FIRE, LIVELIHOOD AND SWAMP MANAGEMENT:

Evidence from Southern Sumatra

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Abstract

This study reveals that the relative importance of livelihood as sources of income in Southern Sumatra swamp has been change dramatically over the last 30 years. The change of the livelihoods was resulted from the degradation of natural resources. A high rate of land covers change from forest to large-scale plantation and transmigration settlement program, as well as a poor forestry practice and ignored the sustainability of swamp forest cause a degraded of land that use by communities.

Sonor, traditional rice cultivation, in which farmer only plant rice during after considerable drought, usually associated with an El Niño event, has become larger in areas and important as a sources of income. The resultant fires burn large areas of wetland forest well beyond the boundaries required for rice production, and without a conscious effort to maintain environmental services. The negative environmental impact from the sonor (smoke/Haze) has increased.

One alternative policy to improve environmental services in wetland areas is through longer period of fallow by allowing natural tree species growing to reach mature production. A common tree growing in wetland areas in Southern Sumatra is Gelam (Melaleuca cajuputi), a fast growing, and high light demanding species with a wide range of end uses. The adoption of this alternative practiced, however, is almost zero. It seems that the alternative land practice is less profitable but has bigger positive environmental impacts. Here, a trade off problem between increasing social benefit and financial benefit occurs.

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1. BACKGROUND

Large-scale fires and associated smoke are an increasing problem in Indonesia and surrounding countries. For instance, major fires occurring in the El Niño years 1982/1983, 1987, 1991, 1994, and 1997 (Dennis, 1999) burned large areas of forest and caused significant economic losses, both in Indonesia where most fires occurred and in neighbouring countries. An estimated 5 million hectares in Indonesia and 70 million people throughout the region were affected. The economic costs of the 1997/1998 fires in Indonesia have been estimated to exceed 9 billion USD with carbon emissions high enough to elevate Indonesia to one of the largest polluters in the world (ADB and BAPPENAS, 1999; Barber and Schweithelm, 2000).

In 1997/98, fire in peat and swamp areas has significantly contributed to smoke and haze problem. It is estimated that around 60 percent of the particulates and carbon dioxide in smoke and haze come from peat fires (ADB-BAPPENAS, 1999). This study outlines case study in swamp areas in Southern Sumatra, where repeated fire occurs due to of community's activities in managing fire to meet similar goals of increased income generation, but without a conscious effort to maintain environmental services.

Based on ICRAF/CIFOR fire study revealed that the major causes of fire in wetland and peat area in Sumatra resulted from human activities to meet their livelihood (Suyanto, *et.al*, 2000). Commonly, fire used as a strategy in "traditional" land management in rice cultivation in swamp areas. This rice farming system is called *Sonor* and to practiced by people in sites only during the drought season. Fire due to this traditional land management system will repeat every drought season (Suyanto and Ruchiat, 2000).

Most of the community members are poor farmers and they have less economic opportunity. The dependable of using fire to generate income is very high. The results of community fire management may not always be positive, but this also depends on whose perspective is adopted to judge the outcomes. At the global perspective, the impacts of using fire are negative, but at the local perspective, whether impacts on the environment are considered to be negative will depend to a large extent on their effects on livelihoods perspectives, the impacts could be positive. With a trade-off situation between supplying good environmental services and generating income for local community's livelihood, it is necessary to identify policy that can improve environment and livelihood simultaneously. If farmers has imposed to implement sustainable land management that provide good environmental services that is often free to beneficiaries but costly to farmers.

2. METHODOLOGY

Participatory and rural rapid appraisal are used to collect general information about the histories of the area, demography, different types of land cover and land forms around, forest cover and condition, and changes over time including livelihoods and sources of income, land use activities, type of management/exploitation methods for each activity including use of fire, land tenure, rules and regulations, enforcement, major developments (markets, roads, canals, mechanical equipment, etc.) through the area that affected land use, history of droughts and fires. The result of this survey will be integrated with the results of the remote sensing-based change analysis. A GIS was used for this integration. The focus is on integrating local people's narratives and sketch maps with land cover change maps and burn scar maps.

3. SITE DESCRIPTION

In general, Indonesian's natural wetland habitats are divided into five major wetland systems, which are: marine, estuarine, palustrine (swamps and marsh), lacustrine (lake) and riverine. Currently, the natural wetlands of Indonesia mostly has been influenced by the human activities as the result of human population and development on the wetlands such as forest harvesting, agricultural practices, fishing and hunting (Wibowo and Suyatno, 1998). In 1998, the total of Indonesian natural wetland remaining size is about 31 million hectare with 7.5 million hectare or 24 % is in Sumatra Island (Table 3.1).

Table 3.1 Remaining size of natural wetlands area in Indonesia.

Islands	Wetland habitats			Total
	Peat swamp	Freshwater swamp	Others	
SUMATRA	4,613,000	1,090,000	1,799,706	7,502,706
KALIMANTAN	3,531,000	171,000	2,506,750	6,208,750
JAVA AND BALI	0	4,500	25,567	30,067
NUSA TENGGARA	0	2,000	118,268	120,268
SULAWESI	34,000	66,000	313,366	413,366
MALUKU	42,000	21,000	197,900	260,900
PAPUA	8,753,000	5,185,000	2,994,785	16,932,785
INDONESIA	**16,973,000**	**6,539,500**	**7,956,342**	**31,468,842**

Others refer to Lake, Coral reefs, and Mangrove forest. (Source: Wibowo and Suyatno, 1998)

Our study sites are located in the wetland area of Southern Sumatra, which are situated in the administrative area of South Sumatra Province and Lampung Province (Figure 3.1). The study sites are Mesuji in Lampung Province, Pampangan and Sugihan in South Sumatra Province. The topologies of those sites vary from freshwater swamp and peat swamps. Sumatra Island, as similar as Kalimantan and Papua Island, commonly has palustrine type of wetland that is comprised mainly of peat swamp and freshwater swamp. The size of peat swamp and freshwater swamp areas in Sumatra Island are about 5.7 million hectare or 76 % of natural wetland habitats in total (Wibowo and Suyatno, 1998).

Repeated fires commonly occur at this site, especially every long dry season, as a result of human activity to meet their need. The patterns of livelihood and swamp management of smallholders surrounding the sites are the part of study focus for this research. Table 3.2 below describes the general information from those three sites, including the ecological and socio economic aspects.

Figure 3.1. Map of Study Sites

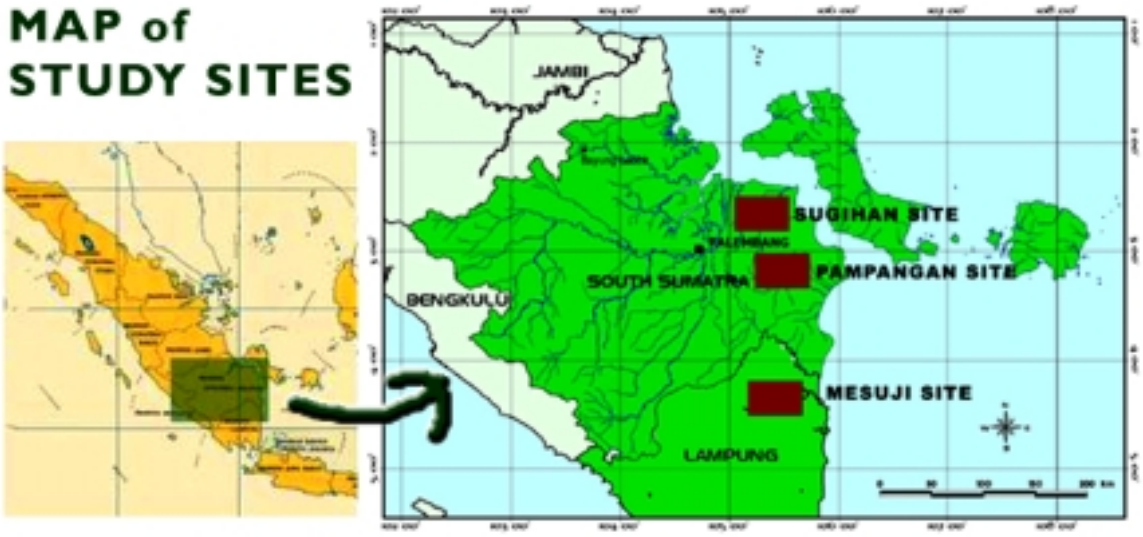


Table 3.2. Description of social, economic and topographic factors in study sites.

Variable	Sub Sites		
	Mesuji	**Pampangan**	**Sugihan**
Area (Km2)			
Sub-district	3918	1563	2594
Study site (Landsat ETM)	246	378	284
Altitude	0-50 meter	0 – 8 meter	0-20 meter
Wetland habitats	Freshwater swamp	Freshwater swamp	Freshwater swamp and peat swamp
Population density in year 2000(prsn/km²)	25	37	12
Settlement for Local	Old establishment	Old establishment	Relatively, new establishment
Local-Main livelihoods	*Sonor,* emigrant labour and logging	*Sonor*, rubber, emigrant labour and logging	*Sonor*, fishing emigrant labour and logging
Migrant-Main Livelihoods	Agriculture, Emigrant labour	n.a	*Sonor*, Agriculture, Emigrant labour
Land use	Oil palm plantation, timber plantation, local and transmigration settlements, sonor area	Rubber plantation, sonor area and local settlements	Wildlife reserve area, production forest area, sonor area, local and transmigration settlements.
Land tenure	Communal land but evolving to more	Communal land	State land, illegal for cultivation

