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Agroforestry and Forestry in Sulawesi series:

Livelihood strategies and land-use system dynamics in South Sulawesi

Noviana Khususiyah, Janudianto, Isnurdiansyah, S Suyanto and James M. Roshetko

World Agroforestry Centre
TRANSFORMING LIVES AND LANDSCAPES

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Abstract

The project 'Agroforestry and Forestry in Sulawesi: Linking Knowledge with Action' (the 'AgFor Sulawesi Project') is being implemented in 3 provinces of Sulawesi, Indonesia (South Sulawesi, Southeast Sulawesi and Gorontalo) from 2011 to 2016 to enhance agroforestry and forestry livelihood systems of rural communities. The baseline survey reported in this document was conducted to support the project. The main objectives were to study the general characteristics of community livelihoods, local farming systems and land-use systems based on community perspectives. The assessment of land-use dynamics, farming systems and livelihood strategies in 2 districts of South Sulawesi was considered essential for designing the next phase of the project. The livelihood baseline study addressed both community and household levels.

The group discussion results within the three village typologies showed that there were quite clear distinctions in terms of livelihood options, tree crops and farm management. In the first typology - degraded land with annual crops system villages (Kayu Loe and Bonto Karaeng), the maize area had increased significantly during the last 40 years; conversely there was a significant decrease in candlenut and other plantation areas. The use of maize induced farmers to manage their land intensively. In the second typology - agroforestry system villages (Pattaneteang and Campaga), coffee and clove cultivation had increased quite significantly during the last 40 years but the maize and forest area had declined. Farmers in these typologies have practised complex agroforestry systems (coffee, cacao and clove) for a long time. In the third typology - timber-based system villages (Tugondeng and Tana Towa), land-use dynamics were different. In Tugondeng the coconut area had increased quite significantly over the last 40 years to the point that it is now the major resource. In Tana Towa, almost all of the land-use options had remained unchanged during the last 40 years owing to strong customary law ('Adat') in the village to protect forest area from conversion/encroachment. The agroforestry systems in these villages mirrored those of the second typology with expanding smallholder timber plantations to support livelihoods.

The household survey concluded that the average total income per year per household for farmers working in typology 1 was lower than that of typologies 2 and 3. The major sources of income for farmers in typology 1 were maize fields and remittances; typology 2 farmers depended on their agroforestry products and typology 3 farmers were supported by coconut plantations and entrepreneurial activities. The daily per capita income of farmers in typology 1 areas was below the international poverty line.

Keywords: AgFor Sulawesi Project, South Sulawesi, land-use dynamics, livelihoods, income, coffee, cacao, cloves, agroforestry

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1. Introduction

The project 'Agroforestry and Forestry in Sulawesi: Linking Knowledge with Action' (the 'AgFor Sulawesi Project') is under implementation in 3 provinces of the island of Sulawesi, Indonesia (South Sulawesi, Southeast Sulawesi and Gorontalo) from 2011 until 2016. The ultimate outcome of the project is to enhance the agroforestry and forestry livelihood systems of rural communities in Sulawesi (Roshetko et al 2012).

The primary challenge is the low diversity of rural livelihoods systems, their high dependence on exotic commodity crops and the ensuing exposure to risk (biological and market). Diverse agroforestry systems in well-managed landscapes with gradients of intensity from intensive rice fields to natural forest are widely considered as more robust and risk adverse so the Project intends to establish them in the 3 cited provinces. Furthermore, suboptimal watershed management is leading to increased soil erosion, sedimentation, landslides and floods. Secondly, analyses indicate that Sulawesi will experience substantial variation in current atmospheric conditions, further exacerbating watershed problems. Enhanced watershed management and adaptation strategies for local farmers are needed to secure livelihoods and protect the environment. Incentives that help the development of environmental service programmes also need to be created. Thirdly, marginalized people lack titles to their land and have little awareness of, or access to, channels for certification or clarification of land status. This perpetuates vulnerability and suppresses investment. Similarly, women's rights are also often sidelined or ignored, indicating a special need for awareness raising and empowerment. Continued encroachment into forest areas is seen as a major driver of deforestation and is symptomatic of the wider conflict between communities and the government. Fourthly, local governance capacity is weak. Decentralization coupled with democratization has caught many districts unprepared. After 10 years, a great deal of local capacity has been built, but self-government is still understood more as entitlement rather than responsibility. Development efforts still lack the long-term vision necessary to achieve sustainability. Community participation in government land-use planning remains rare, as do relevant incentives and benefits for those communities (Roshetko et al 2012).

In order to support the project, a baseline survey was conducted. One of the main objectives of the survey was to study the general characteristics of types of livelihoods in the community, local farming systems and the existing land-use systems in the area based on community perspectives. Assessment

of land-use dynamics, farming systems and livelihood strategies within the 2 selected districts in South Sulawesi Provinces is very important for designing the next phase of the project and also for designing preferred strategies and their viability under local conditions. Two unit analyses were used in the livelihood baseline study—community level and household level. This study provides the baseline community perspectives on land-use dynamics, farming systems, livelihood strategies and more detailed data on household-level activity in South Sulawesi.

2. Methodology

2.1 Study objectives

The main objectives of the study were:

- To identify general characteristics of livelihoods, farming systems and other land-use systems in the area based on community perspectives.
- To do likewise using household surveys.

2.2 Data collection and analysis

Focus group discussions (FGDs) were employed in each sample village in 2 districts of South Sulawesi Province to acquire the data. The FGDs ran throughout the day with 8 farmers participating in each group on average. The participants comprised the village members who were most knowledgeable about local conditions. Topics for discussion revolved around village demographics, history, land-use systems, livelihood sources and land management practices.

Household-level information was collected from 30 households using random stratification from 4 villages in South Sulawesi (Table 1). Whenever possible, the husband and wife from each household were interviewed together. Details are elaborated in the following sections.

3. General overview of the site

3.1 Site characteristics and typologies

South Sulawesi province located in the southern part of Sulawesi Island consists of 20 districts and 3 municipalities with a total area of 45 764 km^2. More than 57% of the province is forested, with the remaining area being occupied by wet paddy systems (9%), wetlands (> 10%) and arable land (nearly 10%). This province is famous for being the first producer of paddy and other food crops including maize, cassava, sweet potato and peanut in the eastern part of Indonesia. Noteworthy plantation crops from South Sulawesi are cacao, coconut, cloves and coffee; cultivation is conducted primarily by smallholders. Bantaeng and Bulukumba districts were selected as sites for the AgFor Sulawesi Project (Figure 1).

Both districts are situated in mountainous land approximately 150 km from Makassar. Bulukumba district is 1 154.7 km^2 in size and was inhabited by 394 757 people in 2010 (BPS 2010). The adjacent district of Bantaeng is smaller, covering 395.83 km^2 with a population of 170 057 people in 2010. In 2007 the Bantaeng and Bulukumba districts were respectively the second and fifth highest producers of maize as a food crop (others being Gowa, Jeneponto and Bone districts). Both districts were also strong producers of paddy. While Bantaeng was not the highest producer, production was still above the average for South Sulawesi (5.01 over 4.7), while Bulukumba was slightly lower than the average (4.68) (BPS Sulawesi Selatan 2008).

In 2010 cacao production in Bantaeng and Bulukumba districts covered 5 377 and 7 456 ha respectively; Bulukumba produced 4 626 tonnes and Bantaeng, 2 157 tonnes.

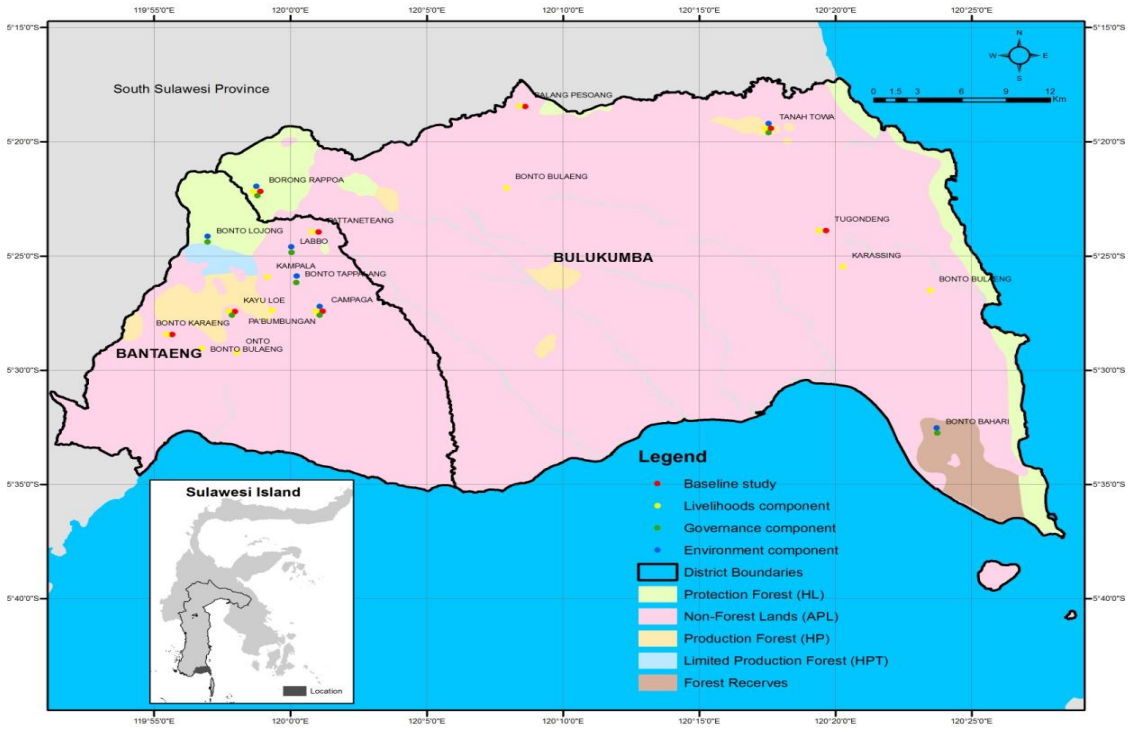

Figure 1. Study site in South Sulawesi

Coconut production is mainly done by smallholders in mixed-garden systems (over 111 526 ha) and to a much lesser extent on a private scale (1431 ha). Of the 83 724 tonnes produced in 2010 in South Sulawesi, Bulukumba and Bantaeng produced 0.9% and 2.6% of this total, respectively.

The situation is similar for clove production which occupies approximately 44 524 ha. Of the 16 385 tonnes produced in 2010, Bulukumba and Bantaeng produced 5.2% and 1.9% of the total, respectively.

Of the total coffee production in 2010 in South Sulawesi of 36 554 tonnes, Bulukumba produced 11.3% and Bantaeng, 4.38%. The total area of coffee production in South Sulawesi managed by smallholders was 70 412 ha (3 800 ha in Bantaeng and 5 179 ha in Bulukumba).

In order to capture general characteristics of each AgFor Sulawesi Project site in South Sulawesi, group typologies were developed during a field trip, which took place after the inception meeting held in Makassar on 25 January 2012. The typologies were based on physical conditions that lead to different major land-use activities and farming practices in each area, while also considering administrative status. The list of typologies is presented in Table 1.

Table 1. Village typologies and details of FGDs and household surveys held in South Sulawesi

Village typologies	Degraded land, annual crops system	Agroforestry system	Agroforestry system	Timber-based system	Total group/ household respondent
	1	2	2	3	
Districts	Bantaeng	Bantaeng	Bulukumba	Bulukumba	
Villages	Onto, Kayu Loe, Bonto Bulaeng, Bonto Karaeng, Pabumbungan	Campaga, Labbo, Pattaneteang, Kampala	Borongrappoa, Balangpesoang, Batu Karopa, Kahayya, Bangkeng Bukit	Karassing, Tugondeng, Tana Towa, Tanah Beru	
FGDs	Kayu Loe Bonto Karaeng	Pattaneteang Campaga	Borongrappoa Balangpesoang	Tugondeng Tana Towa	8 groups
Household survey	Kayu Loe	Campaga	Balangpesoang	Tugondeng	120 households

3.2 Households status

3.2.1 House condition

The condition of farmers' houses can be used to estimate their welfare (BPS 2009). We assessed the condition of houses using 4 variables: types of walls, roof, floor and lighting availability. The condition of houses belonging to farmers working on degraded land with annual crops system (hereafter referred to as typology 1) was poorer compared to houses owned by agroforestry system and timber-based system farmers (typologies 2 and 3, respectively) which was relatively similar.

For typology 1, most floors were made of wood (87%) and lighting was provided by kerosene lanterns (57%) and power from mini-hydro systems (27%). For typology 2, most floors were made of wood (40–77%) and cement (23–43%) and lighting was powered by the public electricity grid (93%). For typology 3, most floors were made of wood (47%) and tiles (33%). Power also came from the public electricity grid (93%) (Figure 2 and 3).

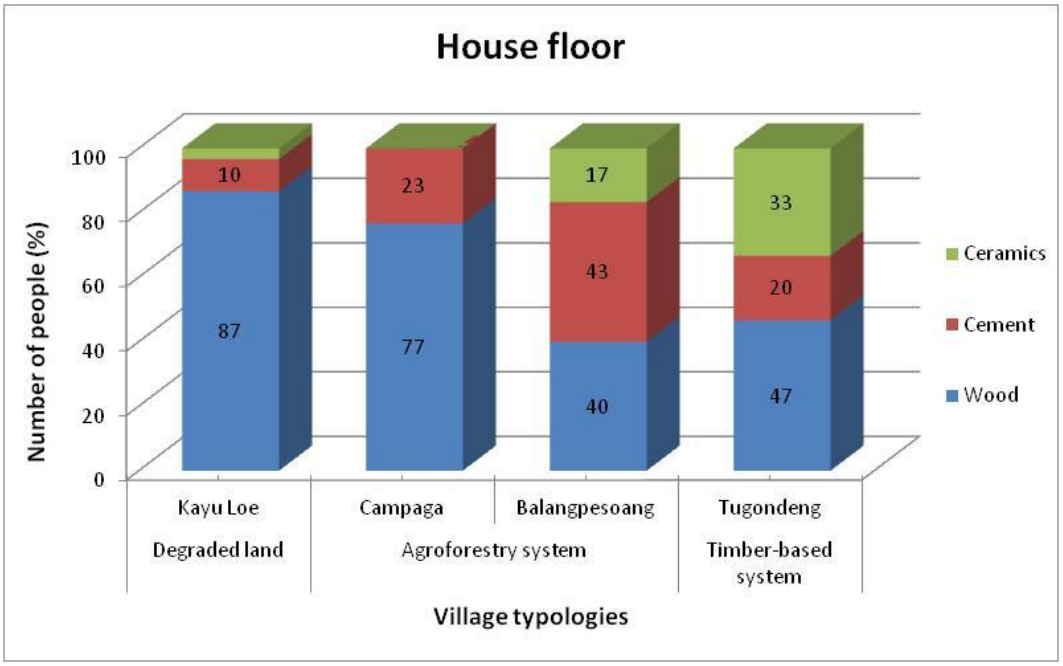

Figure 2. House flooring in South Sulawesi

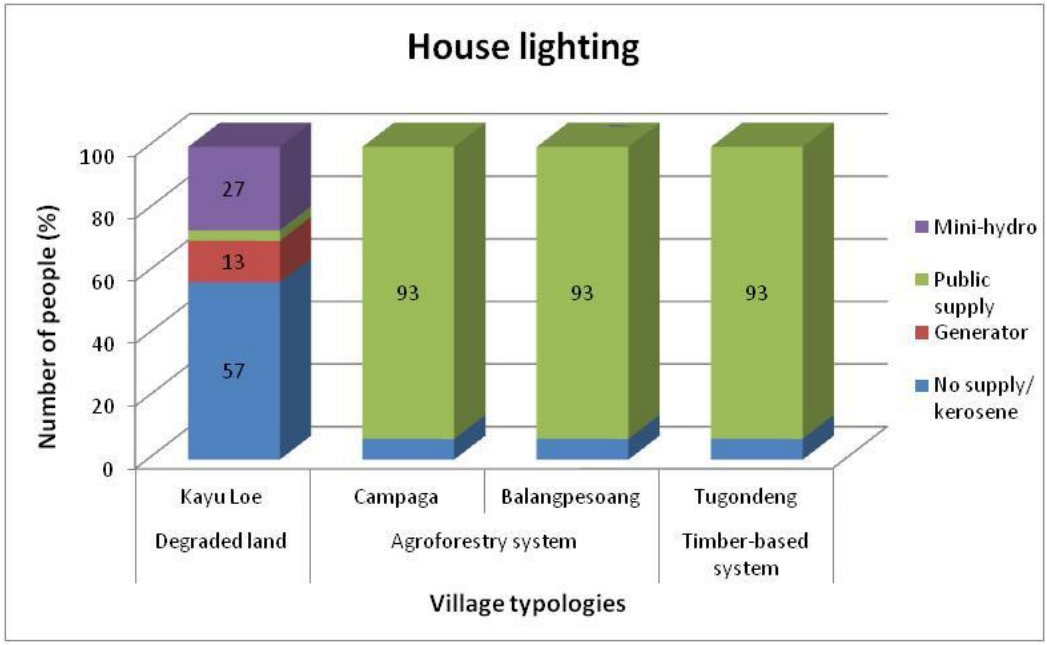

Figure 3. House lighting sources in South Sulawesi

3.2.2 Education

The level of education for typology 1 farmers was very low, while it was about the same for the other 2 typologies. Educational attainment among women was slightly lower than men. However, statistical

analysis indicated that there was no significant difference in education levels between men and women in all areas.

Most of the respondents in South Sulawesi, including both husbands and wives, possessed medium education levels (Table 2 and Figure 4). The average length of schooling for typology 1 farmers was very low at 1.29 years for men and 1 year for women. This typology also had the highest illiteracy rates (61% for men and 79% for women), while rates in Bantaeng and Bulukumba districts were 11.93% and 11.4% respectively (BPS 2012). The mean length of schooling for typology 2 farmers was 5.2–5.7 years for men and 6.0–6.2 years for women. Typology 3 farmers were the most educated with average length of schooling of 9 years for men and 8.9 years for women. However, the results from data analysis using the 't test' demonstrated no significant difference in education levels between men and women in all areas.

