

琉球大学学術リポジトリ

インドネシアにおける伝統的アグロフォレストリーに関する調査研究 – Banten州Baduy共同体を事例として –

メタデータ	言語: 出版者: 琉球大学農学部 公開日: 2011-04-20 キーワード (Ja): アグリフォリスト, 土地利用, 熱帯先住民, 森林利用 キーワード (En): Agroforestry, land use, Indigenous people in tropics, forest utilization 作成者: Chen, Bixia, Nakama, Yuei, Yogi, Taishi, Ichwandi, lin, 陳, 碧霞, 仲間, 勇栄, イチャワンディ, イン メールアドレス: 所属:
URL	http://hdl.handle.net/20.500.12000/19159

Agroforestry by Baduy Community in Banten province, Indonesia

Bixia CHEN¹, Yuei NAKAMA^{2*}, Taishi YOGI³, Iin ICHWANDI⁴

¹Postdoctoral Fellow, Faculty of Agriculture, University of the Ryukyus

²Professor, Department of Subtropical Agricultural Sciences, Faculty of Agriculture, University of the Ryukyus

³Department of Subtropical Agriculture, Faculty of Agriculture, University of the Ryukyus

⁴Lecturer, Department of Forest Management, Faculty of Forestry, Bogor Agricultural University

Abstract: Agroforestry is an integrated approach of combining agriculture and forestry technologies, preserving the natural environment, producing food in a sustainable way and providing the local residents with stable food supply. It has gathered attention in the tropics recent years. This study focuses on status quo of traditional agroforestry in Baduy community, which is still little known. It further discusses the land use, vegetation composition, distribution of plants, and forest uses. There are two types of agroforestry in Baduy community: Kebon and Huma-Jami-Reuma. In a *Kebon*, without slash and burn, there is an upstorey of fruit trees and woods, and a low storey of useful herbaceous plants for food, medicine and ritual. Useful plants could be continuously harvested. A *Huma-Jami-Reuma* is a kind of shifting cultivation after slash and burn. *Huma*, *Jami*, and *Reuma* refer to the different stages of shifting cultivation. During the first year of *Huma*, swidden rice (*Oryza sativa* L.) is majorly planted. One to three years after rice harvest, vegetables are usually planted when the trees are naturally regenerated. This stage is called *Jami* (vegetable stage). During the following 3 to 4 years, it is the stage of secondary forest, called *Reuma*. The fruits and wild plants are produced without maintenance during *Reuma*. Thus, the land might be reused as shifting cultivation after 8 years. In *Jami*, there are numerous useful plants in the understorey. Thus, soil has been preserved with understorey vegetation and the dried straws of harvested rice. Vegetation in *Reuma* consists of *Paraserianthes falcataria* and fruit trees in the upstorey, banana plants, Noni in the middle storey and vegetables and wild useful plants in the understorey. Vegetation has been regenerated from the under storey to the up storey; a multilayered structure has been maintained under such a system. Traditional agroforestry in Baduy community consists of various types of land use and the cycling uses of ecosystem of the soil have been accomplished, which result in the soil preservation and the productive agricultural and forestry production.

Key words: Agroforestry, land use, Indigenous people in tropics, forest utilization

1. Introduction

Since the mid-1980s, in the areas of forestry research there has been a tendency for 'social forestry' to concentrate on trees for fuel wood. Economic function of agroforest has been mentioned as serving the low-income households as essential production system. With recent research foci of ecological concern (Wiersum 1982), agroforestry has been interpreted as a sustainable forestry. The traditional agroforests in West Java reflect the surrounding forest ecosystem, simplifying the features (Michon et. al. 1983).

Social forestry was defined as: "tree planting and

management, at the farm, village or community level, by or for small farmers and the landless". Preserving and restoring the forest resources are unprecedentedly severe, and traditional and sustainable agriculture is dwindling. Suitable use of trees can do so much to improve soil (Westoby 1989).

Agroforestry was categorized as social forestry. It is a new name for practices which are very old - the combination, in time or space, of tree growing with growing crops, raising animals, or both. Agroforestry is an integrated approach of using the interactive benefits from combining trees and shrubs with crops and/or livestock. It combines agricultural and forestry can be

* Corresponding author (E-mail: ynakama@agr.u-ryukyu.ac.jp)

classified into various groups based on their components in space and time. Basically, agroforestry practices have agrisilviculture (trees with technologies to create more diverse, productive, profitable, healthy and sustainable land-use systems (Westoby 1989). Agroforestry is a generic term and crops), silvopastoral (trees with grass and animals), and other combinations (Huxley 1999).

However, a global marketing also has a deep influence on forest production. World forest resource has depleted and environment has been destroyed instead of the great progress concerning modern forest management theories and techniques. With the conversion of agroforests to modernization, they have largely lost their original features of biodiversity and the multi-purpose dimension in household economy (Michon & Mary 1994).

In contrast, the indigenous people, in particular those in the tropics have stuck to their beliefs and lived with the rain forest in a sustainable way for hundreds of years. Baduy people have aroused research interest (Iskandar & Ellen 2000; Ichwandi 2008) with their strict taboos to the access to the outside modern society. However, agroforestry by indigenous people is less known. This study aims to clarify the forest composition of agroforests in indigenous villages, and further discusses various uses of agroforest.

2. Overview of Baduy Community

Indonesia people have a long history to live with tropical rain forests in a sustainable way. The Baduy are a group of ethnic Sundanese who live in a relatively isolated area around Kendeng mountain, in the village (*desa*) of Kanekes, sub-district (*kecamatan*) of Leuwidamar, district (*kabupaten*) of Lebak, in the province of Banten (Fig. 1). In the forest departed from their home, they have developed a particular system to intercrop in small area woodland. Agroforestry of Baduy can be divided into two categories, *Kebon* and *Huma-Jami-Reuma*. In a *Kebon*, without slash and burn, there is an upstorey of fruit trees and woods, and a low storey of useful herbaceous plants. A *Huma-Jami-Reuma* is a kind of shifting cultivation after slash and burn. *Huma*, *Jami*, and *Reuma* refer to the different stages of shifting cultivation. During the first year, swidden rice (*Oryza sativa L.*) is majorly planted. One to three years after rice harvest, vegetables are usually planted when the trees are naturally regenerated. This stage is called *Jami* (vegetable stage). During the following 3 to 4 years, it is the stage of secondary forest, called *Reuma*. The fruits and wild plants are produced without

maintenance during *Reuma*. Thus, the land might be reused as shifting cultivation after 8 years. According to Ichwandi (2008), *Reuma* type secondary forests become fewer and fewer these years.

Seventy-five percent of Indonesia's total land area of 191 million hectares was classified as forest land, and tropical rain forests made up the vast majority of forest cover, particularly in Kalimantan, Sumatra, and Irian Jaya. Forest coverage rate has declined sharply after 1980s. Shifting cultivation was criticized as one of the complex factors contributing to forest deterioration.

