Government of Central Kalimantan

Government of Indonesia

Government of the Netherlands

Master Plan for the Rehabilitation and Revitalisation of the Ex-Mega Rice Project Area in Central Kalimantan






AGRICULTURE IN THE EX-MEGA RICE PROJECT AREA IN CENTRAL KALIMANTAN

Technical Report No. 5

OCTOBER 2008

Euroconsult Mott MacDonald and Deltares | Delft Hydraulics
in association with
DHV, Wageningen UR, Witteveen+Bos, PT MLD and PT INDEC

Master Plan for the Rehabilitation and Rehabilitation of the Ex-Mega Rice Project Area in Central Kalimantan

Technical Report Number 5

Agriculture in the Ex-Mega Rice Project Area in Central Kalimantan

Yusurum Jagau[1], Mohammed Noor[2] & Jan Verhagen[3]

1 University of Palangka Raya

2 Indonesian Swampland Agricuture Research Institute (Balittra)

3 Wageningen UR

Government of Indonesia

Royal Netherlands Embassy, Jakarta

Euroconsult Mott MacDonald & Deltares | Delft Hydraulics

in association with

DHV
Wageningen UR
Witteveen+Bos Indonesia
PT. MLD
PT. Indec

October 2008

Table of Contents

Chapter 1 Introduction

For centuries the Dayak population in Central Kalimantan settled along the river banks, making use of the swamp forests and peatlands. Local settlers and spontaneous migrants began to develop the downstream riverbanks and tidal swamps in the Ex Mega Rice Project (EMRP) area during the 1920s and 1930s followed by government-sponsored transmigration in the swamp and peatland interiors in the 1970s and 1980s. A 1984 study concluded that only some parts of Block A and D were still suitable for new development.[1] The remainder of the area consisted of deep peat (> 2 m) or was already occupied.

After the implementation of the Mega Rice Project (MRP) the livelihood strategies in the area changed dramatically and logging and mining in combination with agriculture became the main livelihood strategies, partly because the natural resource base has been marginalised. Currently, in the rural areas in Central Kalimantan, agriculture is the key livelihood strategy. Besides providing food, agriculture also contributes to economic development in terms of income generation and employment.

Rural poverty is high. A common picture in the area is that of a diversification of livelihood strategies away from agriculture to off farm income generating activities. Permanent or seasonal off farm employment is normally associated with a (temporary) migration towards urban centres such as Banjarmasin and Palangkarya. The success of this strategy depends on the absorption capacity of the urban economy to employ the newcomers. Rising food demand from urban centres also creates opportunities for agriculture. In fact agricultural growth can reduce urban poverty by lowering food costs and reducing rates of migration towards urban centres. Agricultural development can provide an impulse to poverty reduction in rural areas and accelerate economic growth via on- and off-farm employment.

For farmers to be included in the development of the region the planning process should take on a inclusive approaches relating to their livelihood strategies. In the master planning project a farming systems approach is used to combine both biophysical and socio-economic issues relating to the farm household.

In this report an overview of farming systems in the EMRP is given. The report deals mainly with biophysical issues encountered by farmers in the different environments in the EMRP area. Specific development strategies are provided at the end. More detailed work is however needed to provide tailored assistance to local communities and farmers.

[1] Nationwide Study of Coastal and Near Coastal Swamp Land in Sumatra, Kalimantan and Irian Jaya, Nedeco-Euroconsult-Biec, Directorate General of Water Resources Development, Ministry of Public Works, Indonesia, 1984

Chapter 2 Farming Systems

With agriculture providing the main livelihood of the rural population and food and raw material for urban populations and industries, investing in agricultural development is imperative for the economic development of the region. Paradoxically, however, economic growth and poverty reduction lead to declining relative importance of the agricultural sector[2]. How agricultural growth can be used as an engine for both economic development and poverty reduction will depend strongly on market forces and opportunities, the current farming systems including the biophysical, socio-economic and political boundary conditions.

Dixon et al. (2001)[3] define the farming system as a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate. Depending on the scale of the analysis, a farming system can encompass a few dozen or many millions of households.

Looking at farming systems can offer a useful framework for understanding the needs, challenges and market opportunities. Most agricultural development strategies focused on a single commodity (rice, oil palm, citrus, livestock) without considering the farming system. By doing so priorities and policies lacked the link with the most important decision makers, i.e. the farmers, and could not take into account the various opportunities linked to the different farming systems. Farm managers have to respond to environmental as well as market and policy changes and improve efficiency and income. Reducing vulnerability and increasing resilience of farming systems requires a strategy in which social-cultural, institutional and technical knowhow have to be combined. Improving farmer's skills is at the core of any strategy aiming to increase resilience of farming systems. It also requires a strong link of farm level management with science networks.