Table 2. Years of schooling among village typologies in South Sulawesi

Village typologies	Village	n	Years of schooling										Mean years of schooling	t test
			Illiteracy		Primary school		Junior high school		Senior high school		Pass senior high school			
			n	%	n	%	n	%	n	%	n	%		
Degraded land (typology 1)	**Kayu Loe**													
	Male	28	17	61	10	36	1	4	0	0	0	0	1.29	t stat= 0.448 (P>|t|= 0.965)
	Female	28	22	79	4	14	2	7	0	0	0	0	1	
Agroforestry system (typology 2)	**Campaga**													
	Male	26	5	19	15	58	3	12	3	12	0	0	5.15	t stat= -1.103 (P>|t|= 0.460)
	Female	29	2	7	20	69	3	10	3	10	1	3	6.24	
	Balangpesoang													
	Male	30	5	17	14	47	7	23	4	13	0	0	5.73	t stat= -0.304 (P>|t|= 0.495)
	Female	30	4	13	16	53	6	20	4	13	0	0	6.03	
Timber-based system (typology 3)	**Tugondeng**													
	Male	30	0	0	10	33	8	27	11	37	1	3	8.97	t stat= 0.46 (P>|t|= 0.637)
	Female	27	0	0	9	33	7	26	11	41	0	0	8.93	

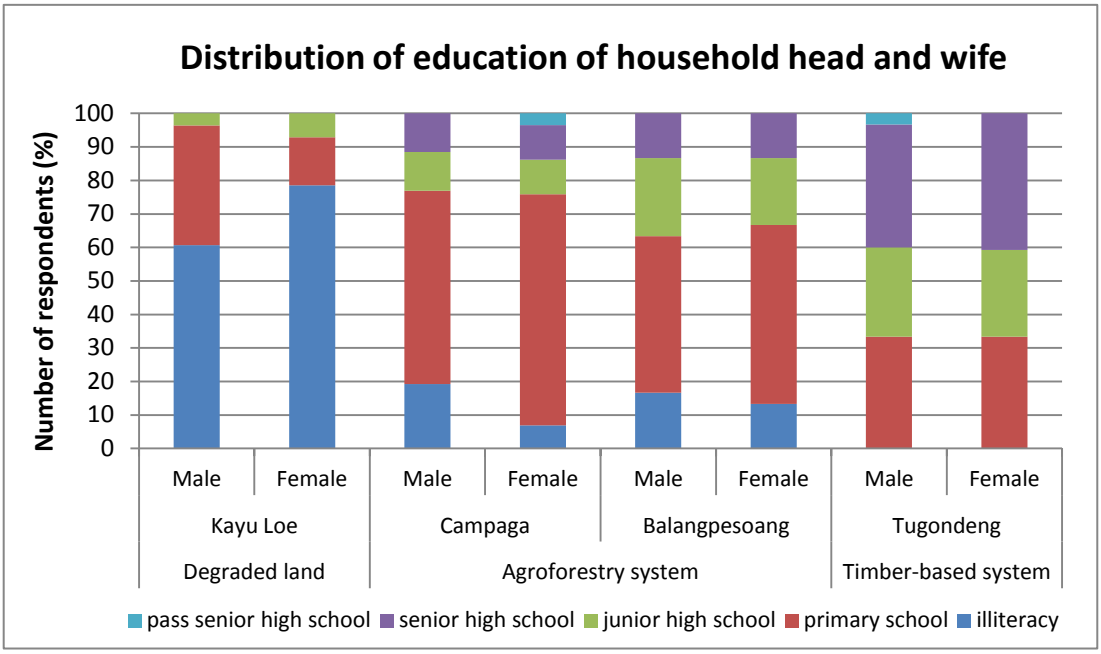

Figure 4. Years of schooling among household heads and spouses in South Sulawesi

Children's education levels were also assessed in South Sulawesi (Table 3 and Figure 5). The mean length of schooling for children of typology 1 farmers was very low (3.3 years for boys and 3.2 years for girls). For typology 2 farmers it was 6.6–8.2 and 7.00–7.40 years for boys and girls, respectively and for typology 3 it was 7.7 and 7.1 years for boys and girls, respectively. However, the results from data analysis using the t test, demonstrated there were no significant differences in child education levels in all areas.

Table 3. Years of schooling among children in South Sulawesi

Village typologies	Village	n	Years of schooling										Mean years of schooling	t test
			Illiteracy		Primary school		Junior high school		Senior high school		Pass senior high school			
			n	%	n	%	n	%	n	%	n	%		
Degraded land (typology 1)	**Kayu Loe**													
	Male	28	17	61	10	36	1	4	0	0	0	0	1.29	t stat= 0.448 (P>Itl= 0.965)
	Female	28	22	79	4	14	2	7	0	0	0	0	1	
Agroforestry system (typology 2)	**Campaga**													
	Male	26	5	19	15	58	3	12	3	12	0	0	5.15	t stat= -1.103 (P>Itl= 0.460)
	Female	29	2	7	20	69	3	10	3	10	1	3	6.24	

	Balangpesoang												
	Male	30	5	17	14	47	7	23	4	13	0	0	5.73	t stat= -0.304 (P>Itl= 0.495)
	Female	30	4	13	16	53	6	20	4	13	0	0	6.03	
Timber-based system (typology 3)	**Tugondeng**												
	Male	30	0	0	10	33	8	27	11	37	1	3	8.97	t stat= 0.46 (P>Itl= 0.637)
	Female	27	0	0	9	33	7	26	11	41	0	0	8.93	

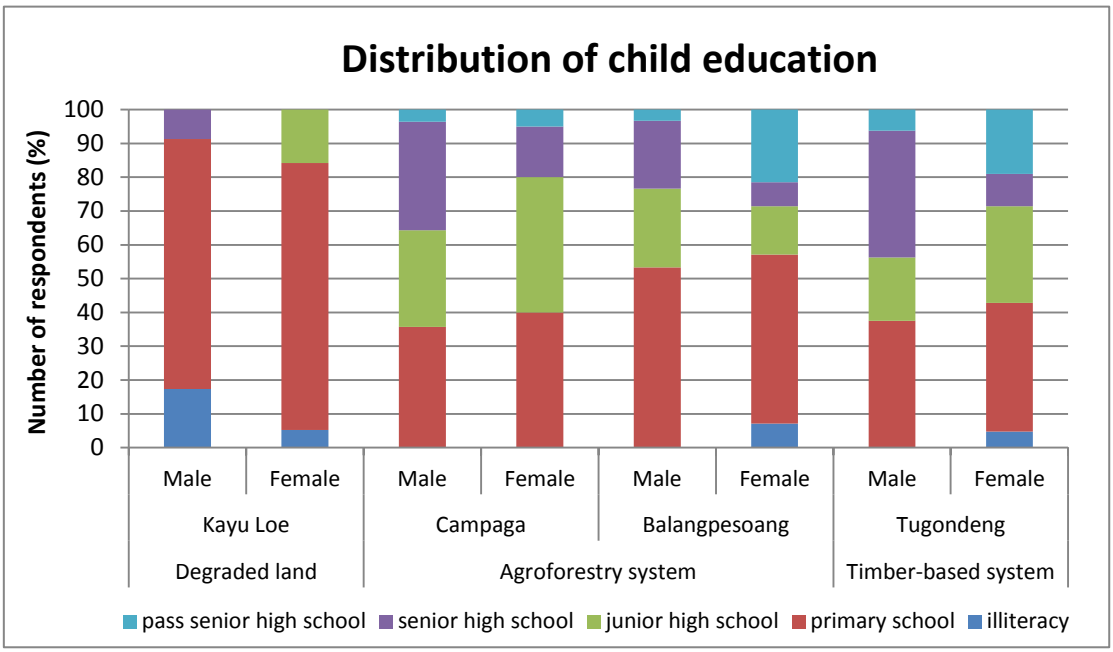

Figure 5. Distribution of child population by years of schooling in South Sulawesi

3.2.3 Household gender distribution

Gender distribution in all 3 typologies was relatively similar although in typologies 1 and 2 there were slightly more men than women. This situation was reversed in typology 3 (Figure 6).

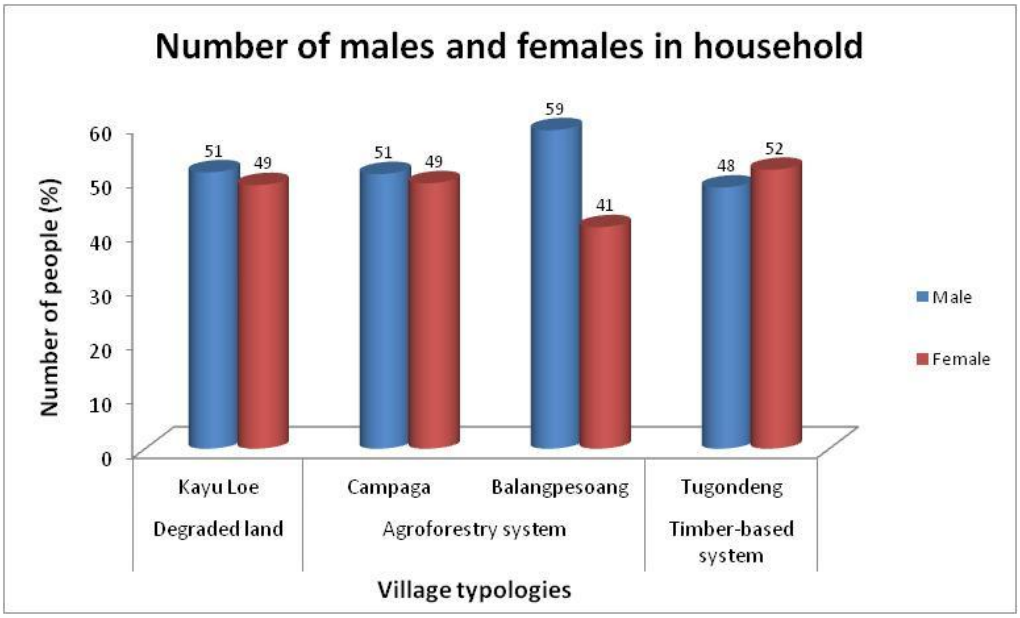

Figure 6. Household gender distribution in South Sulawesi

3.2.4 Ethnicity of household heads

The Makassar ethnic group predominated in most typologies but the Bugis prevailed in Balangpesoang (Figure 7).

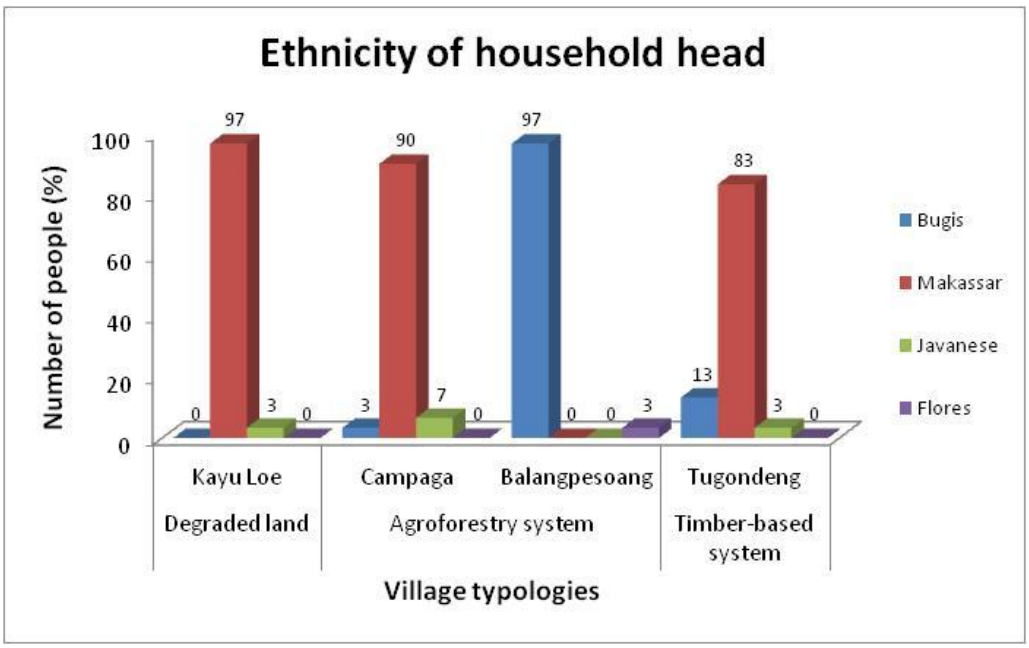

Figure 7. Ethnicity of household heads in South Sulawesi

4. History of the villages and land-use dynamics in South Sulawesi

This chapter discusses the general history of the villages and main land-use systems. Maize, paddy rice and tree-based products were the most common farming outputs in all typologies. Maize was quite dominant in typology 1, while clove-, coffee- and cacao-based agroforestry systems were prevalent in typology 2.

4.1 Community perspectives on village history and land-use dynamics in South Sulawesi

4.1.1 Typology 1 (degraded land with annual crops as major farming system villages)

Farmers in this typology have been growing crops for many years as the foremost agricultural activity. Formerly upland paddy rice, maize and coffee were the main crops but starting in the 1980s, hybrid maize became another option which led to conversion of forest area into farmland.

Kayu Loe

Kayu Loe was established in the 1930s by the village's Makassar forefathers. Initially, the main crops were maize (as staple food), cassava, coffee (local coffee namely 'bugis coffee' or 'bantaeng coffee'), potato, sweet potato, taro and upland paddy rice. Land use was strongly influenced by forest cover (protected and community forest), so the maize area was not extensive at that time. In 1980 farmers started to plant arabica coffee from Jember (Java), then continued with hybrid maize (local name: 'jagung kuning') in 1985. Owing to the hybrid maize boom, the conversion of forest area to maize plots increased rapidly.

At the beginning of the 1990s farmers also planted cloves using seedlings from Manado. Clove cultivation was highly attractive because of the profit generated. To support the farmers, the government supplied 5000 clove seedlings, 45 000 'suren' seedlings and various durian and timber species ('bayang jawa', mahogany, gmelina, and 'sengon') in 2010 and 2011.

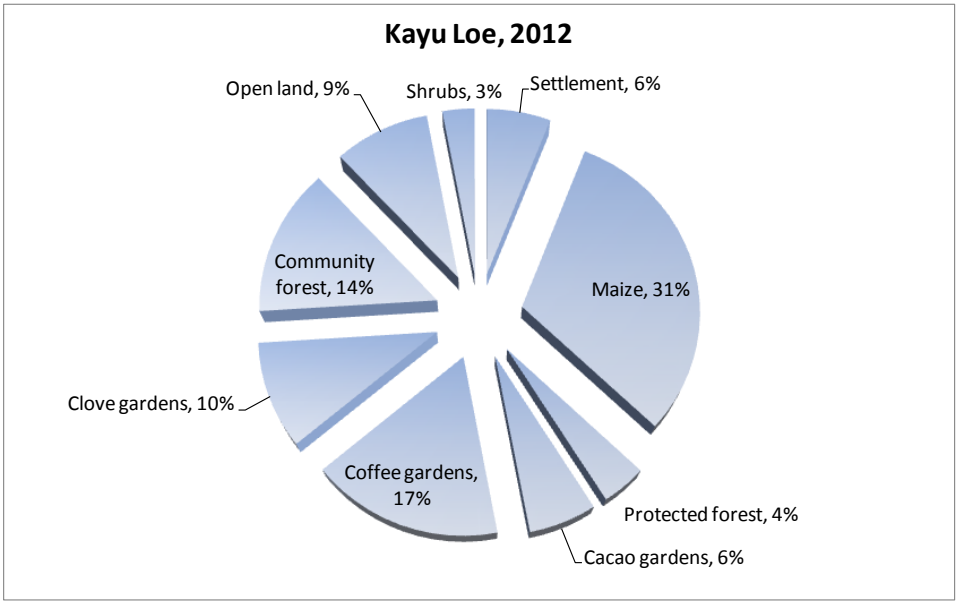

Figure 8. Current land use in Kayu Loe village based on community perspectives

Now maize dominates land use in Kayu Loe as it is grown by around 1/3 of the villagers who also continue with coffee gardens, community forest and clove gardens. In the community forest, farmers plant candlenut, mahogany, 'suren', 'sengon', 'kayu putih' and 'jati putih' (Figure 8). Farmers also mentioned the presence of open land ('Bonto Rampan') which is highly degraded land caused by inappropriate intensive farming practices on sloping land.

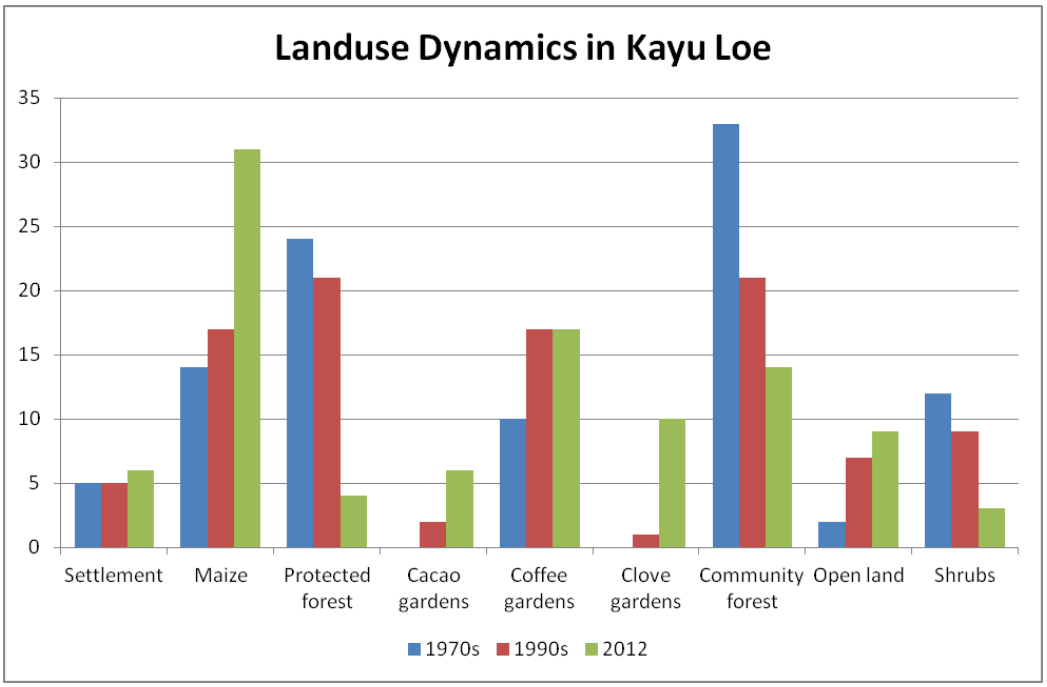

Figure 9. Land-use dynamics in Kayu Loe based on community perspectives

Figure **9** shows that the maize area has expanded considerably during the last 40 years. This trend has been accompanied by a significant decrease in forest cover—both community and protected forest. This situation conforms to the boom in hybrid maize over the same period.