	secure private land		
Poverty status	Poor	Poor	Poor

3.1 Mesuji Site

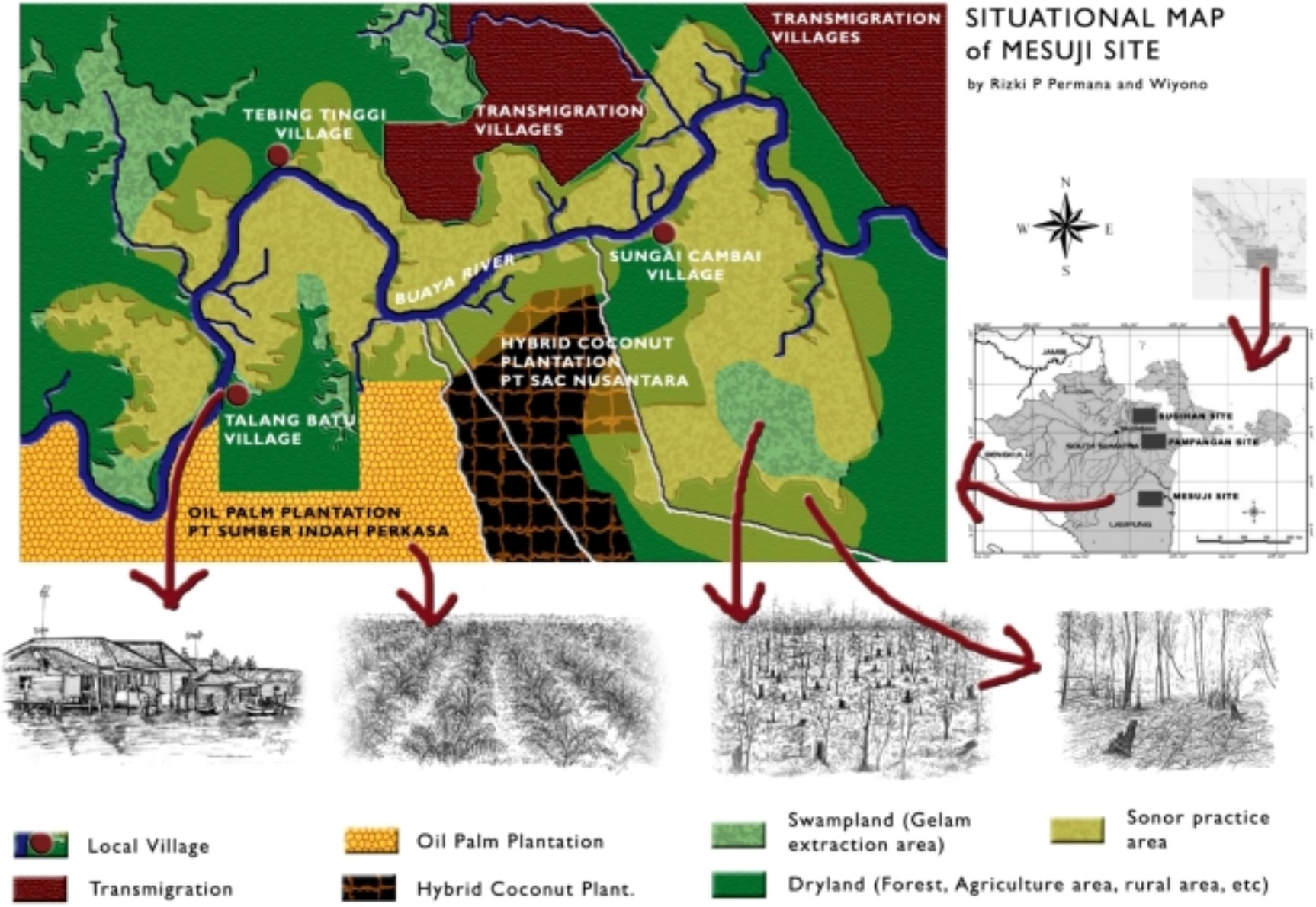
The Mesuji site is located in Mesuji Sub District, Tulang Bawang District, Lampung Province. The elevation of this site ranges from 0 to 50 m above sea level. Soils include alluvial, red/yellow podzolic and swamp soils. Average monthly rainfall during the 1993-1995 dry seasons was 56 mm/month. However, average monthly rainfall between 1994 and 1997 was only 6 mm/month, as it included a very long drought (Agricultural Extension Office, Menggala, 1999). There is a river, called the Buaya River, which crosses the settlements and flow into the Mesuji River (Figure 3.2).

There are two types of community, Local and Migrant. 'Local people' are the Mesuji ethnic group who have lived at this site since long time ago. On the other hand, 'migrants' are people who came to this site in more recently, either under the transmigration settlement scheme or spontaneous. Most of migrants are Javanese.

The local community, from the Mesuji ethnic group, mostly live along the Buaya River. Mesuji people originally came from South Sumatra and have been living at this site since the 1800s. Local communities live at five settlements, which are Sungai Cambai village, Talang Batu village, Talang Gunung Sub Village, Talang Tebing Sub Village, and Talang Stajim Sub Village. In 1991, spontaneous migrants came to the Talang Batu village. The number of migrants who came to that site increased in 1997/1998. Another community is transmigrant, who has settled in this site since early 1993. There are 15 villages of transmigrant and were divided into two locations, which are F Unit and Pangkalan Mas Unit.

At the western side of this site located the industrial timber plantation of PT Silva Inhutani Lampung (PT SIL) that was established in 1989. PT SIL maintained 43,000 ha of land and has planted three main tree species: rubber (*Hevea brasiliensis*), acacia (*Acacia mangium*) and albizia (*Paraserianthes falcataria*). An oil palm plantation, PT Sumber Indah Permai (PT SIP), was also established at this site in 1991 and 1993. Another is PT SAC Nusantara that planted Hybrid Coconut and was established in 1980 and 1992.

Figure 3.2. Situational Map of Mesuji Site



3.2 Pampangan Site

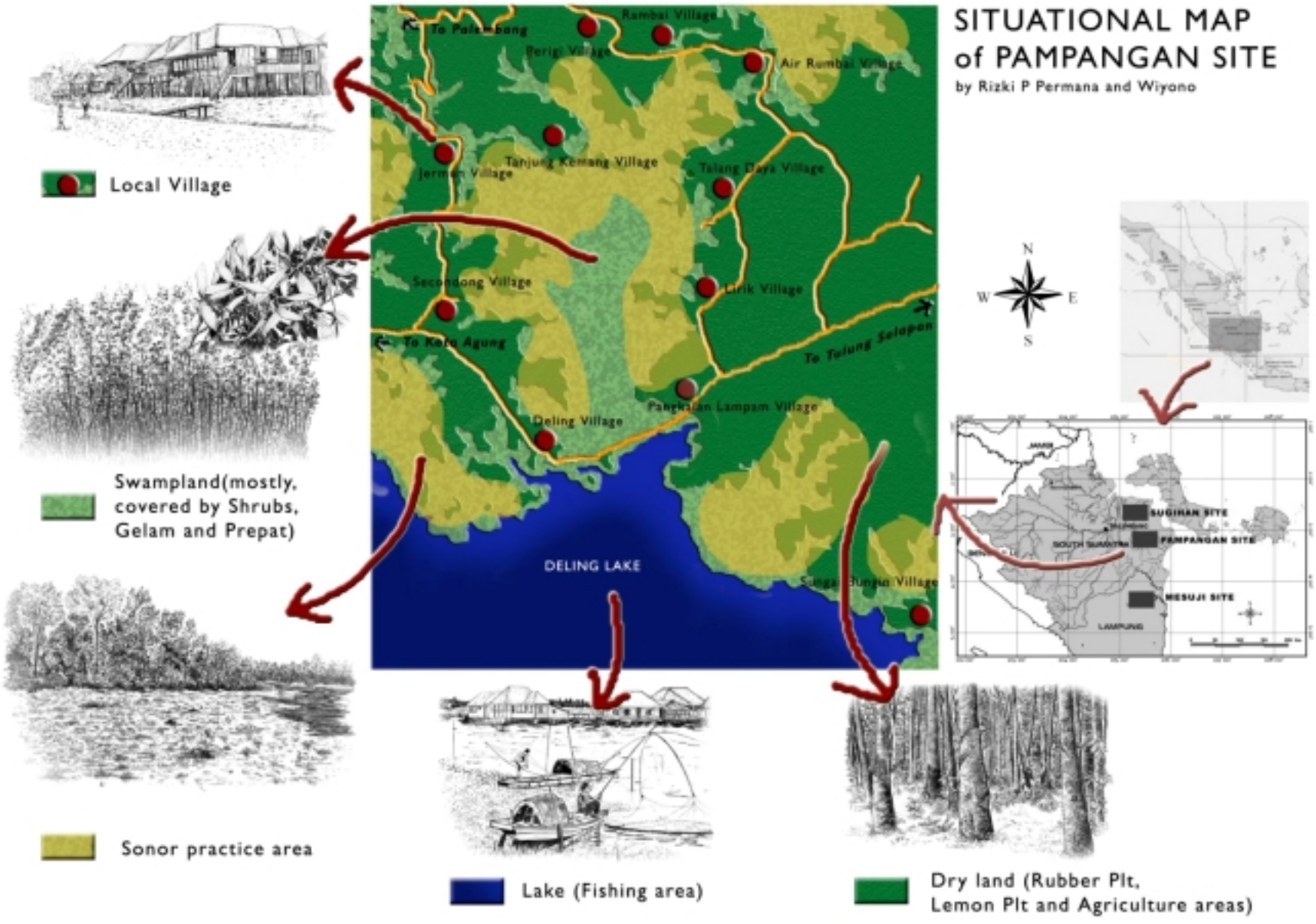
Pampangan site is located in Pampangan Sub District, Ogan Komering Ilir District, South Sumatra Province. The Sub District area is 1,562.69 km2 and consists of 35 villages. The elevation of this site is ± 8 m above sea level and dominated by swamps and rubber plantations. There is a main floodplain lake called Lebak Deling (Figure 3.3). Besides that, two main roads across the site, one is connected Kayu Agung and Tulung Selapan that established in 1913, and the other is connected Palembang and Tulung Selapan that established in 1950s.

We focused on 11 local villages in this site, which are Deling Village, Secondong Village, Jermun Village, Tanjung Kemang Village, Perigi Village, Rambai Village, Air Rumbai Village, Talang Daya Village, Lirik Village, Pangkalan Lampam Village, and Sungai Bungin Village. The migrant communities are very rare. We only found in one a sub village of Deling Village.

The site varies from dry land to swampland. Their founder came to this place in more than a hundred years ago. They did a shifting cultivation, and also planted fruit trees for land marking. In the early 1900s, the Dutch Colonial introduced them a rubber tree/plantation. As a result, since 1950, mostly rubber garden has covered the entire site but the swampland.

Commercial logging activity in this site was started in the early 1960s. At this time, the swamp forest was become a point of interest for extraction. Due to the uncontrolled logging and fires, in the early 1990s the swamp forest was disappeared. Recently, the swampland is covering by *Gelam* (*Melaleuca cajuputii*), Prepat (*Combretacarpus rotundatus*) and Purun (*Lepironia articulata*).

Figure 3.3. Situational Map of Pampangan Site



3.3 Sugihan Site

Sugihan site is located in Air Sugihan Sub District, Ogan Komering Ilir Distric, South Sumatra Province. The area of sub district is 2,594-km2 and population is 31,955 people. The Air Sugihan sub district consists only 19 villages, with 18 of them are transmigration settlement (BPS OKI, 2000). The population density is low that is 12 people per km2. It seems that many areas are unsettled. The site is dominantly by flat swampland, a mixture of peatland and coalescent estuarine/riverine plains with altitude ranges from sea level to 20m.

There are two types of communities, Local and Migrant. The local refers to the people who lived along the Sugihan River (Figure 3.4) and the migrant refers to migrant people who lived in transmigration villages and mostly of them are Java ethnic. We focused our study in Bukit Batu village. This village is a transmigration settlement that was established in 1980. The government reclaimed the swamp forest, developed canals and converted into agricultural land. In this study, we also included all local communities settlements that located along the Sugihan River. The local settlements are Sungai Teku (20 HH), Sungai Kedeper (8 HH), Sungai Baung (22 HH), and Sungai Rasau (30 HH).