Indonesia is also endowed with a long history of human cultivation and diverse cultures. The Baduy community in Banten province, Java Island is an indigenous community in Indonesia living with a traditional lifestyle in isolated environment. Many indigenous communities have faced great pressure since legislation of Basic Agrarian, Forestry Act, and other sector laws do not acknowledge local peoples' customary rights to use the forest resources (Moniaga 1993). In contrast, Baduy community survived because they got the acknowledgement from the government and surrounding society. Since 1968, the Decree of the Governor of West Java No. 203/b.V/Pem/SK/1968, the

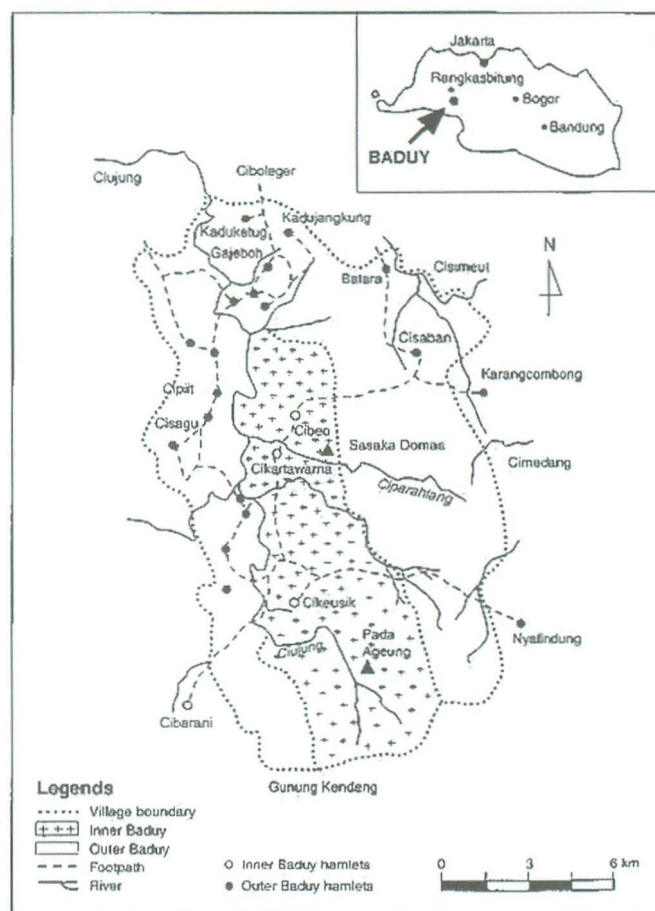


Fig 1. Location of Baduy communities and survey sites
Source: Iskandar, J. and Ellen, R.F. 2000

Baduy community has been endowed with the legal right to live on their sacred land in the state forest reserve. This was before its creation of Banten province from the western most part of West Java Province. In 2001, that decree was further strengthened by a new local government decree No. 32 regarding protection of customary rights of the Baduy community.

The Baduy, who call themselves Kanekes, are a traditional community living in the western part of the Indonesia province of Banten. Their territory consists of 5, 101 ha, and is called Kanekes Village under Leuwidamar Sub-district in Lebak District, Banten province. Their population of between 5,000 and 8,000 is centered in the Kendeng mountains at an elevation of 300-500 meters above sea level. Their homeland in Banten, Java is contained in just 50 km² of hilly forest area 120 km from Jakarta, Indonesia's megalopolis of high-rises and fast cars. Topography is mainly hilly with an average slope of 49%. The average rainfall is 4000 mm/year. The soil is clay latosol. The area was declared by the Governor of West Java as an area of special reserve of sacred forest land and a conservation area for Baduy community under their native customary rights in 1968 (Dinas Sosial, 1999).

The religion of the Baduy is known as *Agama Sunda Wiwitan*, a combination of traditional beliefs and Hinduism. However, due to lack of interaction with the outside world, their religion is more related to *Kejawen* Animism, though they still retain many elements of their original Hindu-Buddhist religion, like the terms they use to define things and objects, and the rituals in their religious activities. A certain amount of Islamic influence has also penetrated into the religion of a few of Outer Baduy in recent years, with some original ideas thrown in for good measure. The ultimate authority is vested in *Gusti Nu Maha Suci*, who according to the Baduy people sent by Adam into the world to lead the life of a Baduy.

The Baduy also observe many mystical taboos. They are forbidden to kill, steal, lie, commit adultery, get drunk, eat food at night, take any form of conveyance, wear flowers or use perfumes, gold or silver, to touch money, or cut their hair. Other taboos relate to defending Baduy lands against invasion: they may not grow *sawah* (wet rice), not use fertilizers, not raise cash crops, not use modern tools for working, nor keep large domestic animals.

The population of about 400 Inner Baduy (IB) people consists of 40 families *Kajeroan* who live in the three villages of Cibeo, Cikertawana, and Cikeusik in Tanah Larangan (forbidden territory) where no stranger is

permitted to spend the night. They are probably the purest Baduy territory. IB people follow the rigid buyout taboo system very strictly, and thus they have made very few contacts with the outside world as they are considered as "People of the sacred inner circle". IB people are the only one of these two major clans that have the *Pu'un*, the spiritual priest of the Baduy. The *Pu'un* is the only people that visit the most hallowed and sacred ground of the Baduy which lies on Gunung Kendeng, in a place called *Arca Domas*. Unlike Outer Baduy (OB), IB peoples are hardly influenced by Islam.

OB people make up the remainder of the Baduy population, living in 22 villages and acting as a barrier to stop visitors from entering the Sacred Inner circle. They do follow the rigid taboo system but not as strictly as IB people, and they are more willing to accept modern influence into their daily lives. For example, some OB people now proudly wear the colorful sarongs and shirts favored by their Sundanese neighbours. In the past OB people only wore their homespun blue-black cloth, and were forbidden to wear trousers. Other elements of civilization (toys, money, batteries) are rapidly infiltrating especially in the villages to the north, and it is no longer unusual for an OB to make a journey to Jakarta, or even to work outside as a hired hand during the rice planting and harvesting seasons. Some even work in big towns and cities like Jakarta, Bogor and Bandung. Animal meat is eaten in some of the outer villages where dogs are trained for hunting, though animal husbandry is still forbidden. No foreigners are allowed to enter IB area. Thus, we limited our survey in OB people area.

At present, OB people also accept tourists in some areas. Handicrafts are on sale for presents. Some OB people were hired as tour guide. However, OB people, in particular, women avoid taking photos, and meeting with tourists. According to the survey data by Ichwandi (2008), income from handicraft sale accounted for 16.2%, and 7.9% of the total household income in OB people and IB people, respectively; while, income from agroforestry accounted for 72.3%, and 83.9% of the total household income in OB and IB people, respectively. It is obvious that Baduy people earn a majority of their income from forests. Durian is the important fruit for the two clans, while, honey is another important product in IB people.

Basically, Baduy people use the firewood for cooking. IB people use firewood from the forest. Both clans use self-sufficient woods to build their houses. Swidden rice is also self-sufficient. IB people consider swidden rice as sacred. Thus, each year they perform sacred rituals by

offering new swidden rice. And it is a taboo to sell swidden rice on the market. Recently, there is an increasing tendency that people buy supplementary rice from the market.

In principle, there is a square in the middle of the village, and houses scatter to surround it. The square is used as a common place that people perform the ritual, making the roof, drying coffee, or hang out washing to dry, and etc. *Orthosiphon aristata*, *Carica papaya* L. and *Curcuma domestica* are planted in the small home gardens that surround each house. The villages are surrounded by the forest and farming land.