Bonto Karaeng

Bonto Karaeng was established in 1970s when 7 Makaserese households from Enrekang and Bantaeng decided to settle in Dusun Papasangan (Bonto Macini). They employed shifting cultivation in a small number of forests and converted them for maize cultivation and settlement purposes. Livelihoods were sustained by maize cultivation, candlenut collection and bamboo harvesting, and products were sold in Bantaeng. In the early 1990s, farmers initiated paddy rice cropping and also planted hybrid maize, which soon became the main crop, and remains so today (Figure 10).

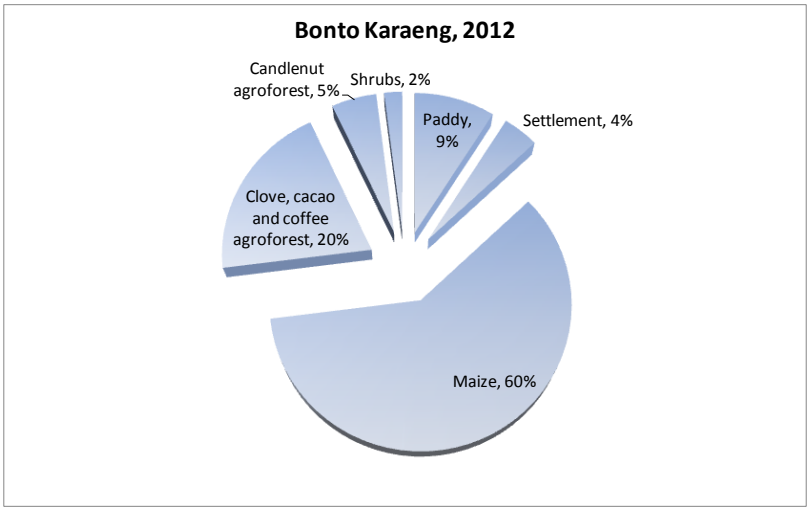

Figure 10. Current land use in Bonto Karaeng village based on community perspectives

Cacao was first introduced in 1996. The government provided 100 000 cacao seedlings in 2000 but many were damaged by serious drought. However, the farmers were still able to derive income from the cacao that remained, prices in 2005 being approximately IDR 10 000 per kilogram.[1] In 2009, when the price of cloves became higher than cacao, farmers' interest was piqued and they obtained seedlings from Bulukumba district. The government also distributed around 3 000 clove seedlings in 2011 to support this endeavour. Current land use in Bonto Karaeng is still dominated by maize (more than half of the total village area), followed by mixed-cropping systems (cloves, cacao and coffee).

[1] US$ 1.00 = IDR 9608 (December 2012).

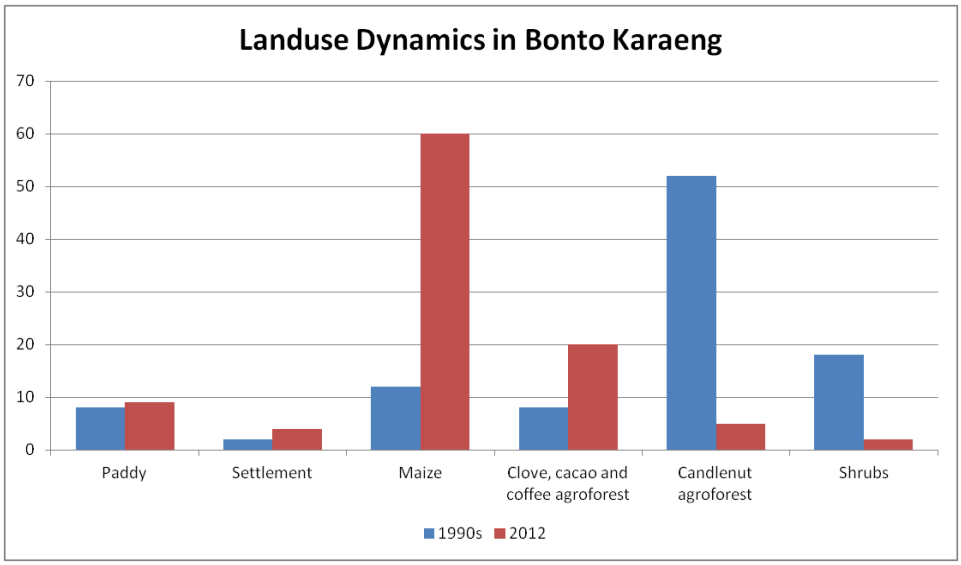

Figure 11. Land-use dynamics in Bonto Karaeng based on community perspectives

Figure 11 Figure 11 shows that the maize area has expanded considerably during the last 20 years. This is juxtaposed by a significant decrease in candlenut alley cropping systems. This situation conforms to the boom in hybrid maize over the same period similar to the situation in the neighbouring village of Kayu Loe.

4.1.2 Typology 2 (agroforestry system villages)

This village typology is found in both Bantaeng and Bulukumba districts. Initially maize, cassava and upland paddy were the staple crops. From the 1990s onwards plantation crops (coffee, cacao and cloves) were introduced and the farming system became more complex.

Agroforestry systems in Bantaeng district

Pattaneteang

Pattaneteang was established by Bugis immigrants from Wajo in the 1930s. The staple crops were coffee, maize, sweet potato and paddy rice. By 1945, farmers had irrigated paddy fields (the irrigation system was a legacy from Dutch colonization) and planted 'bugis' coffee which came from Wajo. Until the 1960s, many varieties of coffee were cultivated in Pattaneteang such as 'bugis', arabica, robusta, dwarf and 'husda' coffee.

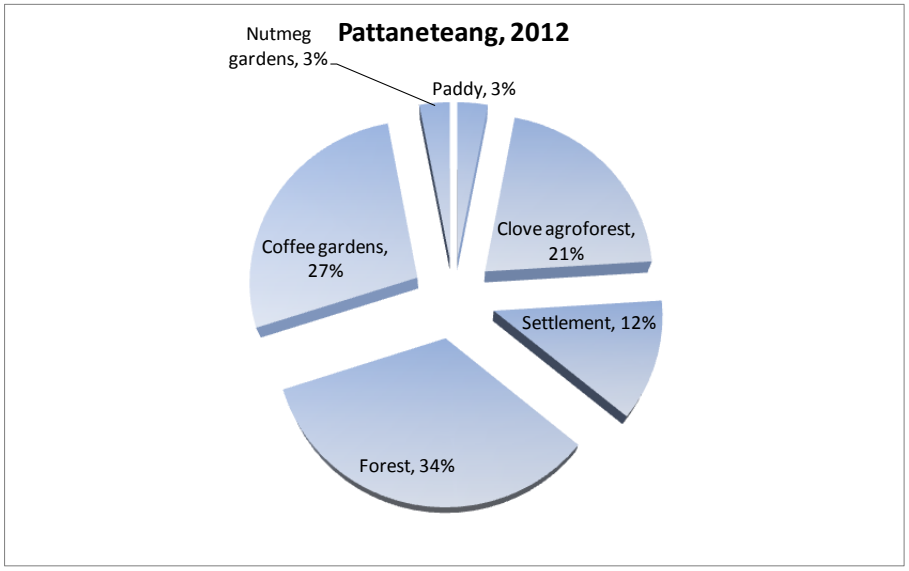

Figure 12. Current land use in Pattaneteang village based on community perspectives

Starting in the early 1970s and up to the 1980s, many farmers planted cloves using seedlings from Ambon Island (Mollucas). In the 2000s, village forest was being encroached to cultivate coffee (around 150 ha) although this has not affected the whole area to date. In 2011, cacao was seriously damaged by black pod disease (*Phytophthora palmivora*) or 'busuk buah kakao' while cloves also suffered from stem borers or ' penggerek batang'. Now, coffee and clove agroforest remains just behind forest as the largest form of land use in Pattaneteang (Figure 12).

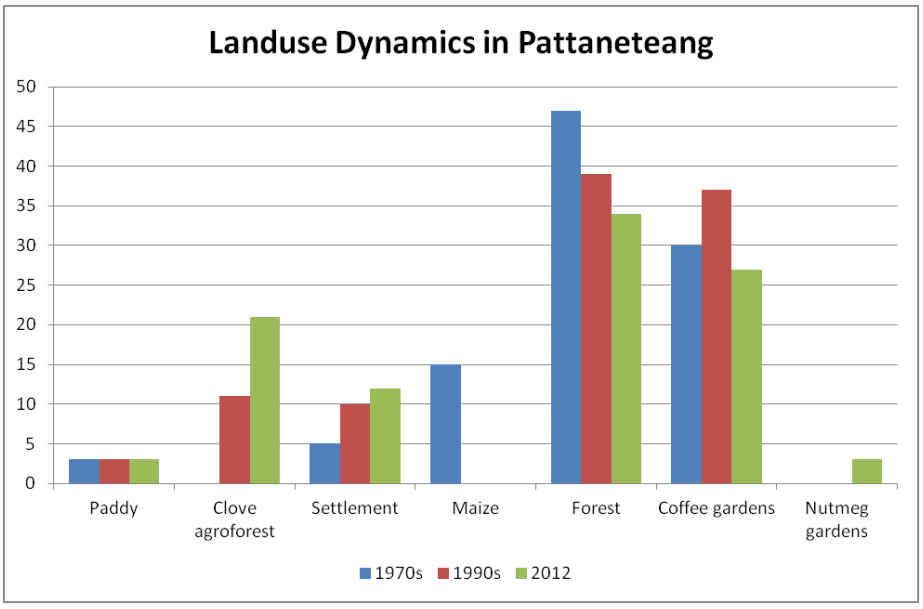

Figure 13. Land-use dynamics in Pattaneteang based on community perspectives

Figure 13 shows the increase in clove agroforest during the last 40 years and the decrease in forest cover. The paddy area remained unchanged due to its location in the valley that has never been converted to other land use. The maize area had eventually disappeared by 2012, evidencing the boom in clove agroforest.

Campaga

Campaga was established in 1930s by Makassar residents. During this early period they subsisted on maize, coffee (bugis coffee), fruit and upland paddy rice. In 1965, farmers started to plant robusta coffee and 20 years later they began cultivation of arabica coffee.

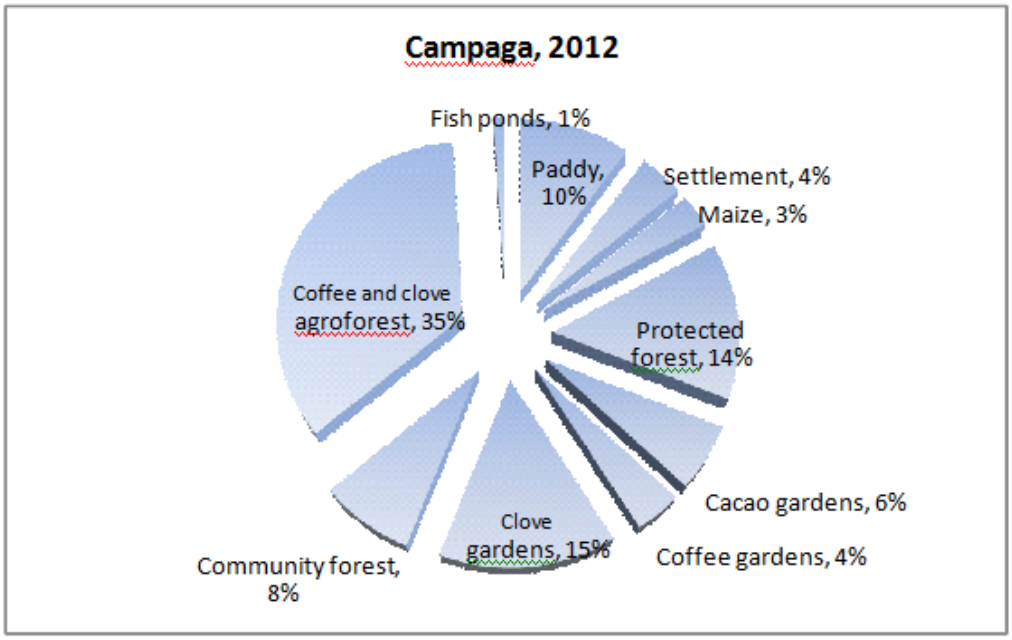

Figure 14. Current land use in Campaga village based on community perspectives

From the 1970s until 2000+, cloves and cacao were introduced to the farmers; the government donated 30 cacao seedlings to each household. Government support for arabica coffee cultivation was provided through the Rehabilitation Project for Export Crops (PRPT Project) in 1985 via credit schemes; this was replicated in 1990 for 'durian aceh' and local durian seedlings. In 2010 the Gernas programme lent assistance for cacao grafting by farmers. In 2002, the cacao crop was severely impacted by pests and disease that significantly lowered output. Currently, land-use systems in Campaga are dominated by coffee and clove agroforest followed by clove gardens and protected forest (Figure 15).

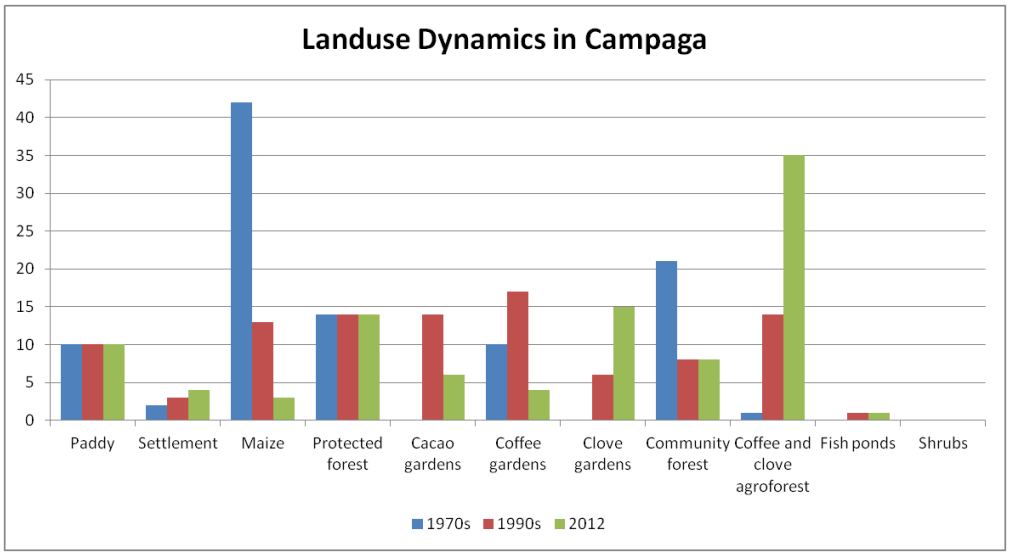

Figure 15. Land-use dynamics in Campaga based on community perspectives

Figure 15 shows that the coffee and clove agroforest area has increased considerably during the last 40 years; conversely the maize area has decreased. The paddy rice area has remained relatively unchanged owing to its valley location (as in Pattaneteang). These conditions illustrate the boom in coffee and clove agroforest and the demise of the maize area.

Agroforestry systems in Bulukumba district

Borongrappoa

According to villagers, Borongrappoa was established in the early 1900s by Bugis and Makassar immigrants from Sinjai and Gowa who relied on maize and upland paddy. In 1945, farmers planted robusta coffee, maize, banana and sweet potato. In the 1950s they established rain-fed paddy fields for harvesting once a year. Cloves were first planted in early 1971, followed by cacao and arabica coffee in 1986. In 1971, the farmers obtained clove seedlings from PT. Sulawesi and Plantation Agency. This company initially managed approximately 480 ha of clove gardens, but operations lasted for one year only owing to land tenure conflicts with the locals.

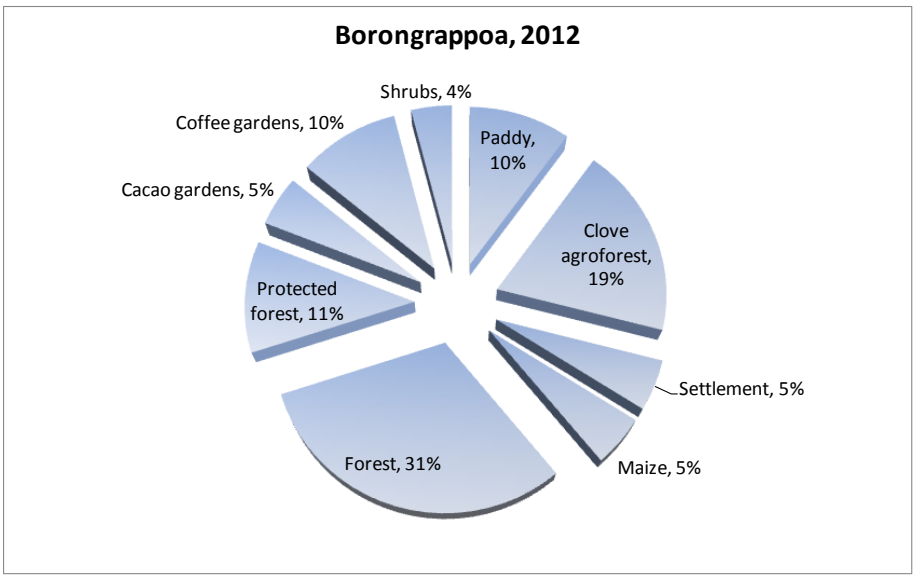

Figure 16. Current land use in Borongrappoa village based on community perspectives

In 1987 the government donated cacao seedlings. Unfortunately, in 2006 cacao was attacked by black pod disease and stem pod borers, which forced farmers to cut down the cacao trees and switch to clove and arabica coffee. Current land use in Borongrappoa is characterized by forest cover, clove agroforest as well as maintenance of protected forest (Figure 16).

