Traditional cropping pattern and management of home garden: Lesson learnt from Ciamis Regency, West Java Province, Indonesia

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Abstract. This study was intended to provide an overview of the patterns and management of cropping systems of home gardens in Cijeungjing District, Ciamis Regency, West Java, Indonesia. Data collection started with a survey identifying the cropping patterns in the research location. Twelve sites were selected for stand conditions. Interviews were conducted with landowners concerning management and dynamics of land use for 5-10 years period. The results showed that the cropping patterns in the home garden were agri-silviculture, mixed-gardens, silvo-fishery and monoculture trees. Agri-silviculture patterns, mixed-gardens and silvo-fishery are generally managed traditionally and characterized using natural tillers, without any specific planting designs, minimal maintenance, and specific tree harvesting cycle, and in a scale of subsistence to semi-commercial. The monoculture pattern is more modern with the selection of commercial tree species, spacing arrangement design, intensive maintenance at the beginning of tree growth, planned harvesting cycle regulation and partnership funding scheme. The home garden land use system does not show much change either from the previous conditions, or the future plans. However, there is still a potential risk of land use change of home garden due to the pressure of population growth.

1. Introduction

Home garden is one of traditional land uses widely developed in rural areas. Kumar and Nair [1] describe home gardens to refer to "farming systems variously described in English language as agroforestry home gardens, household or homestead farms, compound farms, backyard gardens, village forest gardens, dooryard gardens and house gardens". In Indonesia, home garden is still practiced as a traditional land use system mainly in Java island. As one of private tree-based land use systems, home garden become the symbol of sustainability [2], providing both timber and non-timber products, including ecological services [3].Those products undoubtedly contribute to farmer direct consumption, income and intangible benefits [4-6].

Several studies on home garden in Indonesia had been published. Sujarwo and Caneva [7] and Hakim [8], for example, studied the use of vegetation species in home garden in Indonesia. Other studies specifically discussed home garden related to its role in providing food such as Saptana [9]; Astuti and Wahyuni [10]; Chanifah and Sahara [11]; Hariyanto and Jauhari [12]; or economic stratification of home garden such as Poot-Pool, van der Wal [13]. Some researches on the structure and biodiversity of home garden in various sites had been reported, such as Abebe [14];Cruz-Garzia and Struik [15]; Ostwald [16]; Peyre, Guidal [17]; or socio-economic influence to the home garden structure such as Timsuksai and Rambo [18]; Behbahani, Khoshbakht [19]. However, recent

studies on the patterns and management of home garden are still limited. This research aims to provide an overview on the pattern and management of cropping system of home garden by rural communities, a case study in Cijeungjing District, Ciamis Regency, West Java Province, Indonesia.

2. Methods

2.1. Research site

This study was conducted in Cijeungjing Sub-district, Ciamis Regency, West Java Province, Indonesia. This region was chosen as a research location because it represented rural areas dominated by agricultural land use systems. Geographically it is located at 108°238'00" East Longitude and 7°10'44" - 7°28'00" South Latitude. Topographic conditions of this region vary from ramps to hilly with altitudes of 123-252 m above sea level. The climate classification based on Schmidt-Ferguson is classified as type C with average rainfall in the last 10 years reaching 6044 mm per year. This area with an area of 65 km^2 has a population of 15743 families with a total of 53073 people in 2017 [20].

2.2. Data collection and analysis

Preliminary surveys were carried out at the research site to determine the general feature of home gardens. The home garden types were classified based on Sardjono, Djogo [21] and Atangana, Khasa [22]. Based on this classification, 12 sites spread over 7 hamlets were selected purposively representing all of home garden types.

Observation of vegetation structure was carried out by making a 10 m x 20 m observation plot on each of the selected sites. Tree vegetations were measured the stem diameter at breast height (Dbh), total tree height, branch-free height and canopy width to figure out the stand structure using Spatially Explicit Individual-based Forest Simulator (SExI-FS) application. Interviews were carried out to landowners to find out the pattern of land management and the dynamics of land cover in the period of 5-10 years.