3. Methods

In May, 2008, we surveyed one plot of *Kebon*, *Kebon kopi*, *Jami*, and *Reuma*, respectively (Fig. 1). Based on traditional custom, foreigners are not allowed to enter a *Huma*. Through the local guide, we got the permit from the local people to conduct the surveys. In OB, there were a majority of *Paraserianthes falcataria* in the up storey, and banana plants in the low storey in *Reuma*. In *Kebon*, there were a majority of *Paraserianthes falcataria* in the up-storey, and a large number of cultivated plants in the low-storey. Besides a typical *Kebon*, there is a *Kebon kopi*, where coffee trees were accumulated.

The relative locations of plants taller than 1m were drawn in a horizontal distribution figure. Since tallest trees in the surveyed plots are around 6m, the survey data will be split into two parts of those taller than 4m which were grouped into the up storey, and those lower than 4m which were grouped into the low storey.

A rectangle plot of 10m×60m was set to survey the plant composition of different type of agroforests. *Kebon* are mostly small plots of land covered with a dense population of useful tree species. Thus, we chose to survey a plot of 10m×40m in *Kebon*. The relative location of all up storey trees and low storey were measured and tallied. And herbaceous vegetations were identified and recorded. Further, we recorded the plant uses (food, medicine, timber, ritual, or others), regeneration (wild, or cultivated), function (for subsistence or for sale) through interviews. The plant uses was obtained through interviewing the local inhabitants.

4. Results

4.1 Vegetation composition in Jami

Huma is used for swidden farming to plant swidden rice and other crops. *Jami* is fallow land one year after the

slash and burn. We found a total number of 17 trees in the up storey, which is obviously much fewer than the other surveyed plots. From Table 1, we know that *Paraserianthes falcataria*, and *Hibiscus macrophyllus* were the two major species, accounted for 7 and 5 trees. Both are used as timber. Fig. 2 is the horizontal distribution of all up storey trees in *Jami*. It is clear that all six species trees belonging to six genres were scattered in the plot.

Table 2 is a full list of low storey tree species ranked by their numbers (also see Fig. 3). The major species was *Paraserianthes falcataria*, which accounted for 29 small trees. These *Paraserianthes falcataria* trees could be harvested after 5-8 years, which is in accordance with the shifting cultivation cycles. Thus, such an agroforest with a majority of *Paraserianthes falcataria* has become very popular in Indonesia (Iskandar and Ellen 2000). There were also 28 *Musa* sp., and 16 *Sandoricum koetjape*, which would grow up to produce food and fruits.

Nine species of herbaceous plants (Table 3) were found, all of which were edible for family uses. They included *Colocasia esculanta*, *Capsicum annum*, and *Solanum melongena* Linn, which could be used in their everyday lives. They also included spices of *Zingiber* sp., *Curcuma aurantiaca*, *Coleus tuberosus*, and *Alpinia galanga*, either cultivated or wild.

4.2 Reuma

Reuma is a young secondary forest re-grown 3-5 years after *huma*. *Reuma* is usually covered with natural regeneration comprised of a variety of species of shrubs and trees. Table 4 shows a full list of upstorey species in a surveyed *Reuma* plot. *Paraserianthes falcataria* is major species in up storey. The number was 65, and accounted for 82% of the total up storey trees. Among all 79 up storey trees, only 2 of them were fruit trees of *Tamarindus indica* L., and *Parkia speciosa* (Fig. 4).

Table 5 lists all tree species appear in the low storey of *Reuma* (also see Fig. 5). There were 49 *Musa* sp. trees and 36 *Swietenia mahagoni* trees.

Thirteen species of herbaceous plants (Table 3) were found. Five species of *Selaginella plana*, *Curcuma domestica*, *Solanum torvum*, *Centella asiatica*, *Eupatorium odoratum* L. and *Oxalis barrelieri* L. were used as food. Three species of *Centella asiatica*, *Amorphophallus* sp., and *Mikania scandens* were used as medicine. Five species of *Eryngium foetidum*, *Caryota mitis*, *Ageratum conyzoides*, *Phyllanthus niruri*, and *Dicranopteris linearis* were used in the ritual.

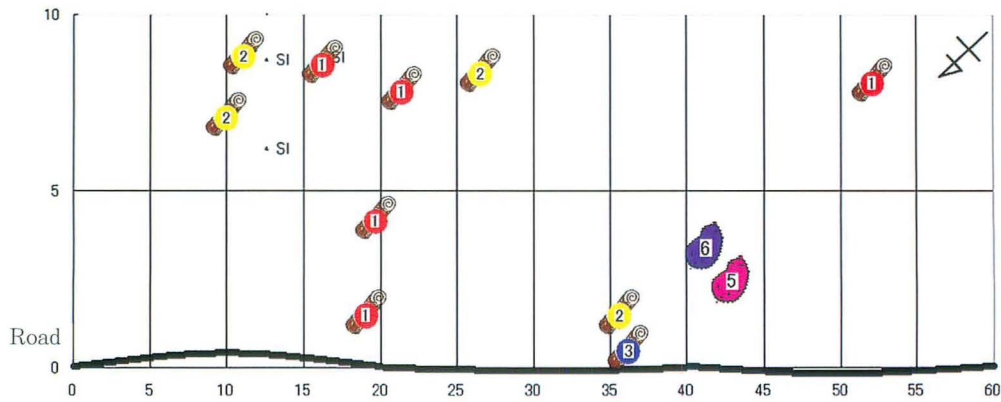


Fig. 2. A horizontal distribution of up storey plants in a Jami
 Note: All figures were drawn based on our survey in 2008.

Table 1. A full list of up storey plant species appeared in surveyed Jami

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	sengon	<i>Paraserianthes falcataria</i>	timber	sale	cultivated	7
2	tisuk	<i>Hibiscus macrophyllus</i>	timber	subsistence	cultivated	5
3	acasia	<i>Acacia mangium</i>	timber	sale, subsistence	cultivated	2
4	afrika	<i>Maesopsis eminii</i>	timber	subsistence	cultivated	1
5	bingglu	<i>Mangifera caesia</i>	Fruits	subsistence	cultivated, wild	1
6	nangka	<i>Artocarpus heterophyllus Lam.</i>	Fruits	subsistence	cultivated	1

4.3 Vegetation composition in Kebon.

Fig. 6 shows the horizontal vegetation distribution of up storey plants in Kebon.. Table 6 lists the detailed information of plants ranked with numbers.

We found 57 trees in the up storey. From the Table 6, we could see that *Paraserianthes falcataria* ranked first, and accounted for 26, about half of the up storey trees. *Paraserianthes falcataria* is an alien species introduced quite recently. They are sold as chip timber for cash income. *Sandoricum koetijape* ranked second, and accounted for 18. They are majorly used as fruits. While, they can also be sold as timber of high quality (Ichwandi 2008). These two species accounted for more than two third of the total up storey trees. There were the other 8 species, including *Hibiscus macrophyllus*, *Gnetum gnemon* LINN., *Maesopsis eminii*, *Durio zibethinus* Murr., *Mangifera odorata*, *Artocarpus heterophyllus Lam.*, *Parkia speciosa*, and *Macaranga tanarius*. They were mostly for family use.