Figure 3.4. Settlement of local communities in Sugihan site along the Sugihan River

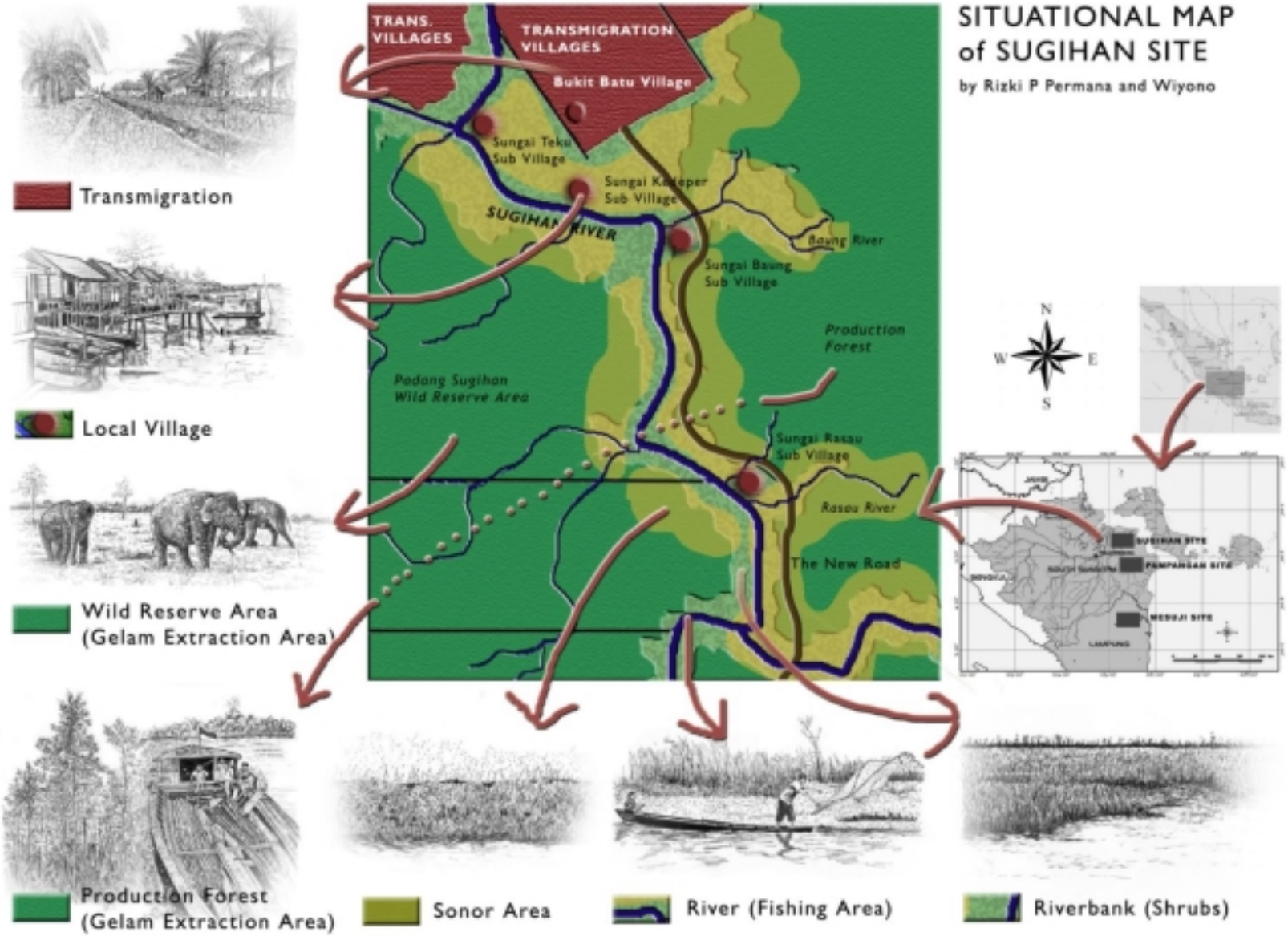
There lies Sugihan River that empties into Bangka Strait (Figure 3.5), and some branch rivers such as: Baung River, Rasau River and Beyuku River. Recently, the government is establishing the new road that connected the transmigration settlement with Riding Village in Pampangan Sub District.

The local communities settlements located at the eastern side in the Production (State) Forestland. Before 1960s, almost none of community lived in this site. Most of them only came for fishing and built some temporary house. The commercial logging activity that started in 1970s has attracted more people to migrate into this site, both legal and illegal.

Western part of Sugihan site is reserved for wildlife. Previously, the location was planned to be a transmigration settlement and the government had developed some primary and secondary canals for that purpose. Due to the presence of elephants and also in surrounding areas, as it was worried that they would disturb the community or even would be interrupted by the human activity, the government localized it into this area. Thus, the land status changed into Wild Reserve based on Ministry of Forestry Decree No. 04/Kpts-II/1983 dated April 19th, 1983. This called Padang Sugihan Wild Reserve with 71,807 ha area and about 232 elephants.

The reserve area has swamp ecosystem and used as a habitat for elephants and some animals such as: monkey, deer, siamang, etc. Recently, the area are dominantly by *Gelam* (*melaleuca cajuputii*), since the uncontrolled fire and illegal logging has derived it into deforested area. In Padang Sugihan Wildlife Reserve -and might similar with some other areas in this site- the vegetation comprised five distinct belts, from west to east, these comprised successively riverine swamp forest by the Padang River, Melaleuca forest, mixed peat swamp forest, Melaleuca forest, and open grassland by the Sugihan River (FFPCP Articles, 2001).

Figure 3.5. Situational Map of Sugihan Site



4. LIVELIHOODS AND SWAMP MANAGEMENT: FROM PAST TO PRESENT

Livelihoods in the study sites are vary and dynamically change over time due to the ecological and economical situation. Some findings from the study shown that most of the livelihoods activity has influenced the swamp condition both ecologically and economically. In contrary, the decrement of swamp forest and the degradation of swamp areas have influenced the livelihoods, indicated by the creation of several new livelihoods.

In general, the livelihoods in the sites are divided into two types that are in-swamp area and off-swamp area. Even the focus is the swamp area, but we also concerned to the off-swamp livelihoods since it has impact on daily income of community who live, mostly, in swamp area.

In-swamp livelihoods are categorized as the livelihood that has dependence on the resources of the swamp area or its activity is done in swamp area. We identified some main in swamp livelihoods, which are: *Sonor* (traditional rice cultivation in swamp area), forest extraction, fisheries, Gelam/swamp paper bark (*Melaleuca cajuputii*) extraction and charcoal production. In contrast, the off-swamp livelihoods are the livelihoods that has no or less dependence on the resource of swamp area and its activity is done out of swamp area. It also could be a new livelihood that is a result of swamp degradation. In many cases these livelihoods also significantly influenced the community income in the sites. We have identified some main off swamp livelihood, which are: food crops cultivation, rubber and lemon plantation, and emigrant labour.

4.1 In-swamp livelihoods

4.1.1 Swamp management for traditional rice cultivation (*Sonor*)

Sonor, as the major farming system, is a system of traditional rice shifting cultivation, which is practiced only during long drought periods on swamp area. In the long dry season, the water table level in the swamp decreases. That condition facilitates them to burn off the swamp for land preparation.

Table 4.1 shows the *Sonor* time at sites based on PRA and RRA interview. There is no time pattern of *sonor* cultivation because it is influenced by climate. In general, however, time cycle of *sonor* cultivation is every 4-5 years. Mesuji site, as the old establishment villages, has

been practicing *sonor* since long time ago. In contrast, Sugihan is a relatively new establishment of villages. Thus, the practice of *sonor* is also relatively new (since 1982).

Table 4.1. The *sonor* time on study site based on PRA and RRA interview

Year	Mesuji site	Pampangan Site	Sugihan Site
Before 1955	*	n.a	n.a
1957	*	n.a	n.a
1961	*	*	n.a
1967	*	*	n.a
1973	*	*	n.a
1977	*	*	*
1981/1982	*	*	*
1987	*	*	*
1991/1992	*	*	*
1994	*	*	*
1997	*	*	*

Most of the communities that practiced *sonor* are local people. At Mesuji and Pampangan sites, the *sonor* lands belong to communal since long time ago. The land tenure, however, has evolved to more private land. At Mesuji site, these lands are not free for the migrants, except if the local people sell the land. While at Sugihan site, the land status is State Forest Zone (Production Forest) and the local people have cultivated the land since end of the 1970s.

Around 85 to 98 percent of total farmers in sites practiced *sonor* in 1997 (Table 4.2). The average land holding for practicing *sonor* per household at Pampangan was 1.2 ha and at Mesuji site was 6.2 ha. In contrast, the average land holding of *sonor* per household at Sugihan site was 12.8 that were almost double that at Mesuji site. The higher land holding of *sonor* at Sugihan site because the land is more abundant, while the population density is lower than other sites.

Table 4.2. Sonor practiced data in 1997 based on system applied and the amount of communities who practiced it.

Site	Community that were doing *sonor* in 1997 (%)	Average area of *sonor* per household (ha)	*Sonor* System in 1997	
			Broadcast (%)	Tugal (%)
MESUJI	**93**	**6.2**	**85**	**15**
PAMPANGAN	**85**	**1.2**	**65**	**35**

SUGIHAN	**98**	**12.8**	**96**	**4**

Under the *Sonor* system, farmers only plant rice during drought seasons. The system requires 5-6 month dry period to be able to burn the swamp forest for planting rice. They burn swampland as much as they can without applying any effort to control escaping. The rice planting is done by broadcasting the seeds as much as they can; depend on how much they wish to harvest the yield. Recently, few farmers especially migrants, use a digging system (tugal) in the *sonor* system. This *Tugal* system usually applies by farmer who has limited area (approximately around 1 ha).

The desirable characteristic of the *sonor* system is extremely low labour demand. There is no crop care activity such fertilizing. The farmers just leave the field after planting the rice seed and return to the field after 6-month later for harvesting.

They usually use fire in land preparation to burn the organic debris (Figure 4.4). Land clearing and land preparation activity are done from the end of September until the end of October. After the first burning, they slash and cut the unburned vegetation. If the burn is incomplete, the remaining vegetation is slashed and burnt again and the land is ready for planting/broadcasting of seeds with the first rain.

The seed is planted in early November. They usually used local paddy varieties such as: *Sawah Kemang, Sawah Putih, and Padi Ampay* that could be harvested after 5 – 6 months since planting time. Some farmers, especially migrants, also try to use high yielding varieties (IR 42 and IR 64). The average use of seed per hectare is varying from 20 kg to 40 kg.

