19. Socioeconomic Baseline Studies: Agroforestry and Sustainable Vegetables Production in Southeast Asian Watershed Case Study, Nanggung Subdistrict, Bogor, Indonesia

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Abstract

This report provides basic socioeconomic data on the study site, namely Kecamatan Nanggung, a subdistrict located in the western part of West Java Province. The study employed a combination of Rapid Rural Appraisal (RRA) technique (to gather data/information at the village level within the subdistrict) and a household survey (to gather data/information at the household level, emphasizing the livelihood and agricultural practices of the respondents). The study site is accessible to two progressive urban centers (Bogor and Jakarta), rich in natural resources (forest and minerals) and has an ideal climate for agriculture. However, most farmers had limited access to professional technical assistance and poor market linkage, particularly with the more progressive urban and regional markets nearby. At the household level, the study reveals that the problems were not merely access to land or landholding size, but also the low level education of most farmers (87.6% never went beyond the elementary level). Based on the average per capita income of the surveyed households in three sample villages, about half (52%) of the surveyed households were living below the poverty line and thus are categorized as poor. Among the sample villages, Hambaro was the poorest, with about 67.7% of its population living below the poverty line.

Keywords: Baseline, vegetable, agroforestry, socioeconomics, Nanggung

1. Introduction

This report is a farm/household level assessment focusing on vegetable farms and household budget analyses, part of the SANREM CRSP program 'Agroforestry and Sustainable Vegetable Production in Southeast Asia Watersheds' in Indonesia implemented by World Agroforestry Centre – ICRAF Southeast Asia and Bogor Agricultural University. It provides an analytical basis for socioeconomic impact assessment of integrated vegetable-

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agroforestry systems. The basic socioeconomic data collected consisted of demographic data, farm characteristics, household income and expenditure, gender roles, and labor availability. The data generated by this study will be used for the economic analysis of vegetable farming, specifically: (a) analysis of the current demographic data of farmers, and (b) analysis of the current vegetable farming practices in terms of social and economic sectors of society.

The study was conducted in Kecamatan Nanggung, a subdistrict located in the western part of West Java Province. Kecamatan Nanggung, endowed with relatively good accessibility to two progressive urban centers of Bogor and Jakarta, is rich in natural resources of forest and minerals and has an ideal climate for agricultural development. Those features hold advantages to support market-based agricultural commodities development through vegetables and agroforestry innovation. Farmers in this subdistrict are primarily smallholders on or below the poverty line with access to less than one hectare (ha) of land. They have limited access to professional technical assistance and poor market linkage, particularly to the more lucrative urban and regional markets in Bogor and Jakarta.

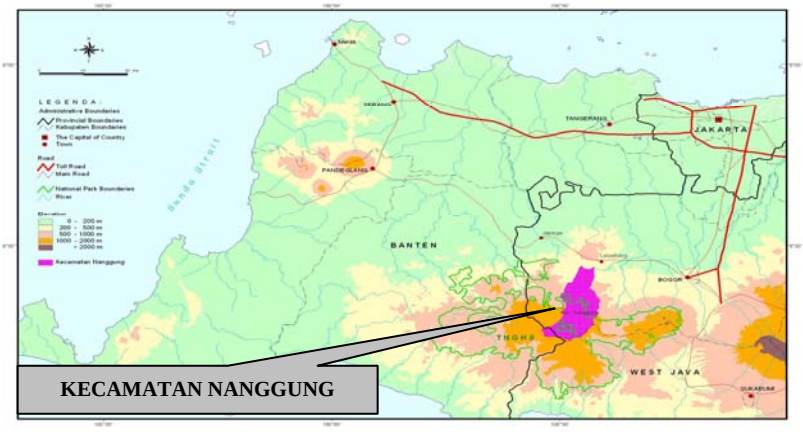

Figure 1. The study site

2. Method

The hypothesis of the study is that the socioeconomic characteristics of farmers' household influence the type of their vegetable farm system and its economic productivity. The data collected by this survey therefore was comprised of three interrelated aspects:

1. Socioeconomic aspects, such as demographic, education, employment, landholdings, income and expenditure;

2. Vegetable farming, agricultural activities and system of production; and

3. Market aspects that focused on marketing practices of agricultural and farm production.

A sample household survey technique was selected to accomplish the study and was carried out in June-July 2006. The survey was conducted in three sample villages (out of ten villages) that were purposively selected according to their potential for vegetable production, their physical characteristics and demography. Table 1 presents the three sample villages and their key characteristics.

Table 1. Characteristics of three sample villages

Attributes	Hambaro	Parakan Muncang	Sukaluyu	Kecamatan Nanggung
Physical characteristics				
1. Altitude *(m above sea level*)	400-700	300-400	300-700	200-1,800
2. Area *(ha)*				
~ Total area	355.78	605.2	207.3	10,999.10
~ Agricultural land *(Excluding national park)*	270	516.8	142.75	7,022.60
~ Paddy fields	225	268.8	7.75	1,740.70
~ *Ladang*/*Kebun*	45	248	87	1,836.50
Demography				
~ Population *(person)*	6,044	10,722	4,530	75,109
~ Number of households *(hh)*	1,268	1,536	1,047	19,321
~ Population density *(ps km^{-1})*	1,699	1,772	2,185	683
~ Agriculture density *(ps ha^{-1})*	22	21	32	11
Accessibility *(km)*				
~ Distance to Nanggung Market	6.5	2	6	
~ Distance to Leuwiliang Market	12	10	11	
~ Distance to national park	23-24	18-19	22-23	
~ Distance to State Forest Company (SFC) land	2-3	8-9	1-2	
~ Distance to gold mining	11-12	11-12	10-11	

Source: Survey data

A total of 185 households were selected in the three sample villages. Within each household, the head of household - defined as an adult with significant decision-making authority in financial matters of the households - was interviewed. Multistage Purposive sampling technique was applied in this survey, with the intended target population being farmers who controlled

Table 2. Population and Sample Size.

	Hambaro			Parakan Muncang			Sukaluyu			Total		
1. Inhabitants of Village	1.257			1.880			1.165			4.302		
2. Population of the Study (Households controlling land)	577			1.545			818			2.940		
3. Sample by Land Size (m^2)	n Pop	n samples	(% of Pop)	n Pop	n samples	(% of Pop)	n Pop	n samples	(% of Pop)	n Pop	n samples	(% of Pop)
5 – 100	194	20	(3.5)	670	26	(1.7)	128	10	(1.2)	992	56	(1.9)
101 – 1000	267	28	(4.8)	620	24	(1.6)	169	12	(1.5)	1056	64	(2.2)
1001 – 2000	72	7	(1.2)	149	6	(0.4)	140	10	(1.2)	361	23	(0.8)
2001 – 4000	28	3	(0.5)	71	3	(0.2)	152	11	(1.3)	251	17	(0.6)
4001 – 6000	9	2	(0.3)	13	2	(0.1)	102	8	(1.0)	124	12	(0.4)
> 6000	7	2	(0.3)	22	2	(0.1)	127	9	(1.1)	156	13	(0.4)
Total (households)	577	62	(10.7)	1545	63	(4.1)	818	60	(7.3)	2940	185	(6.3)

Source: Survey data

[1] RRA consist of short. intensive and informal field surveys that focuses on people own views of their problem (Khon Kaen University 1987; Chambers *et al.* 1989). Generally. the method involves open-ended exploration of important issues and more focused understanding on important themes from key informants' perspectives. Two data collection techniques wereapplied i.e.. field observation and in-depth interview with key informants using semi structured interview guide.

land and practiced vegetable farming. A household census was done in the three villages: of the 4,302 households, 2,940 of them controlled land. The household samples were selected in accordance with landholding size. The population was divided into six subpopulations (strata) based on landholding size. Proportionally with the population percentage, household samples were randomly selected from each stratum. Only household heads with vegetable farming practice experience were selected as sample respondents.

It needs to be noted that prior to the survey, a village level study was carried out that applied Rapid Rural Appraisal (RRA)[2] technique to gather data and information about Kecamatan Nanggung as basis for village selection (Budidarsono et al., 2006).

3. Findings

3.1 Physical characteristics

Kecamatan (subdistrict) Nanggung, located in the western part of West Java Province, is endowed with good accessibility to two progressive urban centers, about 100 km away from Jakarta and 45 km away from Bogor. The subdistrict covers a total area of 109.99 km^2, and spans from Bogor – Rangkasbitung intercity road in the North to the mountain ranges of Gunung Halimun National Park in the South (Fig. 2). Topographically the area constitutes uplands, characterized with gently undulating to steep landscape with the altitude ranging between 400 and 1,800 m above the sea level (m asl). Annual rainfall varies between 3,000 mm and 4,000 mm and the average annual temperature ranges between 22^{o}C and 34^{o}C.

The subdistrict included 7,022.3 (63.8%) ha of arable[3] land comprising of paddy fields (1,740.7 ha), ladang/kebun (upland fields and tree gardens) (1,836.5 ha), community forest (144 ha) and Perhutani/State Forest Corporation (SFC) land (2,050 ha). The remaining area consisted of housing, other infrastructure and land used for other purposes. Table A1 presents details of the land use. A closer look at Table A1, combined with information provided by kecamatan officers, enables us to assume that all paddy fields, ladang/kebun lands and community forests were privately owned. In total these privately held (farmer owned) lands comprised 3,721.3 ha (52.3%). The rest (47.7%) were officially under the management of SFC and other large-scale plantations.

[2]RRA consists of short, intensive and informal field surveys that focuses on people's own views of their problem (Khon Kaen University 1987; Chambers et al., 1989). Generally, the method involves open-ended exploration of important issues and more focused understanding of important themes from key informants' perspectives. Two data collection techniques were applied, i.e. field observation and in-depth interview with key informants using semi-structured interview guide.

[3]Land that is suitable for cultivation.

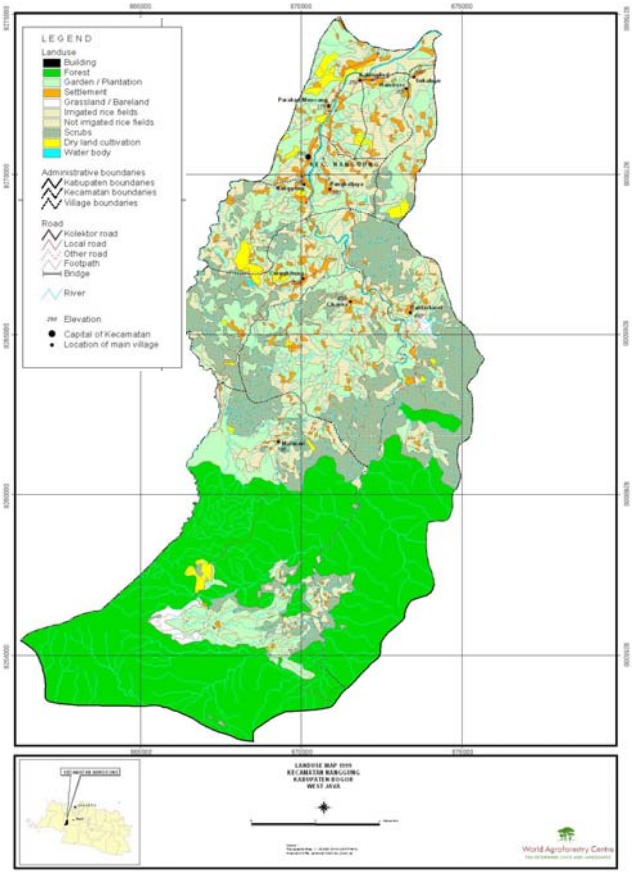

Figure 2. Map of the villages

However, information provided by farmers, government officials and observations showed that there were patches of government land that were cultivated by farmers.