In the MRP with already a strong presents of cash crops like: fruits, coconut, rattan and rubber the link between farmers and markets is clear. However increasing income by taking advantage of market opportunities requires farmers to become better decision makers and better at competing in this market oriented environment. The emphasis on the market and the need of farmers to be competitive requires not only requires better management skills but also accurate and timely market information.
The resources used on which farmers draw, their choice of activities are strongly linked to the biological, physical, economic and cultural environment in which they find themselves and over which they only have limited control. While every farmer is unique, those who share similar conditions also often share common problems and priorities that transcend administrative or political borders. The challenge is to identify specific agricultural and rural development needs and opportunities, and to focus investment in areas where the greatest impact will be achieved. A farming systems

[2] Dorward et al., 2004. World Development Vol. 32, No. 1, pp. 73–89

[3] Dixon et al., 2001 Farming Systems and Poverty FAO and World Bank.

framework can help in understanding local factors and linkages and allow for aggregation of locations with similar development constraints and investment opportunities[4].

Forestry and agriculture are dominant in the area (see Economic Analysis of the EMRP Area) and changes in land use are mainly related to developments in these sectors. For agriculture, changes are partly embedded in the farming systems (i.e. the natural resource base, comprising land water and climate, and the potential to adopt new products and technology by farmers) and partly outside the farming systems and agricultural communities (i.e. trade liberalization and market development; enabling policies supporting institutions and public goods; and, information and educational services).

The external drivers of change are linked to the political, market and economic analysis. Policies at higher scales will try to create incentives for lower scale decision makers to achieve policy goals like food security, economic development, sustainable production, or more recently achieving the Millennium Development Goals and the reduction of greenhouse gas emissions. In agriculture, decisions are made at the farm household level or by the management of an estate or plantation. These are the pivoting points for the agricultural system. Decisions on consumption and production are made that directly affect the biophysical environment. It is the point at which the socio-economic domain and the biophysical domain come together. The process works both ways as revenues from agriculture will also feed back into the regional economy. The sustainable livelihoods approaches, used in the community analyses, advocates an integral analysis across scales and sectors to define poverty reduction strategies. We will focus on the farming systems and cultivation of crops and rearing animals linking to the livelihood approach and land and water management issues. Estate crops, i.e. oil palm, will be discussed but so far no large estates are established in the area, currently about five plantations started operations. Current aims and policies related to agriculture will provide the development orientation for the farming systems and estates. Several national initiatives already provide directions for the revitalisation of agriculture, fisheries and forestry. The most important is the *Revitalisasi Pertanian, Perikanan dan Kehutanan* (RPPK) program that started on June 2005 and which formulated five pillars as the basis for improvements in agriculture. These pillars are: (i) technology, (ii) infrastructure, (iii) finance and investments, (iv) extension and (v) improving the institutional setting. For horticulture (tree crops), a separate programme was launched in 2007 (Revitalisasi Perkebunan). Special attention is given to rice in the Peningkatan Produksi Beras Nasional (P2BN) which aims to increase rice production. The Percepatan Usaha Agribisnis Pedesaan (PUAP) programme provides financial aid (Rp. 100 million per village). The first phase targets about 600 poor villages.

We will focus on the contribution of agriculture to poverty alleviation and the provision of environmental goods and services. In general terms the role of agriculture in development and poverty reduction can be shaped around an increase in share on local and international markets or around the increase in yields via technological or institutional improvements depending on the root cause of poverty. Where in some areas poverty is strongly rooted in the local situation e.g. the natural resources base, and social, cultural and demographic aspects, other areas may be left behind in the market economy and technological advances. In the larger part of the study area the root cause is related to the local biophysical situation, resulting from previous large scale interventions.

[4] Dixon et al., 2001 Farming Systems and Poverty FAO and World Bank.

The farming systems are described in more detail in the following sub-sections. The main entry will be the crop with the largest contribution to the livelihood. Other on farm and off farm activities are also described to complete the overview of the current situation. Based on the natural resource base and socio-economic context recommendations aiming at improving livelihoods based on agriculture are formulated. For details on the hydrological situation we refer to the hydrological report.

Rice is mainly grown in the lowlands to supply food for home consumption but some is sold. The economic returns from these rice system are generally low, so many change gradually to tree crop farming system. For example, in the Kahayan Kuala sub-district, a coastal area, the farming systems has transformed to tree-based coconut farming systems. Rice is also grown in the higher upland areas (e.g. parts of block A), on the peat domes no rice is cultivated.