3. Result and discussion

3.1. Cropping patterns and stand structure

Utilization of vacant land in the form of yards and gardens is one of the most common forms of land use in rural communities. Rural communities in Cijeunjing sub-district utilize their vacant lands with tree crop cultivation, either with or without agricultural crops. Based on observations on selected sample locations, the farmers' land size can be classified as narrow land according to Huvio [23], which is less than 5 ha. Farmers in the study location have their traditional measurement unit for land size, namely 'bata' (1 'bata' = 14 m2). The average ownership of home garden land is 81.6 'bata' (10-150 'bata'); or if converted to hectares, the average is 0.11 ha (0.01-0.21 ha).

The home garden is not separated from the house where the owner lives in a position besides, in front of or behind the house. Some are several to tens kilometers from the homes. Even in some cases, landowners are far outside the city at a distance of several hundred km from their land. In such the cases, often landowners are rich people who invest by buying land and planting trees (with or without lower plants), then rely to the closest person to take care of their land in a mutual partnership.

Based on the combination of vegetation components (trees and annual crops) which refers to the classification according to Sardjono, Djogo [21] and Atangana, Khasa [22], the patterns of land use in the research location can be grouped into 3 systems (**Appendix A**). The three systems are agrisilvicultur, silvofishery/aquaculture and tree monoculture (farm woodlots). The agrisilviculture system is subdivided into sub-systems of trees + annual crops and mixed-garden. Each pattern comprises their vegetation components and structure (**Appendix A; Figure 1**).

Agrisilviculture system of trees + annual crops are characterized by several species of trees and annual crops which are intentionally planted, although not intensively maintained. Tree spacing are generally not regulated and the number of trees is relatively rare (see the stand density and basal area at **Table 1**). Some farmers intentionally allocate an open space at the center of the land to provide enough

space and light for the agricultural plants (**Figure 1**). While the mixed-garden subsystem is a collection of various types of trees with a denser composition. Tree canopies consist of various strata while understoreys are generally not intentionally cultivated.

Silvofishery system is a combination of dryland agriculture and aquaculture. The lands that have enough water canals are generally used by farmers to make fresh water fish ponds. Farmers cultivate several common fish species such as Gurame (*Osphronemus goramy*), Nila (*O. niloticus*), Jaher (*O. mossambicus*). Certain species of trees are also planted along embankment or on dry land around the pond (**Appendix A**). Farmers tend to plant palm tree on embankment to strength the soil while they can get direct benefit from the fruits.

The tree monoculture system comprises a stand consisting of one commercial tree species. Trees are planted at regular spacing. The tree species found in the research location with this pattern include sengon (*Paraserianthes falcataria*), gmelina (*Gmelina arborea*) and teak (*Tectona grandis*). Some species other than the main tree are often still found but in very limited quantities. Generally, farmers left those trees during land clearing because they are considered to be able to be used later.

Table 1. Tree biometrics in various cropping pattern of home garden

Cropping pattern		Stand density (n/ha)	Dbh (cm)	BA (m^2/ha)	Number of tree species
Pattern-1	Trees + annual crops	617	14.45	1.23	5
Pattern-2	Mixed-garden	1633	11.90	3.02	12
Pattern-3	Silvo-fishery	704	15.71	1.79	9
Pattern-4	Tree monoculture / Farm woodlot	2133	9.22	1.81	3

Dbh = Diameter at breast height; BA: Basal area, an aggregate of cross-sectional area of tree stems at Dbh base

Based on the condition of the tree stand, the tree monoculture pattern has the highest tree density reaching more than 2000 trees/ha (**Table 1**). Spatial arrangement in this pattern is quite effective considering the planting is regulated by a certain spacing. The mature stands of this pattern are typically having closed tree canopy with poor light in ground surface (**Figure 1**).

The next cropping pattern having relatively high tree density is mixed-gardens (1633 trees/ha). Farmers do not intentionally cultivate the agricultural crops in this pattern so that they do not necessary to provide an open space. While in silvofishery and agrisilviculture patterns of trees + annual crops, tree density is relatively lower because farmers need an open space for fish ponds and seasonal crops.

Although the silvofishery and agrisilviculture patterns of trees + annual crops have relatively low tree densities, these two patterns have a higher average tree diameter than the other two patterns. The high diameter of the silvofishery and agrisilficulture patterns of trees + annual crops is allegedly related to relatively low tree densities which cause lower competition in water, nutrition and light, and therefore creating optimal growth. In addition, in the tree + annual crop pattern, farmers generally choose few numbers of trees left when doing tree thinning to provide a space for annual crops.