3.2 Infrastructure and public utilities

Infrastructure such as transportation infrastructure, supply of domestic water and electricity, marketing facilities and telephone lines are essential for economic development as well as for the upliftment of the population. Table A2 (p. 293) provides an overview of physical infrastructure in the study area.

Transportation: The study site has 70 km of paved/asphalted road (with a road density of 636 m/km^2) categorized as all-weather roads that are passable by 4-wheeled vehicles, connecting most villages of Kecamatan Nanggung to

the provincial road network (Bogor – Rangkas Bitung). There are also graveled and dirt roads connecting all settlements in this study area to the main asphalted road network. The road density of the two types of roads are 1,004 m/km^2 and 1,058 m/km^2, respectively. Unpaved (dirt and gravel) roads may have limited accessibility for 4-wheeled vehicles, particularly during rainy periods. Reliable access to some of these unpaved roads may be restricted to 4-wheel-drive vehicles or motorcycles. The services of ojeg[4] (public transportation by motorcycles) are available to all villages. Four-wheeled public transport, largely restricted to the paved roads, is available daily, transporting people and goods from kecamatan's market centers in Curug Bitung and Nanggung to the nearest bigger market centre in Leuwiliang and vice versa.

Public utilities: Statistics of kecamatan Nanggung records 7,619 (43.4%) out of 19,321 households that have electricity (Kecamatan Nanggung, 2006). The rest use privately owned power generators or kerosene lamps.

Telephone lines: Regarding telephone lines, PT. Telkom serves seven out of ten villages of Kecamatan Nanggung. There are 1,010 households (5.2%) with private telephone lines the services of which are provided by four private enterprises (concessions).

Water services: Although clean water services are provided by the local government (PDAM) in the subdistrict, these are available to only a few (2%) households in two villages (Nanggung and Parakan Muncang). Most people in Kecamatan Nanggung get clean water for domestic use from springs or shallow wells.

3.3 Marketing facilities

Four markets service the subdistrict. Three markets are within the kecamatan boundary – the weekly Nanggung weekly market, the twice-a-week Curug Bitung market, and the daily Cibeber market. The largest readily accessible market is the daily market in the neighboring subdistrict of Leuwiliang.

3.4 Education

Based on the Kecamatan Nanggung Monthly Report (March 2006), there were 44 primary schools in 10 villages, with 157 teachers and 8,780 pupils, and a junior secondary school (SLTP) located in kecamatan centre with 15 teachers and 439 pupils. All primary and junior secondary schools are public schools. There is also a private senior secondary school, with 14 teachers and 78 pupils. The education situation of Kecamatan Nanggung will be discussed in further detail using demographic data of the surveyed households.

[4]a transportation mode using motorbike; cost per trip (service) depends on the distance and road condition.

4. Socioeconomic Characteristics

4.1 Economic activities

Agriculture is an economic mainstay of the Nanggung population. According to the Statistics of Kecamatan Nanggung, 63.4% of the working population (economically active population) were engaged in agriculture, higher than the national data (46.3%) (Budidarsono et al., 2006). Food production was the main focus of agriculture activity in this study site and paddy cultivation constituted an important farming activity in 'wetland', while maize, cassava, sweet potatoes and vegetables and dryland paddy were common on dry upland areas.

Wherever possible, farmers cultivated paddy continuously for their own consumption. Paddy rice was cultivated in floodplains and even in steep land that can be irrigated (by creeks or springs). All paddy rice areas were terraced. Food security was the main objective of rice cultivation. The paddy field in Nanggung covered an area of 1,741 ha (15.83%) plus some area within Perhutani land.

Two private plantations operated in the subdistrict: (1) a tea plantation (971 ha) in Malasari, purchased by PT. Sari Wangi in 2002 from the previous owner (PT Nirmala Agung); and (2) a rubber plantation run by PT Hevea Indonesia (94 ha). The rubber plantation was established in 1994 but stopped operating in 2000, some of the land in the rubber plantation was cultivated by local farmers.

Mineral extraction also existed in the study area, specifically sand, bentonite and gold mining. Sand mining was found in Sukaluyu and Kelong Liud, while bentonite mining was mainly in Curug Bitung and Cisarua, with the bentonite collector based in Curug Bitung. Although PT Aneka Tambang had exclusive legal rights to gold mining operations in the subdistrict, traditional household level gold extraction operations were common in the villages neighboring PT. Aneka Tambang operations. Traditional gold extraction operations were called 'gurandil' and considered illegal by government authorities. No official statistics exist regarding the number of gurandil. Gurandil enterprises claimed they legally scavenged for gold from the wastes of PT Aneka Tambang. This waste, primarily in the form of mud, was sold by the company for Rp90,000/50kg sack. However the company claimed that the till, which had not yet been processed for gold extraction, was often stolen from the concession area and sold for up to Rp200,000/50kg sack, with price depending on the quality of the till.

4.2 Demography

Statistics of Kecamatan Nanggung shows that total population as of March 2006 was 75,109 with a 104.1 sex ratio (104 males for every 100 females) in 19,321 households. Population growth over 3 years since 2003 was 0.40% per year; it was lower than that for West Java Province (2.20%) and even than the national growth (1.50%) (BPS, 2003). The population density of the area was 683 persons per sq km which was lower than that in West Java in 2003 (1,100/sq km). At the village level, population density varied from 155/sq km in Malasari (the uppermost village) to 2,347/sq km in Kalong Liud. Looking at the agricultural density (ratio between number of people to arable land), the figures indicated that agriculture intensification was necessary in many villages of Kecamatan Nanggung. Agricultural density of Kecamatan Nanggung was 11/sq km, while at the village level the ratio varied from 6/sq km (Malasari) to 33/sq km in Sukaluyu. Seven out of 10 villages were above the kecamatan average.

Regarding demographic characteristics of the household samples, the study considered three aspects: household size, age structure and labor force. These are summarized in Table 3. Total population of households surveyed was 960 persons. There was no significant difference in household size among the three sample villages, which ranged from 1 to 12 persons, and averaged 5.2 per household, which was higher than that in West Java Province (3.5) and even than the national data (3.8) (BPS, 2003). Further, of the sample households, Sukaluyu had the greatest percentage of households with a household size of at least 4 persons (48.3%), while in Hambaro and Parakan Muncang the percentages were 33.9% and 33.3% respectively. There were extended families among the households surveyed, with about five percent of the household samples extended family members.

Looking at the age structure, 66.1% of the family members of the household samples were of working age or part of the economically active population (15 to 65 years old), higher than that in West Java Province (60.6%) and even than the national data (65.7%) (BPS, 2003). Comparing the three villages, Parakan Muncang had the highest proportion of the working age population (72.3%); thus the dependency ratio[6] of the households in Parakan Muncang was the lowest. This indicates that the labor force[7] of Parakan Muncang was higher than in the two other villages.

[6]Ratio indicating the number of dependants family members (aged 0-14 and over the age of 65) to the total working age population (aged 15-64)

[7]The term 'labor force' in this study is identified as working age/economically active population, hence age group of 15-65 years old

Table 3. Family size, age structure and labor force by village

	Hambaro		Parakan Muncang		Sukaluyu		Total	
	n = 62		n = 63		n = 60		n = 185	
Family member								
1. Total household members (*persons*)	343		328		289		960	
2. Sex Ratio	111.73		105.00		97.95		105.13	
Male	181		168		143		492	
Female	162		160		146		468	
3. Household Size								
1 – 4	21	33.9%	21	33.3%	29	48.3%	71	38.4%
5 – 8	32	51.6%	40	63.5%	26	43.3%	98	53.0%
> 9	9	14.5%	2	3.2%	5	8.3%	16	8.6%
4. Range Household Size(*persons/household*)	2 – 11		1 – 12		2 - 10		1 - 12	
5. Average family size	5.5		5.2		4.8		5.2	
6. Nuclear Family Member	330	96.2%	311	94.8%	276	95.5%	917	95.5%
7. Extended Family Member	13	3.8%	17	5.2%	13	4.5%	43	4.5%
Age Structure								
< 15	121	35.3%	79	24.1%	97	33.6%	297	30.9%
15 – 65	216	63.0%	237	72.3%	182	63.0%	635	66.1%
> 65	6	1.7%	12	3.7%	10	3.5%	28	2.9%
Labor Force								
- Proportion of Labor Force	216	63.0%	237	72.3%	182	63.0%	635	66.1%
- Average labor force per household	3.5		3.8		2.9		3.4	
Dependency Ratio	58.8%		38.4%		58.8%		51.2%	

Source: Household survey data

In relation to the respondents' occupation (Table 4), most of the respondents were self employed as farmers, carpenters and traders/merchants or in home industries; very few were civil servants or worked for private companies. In general, most respondents (59.4%) were engaged in agriculture as their main occupation. Regarding other household family members surveyed only 7.1% considered farming as their main occupation. Overall, 17.1% of the surveyed population were engaged in agriculture as their main occupation.

About two-fifths of the respondents were engaged in other activities outside their farm for additional income. These income generating activities

were in addition to their main occupation. In Sukaluyu, half of the respondents considered farming as their side occupations and the dominant activities were farm laborer (17.8%) and trader/merchant (20.5%) (Table 4).

About 22.2% of the family members of working age had no occupation. There were no significant differences among the three sample villages in the proportion of the jobless family members, ranging between 16.2% and 29.8% which was much higher than that of West Java Province (12.3%) and even than the national data (9.5%) (BPS, 2003).

On educational attainment, statistics of Kecamatan Nanggung indicated low education level; only 16.5% of the population in the study area attained senior secondary education (SLTA/SMU/SMA). The household survey found that 5.9 % of the respondents were illiterate, lower than national data (9.07%), and most of the respondents (87.6%) never went beyond elementary level. Table 5 shows that among the family members, only 6.5% attained a higher level of education beyond elementary school, and primary school enrollment rate was also low.

4.3 Housing facilities

Table 6 indicates the physical attributes of the houses where the surveyed household settled, such as building materials, type of floor and roofing, floor space and water closet availability in each house. The larger part of the household samples were settled in reasonably appropriate houses for the rural environment. Most of the houses were made of concrete with appropriate flooring, some houses with ceramic tiles.

All the houses were roof-tiled. Average floor space of the houses was 57.1 m^2, varying between 12 m^2 and 168 m^2; average floor space per person was 11 m^2. Less than half of the households surveyed had indoor toilet facilities.

With regard to electricity, almost all houses of the surveyed households were supplied with electric power from the State Owned Electricity Power (PLN). However, few houses in all villages surveyed (7.0% of the houses) had telephone connections.

4.4 Landholdings and plot history

Comparing the three sample villages, Table 7 shows that average landholding per household was 0.33 ha in Hambaro, 0.43 ha in Parakan Muncang and 0.49 ha in Sukaluyu – averaging 0.42 ha across the study area. The range of landholding per family was 0.33 to 0.49 ha. The larger portion of the surveyed households belonged to the lowest strata of landholding classes; hence 52.4% of the surveyed households controlled less than 0.2 ha of land. Hambaro was the highest where the other two villages were relatively better off in this regard.

Table 4. Percentage distribution of respondents and family members by occupation.

