Working Paper

Agroforestry and Forestry in Sulawesi series:

Livelihood strategies and land-use system dinamics in Gorontalo

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

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Working Paper 241

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Abstract

The project 'Agroforestry and forestry in Sulawesi: linking knowledge with action' (AgFor Sulawesi) project is being implemented in three provinces of Sulawesi, Indonesia (South Sulawesi, Southeast Sulawesi and Gorontalo) from 2011 to 2016 to enhance agroforestry and forestry livelihood systems in 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 two districts of Gorontalo was considered essential for designing the next phase of the project. The livelihood baseline study addressed both community and household levels.

The results of group discussion show the dynamics of land use and diversity of livelihood strategies among village typologies. Maize and vegetables, as well as agroforestry based systems of plantation crops such as coconut, cacao and clove dominate the land use in all the village typologies. In general, community livelihood strategies are dominated by maize, vegetables, and agroforestry tree based products.

Further analysis of household-level information indicates that the number of male and female household members are relatively similar in all villages in all typologies and the majority of household heads were from the Gorontalo tribe. The educational level in Typology 4 villages, especially in Modelidu, is the lowest compared to other respondents. The level of education in the other typologies are relatively similar, with female education level slightly lower than men.

Land tenure status is relatively equal for most typologies, the land owned together by husband and wife - in others the husband has the greatest responsibility. The cultivated land is generally located on private land in the village (Typology 1, Typology 4 and Typology 5). The others work more land in protected forests and production forests (Typology 2 and Typology 3).

Household level analysis also showed that the average annual income per household in Typology 1 is lower compared with other typologies. The main source of income for farmers is also different for each village: Typology 1 sourced from maize yields and agricultural wages; Typology 2 from non-agricultural wages and maize; Typology 3 from maize, chili and agricultural wages; Typology 4 from agroforestry gardens; and Typology 5 from coconut and non-agricultural wages. Sources of income from agriculture (58-88%) is higher than non-agriculture (12-42%) in all the village typologies.

The income per capita of farmers in Typology 1 is lower than in other typologies. Meanwhile farmers in Typology 4 are comparatively the most affluent: revenue per capita per day of farmers in Typology 4 almost doubled compared to farmers in other typologies.

Keywords: AgFor Sulawesi Project, Gorontalo, land-use dynamics, livelihoods, income, coconut, maize, cacao, cloves, candlenut, forest, agroforestry

Acknowledgements

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Contents

List of Figure

List of Tables

1. Introduction

The ‘Agroforestry and Forestry in Sulawesi: Linking Knowledge with Action’ project (the AgFor Sulawesi project) has been developed for implementation in three 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 livelihood 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 more robust and risk adverse; the Project intends to establish them in the 3 cited provinces.

Secondly, suboptimal watershed management is leading to increased soil erosion, sedimentation, landslides and floods. 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 programs 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 raising awareness 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 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 two selected districts in the Gorontalo province is very important for designing the next phase of the project and also for designing preferred strategies that are viable 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 and livelihood strategies, and more detailed data on household-level activity in Gorontalo.

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 two districts of the Gorontalo province to acquire the data. The FGDs ran throughout the day with eight 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.

Information was collected from 30 households of random stratification per village, from eight sampled villages in Gorontalo, Sulawesi (**Table 1**). As much as possible, both the husband and wife of each household were interviewed together. Details are elaborated in the following sections.

3. General Overview of the Site

3.1 Site Characteristics and Typologies

The Gorontalo province is located in the northern part of Sulawesi island - geographically it lays on $0^{o}19'$ - $0^{o}57'$ north latitude and $121^{o}23'$ - $125^{o}14'$ east longitude. The total area of land and sea areas is 12.435 km^2 that is adjacent to two provinces (Central Sulawesi in the west, North Sulawesi in the east, Sulawesi Sea in the north and Tomini Gulf in the south). The province has five regencies and one city, namely Boalemo, Gorontalo, Pohuwato, Bone Bolango, North Gorontalo Regency and Gorontalo City (Gorontalo Dalam Angka 2014).

The minimum and maximum temperatures that occurred in Gorontalo were 22.2ºC in February and 34.2ºC in October respectively. In 2012, the average air temperature was around 26.3 - 27.6ºC. Gorontalo Province has a high relative humidity, reaching 86.5% on average in 2013. The highest rainfall occurred in May (307.9 mm), and the highest number of rainy days were in July and December with 24 days. The average wind speed recorded in 2013 at the meteorological station was generally even for each month, ranging from 1.1 to 2.7 m/sec (Gorontalo Dalam Angka 2014).

According to the Indonesia Investment Coordinating Board the economic structure of Gorontalo Province in 2013 was dominated by agriculture (28%). The biggest agricultural contribution is maize, followed by sweet potato and cassava. The biggest contribution at trade sector is retail, followed by restaurant and hotel. The main commodities of the Gorontalo province are in the plantation sector, namely coconut, cacao, sugar cane, coffee, sugar palm, clove, cashew, kapok, candlenut and vanilla. The main commodities in the fishery sector are fishery catch and aquaculture. In the service sector, the main commodities are nature and culture tourism (Indonesia Investment Coordinating Board 2015). **Figure 1** describes the AgFor site in the Gorontalo province.

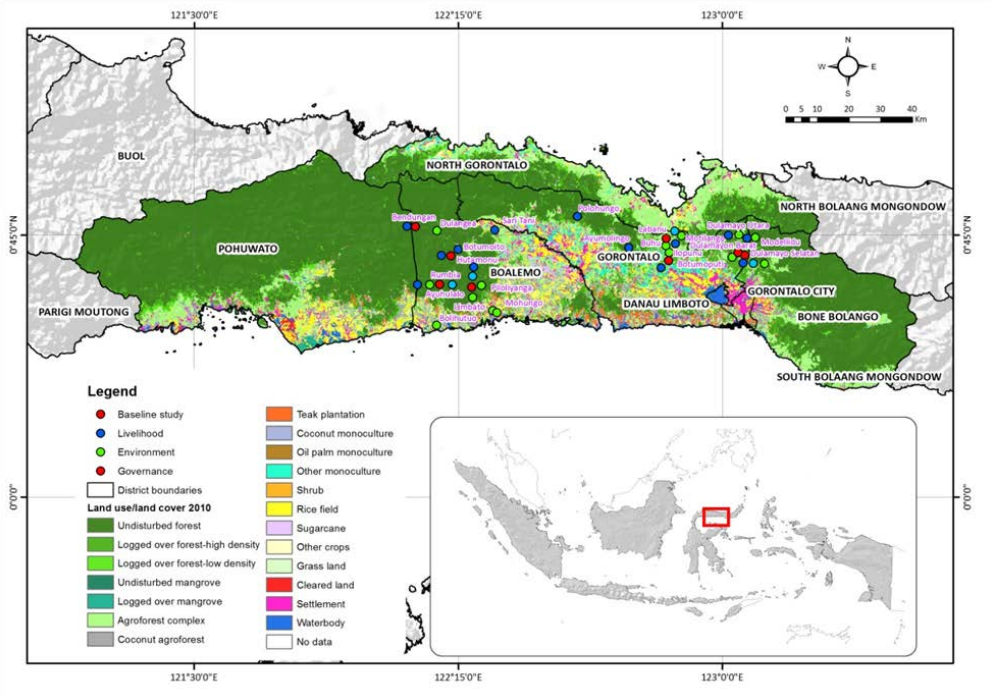

Figure 1. Study site in Gorontalo

Livelihood aspects of the people of Gorontalo closely relate to physical conditions and tenure status that lead to different major land-use activities and farming practices in each area, while also considering administrative status. People with different physical conditions and tenure status possessed different livelihood sources and strategies. The typologies were as illustrated in **Table 1**.

Table 1. Village typologies for FGDs and household surveys in Gorontalo

Site AgFor ICRAF	Village typologies				
	Boalemo District			Gorontalo District	
	APL (Forest for Other Landuses)	**APL-HTR** (Forest for Other Landuses & Plantation)	**HL-HKM** (Protected Forest & Community Forest)	**Complex Agroforestry**	**Medium Agroforestry**
	1	**2**	**3**	**4**	**5**
Intregrated Site (village)	-	Rumbia	Ayuhulalo	*Bordering with HTR, People Protected Forest:* Dulamayo Selatan	*Natural reserve:* Labanu
Main Site (village)	Bendungan	-	Hutamonu	*Bordering with Protected Forest:* Modelidu	*Limited production forest:* Botumoputi
Total village of FGD Survey: 8	1	1	2	2	2
Total Households Survey: 240	30	30	60	60	60

3.2 Household Status

3.2.1 **House Condition**

The condition of farmers' houses can be used as a proxy of their welfare. We assessed the condition of houses using four variables: type of house walls, roofs, floors and lighting, presented in **Figure 2** - **Figure 5**. The condition of the houses was relatively similar in the APL village (hereinafter referred to as Typology 1), APL-HTR village (Typology 2), HL-HKM village (Typology 3), Complex Agroforestry village (Typology 4) and Medium Agroforestry village (Typology 5).

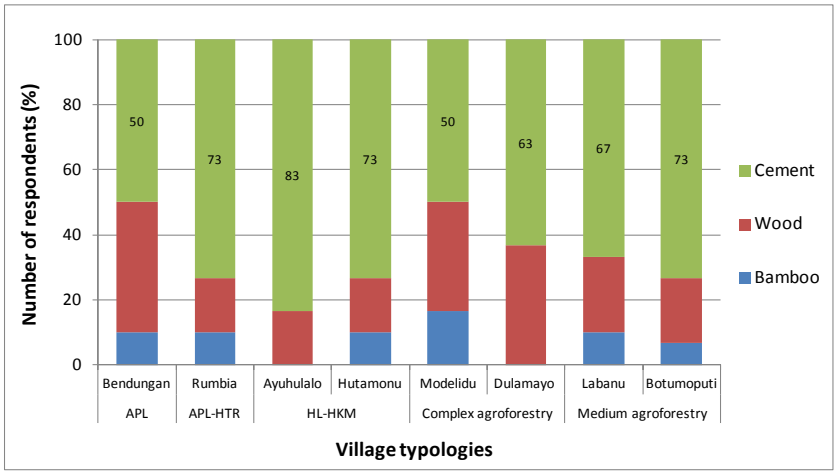

Figure 2. House condition by house wall in Gorontalo

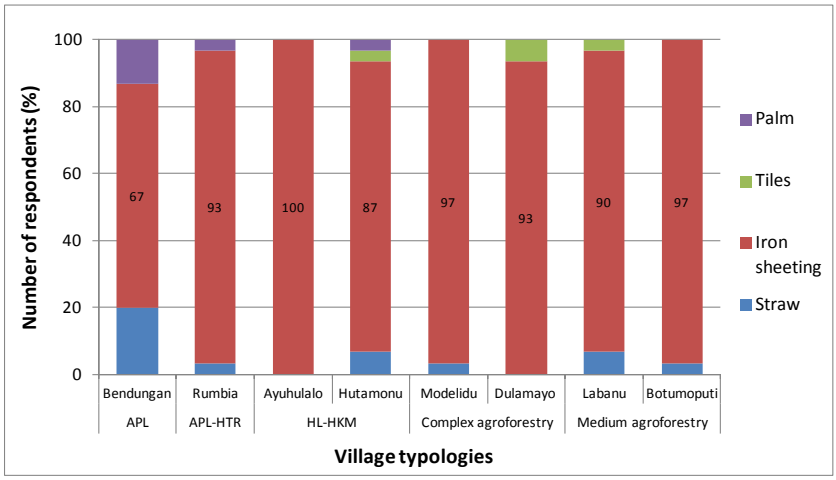

Figure 3. House condition by house roof in Gorontalo

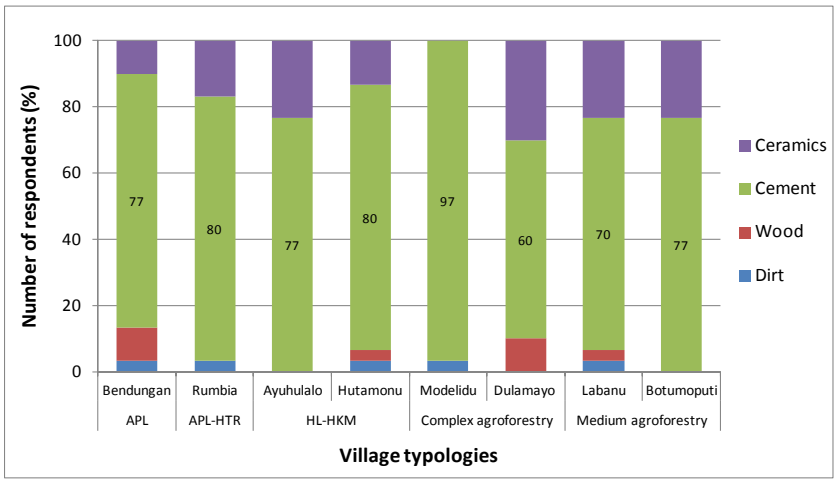

Figure 4. House condition by house floor in Gorontalo

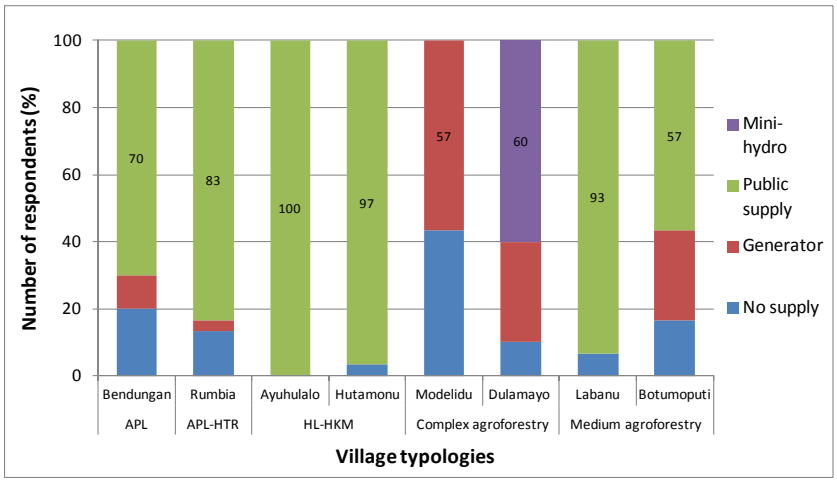

Figure 5. House condition by house lighting in Gorontalo

3.2.2 Education

The education levels of respondents in Typology 4, especially in Modelidu village, were the lowest compared with the other respondents (Table 2). Education levels were relatively similar in all typologies. The level of the education of males was slightly lower than that of females.

Table 2. Distribution of years of schooling among married couples in Gorontalo

Village Typologies	Village	n	Years of schooling										Mean Years of Schooling
			Illiteracy		Primary School		Junior High School		Senior High School		Pass Senior High School		
			n	%	n	%	n	%	n	%	n	%	
APL	**Bendungan**												
	Male	29	0	0	24	83	3	10	2	7	0	0	6.45
	Female	29	0	0	18	62	7	24	4	14	0	0	7.24
APL-HTR	**Rumbia**												
	Male	30	0	0	20	67	4	13	4	13	2	7	7.23
	Female	30	0	0	18	60	7	23	4	13	1	3	7.70
HL-HKM	**Ayuhulalo**												
	Male	30	0	0	25	83	4	13	1	3	0	0	5.77
	Female	30	0	0	21	70	5	17	3	10	1	3	7.13
	Hutamonu												
	Male	29	1	3	19	66	4	14	5	17	0	0	6.55
	Female	27	0	0	16	59	8	30	3	11	0	0	7.30
Complex agroforestry	**Modelidu**												
	Male	30	3	10	26	87	1	3	0	0	0	0	3.87
	Female	28	3	11	21	75	3	11	0	0	1	4	5.00
	Dulamayo												
	Male	29	1	3	19	66	3	10	6	21	0	0	6.59

Village Typologies	Village	n	Years of schooling										Mean Years of Schooling
			Illiteracy		Primary School		Junior High School		Senior High School		Pass Senior High School		
			n	%	n	%	n	%	n	%	n	%	
	Female	28	0	0	18	64	6	21	4	14	0	0	7.14
Medium agroforestry	**Labanu**												
	Male	30	2	7	24	80	2	7	1	3	1	3	5.80
	Female	30	1	3	21	70	2	7	5	17	1	3	6.80
	Botumoputi												
	Male	30	2	7	22	73	5	17	1	3	0	0	5.57
	Female	30	2	7	22	73	3	10	3	10	0	0	6.37

We also calculated the distribution of the education of respondents' children in Gorontalo, Sulawesi (Table 3). The mean length of schooling in Typology 1 was 6.23 years for males and 5.69 years for females. In Typology 2, the average length of schooling was 5.50 years for males and 7.53 years for females. In the Typology 3 it was 6.71 - 6.73 years for males and 8.13 - 8.27 years for females. In the Typology 4 it was 7.27 - 7.47 years for males and 7.06 - 8.00 years for females. In the Typology 5 it was 6.27 - 8.33 years for males and 7.00 years for females.

Table 3. Distribution of child population by years of schooling in Gorontalo

Village Typologies	Village	n	Years of schooling of children										Mean Years of Schooling
			Illiteracy		Primary School		Junior High School		Senior High School		Pass Senior High School		
			n	%	n	%	n	%	n	%	n	%	
APL	**Bendungan**												
	Male	31	0	0	18	58	6	19	5	16	2	6	6.23
	Female	13	0	0	8	62	3	23	2	15	0	0	5.69
APL-HTR	**Rumbia**												
	Male	26	0	0	18	69	4	15	2	8	2	8	5.50
	Female	19	0	0	7	37	7	37	5	26	0	0	7.53
HL-HKM	**Ayuhulalo**												
	Male	31	1	3	18	58	3	10	6	19	3	10	6.71
	Female	33	0	0	13	39	7	21	8	24	5	15	8.27
	Hutamonu												
	Male	30	0	0	17	57	5	17	7	23	1	3	6.73
	Female	23	0	0	10	43	4	17	8	35	1	4	8.13
Complex agroforestry	**Modelidu**												
	Male	30	1	3	14	47	6	20	7	23	2	7	7.27
	Female	32	0	0	15	47	10	31	4	13	3	9	7.06
	Dulamayo												
	Male	32	0	0	15	47	8	25	6	19	3	9	7.47

Village Typologies	Village	n	Years of schooling of children										Mean Years of Schooling
			Illiteracy		Primary School		Junior High School		Senior High School		Pass Senior High School		
			n	%	n	%	n	%	n	%	n	%	
	Female	17	0	0	7	41	1	6	8	47	1	6	8.00
Medium agroforestry	**Labanu**												
	Male	26	1	4	17	65	2	8	4	15	2	8	6.27
	Female	19	0	0	10	53	5	26	3	16	1	5	7.00
	Botumoputi												
	Male	18	0	0	8	44	3	17	5	28	2	11	8.33
	Female	14	0	0	6	43	7	50	1	7	0	0	7.00

3.2.3 Household Gender Distribution

The number of male and female household members was relatively similar in all typologies. In all villages, there were slightly more males per household than females, except for in Typology 3 (Ayuhulalo village), where there were slightly more females than males (Figure 6).