After harvesting, they will let the field fallow for 3-4 years (it depends on the cycles of the dry seasons). During that period, swamp forests rejuvenating and *Gelam* (*Melaleuca cajuputii*) trees will dominate again. Beside *Gelam*, the swamp is also covered with many grass species that commonly exist during the fallow period such as Purun Rawa (*Heleocharis fistulosa* Link.), Belidang (*Scleria multifoliata*), Paku Regis (*Blechnum orientale*), Kalameta Grass (*Panicum pilipes*), Senduduk duo (*Melastoma malabathricum*), etc.

Figure 4.1. Series of *sonor* in Mesuji site, this is also doing in others sites in long dry season

Description:

Sonor in the Mesuji sub site in a long dry season (1) Melaleuca cajuputi is a dominant species growing in dense stands after burning in wetlands and commonly regenerates during the fallow period after the *sonor* cultivation (2) Melaleuca cajuputi and other vegetation is cleared through burning. (3) and (4) If the burn is incomplete the remaining vegetation is slashed and burnt again and the land is ready for planting/broadcasting of seeds with the first rain.

Labour is a major production input in practicing *sonor* cultivation. *Sonor* activity is important to absorb family labour especially during land preparation and planting activities. More than 90% of labour used for these activities is family labour (Table 4.3).

Lack of labour for harvesting is always become a problem. So that, many hired labour is required for harvesting activity. Fortunately, many seasonal labour migrants come from transmigration and outside the site to harvest, using a contract labour system (*"bagi hasil"*). Landowners and labourers receive half share in the harvest. The high cost of harvesting

indicates a lack of labour in this area and also probably the difficulties in harvesting rice under the *Sonor* system.

Table 4.3. The percentage of family and hired labour on the *sonor* activity at the study sites.

Site	Activities	Labour (%)	
		Family Labour	Hired Labour
MESUJI			
Local	Land Preparation	100	0
	Planting	90	10
	Crop Care	n.a	n.a
	Harvesting	50	50
PAMPANGAN			
Local	Land Preparation	87	13
	Planting	94	6
	Crop Care	n.a	n.a
	Harvesting	60	40
SUGIHAN			
Local	Land Preparation	0	0
	Planting	100	0
	Crop Care	n.a	n.a
	Harvesting	58	42
Migrant	Land Preparation	0	0
	Planting	100	0
	Crop Care	n.a	n.a
	Harvesting	30	70

The PRA/RRA survey found that the average production of *sonor* is almost similar to the average production of upland paddy (Table 4.4). Compare to the average production of wetland paddy, the *sonor* production is lower by around 50%. This indicates the differences in land management cultivation where *sonor* is more extensive system that is without using any crop care and is compared to wetland paddy that is more intensive system that is including the use of fertilizer.

Table 4.4. The productivity of wetland paddy, upland paddy and *sonor* paddy in sites.

Site	Productivity per ha (ton/ha) in average			
	Wetland Paddy[1]	Upland Paddy[1]	*Sonor* Paddy[2]	
			BPS Data	(PRA Survey)
Air Sugihan	3.0	0.0	2.1	1.6
Pampangan	2.7	2.7	2.2	1.8
Mesuji	4.4	2.6	n.a	2.2

Source: PRA Surveys and Central of Statistic Bureau

1) Data in 1995 to 2000

2) Data in 1998 (*sonor* in 1997)

Although *sonor* paddy has less productivity but the total production has significantly influenced the total rice production. Figure 4.3 and Figure 4.4 show the data of area and production of paddy (*Gabah Kering Giling*) in Pampangan and Air Sugihan Sub District during period of 1995 – 2000[1]. The figures show the significant increment of paddy production in 1995 and 1998, which are probably caused by the supply from the *sonor* production. The following year after the *sonor* year, the rice production drastically increased. In 1998 the rice production in Pampangan Sub District increased by 26,220 ton or 260 % and in Air Sugihan Sub District increased by 67,609 ton or 350%. This evidence shows the importance of *sonor* cultivation in local rice production.

Figure 4.2. Graphic pattern of area and production of Paddy in Pampangan Sub District

[1] The data for Air Sugihan Sub District is started from 1997 since they are a new sub district, before that they were included in Pampangan Sub District.

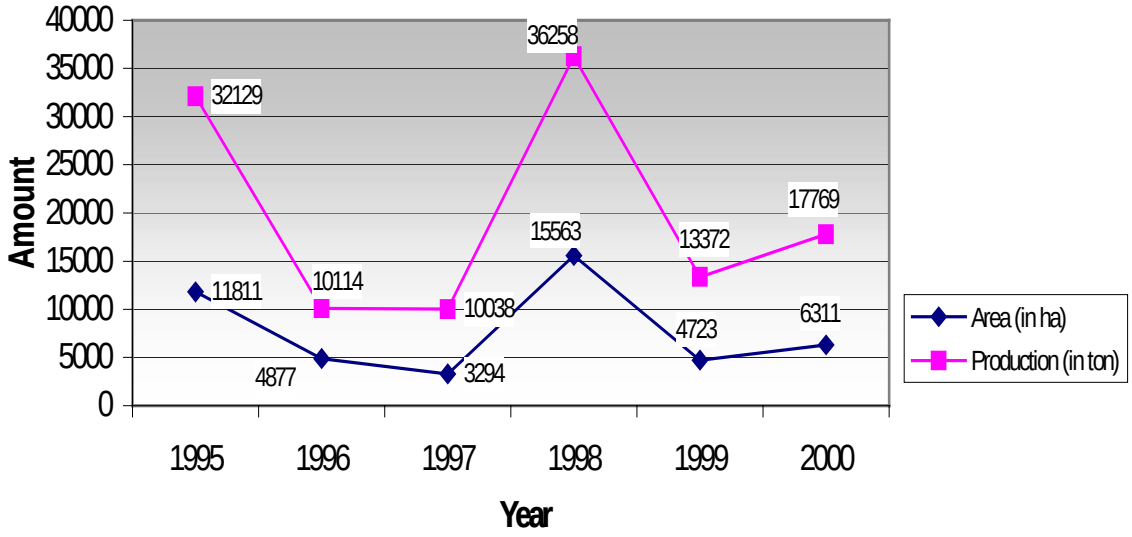
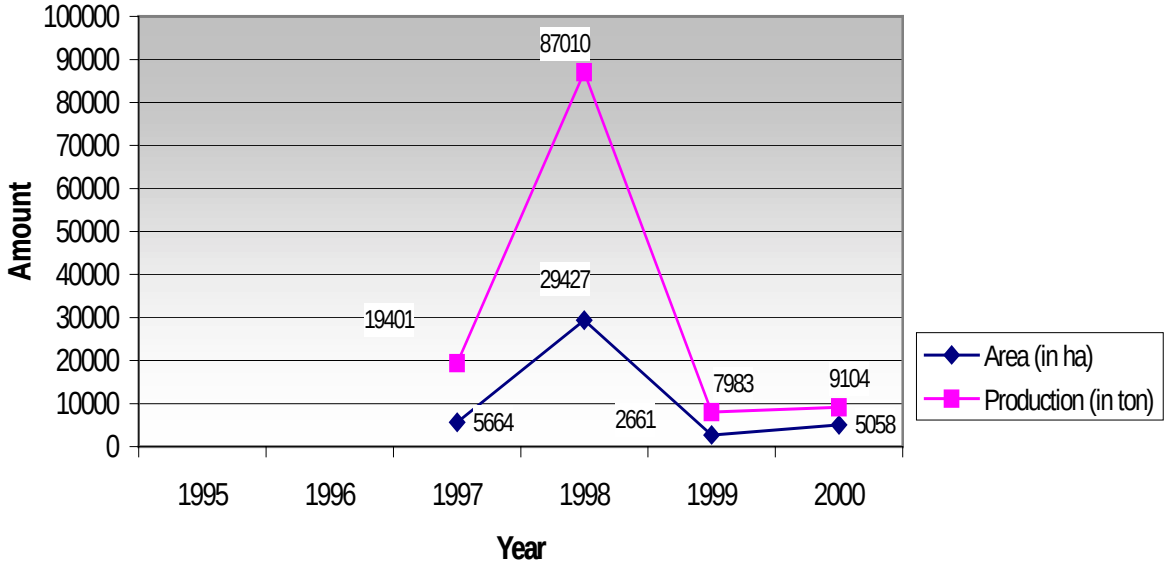


Figure 4.3. Graphic pattern of area and production of Paddy in Air Sugihan Sub District



For the farmer's consumption, *Sonor* rice production play an important role as it shows in the Table 4.5. At Mesuji, the rice production from *sonor* system was mainly used for own consumption. They could store the rice for three, or even four years. After then, their food consumption will be supplied from purchasing, and a few, from upland cultivation.

The average land *sonor* cultivation in Sugihan is the largest, which is 12.8 ha per household. They, however, could fulfil the rice consumption for only one year. The Sugihan farmer is the poorest than other sites farmer. They have lack of capital and finance for seed purchasing and daily consumption. In the *Sonor* season, most of them were owed the money or seeds

from others and should pay it back after the harvesting time. Therefore, most of farmers sold their rice. As a result, *sonor* rice production could fulfil their rice consumption only for one year. After that, the source of rice consumption came from purchasing. For the transmigrant, they still could supply their necessity for food from upland, even in a small amount. But it is not applied in the local, since they do not have any appropriate land for that purpose.

It seems that their dependable of *sonor* production in farmer's livelihood is very high, especially for the local communities. The alternative source of rice cultivation is less. Thus the source of consumption from purchasing is very important.

Table 4.5. Sources of food consumption for the communities after *sonor* in1997.

Site	Sources of Consumption	Year			
		1998	1999	2000	2001
MESUJI					
Local	*Sonor*	100	100	100	50
	Purchasing	0	0	0	48
	Wet Rice Field	0	0	0	0
	Up Land	0	0	0	2
PAMPANGAN					
Local	*Sonor*	98	11	0	0
	Purchasing	2	70	83	80
	Wet Rice Field	0	13	13	13
	Up Land	0	7	4	7
SUGIHAN					
Local	*Sonor*	100	0	0	0
	Purchasing	0	100	100	100
	Wet Rice Field	0	0	0	0
	Up Land	0	0	0	0
Migrant	*Sonor*	50	0	0	0
	Purchasing	50	100	85	85
	Wet Rice Field	0	0	15	15
	Up Land	0	0	0	0

4.1.2 Forest extraction

Large-scale commercial logging in Indonesia started in 1967, when the government of Indonesia took control over the forest management of the country. They initiated a mechanism of concession for forest management to private owned companies. The distribution of forest area into private logging companies made Indonesia the world largest exporter of tropical timber and shipping nearly 300 million m^3 to international markets during the 1970s (Barr, 2001). In mid 1998, more than 69 million ha of forest had been distributed to 651 concessions (Barber and Schweithelm, 2000).