Working age population	Hambaro		Parakan Muncang		Sukaluyu		Sample Villages	
	% of n= 62	% of n= 281	% of n= 63	% of n= 265	% of n= 60	% of n= 229	% of n= 185	% of n= 775
Main Occupation								
1. Farmer	56.5	6.8	34.9	3.8	33.3	8.3	41.6	6.2
2. Farm laborer	9.7	0.7	23.8	0.8	20.0	1.3	17.8	0.9
3. Trader/merchant	24.2	7.1	17.5	6.8	20.0	3.9	20.5	6.1
4. Home industry			1.6		1.7		1.1	
5. Gold extraction		0.4				0.4		0.3
6. Services								
~Transport	1.6		3.2	0.8	5.0	0.9	3.2	0.5
~Other services				1.1	3.3		1.1	0.4
7. Civil servant	3.2	1.1	12.7	3.4	10.0	0.4	8.6	1.7
8. Private company employee		0.4	1.6	1.1		2.6	0.5	1.3
9. Off farm laborer	3.2	1.8	3.2	1.9	3.3	3.5	3.2	2.3
10. Unemployee	1.6	20.3	1.6	29.8	3.3	16.2	2.2	22.3
Total (%)	100	38.4	100	49.4	100	37.6	100	41.9
Side occupation								
1. Farmer	22.6	1.1	46.0	0.4	50.0	0.4	39.5	0.6
2. Farm laborer	24.2	1.8	6.3	0.4	1.7	0.9	10.8	1.0
3. Trader/merchant	11.3		1.6	0.4	5.0	0.9	5.9	0.4
4. Home industry					1.7		0.5	
5. Gold extraction					1.7		0.5	
6. Services								
~Transport								
~Other services			3.2		1.7		1.6	
7. Civil servant	4.8		1.6		1.7	0.4	2.7	0.1
8. Off farm laborer	1.6	0.4	1.6	0.4	8.3	0.9	3.8	0.5
Total (%)	64.5	3.2	60.3	1.5	71.7	3.5	65.4	2.7

Source: Household survey data

Table 5. Percentage distribution of respondents and family members by educational attainment and elementary school enrolment rate.

	Parakan Muncang		Curug Bitung		Cisarua		Sample Villages
Respondents (number)	**(62)**		**(63)**		**(60)**		**(185)**
Never goes to school	6%		5%		7%		6%
Elementary school	88.7%		85.7%		88.3%		87.6%
Junior secondary school			3.2%				1.1%
Senior secondary school	1.6%		3.2%		1.7%		2.2%
Academy/University	3.2%		3.2%		3.3%		3.2%
	100%		100%		100%		100%
Family members (number)	**(281)**		**(265)**		**(229)**		**(775)**
Schooling age but not yet enrolled	7.3%		7.0%		10.4%		8.1%
Never goes to school	3.6%		1.5%		3.5%		2.6%
Kindergarten					1.0%		0.3%
Elementary school	66.5%		51.8%		55.7%		58.2%
Junior secondary school	3.8%		9.5%		5.5%		6.3%
Senior secondary school	1.2%		8.2%		3.1%		4.2%
Academy/University	0.3%		2.7%		0.0%		1.0%
	100%		100%		100%		100%
Primary school enrolment rate	**88.6%**		**90.5%**		**83.7%**		**87.8%**

Source: Household survey data

Table 6. The physical attributes of the houses

Physical Attribute	Hambaro	Parakan Muncang	Sukaluyu	Total
	n = 62	n = 63	N = 60	n = 185
1. Building material				
Full concrete	64.5%	79.4%	60.0%	68.1%
Wood	1.6%	1.6%	3.3%	2.2%
Bamboo	33.9%	19.0%	36.7%	29.7%
2. Type of floor				
Ceramic tile	37.1%	36.5%	40.0%	37.8%
Simple tile	17.7%	31.7%	6.7%	18.9%
Simple concrete cement	22.6%	22.2%	35.0%	26.5%
Wood	6.5%	1.6%	3.3%	3.8%
Bamboo	14.5%	6.3%	10.0%	10.3%
Dirt	1.6%	1.6%	5.0%	2.7%
3. Type of roof				
Roof-tile	98.4%	100%	100%	99.5%
Plant leafs	1.6%	-	-	-
4. In-house bathroom				
Available	46.8%	57.1%	30.0%	44.9%
Not available	53.2%	42.9%	70.0%	55.1%
5. In-house closet				
Available	40.3%	54.0%	30.0%	41.6%
Not available	59.7%	46.0%	70.0%	58.4%
6. Floor width				
≤ 19 M^2	0%	0%	1.7%	0.5%
20-29 M^2	3.2%	3.2%	6.7%	4.3%
30-49 M^2	30.6%	15.9%	36.7%	27.6%
50-99 M^2	61.3%	77.8%	48.3%	62.7%
100-149 M^2	4.8%	3.2%	3.3%	3.8%
≥ 150 M^2	0%	0%	3.3%	1.1%
Floor area range (M^2)	20-120	20-144	20-168	20-168
Avg. floor area (M^2)	56	58	56	
Avg. floor area per person (M^2/person)	10	11	12	11

Source: Household survey data

Looking at the land tenure issue, not all agricultural land controlled by the surveyed household was owned by that household. The study revealed that 11% of the total agricultural land controlled by the surveyed household belonged to others and was cultivated by means of renting, sharecropping, or just *numpang*[9]. It should be noted that sharecropping systems mainly applied to wetland rice fields.

There was unequal distribution of landholdings in the study area. As shown in Figure 3, the bottom 60% of the surveyed household controlled only 15% of total landholding size, and the top 20% about 62% of the total land. Apart from that, regardless of the land use type, average landholding size per household was 0.42 ha, with an average of 0.08 ha per family member. Considering the small landholdings controlled by families, it was not surprising that off farm activities were an important element in their livelihood.

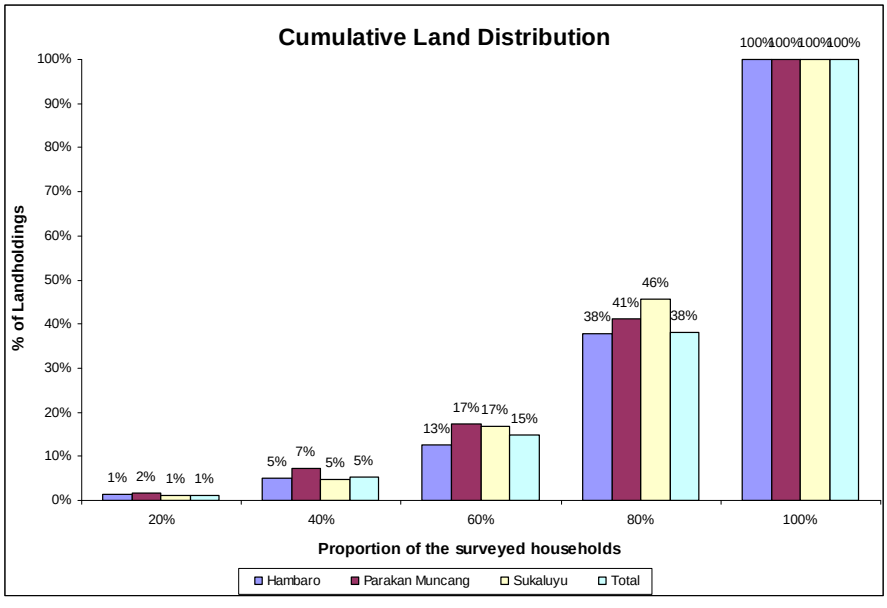

Figure 3. Cumulative distribution of the surveyed household by landholding size
Source: Household survey data

Almost all of plot samples (89%) were privately owned, with more than half (67%) obtained through inheritance. Land was acquired through purchase from other individuals in 21% of the cases (Table 8). Obtaining land by forest clearance (logged-over forest) occurred in 2% of the cases.

[9] *Numpang* is a colloquial term in Bahasa Indonesia that is normally used for or means ride-in. It this context, the word of *numpang* means cultivating other land without any financial consequences, or right to use the land. It happens if the land is not used by the owner.

Table 7. Profile of surveyed households according to landholdings by village and land use type.

	Hambaro			Parakan Muncang			Sukaluyu			Total		
	n	**%**	**Ha**	**n**	**%**	**Ha**	**n**	**%**	**Ha**	**n**	**%**	**Ha**
	n hh =	62		n hh =	63		n hh =	60		n hh =	185	
	n plot =	103		n plot =	102		n plot =	105		n plot =	310	
1. Number of Plot Owned (plot)												
1 plot	62	100%	14.76	63	100%	14.47	60	100%	16.16	185	100%	45.39
2 plots	37	59.7%	5.31	36	57.1%	11.26	36	60.0%	12.67	109	58.9%	29.24
3 plots	4	6.5%	0.52	3	4.8%	0.83	9	15.0%	0.9	16	8.6%	2.26
2. Type of Land Owned (plot)												
Irrigated Paddyfield	37	59.7%	9.85	38	60.3%	10.96	24	40.0%	7.57	99	53.5%	28.38
Rainfed Paddyfield	23	37.1%	4.59	20	31.7%	3.23	21	35.0%	7.21	64	34.6%	15.03
Dry Land	25	40.3%	3.04	23	36.5%	5.36	35	58.3%	8.83	83	44.9%	17.24
Monoculture Garden	7	11.3%	0.76	2	3.2%	0.35	9	15.0%	1.62	18	9.7%	2.73
Simple Agroforest	10	16.1%	1.37	18	28.6%	6.61	15	25.0%	4.48	43	23.2%	12.45
Complex agroforest	1	1.6%	1.00							1	0.5%	1.00
Shrub				1	1.6%	0.04	1	1.7%	0.01	2	1.1%	0.05
3. Land size (m^2) by household												
< 0.1	28	45%	1.35	17	27%	0.88	23	38%	1.25	68	37%	3.48
0.11 - 0.3	11	18%	1.73	25	40%	4.88	7	12%	1.36	43	23%	7.97
0.31 - 0.5	9	15%	3.64	4	6%	1.80	10	17%	4.18	23	12%	9.62
0.51 - 0.7	10	16%	5.94	3	5%	1.95	2	3%	1.13	15	8%	9.02
> 0.71	4	6%	7.94	14	22%	17.55	18	30%	21.30	36	19%	46.79
4. Descriptive statistics of landholding size												
Total Land Size Surveyed (Ha)	20.6			27.05			29.22			76.88		
Avg Land Size (Ha/Hh)	0.33			0.43			0.49			0.42		
Land Size Range (Ha)	0.003 - 3			0.002 - 2			0.003 - 1.8			0.002 - 3		
Std. Deviation	0.33			0.30			0.31			0.31		

Table 8. Ways of obtaining land by land status.

Ways of obtaining land	Privately Owned			Perhutani Land			National Park			Numpang			Total		
	n	%	Ha	n	%	Ha	n	%	Ha	n	%	Ha	n	%	Ha
Opened from Forest				6	2%	3.15							6	2%	3.15
Bought	65	(21%)	25.83										65	21%	25.83
Heritage	203	65%	38.02	5	2%	0.85							208	67%	38.87
Using other persons land	9	3%	3.50	6	2%	1.57	1	0.30%	1.00	15	5%	2.96	31	10%	9.03
	277	89%	67.35	17	5%	5.57	1	0.30%	1.00	15	5%	2.96	310	100%	76.88

Source: Household survey data

Table 8, shows the history of land 'ownership'. Years of ownership ranged from 1 to 61 years, averaging 19.9 years.

The study was able to trace back the land use systems and practices of the plot samples before and during the years of ownership by the current land-holder (Fig. 4). The plot number of land use types remained relatively stable. But looking into further details, it was found that a rainfed paddy field, mono-culture garden, and complex agroforest tended to change by household into other land use types (Table 10). On the other hand, irrigated paddy field, dry-land, and simple agroforest relatively remained stable.