Agriculture in the project area is diverse ranging from cash crops to subsistence farming. Besides the emerging oil palm plantations, all farming systems have a diverse portfolio of crops or are have a strong livestock component. The main focus of the farmer is used to distinguish between the various farming systems. The dominant activity is however in most cases supported by other on and off farm activities. The farming systems in the region are described use the following categories (see Table 1).

Table 1: Farming Systems Categories.

Farming Systems	Principal Livelihoods
Rice Based	Rice, maize, pulses, sugarcane, oil seeds, vegetables, livestock, aquaculture, off-farm employment
Tree Based	Rubber, oil palm, coconuts, rattan, off-farm employment
Livestock Based	Rice, maize, oil seeds, fruits, forest products, livestock, off-farm employment

The regional distribution of the main farming systems is presented in Figure 1.

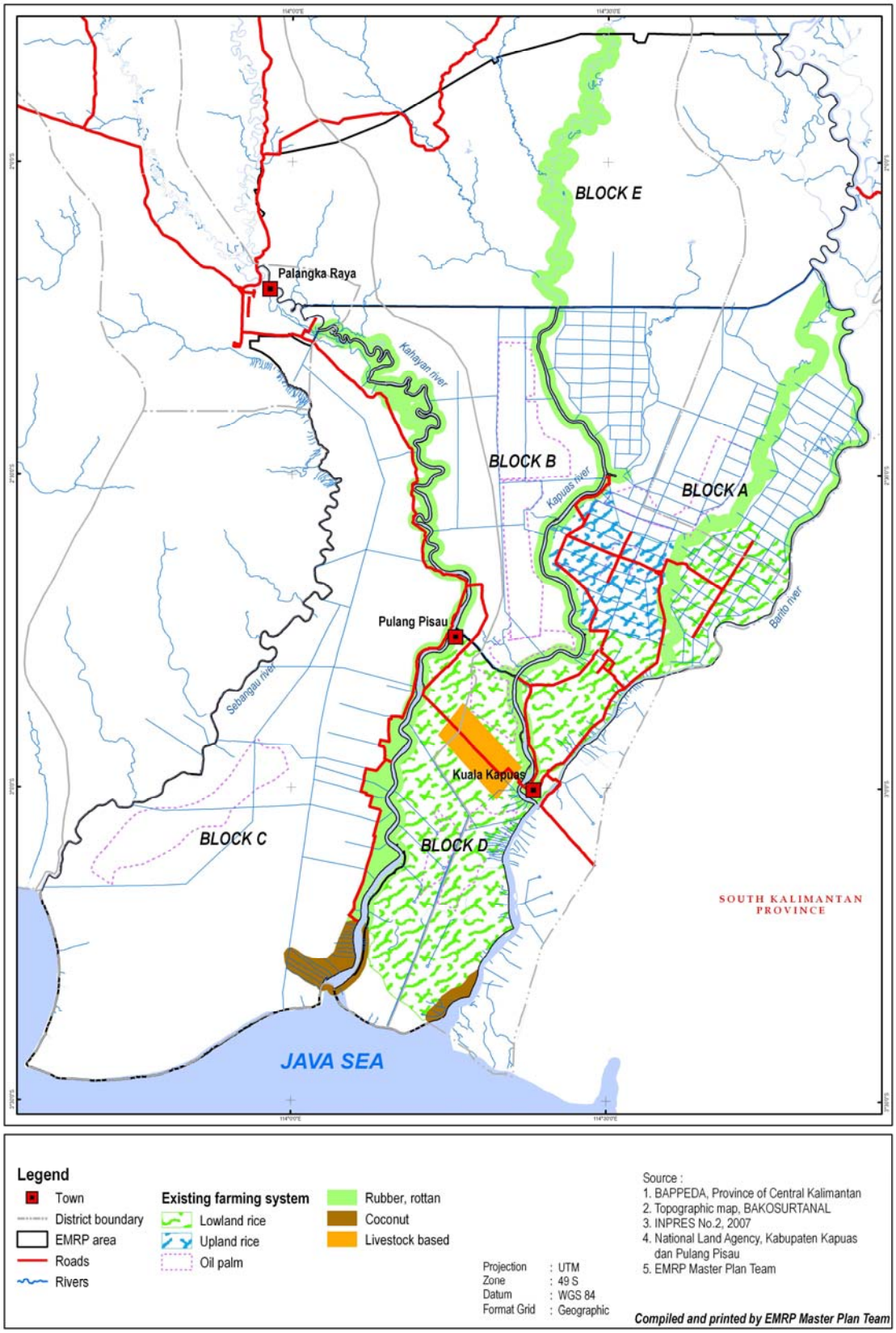

Figure 1: The regional distribution of the main farming systems

The on and off farm activities for each region completing the livelihood strategy are presented in Table 2.