From the economic perception, this policy has really succeeded. Gross Foreign Exchange earnings from the forest sector rose from $6 million in 1966 to more than $564 million in 1974 (Barber and Schweithelm, 2000). Meanwhile, this policy, either direct or indirect has driven deforestation in this country. Over the outer islands as a whole, well over 20 million ha of natural forest have been lost over the past twelve years. This equates to an average overall deforestation rate of 1.7 million ha/yr for the period. Thus, in Sumatra, the total forest area has decreased from 23 million ha to probably less than 16 million ha (World Bank, 2001).

This logging activity has also influenced livelihood activities around the country especially in Sumatra and Kalimantan, which is the first target of forest exploitation since they had the largest stock of commercially valuable tree species and were close to Asian markets (Barber and Schweithelm, 2000). The logging boom has as much impact on migration as has illegal logging, which are still occurring now. Those two impacts have also triggered other impacts such as deforestation/forest lost, land encroachment, fires and others.

All sites show examples of poor forest practices both legal and illegal. Gradually, most of the forests, in particular swamp forests, became degraded land or agricultural land. These degraded swamp forests are mostly covered by *Gelam* (*Melaleuca cajuputii*). Currently, *Gelam* become alternative species for logging activity at the entire sites. The swamp reclamation for other land use such as transmigration and plantation also influenced the physical condition of swamp area since its water table level has been decreased so that high prone to fires in dry season.

4.1.2.1 Commercial logging in Mesuji site

There is a change of pattern from high value timber to low value timber in logging extraction at the Mesuji Site as it shows in Table 4.6 about the rank of extracted species over time.

Before the 1950s, the Mesuji people used timber for their own consumption, such as for house construction and boats (*Klotok*). When small-scale commercial logging started in 1952, Terentang (*Camnosphera* sp) and Prupuk (*Lophopetalum javanicum* Turz) were the most wanted species because of the high prices and demand. In the 1970s to 1980s, after the presence of private logging company with their Forest Concession Holder (HPH), Meranti (*Shorea* sp.) has become the most hunted species. The demand of Meranti was high because the company used it for export purposes and this also caused the price of Meranti increased at that time.

In the mid 1980s, most of the high value timber started to decrease. In general, uncontrolled logging and conversion of some of the forest area to transmigration settlements and plantations, either direct or indirect, also caused the deforestation in this site. Besides that, the fires that occurred from *sonor* activity also accelerated the fast deforestation at this site. After 1990, only *Gelam* (*Melaleuca cajuputii*) and some low value timber species existed at this site. *Gelam* is also well known as a species that relatively resistant when fire occurs in the secondary growth forest.

Table 4.6. Rank of timber extraction in Mesuji site over time.

Species	1951-1970	1971-1980	1981-1985	1986-1990	1991-2000
Gelam	-	-	5	2	1
Meranti	3	1	1	-	-
Prupuk	2	3	3	-	-
Menggeris	4	4	4	1	-
Terentang	1	2	2	-	-
Others	5	5	6	3	2

The rank number shows the popular species that were exploited by loggers. One refers to the most popular and six refers to the least popular.

The decrement of wood sources pushed them to extract *Gelam* (*Melaleuca cajuputii*) as an alternative species for logging activities. Thus, *Gelam* has also been decreasing since the 1990s because of the over exploitation and the problem with regeneration of *Gelam* due to the burning for *sonor* cultivation.

4.1.2.2 Commercial logging in Pampangan site

The pattern of forest exploitation at Pampangan is similar to that at Mesuji site. There is a change from exploitation of high timber value to low value timber. Deforestation has become the main reason for this.

Formerly, Pampangan community cleared the forest to develop upland crops and rubber garden. They only used timber for their own consumption, such as house construction and other purposes. In the 1950s, most of the dry forests were converted into rubber garden and they started to exploit the swamp forest.

In the 1960s, swamp forest began to be extracted in commercial ways as Table 4.8 shows the rank of timber extraction over time. From the first time the commercial logging was started, Meranti (*Shorea* sp.) was the most important species, followed by Prepat (*Combretacarpus rotundatus*). Their rich presence had become a major interest for loggers to extract; in addition they had the high price and market demand. The other species were Ramin (*Gonytylus* sp), Terentang (*Camnosperma auriculata*), and Geronggang (*Cratoxylum arborescens*).

Table 4.8. Rank of timber extraction in Pampangan site over time.

Species	1961 -1980	1981 -1985	1986 - 1990	1991 –1995	1996 - 2000	2001
Gelam	-	-	-	3	3	3
Meranti	1	3	-	-	-	-
Prepat	2	1	1	2	2	2
Others	3	2	1	1	1	1

The rank number shows the popular species that were exploited by loggers. One refers to the most popular and three refers to the least popular.

But, since the mid 1980s, Meranti has disappeared due to the uncontrolled logging and the fires that occurred in swamp areas. Relatively, since the mid 1980s, most of the forest has disappeared and the logging activity was only collecting the burned and sank wood without specify the species. Recently, the only standing species are *Gelam* and Prepat. Prepat especially found in the unburned parts and the areas where *sonor* were not practiced. *Gelam* (*Melaleuca cajuputii*) has been sought since the 1990s, but its demand is low, especially at present. While, Prepat is still being extracted in some small parts of the site, such as in Lirik Village.

Currently, most of the community are only extracting some timber species in the dry land that was planted together with the rubber plantation such as Jelutung (*Dyera costulata*), Seru (*Schima wallichii*), Sungkai (*Peronema canescens*) and Pulai (*Alstonia* sp).

4.1.2.3 Commercial logging in Sugihan site

Similar to other two sites, the pattern of timber extraction in Sugihan has also change from the high value timber to the low value timber. The migration of Bugis people started and had triggered the logging activity in Sugihan in the 1970s. After that, many people followed them by establishing many sawmills along the Sugihan River. They brought the worker from outer site, particularly from Java. This activity had also attracted the local people to work on the forest extraction, while they also still practiced the fishing for their daily income.

Meranti (*Shorea* sp), Ramin (*Gonystylus bancanus*), Pulai (*Alstonia pneumatophora*) and Terentang (*Camnospermum auriculatum*) were the most valuable species in this site so that the loggers mostly extracted those species. Table 4.9 shows the rank of extracted species over time. From the beginning, Meranti was the most wanted species for the loggers because of its high price. In the 1980s, the decrement stock of Meranti increased the price of Ramin and made Ramin became the most wanted species for that time.

Table 4.9. Rank of timber extraction in Sugihan site over times.

Species	Before 1970	1970 – 1980	1981 - 1990	1991 - 1995	1996 - 2000	2001
Meranti	1	1	2	1*	1*	-
Ramin	2	2	1	1*	1*	-
Gelam	-	-	-	2	2	1
Others	3	3	3	1*	1*	-

The rank number shows the popular species that were exploited by loggers. One refers to the most popular and three refers to the least popular.

* = Burned and sank wood

In 1970, the Government of Indonesia issued the policy No 21/1970 about Forest Concession Right and Forest Product Harvesting Right. In 1978, since the status area was determined as production forest, the whole areas at Sugihan site were divided into concessions for some companies, such as PT Daya Penca, PT Sribunian Trading. Co, PT Wijaya Murni, and PT Famili Jaya. Recently, only PT Sribunian that still has the right concession at this site. That policy had also illegalised the smallholder logging activity at this site. In 1986, military and

forestry office's repressive action chased them away and destroyed almost all sawmills. Since then, the smallholder logging activity was decreased.

However, the high value of timber has decreased since the late of 1980s. The uncontrolled logging and also the fires that caused by *sonor* activities for years has deforested the area and decreased many number of high value timber species. Gradually, since the 1990s farmers have extracted the low value timber.

Recently, a few logging activities –they are still implied as illegal loggers- only seeks for the burned and sank woods. They don't specify the species because the standing tree is difficult to find except the *Gelam*. *Gelam* and shrubs have dominated the swamp, and most of the community work for *Gelam* extraction until now. Since 2001, *Gelam* has become their main source income, since the demand has increased.

4.1.3 *Gelam*/ Swamp paper bark (*Melaleuca cajuputii*) extraction

Gelam or swamp paper bark (*Melaleuca cajuputii*) is one of the specific species that occurs in coastal freshwater swamps area, both on mineral soils and moderately deep peat (van Steenis, 1938) and commonly it is a secondary growth tree especially in swamps that have been disturbed, for instance by clearing and fires (Figure 4.4). As shown in the study sites, *Gelam* is the pioneer tree that could growth extensive after the fires. Gelam is single species stands in the areas when fire often prevents the natural succession and instead Gelam develops extensive, because Gelam relatively resistant and its roots can reach the mineral soil beneath the peat (Whitten *et. al*, 1987).

Most of *Gelam* forests are widely exploited for commercial purposes by local communities. *Gelam* extraction at the study sites mostly resulted from the deforestation of swamp forest. The decrease on the amount timber at the sites has caused the use of *Gelam* as an alternative for wood supply.

Gelam extraction in Mesuji started in the 1980s. At that time they could still found the *Gelam* with the diameter above 20 cm. They extracted *Gelam* for sawn timber. But, similar to other previous species, the rapid logging activity has decreased the amount of the trees. As a result, in the 1990s, only small size diameter of *Gelam* can be found. The demand for *Gelam* in Mesuji was relatively high. Meanwhile, in Sugihan, the community has extracted *Gelam* since 1991, but the demand was low.

Figure 4.4. *Gelam* (*Melaleuca cajuputii*), a secondary growth tree especially in swamps that have been disturbed, for instance by clearing or fires.

Commonly, *Gelam* is widely used for construction purposes and is also good for firewood. When *Gelam* is still abundant and the size is bigger, some of the community, especially in Mesuji, use *Gelam* for sawn timber. There are two types of *Gelam* form, in local name, which are *Dolken* and *Dompeng*. The type and size of it is described in Table 4.10. Dolken is a *Gelam* timber with diameter range from 2 to 7 cm and usually sale in pole form. It use for pulp and paper industry, roof construction and house construction. Dompeng is a bigger diameter (> 8 cm) of *Gelam* timber and usually use for sawn timber.

Table 4.10. Type and Size of *Gelam* wood in study sites.