Table 7 shows a full list of low storey plants appeared in the surveyed Kebon. We found 24 banana plants, which were the major species. And *Cordyline fruticosa* ranked second. These trees were planted in a line in the middle of Kebon as a boundary line between

the different land owners. There were a large number of seedlings of up storey woods, which belongs to 12 species. From Fig. 7, we could find that there were a lot of herbaceous plants in the low storey. The major species included *Alpinia galanga*, and *Manihot esculenta*. There were also quite a lot of *Curcuma domestica* and *Canna edulis*.

In Kebon, fourteen species of herbaceous plants (Table 3) were found. Seven species of *Selaginella plana*, *Curcuma domestica*, *Manihot esculenta*, *Canna edulis*, *Alocasia macrorrhiza*, *Alpinia galangal*, and *Melastoma malabaricum* were used as food. Three species of *Mikania scandens*, *Imperata cylindrical*, and *Eupatorium odoratum L.* were used as medicine. Three species of *Phyllanthus niruri*, *Caryota mitis*, and *Histiopteris incisa* were used in the ritual.

4.4 Vegetation composition in Kebon Kopi

Kebon Kopi refers to a home garden which is dominated by coffee trees. Higher storey trees (such as *Paraserianthes falcataria*) are used as shading plants for coffee production Baduy. Fig. 8 shows the horizontal distribution of up storey vegetation of surveyed plot in *Kebon Kopi*.

About 39 trees, 9 species were found in the up storey

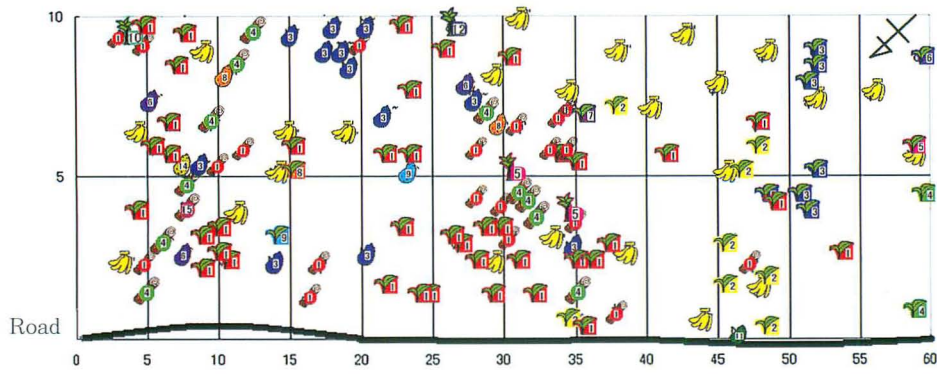


Fig. 3. A horizontal distribution of low storey plants in a Jami

Table 2. A full list of up storey plant species appeared in surveyed Jami

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	sengon	<i>Paraserianthes falcataria</i>	timber	sale	cultivated	29
2	pisang	<i>Musa sp.</i>	food	sale	cultivated	28
3	kacapi	<i>Sandoricum koetjape</i>	Fruits	sale, subsistence	cultivated	16
4	mahoni	<i>Swietenia mahagoni</i>	timber	sale	cultivated	14
5	berenuk	<i>Crescentia cujete</i>	ritual	subsistence	cultivated	3
6	pisitan (=kokosan)	<i>Lansium dubium</i>	Fruits	sale, subsistence	cultivated	3
7	duren (=kadu)	<i>Durio zibethinus Murr.</i>	Fruits	sale	cultivated	2
8	peuteuy	<i>Parkia speciosa</i>	Fruits	Subsistence; sale	Cultivated	2
9	dukuh	<i>Lansium domesticum</i>	Fruits	Subsistence; sale	Cultivated	1
10	gedang (=pepaya)	<i>Carica papaya L.</i>	food	sale	Cultivated	1
11	kaweni	<i>Mangifera odorata</i>	Fruits	subsistence	Cultivated	1
12	cangkudu	<i>Morinda citrifolia</i>	medicine	subsistence	Cultivated	1
13	Ki hiang	<i>Adenanthera pavonina</i>	timber	subsistence	cultivated,wild	1
14	nangka	<i>Artocarpus heterophyllus Lam.</i>	Fruits	subsistence	cultivated	1
15	reungrang	<i>Eugenia sp.</i>	timber	subsistence	wild	1