Table 2: Major farming Systems of the EMRP area

Farming System	Dominant crop	Location	Principal Livelihoods
Rice based	Lowland rice	Dadahup / Petak Batuah	Lowland rice (mostly local variety and few modern high yielding varieties), banana, citrus, vegetables, livestock (chicken and goat), local fish (beje), off-farm work (construction work)
		Palingkau / Mampai	Lowland rice, rambutan, coconut, vegetables.
		Handil Rakyat (Kapuas Kuala)	Lowland rice (local and modern high yielding varieties), coconut, vegetables, off-farm work (construction work)
	Upland rice	Lamunti /Rantau Jaya, Manggala	Upland rice, cassava, vegetables (sweet corn, *bengkuang*, cucumber, longbean, chili pepper), fruit trees (jack fruit, rambutan), livestock (free-range chicken and goat) off-farm work (construction work)
Tree crop based	Rubber	Block E	Rubber, fish catching, hired labour for rubber tapping
		Mantangai	Rubber, fish catching, hired labour for rubber tapping
		Jabiren Raya	Rubber, rice, waged rubber tapping
		Jenamas	Rubber, rattan, fish (catching and beje), hired labour for rubber tapping
		Dadahup	Rubber, rattan, fish catching, hired labour for rubber tapping
		Pandih Batu & Maliku	Rubber, upland rice, cassava, coffea, vegetables, livestock (chicken, goat and cattle), off-farm work (construction work)
	Coconut	Bahaur	Coconut, rice, fish (catching and beje)
		Kapuas Kuala	Coconut, rice, fish (catching and beje)
	Oil-Palm		Oil-palm (two years old)
Livestock-based	Cattle and vegetables	Basarang	Cattle, vegetables (chili pepper, mustard greens), fruit trees (cempedak, rambutan, sallaca), pineapples, rubber

2.1 Rice Based Farming Systems

In the rice-based farming system two subtypes are distinguished: lowland rice-based and upland rice-based systems. The first is generally located near the coast in areas with tidal influence and areas that are regularly flooded. Both the lowland and the upland rice are rainfed. Rice is mainly grown for consumption at the farm level.

BPS Kalteng (2007) reports an average rice production of 2,4 $t.ha^{-1}$. The average yields for lowland rice in the area are slightly higher (2,8 $t.ha^{-1}$) but are still well below the national average for lowland rice (4,6 $t.ha^{-1}$). Rice yields in 2007 in Kapuas, Pulang Pisau and Barito Selatan, reached 2,9 t/ha, 2,8 t/ha; and 2,7 $t.ha^{-1}$ respectively. Rice yields as reported by BPS refer to the standing crop estimate at farm level excluding harvest and post-harvest losses, which will result in higher yield estimates that do not reflect the supply at consumer level[5].

Because the preference for low yielding (on average 1.5 – 2.5 $t.ha^{-1}$ yr^{-1}) local varieties, which require minimum external inputs (e.g. fertiliser, lime and labour) annual production is not always enough to fulfil household demand. As the local varieties require up to 10 months to mature there is no scope for a second rice crop. In some lowland areas high yielding varieties are grown allowing for a second crop.

2.1.1 Lowland rice

In the lowland rice-based systems the most common secondary crops are: rubber, fruit trees (e.g. citrus, rambutan), coconut, banana and vegetables (e.g. chillies, lettuce). Common practices are minimum tillage and the use of raised beds (sorjan system). In the latter system rice is grown in the sunken beds and the secondary crop (e.g. vegetables, banana, citrus) is gown on the ridges. During the dry season upland crops like corn, peanut, mung bean or vegetables (tomato, chilli, peper) are sometimes cultivated in the sunken beds. Corn, peanut, mungbean or vegetables (tomato, chilli, pepper) are sometimes cultivated in the sunken beds. The crop calendar for the swamp area is presented in Figure 2. Land preparation, seeding and transplanting are labour intensive in when using high yielding varieties. In Table 3 a typical layout of a transmigrant rice based farming system is presented.

Figure 2: Crop calendar for rice and horticulture cultivation in the EMRP.