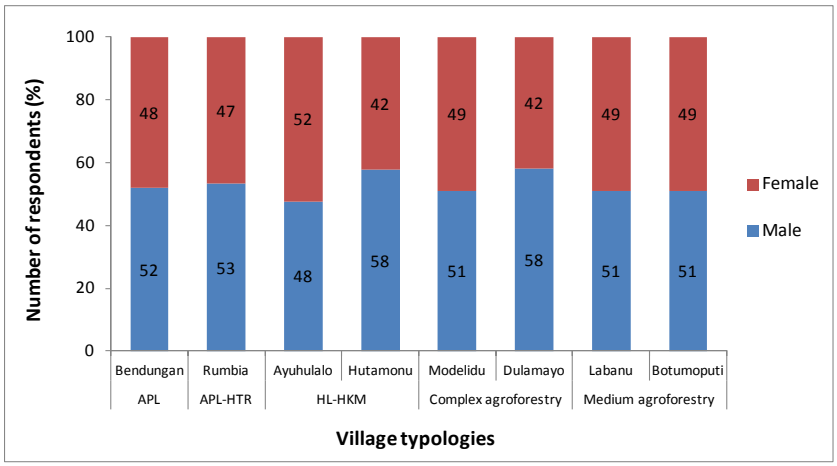

Figure 6. Number of male and female in households in Gorontalo

3.2.4 Ethnicity of Household Heads

The ethnicity of the household head was relatively similar among villages in all the typologies, with Gorontalo being the dominant ethnicity. This is presented in Figure 7.

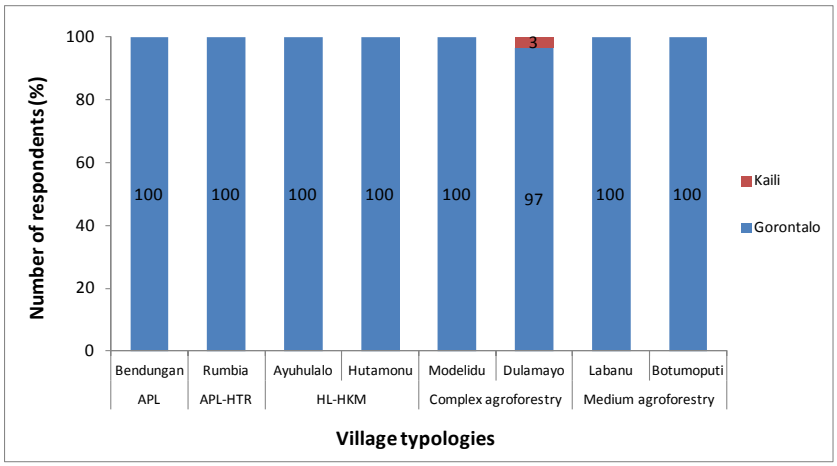

Figure 7. Ethnicity of household head in Gorontalo

4. History of The Villages and Land-Use Dynamics in Gorontalo

4.1 Community Perspectives on Village History and Land-Use Dynamics

4.1.1 **Typology 1: APL Village (Forest for Other Landuses)**

Bendungan Village

Bendungan village was originally formed around 1986 from a hamlet called North Tabulo which was inaugurated as the definitive village in 1988. The name 'Bendungan' was taken from the history that lived in local communities: a story of a wise grandfather lived named Bapu Hilala who dammed the river that flows through Salilama village. He only use a piece of palm leaf that attached to the middle of the river to dam it. He was also diverting the water direction by pulling a *bututu* (a type of fabric bag) into the South Tabulo village. *Tabulo* in local language is also called Bendungan (a dam).

In the 1970s, people who inhabited rural areas generally came from the Tilamuta community, Marisa and Paguyaman who were the Gorontalo tribes. They lived on rice cultivation, both upland paddy and irrigated paddy, chili and maize as well as gathering forest products (wood and rattan). In addition, people also cultivated coconut. Coconut was one of the commodities cultivated by generations within this community. In 1980 the Government through the North Sulawesi Plantation Office (at this time Gorontalo was part of the North Sulawesi province) launched the program Coconut Working Centre (CWC) to provide hybrid coconut seedlings to the community (Susanto 2007). The program was aimed to disseminate hybrid coconut as an alternative to the earlier coconut variety (*kelapa dalam* or tall coconut) that has a long cultivation history. Currently coconut agroforestry has become the dominant landuse in the Bendungan village (Figure 8).

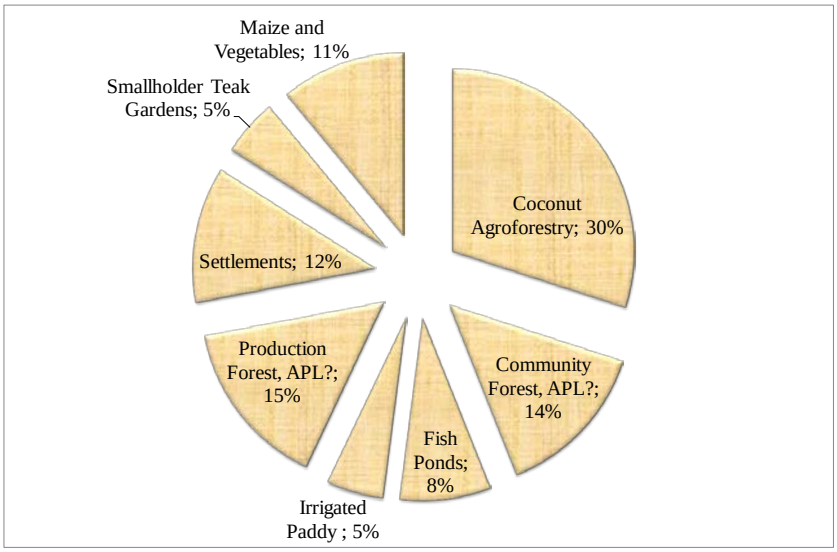

Figure 8. Current landuse in Bendungan village based on community perspectives

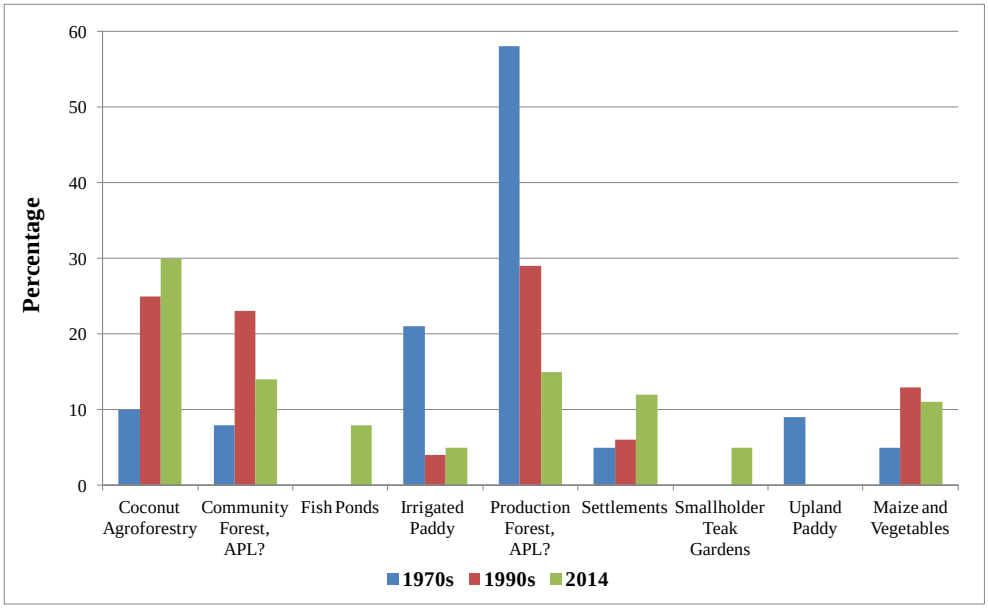

Figure 9. Landuse dynamics in Bendungan village based on community perspectives

In 1990, the villagers had support of cacao seedlings from Gorontalo district government for the area of 20 hectares in each village. In addition, people also had support for coconut and maize seeds. Several Government programs were rolled into this village in the 2000's such as *Inpres Desa Tertinggal* or IDT (provides cattle and microeconomic business support for the community), the Integrated Area Development or PKP, and Micro Credit for farmer or KUT (provides maize seed and fertilizer aid). In 2005 the community were interested in planting teak in their gardens, and so the Government supported a timber planting program through which people recieved 500 hectares of teak seedlings, Gmelina and jackfruit. In similar assistance, the Government also gave 500 hectares of teak seedlings, Gmelina, jackfruit and *nantu* (local timber species) in 2010. The Government also provide

capacity building programs such as the farmer field schools Integrated Pest Management Disease or SLPHT of cacao from Gorontalo Provincial Office.

The landuse dynamics in Bendungan village, as illustrated in Figure 9, show the increase in coconut agroforestry - as much as three times larger since the 1970s. Increased coconut agroforestry area was followed by a reduction in production forest to only a quarter of its previous area. The land demand for rice and maize, as well as coconut, was one of the triggers for the declining forest area.

4.1.2 Typology 2: APL-HTR Village (Forest for Other Landuses & Plantation)

Rumbia Village

Rumbia village was officially formed in 1985 from the village of Tumba, part of the Tapadaa village. This conversion began on the agreement of community and religious leaders within the community. The name "Rumbia" came from the abundance of sago palm tree (*Rumbia*) grown in this village. The people who came at the early time and settled in this village were from the Gorontalo tribe. Rumbia village was known as the large producer of agricultural products such as rice, maize, coconut, chilli, cloves, and sugar palm.

In the 1980s, CWC Program for hybrid coconut was also implemented in Rumbia village. Several technical and extension activities came with hybrid coconut seedlings to support the community. Besides coconut, sugar palm is a popular tree in the community and contributes to commmunity livelihoods. The Government through the Provincial Forestry Office gave attention to it by providing training and support to palm sugar producers in 2001. Recently farmer groups of palm sugar producers have grown and improved rapidly, such as the Idaman group (women group) and Aren Lestari group (male group). The number increased, from 10 groups in 2010 to 15 groups in 2014.

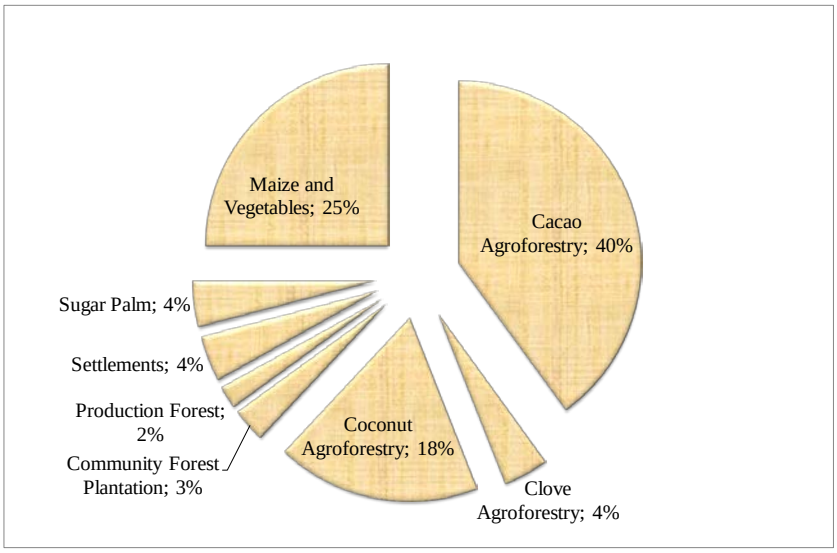

Figure 10. Current landuse in Rumbia village based on community perspectives

The three most prevalent land uses in the Rumbia village are cacao agroforestry, maize and vegetables, and coconut agroforestry (Figure 10). Cacao agroforestry has increased very rapidly in the last ten years since it was introduced in the 2000's. In Rumbia village people grew cacao very enthusiastically and were supported by government assistance through 12000 cacao seedlings per village. Each farmer household got around 600 seedlings per hectare.

The community expressed their interest in cacao since it prices better, and there is a chance to have continuous frequent production compared to coconut. Figure 11 showed the interesting pattern on the presence of large area of cacao agroforestry and a significant decrease of paddy fields and coconut agroforestry. The decline of production forest area was also followed by encroachment of forests since 2002 to cultivate rice and maize fields by the locals who managed themselves. This village is also aware of the community forests scheme, also known as Plantation Forest (HTR), that has 10 000 hectares area. The legality of the management was supported by the Decree of the Ministry of Forestry that was proposed in 2012.

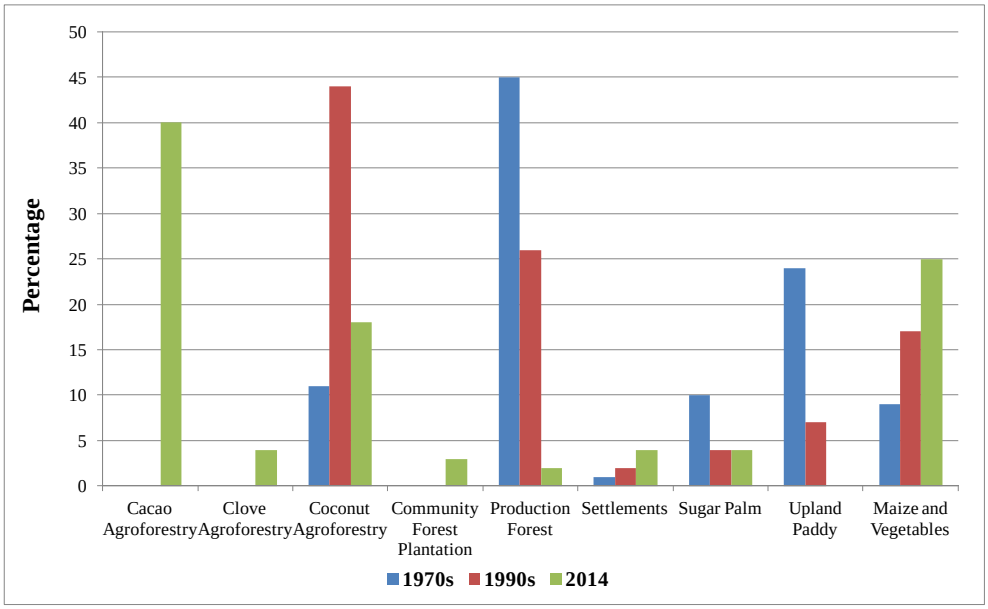

Figure 11. Landuse dynamics in Rumbia village based on community perspectives

A unique tradition of landuse dynamics in Rumbia village that still runs today is the habit of buying and selling crops and land separatedly. It is common practice in the buying and selling process for only crops to be sold while the land is not – this practise makes up around 60% of the sale and purchase of land. There are also people who just sell the land, but not the crops that grow on it – these make up around 30%. And the tendency to sell both crops and land simultaneously have a smaller number (only 10%) compared with the previous pattern.

4.1.3 Typology 3: HL-HKM Villages (Protected Forest & Community Forest)

Ayuhulalo Village

Ayuhulalo, the village name, is taken from the discovery story of a large wood piece which has white stems and leaves. If exposed to the sun then the tree glows like a full moon. So parents named their village Ayuhulalo which means *wood of moon*, or in the language of Gorontalo *ayu odelo hulalo*.

In the 1970s people's livelihood was derived from *damar* wood, *woka* leaves, timber, rattan, and rice farming. The CWC Program also provides people with help in the form of hybrid coconut seedlings and cultivation technical assistance. Coconut agroforestry cultivated by the community now makes up the majority of land use in Ayuhulalo village (Figure 12). In addition, people also receive assistance on teak seedlings from the Forest Service in 2000.

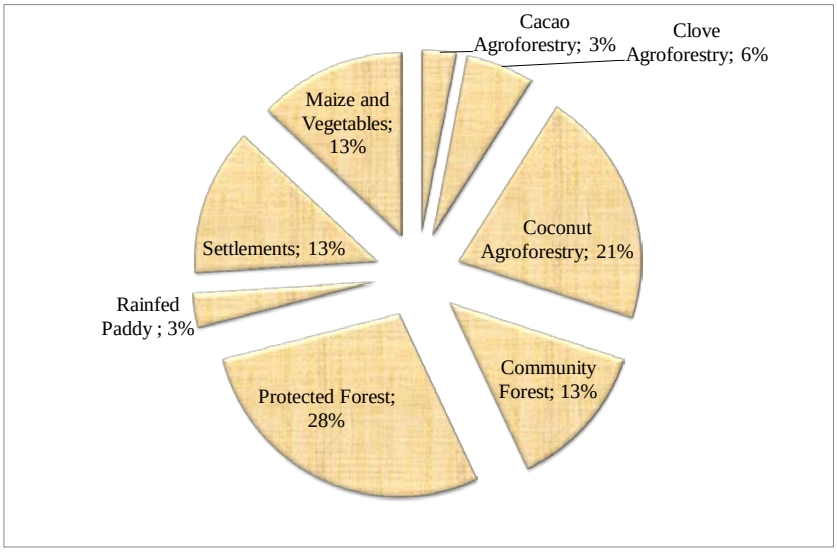

Figure 12. Current landuse in Ayuhulalo village based on community perspectives

Ayuhulalo village has a large proportion of forest in the region: more than 40% of the area. Based on discussions with the community, protected forests and community forests each have an area proportion of 28% and 13% (Figure 12). Furthermore, coconut agroforestry, maize and vegetable fields have a sizeable proportion. The existence of protected forests and community forests in the Ayuhulalo village has a great influence on people's lives in the village. According to the information from community discussion, Ayuhulalo protected forest in the village known as the concession area set in 1970 by the local government. Looking at the dynamic changes of landuse, the protected forest area since the 1970s reduced by half by 2014. On the other hand, the extent of community forests, clove gardens, and fields of maize and vegetables increased in 2014 from the prior year period (Figure 13).

There are certain rules that have been set by the Forest Service for this area, among others including: prohibition from taking or cutting wood, forest burning is prohibited, prohibition from taking or

hunting of animals. If violated, then there will be fines imposed on the offenders. The community recognizes there are a variety of benefits that they get from the presence of the protected forests, such as: a source of clean and abundant water, a source of seedlings, flood prevention and improving the economy of the forest. On the other hand, some of the losses submitted include difficulty in obtaining land for people who do not have land as a result of the ban on forest clearing.

In a different position is the community forest known to the public as “APL forest” which has been managed by the community since the 1980s. At first only about 20 families managed the territory, now in 2014 there were around 80% of households in the village who manage the region. There are ownership rules set in the village, there is an annual tax paid, and ownership is based on who first opened the forest. Currently, there is potential conflict with neighboring villages related to access and control of these lands, especially when cloves,which have been planted since the 1990s, are now inside the Ayuhulalo village area.