Mixed-garden patterns have the highest tree basal area values compared to other patterns (**Table 1**). The high value of the tree basal area is generated from the relatively high tree density and Dbh values. In addition, this pattern also has the highest diversity of tree species. The measurement result shows mixed-garden patterns have the highest number of tree species (12 species), followed by silvifishery patterns (9 species), tree patterns + seasonal crops (5 species) and monocultures (3 species).

All of home garden pattern in this study location seems to have a higher stand density but lower number of species, compared to study in Ethiopia reported by Abebe, Sterck [14]. Abebe reported that the trees density was 475 trees/ha (86-1.082 trees/ha) while the number of species reach 21 species per farm. The structure and species richness in the study location suggest that famers effectively utilize their home garden by cultivating any useful species wherever they find space.

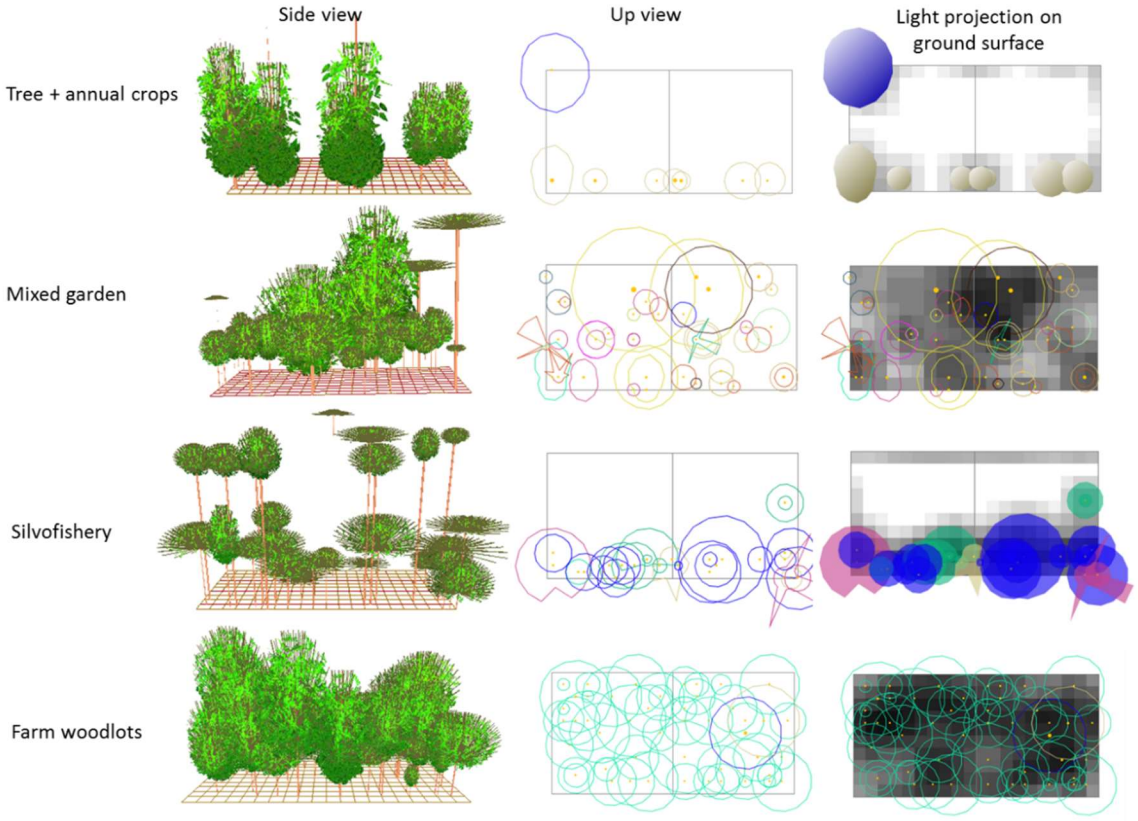


Figure 1. Visualization of home garden cropping patterns

3.2. Land asset management

Each land use pattern has different management techniques (**Table 2**). In the agrisilviculture trees + annual crops and mixed-garden patterns, farmers generally utilize natural seedling and do not carry out intensive maintenance in the cultivation of tree crops. In the agrisilviculture tree + annual crop pattern with the location of the land around the house (yard), farmers generally cultivate the seasonal plants even if only on a subsistence or semi-commercial scale. Some farmers apply practical designs by providing open space in the middle of the land to cultivate down crops and leave the trees around the land. Thus, on a narrow land there are only a few trees (**Table 1**) and farmers do not need to invest specifically to buy tree seeds. In mixed-garden patterns, farmers generally do not allocate much time to take care of their gardens so that they leave the land with various tree species with relatively higher stand densities compared to other patterns. Some farmers enrich their land with certain tree species by buying seedling if there is an empty space that can still be planted. However, farmers rely more on existing natural seedlings and do not arrange certain spatial design.