Table 9. Number of plot samples according to years of 'ownership'

Length of land owner-ship (yrs)	Hambaro		Parakan Muncang		Sukaluyu		Total	
	n	%	n	%	n	%	n	%
0 – 5	9	(9%)	15	(15%)	5	(5%)	29	(9%)
6 – 10	22	(21%)	18	(18%)	17	(16%)	57	(18%)
11 – 15	16	(16%)	8	(8%)	17	(16%)	41	(13%)
16 – 20	14	(14%)	10	(11%)	14	(13%)	38	(13%)
21 – 25	9	(9%)	4	(4%)	10	(10%)	23	(7%)
> 25	33	(32%)	47	(45%)	42	(40%)	122	(39%)

Source: Household survey data

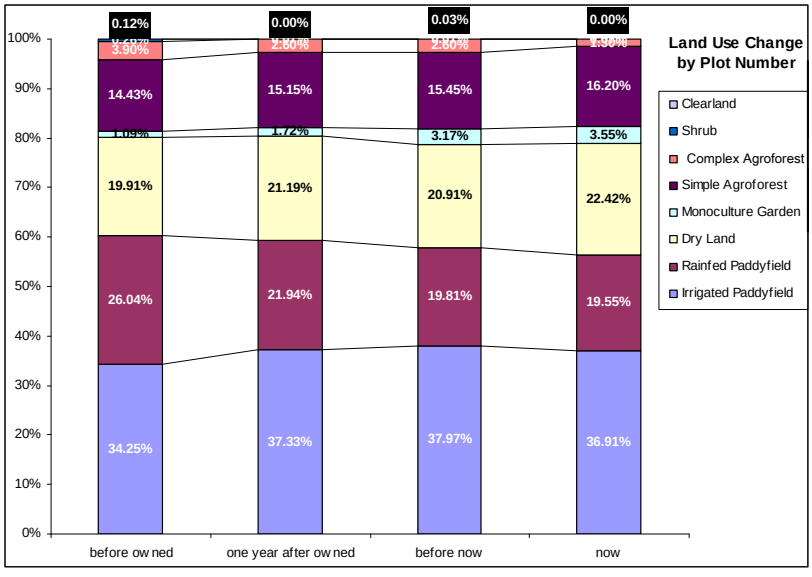

Figure 4. Plot samples utilization before and during ownership Source: Household survey data

Table 10. Land use type before ownership and recent land use.

Land use type before owned	Land Use Type Now: *Irrigated Paddyfield*	*Rainfed Paddyfield*	*Dry Land*	*Monoculture Garden*	*Simple Agroforest*	*Complex agroforest*	*Shrub*	*Clearland*	*Total*
Irrigated Paddyfield	89.0%	3.3%	2.2%	4.4%	1.1%	0%	0%	0%	100%
Rainfed Paddyfield	19.1%	66.3%	9.0%	4.5%	1.1%	0%	0%	0%	100%
Dry Land	1.3%	2.6%	88.5%	6.4%	1.3%	0%	0%	0%	100%
Monoculture Garden	0%	0%	33.3%	50.0%	16.7%	0%	0%	0%	100%
Simple Agroforest	0%	0%	2.6%	0%	97.4%	0%	0%	0%	100%
Complex Agroforest	0%	0%	33.3%	0%	33.3%	33.3%	0%	0%	100%
Shrub	0%	0%	0%	33.3%	0%	0%	66.7%	0%	100%
Clearland	0%	0%	0%	100%	0%	0%	0%	0%	100%
Total	31.9%	20.6%	26.8%	5.8%	13.9%	0.3%	0.6%	0.0%	100%

Source: Household survey data

4.5 Other assets

Information on other assets such as farm implements, savings, motorbikes and electronic equipment (TV and radio) were also collected in this survey to identify the socioeconomic conditions of the target population. The data are summarized as follows.

Table 11. Other assets

Asset	Hambaro	Parakan Muncang	Sukaluyu	Total
	n = 62	n = 63	n = 60	n = 185
1. Radio/Tape	50.0%	57.1%	56.7%	54.6%
2. Television	75.8%	76.2%	61.7%	71.4%
3. VCD/DVD	43.5%	47.6%	43%	44.9%
4. Telephone/Cellphone	8.1%	9.5%	3.3%	7.0%
5. Refrigerator	11.3%	12.7%	8.3%	10.8%
6. Bike	6.5%	4.8%	7%	5.9%
7. Motobike	6.5%	15.9%	8.3%	10.3%
9. Car	3.2%	1.6%	0%	1.6%

Source: Household survey data

Televisions were more common as compared to radios/tape cassette players (Table 11). Comparing all assets, Parakan Muncang seemed better off than the other two villages. The differences in these figures do not seem significant, with the possible exception of motorbikes in Parakan Muncang.

5. Income and Expenditures

This section discusses the living standards of the Nanggung population using two socioeconomic indicators, i.e. income and expenditure. It describes family income (and per capita income), source of income, family expenditure (and per capita expenditure) and expenditure allocation. It also assesses the level of family income and expenditure of the surveyed household compared to national and provincial poverty line to find out their living standard; hence surveyed households were defined as poor if their income or expenditure is below the poverty line.

5.1 Income

Although most of people in Nanggung were engaged in agriculture (working as farmers), it was unlikely that agricultural income was the greatest contributor to family income. Income data derived from this survey showed that agri-

culture was not the main contributor to family income. Table 12 shows that agricultural activities alone contributed only 14% to the total households' income, with an average time spent at 5.16 hours/day. However, comparing these three villages, it is interesting to note that the share of agricultural income of the surveyed household in Hambaro to the total family income was higher than in Parakan Muncang and Sukaluyu, although the average landholding size in Hambaro was slightly less than in other two villages. More detailed observations revealed that in Parakan Muncang, the most accessible village among the three sample villages, 68% of surveyed households were engaged in trade activities. This activity contributed about 42% of the total off-farm income in Parakan Muncang (see Annex).

The fact that off-farm income contributed the most to the total family income explained that most of the surveyed households could not rely mainly on agricultural activities since they had a relatively narrow landholding size for their livelihood. It also indicated that a large portion of people must engage in other income generating activities to meet their family's livelihood needs.

For those households with other sources of income (usually remittance from a son/daughter), although these sources were irregular and relatively small as a portion of total family income, this additional income was meaningful for their livelihood. In this regard, Sukaluyu was the 'best', meaning the amount received from this kind of income was the highest.

From the living standard point of view, it is necessary to question whether the surveyed households could meet their needs from their income alone. To answer such questions, the study applied the poverty line of BPS – Statistics of Indonesia that refers to the daily minimum requirement of 2,100 kilo-calories per capita plus the non-food minimum requirement, such as for living, clothing, schooling, transportation, household necessities and other individual needs. Minimum financial resources needed to meet basic minimum requirements in Indonesia in 2005 was Rp150,000 capita^{-1} month^{-1}, respectively, or in annual basis, Rp1,800,000 capita^{-1} year^{-1} (BPS, 2005).

Using average per capita income of the surveyed households in three sample villages, the study revealed that the average person/family in Nanggung was still above the poverty line. Table 13 shows that the average per capita incomes of the three sample villages were still higher than the poverty line of Indonesia. But because of skewed distribution of income (Fig. 5), it needs to be treated with caution, especially if the number of people below the poverty line were counted. The study found that more than half (52%) of the surveyed households were below the poverty line, meaning that those households could not afford the basic requirements, and thus were categorized as poor. Comparing the sample villages, Hambaro was the poorest among the three sample villages, with about 67.7% of its population below the poverty line.

Table 12. Households' income and average time spent by source of income and by village sample

	Hambaro			Parakan Muncang			Sukaluyu			Total		
	n	Rp 000	%	n	Rp 000	%	n	Rp 000	%	n	Rp 000	%
Agriculture												
Agriculture	44	6,239	11	43	6,541	7	50	10,688	14	137	23,468	10
Livestock & Fishery	13	6,498	11	14	1,463	2	12	382	0.5	39	8,344	4
Total Agriculture Income	**46**	**12,737**	22	**46**	**8,004**	9	**52**	**11,070**	14	144	**31,812**	14
Average time spent in agriculture activities (hours/day)		5.10			5.31			5.11			5.16	
Off Farm Income	**58**	**37,554**	**63**	**60**	**73,529**	**83**	**57**	**36,866**	**47**	**175**	**147,948**	**65**
Average time spent in off-farm activities (hours/day)		5.54			5.83			5.34			5.59	
Non-fixed Income	23	8,937	15	24	7,525	8	21	30,523	39	68	46,985	21
130 Total Household Income	62	59,228	100	63	89,058	100	60	78,459	100	185	226,745	100

Source: Household survey data

Table 13. Descriptive statistics of family income of the surveyed households and people under poverty line

	Hambaro	**Parakan Muncang**	**Sukaluyu**	**Sample Villages**
Number of surveyed households	62	63	60	185
Number of family members	281	265	229	960
Total family income (Rp 000/month)	59,228	89,058	78,459	226,745
Range (Rp 000/month)				
Minimum	28	8	20	8
Maximum	9,306	12,967	3,950	12,967
Average family income per household (Rp 000/month)	955	1,414	1,308	1,226
Income per capita (Rp 000/month)	173	272	271	236
Proportion of people below poverty line				
-of Indonesia (Rp 150,000 capita^{-1} month $^{-1}$)	67.7%	38.1%	51.7%	52.4%

Source: Household survey data

Table 14. Households' expenditure by items (per month)

	Hambaro			Parakan Muncang			Sukaluyu			Total		
	n	Rp000	%	N	Rp000	%	n	Rp000	%	n	Rp 000	%
1. Food	62	21,730	66%	63	24,075	64%	60	18,733	56%	185	64,538	62%
2. Education	42	3,190	10%	33	2,983	8%	39	2,801	8%	114	8,974	9%
3. Electricity	56	2,032	6.1%	57	2,487	-	46	1,875	6%	159	6,394	6%
4. Telphone	3	340	1%	3	170	0%	1	100	0%	7	610	1%
5. Health	28	1,084	3%	33	1,225	3%	38	1,455	4%	99	3,764	4%
6. Transportation	23	1,727		29	1,854		36	3,069		88	6,650	6%
7. Cigarette		-	-	1	50	0.1%		-	-	1	50	0.0%
8. Others	1	1	0%	3	2,385	6%	6	1,323	4%	10	3,710	4%
9. Farm Inputs	60	3,059	9%	59	2,154	6%	53	4,084	12%	172	9,297	9%
Total Household Expenditure	62	**33,163**	**100%**	**63**	**37,383**	**100%**	**60**	**33,440**	**100%**	**185**	**103,986**	**100%**
Family Expenditure per household		**535**			**593**			**557**			**562**	
Average Family Income		**955**			**1,414**			**1,308**			**1,226**	

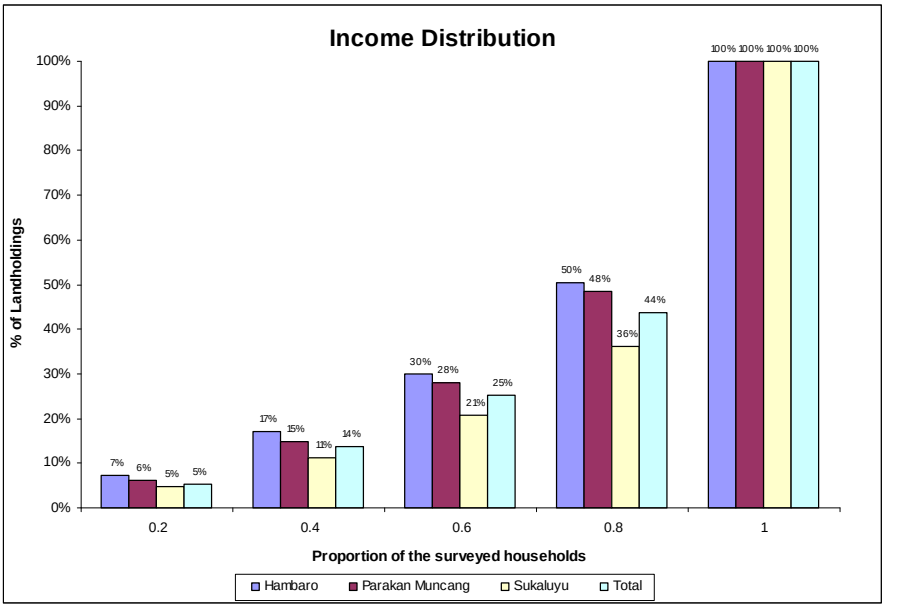

Figure 5. Cumulative distribution of the surveyed household by Income
Source: Household survey data

5.2 Expenditures

Table 14 describes expenditures of the surveyed households in the three sample villages. The data consisted of monthly expenditures derived from the survey. Survey data on household expenditures shows that all expenditures were lower than family income, and that the average expenditure per household was also lower than the average family income (Tables 12 and 13). This demonstrated that almost all income was spent on consumption. Looking closely at the expenditure items, the largest proportion was spent on food (62%) and other non-food consumption categorized as basic needs for the family livelihood, such as housing, clothes, education, transportation and others.