Site	Type (Local Name)	Diameter (cm)	Length (m)	Purposes
Mesuji	*Dolken Kecil*	2 – 4	2	Roof Construction
	Dolken	5 – 7	4, 5, 6	Construction
	Dompeng Dolog	8 – 15	4	Sawn Timber
	Dompeng Log	>16	4	Sawn Timber
Sugihan	*Dolken*	6 – 12	4, 5, 6	Construction and Pulp

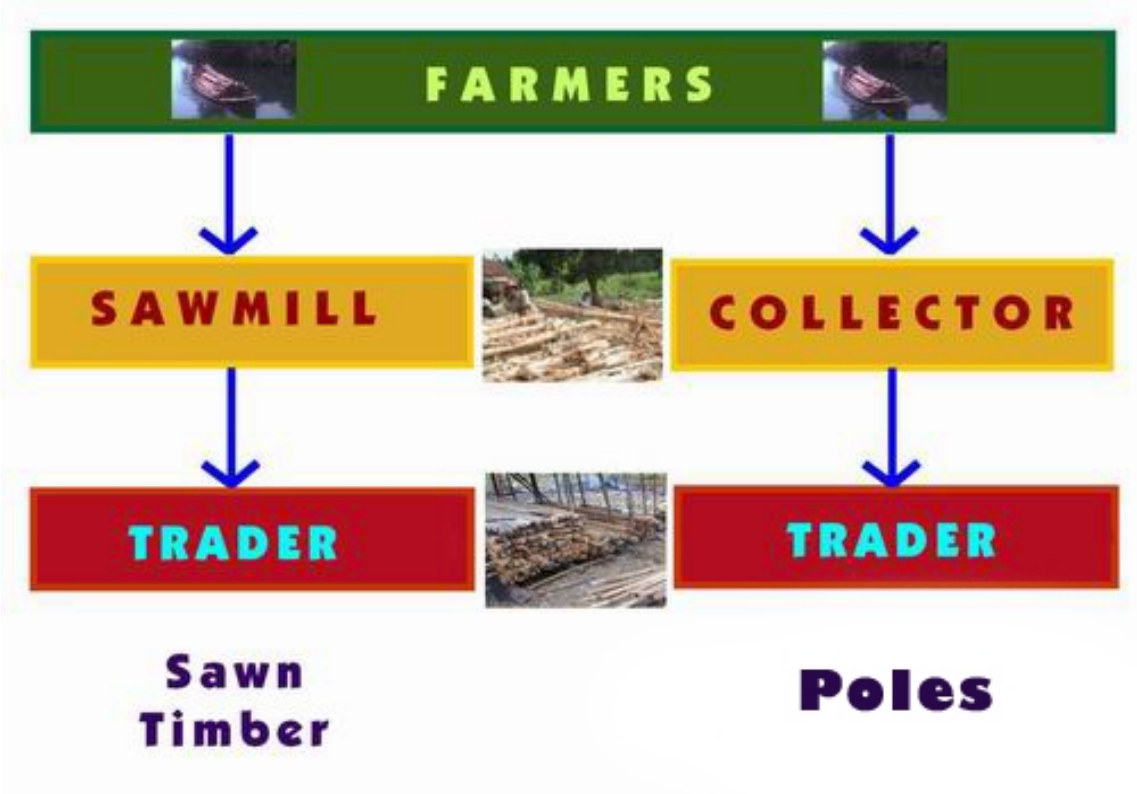
The *Gelam* exploitation usually was done by group of 4 to 6 people using a boat called "*Klotok*" for transportation (Figure 4.7). This boat could hold up to 100 logs of *Gelam*.

Usually they exploited the *Gelam* in wet season, since the increment of water level helped them for transported *Gelam* to the river. The amount of timber exploitation in wet season twice higher than in the dry season.

Figure 4.5. A boat that is used for *Gelam* transportation at Mesuji called *Klotok*.

Figure 4.8 shows a purpose-based marketing network of *Gelam* at Mesuji site and Sugihan sites. For sawn timber *Gelam*, most of farmers log the *Gelam* trees individually and sold it directly to the sawmill. The owners of the sawmill also often lend some money to farmers for the living cost during the extraction season. Farmers, however, must sell the timber to the sawmill owner with lower prices.

Figure 4.6. Diagram level of *Gelam* trading in Mesuji and Sugihan sites based on purposes.



The farm gate price for *dompeng* (a wood material for saw timber) is 150 thousand rupiah per cubic. The sawmills produce two types of sawn timber that is *reng*[2], rafter, and beam. The price of these three types of sawn timber at sawmill level is 300 thousand rupiah per cubic. The trader, however, differentiated the price of sawn timber based on the types that range from 500 to 600 thousand rupiah per cubic.

Since the *Gelam* wood material for sawn timber has been declined and many sawmills have been closed, the trading of *Gelam* wood is more for pole. Farmers sold the *dolken* (a pole with diameter 2-4 cm) to collector. The farm gate price is 500 rupiah per pole to the collector. Then, the collectors sold again to the trader at the price of 1000 rupiah.

Table 4.11. Price of *Gelam* at different trading level in study sites.

Type/Site	Selling Price/Level		
Dolken	**Farmers**	**Collector**	**Trade Agent**
Mesuji and Sugihan	Rp. 500/pole	Rp. 1000/pole	n.a
Dompeng Dolog	**Farmers**	**Sawmills**	**Trader**

[2] Reng is laths used to support or press down roof tiles

Mesuji	Rp. 150,000/m3	Rp. 300,000/m3	Rp. 500,000/m3 (*Reng* Form) Rp. 550,000/m3 (Rafter Form) Rp. 600,000/m3 (Beam Form)

4.1.4 Fisheries

Fisheries have played a significant role as a main source income for their daily live. In Sugihan, fishing activity is the main reason for the former community to came and lived along the Sugihan River.

The fisheries in Southern Sumatra is under an auction system (*Lelang Lebak Lebung*) that managed by Fisheries Service Office (*Dinas Perikanan*) and Local Government (PEMDA). The Dutch Colonial Government introduced *Lebak Lebung* Auction in the early twentieth century with the financial benefits going to local government (PHPAS and AWB, 1991). The government sets different rates for different area and give official government taxes on successful bidders. Based on the auction, the fish harvesting in a fishing area (river or lake), for period of one year is under authority of the auction winner (highest bidders). The auction winner should also responsible in distribution and marketing of fish from the rented area (Koeshendrajana and Cacho, 2001).

The winner could be personal or in a group. In some cases, it is subsequently sub leased to up to a dozen sub leasers who employ fishermen to harvest the area (PHPAS and AWB, 1991) or middlemen or small buyers who have previously covered that region and they split out the area into smaller parcels and rent these out to fishers (Koeshendrajana and Cacho, 2001). The fishermen employed receive a daily salary and percentage of the catch (PHPAS and AWB, 1991). For traditional fishers, they still allowed catching fish in that area, but if it is for commercial purposes, they have to sell the yield to the bidders or his/her sub leaser.

Figure 4.7. One of the floodplain lakes at Pampangan where is auctioned. This man using *Tajur* (Net), a common tool for fish catching.

The fishery in Southern Sumatra extends from the river to swamps area and floodplain lakes (*lebak*). The river and floodplain lakes contain water throughout year; especially in rainy season, and the swamp area tend to lose their water during the dry season. High water usually in December to January, receding water in March to May, low water in June to August, and rising water in September to November (Koeshendrajana and Cacho, 2001).

The fisheries production is followed that seasonal cycle. Based on interviewed, during the dry season, the decrement of water table level of swamp area has concentrated the water and also the fish, into some poles in swamp and easier for them to collected. On that season, they could reach up to 20 kg per day. Contrary in rainy season, they can only collect 5 kg per day. Fish production reaches a peak during June to September (PHPA/AWB, 1991). The seasonal difference of fish yields also describes from their income that could reach Rp. 300,000 per month during the wet season and it can multiply up to 2 to 3 in the dry season (Rusila Noor *et. al*, 1994 in Zieren, Wiryawan and Susanto, 1999). The spawning and breeding season that in early wet season and followed by rapid growth during the mid and late wet season (Zieren, Wiryawan and Susanto, 1999) could be one of the reasons why during the dry season the yield is increased.

Eventually, in the long drought season (El Nino season), for improving the access to those poles, they burn off the dry shrubs. The spreading fires also improve the areas that available for practicing *Sonor* activity on that season. On a small number of the study sites, fires were set to facilitate resource extraction, including fishing, deer hunting, honey production, wildlife habitat modification, and access improvement (Applegate, Chokkalingam and Suyanto, 2001). Some of these fires escaped into forestland, which in many cases was dry and susceptible to uncontrolled burning. Such forestland was largely regarded as open access areas.

Recently, the importance of fishery for the livelihood of Mesuji farmers have declined since the yield has been decreased for the last ten years. The Mesuji people thought that transmigration reclamation and development of some timber and oil palm plantation are the major causes for this problem. This development also has disturbed the water quality, especially in dry season that the water is more acidic and the groundwater is too saline and dirty for drinking. Reported that in JITU and PITU transmigration also have shown some problems associated with swamp reclamation such as saline intrusion to the groundwater in the dry season and the increment of acidity and turbidity of Tulang Bawang River (Giesen, 1991 in Zieren, Wiryawan and Susanto, 1999).

4.1.5 Charcoal production

At Mesuji site, charcoal is one of alternative source incomes for community. Since 1994, farmers have started to produce charcoal. In the beginning, the raw material for charcoal was resulted from timber residue at sawmills, and anyone was free to take this residue. Recently, however, *Gelam* wood is a major raw material for charcoal. The quality of charcoal from *Gelam* wood is better than other species.

Gelam wood residue and *Gelam* poles with "not good" shape condition are the raw material for charcoal production. They usually harvest *Gelam* in shallow swamp and produced charcoal around harvesting area. *Gelam* is extracted daily by charcoal producers. The farmers harvest around 10 to 20 poles of *Gelam* per day. After the extraction, they dig the chamber in swampland (2 m x 2 m x 0.5 m) for woods burning. Wood burning takes 2 full days for changed into charcoal. Commonly, 3 to 5 poles with 8 cm diameter and 5 m length could produce one sack of charcoal. The farmers sold it to the collector at the price of 5000 thousand rupiah per sack.

4.2 Off-swamp livelihoods

4.2.1 Food crops cultivation

Except for rice cultivation under the *sonor* system, food crops cultivation under different cultivation systems such as wetland rice (*sawah*) and annual food crops (*ladang*) has low importance at our study site. Most of local people do not practice wetland rice and annual food crops cultivations. Only a few, Javanese migrants at Sugihan site, practice the wetland rice *(sawah*) and the food crop *(ladang*) cultivation.

At Pampangan site, farmers plant food crops as part of the establishment of smallholder rubber plantation. Commonly, farmer can plant food crop such as rice, cassava, banana, etc, and intercrop it with rubber tree up to three years (Figure 4.8).

Figure 4.8. In a temporary upland in Pampangan site, the land is cultivated by cassava.

4.2.2 Rubber plantation

Rubber in South Sumatra was introduced between 1910 and 1920 (Gouyon, 1999). Boomed of rubber prices in 1909-1912 also led to rapid planting of Rubber in Indonesia, and recorded smallholders production increased from 150 tons in 1912 to 128,000 tons in 1925 (Noordwijk. e*t al*, 1995).