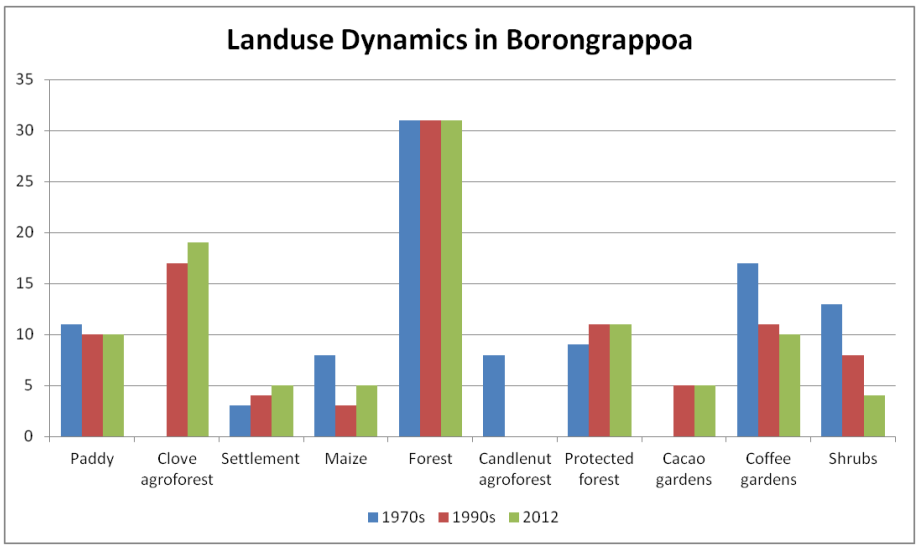

Figure 17. Land-use dynamics in Borongrappoa based on community perspectives

Figure **17** shows the expansion of clove agroforest during the last 40 years, the decline in coffee gardens and disappearance of candlenut agroforest. Forest cover remained unchanged during this period.

Balangpesoang

Balangpesoang was established in the 1920s by Bugis immigrants whose subsistence crops were maize, cassava, bugis coffee and upland paddy rice. In the 1970s many more immigrants arrived from Sinjai, Bulukumba and Ujung Pandang to purchase land and plant cloves. At the end of the 1970s, many indigenous villagers followed suit by establishing clove gardens. In the early 1980s, planting of pepper and cacao was initiated.

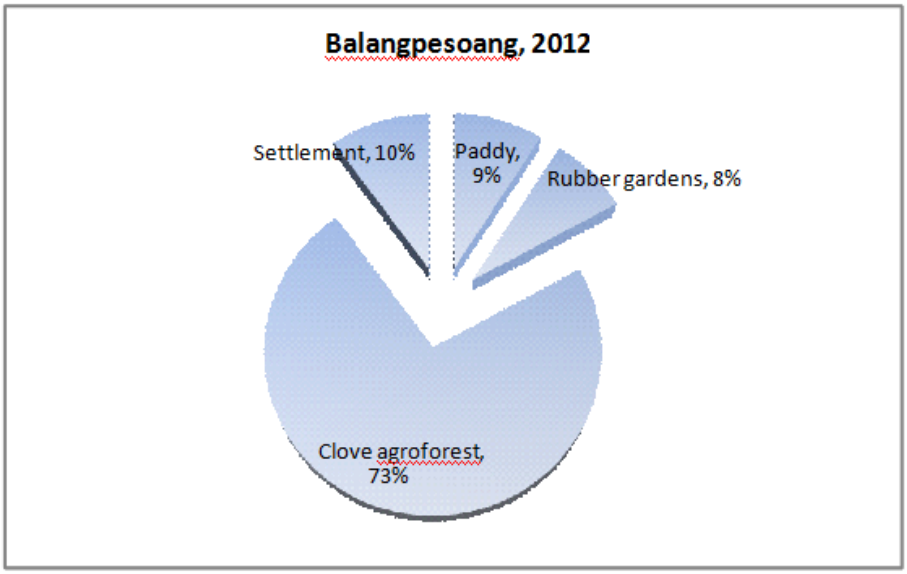

Figure 18. Current land use in Balangpesoang village based on community perspectives

In 1998, around 5 ha of rubber gardens were developed by non-indigenous villagers who sold the rubber to PT. Sulawesi on a contract basis. Recently, many farmers have planted fruit tree species such as rambutan, ‘durian otong’, ‘durian cipaku’ and ‘manggis’. Current village land use is dominated by cloves agroforested with coffee, cacao, fruit and timber trees (Figure 19).

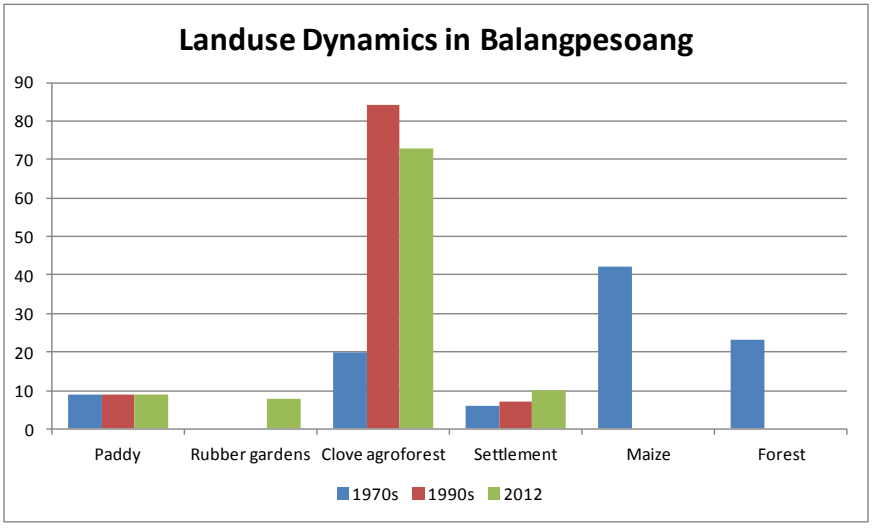

Figure 19. Land-use dynamics in Balangpesoang based on community perspectives

Figure **19** shows the significant increase in clove cultivation during the last 40 years and the eventual disappearance of maize and forest area in the village; the paddy rice area remained stable during this period. Rubber cultivation has started recently. The data evidence the clove boom that has displaced maize cultivation and forest cover.

4.1.3 Typology 3 (timber-based system villages)

The villagers in typology 3 were familiar with marketable timber systems using species such as teak, mahogany, 'suren', gmelina and 'sengon'. However agroforestry practices with coconut, coffee, cloves, maize and tree species were the main land-use activities.

Tugondeng

Tugondeng was established during the Dutch colonial period by Bugis immigrants from Bone who grew maize, upland paddy rice and sweet potato. In 1945 the village was still known as 'kesultanan' (the 'empire'). Demographically the Bugis settlers have now been replaced by Konjo immigrants who predominate in Tugondeng.

In the 1980s, the government provided support in the form of coconut hybrids and the villagers also began to plant cacao during this period, intercropping coconut and cacao in the same gardens. In 1995, an intensive 3-month extension support programme on how to make palm sugar was implemented. The programme also supplied tapping tools, stoves and pans used in the palm sugar-making process.

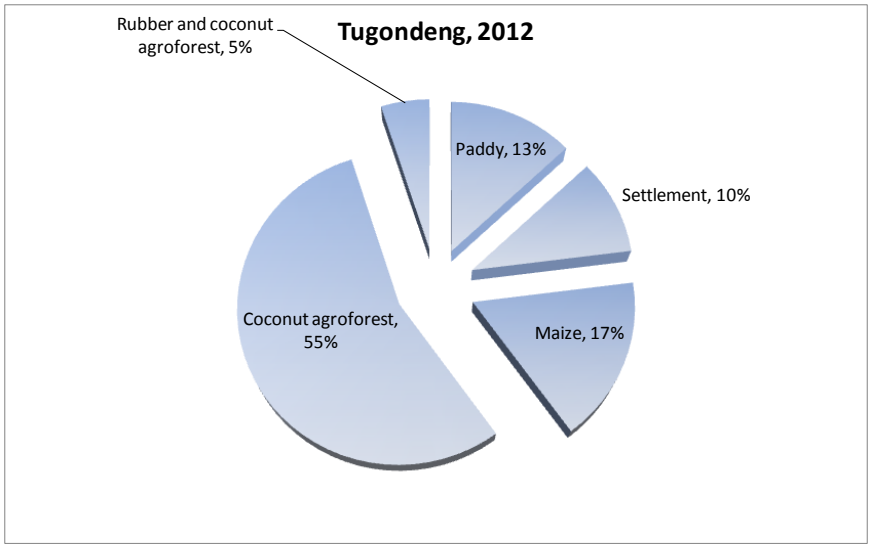

Figure 20. Current land use in Tugondeng village based on community perspectives

Coconut agroforests has now become the main land-use practice in the village, supplemented by maize and paddy rice cultivation. Cacao, paddy and timber trees are integrated into coconut agroforest. Timber gardens (using species such as teak, mahogany, 'suren', gmelina and 'sengon') are also maintained (Figure 21).

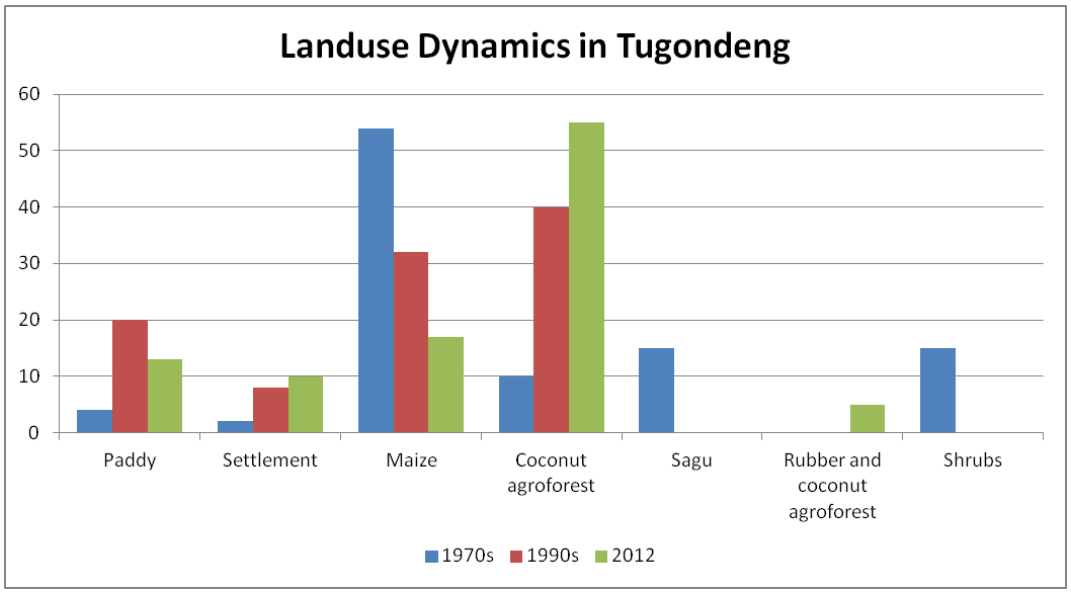

Figure 21. Land-use dynamics in Tugondeng based on community perspectives

Figure 21 indicates the relatively significant increase in coconut agroforest during the last 40 years and the decline in maize cultivation. Sago and shrub plots had disappeared by 2012.

Tana Towa

Tana Towa means the 'oldest village'. It is famous as a traditional village that has very strong cultural ties in South Sulawesi. It was originally settled by the Konjo ethnic group which was sustained by upland paddy rice, maize, coffee, coconut and banana at that time.

'Adat' or community involvement in forest management, in which forests play important roles in rural livelihoods, is likely to lead to substantial changes in the ways forests are managed, ensuring the safeguarding and/or diversification of their multiple benefits. The social security component of community forest management may thus be significant (Arnold 2001). Trees and forests provide a range of benefits in the form of goods and services that arise from direct and indirect use (Arnold and Bird 1999).

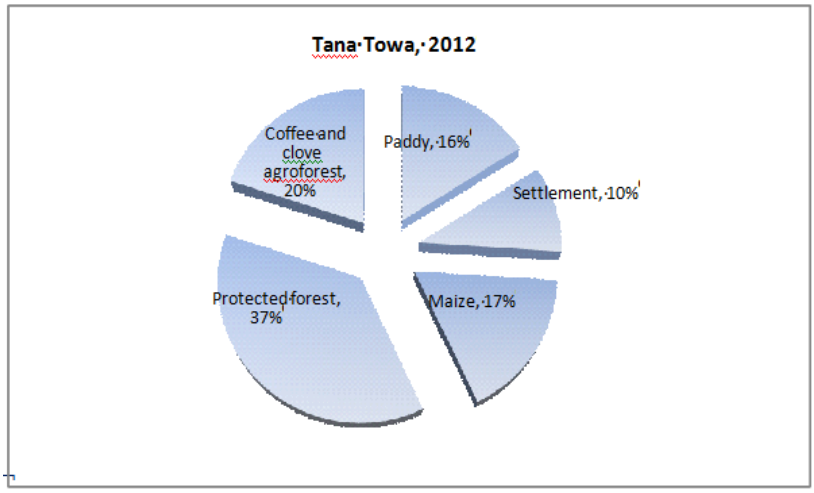

Figure 22. Current land use in Tana Towa based on community perspectives

In the 1990s, people became interested in planting cloves as a new livelihood option through government intervention. From 1991 to 1998, pepper, cacao and cloves were the major village crops.

Currently, the primary land use is protected forest which covers 1/3 of the village area (Figure 23). Strict observance of traditions and customs has protected the village's forests from deforestation. Coffee and clove agroforest is the secondary land-use practice.

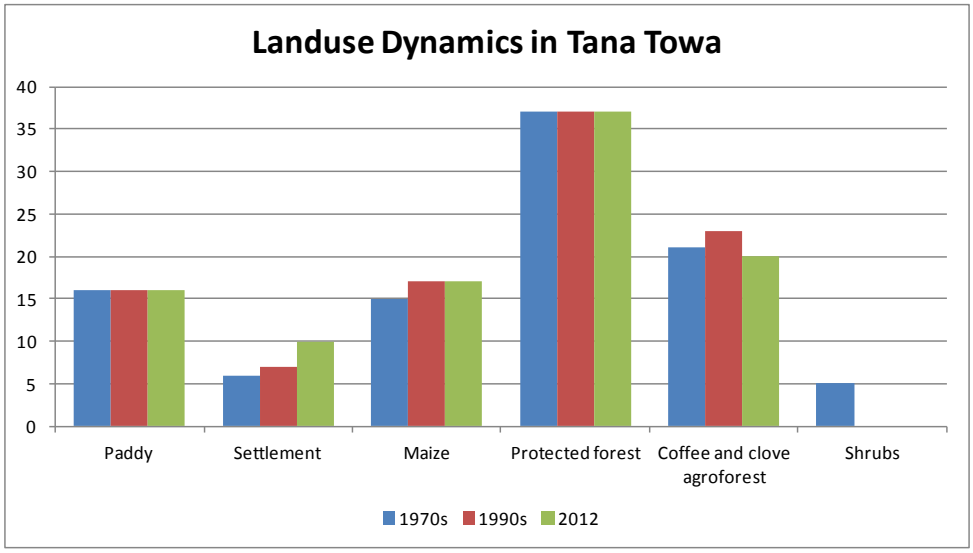

Figure 23. Land-use dynamics in Tana Towa based on community perspectives

Figure 23 shows that land use experienced very few changes during the last 40 years due to strong customary law which also protected forest from encroachment. There was a slight increase in the number of settlements and area cultivated with maize.

4.2 Household perspectives on land characteristics and land use

4.2.1 Land characteristics

Accessibility to land

Location of land

Cultivation in all areas mostly took place on private land located within the village boundaries or outside (a very small percentage). Protected forest was only located in degraded land areas (Figure 24).

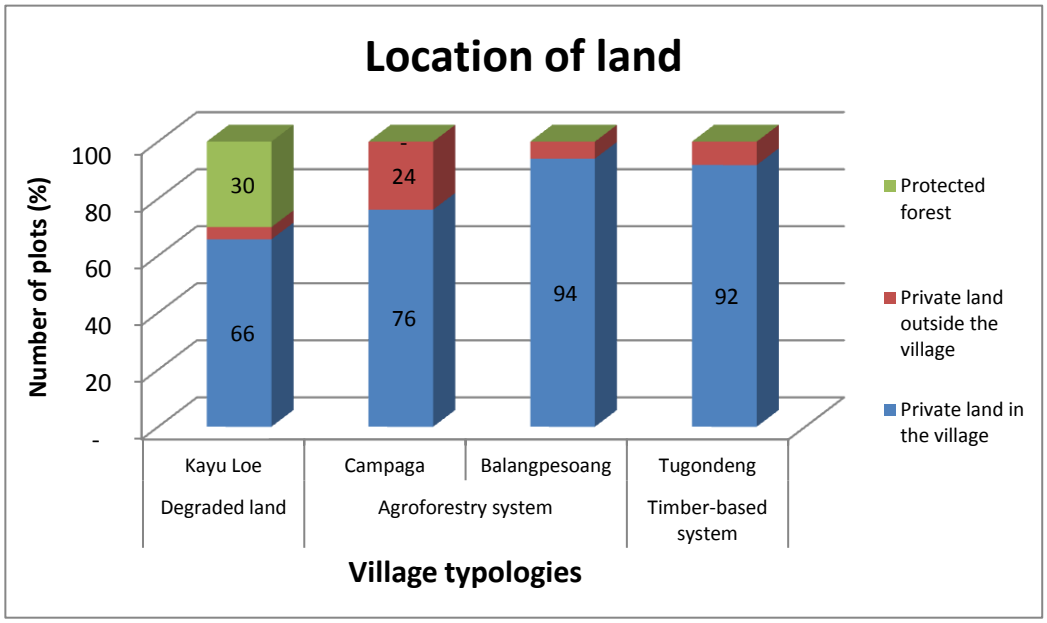

Figure 24. Location of village typology land in South Sulawesi

Field proximity to households

The average walking time from home to the field was relatively similar in all 3 typologies—not more than 1 hour and usually 30 minutes or less.