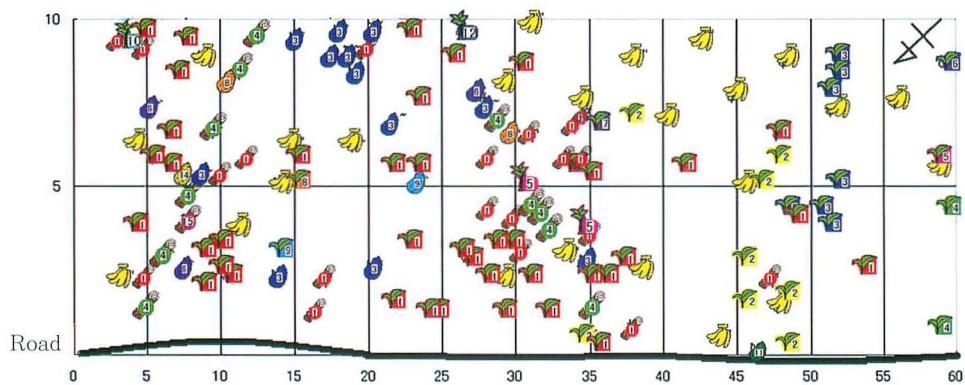


Fig. 4. A horizontal distribution of low storey plants in a Jami

Table 3. A list of useful herbaceous plants found in surveyed plots

	Local Name	Scientific Name	Uses	Function	Regeneration	Ke	Kp	Ja	Rm
1	rane	<i>Selaginella plana</i>	Food	Subsistence	Wild	1		1	1
2	koneng	<i>Curcuma domestica</i>	Food	Subsistence	Cultivated	1	1	1	1
3	kunci	<i>Curcuma aurantiaca</i>	Food	Subsistence	Wild		1		
4	walang	<i>Eryngium foetidum</i>	Ritual	Subsistence	Wild		1		1
5	jukut bau	<i>Ageratum conyzoides</i>	Ritual	Subsistence	Wild		1	1	1
6	capit heur	<i>Mikania scandens</i>	Medicine	Subsistence	Wild	1	1	1	1
7	tumbusi	<i>Phyllanthus niruri</i>	Ritual	Subsistence	Wild	1	1	1	1
8	hiris	<i>Cajanus cajan</i>	Food	Subsistence	Cultivated			1	
9	Sampeu	<i>Manihot esculenta</i>	Food	Subsistence	Cultivated	1			
10	pakis pakujarang	<i>Dicranopteris linearis</i>	Ritual	Subsistence	Wild				1
11	ki hura	<i>Caryota mitis</i>	Ritual	Subsistence	Wild	1			1
12	kumbili	<i>Coleus tuberosus</i>	Food	Subsistence	Cultivated			1	
13	Ileus	<i>Amorphophallus sp.</i>	Medicine	Subsistence	Wild		1		1
14	hui	<i>Ipomoea sp.</i>	Food	Subsistence	Cultivated		1		
15	talas	<i>Colocasia esculenta</i>	Food	Subsistence	Cultivated			1	
16	jahe	<i>Zingiber inflexum</i>	Food	Subsistence	Cultivated		1		
17	lampuyang	<i>Zingiber sp.</i>	Medicine	Subsistence	Wild			1	
18	ganyong	<i>Canna edulis</i>	Food	Subsistence	Cultivated	1			
19	takokak	<i>Solanum torvum</i>	Food	Subsistence	Cultivated				1
20	hanjuang	<i>Cordyline fruticosa</i>	Others	Subsistence	Cultivated	1			
21	eurih	<i>Imperata cylindrica</i>	Medicine	Subsistence	Wild	1	1	1	
22	antan	<i>Centella asiatica</i>	Food	Subsistence	Wild			1	1
23	cabe	<i>Capsicum annum</i>	Food	Subsistence	Cultivated			1	
24	talas deli	<i>Alocasia macrorrhiza</i>	Food	Subsistence	Cultivated	1	1		
25	terong	<i>Solanum melongena</i> LINN.	Food	Subsistence	Cultivated			1	
26	laja	<i>Alpinia galanga</i>	Food	Subsistence	Cultivated	1		1	
27	harendong	<i>Melastoma malabaricum</i>	Food	Subsistence	Wild	1		1	
28	ceronme	<i>Oxalis barrelieri</i> L.	Food	Subsistence	Wild		1	1	1
29	cikur	<i>Kaempferia galanga</i>	Food	Subsistence	Cultivated, Wild		1	1	
30	ki ayang	<i>Eupatorium odoratum</i> L.	Medicine	Subsistence	Wild	1	1	1	1
31	mayasih	<i>Gynura crepidioides</i>	Food	Subsistence	Wild		1	1	
32	cacang kiran	<i>Urena lobata</i>	Medicine	Subsistence	Wild		1		
33	pakis bagedor	<i>Histiopteris incisa</i>	Ritual	Subsistence	Wild	1	1		1
Total						14	17	19	14

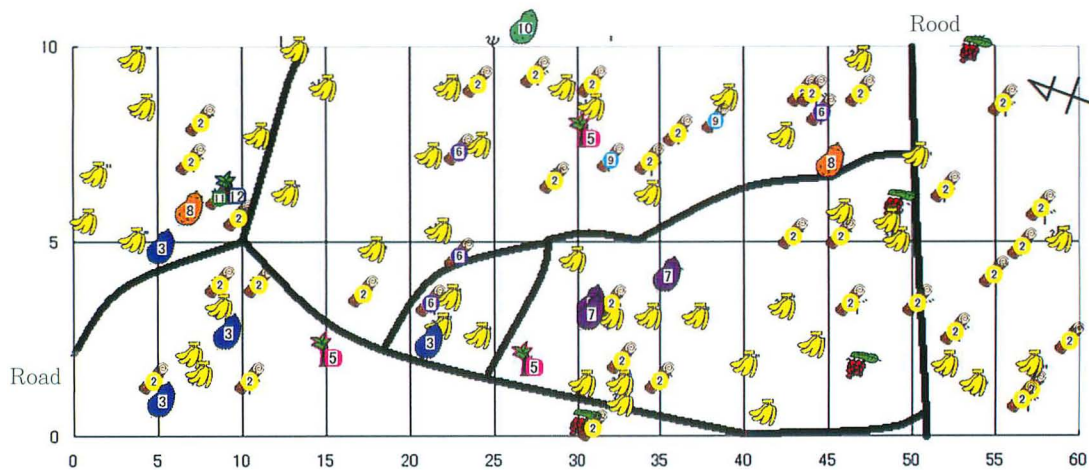


Fig. 5. A horizontal distribution of low storey plants in a Reuma

Table 4. A full list of up storey plant species appeared in surveyed Reuma

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	sengon	<i>Paraserianthes falcataria</i>	timber	sale	cultivated	65
2	mahoni	<i>Swietenia mahagoni</i>	timber	sale	cultivated	10
3	randu	<i>Ceiba pentandra</i>	timber, others	sale, subsistence	cultivated	2
4	asam	<i>Tamarindus indica L.</i>	fruits	subsistence	cultivated, wild	1
5	peuteuy	<i>Parkia speciosa</i>	fruits	sale, subsistence	cultivated	1

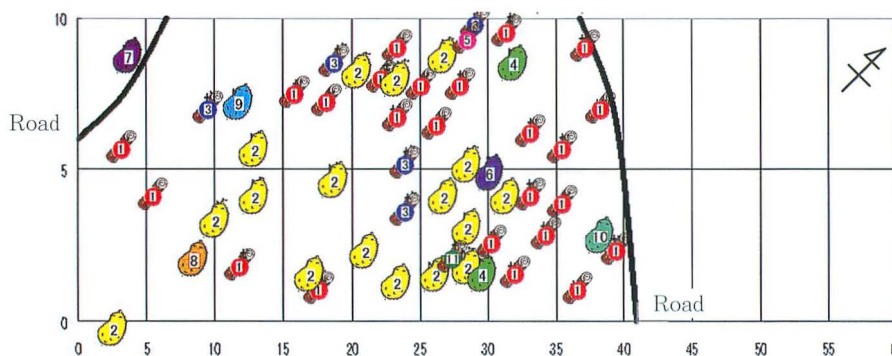


Fig. 6. A horizontal distribution of up storey plants in a Kebon

Table 5. A full list of low storey plant species appeared in surveyed Reuma

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	pisang	<i>Musa sp.</i>	food	sale	cultivated	49
2	mahoni	<i>Swietenia mahagoni</i>	timber	sale	cultivated	36
3	duren(=kadu)	<i>Durio zibethinus Murr.</i>	Fruits	sale	cultivated	4
4	kopi	<i>Coffea sp.</i>	food	sale	cultivated	4
5	randu	<i>Ceiba pentandra</i>	timber, others	sale, subsistence	cultivated	4
6	gedang(=pepaya)	<i>Carica papaya L.</i>	food	sale	Cultivated	3
7	pisitan(=kokosan)	<i>Lansium dubium</i>	Fruits	sale, subsistence	cultivated	3
8	aren(kawung)	<i>Arenga pinnata</i>	Fruits	sale, subsistence	cultivated	2
9	sengon	<i>Paraserianthes falcataria</i>	timber	sale	cultivated	2
10	asam	<i>Tamarindus indica L.</i>	fruits	subsistence	cultivated, wild	1
11	cangcaratan	<i>Nauclea obtusa</i>	timber	subsistence	cultivated	1
12	sulangkar	<i>Leea indica</i>	ritual	subsistence	cultivated	1