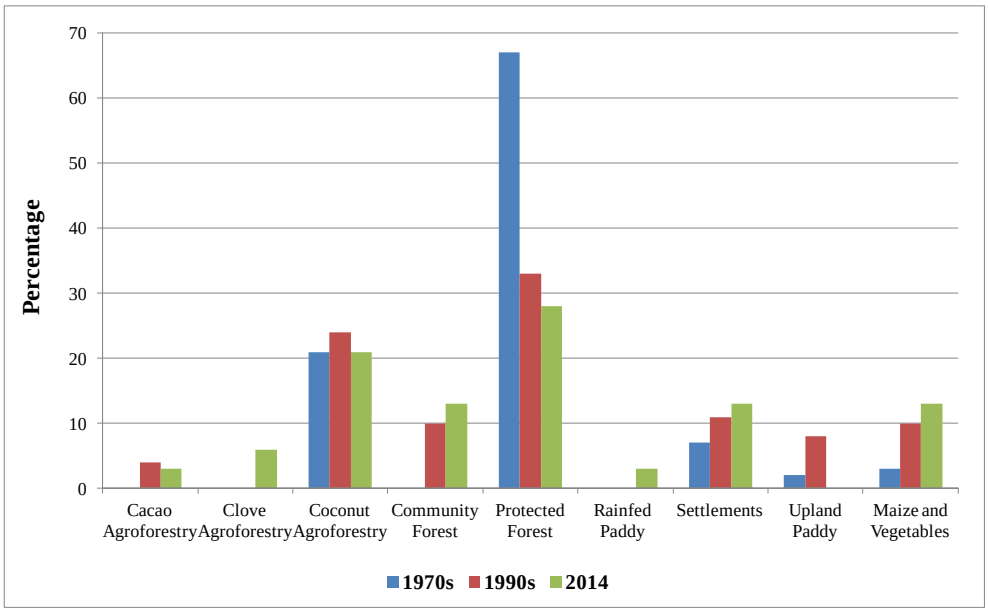

Figure 13. Landuse dynamics in Ayuhulalo village based on community perspectives

Hutamonu Village

Hutamonu village was established in 1979 and is part of the village division of Hamlet 3 of Botumoito; Mr. Mahyudin Pateha asked for the first village chief at the time. Communities generally live as farmers who cultivate maize, sago, tubers, bananas, coconuts, and forest products. In the same time, the first cacao planting came from Minahasa and Gorontalo Regency assistance. Around 20 people get support through cacao seeds for 1125 seedlings per hectare. Unfortunately, this assistance has less than adequate technical knowledge of cacao cultivation.

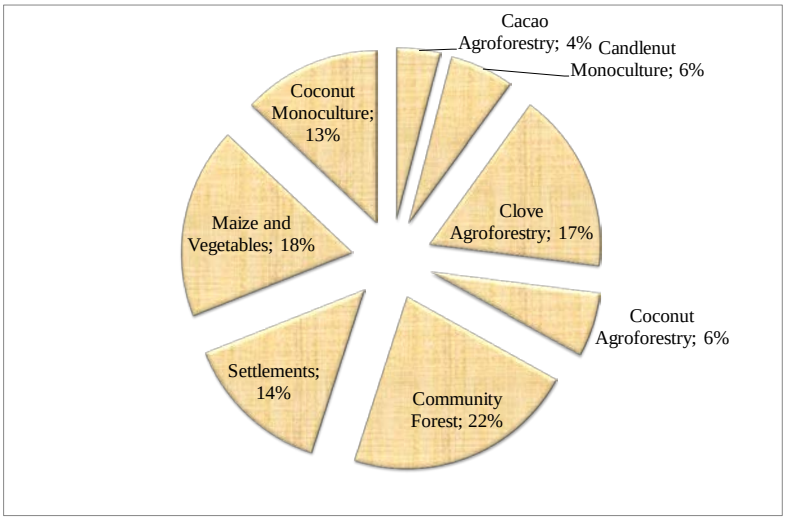

Figure 14. Current landuse in Hutamonu village based on community perspectives

CWC program for hybrid coconut was also started at the same time to increase the productivity of coconut plantations of the people in this village. In the period of 2000 planted cloves began to enter the community, government assistance was still very limited at that time. Cloves began to grow rapidly around 2009-2010 when the community started planting cloves and buy seeds from Botumoito up to Toli-Toli, Central Sulawesi. There were at least 20 families who planted cloves in their maize fields.

Community forest, maize and vegetables, and clove agroforestry are three dominant land uses in the Hutamonu village with the proportions 22%, 18% and 17% respectively (Figure 14). Community forest in the Hutamonu village was known to the public as protected forests long ago. Communities already use the forest for a long time until it was proposed as the community forestry scheme (HKM). At the beginning of the proposal, there were 30 families who joined as forest farmer groups to manage 600 hectares area of HKM.

In 2014, the community said that the Forest Service Gorontalo expressed their approval for HKM area of around 400 hectares. This information also mentioned some rules that apply according to the Forestry Department: land should not be bought and sold, nor transferable, and the plants that are allowed to be planted are annual crops such as cloves, nutmeg, cacao, and durian. Internally the group itself has not yet developed clear rules. However, so far there are people who can see the benefits of this HKM, including: the community can manage agricultural land, an increase in the local economy and the opening up of jobs. On the other hand the community also complained about the severe condition of the access road although many agricultural products are produced there.

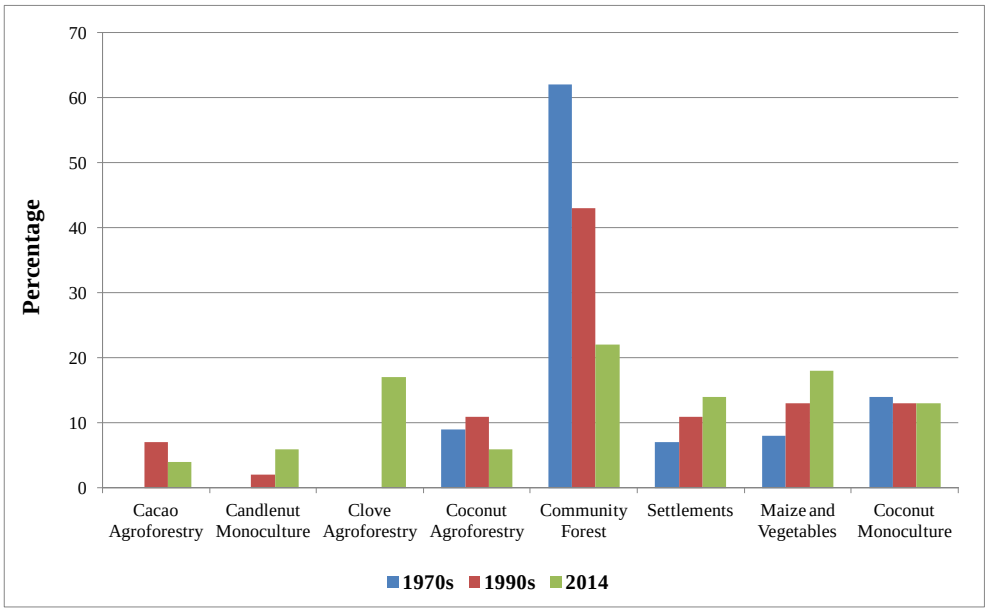

Figure 15. Landuse dynamics in Hutamonu village based on community perspectives

Figure 15 shows the dynamics of land use in Hutamonu from the 1970s to the present. Community forest area was reduced to less than half during this period, while maize and vegetable land and clove agroforestry increased significantly. In the discussion it was mentioned that some community forest area was converted into clove agroforestry, especially after the 2000s when there was mass planting cloves.

4.1.4 Typology 4: Complex Agroforestry Villages (Bordering with HTR, People Protected Forest)

Dulamayo Selatan Village

Dulamayo Selatan village was originally a forest area where people of Bone-Bolango, Limboto, and Gorontalo came for planting. Dulamayo village was first established in 1881. The word "Dulamayo" itself comes from two syllables: "*Dula*" or "*Dulo*" which means “to let”, and the "*mayo*" which means “work”; so Dulamayo means “let’s work”. Dulamayo village officially designated in 1892.

Cloves are known in the village since the 1950s when the village chief brought three clove seeds of Manado - two of them grew well while the other died. Clove cultivation in rural development is increasingly prevalent since 1972 with 100 clove trees planting program being an initiative of the head of the village. Furthermore, in 1978 there were two known clove varieties in the community: Zanzibar and Sikotok. A government program for plantation and reforestation also provided assistance through clove and cacao seeds. It is not surprising therefore that clove agroforestry became one of the dominant landuses in this village (Figure 16).

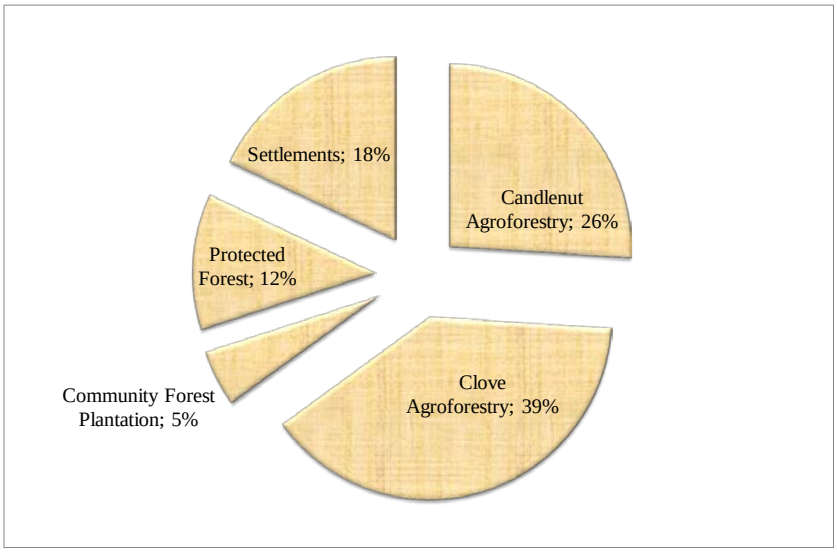

Figure 16. Current landuse in Dulamayo Selatan village based on community perspectives

Figure 16 also illustrates that candlenut agroforestry has the second largest landuse proportion after clove agroforestry. Candlenut is a plant that has long been sought by local communities. One cultural tradition that developed is for a newly married bride and groom in the community to plant 25 candlenut trees in the village; this tradition is carried on even now. Villagers in Dulamayo Selatan used a combination of plantation crop types (cloves, nutmeg, etc.) to develop agroforestry gardens, which consist of various types of trees.

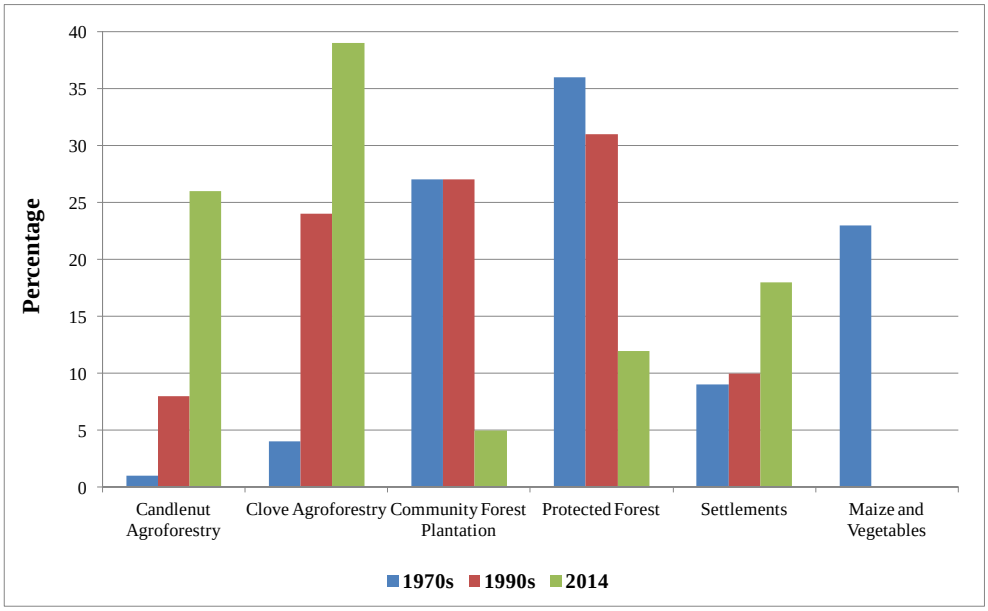

Figure 17. Landuse dynamics in Dulamayo Selatan village based on community perspectives

Dynamics of changes in land use in Dulamayo Selatan showed a decrease in the proportion of protected forest by more than half from the 1970s until 2014 (Figure 17). Meanwhile candlenut agroforestry and clove agroforestry proportions increased very significantly, more than five-fold from

the 1970s until 2014. This phenomenon shows the high public interest in planting clove and candlenut, followed by support from the local government, making the use of land in the village change very dynamically.

Modelidu Village

Since the 1970s the villagers of Modelidu were known as a farming community living from agricultural products such as peppers, tomatoes, maize, and rice fields. The community also utilized forest products such as timber and rattan. In the 1990s, cacao entered into the village through the help of the Department of Agriculture. Unfortunately due to high pest infestation at the time, many cacao fields could not be harvested. Maize has been cultivated for many years and supported by the Government through various provisions of hybrid maize seeds in 2001, 2002, and 2012.

In the 2000s people began planting teak in their maize fields. Mr. Rahman Tongi is one of the pioneer farmers who planted teak in Modelidu village. Teak seedlings were imported from Java, some farmers bought it from Kwandang at price IDR7500 to 10 000 per seedling. Currently, smallholder teak continues to grow in this village, occupying nearly one-fifth of the land use proportion of the village (Figure 18).

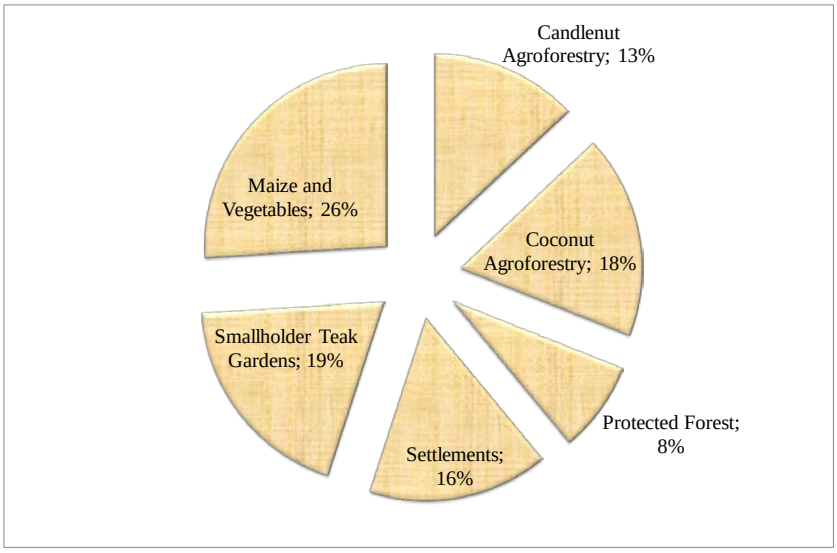

Figure 18. Current landuse in Modelidu village based on community perspectives

The majority of villagers (90%) plant teak, and had already started to harvest the timber in 2014. Figure 18 shows the proportion of land use in the village; the three largest land uses are maize and vegetables, smallholder teak gardens, and coconut agroforestry which had proportions 26%, 19% and 18% respectively.

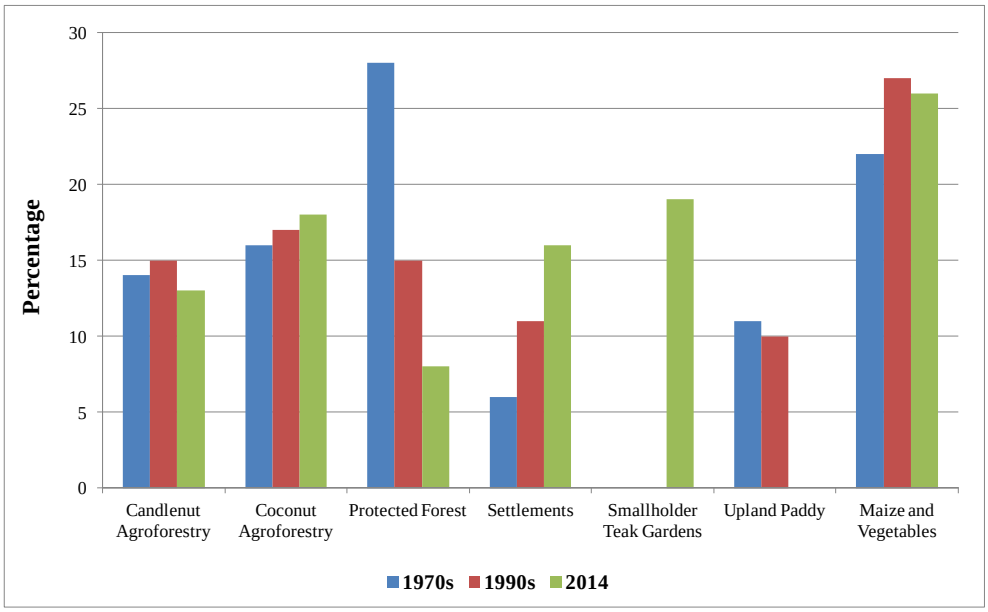

Figure 19. Landuse dynamics in Modelidu village based on community perspectives

Figure 19 shows the dynamics of land use in the Modelidu village from the 1970s until 2014. The community said that the forest area was reduced drastically; on the other hand, there was a significant increase of settlements and maize and vegetables area. This was accompanied by a significant increase in smallholder teak gardens.

4.1.5 Typology 5: Medium Agroforestry Villages (Surrounding Natural Reserve and Limited Production Forest)

Labanu Village

In the 1950s a lot of people came from various regions such as Limboto, Telaga and Gorontalo city to Labanu village for planting maize, rice, banana and teak. The village name Labanu comes from a local timber name, *Labanu*. This village formerly was part of Motilango village, which expanded into separate villages. Since 1995 it has had very good access as it is connected to the Trans-Sulawesi mainroad (Gorontalo-Manado route).

Labanu village community has participated in various government programs for a long time. In the 1950s, the community planted 150 hectares of teak through the government reforestation program. A few years later, people also received support from the Department of Forestry to plant teak on their own land. Teak is commonly cultivated with paddy during the first year. Figure 20 shows the current land use based on the community perception. Smallholder teak garden has the largest proportion of the land use, covering one third of Labanu Village area. The second and third largest land use are settlement, and maize and vegetables. In the 1990s, the community received government assistance through CWC programs for clove seeds and other crops such as coconut, teak, cacao, candlenut,

jackfruit, and mango. Currently clove agroforestry also has a large proportion in Labanu village, after teak and maize.

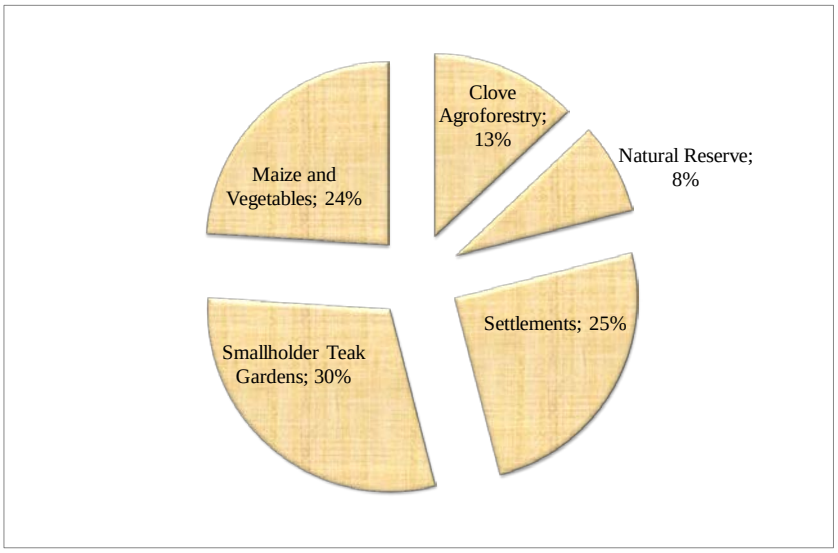

Figure 20. Current landuse in Labanu village based on community perspectives

Interestingly, the Labanu area also includes a forested area called Nature Reserve of Tangale Forest, already known to the public for a long time. Nature Reserve Forest Management Tangale is handled directly by KSDA in Manado, but the area is entrusted to the management of the National Park Nani Wartabone. Tangale forest nature reserve was set by the Minister of Forestry No. 431/Kpts/II/92 dated May 5, 1992; the forest area was designated for the protection of flora and aesthetic with an area of 113 hectares (Department of Forestry 2002, Sunarti 2007).