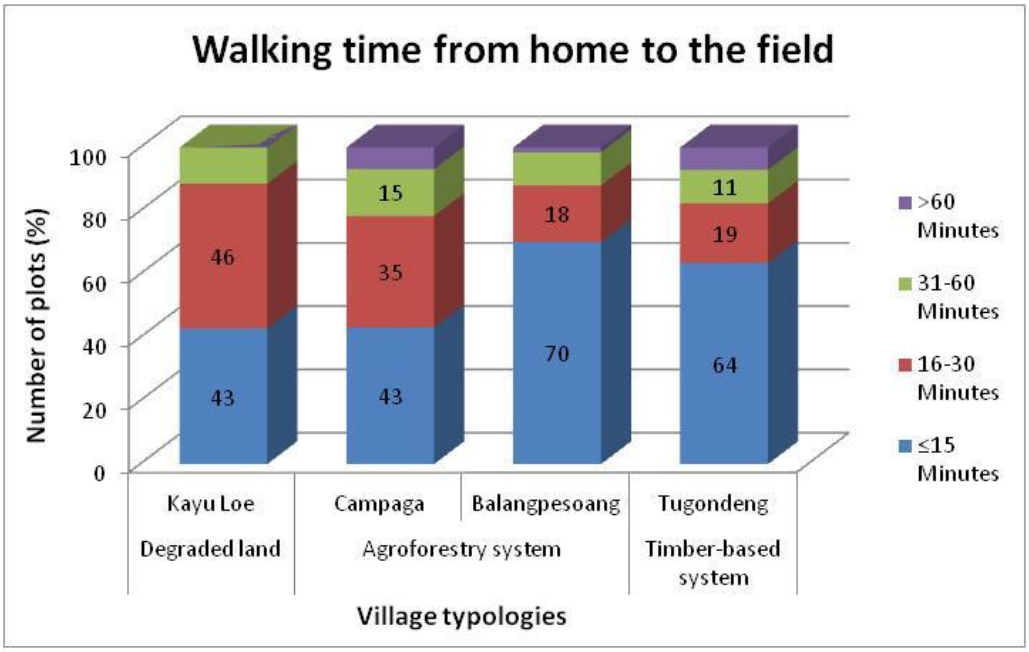

Figure 25. Walking time from home to the field in South Sulawesi

Land level

The land level in all 3 typologies was either sloping or flat (Figure 26).

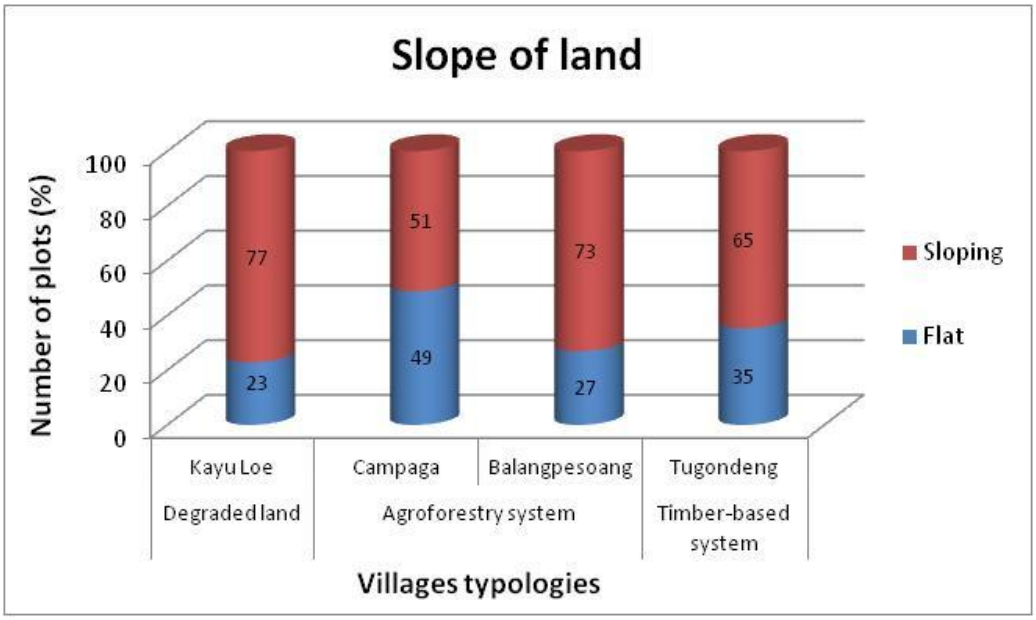

Figure 26. Land level in South Sulawesi

Current management status

Land management in all 3 typologies was relatively similar—mostly owned and self-cultivated (Figure 27). Most land had either been inherited or purchased (Figure 28).

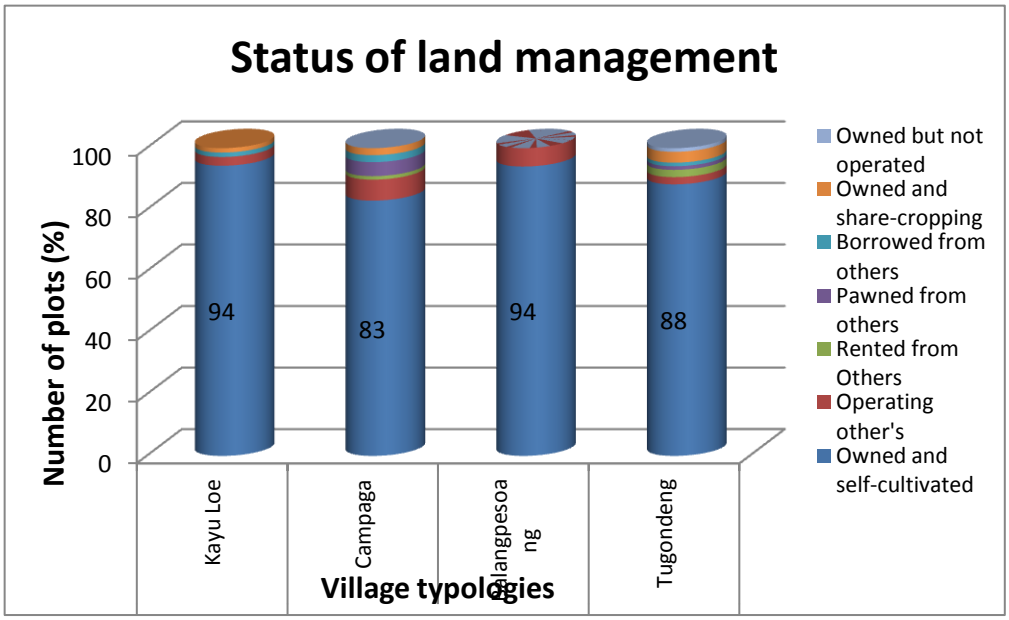

Figure 27. Status of management in South Sulawesi

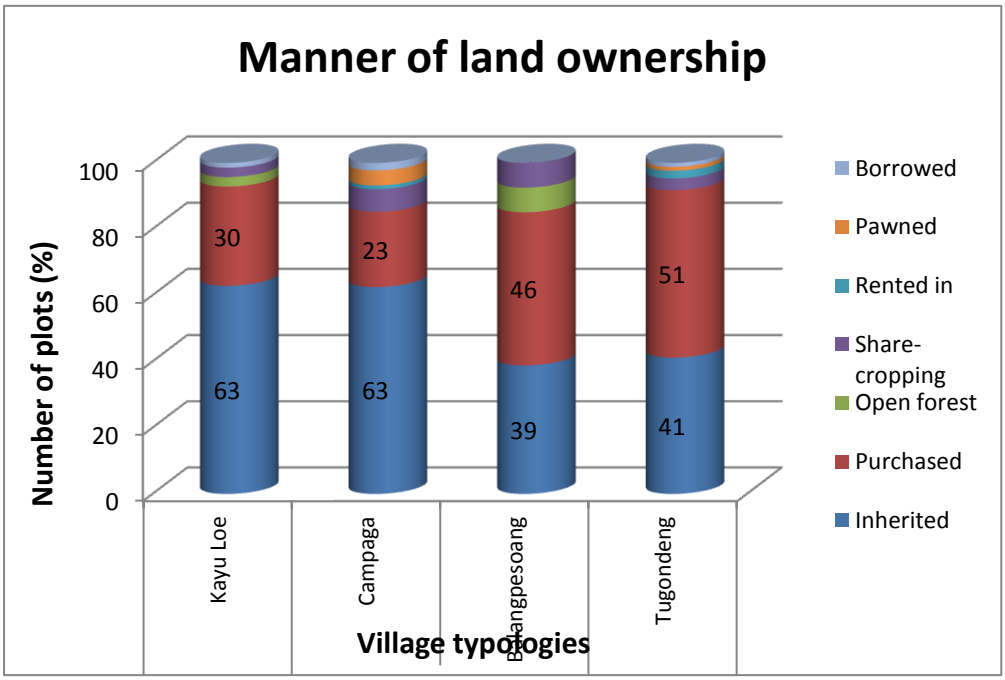

Figure 28. Type of land tenure in South Sulawesi

Source of land

Most plots in typology 1 originated from the husband's parents, in typology 2 from husband's parents and other people, while in typology 3 from other people.

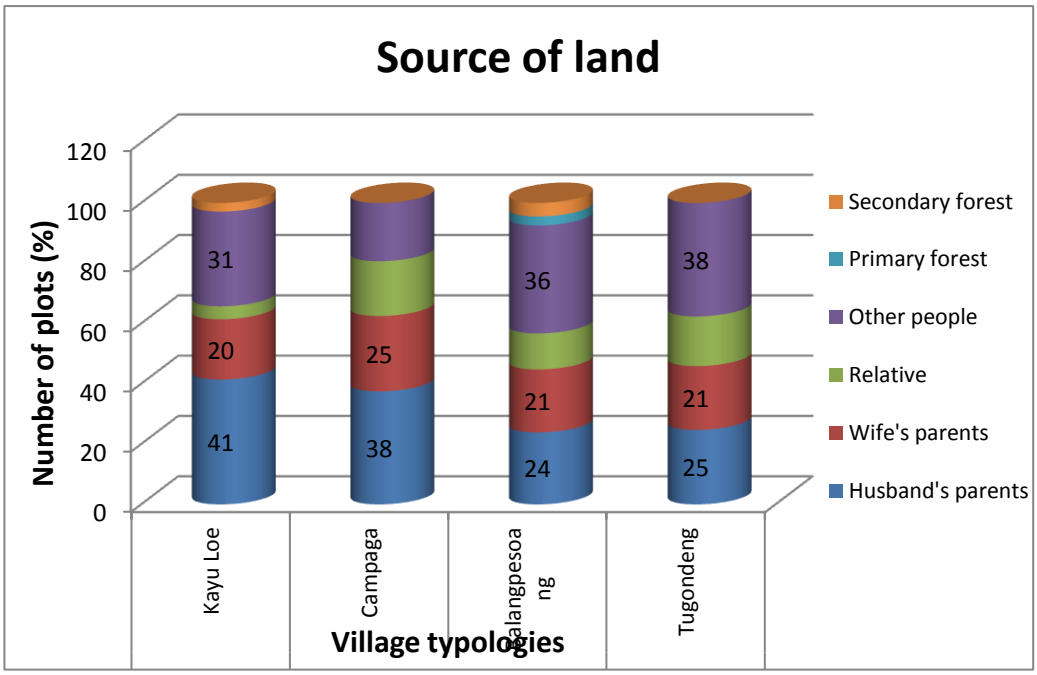

Figure 29. Sources of land in South Sulawesi

Figure 29 reveals that in typology 1, 41% of the plots came from the husband's parents, followed by other people (31%) and the wife's parents (20%). Relatives and secondary forest accounted for less than 8%. In typology 2, 24−38% of the plots came from the husband's parents, followed by the wife's parents (21–25%) other people (19–36%) and other sources (18–19%). Most of the plot holdings in typology 3 came from other people (38%), followed by the husband's parents (25%), the wife's parents (21%) and then relatives (16%).

Timeline of land acquisition

The distribution of plot holdings by year of land acquisition differed in all 3 typologies. Most of the plot holdings in typologies 1 and 3 were obtained after 2000, while in typology 2 they were obtained in the years 1980−1989 and 1990–1999.

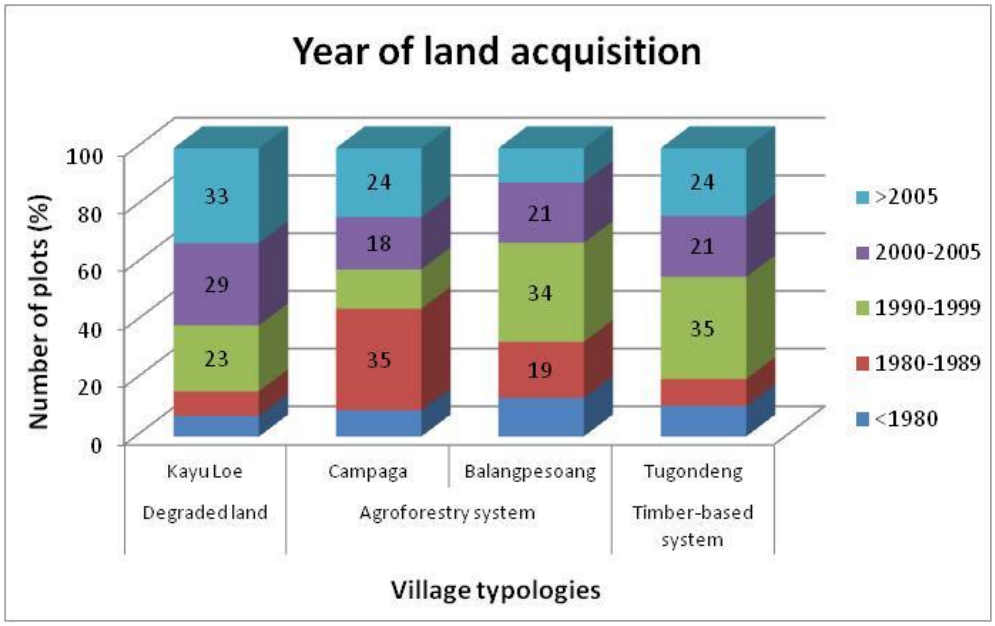

Figure 30. Timeline of land acquisition in South Sulawesi

Figure 30 shows that most plots in typology 1 were obtained in the years after 2000 (62%) and 23% in 1990–1999. In typology 2, 35% of the plots owned in Campaga village were obtained from 1980–1989 and 24% after 2005; in Balangpesoang village 34% of the plots owned were obtained in 1990–1999 and 33% after 2000. On the other hand, most of the land in typology 3 was obtained after 2000 (45%) and from 1990–1999 (35%).

4.2.2 Land-use and tenure status in South Sulawesi

Current land tenure status

In typologies 1 and 2 there was a tendency for husbands to own the land, but in typology 3 married couples were more likely to have joint ownership (Figure 31).

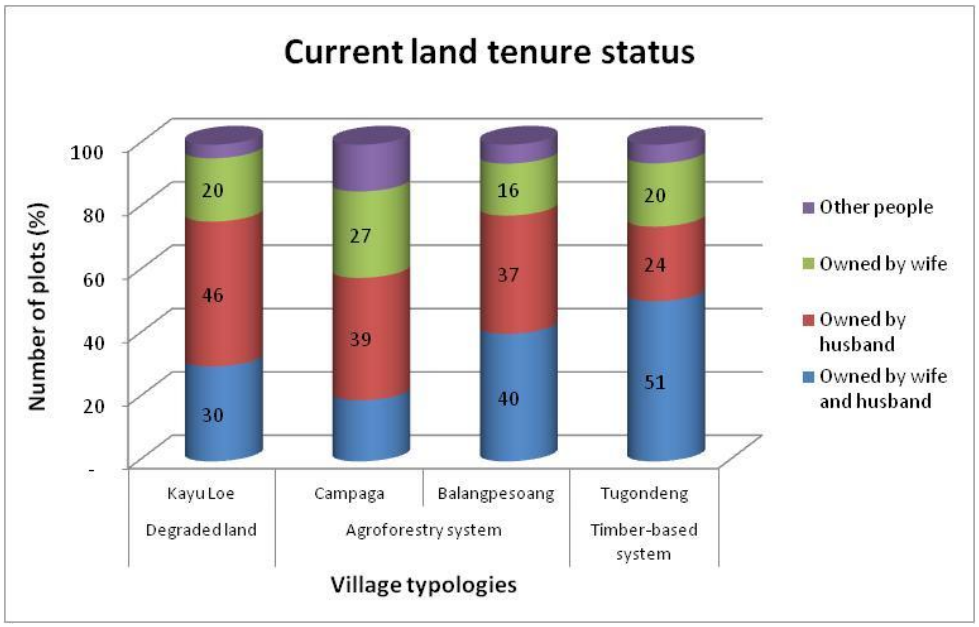

Figure 31. Current land tenure status in South Sulawesi

Previous land-use patterns

Figure 32 shows that former land use in typology 1 was dominated by maize fields (77%), followed by coffee agroforest (13%) and other crops (10%). Previous land use in typology 2 was characterized by mixed gardens/agroforest (30–33%), maize cultivation (25–27%), clove agroforest (33%), rice fields (17% in Balangpesoang), bush fallow (6–11% in Campaga) and other crops (6–14%). In typology 3, maize fields (34%), coconut agroforest (28%), cacao agroforest (11%), mixed gardens (10%), paddy rice fields (8%), bush fallow (7%) and trees (2%) were earlier land-use patterns.

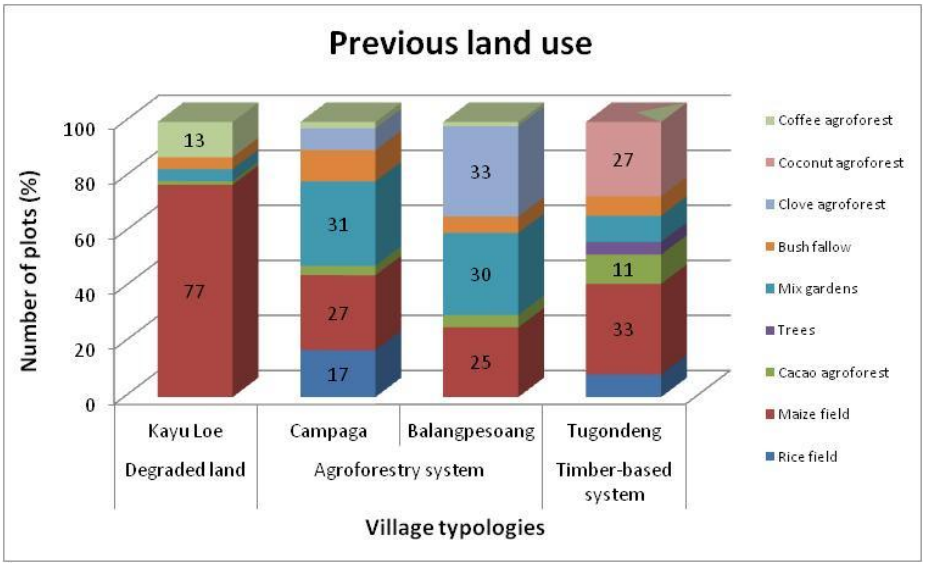

Figure 32. Previous land use in South Sulawesi

Current land-use patterns

In typology 1, maize fields (69%) feature prominently followed by coffee agroforest (20%). In typology 2, mixed gardens (60–75%) and clove agroforest (14–19%) predominate. In typology 3 coconut agroforest (38%), mixed gardens (24%), cacao agroforest (18%), trees (9%), rice fields (7%) and other crops (5%) are current land-use patterns (Figure 33).