Month											
Jan	**Feb**	**Mar**	**April**	**May**	**Jun**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1. Local Variety of Lowland Rice (1 time/yr)											
	/Trans planting/					/Harvest/		/Land preparation/		/Seeding/	
2. High Yielding Variety of Lowland Rice (2 times/yr)											
		/Harvest/	/Land Prep.+ Seeding/		/Trans planting/		/Harvest/			/Land prep.+ Seeding/	
3. Local Variety of Upland Rice (1 time/yr)											
		/Harvaest/		/Fallow/						/Land prep. +planting	
4. Horticulture (2-3 times/yr)											
/Planting/			/Harvest/	/Planting/			/Harvest/	/Planting/			/Harvest/

[5] Pantjar Simatupang and Timmer, 2008. Bulletin of Indonesian Economic Studies, Vol. 44, No. 1: 65–79

The local rice varieties are photoperiod or day-length sensitive. This is an important characteristic as it allows farmers to delay transplanting until April if water levels in March are too high. Because flowering is triggered by day-length rice plants that are transplanted at different times still flower and mature at the same time without strong effects on yields. This characteristic is also helpful in overcoming labour shortages during the planting period. But as crop mature at the same time it creates labour shortage during harvesting.

Table 3: Field pattern of a typical rice based farming system in transmigration areas.

Land Management	**Soil type**	
	Peat	Acid sulphate
House field (0,25 ha)	Banana Coffee Coconut Local Chicken	Tree crop Vegetable Local chicken Fish
Farm field I (1 ha) Sorjan/Sunken bed Sawah/Raised bed	Corn Peanut Long bean Citrus Rice (HYV–Local Var) Bean	Upland crop Citrus Rambutan Vegetable Rice (HYV-HYV)
Farm field II (1 ha) Sawah	Rice (Local var) Taro /Cassava Tree Crop/ Forest Crop	Rice (Local var) Tree Crop/ Forest Crop

Source: BALITTRA. 2001. 40 tahun Balittra 1961-2001. Perkembangan dan Program Penelitian ke Depan. Balittra. Banjarbaru.

The cultivation of local rice varieties is complex. Most striking is the land preparation, which is done via a type of slash and burn method during September to October. A scythe-like tool (tajak) is used to clear the land. The cut weeds are collected and composted or burned in the field and applied as fertiliser to the land before planting. Currently the use of herbicides to clear the land is increasing as burning has become illegal.

The seedlings are prepared in a triple transplanting from October to January. Transplanting is done in February - March and harvesting is in July - August. Except for green manure, hardly any other fertilizer in applied. During final transplanting, no definite plant spacing is required, 2 or 3 seedlings are planted at 30 X 30-cm spacing. Because of the initial relative high water level and the tallness of the local varieties during vegetative growth weed pressure is low and no weeding is required during the growing season resulting in a low labour demand.

Transmigrant farmers usually grow not more than one hectare of rice mainly for home consumption. Generally the yields from are very low about 1 $t.ha^{-1}$ occasionally yields can reach 3 $t.ha^{-1}$. Cause of the low yields are diverse - partly it is related to the low fertility and high acidity of the land but also pests like rice bugs, rats, birds and pigs are to blame. For example, during early planting the mole cricket (*Gryllotalpa* spp.) can wipe out an entire harvest.

In some areas two crops of rice are grown in a year, this is only possible using early-maturing high yielding varieties e.g. IR64, IR66, and Ciherang. In most cases the first crop is a high yielding variety followed either by a local or again a high yielding

variety. The high yielding varieties can yield up to 5 to 6 t.ha^{-1} provided the correct and timely application of inputs and management. These varieties are however not widely used because of the high labour and high input requirements. Because of the low economic returns farmers have no incentives to increase production.

Input levels are too low or imbalanced to achieve the high production levels. Input levels are however highly variable. In Block D (Manggala) farmers growing high yielding varieties are reported to apply about 800 kg lime, urea applications range from 50 to 200 kg per ha (equivalent to 25 – 100 kg N) and 0 – 300 kg SP36 (0 – 110 P_2O_5) per ha. None of the farmers applied KCL. Most farmers are at the lower end of the application range. Recommended amounts of urea for high yielding varieties are 180 – 240 kg (90 – 120 kg N) per ha. For SP36 this is 125 – 250 kg (45 – 90 P_2O_5) per ha. KCL recommendations range from 75 – 100 kg (45 -60 kg K_2O) per ha. Clearly farmers regard lime and N as crucial inputs but the imbalance with other crucial nutrients does not only reflect the high prices of these inputs but also shows the lack of knowledge at the farm level and the failure of the agricultural extension service.