Farmers generally design tree planting on their land in the silvofishery and tree-monoculture patterns. Planting design in the form of spatial arrangement is practiced by regulating certain spacing, especially in tree-monoculture patterns. Farmers usually apply total land clearing in the land preparation stage, or just leave few trees which are considered not disturbing the main tree species. In this pattern, landowners are generally farmers who afford to provide financial investment by buying seedlings and planting with a tight spacing of 2 m x 2 m, 2 m x 3 m or 3 m x 3 m. Farmers also usually apply an intensive maintenance on this monoculture pattern. While in the silvofishery pattern, farmers build fish ponds and planting certain trees on the fringes and embankments of fish ponds. Land owners generally choose the species that can strengthen the soil, while also producing fruits, such as coconut tree (*Cocos nucifera*), areca nut tree (*Areca catechu*), and duku tree (*Lansium domesticum*). However, because it does not become main product, farmers do not apply an intensive maintenance on these tree crops.

Table 2. Land and product management of home garden

Land management	Pattern-1	Pattern-2	Pattern-3	Pattern-4
Tree plantation/propagation	Natural regeneration, seedling	Natural regeneration, seedling	Seedling, natural regeneration	Seedling
Planting design/spatial arrangement	With or No design	No design	No design	Regular planting space
Maintenance	No/minimum maintenance	No/minimum maintenance	No/minimum maintenance	Intensive maintenance
Technological input	traditional	traditional	traditional	More advance
Tree harvesting	No certain rotation	No certain rotation	No certain rotation	Technical rotation
Financial source	Self-financing	Self-financing	Self-financing	Partnership, Self-financing
Product utilization	Subsistence, semi-commercial	Subsistence, semi-commercial	Subsistence, semi-commercial	commercial

The traditional management of home gardens generally does not use certain technological inputs, except in the tree monoculture pattern. The other three patterns only grow trees (and seasonal crops) on subsistence and semi-commercial scales, do not use superior seedlings, and do not make efforts to increase production (both timber and non-timber production). While in the monoculture pattern, land owners already have a management orientation on a commercial scale, so that it starts with the selection of superior seedlings, as well as intensive maintenance in the form of fertilization and weeding in the first 2 years.

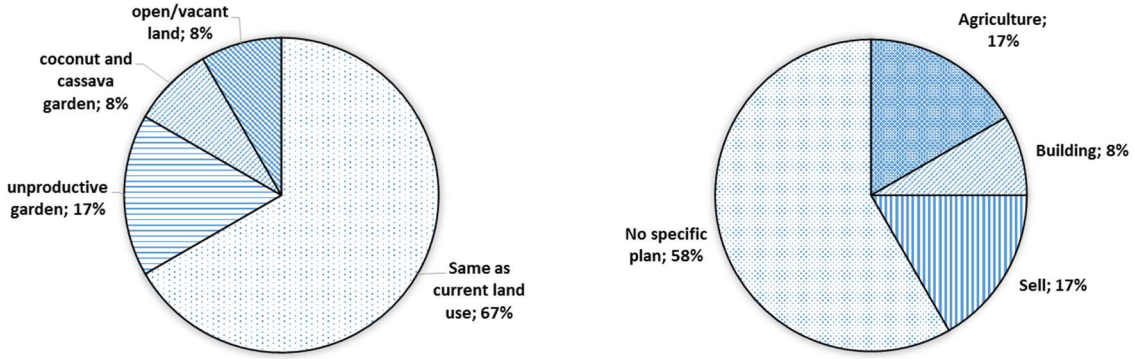
In the case of timber harvesting, farmers generally do not apply certain cycles, unless in tree monoculture pattern. Farmers commonly harvest their trees when they need money by choosing selected trees. Meanwhile in the tree monoculture pattern, land owners plan to harvest trees at a particular age depending on the species. For the sengon and gmelina species, for example, farmers plan to harvest at the age of 8-10 years, or by looking at the growth of trees to a certain diameter that reaches a price that is considered feasible.