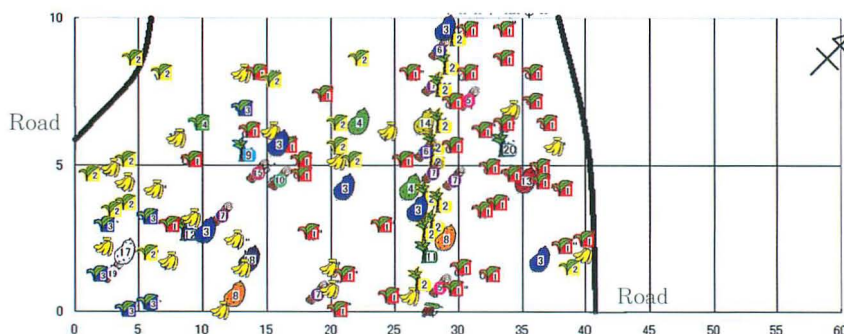


Fig. 7. A horizontal distribution of low storey plants in a Kebon

Table 6. A full list of up storey plant species appeared in surveyed Kebon

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	sengon	<i>Paraserianthes falcataria</i>	Timber	Sale	Cultivated	26
2	kacapi	<i>Sandoricum koetjape</i>	Fruits	Subsistence; sale	Cultivated	18
3	tisuk	<i>Hibiscus macrophyllus</i>	Timber	Subsistence	Cultivated	5
4	tangkil	<i>Gnetum gnemon</i> LINN.	Fruits	Subsistence	Cultivated	2
5	afrika	<i>Maesopsis eminii</i>	Timber	Subsistence	Cultivated	1
6	duren (=kadu)	<i>Durio zibethinus</i> Murr.	Fruits	Sale	Cultivated	1
7	kaweni	<i>Mangifera odorata</i>	Fruits	Subsistence	Cultivated	1

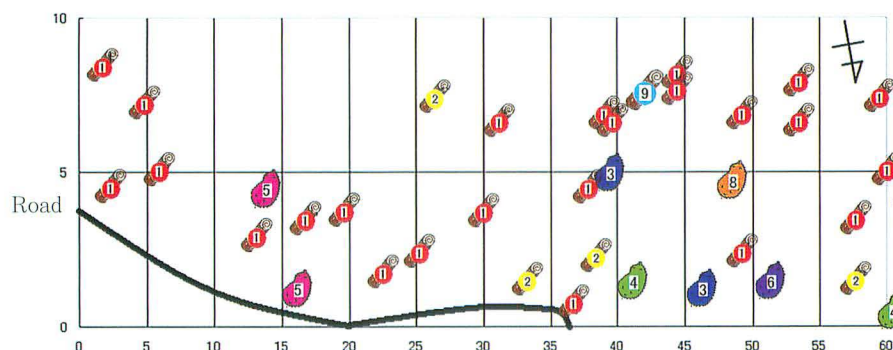


Fig. 8 A horizontal distribution of up storey plants in a Kebon Kopi

Table 7. A full list of low storey plant species appeared in surveyed Kebon

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	pisang	<i>Musa sp.</i>	food	Sale	cultivated	24
2	hangjuang	<i>Cordyline fruticosa</i>	Others	Subsistence	cultivated	14
3	duren (=kadu)	<i>Durio zibethinus</i> Murr.	fruits	Sale	cultivated	7
4	kacapi	<i>Sandoricum koetjape</i>	fruits	Sale, subsistence	cultivated	5
5	lame	<i>Alstonia scholaris</i>	timber	Sale	cultivated	5
6	mahoni	<i>Swietenia mahagoni</i>	timber	sale	cultivated	5
7	tisuk	<i>Hibiscus macrophyllus</i>	timber	Subsistence	cultivated	5
8	Aren (=kawung)	<i>Arenga pinnata</i>	fruits	Sale, subsistence	cultivated	4
9	ki sereuh	<i>Zizyphus mauritiana</i>	medicine	Subsistence	Wild	2
10	mara	<i>Macaranga rhizinoides</i>	timber	Subsistence	cultivated	2
11	berenuk	<i>Crescentia cujete</i>	Rituals	Subsistence	cultivated	1
12	cangkudu	<i>Morinda citrifolia</i>	medicine	Subsistence	cultivated	1
13	dukuh	<i>Lansium domesticum</i>	fruits	Sale, subsistence	cultivated	1
14	kelapa	<i>Cocos nucifera</i>	fruits, timber	Sale, subsistence	cultivated	1
15	cangcaratan	<i>Nauclea obtusa</i>	timber	Subsistence	cultivated	1
16	kopi	<i>Coffea sp.</i>	food	Sale	cultivated	1
17	nangka	<i>Artocarpus heterophyllus</i> Lam.	fruits	Subsistence	cultivated	1
18	nangka walanda	<i>Annona muricata</i> L.	fruits	Subsistence	cultivated	1
19	sengon	<i>Paraserianthes falcataria</i>	timber	Sale	cultivated	1
20	kareumbi	<i>Homalanthus populneus</i>	Rituals	Subsistence	Wild	1



Fig. 8 A horizontal distribution of up storey plants in a Kebon Kopi

Table 8. A full list of up storey plant species appeared in surveyed Kebon kopi

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	sengon	<i>Paraserianthes falcataria</i>	timber	sale	cultivated	25
2	mara	<i>Macaranga rhizinoides</i>	timber	subsistence	cultivated	4
3	kelapa	<i>Cocos nucifera</i>	fruits, timber	sale, subsistence	cultivated	2
4	peuteuy	<i>Parkia speciosa</i>	fruits	sale, subsistence	cultivated	2
5	Pisitan (=kokosan)	<i>Lansium dubium</i>	fruits	sale, subsistence	cultivated	2
6	aren (=kawung)	<i>Arenga pinnata</i>	fruits	sale, subsistence	cultivated	1
7	sulangkar	<i>Leea indica</i>	rituals	subsistence	cultivated	1
8	Duren (=kadu)	<i>Durio zibethinus Murr.</i>	fruits	sale	cultivated	1
9	laban	<i>Vitex pubescens</i>	timber	subsistence	cultivated	1

Table 9. A full list of low storey plant species appeared in surveyed Kebon Kopi

Rank	Local name	Scientific name	Uses	Purposes	Regeneration	No.
1	kopi	<i>Coffea sp.</i>	food	sale	cultivated	97
2	pisang	<i>Musa sp.</i>	food	sale	cultivated	23
3	sengon	<i>Paraserianthes falcataria</i>	timber	sale	cultivated	3
4	Ki hiang	<i>Adenanthera pavonina</i>	timber	subsistence	cultivated & wild	2
5	mara	<i>Macaranga rhizinoides</i>	timber	subsistence	cultivated	2
6	pisitan (=kokosan)	<i>Lansium dubium</i>	fruits	sale, subsistence	cultivated	2
7	bintenu	<i>Melochia umbellata</i>	ritual	subsistence	wild	1
8	duren (=kadu)	<i>Durio zibethinus Murr.</i>	fruits	sale	cultivated	1

(Table 8). *Paraserianthes falcataria* was the major species, and accounted for 25 trees. All these 9 species were majorly used as self-sufficient timbers.

Table 9 shows that the majority of low storey were coffee sp., and accounted for the number of 97. *Musa sp.* ranked second, and accounted for 23 (also see Fig. 9). About 6 species followed them. They were *Paraserianthes falcataria*, *Adenanthera pavonina*, *Macaranga cf.*

rhizinoides, *Lansium dubium*, *Melochia umbellata*, and *Durio zibethinus Murr.* Compared with *Kebon*, trees planted in a *Kebon Kopi* had few species.