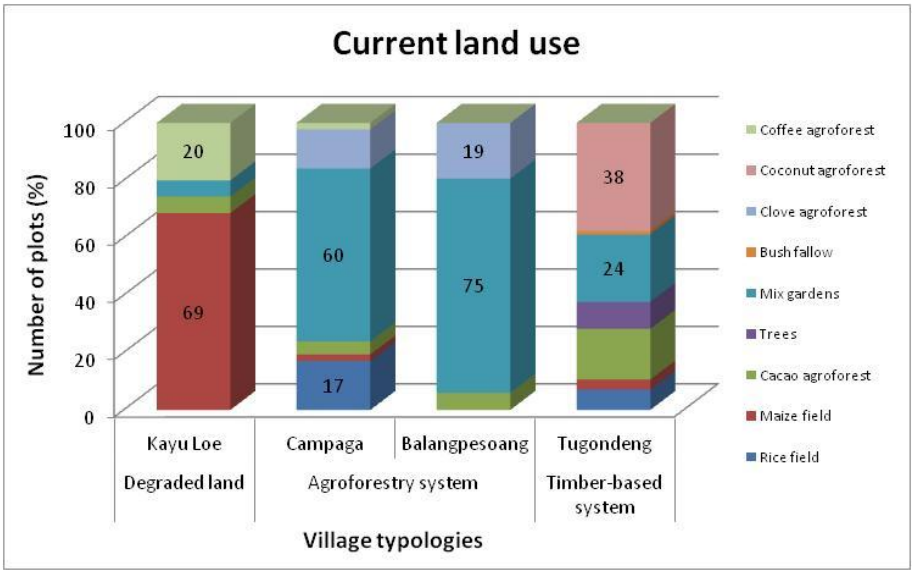

Figure 33. Current land-use patterns in South Sulawesi

Land use before and after 1 year of formal acquisition

Land use before and after 1 year of formal acquisition is detailed in Figure 34 and Figure 35.

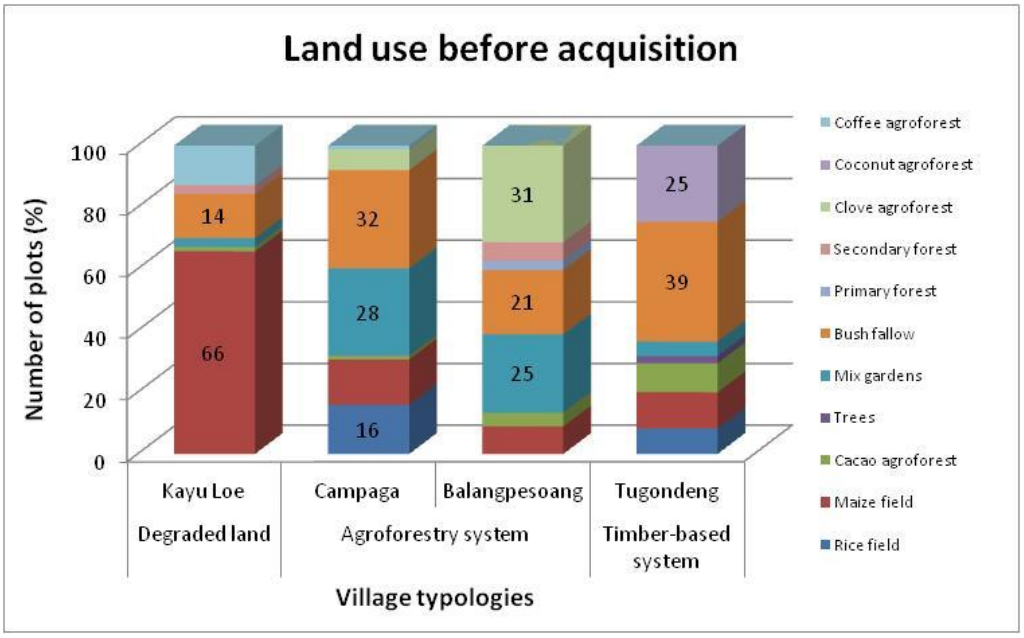

Figure 34. Land use before acquisition in South Sulawesi

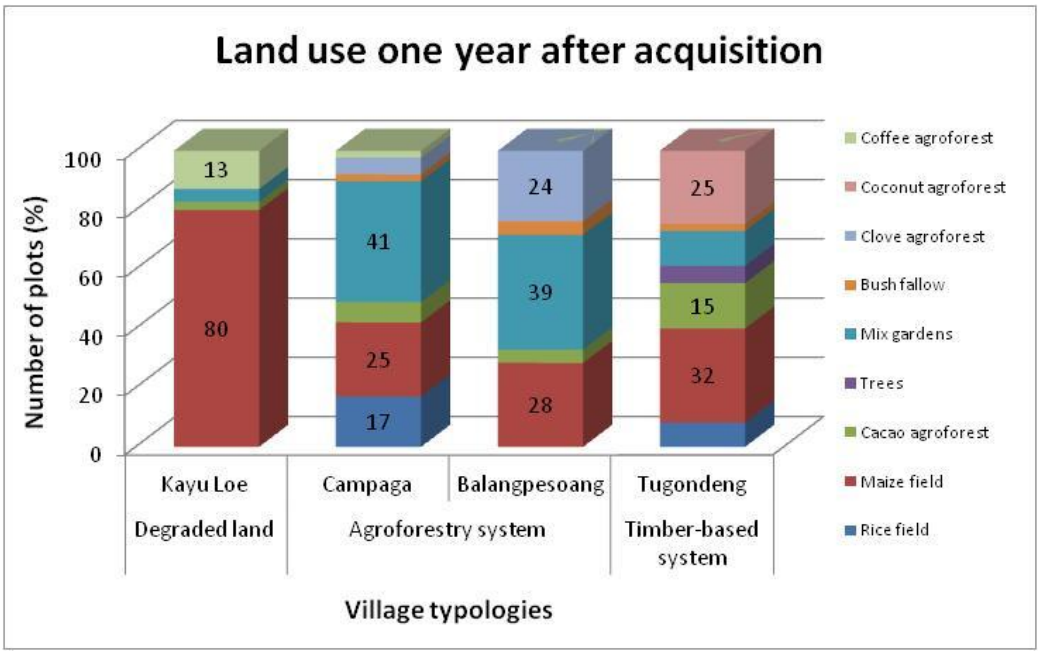

Figure 35. Land use 1 year after formal acquisition in South Sulawesi

Tree distribution in current land use

Five types of tree species were planted by farmers under different conditions in each village. The average total of trees per hectare in South Sulawesi is summarized in

Table **4**. In South Sulawesi all of the plot gardens were planted with perennial crops, multipurpose trees (MPTs) such as fruit, timber, banana and shade trees (others). More timber trees were grown in typology 3 compared to other villages. Typology 1 was dominated by perennial crops (cacao and coffee, 71%). In typology 2, perennial crops approximately paralleled the number of MPTs such as fruit and shade trees. The percentage of perennial crops was slightly higher than MPTs. In typology 3, distribution comprised timber trees (36%), perennial crops (45%) and MPTs (15%).

Table 4. Average total of trees per hectare in South Sulawesi

Village typologies	Villages	n	Average total of trees per hectare									
			Perennial crop		MPTS		Timber		Banana		Others	
			n	%	n	%	n	%	n	%	n	%
Typology 1	Kayu Loe	557	397	71	62	11	56	10	12	2	30	5
Typology 2	Campaga	781	475	61	237	30	40	5	24	3	5	1
	Balangpesoang	534	236	44	236	44	46	9	7	1	9	2
Typology 3	Tugondeng	742	336	45	112	15	264	36	30	4	0	0

Others: Gamal, bamboo.

5. Community livelihood options

5.1 Typology 1 (degraded land with annual crops as major farming system villages)

Maize, potatoes, onion and paddy rice were major crops in this typology. There had been no dominant tree-based farming system since the decline of candlenut.

Maize and other crops

Maize was a significant crop for several villages in Bantaeng district, especially in the western part. A survey of 2 villages, Kayu Loe and Bonto Karaeng, showed that maize cultivation was the main livelihood (Figure 36).

Initially, farmers had planted local maize varieties which had low productivity. They planted maize as a subsistence crop. With the influx of hybrid maize, introduced between 1985 and 1990, maize production increased considerably. Many farmers in the 2 villages were interested in planting maize and other crops such as potatoes and onions.

High demand for maize cultivation induces land conversion of forest- or shrubland into maize fields. In some places, many farmers did not consider soil conservation during maize cultivation which led to a drastic decline in soil fertility. This is evidenced by the current expanse of highly degraded land called ‘Bonto Rampan’.

Maize

The maize seeds used were generally improved varieties such as Bisi-2, NK-22, and NK-33. Communities also employed yellow maize obtained from the government or seeds they had developed themselves. Planting was characterized by 20 × 80 cm or 20 × 75 cm spacing.

Farmers applied ZA and urea fertilizers which were applied twice a year. The first application was usually at the age of 25 days and the second application at the age of 40 days. Harvesting was started in the fourth to fifth month with average production of 3−4 tonnes per hectare (dried maize). People generally sold harvested maize in Bantaeng at IDR 1300 per kilogram (dry).

Currently, the main obstacles to maize farming for these communities are:

- High cost of maize seeds
- Expensive fertilizer and chemicals
- The highly fluctuating retail price of maize

Potato

The farmers used potato seedlings such as P-2, Arnola, B-1 and B-2 with spacing of 50 × 50 cm. Plots were maintained once a year via weeding and fertilizer application using urea, organic fertilizers or manure.

In 1 cropping season, 3−4-month-old potatoes were able to produce 400 cans per hectare of potatoes (1 can = 15 kg) or about 6 tonnes per hectare. Potatoes were generally marketed in or outside the village at IDR 60 000 per can or about IDR 4 000 per kilogram. The main obstacles faced by farmers were expensive and hard to get potato seeds and an unreliable rainy season that impacted harvests.

Onion

In general, farmers used Palipi, Flores and Bima seeds which were available at farm shops. Onion spacing was 20 × 20 cm. Urea and manure were applied once a year and liquid fertilizer was applied twice a week to the onion plants.

Onion could be harvested at 70 days with production of around 4 tonnes per hectare. Onions were sold to markets inside and outside the village at IDR 2 500 per kilogram.

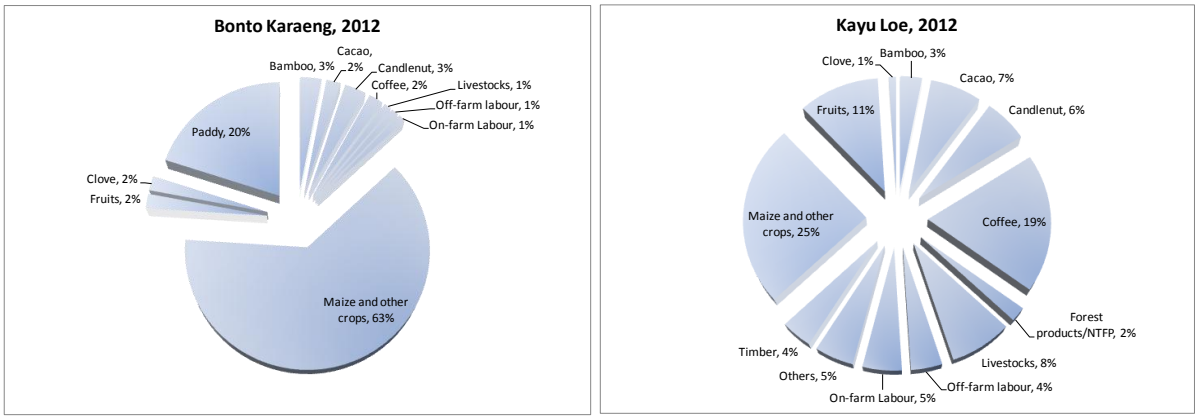

Figure 36. Recent livelihood options in Kayu Loe and Bonto Karaeng based on community perspectives

Paddy rice

The paddy rice cultivation area in Bonto Karaeng was developed by farmers in the 1990s. The varieties of paddy used were Memberamo, Ciherang and Ciliwung. Fields were maintained twice a year with fertilizer application of ZA and urea.

In terms of paddy production, planting 14 packages of seeds (around 5 kg) could produce 70 large sacks of paddy (around 550 litres[2] of rice) per hectare. The rice price was IDR 6400 per litre, but few farmers sold their rice as most was used for consumption.

The main obstacles to paddy cultivation were pest attacks (rodents and birds).

5.2 Typology 2 (agroforestry system villages)

Coffee, cacao, cloves and fruits were the main tree-based crops which were widely cultivated in this typology. The government provided considerable support to promote them.

Coffee

Coffee was one of the main crops which were widely cultivated in the surveyed village. Initially, people were only aware of local coffee (bugis coffee). To increase the cultivation and productivity of coffee, the government supplied robusta and arabica coffee seedlings over more than 2 decades (1970s−1990s). Most villagers in Pattaneteang, Campaga and Borongrappoa depended on coffee production (Figure 37).

Currently, arabica and robusta coffee is still grown in gardens, although other coffee types such as bugis coffee are still cultivated. Coffee planting is generally established through clearing of forest, shrubland and old maize fields. Plant spacing varies—2 × 2 m, 2 × 3 m, 3 × 3 m and 2.5 × 2.5 m. Cacao, cloves, fruits and timber trees are also intercropped at different intensities.

Weeding is carried out 1−3 times a year through slashing, spraying and hoeing. Fertilizer application is carried out twice a year, usually at the beginning and end of the rainy season. Fertilizers are usually applied, namely urea, ZA, KCL and manure.

Coffee starts to bear fruit at 2 years and produces good fruit at 3−4 years. Arabica coffee is harvested from April to July while robusta coffee is gathered between June and August. Coffee production

[2] Litre is generally used to measure several agricultural products such as paddy, pepper and cloves

ranges from 350 to 400 kg per hectare (dry coffee). Pattaneteang has high coffee productivity—arabica coffee can produce up to 600 kg per hectare and robusta 400 kg per hectare.

Coffee is marketed through traders in the village who later sell it to the nearest town or in Makassar. The traders are either local or from outside the region (Gowa and Jeneponto for example). Retail prices range from IDR 12 000 to IDR 17 000 per kilogram of dry fruit. The retail price of fresh fruit is lower than the dry variety.

The main constraints in coffee cultivation are:

- Drying of coffee beans harvested in the rainy season
- Low retail price for arabica coffee, because fresh fruits are sold just after harvesting without any drying (in Pattaneteang)
- Pests and diseases: stem borers, wild boar, monkeys, squirrels and opossums.
- It is difficult to grow coffee in mountainous areas (Borongrappoa).

Cacao

Currently, cacao is an important crop in Campaga, Balangpesoang and Kayu Loe. In Campaga, cacao began to be cultivated widely in the 1980s when the government provided seedlings to farmers. Now, most farmers make their own cacao seedlings while others get them from the Plantation Agency. Some farmers also buy them outside the village at about IDR 1 000 per seedling (15 cm height), or fruit at IDR 250 per piece. Various spacings are used—4 × 4 m, 3 × 4 m, 4 × 5 m, 2 × 2 m, 3 × 3 m and 3.5 m × 3.5 m. Farmers intercrop cacao with coffee, fruit and timber species at different intensities.

Cacao crops are maintained 3 times a year via spraying, slashing and hoeing. Some farmers apply fertilizer while others do not. Fertilizers (urea, ZA or liquid organic fertilizer) are applied once a year. However this changes to twice a year directly after fruiting. Pruning of branches is also carried out twice a year.

Production of smallholder cacao varies, depending on crop age and level of maintenance but ranges between 100−350 kg per season. Retail price fluctuates between IDR 16 000 to 18 000 per kilogram of dry cacao. Farmers sell cacao in the city and to traders who come to the villages to purchase the cacao.

The main threats to crops are black pod disease (*Phytophthora palmivora*), cacao pod borers, other pests and rodents. Farmers' knowledge of managing pests and diseases is still fairly limited, so increasing their capacity in this context is important for pest control.

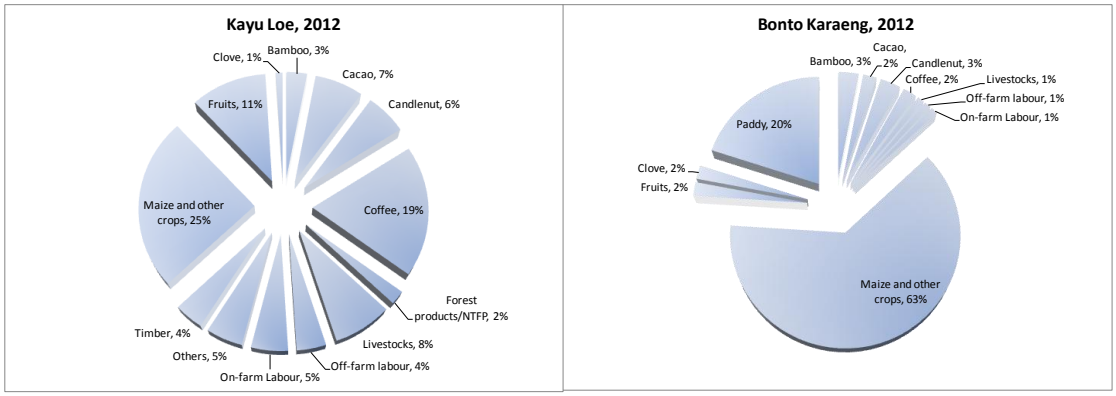

Figure 37. Recent livelihood options in Pattaneteang and Campaga based on community perspectives

Cloves

Pattaneteang, Balangpesoang, Campaga and Borongrappoa villages depend on clove plantations as their main livelihood option and the crop is the main component of smallholder plantation (Figure 38). Farmers started to plant cloves in the 1970s and cultivation became widespread in the early 1980s.

There are several types of cloves in Pattaneteang such as 'Sansibar,' Sikotok' and 'Siputih' (Ambon clove). Many farmers buy seedlings and cloves in the Banyorang area and also in Bulukumba. Seedlings cost approximately IDR 5 000 (25 cm height) and IDR 10 000 (50 cm height). In addition, some people develop their own clove seedlings.

Spacing varies—6 × 6 m, 6 × 7 m, 7 × 7 m and 8 × 8 m—with planting holes of 70 x 70 x 70 cm or 100 x 100 x 100 cm. In general, most people do not apply fertilizer to their clove plantation and maintenance is carried out two to three times a year via spraying, clearing and hoeing. Some farmers apply urea, SP36, KCL or manure twice a year.