Sources of financing for home garden management, especially in the agrisilviculture and silvofishery patterns, is originated from farmers themselves. Farmers do not need to provide a high investment since the cultivation of seasonal crops and fisheries is not in a commercial scale. In addition, tree cultivation on a small land is a long-term investment and does not require large investments especially when they use natural seedlings without an intensive maintenance. In different cases, especially in the tree monoculture patterns, landowners who do not have enough financial capital collaborate with investors to plant trees on a commercial scale. The partnership scheme is generally with a profit-sharing system with agreed sharing.

3.3. Land use dynamics

The traditional land use of home garden in the rural areas seems not changed much. This can be seen in the land use changes during the last 5-10 years, as well as plans for the next 5-10 years based on land owner's information. The majority (67%) of the land use patterns of the previous 5-10 years are the same as recent pattern (**Figure 2**). A relatively smaller portion of previous land use was in the form of unproductive mixed-gardens, coconut and cassava plantations and open/vacant land. Aland use change

occurs in the tree monoculture patterns where farmers practiced land clearing during the land preparation stage before tree plantation.



Last 5-10 years Plan for future 5-10 years

Figure 2. Land use dynamics of yards and gardens

Landowners in general (58%) do not have specific plans to make changes to their land use patterns. Some respondents stated that they want to cultivate more agricultural/seasonal crops more intensely if they have enough financial capital. Some other respondents plan to build houses for their heirs. Other respondents plan to sell their land to meet their needs, beside because they still have other land assets elsewhere.

The transformation of home garden characteristics seems highly related to socio-economic condition of the landowners, conforming previous studies [24, 25]. Each economic level of famers could result in different strategy in managing their home garden land [13]. Farmers with low financial capital usually cultivate seasonal crops for their direct consumption. Those farmers are usually the landowners who do not have specific plan to change the condition of their home garden land. In contrast farmers with strong financial capital could be able to manage change their land into more productive cropping system. Landowners whose the main job is not a farmer cannot allocate their time for the land, therefore they tend to manage the land into a long term investment in form of tree monoculture or mixed-tree species. Here, a partnership system among farmers can be a good case on how farmers collaborate their capitals (land, financial, labor) to shift the traditional into more modern management.

4. Conclusion

Cropping patterns in home garden found in the study location were agrisilviculture with tree + annual crops, mixed-gardens, silvofishery and tree monoculture. Land management of agrisilviculture patterns, mixed-gardens and silvofishery is traditionally characterized by the use of natural seedlings, without any specific planting designs, poor or without maintenance, and without a tree harvesting rotation planning. While the tree monoculture pattern is relatively more advance planning with the selection of certain commercial tree species, applying regular plantation spacing, intensive maintenance at the beginning of tree growth, the planned harvesting cycle at a certain age and the existence of a partnership funding scheme. The home garden land use system does not show much change either from the previous conditions, or the future plans. However, there is still a potential risk of land use change of home garden due to the pressure of population growth.

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Appendix

Appendix A. Home garden characteristics in Cijeungjing Sub-district, Ciamis Regency