Most of the harvested rice is used for home consumption and the surplus is sold as brown rice. Brown rice is also sold to middlemen who visit the farmers seasonally or from small cooperatives. The rice is polished and sold by these middlemen or merchants to retailers or directly to the consumers. The different market channels are presented in Figure 3. These middlemen arrive at the farms during harvesting, when prices are low. Also during this period farmers require cash to settle debts and buy inputs for the next crop. During the field visits in 2008 the reported price range for local varieties was between 2.300 – 2.500 Rp per kg, for high yielding varieties this was 2.100 – 2.200 per kg.

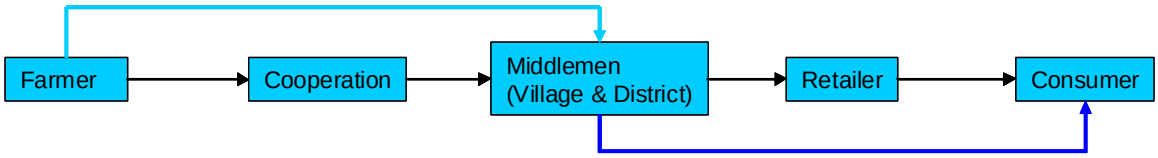

Figure 3: The main marketing channels for rice.

Other crops that provide an important source of income are banana, coconut, citrus, vegetables, corn, cassava and peanut. Most products are sold directly by the farmer at the local market. Selling products from home gardens is especially important in the transmigration area. Crops are grown after or intercropped with rice. The yields are generally low e.g. corn 0.5 – 1 ton.ha^{-1} dry grain, peanut is about 1.0-1.4 t.ha^{-1}; and cassava 6.0-8.0 t.ha^{-1}. Most vegetables like longbean, tomato, eggplant, cucumber, and also fruits are planted near the home-stead garden (about 0.25 hectare per household). In general cropping patterns in the transmigrant areas are more complex, combining rice, uplands crops, horticulture as compared to local farmers who mainly limited activities to rice and tree crops.

In the transmigration area of Sekata Bangun in Mantangai subdistrict the average household is about 1 to 3 persons with a combined annual income of Rp.4,235.200. About 33% of this income was derived from selling products (livestock, fruits and vegetables); 66% came from bartering food crops (rice, corn and cassava); the remaining 7% was earned via off-farm labour (mainly construction work).

For Petak Batuah (see Table 4) a higher total income is reported and a notably higher share of off-farm labour. Also the relative high labour requirements are clear.

Table 4: Contribution of Various Activities to Total Income for Rice Based in farming system. in Petak Batuah Village, Dadahup A5, Kapuas, Central Kalimantan.

No.	Activity	Income		Cost of Employment	
		Value (Rp)	Proportion (%)	Physical (DW)	Value (Rp/DW)
1.	Food crop:				
	- Paddy	4.505.030	47,34	171,6	26,253
	- Livestock	460.714	4,84	15,0	30.714
	- Horticulture	600.000	6,31	20,0	30.000
	- Vegetable	203.000	2,13	8,0	25.375
	- Other	472.570	4,97	20,0	23.628
2	Fishing	120.000	1,26	4,8	25.000
3	Labour	1.600.000	16,81	64,0	25.000
4	Off-farm	1.555.000	16,34	38,8	40.033
	Total	9.516.314	100,00	342,2	-

DW = day work (1 DW = 8 hours work)

Source: Rina, Y. I. Ar-riza, and M. Noor. 2008. *Profil sosial ekonomi dan kelembagaan petani di lahan bukaan baru: Kasus Desa Petak Batuah, Dadahup A2, Kalteng. Paper presented in the National Seminar of Rice, Sukamandi (West Java), August 22-24, 2008*.

Also in the lowland rice systems rearing livestock like chicken, duck, and goat is a common activity. It can contribute up to 30% of the total income of households in transmigration areas. Livestock provides an important cash flow and is often used for expenses such as education for children, religious ceremonies, etc. Livestock is more or less a bank account on legs.

Fishing in different forms ranging from river and canal fishing to the traditional “beje” is an important source of household income (see also the Master Plan Fisheries Technical Report). The in field combination of rice and fish could be an alternative for this system but this method is seldom applied by the farmers.

As indicated before off-farm activities are important in the lowland rice-based farming of the EMRP, mainly because agriculture fails to provide enough income. After the final transplanting the head of the household starts working in the district or provincial capital city. Most find work in transportation and construction sectors. The income gained from these activities can contributed up to 40% of to the total annual household income.

Rice is combined with other crops (e.g. citrus, banana, rambutan) either intercropped, relay cropped or in rotation. Rice is harvested once or twice a year. Generally farmers prefer the local late-maturing variety (10 months from seeding) with only one harvest per year.