This forest nature reserve continues to be maintained and protected by the state and the community with the rules of the Forest Service and support from the Labanu village. Forest Service rules allow villagers to enter the forest, but prohibit them from cutting wood or taking animals, rattan or stones from the forest. Violations of these rules can be penalized in the form of warnings to severe sanctions (imprisonment). Nature Reserve Tangale benefits perceived by the public include: the availability of abundant water, soil that retains moisture and does not dry quickly, an area to protect rare animals such as lizards or tarsiers, snakes, wild boar and other wild animals, as well as preventing the occurrence of landslides, especially road axis Trans Sulawesi directly adjacent to the nature reserve.

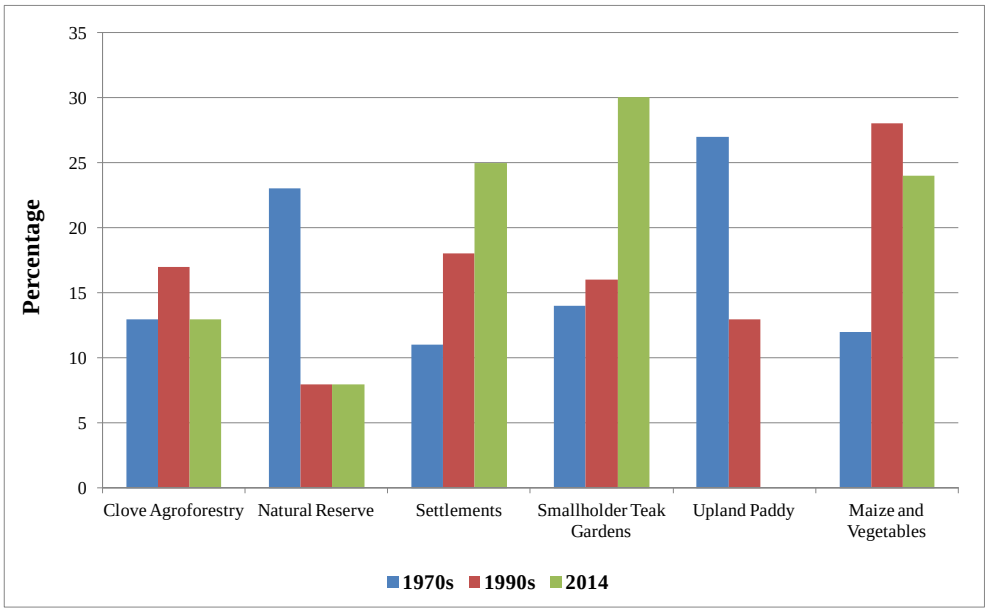

Figure 21. Landuse dynamics in Labanu village based on community perspectives

Land use changes dynamics in Labanu village based on public perception, as indicated in Figure 21, illustrate an increase in smallholder teak gardens, maize and vegetables, as well as settlements up to double today compared to in the 1970s. On the other hand, there was a decrease of upland paddy and natural reserve late in the period 1970-1990, although the proportion of natural area reserve Tangale has not changed much from1992 to the present.

Botumoputi Village

In the late 1940s the Botumoputi village was still forested when Gorontalo and surrounding communities came to open agricultural land of maize and coconut. In addition, people also took forest products such as timber, rattan, honey, and *woka* leaves. People increasingly flocked to the Botumoputi village in the 1970s, mostly from Gorontalo and partly from Manado and Java. However, the condition of rural infrastructure there is still very minimal; there is no electricity nor paved roads in the village.

People lived from farming and maize was the staple food at that time. Cacao plants first entered into Botumoputi in 1978 when one of the farmers, Mr. Taha, brought and planted 50 cacao seedlings from Central Sulawesi. In addition to cacao, teak became one of commercial tree species that community managed for a long time. Local authorities provided support for the establishment of the smallholder teak. Forest Service provided information about teak maintenance: the potential benefits, high prices of timber and the opportunities for future savings. In the 2000s many communities started planting teak, mostly buying the seeds and seedlings from Labanu village.

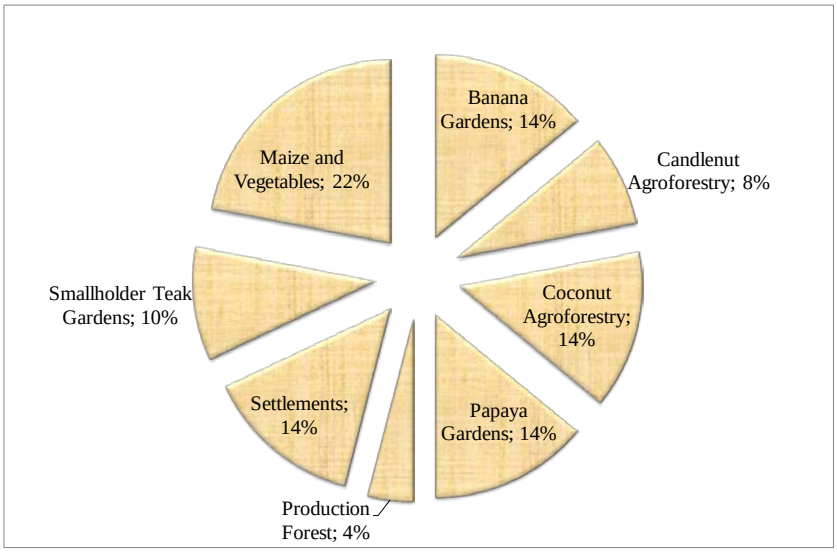

Figure 22. Current landuse in Botumoputi village based on community perspectives

Figure 22 shows the current land use in Botumoputi based on public perception. Maize and vegetables is the largest land use proportion, followed by coconut agroforestry, banana gardens, papaya gardens, and settlements. Banana gardens and papaya gardens are very popular land uses in Botumoputi due to their contribution to the income of rural communities.

There is also forested area, known as State Forest, inside the Botumoputi area. There are village rules to ban logging and promoting tree planting (teak and gmelina). The community perceived the benefits of forest, including: maintaining ecosystems, preventing erosion, stabilizing the air temperature and keeping the springs. However, disadvantages of forests include their role as a hiding place for agricultural pests such as wild pigs and monkeys.

Land use change dynamics based on public perception indicate that the proportion of forest area declined by a quarter from 1970 to 2014 (Figure 23). A similar trend also occured for coconut agroforestry. Conversely, there was an increase in the proportional area of papaya gardens, smallholder teak gardens, candlenut agroforestry and settlements.

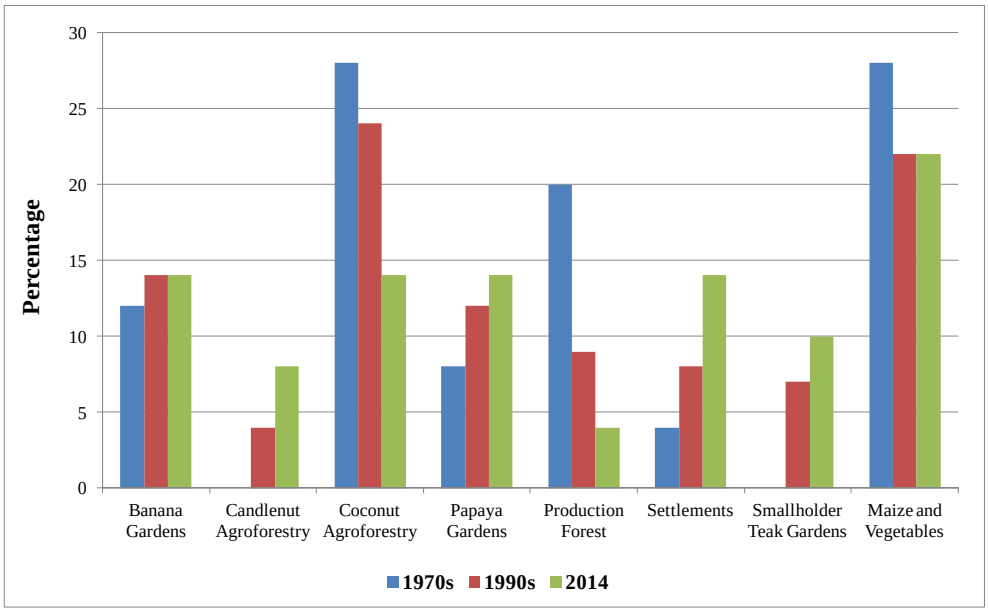

Figure 23. Landuse dynamics in Botumoputi village based on community perspectives

4.2 Household Perspectives on Land Characteristics and Land Use

4.2.1 **Land characteristics**

Accessibility to land

Location of land

The locations of cultivated land in Typology 1, Typology 4 and Typology 5 were relatively similar, with most located on private land inside the village. Otherwise in Typology 2 and Typology 3, most of the land is located in state production forest and state protected forest. This is presented in Figure 24.

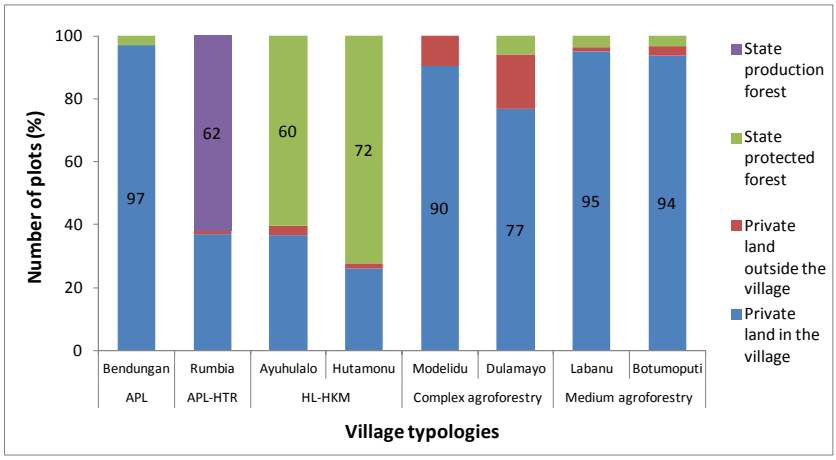

Figure 24. Location of land in Gorontalo

Field proximity to households

The average walking time from home to the field was relatively different among all typologies. In Typology 1 the walking time was longer than for the other villages (Figure 25).

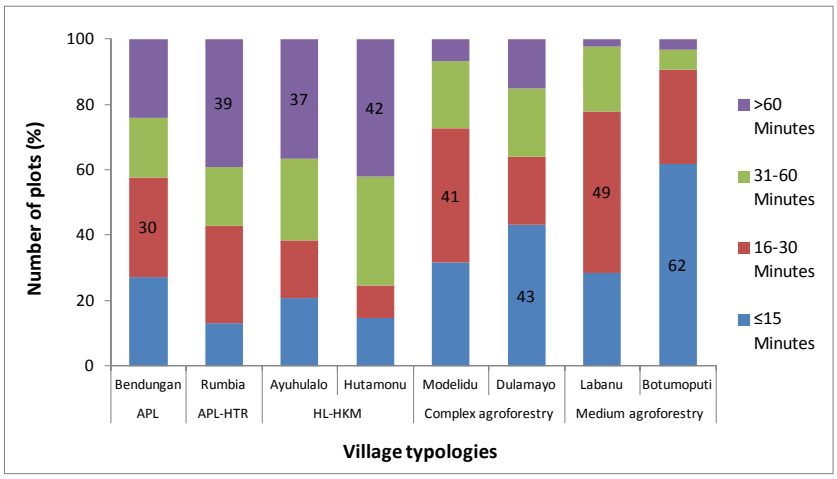

Figure 25. Walking time from home to the field in Gorontalo

Land level

Each typology has a different land surface conditions, but the majority of the typologies had relatively similar sloping conditions (Figure 26).

Figure 26 shows that the slope of the land in Typology 1 areas was 64% sideways and 36% flat. In Typology 2 areas the slope was 88% sideways and 12% flat. In Typology 3 areas, most of the land slope was sideways (82-84%), while 16-18% was flat. The most of the land in Typology 4 areas was sideways (92-93%), in Typology 5 areas the slope was 77-79% sideways and 13-19% flat.

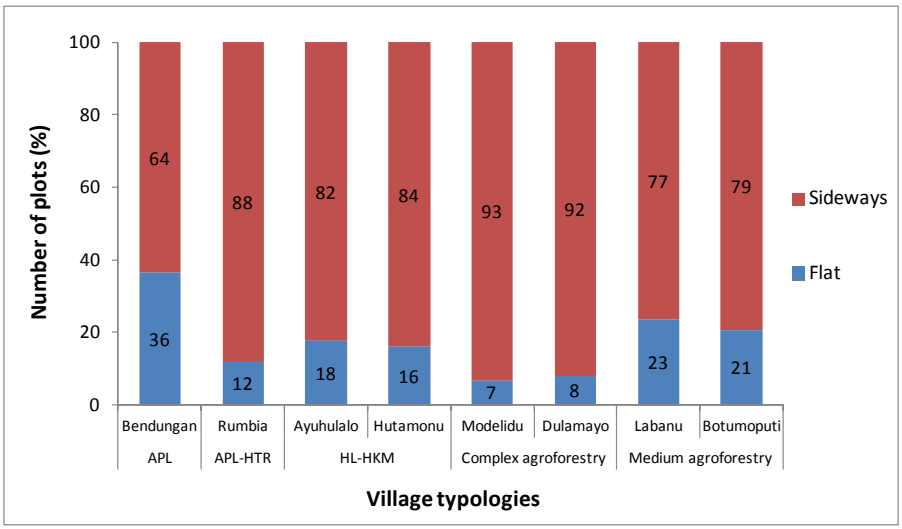

Figure 26. Slope of land in Gorontalo

Current land management status

The most recent statuses of land management in all typologies are relatively similar; the majority of land in all areas are owned and self-cultivated (Figure 27)

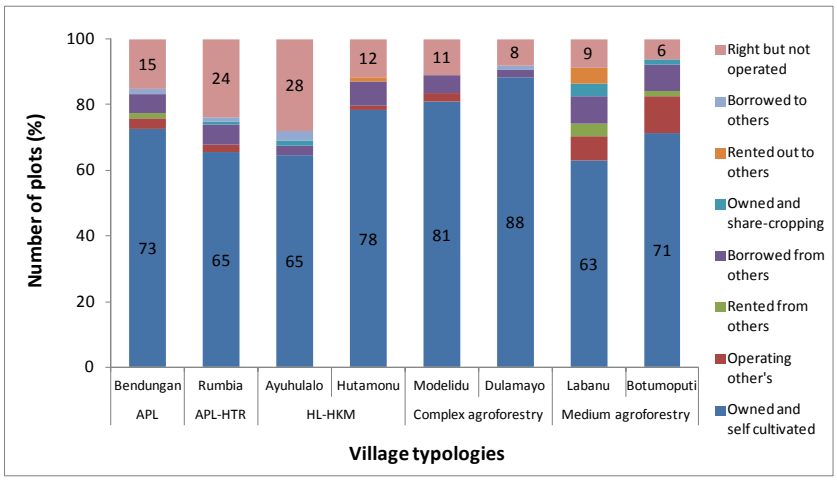

Figure 27. Status of land management in Gorontalo

Manner of land ownership

The majority of land ownership in all village areas were inherited, purchased and opened forest.

Figure 28 shows that the majority of land ownership in Typology 1 areas was purchased (38%), inherited (32%) and open forest (18%). In Typology 2 areas 32% of the land was inherited, 31% was open forest and 29% was purchased. Land ownership in Typology 3 areas was 39-41% inherited, 23-31% open forest and 25-29% purchased. In Typology 4, land ownership was 27-53% open forest, 26-44% inherited and 14-27% purchased. In Typology 5, 35-38% of owned land was inherited, 22-33% was purchased and 9-22% was open forest. Other manners of land ownership in all areas were very low.

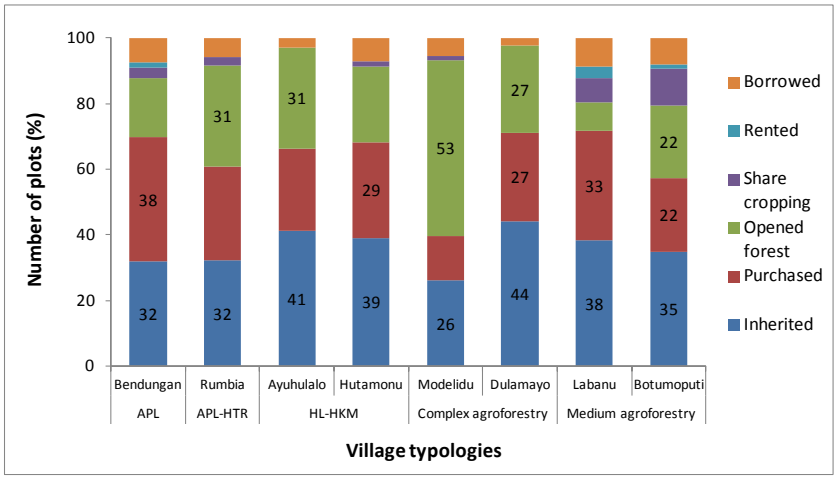

Figure 28. Manner of land ownership in Gorontalo

Source of land

Figure 29 shows the distribution of plot holdings by the source from which the land was obtained. Land source distribution was different in all typology areas. The main source of land in Typology 1 differed to that of other typologies – mostly coming from other people's land and the husband's parents, while in the other typologies (Typologies 2,3,4 and 5) land was sourced from the secondary forest.

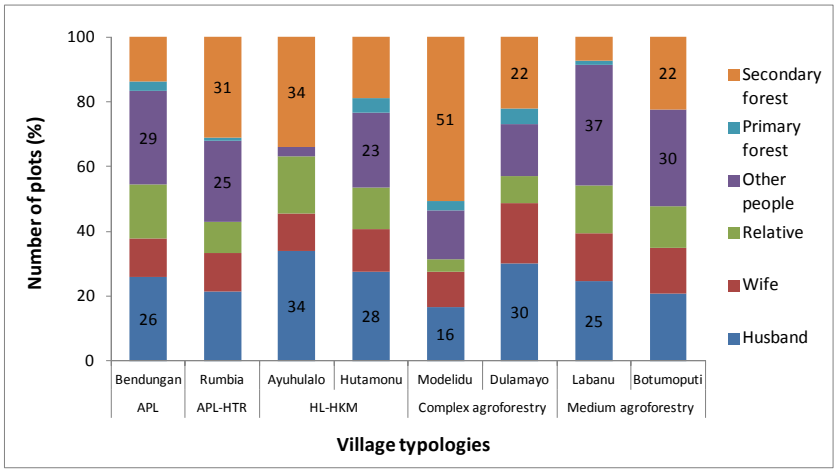

Figure 29. Source of land in Gorontalo

Timeline of land acquisition

Figure 30 shows the distribution of plot holdings by year of land acquisition, which was relatively similar among all typologies. Most of the plot holdings by year of land acquisition in all villages were obtained after 2000.