The plants begin to bear fruit at the age of 5 years and good fruit at 5−7 years of age. Harvesting is normally conducted from July to October (50 litres or 25 kilograms of fresh fruit per tree). Cloves that have matured to 15−20 years of age can produce ± 200 litres or 100 kilograms of fresh fruit per tree. In Pattaneteang, cloves are sold mostly outside the village, usually in the market in Banyoran subdistrict. While in Balangpesoang, they are sold to traders in the village or to the markets in

Bulukumba and Makassar. The retail price of fresh fruit is IDR 45 000 per kilogram and IDR 125 000 per kilogram for dry fruit.

The main constraints are:

- Stem borer attacks over the last 10 years
- No specific harvesting seasons; fruiting depends on the weather. In the last 5 years in Pattaneteang there have only been 2 years of clove harvesting
- Low price of clove in the rainy season

Fruits

Balangpesoang is a successful fruit-producing community and fruit cultivation also contributes to community livelihoods in Borongrappoa and Kayu Loe. Common fruits grown are parkia, lansium, durian, rambutan, mangosteen, banana, avocado, jackfruit and 'labbusiang'.

The Balangpesoang community started to plant diverse fruits like rambutan, mangosteen, durian, durian cipaku and durian montong in the 1990s. This was generated by pest attacks in the cacao crop which induced farmers to replace cacao with fruit trees.

The fruit trees were intercropped with cloves using spacing of 8 x 8 m. Farmers used improved seedlings or grafting seedlings. Weeding and fertilization was carried out routinely.

The main constraints are:

- Marketing, especially in major harvesting seasons
- Pests and diseases—fungus on leaves, mushroom stems and fruits
- Falling fruit during the rainy season.

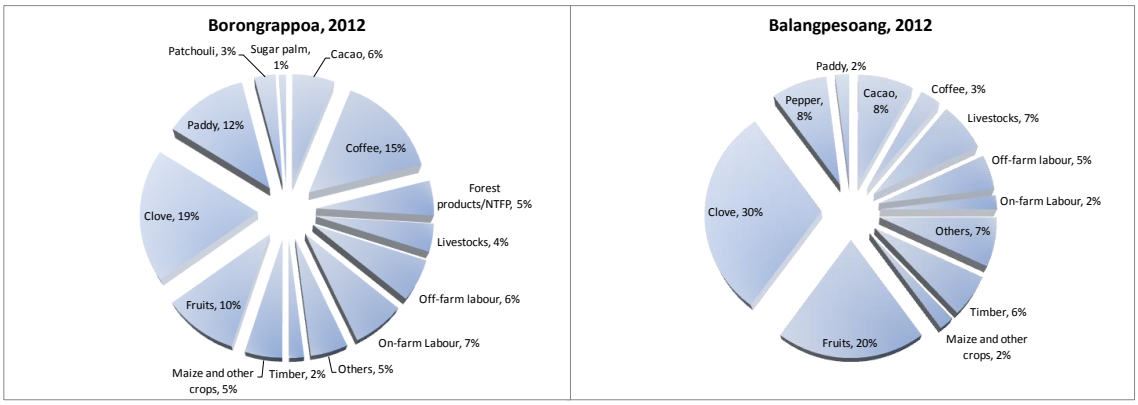

Figure 38. Recent livelihood options in Borongrappoa and Balangpesoang based on community perspectives

5.3 Typology 3 (timber-based system villages)

Timber was a rising commodity in several parts of this typology. Coconut, palm sugar, paddy and maize also contributed significantly to community welfare (Figure 39).

Timber

Farmers' interest in raising timber was sparked by information from external sources that this could be a lucrative option. In 2005 Tugondeng village started to plant timber using saplings from the Forestry Department, as well as some local wood species from the wild. In 2011/2012, the Agriculture Department and Forestry Department provided teak, mahogany, suren, gmelina and sengon saplings for farmers in Tugondeng and Tana Towa; however they have yet to become major income-generating sources. Currently, the timber production centre is located elsewhere in Herlang district.

Paddy rice

Paddy rice is an important crop for local communities, especially in Tana Towa where local and hybrid paddy rice varieties are cultivated with government support. Local varieties are black rice ('pare leleng kuru'), red glutinous rice, white glutinous rice, plain rice ('pare sahe') and the government provides the hybrid rice PB-5.

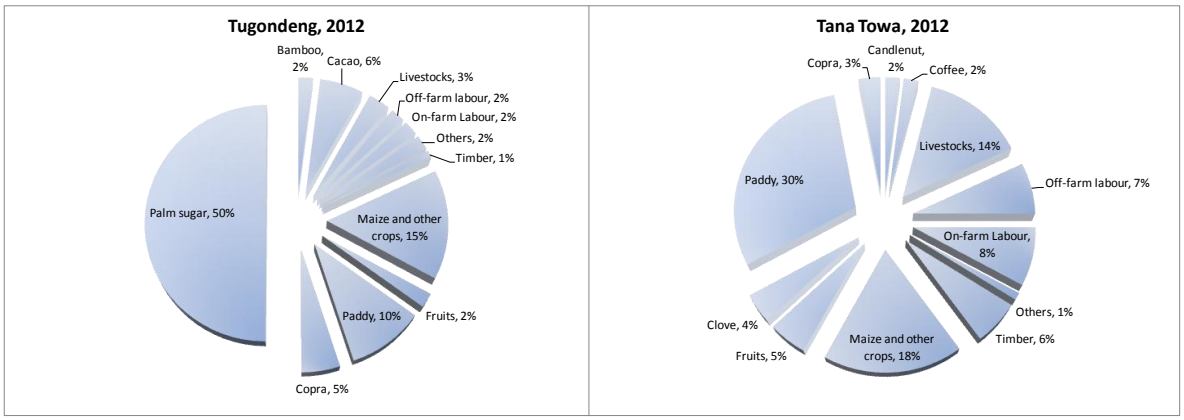

Figure 39. Recent livelihood options in Tugondeng and Tana Towa based on community perspectives

Tana Towa farmers apply fertilizer twice a year using triple superphosphate (TSP) and urea (10 sacks for 1 planting season). The harvested rice is mainly used for own consumption. The main threats to paddy rice cultivation are pests—planthoppers, rodents, wild boar and stem borers—and disease.

Maize and other crops

Farmers plant hybrid maize obtained from the government twice a year. Hybrid maize produces a maximum of 5 tonnes per hectare (dried maize). Weeding is carried out twice a year and the fields are fertilized with 7 sacks per hectare of mixed fertilizer (urea, TSP, ZA, NSPK). Currently, farmers sell maize to the village market/traders or to the market in Bulukumba; prices are approximately IDR 1100 per kilogram. Pests (rodents) are the most significant constraint.

Coconut and palm sugar

Coconut is an important resource, especially in Tugondeng village where coconut agroforest occupies more than half of the land use. In the 1980s many farmers planted coconut using hybrid seedlings from a government support programme. Currently, coconut seedlings are provided by the government at IDR 1500 per seedling (50 cm height); villagers also cultivate their own seedlings. Apparently it is easy to produce coconut seedlings by picking the fruit directly and planting it in beds or polyethylene bags for 3 months after which it is ready for planting in fields.

Coconut planting employs spacing of 8 × 8 m. Fertilizer is applied twice a year, using a mixture of TSP, urea, ZA, and kieserite at 4 sacks per hectare (distributed by hand). Coconut hybrids begin to bear fruit at 4 years and fruiting peaks at 10 years. Coconut is harvested every 4 months or 3 times a year, and can produce around 3000 fruits per hectare. Approximately 7 coconut fruits will produce 2 kg of fresh copra. Local people sell the copra to village traders at IDR 2100 per kilogram (fresh copra) and IDR 5000 per kilogram (dry copra).

Many farmers also produce palm sugar in Tugondeng village. Farmers tap the coconut trees in the morning (06:00 to 07:30) and afternoon (15:00 to 17:00). In every coconut tree, farmers tap 2−3 young shoots that produce an average of 2 litres of extract per tree that is used to make palm sugar. Generally farmers use fuelwood for producing the palm sugar.

Farmers sell the palm sugar to traders who come to the village who repackage it for the large market in Makassar. Palm sugar prices for the collector can reach IDR 8000 per kilogram which is quite high compared to copra. Gross income for copra farmers can be as much as IDR 2 million per month for 1 hectare and palm sugar can generate as much as IDR 3 million per month for 1 hectare.

The main constraints for management of coconut plantations today are frequent wild boar attacks, old/dying coconut trees in the gardens, as well as fluctuations in copra and palm sugar prices at the farm gate.

5.4 Important indicators of livelihoods based on household surveys

5.4.1 Source of income

The basic income equation for income from self-employment (in agriculture or business) is:

$$I = \sum_{i=i}^{n} p_i y_i - \sum_{j=1}^{m} q_j v_j$$

Income (*I*) is gross value (price times quantities of all *n* products) minus total costs (price times quantities of all *m* purchased inputs), for example, fertilizers, seeds, tools, hired labour (Angelsen and Lund 2011).

The average total of income per year per household for typology 1 farmers was lower than the other 2 typologies. The income differences among the 3 typologies were high as was the major source of income.

The calculation of income included the value of consumed commodities, with 62% of income from rice fields for typology 2 farmers being consumable income. However, most of the income came from cash crops.

For typology 1 farmers, the major sources of income were maize fields (28.3%), remittances (20.6%) and wage labour (12.2%) (Table 5). For typology 2 farmers, the major source of income was mixed gardens/agroforestry products (29.5–31.8%) and entrepreneurship (13.4%–32.7%). Other sources of income were rice fields, cloves and wage labour. For typology 3 farmers, the average total income per year per household was the highest. Their major source of income was coconut agroforest (23.2%). Other sources of income were entrepreneurship (23.7%) and mixed gardens/agroforestry products (18.3%).

Table 5. Sources of income in South Sulawesi in 2012.

Source of income	Average income per household							
	Typology 1		Typology 2				Typology 3	
	Kayu Loe village		Campaga village		Balangpesoang village		Tugondeng village	
	IDR	%	IDR	%	IDR	%	IDR	%
1. On-farm/ agriculture	5 877 350	45.2	12 470 985	52.3	8 377 393	39.4	21 764 539	60.3
Rice field	-	-	2,519,550	10.6	0	-	823,217	2.3
Maize field	3 688 182	28.3	59 383	0.2	0	-	448 167	1.2
Cacao agroforest	284 208	2.2	153 817	0.6	394 233	1.9	4 995 860	13.8
Mixed gardens (agroforest)	334 467	2.6	7 045 085	29.5	7 064 477	33.2	6 604 790	18.3
Coconut agroforest	-	-	-	-	0	-	8 373 406	23.2
Clove agroforest	-	-	2 179 617	9.1	526 683	2.5	-	-
Trees	-	-	-	-	0	-	84 783	0.2
Coffee agroforest	1 059 110	8.1	5550	0	0	-	-	-
Other agriculture	511 383	3.9	507 983	2.1	392 000	1.8	434 317	1.2
2. Off-farm/ non-agriculture	7 134 400	54.8	11 378 300	47.7	12 869 500	60.6	14 314 167	39.7
Fuelwood	669 933	5.1	884 000	3.7	918 900	4.3	607 000	1.7
Wage labour	1 582 133	12.2	2 292 667	9.6	2 032 667	9.6	1 038 500	2.9
Entrepreneurship	636 667	4.9	3 186 000	13.4	6 942 933	32.7	8 560 667	23.7
Professional	454 000	3.5	1 390 667	5.8	360 000	1.7	828 000	2.3
Other	1 111 667	8.5	3 131 633	13.1	2 141 667	10.1	3 140 000	8.7
Remittances	2 680 000	20.6	493 333	2.1	473 333	2.2	140 000	0.4
3. Total income per year	13 011 750	100	23 849 285	100	21 246 893	100	36 078 706	100

Figure 40 shows that the share of income per household for typology 1 farmers was similar from off-farm/non-agricultural activities (55%) and on-farm/agricultural activities (45%). For typology 2 farmers the difference was again only slight. For typology 3 farmers, the share of income from on-farm/agricultural work (60%) was higher than off-farm/non-agricultural work (40%).

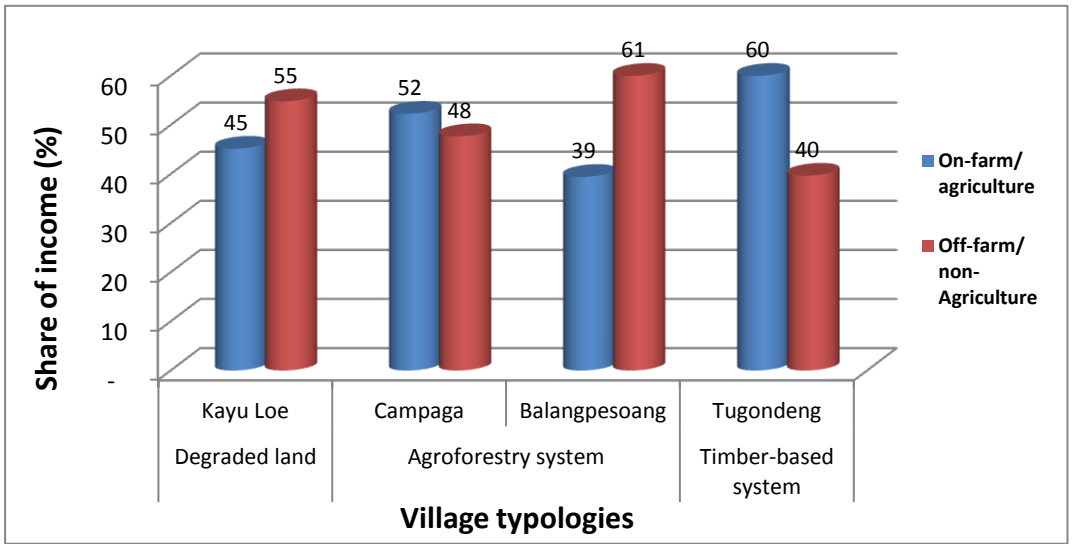

Figure 40. Sources of income in South Sulawesi in 2012

5.4.2 Income per capita

The daily income per capita for typology 1 farmers was lower than the other 2 typologies and it was below the international poverty line (Figure 41).

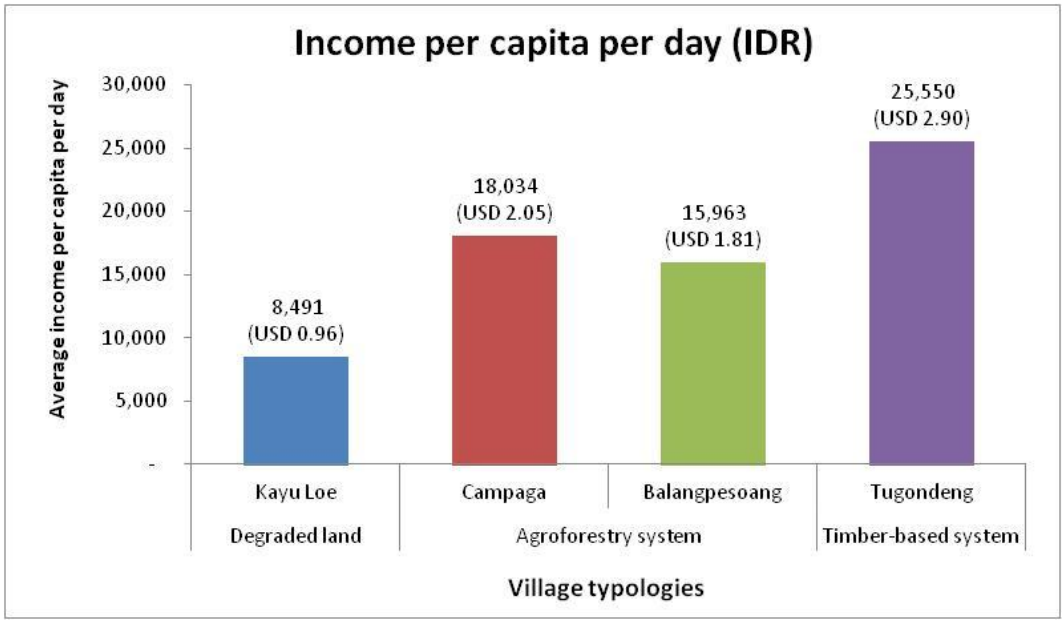

Figure 41. Income per capita per day in South Sulawesi in 2012

5.4.3 Land holdings

The average land holding per household for typology 3 farmers (2.09 ha) was larger than the other 2 typologies (Figure 42). The composition of land holdings also differed across all 3 typologies (Table 6).

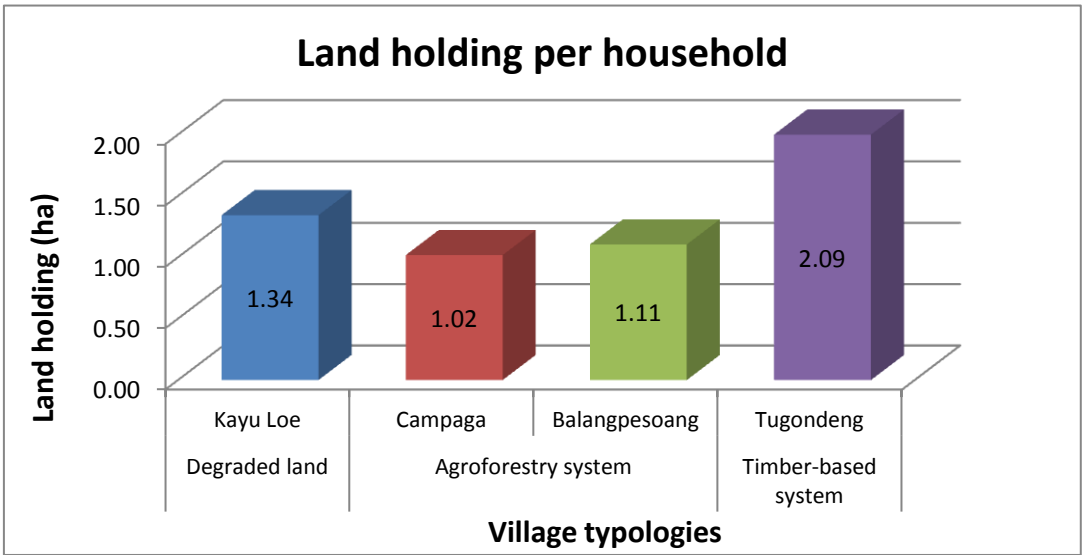

Figure 42. Land-holding size per household in South Sulawesi

Table 6. Average land holding by composition in South Sulawesi

Typologies	Villages	Average land holding by composition (ha)								
		Rice	Maize	Cacao	Mixed-gardens	Trees	Cloves	Coconut	Coffee	Bush fallow
Typology 1	Kayu Loe	0.00	0.86	0.05	0.14	0.00	0.00	0.00	0.29	0
Typology 2	Campaga	0.20	0.01	0.03	0.65	0.00	0.08	0.00	0.04	0
	Balangpesoang	0.00	0.00	0.07	0.83	0.00	0.20	0.00	0.00	0
Typology 3	Tugondeng	0.18	0.04	0.32	0.65	0.22	0.00	0.68	0.00	0.01

6. Conclusion

The group discussion results within the 3 typologies showed that there were quite clear differences in terms of livelihood options, tree crops and farm management. These differences were influenced by historical differences in land management, land use and land-use dynamics, and market access.