The study also revealed that about 15% of surveyed households had negative income, which meant higher expenditures than income. As seen in Table 15, Sukaluyu was the worst among the three sample villages, with about 22% of the people having negative income.

6. Farming System Characteristics

This section presents the profile of farming practices of the surveyed households based on information gathered through interviews. It describes how farmers managed their agricultural land and the production with special emphasis on vegetable farming management.

Table 15. Households' expenditure by items (per month)

Percentage of Expenditure to Income	Hambaro		Parakan Muncang		Sukaluyu		Total	
	n	%	n	%	n	%	n	%
≤ 50%	14	22.6	25	39.7	16	26.7	55	29.7
50-75%	19	30.6	14	22.2	14	23.3	47	25.4
76-100%	18	29.0	20	31.7	17	28.3	55	29.7
100%<	11	17.7	4	6.3	13	21.7	28	15.1

Source: Household survey data

6.1 Physical characteristics

As mentioned earlier, agricultural land controlled by the surveyed households was comprised of rice fields, dryland agriculture, monoculture gardens (e.g. cassava, *timun*), and traditional multispecies tree gardens. Table 16 shows that of 310 plots, 163 plots (43.4 ha) were rice fields, 83 plots (17.2 ha) dryland agriculture (*Tegal/ladang*), 18 plots (2.7 ha) monoculture gardens and 43 plots (12.4 ha) multi-species tree gardens controlled by the surveyed households.

Intensive agriculture (paddy fields, dryland and monoculture gardens) mostly took place in relatively flat areas. More than 80% of the plots were considered by the respondents as gently to slightly steep areas. Regarding soil fertility, most respondents considered their land fertile to very fertile. With the exception of the irrigated paddy fields, all other plots depended on rain as a source of water to support crop production.

Using the village as a basis for plot characteristics in three villages, as seen in Table 17, agricultural land mostly situated in undulating areas were from gentle to steep slopes. As to soil fertility, most of the land was quite fertile; only 0.3% of the plots were considered by the respondents as in fertile.

From the interviews with the respondents we found 23 vegetable species and two staple crop species (paddy and cassava). The top five vegetable species found in the sample plot samples were: Pisang (*Musa* sp.), Kacang panjang (*Vigna sinensis*), Timun (*Trichosanthes cucumeroides* Maxim), Kucai (*Allium tuberosum*) and Buncis (*Phaseolus vulgaris*). These species were mostly cultivated by farmers in dryland and simple agroforest plots.

Table 16. Physical characteristics of plot controlled by household by land use type

	Irrigated paddy field	Rainfed paddy field	Dry land	Monoculture Garden	Simple Agro-forest
Number of plots	99	64	83	18	43
Total area (Ha)	28.38	15.03	17.24	2.73	12.45
1. Distance from village (m)					
≤500 m	82%	83%	95%	78%	77%
500-1,000 m	5%	6%	0%	22%	19%
1,000 m<	13%	11%	5%	0%	5%
2. Time needed to go to the plot (minutes)					
1-15	80%	84%	89%	83%	63%
16-30	16%	13%	10%	11%	35%
31-60	4%	3%	1%	6%	2%
>60					
3. Plot fertility					
Quite fertile to very fertile	87%	53%	87%	83%	67%
Less fertile	13%	47%	12%	17%	33%
Not fertile			1%		
4. Plot slope					
Flat to slightly slope	88%	64%	93%	89%	47%
Gently slope	12%	36%	5%	11%	40%
Slightly step to step slope	0%	0%	2%	0%	14%
5. Water source for irrigation					
Technical drainage	14%				
Simple drainage	9%	2%	2%		
Direct from river	17%	5%	4%	11%	2%
Water spring	53%	8%	14%	6%	7%
Rain fed	6%	86%	80%	78%	91%
Others	1%			6%	

Source: Household survey data

Table 17. Physical characteristics of plot controlled by household by village

	Hambaro	Parakan Mun-cang	Sukaluyu	Total
Number of plots	103	102	105	310
Total area (Ha)	20.60	27.0537	29.2241	76.8793
1. Distance from village (m)				
≤500 m	79.6%	75.5%	80.0%	78.4%
500-1,000 m	9.7%	20.6%	11.4%	13.9%
1,000 m<	10.7%	3.9%	8.6%	7.7%
2. Time needed to go to the plot (minutes)				
1-15	83.5%	88.2%	72.4%	81.3%
16-30	15.5%	10.8%	21.0%	15.8%
31-60	1.0%	1.0%	6.7%	2.9%
>60				
3. Plot fertility				
Quite fertile to very fertile	70.9%	76.5%	81.9%	76.5%
Less fertile	28.2%	23.5%	18.1%	23.2%
Not fertile	1.0%			0.3%
4. Plot slope				
Flat to slightly slope	71.8%	79.4%	82.9%	78.1%
Gently slope	25.2%	20.6%	12.4%	19.4%
Slightly step to step slope	2.9%		4.8%	2.6%
5. Water source for irrigation				
Technical drainage	9.7%	2.0%	1.9%	4.5%
Simple drainage	3.9%	4.9%	2.9%	3.9%
Direct from river	11.7%	2.0%	11.4%	8.4%
Water spring	12.6%	36.3%	21.9%	23.5%
Rain fed	62.1%	53.9%	61.0%	59.0%
Others		1.0%	1.0%	0.6%

Source: Household survey data

Table 18. Vegetables species cultivated by surveyed household (by land use types)

No	Commodity	Irrigated Paddyfield	Rainfed Paddy field	Dry Land	Monoculture Garden	Simple Agroforest	Total
		(% of n=99)	(% of n=64)	(% of n=83)	(% of n=18)	(% of n=43)	(% of n=307)
1	Bayam (*Alternanthera amoena voss)*			1.2%			0.3%
2	Buncis (*Phaseolus vulgaris)*		1.6%	4.8%		7.0%	2.6%
3	Cabe (*Capsicum frutescens)*			7.2%	5.6%	2.3%	2.6%
4	Caesin (*Brassica rapa L.*)	1.0%		3.6%			1.3%
5	Jagung (*Zea mays L.)*			4.8%		4.7%	2.0%
6	Jahe (*Zingiber offcinale)*	1.0%	1.6%	3.6%	5.6%		2.0%
7	Kacang kedelai (*Soya max piper)*		1.6%				0.3%
8	Kacang panjang (*Vigna sinensis)*	2.0%		12.0 %		7.0%	4.9%
9	Kacang tanah (*Arachis hypogaea)*	1.0%	1.6%	2.4%	5.6%		1.6%
10	Kangkung (*Ipomoea aquatica forsk)*			1.2%			0.3%
11	Katuk (*Sauropus androgynus merr)*			1.2%			0.3%
12	Kucai (*Allium tuberosum*)			3.6%		16.3%	3.3%
13	Kunyit (*Curcuma longa)*	1.0%		3.6%		2.3%	1.6%
14	Lengkuas (*Alpinia galangal)*			7.2%		4.7%	2.6%
15	Padi (*Oryza sativa L.)*	99.0%	95.3%	2.4%			52.4%
16	Pepaya (*Carica papaya L.)*			2.4%			0.7%
17	Pisang (*Musa sp.)*	2.0%	1.6%	26.5 %	16.7%	18.6%	11.7%
18	Sawi (*Brassica juncea (L.) chern)*			1.2%			0.3%
19	Sereh (*Andropogon citratus dc)*			2.4%		4.7%	1.3%
20	Singkong (*Manihot esculenta)*	1.0%	7.8%	47.0 %		20.9%	17.6%
21	Talas (*Colocasia esculenta)*			3.6%		2.3%	1.3%
22	Terong (*Solanum melongena L.)*			2.4%			0.7%
23	Timun (*Trichosanthes cucumeroides maxim)*	3.0%		9.6%		7.0%	4.6%
24	Tomat (*Solanum lycopersicum)*			3.6%			1.0%
25	Ubi Jalar (*Ipomoea batatas)*				5.6%		0.3%

Simple agroforests or *Dudukuhan* are traditional tree farming systems commonly found in West Java, where farmers realized that Dudukuhan were underproductive and had great untapped potential to meet the rising demand for tree and annual crop products in West Java. Farmers were interested in intensifying the management of their dudukuhans, but hesitated because they did not know where to focus their efforts (Manurung, 2008).

The Dudukuhan process starts with fallow systems, which were cleared by farmers to establish 'huma or tegalan' upland systems of banana and annual crops for 3 to 4 years. During that period, farmers enriched the huma by planting seedlings or wildlings of the priority tree species (Manurung, 2008).

Table 19 shows that the tree species planted in Dudukuhan were Alpukat (*Persea americana*), Melinjo (*Gnetum gnemon*), Nangka (*Artocarpus heterophyllus*), Jengkol (*Pithecellobium jiringa*), Durian (*Durio zibethinus*), Kecapi (*Sandoricum koetjape*), Sengon (Paraserianthes *falkataria*), Mangga (*Mangifera indica*), Petai (*Parkia speciosa*), and Pinus (*Pinus* sp.). Kacang panjang (*Vigna sinensis*), Timun (*Trichosanthes cucumeroides* Maxim), Kucai (*Allium tuberosum*) and Buncis (*Phaseolus vulgaris*) were the most common annual crops cultivated by farmers under the Dudukuhan system.