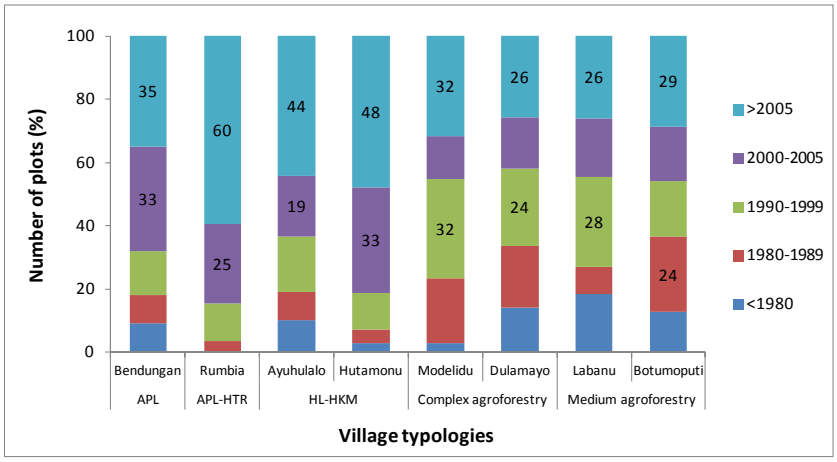

Figure 30. Year of land acquisition in Gorontalo

4.2.2 Land-use and tenure status in Gorontalo

Current land tenure status

The majority of the current land tenure status in all typology areas was relatively similar (Figure 31). Ownership by the husband alone, and by wife and husband together, make up the majority of land tenure status in all of the villages.

Figure 31 shows current land tenure status in the eight villages. In Typology 1 areas, most of the land tenure status was owned by the wife and husband (44%) and by the husband (36%). In comparison, 50% of the current land tenure status in the Typology 2 areas was by the wife and husband and 29% was by the husband. In Typology 3 areas, 52% of the current land tenure status was owned by the wife and husband and 25-31% by the husband (25-31%). In Typology 4 areas, 49-67% of the current land tenure status was owned by the wife and husband and 16-31% by the husband and in Typology 5 areas 40-44% was owned by the wife and husband and 21-28% by the husband.

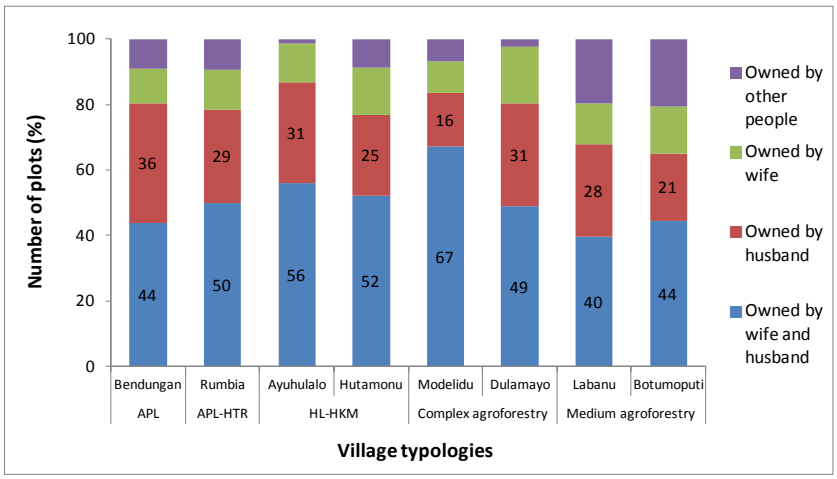

Figure 31. Current land tenure status in Gorontalo

Previous and current land use

Figure 32 describes the use of land prior to this time, while Figure 33 describes the current land use by people in the village. Figure 32 shows that the land use before the current typology is almost the same in all; there is little difference alone. The main previous land uses in Typology 1, Typology 2 and Typology 3 areas were relatively similar, being crop fields and bush fallow. However in Typology 4 the main previous land uses were crop fields, bush fallow and coconut agroforest. In comparison, the main previous land uses in the Typology 5 were crop fields and agroforestry.

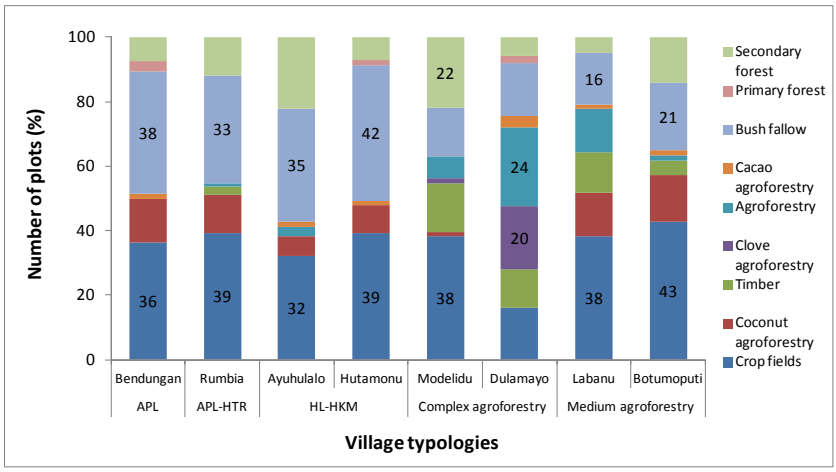

Figure 32. Previous land use in Gorontalo

Current land use at all typologies in Gorontalo were relatively different and quite complex as illustrated in Figure 33. However, the current dominant land use in Typologies 1, 2 and 3 was the same: field crops (maize and chili). Meanwhile the dominant land use was agroforestry in Typology 4 and coconut agroforestry in Typology 5.

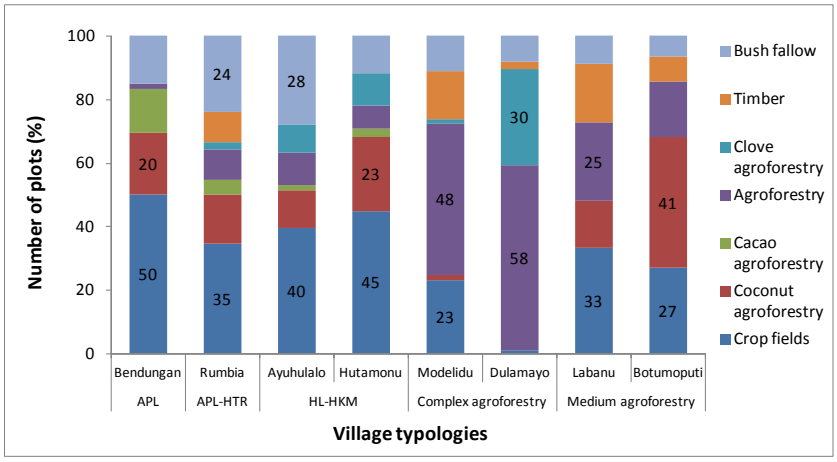

Figure 33. Current land use in Gorontalo

Land use before and after 1 year of formal acquisition

The land use before acquisition was different in all typology areas (Figure 34). The main land uses before acquisition in Typology 1 were bush fallow and crop fields. In Typology 2, Typology 3 and Typology 5 areas were relatively similar, being bush fallow and secondary forest. However in Typology 4 the main land uses were bush fallow, crop fields and secondary forest (Figure 34).

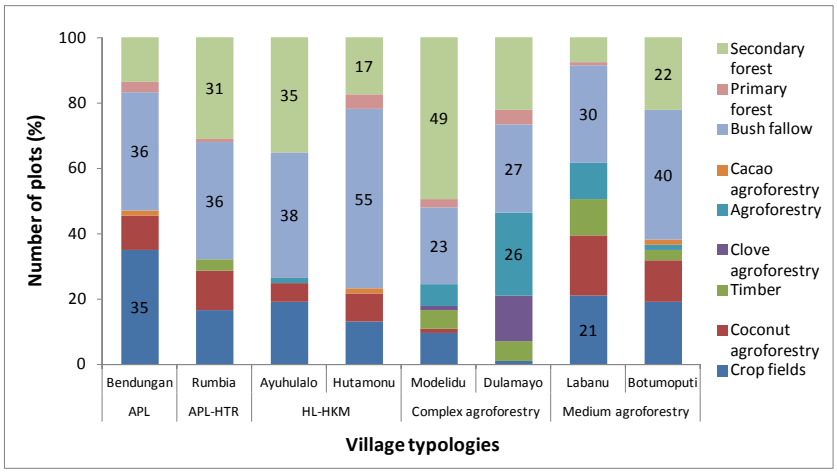

Figure 34. Land use before acquisition in Gorontalo

The land use one year after acquisition was different in all the typology areas. The main land use one year after acquisition in the Typology 1, 2, 3 and 5 areas were the same, being crop fields. However in the Typology 4 the main land uses one year after acquisition were agroforestry and crop fields (Figure 35).

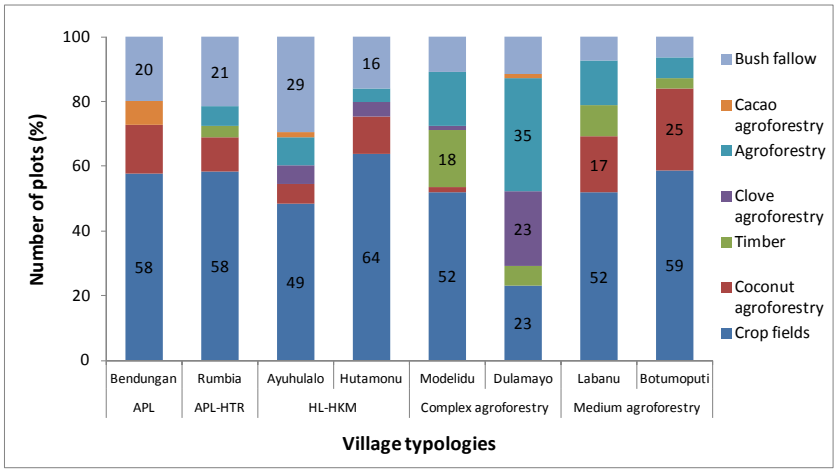

Figure 35. Land use one year after acquisition in Gorontalo

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 Gorontalo is summarized in Table 4. In Gorontalo, all gardens were planted with perennial crops, multipurpose trees (MPTs) such as fruit, timber and annual crops (banana). Crop-wise, perennial crops (cacao, clove and coconut) predominated in all villages.

Table 4. Total average of plants per hectare in Gorontalo

Village typologies	Villages	Total average of plants per hectare				Total
		Perennial crops	MPTs	Timber	Annual crops	
APL	Bendungan	157	2	5	2	166
APL-HTR	Rumbia	93	19	43	23	177
HL-HKM	Ayuhulalo	95	20	0	9	123
	Hutamonu	137	10	3	20	170
Complex agroforestry	Modelidu	44	98	83	15	240
	Dulamayo	116	76	1	6	199
Medium agroforestry	Labanu	41	10	138	10	199
	Botumoputi	73	12	87	34	205
Total average		94	31	45	15	185

5. Community Livelihood Options

5.1 Typology 1: APL Villages (Forest for Other Landuses)

Bendungan Village

Maize, Chilli and Vegetables

Maize is a major commodity in Bendungan village; it has been cultivated with chili and vegetables for a long time and has become the main source of livelihood for the Bendungan community (Figure 36). Farmers use several hybrid maize varieties of the commercial names: Bisi 2, Pioneer, and Arjuna. They often use derivative seedlings from those hybrid maize varieties up to twice per planting season. Maize cultivation practices in this village are quite intensive using fertilizer and pesticide spraying during the season. Farmers use the Urea and compound fertilizers such as NPK Phonska which are applied twice during the growing season. Likewise with pesticides, which are sprayed at least twice to overcome weed and pest attack.

Maize harvesting is started at 120 days (about four months) after planting. In 2003, the community experienced an abundant maize harvest period; it achieved 5.5 tonnes of maize per hectare. However, in the 2014 maize harvest period there was a harvest of about 1.6 tonnes per hectare with a selling price at IDR 245 000 per sack. Maize are usually sold to buyers in the village, the traders from outside villages who usually sell to PT Harim Group, a company that processes maize. Some constraints

presented by farmers are pests such as rats, monkeys and cows which break the fields and damage maize.

Cacao

Cacao has been cultivated in Bendungan for around 10 years and originally came from Government aid. The seeds in the form of cacao clones Sulawesi 1 and Sulawesi 2 were first imported from Jember (East Java) and Kolaka (Southeast Sulawesi). The community used the cacao plants at spacing 9x9 m. As is found in several places, fertilizing, pruning, weeding and spraying occur as standard practice in cacao cultivation on Bendungan, although most people do not do such intensive cultivation.

During big harvest season, usually May and June, cacao production can reach up to 500 kilograms per hectare. Some in the community complained about the fluctuating price of cacao, however cacao still sells at a price of IDR 38 000 per kilogram to Palu (Central Sulawesi). Pests and diseases is one of the biggest obstacles farmers face for cacao in Bendungan village currently.

Coconut and Copra

Coconut cultivation in this region has occurred for around 50 years, which is the heritage of the village elders. On average, every family has two hectares of coconut land. Coconut cultivation is done at 9x9 m planting distance and farmers cultivate both hybrid coconut and tall coconut. Fertilization is done at least once a year on a coconut plantation, while the old coconut plantation tends not to be fertilized again by farmers.

Coconut harvesting is done after reaching the age of five years for tall coconut and approximately three years for hybrid coconut. When a coconut plantation reaches the age of 10 years, coconut production reaches up to 40-100 fruits per tree for each harvest at three months. Coconut products are sold mostly in the form of copra, which is produced by drying peeled coconuts for three to four days (depending on weather), then smoked (*porono*) for one day. Copra is generally marketed outside the village such as in Salilama, Tabulo up to Marisa and Paguat area. Constraints disclosed by farmers regarding the cultivation of coconuts are: the unstable price depending on the location and distance to markets, pests and diseases, and the harvest/climbing cost of coconut at harvesting season.

Paddy

The Bendungan community cultivates paddy three times a year. The planting season generally falls in August, January, and May every year. Farmers use various rice varieties such as IR64, Ciherang, Timus, Super Win, and Memberamo. Fertilization is done three times in one season, followed by pesticide application to control pests and diseases such as stem borers, rice bugs and snails.

Rice production in the Bendungan is up to 1.5 tonnes per hectare, but unfortunately only about 15 families cultivate paddy rice with a total area of about five hectares. The production is mostly used for consumption and only a small portion is sold in the village or to surrounding neighbors.

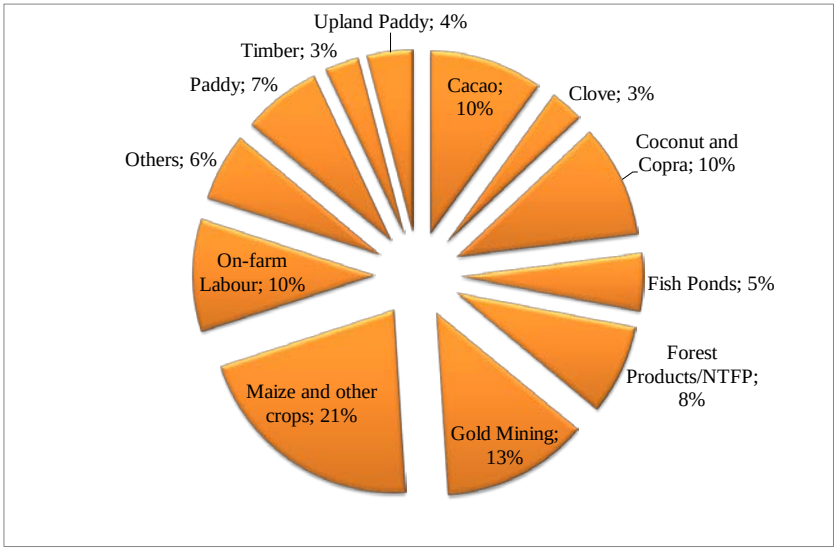

Figure 36. Current livelihood options in Bendungan village based on community perspectives

5.2 Typology 2: APL-HTR Villages (Forest for Other Landuses & Plantation)

Rumbia Village

Maize and Soybeans

Maize has been an important soure of livelihood in Rumbia for a long time (Figure 37), replacing the position of forest extraction products which started becoming obsolete in society after the 1970s era. Maize currently provides important economic value for Rumbia farmers. Farmers in Rumbia have an average maize land area of two hectares. Local varieties of maize or maize hybrids are grown alongside soy, chili peppers and other crops. Each hectare of land can produce three to six tonnes of maize each harvest, with a frequency of two to three harvests a year.

Maize is generally sold to traders in the village or the container from the outside in the form of dry maize at a price of IDR 230 000 per quintal. Sometimes farmers sell directly to large companies such as PT Harim Group (located in Pohuwato) with better prices of IDR 250 000 per quintal.

Cacao

Cacao was gradually planted by farmers replacing coconut plantation area. At first, cacao was grown together with maize, chilli and soy cacao with a spacing of 4x4 m. Farmers use cacao seedlings from from Southeast Sulawesi, partly derived from the seeds of the local superior. The seedlings are generally provided as government assistance, or purchase from a local seed merchant.

Cacao land preparation was done by slashing and burning. Cacao cultivation patterns are quite intensive where farmers use fertilizers, pesticides, and regular pruning. However, the current biggest obstacle perceived by farmers is pests and diseases. Stem cancer, black pod, dry shoots and root

fungus are a few symptoms that were mentioned by farmers. The same condition occurred in the other cacao centers, where the intensity of pests and diseases was quite high resulting in decreased cacao production. In addition, farmers' access to fertilizer is also somewhat limited. The issues of farmers' fertilizer scarcity and lack of fertilizer aid from the government to overcome this were raised during the discussion.

Cacao is generally sold inside the village, with the average price of IDR 25 000 per kilogram of cacao. Cacao cultivation is quite promising for farmers themselves as cacao is easy to market, a lot of buyers come to the village, and the prices are relatively good.

Palm sugar

Sugar palm trees provide substantial benefits to Rumbia farmers. Various parts of a palm tree such as the trunk and coconut husk can be used for roofs and manufacturing, or even to make a broom. Sugar palm trees also produce a sap that can be consumed directly or made into palm sugar for consumption. The sap is harvested twice, in the morning and evening, to use as a base for the manufacturing of palm sugar. The sap has to be collected and cooked, usually the cooking process is done twice a week. The time required for cooking the sap is about seven hours, starting at 0700 in the morning until 1400 in the afternoon.

Farmers who have five to seven sugar palm trees are expected to produce 20 pieces of brown sugar in a week. Sugar palm marketing is quite easy, being sold directly inside the village market or through collectors in the village. One of the obstacles that emerged is the difficulty of raw materials production during the dry season due to the lack of sap produced. Drought is believed to affect production of sap from sugar palm trees.

Coconut and Copra

In Rumbia coconut gardens are usually planted crops mixed with fruit (banana, jackfruit, longan), coffee, and teak. Farmers used coconut spacing of 9x9 m with land clearance routine done two to three times per year. Coconuts start generating at the age of five years after planting, and harvesting is done after approximately four months. If the coconut tree is well maintained it can produce 30 coconuts per tree (age > 10 years).