Plot	Land size ('bata')	Land use system (Sardjono et al, 2003; Atangana et al, 2014)		Vegetation components	
		System	Sub-system	Tree	Annual crops/understorey
1	104	Agrisilviculture	Tree + annual crop	Mahogany (*Swietenia*sp), Tisuk (*Hibiscus macrophyllus*), Petai (*Parkiaspeciosa*), Coconut (*Cocos nucifera*), Rambutan (*Nepheliumlappaceum*), Pangsor (*Ficuscallosa*)	Pineapple (*Ananas*sp), Cassava (*Manihot esculenta*), Caya-caya (*Cnidoscolusaconitifolius*), Turmeric (*Curcuma longa*), Ganyong (*Canna discolor*), Banana (*Musa*sp), Sweet potato (*Ipomoea batatas*), Suweg (*Amorphophallus*sp), Papaya (*Carica papaya*), Ubiungu (*Ipomoea*sp), Katuk (*Sauropusandrogynus*)
2	10	Agrisilviculture	Mixed-garden	Teak (*Tectona grandis*), Jengkol (*Archidendron pauciflorum*), Sengon (*Paraserianthes falcataria*), Gmelina (*Gmelina arborea*), Khaya (*Khaya anthoteca*), Coconut (*Cocos nucifera*), Petai (*Parkia speciosa*), Rambutan (*Nephelium lappaceum*), Manglid (*Magnolia chamapaca*)	Talas (*Colocasia esculenta*), Banana (*Musa*sp), Ubikaret (*Cnidoscolusaconitifolius*), Garut (*Marantaarundinacea*)
3	150	Agrisilviculture	Tree + annual crop	Mahogany (*Swietenia*sp), Rambutan (*Nepheliumlappaceum*)	Sweet potato (*Ipomoea batatas*), Banana (*Musa*sp), Talas sente (*Alocasiamacrorrhiza*), Ubiungu (*Ipomoea*sp), Cassava (*Manihot esculenta*), Talas (*Colocasia esculenta*)
4	100	Agrisilviculture	Tree + annual crop	Mango (*Mangiferaindica*), Tisuk (*Hibiscus macrophyllus*), Sengon (*Paraserianthesfalcataria*), Coconut (*Cocos nucifera*), Rambutan (*Nepheliumlappaceum*), Petai (*Parkiaspeciosa*)	Banana (*Musa*sp), Turmeric (*Curcuma longa*), Pineapple (*Ananas*sp), Mangkokan (*Polysciasscutellaria*), Papaya (Carica papaya), Cassava (*Manihot esculenta*)
5	100	Tree monoculture	Gmelina stand	Gmelina (*Gmelina arborea*), Mahogany (*Swietenia* sp), Ceiba (*Ceiba petandra*), Jengkol (*Archidendron pauciflorum*)	Wild grass
6	60	Agrisilviculture	Mixed-garden	Bintinu (*Melochia umbellata*), Durian (*Durio zibethinus*), Mahogany (*Swietenia* sp), Duku (*Lansium domesticum*), Tisuk (*Hibiscus macrophyllus*), Pangsor (*Ficus callosa*), Jengkol (*Archidendron pauciflorum*), Coconut (*Cocos nucifera*), Rambutan (*Nephelium lappaceum*), Jackfruit (*Artocarpus heterophyllus*), Petai (*Parkia speciosa*), Pulai (*Alstonia* sp.), Heras (*Vitex* sp.)	Banana (*Musa*sp), Pineapple (*Ananas*sp), Turmeric (Curcuma *longa*), Cassava (*Manihotesculenta*), Gadung (*Dioscoreahispida*), Talas (*Colocasia esculenta*), Garut (*Marantaarundinacea*)
7	60	Silvofishery	Tree + fish pond	Pinang (*Areca catechu*), Jackfruit (*Artocarpusheterophyllus*), Petai (*Parkiaspeciosa*), Tisuk (*Hibiscus macrophyllus*)	Katuk (*Sauropusandrogynus*), Cassava (*Manihot esculenta*), Talas (*Colocasia esculenta*), Turmeric (*Curcuma longa*), Pineapple (*Ananas*sp), Banana (*Musa* sp); Fish: Gurame (*Osphronemus goramy*), Nila (*O. niloticus*), jaher (*O. mossambicus*)
8	80	Silvofishery	Tree + fish pond	Clove (*Syzygiumaromaticum*), Jackfruit (*Artocarpusheterophyllus*), Mahogany (*Swietenia*sp), Kemiri (*Aleuritesmoluccanus*), Duku (*Lansiumdomesticum*), Petai (*Parkiaspeciosa*), Mango (*Mangiferaindica*), Coconut (*Cocos nucifera*), Rambutan (*Nepheliumlappaceum*), Water apple (*Syzygium aqueum*), Tisuk (*Hibiscus macrophyllus*), Starfruit (*Averrhoaparambola*), Heras (*Vitex* sp.), Gmelina (*Gmelina arborea*), Coklat (*Theobroma cacao*), Ceiba (*Ceiba petandra*), Guava (*Psidium guajava*), Sengon (*Paraserianthesfalcataria*), Wangkal (*Albiziaprocera*)	Salak (*Salaccazalacca*), Pineapple (*Ananas*sp), Papaya (*Carica papaya*), Turmeric (*Curcuma longa*), Lengkuas (*Alpiniagalanga*),Mangkokan (*Polysciasscutellaria*), Banana (*Musa*sp), Cassava (*Manihot esculenta*), Katuk (*Sauropusandrogynus*), Serehwangi (*Cymbopogon nardus*), Kencur (*Kaempferiagalanga*), Pandan (*Pandanus* sp), Alang-alang (*Imperatacylindrica*): Fish: Gurame (*Osphronemus goramy*), Nila (*O. niloticus*), jaher (*O. mossambicus*)
9	150	Tree monoculture	Sengon stand	Jackfruit (*Artocarpusheterophyllus*), Sengon (*Paraserianthesfalcataria*), Sirsak (*Annona muricata*),	Cassava (*Manihot esculenta*), Banana (*Musa*sp), Talas (*Colocasia esculenta*), Kapol (*Amomum compactum*)