The local varieties (Siam Kuning, Sian Unus, Bayar Kuning, Bayar Putih, Gadabung) are preferred because of their adaptability to the local (acid) environments and their resistance to pests and diseases. The superior grain quality and the preference as staple food by local communities above the improved rice varieties result in a secure market and higher prices for the local varieties even though yields are lower (1.5 to 2.5 $t.ha^{-1}$) for local varieties compared to the improved varieties (3 to 4 $t.ha^{-1}$). Potential yields for the local variety are 3 to 3.5 $t.ha^{-1}$ and 5 to 6 $t.ha^{-1}$ for the improved variety. Clearly current yields are below reported potential yields indicating

scope for improvements through optimisation and intensification.

One of the main advantages of the local varieties is the low labour requirement which allows farmers to invest time in more rewarding on and off-farm income generating activities (see also Table 1 and Table 5). Many rice varieties that are developed and promoted by the Indonesian Research Institute for Rice in Sukamandi and the Indonesian Swampland Agriculture Research Institute in Banjarbaru are adapted to the conditions in the swamplands (Annex 1).

Table 5: Yield, input, cost, capital and revenue of four commodities.

Farming Output-input	**Lowland Rice**		**Corn (1 ha)**	**Soybean (1 ha)**	**Cassava*) (4 ha)**
	High Yield Variety (0,5 ha)	Local Variety (0,5 ha)			
1. Revenues					
- Yield (kg)	1,250	600	4,000	1,300	14,000
Revenue (Rp)	2,500,000	1,200,000	3,000,000	5,200,000	21,000,000
2. Costs					
- Labor cost	700,000	675,000	1,737,500	1,875,000	11,425,000
- Input cost	306,000	134,000	925,000	650,000	1,725,000
- Capital cost	52,312	106,170	138,450	82,063	682,800
Total Cost (Rp)	1,058,312	914,170	2,800,950	2,607,063	13,823,000
3. Benefit					
Net Income	**1,441,688**	**285,830**	**199,050**	**2,582,938**	**7,166,200**
R/C ratio	**2,36**	**1,31**	**1,07**	**1,99**	**1,52**

Sources : Hikmat, et al M., Maskad and U. Gunasyah, 2006. Final Report *Identifikasi dan evaluasi potensi lahan untuk perwilayahan komoditas pertanian dalam mendukung Prima Tani di Kec. Mentangai, Kab. Kapuas, Kalteng*. BBSDLP AARP, Agric. Dep. Jakarta/Bogor.

2.1.2 Upland Rice Based Farming Systems

Upland rice is found in hydro-topographical types C and D of the swamp area. Water table levels higher than 50 cm are unfavourable for upland rice production. Cultivation of upland rice starts in October and harvesting is in February. The EMRP area has about 23,660 ha of upland rice. Land preparation is done via a slash and burn type method from September to October. Current provincial regulations allow the careful use of fire for land clearing in non-peat land and land with shallow (<50cm) peat, although land clearance without burning is promoted as the preferred method because of the haze causing health problems and releasing carbon dioxide to the atmosphere.[6] The use of fire in peat areas deeper than 50cm is currently prohibited.

Rice yields are generally lower than in the lowland systems. Yields a usually less than 2 t.ha-1. The reasons underlying these low yields are the same as for the lowland rice systems. The soil conditions are however less favourable and increasing rice production in the uplands will be more challenging. The upland systems also have a higher pressure of pest and diseases. Damages from rats, bird, pig, insects and bacteria are more common. Rats can destroy a complete harvest. Pigs and rats are difficult to combat near forests and in areas with abandoned land.

[6] Regulation of the Governor of Central Kalimantan No. 52/2008 on Guideline for Land Clearance by Communities in Central Kalimantan.

Upland rice is rainfed and as water availability is a constraint, short duration varieties are grown (see Table 6).

Table 6: Characteristics of uplands rice varieties

Rice Variety	Age (days)	Yield potential (t GKG/ha)
Situ gintung	115-140	2,0-3,5
Gajah mungkur	90-95	2,0-3,0
Kalimutu	90-95	2,0-3,0
Way rarem	100-115	3,0-4,0
Jati luhur	95-100	2,5-3,5

Source: Puslitbangtan (in: Noor, M. (1996) Padi Lahan Marjinal, Penebar Swadaya. Jakarta)

During the dry season other more drought tolerant crops like peanut, corn, soybean and mungbean are grown. Risk of crop failure remains high during the dry season. In experimental fields in the uplands supplemental pump irrigation is applied.