Marketing is usually done in the form of coconut copra, sold for IDR 500 000 per quintal to large companies (e.g. PT Harim Group). When sold to container merchants in the village, farmers usually get lower prices – IDR 400 000 per quintal. Constraints experienced by the coconut farmers and copra are labor difficulties or labor to harvest coconut palm climbing. These workers usually come from outside the village with climbing labor costs of IDR 3000 per tree. Furthermore, stripping bark of coconut or gouging can reach IDR 60 000 in labor costs per thousand of coconut fruits.

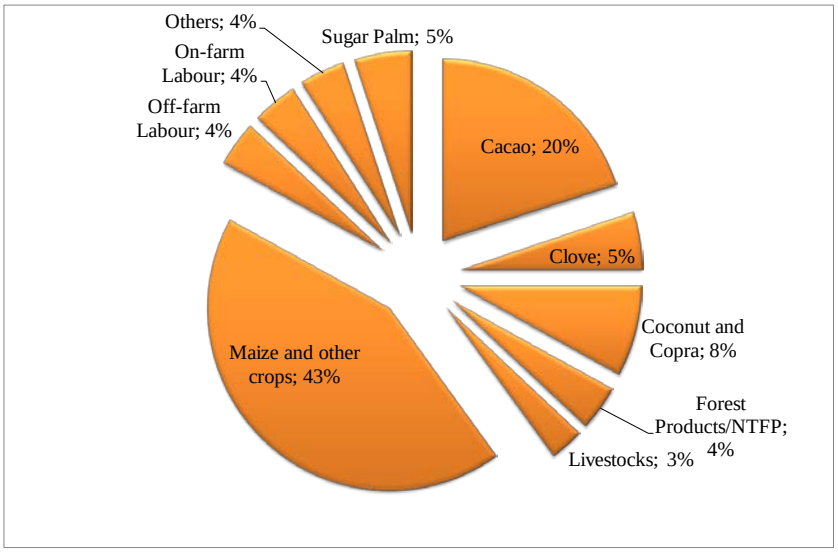

Figure 37. Current livelihood options in Rumbia village based on community perspectives

5.3 Typology 3: HL-HKM villages (Protected Forest & Community Forest)

Ayuhulalo Village

Maize and vegetables

Maize and vegetables are the main source of livelihood in Ayuhulalo (Figure 38). Maize was planted two seasons of the year, the big season (*tauwa* season) and low season (*hulita season*). On average people in Ayuhulalo have about two hectares of land per family. There is an array of local maize varieties that are planted by communities such as binde kiki, binde putih, binde kuning, and hybrid maize (including Bisi 2, Pasi 18 Pertiwi 2 and Pertiwi 3).

Fertilization and weed control is done regularly during the growing season of maize. In addition to maize, the farmers also planted a variety of vegetables such as peppers, eggplant, beans, cucumber and spinach. Maize yields in the village ranged from 3.5 to 4.5 tonnes per hectare. Maize marketing occurs through traders or middlemen inside or outside the village. The selling price is diverse and ranges from IDR 2300 to IDR 2500 per kilogram.

Coconut and Copra

Hybrid coconut and tall coconut are usually planted using a spacing of 9x9 m or 10x10 m. The seeds used generally come from local coconut seedlings. Maintenance of coconut plantations is usually done through fertilization which is performed on young coconut plantations, while farmers are reluctant to use fertilizers on older plantations that are no longer productive.

Coconut is usually sold in coconut fruit or copra. Coconuts are sold around for IDR 300 to IDR 700 per seed (IDR 1000 to IDR 2000 for three fruits), while copra is sold at IDR 450 000 per quintal.

Currently the biggest obstacle in coconut cultivation is that coconut trees are no longer productive so output is reduced a lot. Most of the coconut trees are now aged 30 - 40 years and need to be rejuvenated. The next obstacle is pests such as beetles that damage the buds until the first shoots of coconut. The prices are quite volatile and considered as obstacles for farmers, sometimes varying from IDR 200 000 per quintal up to IDR 800 000 per quintal.

Timber and NTFP

Protection forests around the village became a source of livelihood for the villagers of Ayuhulalo. This area was already known to the public as defined forest area around 1970. People understand the ban imposed in these forest areas, which include: ban on cutting trees, burning forests, and hunting wild animals in the forest. However, some community forest products can be utilized such as rattan, woka leaves, resin and palm. In addition, people feel the other benefits of the existence of this forest: a source of clean water, abundant water availability, a source of germplasm and seeds, flood prevention, and to support the economic boom of forest products.

The community also recognizes the term APL forest that has been managed since 1980 by about 20 families. Currently, almost 80% of family heads are managing the land. Land that is known to society as the APL is currently in conflict-prone conditions. There is land management by local communities in the next village (village Tutulo) which were planting it with cloves.

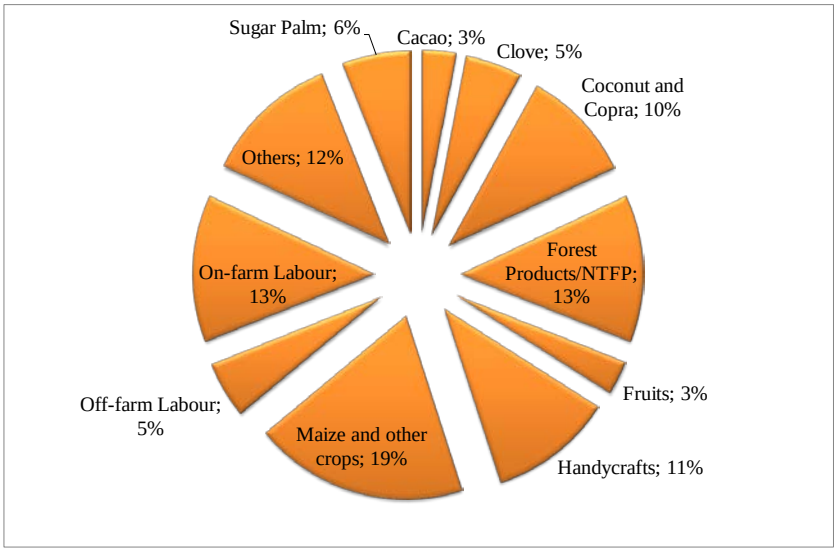

Figure 38. Current livelihood options in Ayuhulalo village based on community perspectives

Hutamonu Village

Maize and Vegetables

Maize and vegetables have been the main source of livelihood for people in Hutamonu since a long time ago (Figure 39). They also cultivate sago, tubers, bananas and coconuts. People plant local maize varieties and hybrids such as Bisi 2, Pioneer, *Binde pulo* and White Maize (*badia*) two to three times a

year. Fertilizing and weeding occurs at least twice in one season. Fertilizers that are commonly used are Urea, NPK Phonska, and NPK Pelangi. Maize in the form of dry milled sells inside and outside the village (Paguyaman) to local traders and collectors at a price of IDR 240 000 per quintal.

Farmers are also planting chilies (*rica* in Gorontalo language). *Rica kampung* and *Rica huta* are the local chili varieties used by farmers. Within a year chili can be harvested up to three times and produce for 2.5 years (*rica hutan*). The price varies, currently reaching IDR 10 000 per kilogram, but sometimes falling to IDR 3000 per kilogram. At low price season, farmers will not harvest chili and abandon it in the garden. Price fluctuation, pests and diseases, expensive seeds, and dry season are some constraints in chili cultivation.

Coconut and Copra

Farmers cultivate tall coconut and hybrid coconut from seeds obtained in the village and its vicinity. Most of the coconut was grown during the 1980s as a rejuvenation of coconut planted earlier in the Dutch colonial period. Spacing used by farmers for coconut is 8x8 m. Most of the coconut trees are more than 20 years old and not fertilized. Fruit production is between 30-50 fruits per tree depending on the condition of the tree, with a harvest period of three months. Copra is sold to local traders at the price IDR 520 000 per quintal. The prices are quite volatile, ranging from IDR 350 000 to IDR 1 million per quintal.

One of the unique customary practices in coconut cultivation is farmers sometimes buying or selling coconut trees without buying or selling the land. Immature coconut trees that are not yet fruiting (aged 2-3 years) are sold at a price of IDR 75 000 per tree, while the mature trees (5-6 years of age) for are sold for IDR 250 000 per tree. People also use the term "pajak buah" or fruit taxes, where farmers sell coconut trees at certain harvest periods of time, e.g. five years. The right to harvest the coconut belongs to the buyer until five years harvest period since it was sold.

Some constraints perceived by many coconut farmers are: difficult finding coconut climbers at harvest time, coconut beetles, and the unstable fluctuating price of copra. This condition has become worse and so burdens the farmers since coconut harvesting costs are relatively high, almost 50% of the total sales during the harvest.

Clove

Cloves first entered and were planted by the village in 2000 and were limited only to a few selected farmers. Farmers use cloves seedlings from the Potanga village. The seedlings are purchased at IDR 15 000 to IDR 25 000 per one meter high seedling. Clove varieties that widely known to farmers are Sikotok and Zanzibar.

Information on clove cultivation techniques were obtained from extension agencies (Department of Plantation and Forestry). Spacing used by farmers is 7.5x7.5 m or 9x9 m. Farmers sell their cloves to local traders or collectors from outside the village at a price of IDR 125 000 per kilogram. Pest such

as pigs and rats and disease causing dried stems are some obstacles that many clove farmers experienced.

Cacao

Cacao seeds came for the first time in 1979 from Minahasa and Gorontalo districts. The cacao seeds were given to 20 families who recieved 1125 trees per hectare. The cacao seedlings were obtained through the CWC project, but unfortunately many of them died. Furthermore, 50 families of farmers tried to buy their own cacao beans from Toli-Toli (Central Sulawesi) in 2000.

Lately, through The One Million Cacao Program Movement, farmers get support from village funds or ADD for 500 cacao grafting seedlings per village. The seedlings are already planted in the village using 4x3 m or 4x4 m spacing. Farmers recognize the current cacao management is not optimal as it is not fertilized or pruned properly. The production result is not optimum and becomes worse due to destructive attacks from pests of cacao.

Forest

The people have been aware of these forests since long ago. Several years ago there was no social forestry scheme (HKM), however, people were already allowed to access the area. A group of farmers recently developed a social forestry scheme with members from around 30 households. In 2014 the group made a request through the village leader, with 600 hectares of land proposed under the HKM scheme. Information from the Forest agency indicated that the agency dedicated 400 hectares of land to this scheme. The HKM process is still ongoing today. The public responded positively to the existence of this scheme and are optimistic about the benefits for them. One of the most important benefits for farmers now is the available agricultural land for the community to plant a variety of annual crops such as cloves, nutmeg, cacao, and durian. It will expand economic growth and create a number of new jobs.

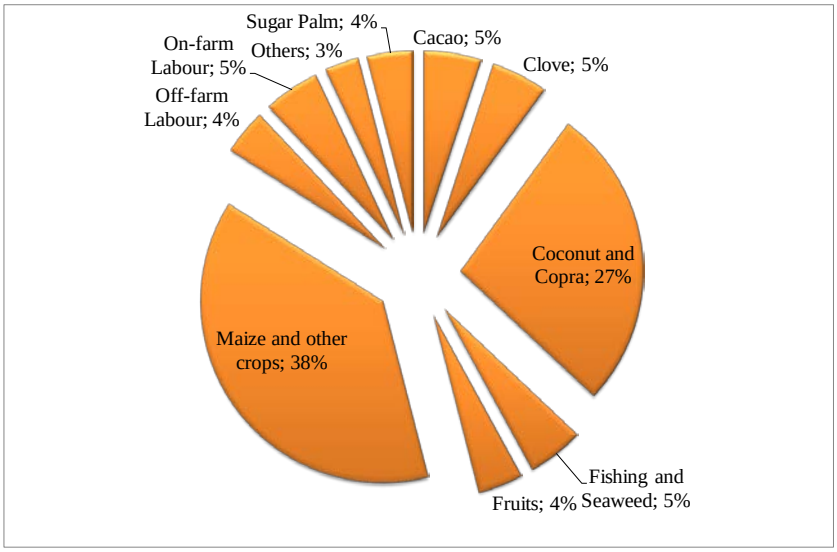

Figure 39. Current livelihood options in Hutamonu village based on community perspectives

5.4 Typology 4: Complex Agroforestry Villages

Dulamayo Selatan Village (Bordering with HTR, People Protected Forest)

Candelnut, Coffee and Fruits (Longan, Durian)

Candlenut is a tree species that has been cultivated since long ago by local villagers. Now, there are local rules that require a newly married couple to plant 25 candlenut trees inside the village. The candlenut is now the main source of people's livelihood together with palm sugar, fruit and cloves (Figure 40).

Candlenut agroforestry is practiced in Dulamayo Selatan society, which endeavors to plant candlenut together with other cash crops and fruits such as coffee, longan, and durian. Spacing suggested is 10x10m, however if farmers intercrop and mix it then spacing varies widely depending on each farmer. Candelnut harvesting begins when the tree is five years old, when it bears fruit.

Candlenut selling is usually in the form of grain candlenut with the selling price IDR 5000 per kilogram. It is also sold as shelled candlenut fruit at the price IDR 22 000 per kilogram. Every three kilograms of grain shelled candlenut will generate about one kilogram of shelled candlenut. Before marketing, shelled candlenut is fogged for a day and a night. Candlenut marketing is done through local traders in the village, sold directly to the Gorontalo and Surabaya. The candlenut wood also has a pretty high resale value. A candlenut tree with a diameter of 0.5-1m or about 10 years old will sell for up to IDR 200 000 per tree.

Palm Sugar

Sugar palm trees offer multiple benefits for the people of Dulamayo Selatan. Besides sap for consumption, fruit and sago, the fibers may also be taken to make broom fibers. Palm sugar is produced from the sap and contributes significant revenue for the family. Villagers still rely on sugar palm that grows wild in forest area which are harvested and processed, instead of sugar palm trees from domestic cultivation.

The recorded data says about 20 families manage sugar palm sap into palm sugar. On average each family manages 6-7 trees. The trees begin to bear fruit at 15 years old, and a clump of sugarpalm trees consists of 7-8 individual trees. Sap is harvested and cooked for seven hours using firewood, starting at 0700 in the morning until 1400 in the afternoon. Palm sugar produced in the village reaches 10 kilograms per day or 60 kilograms per week. The selling price is around IDR 11 000 per kilogram which is usually marketed in the village.

Currently the main obstacles in palm sugar management is the limited availability of firewood to cook the sap and also poor road access. Firewood is needed in large enough quantities to produce palm sugar constantly. The access road is very bad and slippery, especially when it rains – this can lengthen

access time to trees which are always located in the jungle (2-5 hours walking from the village). In addition, conflict can occur over unclear tree ownership rules. Trees are usually located in the forest which is accessible to anyone, so if a tree is taken by others it will lead to conflict between farmers and processors of palm sugar.

Clove

In 1959 cloves were first planted by the village chief using seeds derived from Manado, North Sulawesi. Two of the plants continue to grow even now. In 1972, around 100 clove trees were planted at the initiative of the village head, cloves have since become a popular plant in Dulamayo Selatan.

Clove cultivation is done in patterns along with cacao agroforestry and fruit trees such as longan, durian and rambutan. Spacing used for cloves are 7x9 m, 8x8 m or 10x10 m, and cacao is grown in the garden with a planting distance of 3x4 m or 4x4 m. Fruit species are planted on the edge of the garden. Now cloves are mostly over 10 years old, with the ideal production reaching 100 kilograms per tree (Zanzibar varieties are aged up to 40 years). Clove garden maintenance uses fertilizing and weeding, especially on young cloves aged 1-5 years. The main constraints experienced by farmers today are frequent water shortages during the dry season, harvesting labor, and pests and diseases.

Forest

Dulamayo Selatan people see forest as a rich benefits resource with an important role in people's livelihoods. The existence of forest is believed to maintain soil nutrients, offer water source protection, provide economic resources and income to the community, prevent erosion on sloping areas, as well as operate micro-hydro turbines that generate electric current for the community. Until now, people still manage sugar palm inside the forest area as one of the important sources of livelihood in Dulamayo Selatan.

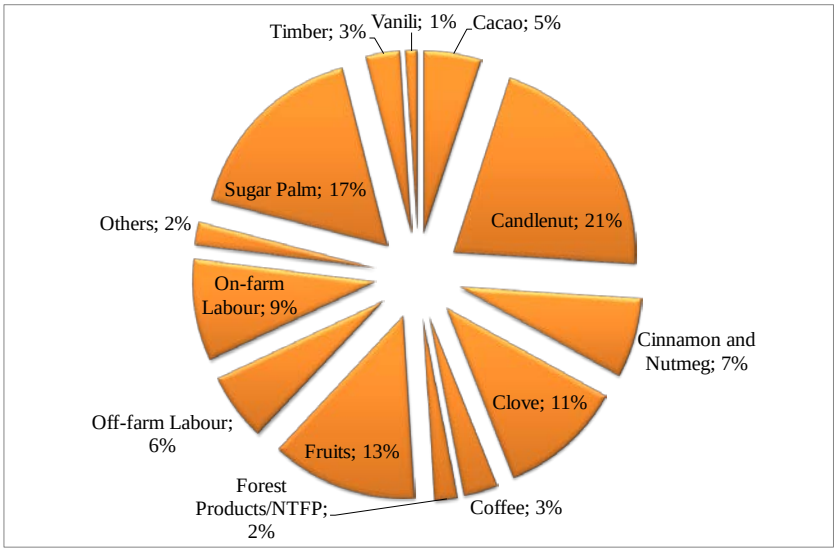

Figure 40. Current livelihood options in Dulamayo Selatan village based on community perspectives

Modelidu Village (Bordering with Protected Forest)

Palm Sugar

Similar to Dulamayo Selatan, palm sugar is one of the main sources of livelihood for villagers in Modelidu. Maize, vegetables and fruits are other sources (Figure 41). The sugar palm trees are located in the forest area which is about one km from the village. Besides being processed as palm sugar, the sugar palm sap is also processed into a traditional beverage known as *saguer*. Other parts of the palm trees like fronds, palm fiber and sticks are also utilized by people as handicrafts.

Palm sugar farmers in Modelidu manage 5-6 palm trees that produce about 30 kilograms of palm sugar per week. Sap is harvested and cooked for 6-7 hours to crystallize into palm sugar. The selling price of palm sugar at farmer level is between IDR 8000 to IDR 10 000 per kilogram, while *saguer* appreciated IDR 5000 per gallon (containers with a capacity of five liters). Palm sugar and saguer is still largely sold on the market in the village.

Maize and Chili Gardens

Maize, chilli and vegetable gardens are one source of livelihood that is quite popular in Modelidu. Although most of the chilli gardens are not fertilized, farmers weed their gardens at least four times a year. Chillies will reach the harvest time at 4-6 months, then they can be harvested up to the age of one year or more. Chili crops are grown on land 0.5 hectare in size with spacing of 60x60 cm which is used to produce up to 60 kilograms of chili per month. The selling price of chilli in the village to buyers who come directly to the farmers now reaches IDR 18 000 per kilogram. Drought and pest attack are some of the obstacles perceived by chili farmers today.