Plot	Land size ('bata')	Land use system (Sardjono et al, 2003; Atangana et al, 2014)		Vegetation components	
		System	Sub-system	Tree	Annual crops/understorey
10	80	Tree monoculture	Teak stand	Teak (*Tectonagrandis*), Petai (*Parkiaspeciosa*), Coconut (*Cocos nucifera*)	Wild grass
11	15	Silvofishery	Tree + fish pond	Coconut (*Cocos nucifera*), Mahogany (*Swieteni*asp), Duku (*Lansiumdomesticum*)	Banana (*Musa*sp), Turmeric (*Curcuma longa*), Suweg (*Amorphophallus*sp), Papaya (*Carica papaya*); Fish: Gurame (*Osphronemus goramy*), Nila (*O. niloticus*), jaher (*O. mossambicus*)
12	70	Agrisilviculture	Mixed-garden	Kokosan (*Lansium* sp), Pukih (*Cynometra cauliflora*), Coconut (*Cocos nucifera*), Petai (*Parkia speciosa*), Avocado (*Persea* sp), Tisuk (*Hibiscus macrophyllus*), Green sapodilla (*Manilkara zapota*), Jackfruit (*Artocarpus heterophyllus*), Rambutan (*Nephelium lappaceum*), Mahogany (*Swietenia* sp), Heras (*Vitex* sp.), Tamarin (*Tamarindus indica*), Jengkol (*Archidendron pauciflorum*), Sentul (*Sandoricum koetjape*)	Lengkuas (*Alpiniagalanga*), Mangkokan (*Polysciasscutellaria*), Papaya (*Carica papaya*), Banana (*Musa*sp), Cassava (*Manihot esculenta*)