Table 19. Trees & annual crops species combination found in the household survey

Tree Species	Annual Crop Species
Alpukat (*Persea Americana)*, Nangka (*Artocarpus heterophyllus*)	Kucai (*Allium tuberosum*)
Jengkol (*Pithecellobium jiringa*), Durian (*Durio zibethinus*)	Kucai (*Allium tuberosum*)
Jengkol (*Pithecellobium jiringa*), Petai (*Parkia speciosa*)	Kacang panjang (*Vigna sinensis)*
Kecapi (*Sandoricum koetjape*), Sengon (*Paraserianthes falkataria)*, Mangga (*Mangifera indica*)	Buncis (*Phaseolus vulgaris)*, Kacang panjang (*Vigna sinensis)*
Mahoni (*Swietenia macrophylla King*), Sengon (*Paraserianthes falkataria)* Melinjo (*Gnetum gnemon*)	Buncis (*Phaseolus vulgaris)*, Kacang panjang (*Vigna sinensis)*
Melinjo (*Gnetum gnemon*)	Buncis (*Phaseolus vulgaris)*, Kacang panjang (*Vigna sinensis)*
Nangka (*Artocarpus heterophyllus*), Rambutan (*Nephelium lappaceum*)	Buncis (*Phaseolus vulgaris)*, Kacang panjang (*Vigna sinensis)*
Petai (*Parkia speciosa*)	Kacang panjang (*Vigna sinensis)*, Timun (*Trichosanthes cucumeroides* Maxim*)*
Pinus (*Pinus* sp.)	Timun (*Trichosanthes cucumeroides* Maxim*)*, Kucai (*Allium tuberosum*), Buncis (*Phaseolus vulgaris)*, Kacang panjang (*Vigna sinensis)*
Sengon (*Paraserianthes falkataria)*	Kucai (*Allium tuberosum*), Kacang panjang (*Vigna sinensis),* Timun (*Trichosanthes cucumeroides Maxim)*
Melinjo (*Gnetum gnemon*), Nangka (*Artocarpus heterophyllus*)	Buncis (*Phaseolus vulgaris)*, Kacang panjang (*Vigna sinensis)*

Source: Household survey data.

Households which were experienced with tree-annual crop farming system accounted for only 10.3% of the total households (Table 20). Comparing these three villages, it is interesting to note that in Sukaluyu, about 25% of surveyed households were experienced with tree-annual crop farming system.

Table 20. Number of Households experienced in tree-annual crop farming system

	Hambaro		**Parakan Muncang**		**Sukaluyu**		**Total**	
	n	%	n	%	n	%	n	%
Household experienced	1	1.6%	3	4.8%	15	25.0%	19	10.3%
Household not experienced	61	98.4%	60	95.2%	45	75.0%	166	89.7%

Source: Household survey data

7. Labor and External Inputs

This part of the report presents the level of inputs (external inputs application and labor inputs) allocated to farm management by the surveyed households.

With regard to labor inputs, based on activities implemented, the data shows that land preparation was the activity most commonly conducted in the farm. Harvesting, maintaining and planting, respectively were the activities that required the most labor. As seen in Table 21, the number of person-days involved in land preparation was much higher than the number of person-days involved in other activities. The number of person-days involved in nursery activities and fertilizing activities was the lowest compared with the other activities.

Table 22 shows that the larger area of plot samples the less labor input will be. It was understandable that farmers with small parcels tended to intensify their land for their livelihood. It is also related to the availability of labor, as farmers with larger areas of agricultural land, but with an insufficient amount of labor, tended to practice less labor-intensive agricultural systems, such as tree-based systems.

The use of fertilizer, both chemical and green manure, was quite common in all sample plots in the study site, except for complex agroforests and fallow lands. Table 23 presents the fertilizer rate of every land use category. In general, the rate of fertilizer varied according to land use category and varied among plots within the land use category, reflecting the variation of land use practices and agricultural undertaking. External agricultural inputs used by the surveyed households was quite high.

Table 21. Level of labor input by land use type

	Irrigated Paddyfield	Rainfed Paddyfield	Dry Land	Monocul ture Garden	Simple Agroforest
No. of Plots	99	64	83	18	**43**
Total Area (ha)	28.38	15.03	17.24	2.73	**12.45**
Labor inputs					
1.1 Land Preparation					
~ Plot with land prep. activity (%)	100%	100%	84%	89%	**44%**
~ Average Labor (ps-day/ha)	121.5	117.2	160.3	78.6	**57.2**
1.2 Nursery					
~ Plot with land prep. activity (%)	95%	92%	12%	6%	**2%**
~ Average Labor (ps-day/ha)	10.9	10.6	1.7	0.1	**0.3**
1.3 Planting					
~ Plot with planting activity (%)	99%	98%	83%	89%	**44%**
~ Average Labor (ps-day/ha)	57.0	50.8	80.9	24.1	**33.8**
1.4. Maintaining					
~ Plot with Crop care activity (%)	98%	97%	70%	89%	**33%**
~ Average Labor (ps-day/ha)	64.5	52.4	107.7	33.1	**27.5**
1.5. Fertilizing					
~ Plot with Fertilizer. activity (%)	95%	86%	48%	72%	**33%**
~ Average Labor (ps-day/ha)	13.5	14.9	20.8	10.1	**6.7**
1.6. Harvesting					
~ Plot with harvesting activity (%)	98%	97%	75%	72%	**42%**
~ Average Labor (ps-day/ha)	66.6	56.0	49.1	19.1	**16.0**

Source: Household survey data

Table 22. Labor inputs by land holding size and land use type

Land Size (ha) by Household	Irrigated Paddy field	Rainfed Paddy field	Dry Land	Monocul ture Garden	Simple Agroforest
	Average Labor Input (person-days/ha)				
<0.1	483	433	580	274	**185**
0.11-0.3	234	215	261	93	**118**
0.31-0.5	128	59	60	19	**124**
0.51-0.7	113	45	30		
>0.71	**254**	**45**	**73**		**21**

Source: Household survey data

Table 23. Level of external input by type of land use type; Source: Household survey data

	Irrigated Paddyfields	Rainfed Paddyfields	Dry Land	Monoculture Garden	Simple Agroforest
No. of Plots	99	64	83	18	43
Total Area (ha)	28.38	15.03	17.24	2.73	12.45
External Inputs					
Chemical Fertilizer					
Urea					
~ Plot applying (%)	100%	97%	39%	44%	23%
~ Average Rate (kg ha^{-1})	426.5	691.7	179.5	180.6	28.7
SP-36					
~ Plot applying (%)	91%	94%	54%	56%	35%
~ Average Rate (kg ha^{-1})	160.0	228.8	105.0	117.8	17.7
KCL					
~ Plot applying (%)	24%	16%	20%	39%	16%
~ Average Rate (kg ha^{-1})	30.6	22.1	72.0	48.7	4.3
NPK					
~ Plot applying (%)			2%	22%	
~ Average Rate (kg ha^{-1})			1.5	11.9	
Other					
~ Plot applying (%)	5%	2%	5%	0%	5%
~ Average Rate (kg/ha^{-1})	5.1	2.3	91.4	-	7.0
Organic Fertilizer					
~ Plot applying (%)	21%	16%	52%	78%	30%
~ Average Rate (kg ha^{-1})	348.9	721.1	3,836.0	4,049.7	972.0
Pesticide					
~ Plot applying (%)	88%	91%	33%	44%	16%
~ Average Rate (ml ha^{-1})	6,368.6	2,402.5	10,214.1	1,087.5	364.0

The study found that chemical fertilizer was applied in all paddy fields and organic fertilizer mostly was applied in monoculture gardens and dryland plots. The rate of chemical fertilizer application was also quite high, ranging between 2 and 7,500 kg ha^{-1}. For organic fertilizer, some plots, especially monoculture gardens, applied reasonably high rates, up to 34 tons ha^{-1}.

Similar to fertilizer application, the rate of pesticide application and type of pesticides used varied according to land use category. Table 23 shows that all types of pesticides were applied for all land use categories. While paddy fields in the study site mostly applied herbicide to reduce labor costs for weeding. The rate of pesticide application for dryland was the highest among the other land use categories.

8. Farm Outputs

Regarding the farm outputs, Table 24 presents the vegetable commodities produced in the plot. Almost all commodities harvested in the plot were sold by the surveyed households. Most of the harvested yields (89% or more)

were sold for 22 annual commodities. Only 76.5% of corn yields and 29.6% of rice were sold. All (100%) of the 'sawi' *(Brassica juncea)* produced was consumed by households.

Paying attention to the returns from these gardens, data derived from respondents shows that among the commodities produced in the plot (excluded paddy), *Timun, Cabe, Caesin, Jagung, Kacang kedelai* and *Ubi Jalar* were the most valuable species, providing above 5,000,000 rupiah per ha.

The study found that most of the yields of the species planted in the plots were sold. Data recorded from the surveyed household shows that high-value species (*Cabe, Caesin, Kacang kedelai*) were mosly sold directly through consumers, showing that farmers lacked adequate market information and market access, while other species (*Jagung, Timun, Ubi jalar*) were mostly sold through collectors.

Table 24. Farm outputs by land use type (per plot)

No	Commodity	Unit	n = plot	Yield		Yield Consump (%)	Yield Sold (%)
				Total	Avg (per plot)		
1	Bayam (*Alternanthera amoena voss)*	ikat	1	900	900		100%
2	Buncis (*Phaseolus vulgaris)*	*kg*	8	2,020	253	1.3%	98.7%
3	Cabe (*Capsicum frutescens)*	*kg*	8	754	94	4.5%	95.5%
4	Caesin (*Brassica rapa L.*)	kg	4	410	103		100%
5	Jagung (*Zea mays L.)*	kg	6	1,500	250	23.5%	76.5%
6	Jahe (*Zingiber officinale)*	*kg*	6	400	67		100%
7	Kacang kedelai (*Soya max piper)*	kg	1	50	50	10.0%	90.0%
8	Kacang panjang (*Vigna sinensis)*	*kg*	15	8,925	595	0.6%	99.4%
9	Kacang tanah (*Arachis hypogaea L)*	kg	5	580	116	1.7%	98.3%
10	Kangkung (*Ipomoea aquatica forsk)*	ikat	1	120	120		100%
11	Katuk (*Sauropus androgynus merr)*	ikat	1	600	600		100%
12	Kucai (*Allium tuberosum*)	ikat	10	9,100	910		100%
13	Kunyit (*Curcuma longa)*	*kg*	5	7,100	1,420		100%
14	Lengkuas (*Alpinia galangal)*	*kg*	7	2,640	377	0.8%	99.2%
15	Padi (*Oryza sativa L.)*	kg	161	100,805	626	70.4%	29.6%
16	Pepaya (*Carica papaya L.)*	kg	2	1,200	600		100%
17	Pisang (*Musa sp.)*	*tandan*	36	859	24	10.2%	89.8%
18	Sawi (*Brassica juncea (L.) chern)*	kg	1	10	10	100%	
19	Sereh (*Andropogon citratus dc)*	kg	4	1,050	263		100%
20	Singkong (*Manihot esculenta)*	*kg*	54	26,680	494	6.3%	93.7%
21	Talas (*Colocasia esculenta)*	*kg*	4	565	141	7.1%	92.9%
22	Terong (*Solanum melongena L.)*	kg	2	150	75		100%
23	Timun (*Trichosanthes cucumeroides maxim)*	kg	14	13,045	932	0.3%	99.7%
24	Tomat (*Solanum lycopersicum)*	kg	3	496	165	0.2%	99.8%
25	Ubi Jalar (*Ipomoea batatas)*	*kg*	1	450	450	11.1%	88.9%