In addition to chili, red ginger and turmeric have a huge potential for the community. Seeds of red ginger and turmeric are easily available in the market in the village. Farmers usually seek red ginger and turmeric with a spacing of 30x30 cm. Red ginger can be harvested at the age of 8 months, while turmeric can be harvested after at least 10 months. The harvest is sold to traders who come to the village and also in the local market. The selling price of ginger can reach IDR 8000 per kilogram, while turmeric IDR 3000 per kilogram. The main constraints perceived by farmers are pests and diseases, especially the caterpillar pests that damage ginger and turmeric.

Candlenut, Coconut and Fruits

Candlenut is also a main source of livelihood of the people Modelidu. Candlenut is arranged with a spacing of 8x8 m or 10x10 m, planted mixed with other fruit trees. Candlenut fruits at 10 years old - today most candlenut trees in Modelidu are 12 years old. Marketing is usually in the form of grain candlenut (candlenut with the shell) that is sold at IDR 4000 per kilogram. Clean and peeled candlenut is valued at around IDR 26 000 per kilogram. Candlenut marketing is generally in the region of the village. In difficult times where candlenut is barren or unproductive, sometimes farmers choose to sell the wood of candlenut trees at the price IDR 100 000 per tree.

In addition to candlenut gardens, longan is planted simultaneously and has quite a high sale value. Longan buyers come directly to the villages and buy at a price of IDR 70 000 per *kas* (box made of wood). One box is equivalent to approximately 30 kilograms of longan and the production of longan in this village can reach 3-5 per tree per harvest.

Agroforestry cultivation of coconut in the village uses a spacing of 10x10 m. Coconut plantations are cleaned at least 3-4 months, but farmers rarely fertilize their crops. Coconut harvesting is done every 3 months where every productive coconut tree is capable of producing 20-60 coconuts per tree. Marketing coconut generally occurs still within the village.

Teak

Farmers planted smallholder teak using spacing of 3x4 m. Teak seedlings used include *jati mas* and *jati super* purchased from outside the village (District of Kwandang, Gorontalo district). The price of teak seedlings is around IDR 10 000 per tree or IDR 10 000 per kilogram of teak seed. Teak is mostly cultivated and harvested at the age of 14-15 years.

The selling price of teak in this village is about IDR 1 400 000 per cubic meter, where buyers come to cut and measure cubes of timber. Buyers generally come from outside the district, and teak is transported and sold up to Makassar, South Sulawesi. The biggest perceived challenges for farmers are harvesting after a long waiting time, meaning farmers need to find alternative short-term sources of income. In addition to long waiting times, the selling price of wood tends to vary for farmers during harvest time.

Forest

Modelidu people see the forest as a source of many benefits, such as to prevent erosion, and as alternative sources of livelihoods (sugar palm and timber). However, it is also felt that the existence of forest can cause losses due to vermin plants that live and nest in the forest. Attack from wild animals such as monkeys and pigs also often affects farmer cropping.

Today people understand that there is a ban on cutting trees in the forest, and special permission is needed to do it. Nevertheless, the business community relating to forests continues to grow, among which is the nursery timber and fruits. Pak Nasir, one of the residents, started breeding tree crops in 1996, originally starting with nyatu seed, walnut and mahogany. Currently he is producing varieties of: nyatu, candlenut, gmelia, mahogany, durian, rambutan, iron reef (*karang besi*) and jackfruit. The seeds produced are mostly sold to markets outside the village. Seed production now has reached 800 thousand seedlings per year.

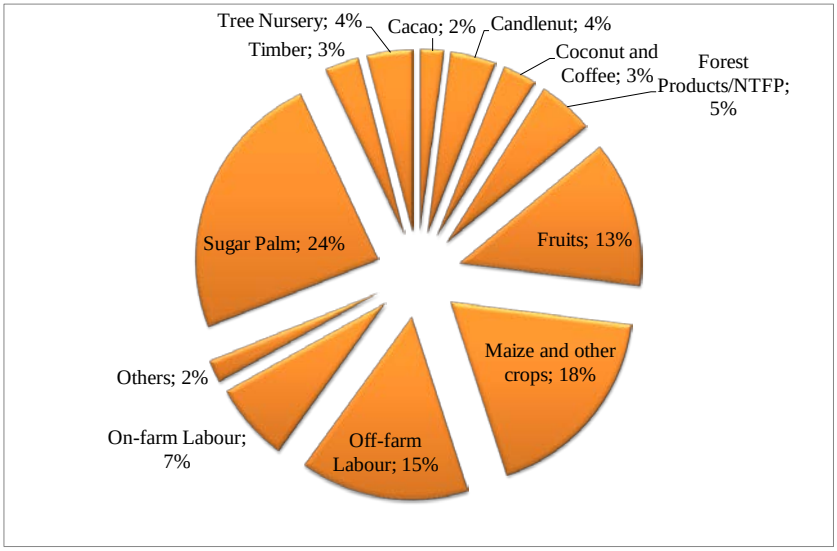

Figure 41. Current livelihood options in Modelidu village based on community perspectives

5.5 Typology 5: Medium Agroforestry Villages

Labanu Village (Village surrounding Natural Reserve)

Maize, chili and vegetables

Maize, chili and vegetables are generally operated mixed with perennials such as teak, clove, or candlenut – they may be old, young or newly planted. Maize, chili and vegetables are the main sources of livelihood of the people in Labanu (Figure 42). Farmers mostly use hybrid maize seeds and local maize. Maize and chilli cropping patterns are done quite intensively through the use of fertilizers (Urea, NPK Phonska) and herbicides.

Maize is fertilized using four sacks of urea and four sacks of Phonska per hectare of land. Land is regularly cleaned and sprayed with herbicide until the harvest arrives. Maize production can reach four tonnes per hectare when fertilized 1-2 times per season. Maize and chilli is marketed both in the village and outside the village. The selling price of maize is IDR 2800 per kilogram, while the price of chili is IDR 20 000 per kilogram. The price fluctuation is referred to as one of the major constraints experienced by farmers.

Teak

Smallholder teak is cultivated with cacao, candlenut, coffee, mango, and nutmeg. Teak seedlings are taken from the gardens around the village which have a tree age over 30 years. Teak varieties cultivated by the community include *jati super*, *jati mas*, and local teak. Teak was originally planted densely with a spacing of 1x1 m. After three years teak plantations begin thinning and are planted at spacing 2x2 m. Thinning timber is sold or used as firewood. Teak is then maintained at a spacing of 4x4 m up to harvest time.

At the time of newly planted teak, the land is also cultivated with maize, chilli and vegetables. Teak is harvested at the age of 15 years, and can be sold in the stands with a price of IDR 70 000 to IDR 90 000 per tree depending on the girth. Teak with a trunk circumference of 70 cm can be sold for IDR 70 000 per tree, trees with a circumference of 80 cm for IDR 80 000 per tree, and those with a circumference of 90 cm for IDR 90 000 per tree. Most buyers come from outside the village, and teak are sold then brought up to the outer islands. The price of teak wood is around IDR 3 million for one cubic meter.

On the teak plantation people also planted cacao with a spacing of 3x3 m, or candlenut with a spacing of 8x8 m. Cacao farmers planted seedlings imported from Tolinggula and North Gorontalo areas. Farmers do not really understand the type of cacao planted, but most admitted cultivating cacao crop, cultivated at least two times a year. The selling price of cacao (after a two-day drying period) currently reaches IDR 15 000 to IDR 17 000 per kilogram when sold in the village. The main obstacle as identified by the people is the presence of pests and diseases in the roots (root fungus) and leaves which can also attack cacao.

Clove

Farmers planted clove in agroforestry pattern, where cloves are planted with coconuts, bananas, and maize. Clove, coconut, and banana growers planted with a spacing of 9x9 m, 8x8 m and 2x2 m respectively. Farmers recognize two kinds of cloves, the Zanzibar clove and usual clove. Farmers can get both types of seeds from merchants in Manado.

Cloves are fertilized once every six months after weeds have been cleared around them. Cloves 1-3 years of age were able to produce up to 0.5 kilograms per tree, to rise again at an age over 3 years to reach one kilogram per tree up to a maximum of 6 years which can produce up to 15 kilograms per tree. The selling price of cloves is around IDR 150 000 per kilogram of dried cloves sold in the village. Coconut planted alongside cloves can produce 40-50 fruit per tree at harvest every three months. Farmers sell coconut, generally in the form of copra, at a price of IDR 60 000 per quintal of copra sold to village collectors.

Forest

The forest in this region has been known for a long time by the public as a Tanggale nature reserve. People understand the rules of the Forest Service Nature Reserves such as: they should not cut down trees, take the wood, rattan or stones, nor hunt animals. There are a lot of rules and sanctions, both from the Forest Service and the local village rules. These rules help to preserve forests and provide benefits that many people mentioned in the discussion. Among them: the availability of abundant water, soil does not dry quickly in the dry season, landslide prevention, especially in the edge of the road, and providing a home to wild or rare animals such as the tarsier (*tendelenga* in Gorontalo languange), snakes and pigs.

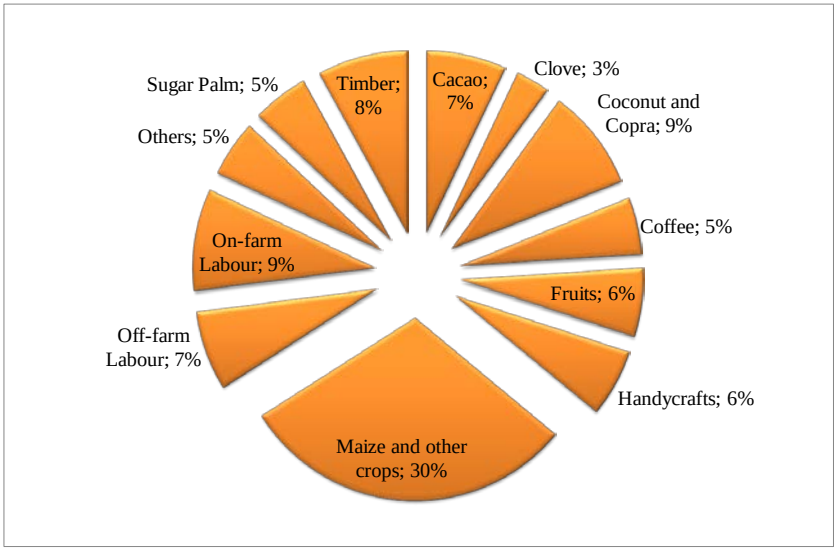

Figure 42. Current livelihood options in Labanu village based on community perspectives

Botumoputi Village (Village surrounding Limited Production Forest)

Maize and Chili

The village community of Botumoputi plant local and hybrid maize as the their main source of livelihood (Figure 43). Some local maize varieties carried by the public include: *Binde kiki, Binde moluala, Binde daa, Binde damahu, Binde pulo*. Hybrid maize varieties including *Manado Kuning* and Bisi 2. People plant maize hybrids for sale, while local maize is preferred for their own consumption. Advantages associated with local maize are recognized as taste and storability. Local maize tastes better to consumers and is durable for storage (up to six months after harvest), while hybrid maize tastes bland and can be retained for 1 month after harvest. Local maize seeds are harder to come by than hybrid maize seeds. The age of maize plants at harvest was varied: 70 days old for *Binde damahu* and *Binde Pulo*, 90 days old for *Binde kiki*, 100 days old for *Binde momala*, while Bisi 2 and *Manado Kuning* are harvested at 120 days.

During the growing season, maize is cleaned and cultivated twice per season with Urea and NPK Phonska. Maize hybrids have a higher production rate than local varieties. Hybrid maize can produce up to 3-4 tonnes per hectare, while the local maize can produce 2-2.5 tonnes per hectare. Maize is sold to traders in the village for around IDR 2800 per kilogram.

Chili (*rica* or *malita*) is planted with a distance of 60x60 cm. Some local chili varieties such as *rica jarum, rica syirup* and *rica kapas* are the most widely planted by farmers. Harvest begins after the chilis are three months old – the crop can produce 50 kilograms per hectare in one week. The selling price reaches IDR 20 000 per kilogram on the market. The main obstacle experienced by farmers is relatively difficult treatment because of lack of water and volatile prices.

Coconut and Copra

Botumoputi farmers plant coconut with cacao, banana, papaya, maize, tubers and legumes. Coconut is planted with a spacing of 8x8 m with cacao at a spacing of 2x2 m, and papayas at a spacing of 5x5 m and 4x2 m at the edges, while also planted with beans, maize, and tubers. A commonly used fertilizer is NPK Phonska and the plants are cleaned at least twice a year.

Coconut harvesting is done 4 times a year; now most palm trees are 30-40 years old. Its production can reach 200 fruit per tree per year with the selling price of copra IDR 300 000 per quintal. Peeled coconut fruit is also sold to nata de coco factories which are located in North Isimu (about three km from the village) at a price of IDR 1 250 000 per quintal. Cacao is also sold to the Telaga area within 30 km of the village at a price of IDR 14 000 per kilogram. Constraints experienced by coconut farmers include pests and diseases, as well as damaged cacao due to fallen coconut branches.

Candlenut and Fruits (Jackfruit, Mango)

Candlenut is planted mixed with jackfruit, mango and teak. Candlenut planted by farmers is mostly local varieties that begin to bear fruit at the age of 7-8 years. Mango species planted include mango dodol community, board, arumanis, and kuini. Meanwhile, jackfruit varieties include *bidula, nangka oto, nangka sirup, nangka bubur*. Spacing for candlenut is 10x10m with minimal management, lack of fertilizers and cleaning gardens. Candlenut aged over 11 years can produce up to 2600 seeds per tree. Candlenut is generally sold in the form of pecan seeds worth IDR 4000 per sack of grain or shelled pecan already dried for 7 days at a price of IDR 8000 per kilogram. Candlenut is generally sold in the village and at the weekly market.

Papaya and Banana

Papaya is cultivated with a spacing of 3x3 m and 4x4 m. Cultivated papaya varieties include: orange papaya (somewhat red-colored fruit, long and oval shapes) and syrup papaya (yellow fruit, round shape). Papaya cultivation is done using fertilizer and pesticide applications at least twice a year. Papaya harvest begins at the age of six months and lasts up to two years. Harvesting is done every two weeks and on average two fruit are produced per tree. The selling price in the village market today is IDR 7000 per fruit. Farmers often complain of pests including bats and birds. Other constraints include weather (too much rain will rot the fruit) and land conditions; plantations are generally on steep slopes and this can be a challenge in papaya cultivation.

Banana varieties known to the Botumoputi public include: *pisang sepatu, pisang raja, pisang ambon, pisang australia, pisang susu, pisang kapok, pisang tanduk* and *pisang goroho*. Banana harvest is done at the age of one year after planting and selling price varies between IDR 12 000 and IDR 15 000 per bunch. Marketing of bananas is admittedly very easy, with no problems at the farm level. However, pests and diseases such as banana wilt before fruiting, yellowed and damaged fruits and black fruit became a problem that is often experienced farmers.

Teak

Teak is often grown alongside other crops such as walnut, jackfruit, mango, and banana. Teak is planted with a spacing of 6x6m and is rarely cultivated and cleaned. Teak plantations are interspersed with maize, chilies and beans until the teak is two years old. Teak harvesting can be done after the age of about 10 years. Teak tree rings of one meter can be sold at a price of IDR 450 000 per tree. Buyers come directly into the garden from inside and even outside the island of Sulawesi. The biggest challenge of teak is a long drought, so the plants are easily burnt and damaged, as well as the waiting time for harvest.

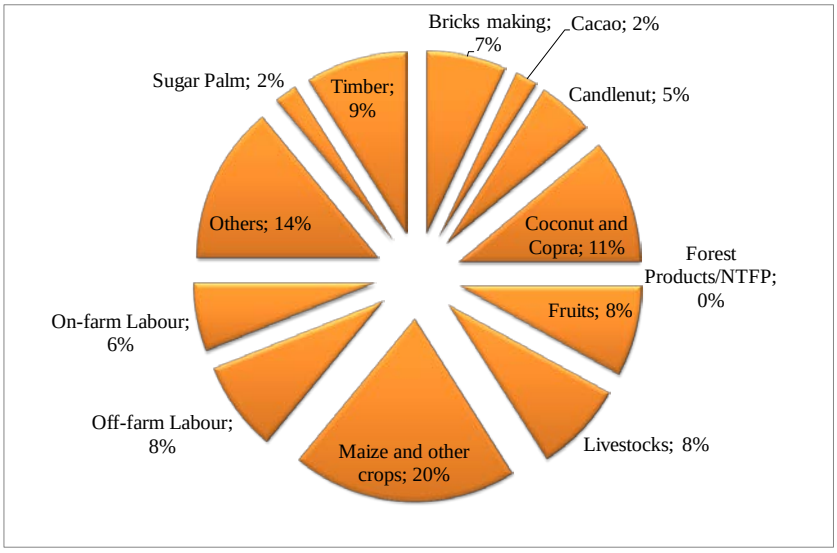

Figure 43. Current livelihood options in Botumoputi village based on community perspectives

5.6 Important Indicators of Livelihoods based on Household Surveys

5.6.1 Sources of Income

The basic 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 multiplied by quantities of all *n* products) minus total costs (price multiplied by quantities of all *m* purchased inputs), for example: fertilizers, seeds, tools and hired labour (Angelsen and Lund 2011).

The average total income per year per household in the Typology 1 was lower than in the Typology 2, Typology 3, Typology 4 and Typology 5 (Table5). The major sources of income for farmers in all villages were also different. For farmers in Typology 1 it was Maize fields and agriculture wage. In

the Typology 2 it was non agriculture wage and maize fields. In the Typology 3 it was maize fields and chilli fields and agriculture wage. In Typology 4 it was agroforestry and Typology 5 it was coconut agroforestry and nonagriculture wage.

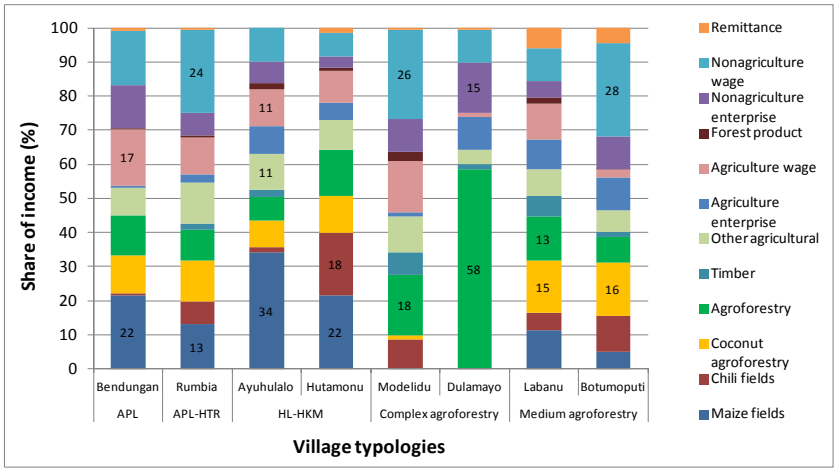

Figure 44. Sources of income by activity type in Gorontalo in 2014

The calculation of income included the value of consumed commodities. However, most of the farmer income came from cash crops. Figure 44 shows the share of farmers' income from all activities in Gorontalo. Figure 44 shows that in all typologies on-farm income (58-88%) is higher than off-farm income (12-42%).