Note: 1 bata = 14 m^2

References

[1] Kumar B M and Nair P K R 2006 *Tropical Homegarden: A Time-tested Example of Sustainable Agroforestry*, ed Kumar B M and Nair P K R (Springer)
[2] Kumar B M and Nairm P K 2004 *Agroforestry systems* **61** 135–152
[3] Puspitojati T et al 2014 *Hutan Rakyat, Sumbangsih Masyarakat Pedesaan untuk Hutan Tanaman (Private Forest, Contribution of Rural Community for Plantation Forest)* (Yogyakarta: Kanisius)
[4] Szulecka J, Obidzinski K and Dermawan A 2016 *Forest Policy Economics* **62** 19–29
[5] Belcher B M 2005 *International Forestry Review* **7** 81–88
[6] Angelsen A and Wunder S 2003 *Exploring the Forest – Poverty Link: key concepts, issues and research implications* (Bogor: CIFOR)
[7] Sujarwo W and Caneva G 2005 *Human Ecology* **43** 769–778
[8] Hakim L 2014 *Etnobotani dan Manajemen Kebun-Pekarangan Rumah: Ketahanan Pangan, Kesehatan dan Agrowisata (Ethnobotany and Management of Home Grounds: Food Security, Health and Agro Tourism)* (Malang: Penerbit Selaras)
[9] Ashari, Saptana and Purwantini T B 2012 *Forum Penelitian Agro Ekonomi* **30** 13–30
[10] Astuti, U.P. and T. Wahyuni. *Minat Petani dalam Budidaya Sayuran di Lahan Pekarangan (Farmer Interest on Vegetable Cultivation in Homegarden Land)*. in *Prosiding Seminar Nasional Sains & Teknologi V*. 2013. Lampung: Lembaga Penelitian Universitas Lampung.
[11] Chanifah and D. Sahara. *Potensi dan Masalah Pengembangan Lahan Pekarangan Pedesaan untuk Mendukung Ketahanan Pangan Rumah Tangga (Potency and Problem on Rural Homegarden Development to Support Household Food Security)*. in *Prosiding Seminar Nasional Optimalisasi Pekarangan*. 2012. Semarang: UNDIP.
[12] Hariyanto, W. and S. Jauhari. *Kontribusi Lahan Pekarangan dalam Pemenuhan Kebutuhan Pangan dan Gizi Keluarga (Contribution of Homegarden in Fulfilling Food and Nutrition Family Need)*. in *Prosiding Seminar Nasional Optimalisasi Pekarangan*. 2012. Semarang: UNDIP.
[13] Poot-Pool, W.S., et al., *Economic Stratification Differentiates Home Gardens in the Maya Village of Pomuch, Mexico.* Economic Botany, 2012. **66**(3): p. 264-275.
[14] Abebe, T., et al., *Diversity, composition and density of trees and shrubs in agroforestry homegardens in Southern Ethiopia.* Agroforest Syst, 2013. **87**: p. 1283-1293.

[15] Cruz-Garzia, G.S. and P.C. Struik, *Spatial and Seasonal Diversity of Wild Food Plants in Home Gardens of Northeast Thailand.* Economic Botany, 2015. **69**(2): p. 99-113.
[16] Mattsson, E., et al., *Quantification of Carbon Stock and Tree Diversity of Homegardens in a Dry Zone Area of Moneragala District, Sri Lanka.* Agroforest Syst, 2015. **89**: p. 435-445.
[17] Peyre, A., et al., *Dynamics of homegarden structure and function in Kerala, India.* Agroforestry Systems, 2006. **66**: p. 101-115.
[18] Timsuksai, P. and A.T. Rambo, *The Influence of Culture on Agroecosystem Structure: A Comparison of the Spatial Patterns of Homegardens of Different Ethnic Groups in Thailand and Vietnam.* PLoS ONE, 2016. **11**(1): p. 1-15.
[19] Behbahani, A.G., et al., *Assessing the effect of Socio-economic factors on Agrobiodiversity in homegardens of Jajrood and Jamabrood in Tehran province (Iran).* Advances in Environmental Biology, 2012. **6**(5): p. 1708-1715.
[20] Central Bureau of Statistic of Ciamis Regency, *Ciejungjing Sub-District in Number (Kecamatan Cijeungjing dalam Angka) Year 2018*. 2018, Central Bureau of Statistic of Ciamis Regency.
[21] Sardjono, M.A., et al., *Klasifikasi dan Pola Kombinasi Komponen Agroforestri (Classification and Combination Pattern of Agroforestry Components)*. 2003, Bogor, Indonesia: World Agroforestry Centre (ICRAF).
[22] Atangana, A., et al., *Tropical agroforestry*. 2013: Springer Science & Business Media.
[23] Huvio, T., J. Kola, and T. Lundström, *Small-scale farmers in liberalised trade environment*. 2005, Helsingin yliopisto, taloustieteen laitos.
[24] Kabir, M.E. and E.L. Webb, *Household and Homegarden Characteristics in Southwestern Bangladesh.* Agroforest Syst, 2009. **75**: p. 129-145.
[25] Linger, E., *Agro-ecosystem and socio-economic role of homegarden agroforestry in Jabithenan District, Nort-Western Ethiopia: implication for climate change adaptation.* SpringerPlus, 2014. **3**(154): p. 1-9.