Source: Household survey data

Table 25. Farm income by land use type (per ha); Source: Household survey data

No	Commodity	Unit	n = plot	Price (Rp/unit)	Average Yield (per ha)	Income (Rp000/ha)
1	Bayam (*Alternanthera amoena voss)*	ikat	1	500	9,000	4,500
2	Buncis (*Phaseolus vulgaris)*	*kg*	8	1,650	677	1,116
3	Cabe (*Capsicum frutescens)*	*kg*	8	7,500	1,007	7,549
4	Caesin (*Brassica rapa L.*)	kg	4	1,500	3,400	5,100
5	Jagung (*Zea mays L.)*	kg	6	3,000	1,904	5,713
6	Jahe (*Zingiber offcinale)*	*kg*	6	2,167	1,735	3,759
7	Kacang kedelai (*Soya max piper)*	kg	1	2,000	2,500	5,000
8	Kacang panjang (*Vigna sinensis)*	*kg*	15	1,321	2,008	2,653
9	Kacang tanah (*Arachis hypogaea L)*	kg	5	2,200	1,680	3,696
10	Kangkung (*Ipomoea aquatica forsk)*	ikat	1	500	1,200	600
11	Katuk (*Sauropus androgynus merr)*	ikat	1	500	2,000	1,000
12	Kucai (*Allium tuberosum*)	ikat	10	405	4,242	1,718
13	Kunyit (*Curcuma longa)*	*kg*	5	833	3,824	3,187
14	Lengkuas (*Alpinia galangal)*	*kg*	7	686	1,831	1,256
15	Padi (*Oryza sativa L.)*	kg	161	2,369	4,151	9,834
16	Pepaya (*Carica papaya L.)*	kg	2	650	2,625	1,706
17	Pisang (*Musa sp.)*	*tandan*	36	7,741	428	3,315
18	Sawi (*Brassica juncea (L.) chern)*	kg	1		40	-
19	Sereh (*Andropogon citratus dc)*	kg	4	475	1,421	675
20	Singkong (*Manihot esculenta)*	*kg*	54	510	6,924	3,531
21	Talas (*Colocasia esculenta)*	*kg*	4	500	1,831	916
22	Terong (*Solanum melongena L.)*	kg	2	1,025	300	308
23	Timun (*Trichosanthes cucumeroides maxim)*	kg	14	975	8,999	8,774
24	Tomat (*Solanum lycopersicum)*	kg	3	1,750	1,754	3,070
25	Ubi Jalar (*Ipomoea batatas)*	*kg*	1	1,000	5,000	5,000

Fruit and vegetable products from Nanggung were marketed through four channels:

Channel 1: Farmer → local household or local market

Channel 2: Farmer → local collector → local trader → local customer or local market

Channel 3: Farmer → local collector → regional trader or retailer → urban customer (Bogor or Jakarta)

Channel 4: Farmer → local collector → local trader → regional trader → regional retailer → urban customer (Bogor or Jakarta)

The main types of market agents were farmers, collectors, local and regional traders and regional retailers. The role of farmers was largely restricted to production. Collectors, traders and retailers, to different degrees, were all engaged in sorting, grading, storage and transportation (Tukan, 2005).

Table 26. Marketable commodities and the marketing chain used (in percentage by commodities)

No	Commodity	Market	Collector	Consumer	Wholesaler
1	Bayam (*Alternanthera amoena voss)*			100%	
2	Buncis (*Phaseolus vulgaris)*	12.5%	87.5%		
3	Cabe (*Capsicum frutescens)*	33.3%	33.3%	33.3%	
4	Caesin (*Brassica rapa L.)*		25.0%	75.0%	
5	Jagung (*Zea mays L.)*		100%		
6	Jahe (*Zingiber offcinale)*	75.0%	25.0%		
7	Kacang kedelai (*Soya max piper)*			100%	
8	Kacang panjang (*Vigna sinensis)*	14.3%	78.6%	7.1%	
9	Kacang tanah (*Arachis hypogaea L)*		100%		
10	Kangkung (*Ipomoea aquatica forsk)*			100%	
11	Katuk (*Sauropus androgynus merr)*	100%			
12	Kucai (*Allium tuberosum*)		100%		
13	Kunyit (*Curcuma longa)*	66.7%	33.3%		
14	Lengkuas (*Alpinia galangal)*	16.7%	83.3%		
15	Padi (*Oryza sativa L.)*		57.1%	28.6%	14.3%
16	Pepaya (*Carica papaya L.)*		100%		
17	Pisang (*Musa sp.)*		84.6%	15.4%	
18	Sawi (*Brassica juncea (L.) chern)*				
19	Sereh (*Andropogon citratus dc)*		100%		
20	Singkong (*Manihot esculenta)*		84.4%	15.6%	
21	Talas (*Colocasia esculenta)*		100%		
22	Terong (*Solanum melongena L.)*	50.0%	0.0%	50.0%	
23	Timun (*Trichosanthes cucumeroides maxim)*	7.1%	92.9%		
24	Tomat (*Solanum lycopersicum)*			100%	
25	Ubi Jalar (*Ipomoea batatas)*		100%		

Source: Household survey data

9. Gender Roles in Agricultural Undertaking

This section contributes to a better understanding of the roles women and men play in the different stages of agriculture as well as other production and income-generating activities. This study looks at what different women and men do especially in agricultural activities. Table 27 shows that women involved in agriculture were limited to certain activities in paddy fields. Women had proportionally more than 15% of labor input only in nursery, maintaining, fertilizing, and harvesting, but for other land uses, the proportion of women labor was very small. Involvement in agriculture may therefore partly depended on whether or not the household could afford to hire labor. Gender roles in Nanggung were probably restricted by socio-cultural factors.

The gender role in cultivating vegetables depended on the skills of the father, mother and children. Some perennial vegetable tree crops (Melinjo, Petai etc.) needed special skills in harvesting, such as climbing. Gender roles in selling products depended on the quantity. If the harvested products were in great number, then the father would sell the produce through wholesalers or directly to the market. But when the produce was in small amounts, the mother sold the produce at retail to the local stores (Setiawan, 2006).

Table 27. Average level of labor input by land use type (per plot)

	Irrigated Paddyfield	Rainfed Paddyfield	Dry Land	Monoculture Garden	Simple Agroforest	Total
No. of Plots	99	64	83	18	43	**307**
Total Area (ha)	28.38	15.03	17.24	2.73	12.45	**75.83**
Labor inputs						
Land Preparation						
~ Proportion of male (%)	99.7%	99.2%	99.2%	100%	99.6%	**99.4%**
~ 110	0.3%	0.8%	0.8%	0%	0.4%	**0.6%**
Nursery						
~ Proportion of male (%)	73.4%	92.7%	100%	100%	100%	**82.4%**
~ Proportion of female (%)	26.6%	7.3%	0%	0%	0%	**17.6%**
Planting						
~ Proportion of male (%)	59.6%	54.7%	83.3%	84.9%	94.1%	**71.1%**
~ Proportion of female (%)	40.4%	45.3%	16.7%	15.1%	5.9%	**28.9%**
Maintaining						
~ Proportion of male (%)	56.1%	52.1%	78.2%	78.7%	88.3%	**67.9%**
~ Proportion of female (%)	43.9%	47.9%	21.8%	21.3%	11.7%	**32.1%**
Fertilizing						
~ Proportion of male (%)	75.1%	98.0%	89.8%	70.5%	99.5%	**87.1%**
~ Proportion of female (%)	24.9%	2.0%	10.2%	29.5%	0.5%	**12.9%**
Harvesting						
~ Proportion of male (%)	66.5%	70.4%	78.9%	88.3%	98.3%	**72.5%**
~ Proportion of female (%)	33.5%	29.6%	21.1%	11.7%	1.7%	**27.5%**
Total Labor Input						
~ Proportion of male (%)	76.0%	77.9%	87.9%	90.4%	95.9%	**82.4%**
~ Proportion of female (%)	24.0%	22.1%	12.1%	9.6%	4.1%	**17.6%**

Source: Household survey data

Looking at Table 28, the expenditures on agricultural inputs were mostly the domain of men. This meant that it may have been difficult for women to make decisions over how money was spent.

Table 28. Who controls the expenditures for agricultural inputs

	Hambaro		Parakan Muncang		Sukaluyu		Total	
	n = 62		n = 63		N = 60		n = 185	
Family head	49	79.0%	54	85.7%	49	81.7%	152	82.2%
Wife	11	17.7%	3	4.8%	4	6.7%	18	9.7%
No agricultural expenditure	2	3.2%	6	9.5%	7	11.7%	15	8.1%

Source: Household survey data

Figure 5. Watershed study site in Nanggung, Bogor, Indonesia

10. Conclusions

1. The project site, Kecamatan Nanggung, included 7,022.3 (63.8%) ha of arable land comprising of paddy fields (1,740.7 ha), ladang/kebun (1,836.5 ha), community forest (144 ha), and Perhutani/State Forest Corporation (SFC) land (2,050 ha). Housing, infrastructure including roads and other purposes accounted for the remaining area. All paddy fields, ladang/kebun lands and community forests were privately owned. In total, these privately held (farmer owned) lands comprised 3,721.3 ha (52.3%). The rest (47.7%) were officially under the management of SFC and other large-scale plantations.

However, discussion with farmers and government officials and observation found that some patches of government land were being cultivated by farmers. Detailed data was not available.

2. Population growth during the last three years (since 2003) was 0.40% per year, lower than West Java Province and even lower than national growth. Population density of the area was 683 persons per sq km, lower than for West Java, varied from 155 persons/sq km in Malasari (the uppermost village) to 2,347 persons/sq km in Kalong Liud. Agricultural density of Kecamatan Nanggung was 11 persons/ha, while at the village level the ratio varied from 6 persons/ha (Malasari) to 33 persons/ha in Sukaluyu. Seven out of 10 villages were above the kecamatan average, indicating that agricultural intensification is necessary in many villages of Kecamatan Nanggung.

3. Agriculture is an economic mainstay of Nanggung population, where 63.4% of the working population (economically active population) were engaged in agriculture, higher than the national data (46.3%). The survey clearly demonstrated that problems stemmed not merely from the natural capital available for the people, but also in the form of limitations of human capital and financial capital that were not easy to resolve. There was evidence of low level education attainment, such as 5.9 % of the respondents were illiterate, and most of the respondents (87.6%) never studied beyond the elementary level and primary school enrollment rate was also low (87.8%).

4. The largest proportion of family income was spent on food (62%) and other non-food consumption that was categorized as basic needs for the family livelihood. Although most of the people in Nanggung were farmers, agriculture did not contribute the most to family income, contributing only 14% to the total household income. Applying the poverty line of BPS (2005), the study found that 52% of the surveyed households were below the poverty line, and thus categorized as poor. Hambaro was the poorest among the three sample villages, where about 68% of the people were below the poverty line.

5. The surveyed households controlled 310 plots of which 163 plots (43.4 ha) were rice field, 83 plots (17.2 ha) dryland agriculture (*Tegal/ ladang*) and 18 plots (2.7 ha) monoculture gardens and 43 plots (12.4 ha) multi-species tree garden. The study revealed that 11% of the agricultural land controlled by the surveyed household belonged to others and were cultivated by arrangement, either through rental, sharecropping, or just *Numpang*. Unequal land distribution was a characteristic of the study site, where the bottom 60% of the surveyed household controlled only 15% of total landholdings, while the top 20% controlled about 62%. Land use systems practices of the plot samples before and during the years of ownership by the current landholder, the number of plots of the land use types relatively remained stable. Rainfed paddy fields, monoculture gardens, and complex agroforests, tended

Figure 6. 'Kebun' tree system at research site

Figure 7. On-farm demonstration plots utilizing tree garden understories for vegetable growing

to be changed by households into other land use types. Irrigated paddy fields, dryland and simple agroforests relatively remained stable.

6. Intensive agriculture (paddy fields, dryland and monoculture gardens) mostly took place in relatively flat areas, with more than 80% of the plots considered by the respondents as gently to slightly steep area. Most respondents considered their land quite fertile to very fertile. With the exception of the irrigated paddy fields, all other plots depended on rain as a source of water to support crop production.