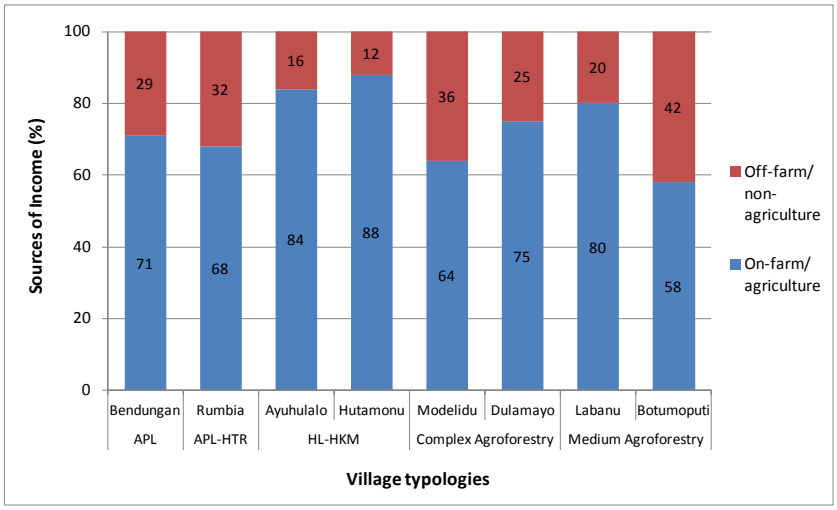

Figure 45. Sources of Income in Gorontalo in 2014

Figure 45 shows that in all typologies on farm income (58-88%) is higher than off farm income (12-42%).

Table 5. Sources of income in Gorontalo in 2014

Source of Income	Average income per household per village															
	APL		APL-HTR		HL-HKM				Complex Agroforestry				Medium Agroforestry			
	Bendungan		Rumbia		Ayuhulalo		Hutamonu		Modelidu		Dulamayo		Labanu		Botumoputi	
	IDR	%	IDR	%	IDR	%	IDR	%	IDR	%	IDR	%	IDR	%	IDR	%
1. On-farm/agriculture	397 552 342	70.70	533 355 639	68.36	727 980 714	83.77	677 953 464	88.24	445 222 057	63.80	1 029 859 114	75.17	792 878 133	79.58	290 758 036	58.48
Maize fields	121 082 985	21.53	101 669 729	13.03	296 763 286	34.15	165 245 686	21.51	1 010 000	0.14	0	0.00	111 798 690	11.22	24 868 643	5.00
Chili fields	3 127 429	0.56	53 335 643	6.84	13 610 000	1.57	141 597 200	18.43	58 801 000	8.43	2 055 000	0.15	52 325 000	5.25	52 118 071	10.48
Coconut agroforest	62 167 500	11.06	92 814 375	11.90	66 882 143	7.70	83 699 543	10.89	8 605 500	1.23	0	0.00	152 223 500	15.28	77 592 750	15.61
Agroforestry	66 841 429	11.89	69 417 393	8.90	61 923 286	7.13	103 864 036	13.52	123 412 557	17.68	798 906 614	58.31	128 442 086	12.89	37 165 714	7.47
Timber	0	0.00	15 569 500	2.00	17 315 000	1.99	0	0.00	47 755 000	6.84	22 136 000	1.62	59 163 857	5.94	7 626 857	1.53
Other agricultural	45 413 000	8.08	93 263 000	11.95	91 957 000	10.58	66 231 000	8.62	72 136 000	10.34	58 936 000	4.30	78 810 000	7.91	32 126 000	6.46
Agriculture enterprise	3 000 000	0.53	18 484 000	2.37	70 866 000	8.15	40 000 000	5.21	8 027 000	1.15	129 075 500	9.42	87 280 000	8.76	47 520 000	9.56
Agriculture wage	94 160 000	16.75	85 827 000	11.00	93 808 000	10.79	72 006 000	9.37	106 320 000	15.24	18 750 000	1.37	104 080 000	10.45	11 480 000	2.31
Forest product	1 760 000	0.31	2 975 000	0.38	14 856 000	1.71	5 310 000	0.69	19 155 000	2.74	0	0.00	18 755 000	1.88	260 000	0.05
2. Off-farm/non-agriculture	164 750 000	29.30	246 860 000	31.64	141 062 000	16.23	90 350 000	11.76	252 635 000	36.20	340 144 000	24.83	203 480 000	20.42	206 468 000	41.52
Nonagriculture enterprise	70 000 000	12.45	52 200 000	6.69	55 392 000	6.37	26 400 000	3.44	66 720 000	9.56	201 694 000	14.72	47 380 000	4.76	47 448 000	9.54
Nonagriculture wage	90 650 000	16.12	189 160 000	24.24	85 670 000	9.86	52 950 000	6.89	182 765 000	26.19	131 450 000	9.59	95 700 000	9.60	136 870 000	27.53
Remittance	4 100 000	0.73	5 500 000	0.70	0	0.00	11 000 000	1.43	3 150 000	0.45	7 000 000	0.51	60 400 000	6.06	22 150 000	4.45
3. Total income per year	562 302 342	100	780 215 639	100	869 042 714	100	768 303 464	100	697 857 057	100	1 370 003 114	100	996 358 133	100	497 226 036	100

5.6.2 Daily Income per Capita

The daily income per capita of farmers in the Typology 1 was lower than in the the Typology 2, Typology 3, Typology 4 and Typology 5. The daily income per capita of farmers in Typology 1 was poorer compared with the other farmers, meanwhile farmers in the Typology 4 were richer than the farmers from the other villages. The daily income per capita of farmers in the Typology 4 was almost twice that of the farmers from the Typology 1 village.

The daily income per capita of farmers in the Gorontalo Province is presented Figure 46. Using the international poverty line standard of USD 1 a day, the percentage of farmers' income was above the international poverty line in Gorontalo. Thus we can conclude that farmers in all villages were living above the international poverty line of USD 1 per day.

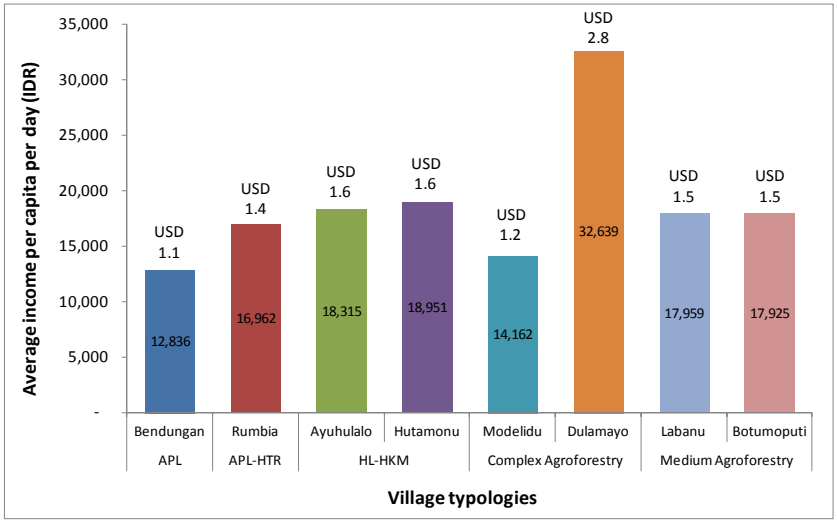

Figure 46. Income per capita in Gorontalo in 2014

5.6.3 Land Holdings

The average land holding per household in Typology 2 (2.53 hectares) was larger than the Typology 1 village (1.44 hectares), Typology 3 (1.45 hectares), Typology 4 (1.03 hectares) and Typology 5 (1.24 hectares). The compositions of land holdings by land-use types were different across the sites (presented in Figure 47).

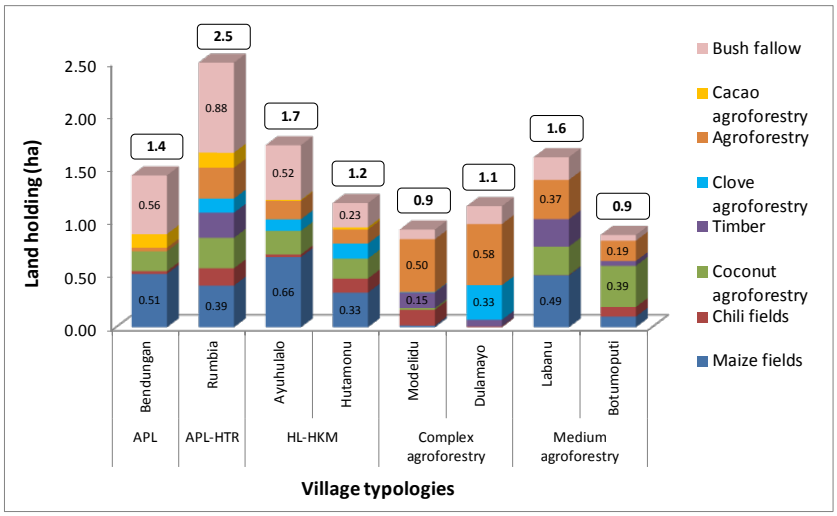

Figure 47. Average land holding by land use (hectares) in Gorontalo

In Typology 1, the major land use of land holding was bush fallow (1.4 hectares) and maize fields (0.51 hectares). Meanwhile in the Typology 2, the major land use of land holding per household was bush fallow (0.88 hectares) and crop fields (0.56 hectares). In the Typology 3, the major land use of land holding per household was crop fields (0.46-0.71 hectares) and bush fallow (0.23-0.52 hectares). In the Typology 4, the major land use of land holding per household was mixed-gardens/agroforestry (0.50-0.58 hectares). In Typology 5, in Labanu Village the major land use was Maize fields (0.49 hectares) and agroforestry (0.37 hectares) and in Botumoputi Village it was coconut agroforest (0.39 hectares), crop fields and agroforestry (0.19 hectares) as described in Table 6.

Most of the location land holding per household for farmers was relatively similar in Rumbia, Ayuhulalo and Hutamonu Village areas. The majority of the location land holding in all village areas was state production forest and protected forest (>60%) and private land (<=40%).

The major land use in a number of the villages in Gorontalo was bush fallow. The major reason for not cultivating this land in the Typology 1 was lack of labor (48%) and lack of capital (20%). In the Typology 2 the major reasons were lack of capital (38%) and lack of labor (25%). In Typology 3 the reasons were a lack of capital (38-45%) and lack of labor (25-36%). In Typology 4 the reasons were pest and desease (24-32%), a lack of capital (20-26%) and lack of labor (19-22%). In the Typology 5, in Labanu Village 28% of the respondents gave the reason of pest and desease and 22% cited a lack of labor and a lack of capital. In Botumoputi Village 29% of the respondents gave the reason of a lack of capital and 24% of the respondents gave the reason of a lack of productive land (Figure 48).

Table 6. Average land holding by land use in Gorontalo

Village Typologies	Villages	Average land holding by land use (hectares)							
		Maize fields	Chili fields	Coconut agro-forestry	Timber	Clove agro-Forestry	Agro-Forestry	Cacao agro-forestry	Bush fallow
APL	Bendungan	0.51	0.03	0.19	0.00	0.00	0.03	0.13	0.56
APL-HTR	Rumbia	0.39	0.16	0.29	0.24	0.13	0.29	0.14	0.88
HL-HKM	Ayuhulalo	0.66	0.03	0.22	0.00	0.11	0.18	0.01	0.52
	Hutamonu	0.33	0.13	0.19	0.00	0.14	0.13	0.02	0.23
Complex agroforestry	Modelidu	0.02	0.15	0.02	0.15	0.00	0.50	0.00	0.09
	Dulamayo	0.00	0.01	0.00	0.06	0.33	0.58	0.00	0.17
Medium agroforestry	Labanu	0.49	0.00	0.27	0.26	0.00	0.37	0.00	0.21
	Botumoput	0.10	0.09	0.39	0.05	0.00	0.19	0.00	0.05

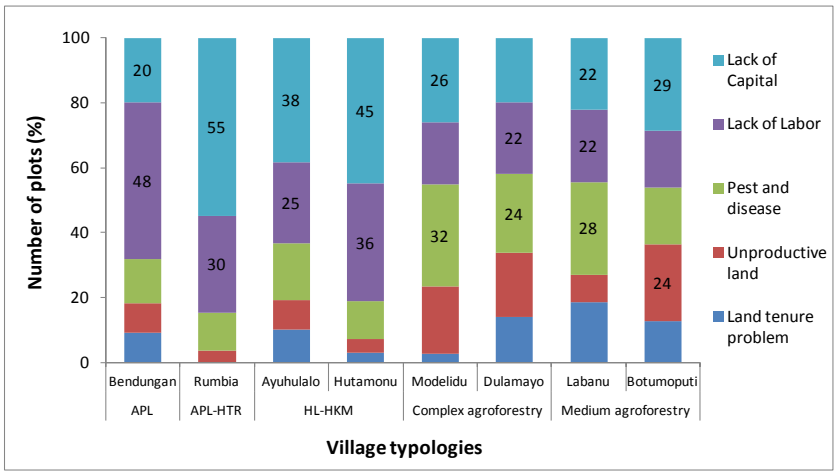

Figure 48. Reasons for not cultivating the fields in Gorontalo

The majority of the length of bush fallow cultivation across all villages was less than 5 years (30-100%) or 6–10 years (0-50%), (Figure 49). In the Typology 1 village the length of bush fallow cultivation was 30% less than 5 years and 40% 6-10 years. In the Typology 2, 75% of fallow was less than 5 years and 15% was 6–10 years. In the Typology 3 areas 50-89% was less than 5 years and 5-25% was 6-10 years. In the Typology 4, 57-100% of fallow was less than 5 years and 15% was 0-29 years. Whereas in the Typology 5, 43-50% of fallow was less than 5 years and 43-50 % of fallow was 6-10 years.

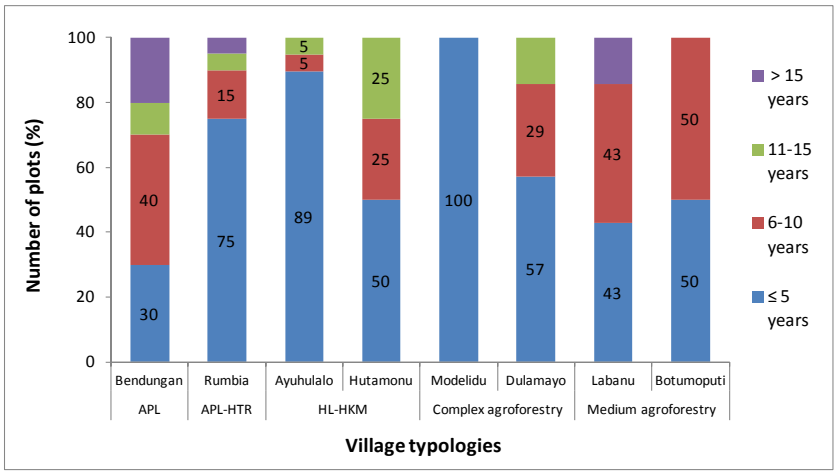

Figure 49. Years of fallow cultivation in Gorontalo

6. Conclusion

The dynamics of land use and livelihood strategies in all these villages are very diverse. Maize and vegetables, as well as agroforestry systems of plantation crops (coconut, cacao and clove) dominate land use in all the typologies of the village. In general, community livelihood strategies are dominated by maize, vegetables, and agroforestry systems.

Community perspectives of the dominant land use in each typology show that Typology 1 village is dominated by coconut agroforestry and forest areas (production forests and the people). Dynamics of changes in land use showed an increase in the proportion of coconut agroforestry, community forests and maize fields. The increase was associated with a decrease in the proportion of forest area to only a quarter of its previous total. The land demand for coconut agroforestry and maize is recognized as having contributed to triggering the decline of forest area in these villages.

Typology 2 village is dominated by cacao agroforestry, maize and vegetables and coconut agroforestry. Dynamics of changes in land use showed an increase in the proportion of cacao agroforestry area, maize fields and vegetables, accompanied by a decrease in the proportion of upland rice and forest production. Currently the forest area that is managed by community is used to cultivate maize and vegetables.

Typology 3 village is dominated by protected forest areas, community forests, coconut agroforestry, clove agroforestry and maize and vegetables. Dynamics of changes in land use in the Ayuhulalo village shows the proportion of protected forests was reduced by half, while the most land was under public forests and clove agroforestry, and the area of maize and vegetable production increased. Likewise, in the Hutamonu village the proportion of private forest area was reduced by half, while maize and vegetable and clove agroforestry increased significantly.

Typology 4 village is dominated by clove agroforestry, candlenut agroforestry, maize and vegetables and smallholder teak. Dynamics of changes in land use in the Dulamayo Selatan village showed a decrease in the proportion of protected forest area by more than half in the 1970s, while the candlenut agroforestry and clove agroforestry proportion increased very significantly. In the Modelidu village forest proportion area has drastically reduced, and there is an increase in the proportion of village areas, maize and vegetables and smallholder teak.

Typology 5 village is dominated by smallholder teak, maize and vegetables, clove agroforestry and coconut agroforestry. Dynamics of changes in land use in the Labanu village showed an increased proportion of smallholder teak garden and maize and vegetable production. There was a decline in the proportion of upland rice fields and forest nature reserves in the period 1970-1990. The proportion of Tangale nature reserves area did not change from 1992 to the present. Meanwhile in the Botumoputi village there were vast changes; coconut agroforestry and forests declined by a quarter. Conversely, there was a rise of proportions of papaya garden, teak garden, candlenut agroforestry.

Analysis of household-level information indicates that the number of male and female household members is similar in all typologies, with the majority of household heads from the tribe Gorontalo. The educational level of typology 4 farmers is lowest in the village of Modelidu to other villages. The level of education for farmers of the other typologies is relatively similar, with female education level slightly lower than that of men. Land tenure in most typologies is relatively equal with the land owned by husband and wife together, while in some cases the husband is the party with the greatest responsibility. The location of cultivated land is generally on private land in the village (Typology 1, Typology 4 and Typology 5); but may also be in protected forests and production forests (Typology 2 and Typology 3).

Household level analysis also showed the average total income per year per household in Typology 1 is lower compared with other typologies. The main source of income for farmers in each village is also different: Typology 1 income is mainly sourced from maize yields and agricultural wages; Typology 2 from non-agricultural wage and maize; Typology 3 from maize, chili and agricultural wages; Typology 4 from agroforestry gardens; and Typology 5 from coconut and non-agricultural wage. Sources of income from agriculture are higher (58-88%) than from non-agriculture (12-42%) in all village typologies .

The income per capita of farmers in Typology 1 is lower than in other typologies. Farmers in Typology 1 are the poorest among farmers in all typologies. Meanwhile farmers in Typology 4 are the most affluent in comparison with farmers in other typologies. Revenue per capita per day in Typology 4 is almost double compared to farmers in other typologies.

The average land ownership per household in Typology 2 (2.53 hectares) is greater than in Typology 1 (1.44 hectares), Typology 3 (1.45 hectares), Typology 4 (1.03 hectares) and Typology 5 (1.24 hectares). The composition of land ownership is based on different types of land use in all locations. In Typology 1, the dominant form of land owned per household is shrubs (1.4 hectares); Typology is

also shrubs (0.88 hectares); Typology 3 is agrciluture fields (chili and maize); and Typology 4 agroforestry plantations (0.50 to 0.58 hectares). While in Typology 5, in the village of Labanu the main form of land ownership is maizefields (0.49 hectares) and in Botumoputi village, coconut agroforestry (0.39 hectares).

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