh planted *Ochna intergerrima* (Lour.) Merr. (Ochnaceae) because it was a traditional New Year flower, the symbol of happiness and accomplishment.

Table 18: List of ornamental uses species in the homegardens

Scientific name	Family name	English name	Vietnamese name
<i>Caladium bicolor</i> (Ait.) Vent.	Araceae		Môn đóm
<i>Canna generalis</i> Bail.	Cannaceae	Indian shot	Ngải hoa
<i>Canna</i> sp.	Cannaceae		Hoa chuối
<i>Catharanthus roseus</i> (L.) G. Don	Apocynaceae		Dừa cạn
<i>Chrysanthemum indicum</i> L.	Asteraceae		Cúc kim
<i>Chrysanthemum morifolium</i> Ramat.	Asteraceae		Cúc hoa trắng
<i>Cosmos sulphureus</i> Cav.	Asteraceae	Yellow cosmos	Chuông chuông
<i>Cycas revoluta</i> Thunb.	Cycadaceae		Vạn tuế
<i>Dahlia pinnata</i> Cav.	Asteraceae		Thược dược
<i>Eleutherine bulbosa</i> (Mill.) Urb.	Iridaceae		Sâm đại hành
<i>Epiphyllum oxypetalum</i> (DC.) Haw.	Cactaceae	Phyllocactus	Quỳnh hoa
<i>Gerbera jamesonii</i> Bolus ex Hook.f.	Asteraceae		Cúc đồng tiền
<i>Gladiolus hybridus</i> Hort.	Iridaceae	Cornflag	Layon
<i>Gomphrena globosa</i> L.	Amaranthaceae		Cúc bách nhật
<i>Haemanthus multiflorus</i> (Tratt.) Martyn	Amaryllidaceae		Hồng tú cầu
<i>Heliconia bihai</i> (L.) L.	Heliconiaceae	Wild plantain	Mỏ phượng
<i>Hibiscus rosa-sinensis</i> L.	Malvaceae		Dâm bụt
<i>Hylocereus</i> sp.	Cactaceae		Tiểu quỳnh
<i>Ixora coccinea</i> L.	Rubiaceae		Trang đỏ
<i>Kalanchoe pinnata</i> (Lam.) Pers	Crassulaceae		Thuốc bỏng
<i>Ochna atropurpurea</i> DC.	Ochnaceae		Mai tứ quý
<i>Ochna intergerrima</i> (Lour.) Merr.	Ochnaceae		Mai vàng
<i>Phyllostachys aurea</i> Munro	Poaceae		Trúc vàng
<i>Polianthes tuberosa</i> L.	Agavaceae		Huệ
<i>Polyscias fruticosa</i> (L.) Harms	Araliaceae		Đinh lăng
<i>Portulaca pilosa</i> L. Subsp. <i>grandiflora</i> (Hook.) Gess.	Portulacaceae		Hoa 10 giờ
<i>Punica granatum</i> L.	Punicaceae		Lựu
<i>Rosa chinensis</i> Jacq.	Rosaceae	Rose	Hoa hồng

<i>Sabina aquamata</i> (Butch-Ham.) Ant	Cupressaceae		Tùng
<i>Strelitzia reginae</i> Banks.	Streliziaceae	Bird of paradise	Thiên điều
<i>Ficus religiosa</i> L.	Moraceae	Peepul tree	Bồ đề
<i>Tagetes erecta</i> L.	Asteraceae		Cúc vạn thọ
<i>Wrightia religiosa</i> (Teijsm.etBinn.) Hook.f.	Apocynaceae		Mai chiếu thủy
<i>Zephyranthes carinata</i> Herb.	Amaryllidaceae		Lan huệ hồng to

Homegardens also provided products for other functions, such as culture, insecticide (*Melia azedarach*) and ritual.

To sum up, homegardens in the upland areas of the North Central Coast of Vietnam could fully meet the needs of local people. Cereals, vegetables, medicinal herbs, fuelwoods and construction material were provided by homegardens in the remote areas. The number of fruit, beverage and fodder species were similarly found in the studied sites, but those used for ritual and ornamental purposes were greater at shorter distances than at longer distances from the central city.

5.3.3 Cash and non-cash species used in the homegardens

Depending on the preference of owner and effect of geographic, economic and social conditions, we can define cash and non-cash species in the homegardens. In the remote areas, because of the shortage of outlets for homegarden products, people cultivated their homegardens for domestic uses. Table 19 illustrates the difference in homegarden product use at the studied sites.

Table 19. The number of saleable and domestic use species in the homegardens

Commune	Hongha		Hongtien		Binhthanh		Huongho	
	N ₀	%	N ₀	%	N ₀	%	N ₀	%
Cash	11	14.3	24	32.9	33	49.3	37	58.7
Domestic use	77	100.0	62	84.9	66	98.5	63	100.0
Total species	77	-	73	-	67	-	63	-

Most homegarden products were used in domestic consumption. At Hongha 14.3% of the total were planted for cash, moreover, 32.9% at Hongtien, 49.3% at Binhthanh and 58.7% at Huongho.

The homegarden products from mountain areas to lowland areas changed strongly from cereal food and vegetables for self-sufficiency, to fruits and other products that could be used for cash income.