Figure 8a. Sloping open field where soil erosion frequently occurs

Figure 8b. Growing indigenous plants in the sloping area to reduce erosion

7. We found 23 vegetable species and two staple crop species (paddy and cassava). The top five vegetable species found in plot samples were: Pisang (*Musa* sp.), Kacang panjang (*Vigna sinensis*), Timun (*Trichosanthes cucumeroides* Maxim), Kucai (*Allium tuberosum*) and Buncis (*Phaseolus vulgaris*). These species are mostly cultivated in dryland and simple agroforest plots. The tree species used to be planted in Dudukuhan were Alpukat (*Persea americana*), Melinjo (*Gnetum gnemon*), Nangka (*Artocarpus heterophyllus*), Jengkol (*Pithecellobium jiringa*), Durian (*Durio zibethinus*), Kecapi (*Sandoricum koetjape*), Sengon (Paraserianthes *falkataria*), Mangga (*Mangifera indica*), Petai (*Parkia speciosa*) and Pinus (*Pinus* sp.). Kacang panjang (*Vigna sinensis*), Timun (*Trichosanthes cucumeroides* Maxim), Kucai (*Allium tuberosum*) and Buncis (*Phaseolus vulgaris*) were the most common annual crops cultivated by farmers under the Dudukuhan system.

8. Land preparation was the activity most commonly conducted in the farm. Harvesting, maintaining and planting required the most labor. The number of person-days involved in land preparation was much higher than the number of person-days in other activities. The number of person-days involved in nursery activities and fertilizing activities was the lowest compared with other activities. Labor inputs showed that the larger area of plot samples, the less labor inputs. It was understandable that farmers with small parcels tended to intensify their land for their livelihood. It was also related to the availability of labor, as farmers with larger areas but with insufficient amounts of labor tended to practice less labor-intensive agricultural systems, such as tree-based systems.

9. The use of fertilizers, both chemical and green manure, was quite common in all sample plots in the study site, except for complex agroforests and fallow lands. The fertilizer rate of every land use category varied according to land use category and varied among plots within the land use category, reflecting the variation of land use practices and agricultural undertaking. The study found that chemical fertilizer was applied in all paddy fields and organic fertilizer was mostly applied in monoculture gardens and dryland plots. The rate of chemical fertilizer application was also quite high, ranging between 2 and 7,500 kg ha^{-1}, whereas for organic fertilizer, some plots, especially monoculture gardens, had reasonably high application rates, up to 34 tons/ha. The rate of pesticide application and type of pesticide use varied according to land use category. All types of pesticides were applied for all land use categories while in paddy fields herbicide was mostly applied to reduce the labor cost for weeding. The rate of pesticide application for dryland was the highest among the other land use categories.

10. Almost all commodities harvested were sold by the surveyed households. Most of the harvested yields (89% or more) were sold for 22 annual commodities. Only 76.5% of corn yields and 29.6% of rice were sold. All of the sawi produced were consumed by households

Figure 9. Katuk (*Sauropus androgynous)* a commercial indigenous vegetable

11. Data recorded from the surveyed households showed that high-value species (*Cabe, Caesin, Kacang kedelai*) were mosly sold directly through consumers, showing that farmers lacked adequate market information and market access, while other species (*Jagung, Timun, Ubi jalar*) were mostly sold through collectors. Other evidence of poor marketing ability of farmers in Nanggung was also found. None of the surveyed households processed the commodities harvested, thus missing the opportunity to gain additional market margin through value-added processing.

12. Women's involvement in agriculture was limited to certain activities in paddy fields. They had proportionally more than 15% of labor input only in nursery, maintaining, fertilizing, and harvesting activities, and very small inputs for other land use. Involvement in agriculture therefore partly depended on whether or not the households could afford to hire labor. Gender roles in Nanggung were probably restricted by socio-cultural factors. The gender role in cultivating vegetables depended on the skills of the father, mother and children; and selling products depended on the quantity of the produce, and expenditures on agricultural inputs were mostly the responsibility of men, making it difficult for women to make decisions over how money was spent.

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ANNEX TABLES

Table A1. Physical Infrastructure and Public Utilities of Kecamatan Nanggung

Physical Infrastructures and Public Utilities	Unit	Ratio to the Related Significance Unit
Road network		
- Paved/asphalted	70 km	636 m km^{-2}
- Graveled	110.5 km	1,004 m km^{-2}
- Dirt road	116.4 km	1,058 m km^{-2}
Irrigation facilities		
- Dam (public work)	3	
- Dam (self-reliance)		
Domestic water		
- Sallow well		
- Community domestic water network		
Electricity supply (PLN)	7,619 houses in nine villages	43.40%
Telephone line	1,010 households	5.22%
Education Facility		
- Kindergarten	1	
- Elementary school (SD/MI)	44 /16	
- Junior secondary school (SLTP/ MT)	1/3	
- Senior secondary school (SMU)	0	
Health Facility		
- *Puskesmas* - Public health centre	2	
- *Puskesmas Pembantu*	2	
- *Posyandu* - Integrated health services for mother and children (settlement based)	92	9 $village^{-1}$
- Family planning post	1	
Marketing facilities		
- Market	2	
- Kios /*warung*	587	
- *Toko*	39	
- others	295	

Table A2. Land Uses in Kecamatan Nanggung (ha).

	Malasari	Bantar Karet	Cisarua	Curug Bitung	Nanggung	Pangkal Jaya	Sukaluyu	Hambaro	Kalong Liud	Parakan Muncang	Jumlah
Total Area	4,756.40	841.04	1,411.00	1,397.00	697.40	398.92	**207.30**	**355.78**	329.00	**605.20**	10,999.05
Total Agricultural Land (*Available Land Excluded TNGH*)	2,801.00	434.68	635.00	1,268.07	374.44	319.30	**142.75**	**270.00**	260.55	**516.79**	7,022.58
Paddy fields	240.00	117.18	275.00	150.50	100.44	227.00	**7.75**	**225.00**	129.10	**268.76**	1,740.73
Ladang/Kebun	-	162.18	325.00	767.57	14.00	56.30	**87.00**	**45.00**	131.45	**248.03**	1,836.53
Large Scale Plantation	971.00	-	30.00	50.00	200.00	-	-	-	-	-	1,251.00
Perhutani Land	1,590.00	155.32	5.00	300.00	-	-	-	-	-	-	2,050.32
Community Forest	-	-	-	-	60.00	36.00	**48.00**	-	-	-	144.00
TNGH	1,787.00	-	-	50.50	-	-	-	-	-	-	1,837.50
Fishpond	-	5.00	3.00	3.50	3.00	3.64	**0.75**	**1.05**	-	**4.50**	24.44
Housing	43.00	62.50	68.00	60.00	35.00	32.00	**60.00**	**45.05**	24.27	**25.50**	455.32

Source: Household survey data, processed

Table A3. Household Income by Source of Income.

Source of Income	Hambaro				Parakan Muncang				Sukaluyu				Total			
	n Hh		Total Income		n Hh		Total Income		n Hh		Total Income		n Hh		Total Income	
Agriculture																
Agriculture	44	71%	6,239,068	11%	43	68%	6,541,074	7%	50	83%	10,687,905	14%	137	74%	23,468,047	10%
Livestock & Fishery	13	21%	6,498,246	11%	14	22%	1,463,249	2%	12	20%	382,080	0%	39	21%	8,343,575	4%
Total Agriculture Income	46	74%	12,737,313	22%	46	73%	8,004,323	9%	52	87%	11,069,985	14%	144	78%	31,811,622	14%
Off Farm																
Civil Servant	6	10%	2,450,000	4%	20	32%	12,750,000	14%	11	18%	2,555,666	3%	37	20%	17,755,666	8%
Farm Laborer	33	53%	7,462,833	13%	25	40%	8,767,500	10%	28	47%	6,731,000	9%	86	46%	22,961,333	10%
Gold Extraction	1	2%	150,000	0.3%	-	-	-	-	3	5%	950,000	1%	4	2%	1,100,000	0%
Home Industry	-	-	-	-	1	2%	3,000,000	3%	4	7%	650,000	1%	5	3%	3,650,000	2%
Off Farm Laborer	22	35%	8,320,750	14%	12	19%	5,000,000	6%	11	18%	4,000,000	5%	45	24%	17,320,750	8%
Private company employee	3	5%	650,000	1%	1	2%	300,000	0%	6	10%	2,010,000	3%	10	5%	2,960,000	1%
Services																
Transport	1	2%	1,500,000	3%	4	6%	2,450,000	3%	4	7%	1,650,000	2%	9	5%	5,600,000	2%
Others	-	-	-	-	3	5%	4,100,000	5%	3	5%	3,760,000	5%	6	3%	7,860,000	3%
Trader/Merchant	40	65%	17,020,000	29%	43	68%	37,161,498	42%	26	43%	14,559,166	19%	109	59%	68,740,664	30%
Total Off Farm	58	94%	37,553,583	63%	60	95%	73,528,998	83%	57	95%	36,865,832	47%	175	95%	147,948,413	65%

Table A3. (Continued)

Source of Income	Hambaro				Parakan Muncang				Sukaluyu				Total			
	n Hh		Total Income		n Hh		Total Income		n Hh		Total Income		n Hh		Total Income	
Non-fixed Income																
Given from son/daughter	20	32%	5,336,667	9%	23	37%	5,525,000	6%	17	28%	7,898,334	10%	60	32%	18,760,001	8%
Others	3	5%	3,600,000	6%	1	2%	2,000,000	2%	4	7%	22,625,000	29%	8	4%	28,225,000	12%
Total Non-fixed Income	23	37%	8,936,667	15%	24	38%	7,525,000	8%	21	35%	30,523,334	39%	68	37%	46,985,001	21%
Total Household Income	62	100%	59,227,564	100%	63	100%	89,058,321	100%	60	100%	78,459,151	100%	185	100%	226,745,036	100%

Table A4. Vegetables Species Cultivated by surveyed household (by landuse types and Hectare).

No	Commodity	Irrigated Paddyfield		Rainfed Paddyfield		Dry Land		Monoculture Garden		Simple Agroforest		Total	
		(% of n=99)	Area (ha)	(% of n=99)	Area (ha)	(% of n=99)	Area (ha)	(% of n=99)	Area (ha)	(% of n=99)	Area (ha)	(% of n=99)	Area (ha)
1	**Bayam** (*Alternanthera amoena voss)*					1.2%	0.10					0.3%	0.10
2	**Buncis** (*Phaseolus vulgaris)*			1.6%	0.25	4.8%	2.15			7.0%	1.10	2.6%	3.50
3	**Cabe** (*Capsicum frutescens)*					7.2%	1.18	5.6%	0.15	2.3%	0.10	2.6%	1.43
4	**Caesin** (*Brassica rapa L.*)	1.0%	0.05			3.6%	0.21					1.3%	0.26
5	**Jagung** (*Zea mays L.)*					4.8%	1.85			4.7%	0.28	2.0%	2.13
6	**Jahe** (*Zingiber offcinale)*	1.0%	0.60	1.6%	0.02	3.6%	0.51	5.6%	0.02			2.0%	1.15
7	**Kacang kedelai** (*Soya max piper)*			1.6%	0.02							0.3%	0.02
8	**Kacang panjang** (*Vigna sinensis)*	2.0%	0.16			12.0%	4.27			7.0%	0.98	4.9%	5.41
9	**Kacang tanah** (*Arachis hypogaea L)*	1.0%	0.10	1.6%	0.03	2.4%	0.60	5.6%	0.10			1.6%	0.83
10	**Kangkung** (*Ipomoea aquatica forsk)*					1.2%	0.10					0.3%	0.10
11	**Katuk** (*Sauropus androgynus merr)*					1.2%	0.30					0.3%	0.30
12	**Kucai** (*Allium tuberosum*)					3.6%	1.55			16.3%	2.55	3.3%	4.10
13	**Kunyit** (*Curcuma longa)*	1.0%	0.60			3.6%	1.01			2.3%	0.50	1.6%	2.11