In Kayu Loe and Bonto Karaeng (typology 1), the maize area had increased significantly over the last 40 years while candlenut cultivation and forest cover had declined. This situation corresponded to the boom in hybrid maize in the same period. Furthermore, the land in Kayu Loe and Bonto Karaeng was degraded by prolonged erosion resulting from improper local land management practices (highly intensive cultivation of maize).

In Pattaneteang and Campaga (typology 2) coffee and clove agroforest had increased quite significantly during the last 40 years accompanied by a decrease in maize cultivation and forest cover. The paddy rice area in the valley remained unchanged as land conversion was avoided. The maize area had disappeared by 2012. These conditions reflect the boom in coffee and clove agroforest. Farmers in Bantaeng and Bulukumba districts had been practising complex agroforestry systems for a long time. Coffee, cacao and cloves were mixed with various types of crops and fruits. Farming practices were influenced by government policy that had introduced the plantation crops. The limited amount of land owned by farmers forced them to employ agroforetsry.

In Tugondeng and Tana Towa (typology 3) land use differed. In Tugondeng the coconut area had increased quite significantly over the last 40 years and it is now the main resource. Concomitantly maize cultivation had decreased and the sago and shrub area had disappeared by 2012 (the opposite being the case in Tana Towa). Almost all forms of land use remained unchanged during the last 40 years due to strong customary law (Adat) in the village. The Adat was very effective in preserving protected forest area from encroachment. There was a minor increase in the number of settlements and maize area owing to conversion of shrubland. Recently, timber-based systems have been integrated with other farming practices. The agroforestry systems practised in this typology were similar to typology 2. However, the development of smallholder timber plantations in these villages made timber a rising and popular livelihood. The area is well known as a source of natural timber (‘biti’ or vitex, local teak and so forth) in South Sulawesi as well as being a beneficiary of government policy which induced the timber surge.

The condition of farmers’ houses can be used as a proxy for their welfare. Houses in typology 1 were in a poorer state than the other 2 typologies in which house condition was relatively similar. The same applied to the level of education in typology 1 compared to typologies 2 and 3. The level of education for women was slightly lower than that for men. The dominant ethnicity of the household head in all typologies was Makassar or Bugis.

In all 3 typologies farmers’ land was owned and self-cultivated—the land having been inherited or purchased. Most of the land in typology 1 was inherited from the husband’s parents; in typology 2 it was usually inherited from the husband’s parents or purchased from other people; and in typology 3 most land was purchased from other people.

The average total of income per year per household for typology 1 farmers was lower than the other 2 typologies. The major sources of income in typology 1were maize fields and remittances; in typology 2 agroforestry products; and in typology 3 coconut agroforest and entrepreneurial work.

The daily income per capita of farmers in typology 1 was lower than the other 2 typologies and below the international poverty line: IDR 8491 (US$ 0.96) in typology 1; IDR 18 034 (US$ 2.05) and IDR 15 963 (US$ 1.81) in typology 2; and IDR 25 550 (US$ 2.90) in typology 3.

The average land holding per household for typology 3 farmers (2.09 ha) was larger than for typology 1 and typology 2 farmers —1.34 and 1.06 ha respectively. The major land use for typology 1 farmers was maize fields (0.86 ha) and mixed gardens/agroforestry (0.65–0.80 ha) for typology 2 farmers. In typology 3 it was coconut agroforest (0.68 ha) and mixed gardens/agroforestry (0.65 ha).

Recommendations

- Increase farmers' access to and knowledge of affordable quality seedlings
- Increase extension activities through provision of appropriate materials and direct practice in the field. Develop useful guides on cultivation techniques (coffee, cacao, cloves), as well as pest and disease management
- Expand marketing networks/techniques and product quality for maintaining competitive prices in the market. Establish micro-credit institutions to support marketing of agricultural products
- Develop and increase capital provision for farmers to expand their businesses
- Support the rejuvenation of smallholder plantations, such as coconut in Tugondeng
- Encourage capacity building in cultivation of other potential crops, such as training on cultivation of rubber
- Provide appropriate technology for the improvement of product quality and diversification of plantation crops

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27. Social and Environmental Trade-Offs in Tree Species Selection: A Methodology for Identifying Niche Incompatibilities in Agroforestry *[Appears as AHI Working Paper no. 9]*
28. Managing tradeoffs in agroforestry: From conflict to collaboration in natural resource management. *[Appears as AHI Working Paper no. 10]*
29. Essai d'analyse de la prise en compte des systemes agroforestiers pa les legislations forestieres au Sahel: Cas du Burkina Faso, du Mali, du Niger et du Senegal.
30. Etat de la recherche agroforestière au Rwanda etude bibliographique, période 1987-2003

2007

31. Science and technological innovations for improving soil fertility and management in Africa: A report for NEPAD's Science and Technology Forum.
32. Compensation and rewards for environmental services.

33. Latin American regional workshop report compensation.
34. Asia regional workshop on compensation ecosystem services.
35. Report of African regional workshop on compensation ecosystem services.
36. Exploring the inter-linkages among and between compensation and rewards for ecosystem services CRES and human well-being
37. Criteria and indicators for environmental service compensation and reward mechanisms: realistic, voluntary, conditional and pro-poor
38. The conditions for effective mechanisms of compensation and rewards for environmental services.
39. Organization and governance for fostering Pro-Poor Compensation for Environmental Services.
40. How important are different types of compensation and reward mechanisms shaping poverty and ecosystem services across Africa, Asia & Latin America over the Next two decades?
41. Risk mitigation in contract farming: The case of poultry, cotton, woodfuel and cereals in East Africa.
42. The RELMA savings and credit experiences: Sowing the seed of sustainability
43. Yatich J., Policy and institutional context for NRM in Kenya: Challenges and opportunities for Landcare.
44. Nina-Nina Adoung Nasional di So! Field test of rapid land tenure assessment (RATA) in the Batang Toru Watershed, North Sumatera.
45. Is Hutan Tanaman Rakyat a new paradigm in community based tree planting in Indonesia?
46. Socio-Economic aspects of brackish water aquaculture (*Tambak*) production in Nanggroe Aceh Darrusalam.
47. Farmer livelihoods in the humid forest and moist savannah zones of Cameroon.
48. Domestication, genre et vulnérabilité : Participation des femmes, des Jeunes et des catégories les plus pauvres à la domestication des arbres agroforestiers au Cameroun.
49. Land tenure and management in the districts around Mt Elgon: An assessment presented to the Mt Elgon ecosystem conservation programme.
50. The production and marketing of leaf meal from fodder shrubs in Tanga, Tanzania: A pro-poor enterprise for improving livestock productivity.
51. Buyers Perspective on Environmental Services (ES) and Commoditization as an approach to liberate ES markets in the Philippines.
52. Towards Towards community-driven conservation in southwest China: Reconciling state and local perceptions.
53. Biofuels in China: An Analysis of the Opportunities and Challenges of Jatropha curcas in Southwest China.
54. Jatropha curcas biodiesel production in Kenya: Economics and potential value chain development for smallholder farmers
55. Livelihoods and Forest Resources in Aceh and Nias for a Sustainable Forest Resource Management and Economic Progress
56. Agroforestry on the interface of Orangutan Conservation and Sustainable Livelihoods in Batang Toru, North Sumatra.
57. Assessing Hydrological Situation of Kapuas Hulu Basin, Kapuas Hulu Regency, West Kalimantan.
58. Assessing the Hydrological Situation of Talau Watershed, Belu Regency, East Nusa Tenggara.
59. Kajian Kondisi Hidrologis DAS Talau, Kabupaten Belu, Nusa Tenggara Timur.
60. Kajian Kondisi Hidrologis DAS Kapuas Hulu, Kabupaten Kapuas Hulu, Kalimantan Barat.
61. Lessons learned from community capacity building activities to support agroforest as sustainable economic alternatives in Batang Toru orang utan habitat conservation program (Martini, Endri et al.)
62. Mainstreaming Climate Change in the Philippines.
63. A Conjoint Analysis of Farmer Preferences for Community Forestry Contracts in the Sumber Jaya Watershed, Indonesia.
64. The highlands: a shared water tower in a changing climate and changing Asia
65. Eco-Certification: Can It Deliver Conservation and Development in the Tropics.
66. Designing ecological and biodiversity sampling strategies. Towards mainstreaming climate change in grassland management.
67. Towards mainstreaming climate change in grassland management policies and practices on the Tibetan Plateau
68. An Assessment of the Potential for Carbon Finance in Rangelands
69 ECA Trade-offs Among Ecosystem Services in the Lake Victoria Basin.
69. The last remnants of mega biodiversity in West Java and Banten: an in-depth exploration of RaTA (Rapid Land Tenure Assessment) in Mount Halimun-Salak National Park Indonesia

70. Le business plan d'une petite entreprise rurale de production et de commercialisation des plants des arbres locaux. Cas de quatre pépinières rurales au Cameroun.
71. Les unités de transformation des produits forestiers non ligneux alimentaires au Cameroun. Diagnostic technique et stratégie de développement Honoré Tabuna et Ingratia Kayitavu.
72. Les exportateurs camerounais de safou (Dacryodes edulis) sur le marché sous régional et international. Profil, fonctionnement et stratégies de développement.
73. Impact of the Southeast Asian Network for Agroforestry Education (SEANAFE) on agroforestry education capacity.
74. Setting landscape conservation targets and promoting them through compatible land use in the Philippines.
75. Review of methods for researching multistrata systems.
76. Study on economic viability of *Jatropha curcas* L. plantations in Northern Tanzania assessing farmers' prospects via cost-benefit analysis
77. Cooperation in Agroforestry between Ministry of Forestry of Indonesia and International Center for Research in Agroforestry
78. "China's bioenergy future. an analysis through the Lens if Yunnan Province
79. Land tenure and agricultural productivity in Africa: A comparative analysis of the economics literature and recent policy strategies and reforms
80. Boundary organizations, objects and agents: linking knowledge with action in agroforestry watersheds
81. Reducing emissions from deforestation and forest degradation (REDD) in Indonesia: options and challenges for fair and efficient payment distribution mechanisms

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82. Mainstreaming climate change into agricultural education: challenges and perspectives
83. Challenging conventional mindsets and disconnects in conservation: the emerging role of eco-agriculture in Kenya's landscape mosaics
84. Lesson learned RATA garut dan bengkunat: suatu upaya membedah kebijakan pelepasan kawasan hutan dan redistribusi tanah bekas kawasan hutan
85. The emergence of forest land redistribution in Indonesia
86. Commercial opportunities for fruit in Malawi
87. Status of fruit production processing and marketing in Malawi
88. Fraud in tree science
89. Trees on farm: analysis of global extent and geographical patterns of agroforestry
90. The springs of Nyando: water, social organization and livelihoods in Western Kenya
91. Building capacity toward region-wide curriculum and teaching materials development in agroforestry education in Southeast Asia
92. Overview of biomass energy technology in rural Yunnan (Chinese – English abstract)
93. A pro-growth pathway for reducing net GHG emissions in China
94. Analysis of local livelihoods from past to present in the central Kalimantan Ex-Mega Rice Project area
95. Constraints and options to enhancing production of high quality feeds in dairy production in Kenya, Uganda and Rwanda

2010

96. Agroforestry education in the Philippines: status report from the Southeast Asian Network for Agroforestry Education (SEANAFE)
97. Economic viability of Jatropha curcas L. plantations in Northern Tanzania- assessing farmers' prospects via cost-benefit analysis.
98. Hot spot of emission and confusion: land tenure insecurity, contested policies and competing claims in the central Kalimantan Ex-Mega Rice Project area
99. Agroforestry competences and human resources needs in the Philippines
100. CES/COS/CIS paradigms for compensation and rewards to enhance environmental Services
101. Case study approach to region-wide curriculum and teaching materials development in agroforestry education in Southeast Asia
102. Stewardship agreement to reduce emissions from deforestation and degradation (REDD): Lubuk Beringin's Hutan Desa as the first village forest in Indonesia
103. Landscape dynamics over time and space from ecological perspective

104. Komoditisasi atau koinvestasi jasa lingkungan: skema imbal jasa lingkungan program peduli sungai di DAS Way Besai, Lampung, Indonesia
105. Improving smallholders' rubber quality in Lubuk Beringin, Bungo district, Jambi province, Indonesia: an initial analysis of the financial and social benefits
106. Rapid Carbon Stock Appraisal (RACSA) in Kalahan, Nueva Vizcaya, Philippines
107. Tree domestication by ICRAF and partners in the Peruvian Amazon: lessons learned and future prospects in the domain of the Amazon Initiative eco-regional program
108. Memorias del Taller Nacional: "Iniciativas para Reducir la Deforestación en la region Andino - Amazónica", 09 de Abril del 2010. Proyecto REALU Peru
109. Percepciones sobre la Equidad y Eficiencia en la cadena de valor de REDD en Perú – Reporte de Talleres en Ucayali, San Martín y Loreto, 2009. Proyecto REALU-Perú.
110. Reducción de emisiones de todos los Usos del Suelo. Reporte del Proyecto REALU Perú Fase 1
111. Programa Alternativas a la Tumba-y-Quema (ASB) en el Perú. Informe Resumen y Síntesis de la Fase II. 2da. versión revisada
112. Estudio de las cadenas de abastecimiento de germoplasma forestal en la amazonía Boliviana
113. Biodiesel in the Amazon
114. Estudio de mercado de semillas forestales en la amazonía Colombiana
115. Estudio de las cadenas de abastecimiento de germoplasma forestal en Ecuador
116. How can systems thinking, social capital and social network analysis help programs achieve impact at scale?
117. Energy policies, forests and local communities in the Ucayali Region, Peruvian Amazon
118. NTFPs as a Source of Livelihood Diversification for Local Communities in the Batang Toru Orangutan Conservation Program
119. Studi Biodiversitas: Apakah agroforestry mampu mengkonservasi keanekaragaman hayati di DAS Konto?
120. Estimasi Karbon Tersimpan di Lahan-lahan Pertanian di DAS Konto, Jawa Timur
121. Implementasi Kaji Cepat Hidrologi (RHA) di Hulu DAS Brantas, Jawa Timur.
122. Kaji Cepat Hidrologi di Daerah Aliran Sungai Krueng Peusangan, NAD,Sumatra
123. A Study of Rapid Hydrological Appraisal in the Krueng Peusangan Watershed, NAD, Sumatra.

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124. An Assessment of farm timber value chains in Mt Kenya area, Kenya
125. A Comparative financial analysis of current land use systems and implications for the adoption of improved agroforestry in the East Usambaras, Tanzania
126. Agricultural monitoring and evaluation systems
127. Challenges and opportunities for collaborative landscape governance in the East Usambara Mountains, Tanzania
128. Transforming Knowledge to Enhance Integrated Natural Resource Management Research, Development and Advocacy in the Highlands of Eastern Africa

129. Carbon-forestry projects in the Philippines: potential and challenges The Mt Kitanglad Range forest-carbon development
130. Carbon forestry projects in the Philippines: potential and challenges. The Arakan Forest Corridor forest-carbon project

131. Carbon-forestry projects in the Philippines: potential and challenges. The Laguna Lake Development Authority's forest-carbon development project
132. Carbon-forestry projects in the Philippines: potential and challenges. The Quirino forest-carbon development project in Sierra Madre Biodiversity Corridor
133. Carbon-forestry projects in the Philippines: potential and challenges. The Ikalahan ancestral domain forest-carbon development
134. The Importance of Local Traditional Institutions in the Management of Natural Resources in the Highlands of Eastern Africa
135. Socio-economic assessment of irrigation pilot projects in Rwanda
136. Performance of three rambutan varieties*(Nephelium lappaceum* L.*)* on various nursery media
137. Climate change adaptation and social protection in agroforestry systems: enhancing adaptive capacity and minimizing risk of drought in Zambia and Honduras

138. Does value chain development contribute to rural poverty reduction? Evidence of asset building by smallholder coffee producers in Nicaragua
139. Potential for biofuel feedstock in Kenya
140. Impact of fertilizer trees on maize production and food security in six districts of Malawi.

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141. Fortalecimiento de capacidades para la gestión del Santuario Nacional Pampa Hermosa: Construyendo las bases para un manejo adaptativo para el desarrollo local. Memorias del Proyect
142. Understanding rural institutional strengthening: A cross-level policy and institutional framework for sustainable development in Kenya
143. Climate change vulnerability of agroforestry
144. Rapid assesment of the inner Niger delta of Mali
145. Designing an incentive program to reduce on-farm deforestationin the East Usambara Mountains, Tanzania
146. Extent of adoption of conservation agriculture and agroforestry in Africa: the case of Tanzania, Kenya, Ghana, and Zambia
147. Policy incentives for scaling up conservation agriculture with trees in Africa: the case of Tanzania, Kenya, Ghana and Zambia
148. Commoditized or co-invested environmental services? Rewards for environmental services scheme: River Care program Way Besai watershed, Lampung, Indonesia.
149. Assessment of the headwaters of the Blue Nile in Ethiopia.
150. Assessment of the uThukela Watershed, Kwazaulu.
151. Assessment of the Oum Zessar Watershed of Tunisia.
152. Assessment of the Ruwenzori Mountains in Uganda.
153. History of agroforestry research and development in Viet Nam. Analysis of research opportunities and gaps
154. REDD+ in Indonesia: a Historical Perspective.

The World Agroforestry Centre is an autonomous, non-profit research organization whose vision is a rural transformation in the developing world where smallholder households strategically increase their use of trees in agricultural landscapes to improve their food security, nutrition, income, health, shelter, energy resources and environmental sustainability. The Centre generates science-base knowledge about the diverse role that trees play in agricultural landscapes, and uses its research to advance policies and practices that benefit the poor and the environment.

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