Rubber is the main source income for Pampangan communities. In the 1950s, most of the dry land area in Pampangan site was covered by rubber plantation. The rubber farming system at this site sometimes is called 'jungle rubber' because wild woody species were also allowed to grow among the rubber trees, which may help protect the rubber from weeds. The rubber trees were planted intercropped with other tree such as Petai (*Parkia speciosa*), Duku (*Lansium* sp), Aren (*Arenga* sp), Seru (*Schima wallichii*), Cempedak (*Artocarpus* sp), Durian (*Durio* sp.) and Tampui (*Baccurea griffithiii*).

Figure 4.9. Rubber plantation in Pampangan. Most of the gardens are more like a jungle rubber/complex agroforestry, which were planted together with other trees.

Annually, in a hectare, the rubber plantation can produce approximately 2000 kg of wet latex (slab) in average. Assumed that the number of week for tapping in a year is 44. With 70 % reduction of water content, the Dry Rubber Content at Pampangan site, annually, can reach 600 kg in average. This amount could be less in connection to the less of taping days in a year. This is because the tapping period is influenced by the climate. In dry season, the intensity for tapping is high (6 days a week) and it could produce more latex than rainy season (less than 5 days per week). But, in long dry season (El Nino), latex production is decreasing and influenced to their source income.

Purchasing system for latex is through the broker and auction. Recently, the high price in auction system has made most of the farmers sell their production in auction moment instead of the broker. Through the auction, a kilogram of wet latex (slab) could be paid about 1200 to 1500 rupiah per kg.

4.2.3 Lemon plantation

In the mid 1980s, Agricultural Research Office at Pangkalan Lampan introduced a pilot project of lemon plantation at Pampangan Site. Since that time, some farmers were interested to plant lemon as a new alternatives tree crops. However, because of the high cost of establishing and crops care, the area of lemon plantation is very small. Our key respondents estimate that the area of lemon plantation is only 10% of the total tree crop plantation.

Lemon can be harvested at the fourth year after planting and it can be harvested every year up to 8 year. The average production is 4-5 ton per hectare per harvesting season. Usually farmers sold the lemon (un-harvested) at the field. Based on the estimation of lemon production, traders offer a biding to buy lemon. The average price of lemon is 14 million rupiah up to 30 million rupiah per hectare.

4.2.4 Emigrant labour

Since the forest at our study sites has been degraded, the Mesuji and Sugihan farmers have moved temporary to others areas to log the forest. Commonly, they worked as a group. This new livelihood becomes very important for the community, since the forest has degraded and the yield of fishing has also diminished. Income from *sonor* also only contributes for every 4-5 year cycle. For the transmigrant at Sugihan site, the poor quality of land is a main reason for them to be a migratory worker. This livelihood, however, may create other degraded areas in other places. Riau and Jambi Province are favourite places for them to do the logging, either legal or illegal. Besides logging, they also work in oil palm plantation and mining extraction.

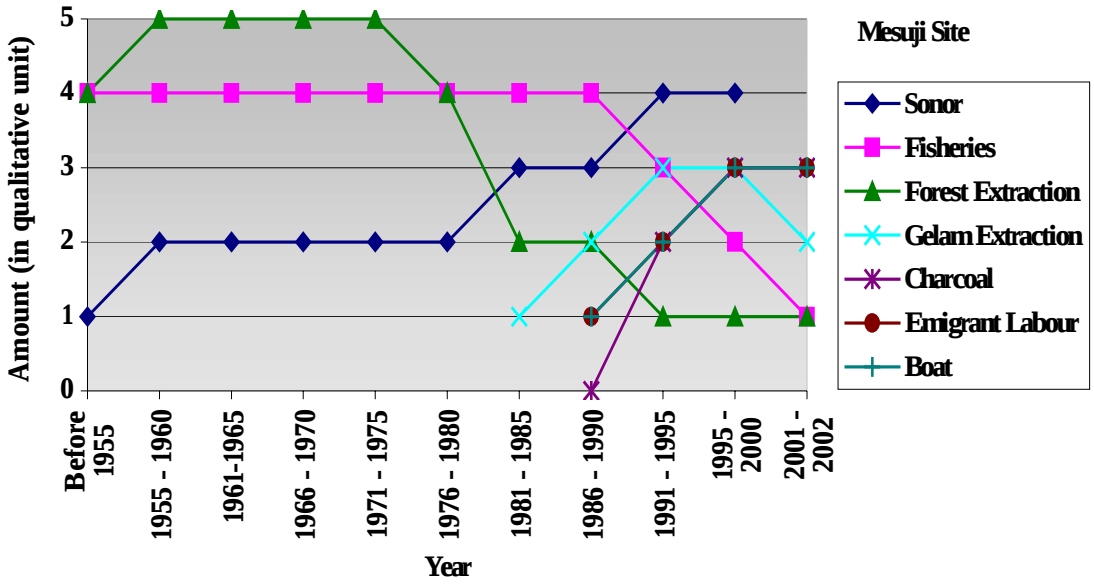
5. LIVELIHOOD IMPACTS

The main focus of this study is to have a better understanding of community's livelihood activities related to the swamp management. Figure 4.1, 4.2 and 4.3 show the trends of relative importance of livelihood types for each study site. Qualitative measurement and a five-year range of time were used. Ranking of relative importance is classified as: (1) Very low; (2) Low; (3) Average; (4) High; and (5) Very High.

5.1 Mesuji site

Before 1955, fishing was the most important source of livelihood for Mesuji community. The abundance of swampland supplied a lot of amount of fish. In 1955, however, the Mesuji people have started to log the forest for commercial purpose. From 1955 to the early 1980s, the commercial logging activity became the most important livelihood, while fishing became the second rank. The importance of commercial logging activity, however, has decreased since the early 1980s. At present, the importance of commercial logging is the lowest. The high deforestation rate, mainly a conversion of swampland for transmigration settlement and establishment of timber and tree plantation in the early 1990s caused the decrement of importance of commercial logging at this site. It is predicted that the conversion has also influenced the yields of fishing. At present, fishing has become the second lowest important of livelihood at Mesuji site.

Figure 5.1. Graphic of livelihood trends in Mesuji site



The livelihood of Mesuji community is mainly based on traditional rice cultivation called the *Sonor* system. Until 1980, the importance of *sonor* was relatively low compare to other livelihood types. Since the 1980s, however, the importance of *sonor* has increased and it became the major livelihood of Mesuji people. It is understandable since the log over area of forest has increased; it gave more access for farmers to practice *sonor*.

The ecological change of swamp forest in this site due to high deforestation and high development, has not only changed the relative importance of livelihood types, but also created new livelihood types. The first new livelihood type is *Gelam* trees extraction. During the fallow period, the swampland regenerate and *Gelam* (*Melaleuca cajuputi)* trees are becoming the dominant species. The fires have facilitated the regeneration and expansion of areas of *Gelam,* a fast growing species that responds positively to the disturbance. The importance of *Gelam* extraction was increasing during 1976 to 2000. Recently, however, the relative importance of this new livelihood has decreased due to the small number of mature *Gelam* trees.

Gelam trees can also used for charcoal. Since the late 1980s, farmer has produced charcoal from the *Gelam* trees. The importance of charcoal production has increased since the mature or bigger diameter *Gelam* trees become rare and only smaller diameter *Gelam* trees are available. The small diameter *Gelam* trees are more appropriate for charcoal production than for sawmill or plywood.

An important new livelihood due to a degraded of natural resources is emigrant labour. Since 1985 until now, people in this study site often have been working as a group to log the forest at outside of their settlement. This new livelihood becomes very important for the community, since the forest has degraded, the yield of fishing has also diminished and they can only cultivate *sonor* for every 4-5 year cycle. This livelihood, however, could create other degraded areas in other places.

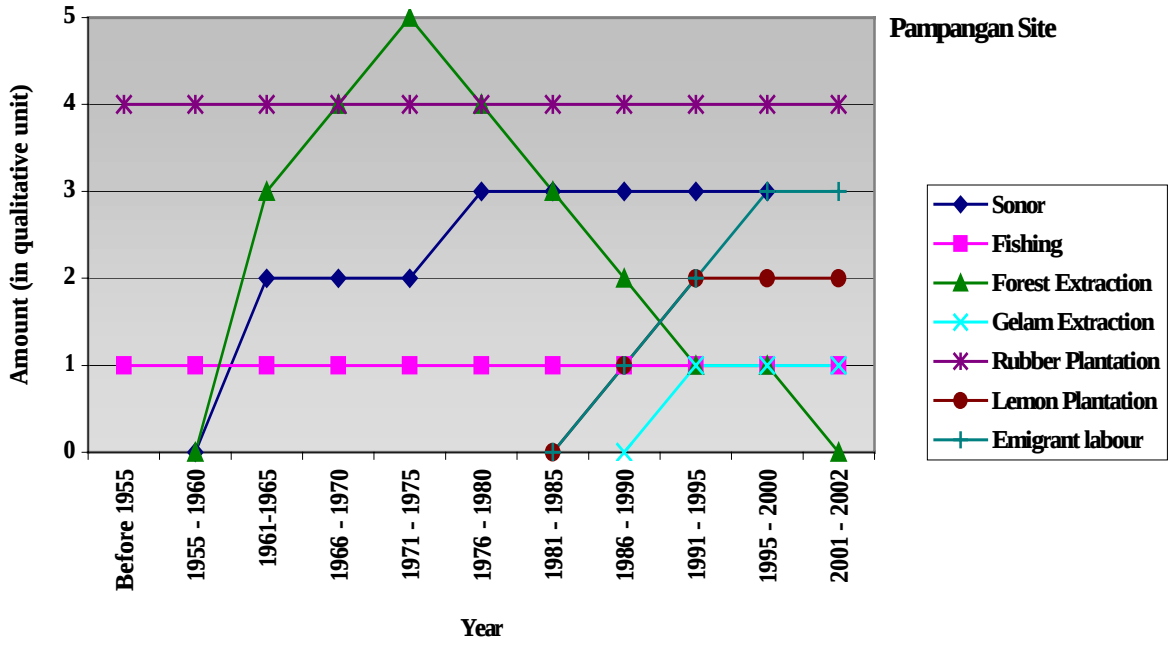
5.2 Pampangan site

Pampangan site is situated in both dry land and swampland. Most of the dry land is covered by rubber plantation. Rubber is main source income for the community in all year. Figure 4.2 shows that since long time ago rubber has been a stable livelihood for them. Commonly, the rubber gardens are inherited from their parents. The rubber farming system at this study site

sometimes is called 'jungle rubber' because wild woody species also are allowed to grow among the rubber trees, which may help to protect the rubber from weeds.