Concerning the herbaceous plants in *Kebon kopi*, we found 17 species (Table 3). Eight species of *Curcuma domestica*, *Curcuma aurantiaca*, *Ipomoea sp.*, *Zingiber inflexum*, *Alocasia macrorrhiza*, *Oxalis barrelieri L.*, *Gynura crepidioides*, and *Kaempferia galanga* were

Table 10. A full list of tree species and tree numbers in up and low storey

No.	Local name	Scientific name	use*	purpose	Regeneration	Ke	Kp	Ja	Rm	Total
1	segon	<i>Paraserianthes falcataria</i>	timber	sale	cultivated	27	28	36	67	158
2	mahoni	<i>Swietenia mahagoni</i>	timber	sale	cultivated	5		14	46	65
3	kacapi	<i>Sandoricum koetjape</i>	fruit	subsistence, sale	cultivated	22		16		38
4	duren (=kadu)	<i>Durio zibethinus Murr.</i>	fruit	sale	cultivated	7	2	2	4	15
5	tisuk	<i>Hibiscus macrophyllus</i>	timber	subsistence	cultivated	10		5		15
6	pisitan (=kokosan)	<i>Lansium dubium</i>	fruit	sale, subsistence	cultivated		4	3	3	10
7	mara	<i>Macaranga rhizinoides</i>	timber	subsistence	cultivated	2	6			8
8	aren (kawung)	<i>Arenga pinnata</i>	fruit	sale, subsistence	cultivated	4	1		2	7
9	randu	<i>Ceiba pentandra</i>	timber, others	sale, subsistence	cultivated				6	6
10	peuteuy	<i>Parkia speciosa</i>	fruit	sale, subsistence	cultivated	1	2	2	1	6
11	lame	<i>Alstonia scholaris</i>	timber	sale	cultivated	5				5
12	angka	<i>Artocarpus heterophyllus Lam.</i>	fruit	subsistence	cultivated	2		2		4
13	kelapa	<i>Cocos nucifera</i>	fruit, timber	sale, subsistence	cultivated	1	2			3
14	ki hiang	<i>Adenanthera pavonina</i>	timber	subsistence	cultivated, wild		2	1		3
15	acasia	<i>Acacia mangium</i>	timber	sale, subsistence	cultivated			2		2
16	cangcaratan	<i>Nauclea obtusa</i>	timber	subsistence	cultivated	1			1	2
17	tangkil	<i>Gnetum gnemon LINN.</i>	fruit	subsistence	cultivated	2				2
18	asam	<i>Tamarindus indica L.</i>	fruit	subsistence	cultivated, wild				2	2
19	kaweni	<i>Mangifera odorata</i>	fruit	subsistence	cultivated	1		1		2
20	afrika	<i>Maesopsis eminii</i>	timber	subsistence	cultivated	1		1		2
21	dukuh	<i>Lansium domesticum</i>	fruit	sale, subsistence	cultivated	1		1		2
22	waru	<i>Macaranga tanarius</i>	timber	subsistence	cultivated	1				1
23	kedondong	<i>Spondias dulcis</i>	fruit	subsistence	cultivated	1				1
24	angka walanda	<i>Annona muricata L.</i>	fruit	subsistence	cultivated	1				1
25	bingglu	<i>Mangifera caesia</i>	fruit	subsistence	cultivated, wild			1		1
26	reungrang	<i>Eugenia sp.</i>	timber	subsistence	wild			1		1
27	laban	<i>Vitex pubescens</i>	timber	subsistence	cultivated		1			1
total						19	9	15	9	415

Table 11. Uses of Herbaceous Plants as medicine and rituals

Species	Family	Local Name	Usage
<i>Leea indica</i>	<i>Leeaceae</i>	sulangkar	Traditional medicine for headache, leaf is extracted and drunken
<i>Melochia umbellata</i>	<i>Malvaceae</i>	bintinu	Traditional medicine for broken bone (leg or hand), fresh bark is covered on the broken hand
<i>Crescentia cujete</i>	<i>Bignoniaceae</i>	berenuk	Traditional and natural poison for curing plant diseases, fruit is extracted and add some water, than sprayed to agriculture crops (see Ngirap Sawan in my paper)
<i>Omalanthus populneus</i> or <i>Homalanthus populneus</i>	<i>Euphorbiaceae</i>	karembi or kareumbi	Traditional/natural dye for cloth (colour is black), leaf and fruit is extracted.

used as food. Five species of *Mikania scandens*, *Amorphophallus* sp., *Imperata cylindrical*, *Eupatorium odoratum* L., and *Urena lobata* were used as medicine. Three species of *Eryngium foetidum*, *Phyllanthus niruri*, and *Histiopteris incisa* were used in the ritual.

5. Discussions

5.1 A Biological richness with a majority of high commercial plants

Traditional agroforests in Baduy present a multi-layered forest with rich varieties of useful trees and crops. In the surveyed plots, we found a total number of species accounting for 27 in the up storey and the low storey. Tree composition suggests a high diversity of tree species in Baduy agroforest. It is worth noting that a majority of timber trees in the up storey and fruit trees in low storey. The plants taller than 4m majorly compose of timber and fruits. While, the plants lower than 4m majorly compose of seedling of wood and fruit trees, and herbaceous plants, banana plants, and Noni trees.

It might suggest a tendency that the major purpose of agroforest is to produce for cash income. The poor people often planted trees to meet contingencies and as a part of deliberate long-term strategies for saving and security (Chambers & Leach 1987; Ichwandi 2008).

Paraserianthes falcataria (Albizia), and *Swietenia mahogani* (Mahogany) are two most important species planted in the Baduy agroforests. A total number of 158 Albizia were found in up storey and low storey of the four surveyed plots. The total number of Mahogany was 65. Recent years, it sees an increasing trend of Albizia plantation, and a shrink of Mahogany because of marketing.

Albizia and Mahogany are two most important timber trees in Indonesia. Albizia is a multipurpose tree, used for a number of products and services. Products from the species are fodder, fuel, fiber and timber. Cattle can feed on the leaves. The wood is used for fuel and charcoal and for pulp production. It is suitable for light construction, handy crafts, cigar boxes, veneer, matches, musical instruments, particleboards and cabinets. Services provided from the species are erosion control, shade crop (e.g. coffee, cocoa, tea), reclamation of mining land, nitrogen fixing, soil improvement, and as an ornamental tree (Budelman 1989).

Albizia was at first planted mainly in areas adjacent the Baduy enclave during the 1980s to replace clove, following the collapse of the clove market. By 1985, *Pu'un* (a hereditary spiritual leader, the highest community

leader, who is considered as sacred) allowed the Baduy to plant Albizia. The species was selected because it is fast growing, nitrogen-fixing, easily cultivated, provides for various household needs (such as firewood and building materials), as well as yielding a cash income (Soerianegara & Lemmens, 1994).

Mahogany trees (*Swietenia macrophylla* & *Swietenia mahogani*) originate in the Neotropics, but, like Teak, have been cultivated in Central Java for hundreds of years. They are part of a highly complex community agro-forestry ecosystem that dominates the Central Java landscape. The commercial importance of this species is insignificant as available quantities are small (Ichwandi 2008).