Since most forest in dry land was converted to rubber, the swamp forest has become the major source of wood material. Logging for commercial purposes started in the 1960s. Since then the logging had become the most important source of income, similar with rubber. The importance of logging for farmer's livelihood has declined since the mid 1970s. Uncontrolled and poor logging practice predicted as the main factor for that decrement. At present, no more farmers practice logging for commercial purpose due to a degraded of swamp forest.

Figure 5.2. Graphic of livelihood trends in Pampangan site.



For Pampangan communities, their dependable to *sonor* is not as high as the Mesuji. The share income from rubber is more important. The limited areas for *sonor* also become other reason for not using *sonor* as their main livelihood. Commonly they only cultivate 1-2 ha of swamps area for *sonor* practice. In contrast, they ranked *sonor* in the first place for their source income in the long dry season that usually happen in five years. This predicted because the income from rubber usually decrease in the long dry season, since the latex production is declining. Commonly, rice from *sonor* is mostly used for their own consumption.

Even *Gelam* (*Melaleuca cajuputi*) also dominates the swampland, but in Pampangan site, *Gelam* extraction is relatively low. Most of the existed *Gelam* are relatively low diameter. It is predicted because of the repeated fire in swamp area and made the *Gelam* could not grow more bigger. Beside that, the remote and hard accessibility of *Gelam* extraction areas is also

influenced the Gelam trading in this site, since the transportation cost is higher than the average cost of *Gelam* itself.

The swamp forest at this site has also degraded, resulting people to work as logger in outside the villages. Approximately, about 50 % of the household (mostly men) work outside the site (emigrant labour) as a logger. Their rubber trees usually tapped by their wife or other family members and used for their daily income.

The others source income are lemon plantation and fisheries. Lemon plantation that started in 1985 shows the low increment because the cost of establishment and crop care are relatively high. In Pampangan site, at present, lemon is the third rank of community livelihood after the rubber plantation and emigrant labour.

The importance of fisheries in the livelihood at site is low. The fisheries area is only lake, since there is no big river in our study site and most of the small river is already get dry. The fisheries activity as a source income is under Lebak Lebung auction, the common system for fisheries in Southern Sumatra, and only the winner could work in the winning area such as lebak (lake) or river. In Pampangan, only small communities lived from fisheries because of the high cost for winning the auction. Traditional fisher folk are still allowed to harvest fish in the area for subsistence purposes only. Usually they joined with the winner and sold the yield to him.

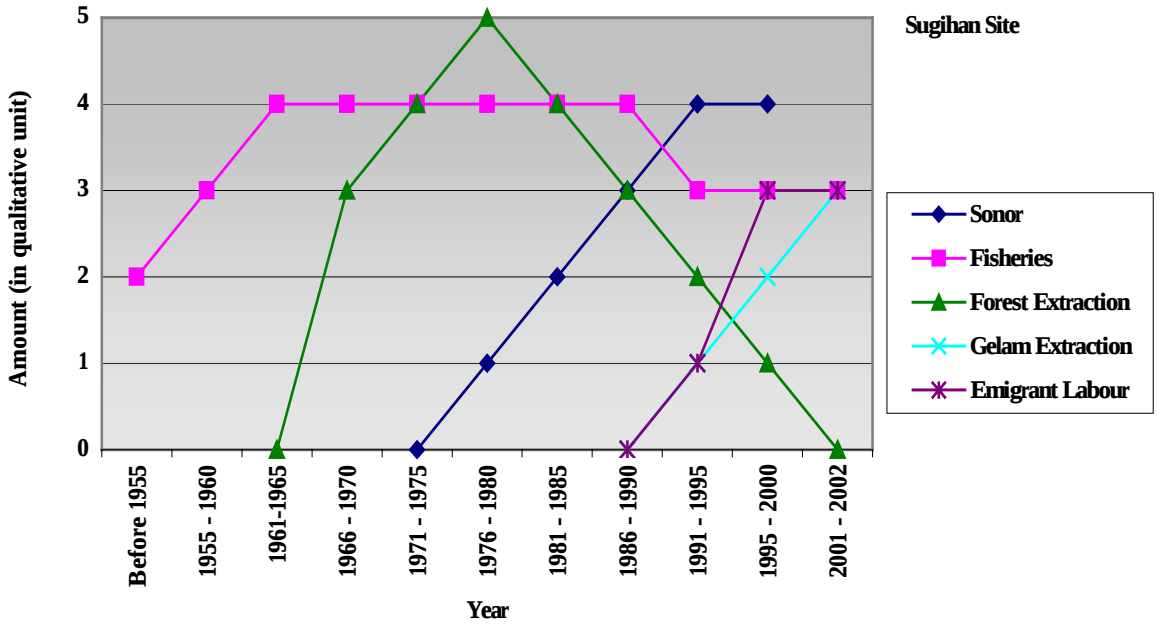
5.3 Sugihan site

In Sugihan, fisheries are the oldest livelihood for the local community. They have been doing it since a long time ago. It was also the main reason for their migration to this site (Inbox below). At present, fishing still becomes their main livelihood in regular year even the yield has decreased. It has been declining since the mid 1980s, when the swamps were reclaimed and the canals were established for development of transmigration and also for logging transportation.

Their livelihood was changed in the early 1970s along with the migration of loggers into this site. Since that, the population had increased and as the main purpose for migration, logging had been their main activity up to the 1990s. Uncontrolled logging both smallholder and companies with concession right had fasted the deforestation and directly decreased the population in this site.

Sonor in Sugihan, similar in other sites, is done after the long drought season. The importance of *sonor* in Sugihan site has increased since the 1980s. On that time, the logging activity has started to decrease and the deforested area has opened access to extent the *sonor* area.

Figure 5.3. Graphic of livelihood trends in Sugihan site.



Since the demand of *Gelam* has increased for the last two years, this new livelihood has become a new source income for people in Sugihan site. Extensive *sonor* area has regenerated the wetland forest and *Gelam* become a dominant species after the fallow period in this site. With variant of diameter, *Gelam* in Sugihan become most wanted species after the previous logging activity has over. Actually, the income from *Gelam* could improve their daily need, but the demand on *Gelam* that could not be predicted is become another risk factor for the local community in Sugihan.

For transmigrant community at Sugihan site, the changing of their livelihood pattern is connected with the land fertility. In early years, the transmigrant planted annual crops in their first land and their second land was still covered by forest. At that time, they exploited the timber from the second land and sold it to sawmills. In 1984, almost all the first land had already proceeded and they started to precede the second land. By then, in 1990 the whole areas had proceeded and planted. At the same year, their lands were flooded for 2 months. As a result, the lands were infertile and poor, since the acid were increased and difficult to plant. That derived the high migration from their villages to other places to finds another livelihoods

as a emigrant labour, or even, to return to their homeland in Java. Most of emigrant labours are working as a mining labour in Bangka Island and as logger in some places such as Jambi and Riau Province. As a result, their neglected lands have caused pest attacks and failure harvests to others who cultivated their land.

With those conditions above, *sonor* becoming important source income from the communities in Sugihan, both local and transmigrant. Both local and transmigrant were ranked *sonor* as their first income in long dry season, and their dependable to *sonor* is as high as the Mesuji people.

Inbox 1. From fishing to logging

Harun Husni, 70 years old, is one of the pioneers who came into Sugihan. In 1975, he won the lebak lebung auction -a common fishing system in South Sumatra- in Baung River and brought his family to there for fishing. The Bugis people came in 1977 – 1978 and developed sawmills along the Sugihan River. This was stimulated him to do the same thing, as he saw that the logging activity was more easier for reached the money. Soon, he started developed canals for logging transportation and built a sawmill in 1982. He concentrated on this and took more profit from logging activity instead of fishing. In 1985, the government with military force destroy the "illegal" sawmills along the Sugihan River and caught the actor who involved in this activity. He also became one of the targets, since he owned one of the big sawmills in here. He was escaped and fled from his house for months, to avoiding the caught. When he came back, his sawmill has been destroyed, but he insisted and tried to build a new sawmill until 1989. The decrease of timber source is one of reasons for him for closing the sawmill, beside

6. CONCLUSION

The swamp areas at our study sites have been degraded due to unsustainable of livelihoods activities. The degradation of swamp areas turns farmers to adjust their livelihoods. The relative importance of livelihoods as sources of income has been changed dramatically, include a new livelihoods created to respond on the change of natural resources.

Sonor become more important source of income for communities. The area of *sonor* has also broadened as increasing access and availability to log over forest. For the last twenty years, uncontrolled forest management at the study sites has caused the fast deforestation. Both legal and illegal logging[3] actors were applied poor forestry practice and ignored the sustainability of swamp forest. As a consequence of extended *sonor* areas, the negative impacts on environment (smoke/haze) have increased. To address this problem, improving land management to more sustainable land management is a key for addressing the policy issue.

Improving land management of *sonor* system through longer period of fallow by maintenance of Gelam (*Melaleuca cajuputi*) to reach mature production could be an alternative sustainable land management in wetland area. The *gelam* plantation, however, seems not attractive for the farmers because of less profitable than the existing land practices. To increase the attractiveness of the *gelam* plantation, the environmental services provided by the new option need to be valued. In this case, *gelam* plantation provides a carbon sequestration that can be contributed to reduce a global warming.

The carbon fund mechanism could be an alternative policy option for the government to value the stock of carbon (Gelam) that will be provided/planted by the farmers at the sonor-practice areas. One of the potential sources of fund on environmental transfer is the Clean Development Mechanism (CDM). Negotiations about the eligibility and protocols for carbon sequestration projects to be recognized for carbon credits within the Kyoto Protocol are in progress.

[3] Illegal logging takes several forms, including cutting in protection forest, over cutting or cutting by third parties in concessions, violation of Government of Indonesia regulation regarding concession operations and using clear felling permits (IPK) that were issued for other location (World Bank, 2001). It can be done in small or big scale parties such as: companies, smallholders or communities.

The Indonesia government has been progressing to establish national CDM for forestry, including determining the institutional framework and transfers mechanisms for local community or firm who eligible to obtain compensation under the carbon credit scheme. The study of national CDM also includes identifying other sources of money (non Kyoto fund). One of potential sources of money is likely to be the national reforestation fund. The mechanisms of using this fund need to be explored.

Through reviewing the national CDM framework, the more in depth study is required to examine more specific questions on transfer mechanisms such as how will the payment be made to the communities, how often is the payment to be made, who will make the payment and who will administer the payment.

7. ACKNOWLEDGEMENT

The support of the European Commission through a research grant to determine the underlying causes and impacts of fire in Indonesia is gratefully acknowledged. The research results reported here is part of that study. We are grateful to……..for their insightful comments, Danan P. Hadi for providing maps and Wiyono for the amazing illustrations. We also thank Mufti Mubarak, Mamat Rahmat, Muhammad Nurul Iman, and Edwin Jonson for their excellent assistance during fieldwork. We are indebted to all communities for their patience, cooperation and hospitality in the field.

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