Leguminous plants have been chosen to improve soil. Agroforest in Baduy consist of a high biodiversity and a sustainable land management. However, agroforest becomes market orientated, planting with trees of high commercial value, such as Albizia and Mahogany.

5.2 Preservation of social and cultural tradition

Religious ritual and ceremonies consist of a dispensable part of Baduy indigenous people. A recent research (Iskandar & Ellen 2000) also mentioned that the contribution of Albizia to conservation of swidden farming, which is considered by the Baduy to be central identity.

A total amount of 33 species of useful herbaceous plants, wild or cultivated were found in the surveyed plots (see table 3). Besides the introduction and cultivation of cash crops and timbers (e.g. Albizia), traditional culture and religious activities have been well preserved through indigenous agroforestry practice.

5.3 An environment-friendly way of forest management

Based on traditional beliefs, chemical fertilizers or pesticide are not allowed to be used in Baduy communities. Agroforest is structurally similar to the tropical forest ecosystem (Michon et. al 1983). Different from the modern high-yielding technological agrosystems, forest seems less cared and controlled in a traditional Baduy agroforest. Figs. 2, 4, 6, and 8 show the horizontal distribution of up-storey trees or crops in surveyed plots. From the figures, it is hard to read the regulation of planting distance. It is clear that agroforests in Baduy were less managed, and thus less labor intensive.

6. Conclusion

Agroforest in Baduy is structurally similar to natural tropical forest. In the long history, people have modified the natural forest to meet various needs for timber, food, and medicine. The nutritional and material uses are essential to support people's life. Agroforest is multilayered with rich species of trees and herbaceous plants. Different types of agroforest, *Jami*, *Reuma*, and *Kebon* present a different stage of forest cycling succession.

Modern technical management is little found in a Baduy agroforest. Up storey trees were more planted in a casual way than planned in regular space. According to their norms and traditions, chemical fertilizers or pesticides are not allowed to be used. A rich species diminish the risk of exposure to pest attacks. Leguminous plants such as *Albizia* were introduced to improve the soil quality. With the indigenous knowledge developed in a long history, agroforest practice achieves a sustainable development and the ecological goals.

A new trend of market orientation production was found in Baduy. Baduy produced timber and fruits for cash income. *Albizia*, Mahogany, banana, coffee, and durian are most important to earn income. A traditional subsistence function of agroforest has modified to be more economic function for sale purpose.

Besides economic purpose, agroforest has played an important role of preserving the traditional culture and religions. Different from natural forest, grass and seedlings less than 1 m in the low storey were almost completely modified by people. Seedling and useless grass were removed. While, useful plants were kept or cultivated for diverse purposes, food, medicine, religious rituals. It is worth noting that agroforest has played a vital role in indigenous culture preservation.

Agroforest in Baduy has been developed and modified from the natural tropical forest in the long history. Agroforestry by indigenous knowledge embodies ecological significance and sustainable management. It also presents a well preservation of local culture and religion and turns to produce for the market besides traditional self-subsistence production.

References

Budelman, A. 1989. *Paraserianthes falcataria* - Southeast Asia's Growth Champion, *NFT Highlights*. Retrieved October 4th, 2009, from http://www.winrock.org/fnrm/factnet/factpub/FACTSH/P_falcataria_bckup.html

- Chambers, R. and Leach, M., 1987, Trees to meet contingencies: savings and security for the rural poor. Discussion Paper 228, IDS, University of Sussex.
- Chernara, J.M. 1989. Managing rivers of hunger: the Tukano of Brazil. *Advances in Economics Botany*, 7: 238-248.
- Dinas Sosial. 1999. Informasi pembinaan kesejahteraan sosial masyarakat Baduy di Kabupaten Lebak. Cabang Dinas Sosial Propinsi Dati I Jawa Barat. Kabupaten Lebak.
- Huxley, P. 1999. Tropical agroforestry. *Blackwell Science Ltd*, Massachusetts.
- Ichwandu, I. 2008. A Study on the Characteristics of Forestry Development in Java, Indonesia. Unpublished doctoral dissertation, Kagoshima University, Japan.
- Iskandar, J. and Ellen, R.F. 2000. The contribution of *Paraserianthes (Albizia) falcataria* to sustainable swidden management practices among the Baduy of West Java. *Human Ecology*, 28: 1-17.
- Michon, G., Botaniq, J., Hechetsweiler, P., and Ducatillon, C. 1983. Tropical forest architectural analysis as applied to agroforests in the humid tropics: the example of traditional village-agroforests in West Java. *Agroforestry Systems*, Vol.1 No. 2, p 117-129.
- Moniaga, S. 1993. Toward community-base forestry and recognition of adat property right in the outer island of Indonesia. In: *Legal Framework for forest management in Asia: Case studies of community-state relation* (ed. Fox, J.). Honolulu Environmental and Policy Institute, East-west center, Hawaii.
- Soerianegara, K., and Lemmens, R. H. M. J. (Eds.), 1994. *Timber trees: Major commercial timbers, Plant resources of South East Asia* (Prosea), Bogor. 5(1): 319-325.
- Westoby, J. 1989. *Introduction to world forestry*. Basil Blackwell Ltd, New York.
- Wiersum, K.F., 1982. Tree gardening and taugya on Java: Examples of agroforestry techniques in the humid tropics. *Agroforestry systems* 1:53-70.

インドネシアにおける伝統的アグロフォレストリーに関する調査研究 — Banten州 Baduy 共同体を事例として —

概要：

アグロフォレストリーは林業と農業を組み合わせることで、自然環境を保全しながら、多様な食料を持続的に生産し、地域住民の生活の安定に寄与できる手段として、近年、熱帯地域で注目されている。

本研究は、これまであまりよく知られていない Baduy 共同体の伝統的なアグロフォレストリーの実態について、土地利用形態、植物の空間利用、栽培植物の分布、森林利用などの面から検討したものである。

Baduy 共同体の土地利用には Kebon 型と Huma-Jami-Reuma 型の 2 つがある。Kebon 型には、焼畑はなく、上層でフルーツや用材林を育成し、下層で有用草本（食用、薬用、祭祀）を栽培する。ここでは持続的に有用植物が収穫できる。Huma-Jami-Reuma 型は焼畑移動耕作の各時期の名称である。Huma は焼畑後、主に陸稲を植える 1 年間のこと。Jami は陸稲収穫後、野菜を栽培すること。Reuma は二次林化した状態のこと。ここではフルーツや野生植物を採取する。そのサイクルは約 8 年である。Jami では下層での有用草本の植栽が多い。そこでの土壌は下層植生や前作陸稲の枯れ草で保全されていた。Reuma では上層はモルッカネムと果樹、中層にバナナとノニ、下層は野菜と野生有用種で構成され、植生は下層から上層へと段階的に更新される仕組みになっていた。このシステムが植生の多層構造を維持している。

Baduy 共同体の伝統的なアグロフォレストリーは、それぞれの土地利用タイプが組み合わさって、土地の生態的循環利用を完結させており、そのことが土壌保全と持続的な農林業の多様な生産につながっていると考えられる。

キーワード：アグリフォリスト、土地利用、熱帯先住民、
森林利用