Challenges in the Rice Based Farming Systems

The main issues that will have to be addressed in the rice farming system are:

- low yields and small farm size
- limited farm diversification
- the absence of adequate local capacity for agricultural product processing

Low yields and small farm size

Despite the production potential, rice yields in the lowland systems are generally very low. The reasons for this low production are twofold. First because of the low economic returns, farmers have no incentives to increase production, and second, the poor biophysical conditions of the area. Rice is the staple food and increasing production remains important as (a) poor farmers do not have the purchasing power to achieve food security and (b) the region aims at increasing the self sufficiency in rice. In this section we will concentrate on the biophysical limitations - the socio-economic issues are discussed in the socio-economic technical reports.

The most important factor limiting production is the high acidity of soil and water. This issue will have to be addressed to increase crop productivity. Currently two complementary strategies are available: liming and water management. By applying lime the pH is temporarily increased. Water management aiming at flushing out the acidity is a long-term strategy to reduce acidity (see also water management technical report). Acid tolerant rice varieties are not readily available and creating such varieties will take 10-15 year by the international scientific community.

For the upland system, specific problems are water related stress, toxicities mainly by aluminium (Al), iron (Fe), sometimes manganese (Mn), low soil fertility and the high abundance and pressure of pest and diseases.

Introducing early-maturing high-yielding varieties to increase productivity has failed partly because effective water management to address the high acidity was not in place. With proper water and nutrient management the high yielding varieties have the potential to dramatically increase production levels even with current low-tech land preparation methods. This option will require more labour during the growing season, mainly for weeding.

Recommended rates of fertilizer for rice are well above the actual applied amounts. This is because of the high prices and low revenues but also because research, extension and farmers are not well connected. Fertiliser recommendations are not location or region/location specific. This is perhaps best shown by the fact that there is no clear distinction in fertiliser recommendation between mineral soils and peat soils.

Limited farm diversification
Although intensification is an important strategy in the rice systems, diversification of on-farm and off-farm activities are important complementary strategies which need to be developed.

The most common forms of on farm diversification are the addition of livestock production and small-scale on-farm aquaculture (fishpond, rice fish culture, or shrimps/crabs culture). Household income of farmers in the EMRP area are met from non-crop activities like livestock (e.g. livestock contributes 30% of total income in the Dadahup transmigration area), collecting fish from river and canals and in some areas by collecting fish from traditional fish capture ponds *(beje)* (see fisheries report). In Barito Selatan *beje* and "swamp buffalo" (*kerbau rawa*) are the mains sources of additional income. Poor farmers, mainly found in transmigration areas, generally do not have the technical and financial capabilities to develop alternative income from tree crops like rubber. Most traditional Dayak farmers have a strong preference for tree crops.

The absence of adequate local capacity for agricultural product processing
Farmers usually sell their products directly on the market or to middlemen without further processing, even during the peak season of harvest, when prices drop. Support to increase the local capacity for agricultural product processing can improve the position of the farmers via adding value to agricultural products by e.g. processing of fruits and other crops.

2.2 Tree Crop Farming Systems

The tree crop farming system in the EMRP is closest linked to the traditional Dayak livelihood strategy. Three types are distinguished: rubber, coconut and oil palm farming systems. Both rubber and coconut are well established in the region and are linked to smallholder agriculture. The latter is emerging as an estate crop with potential for jobs and a possible access to a new market for smallholder farmers.

Fishing is an important source of protein and income in the traditional tree crop farming systems (rubber and oil palm). Fish are collected directly from the rivers or are caught using "*beje*" (see also fisheries report). *Beje* is a pond system found in areas that are regularly flooded (river floodplains and swamps). *Beje* are usually manmade but also natural depressions are used. In the dry season when water retreats after flooding, fish are trapped in the *beje* and collected. Dimensions of *beje* vary but are normally 10 by 30 m and 1,5 – 2 m deep. Research indicates that about 5 – 12 different fish species can be caught using a *beje* (see Table 7).

Table 7: Yields from traditional fish capture ponds (*beje).*

No.	Fish species – Local Name (*Species*)	Fish composition (% weight)	Average weight of catch ± sd (kg)
1	Sapat siam (*Trichogaster pectoralis*)	31,66 ± 1,42	55,9 ± 28,0
2	Sepat rawa (*Trichogaster trichopterus*)	21,54 ± 1,04	11,2 ± 3,8
3	Gabus (*Chana striata*)	17,85 ± 0,83	128,2 ± 66,1
4	Betok (*Anabas testudineus*)	15,29 ± 0,90	32,2 ± 21,3
5	Tambakan (*Helostoma temminckii*)	3,58 ± 0,11	89,1 ± 42,2
6	Baung (*Mystus nemurus*)	2,89 ± 0,13	63,0 ± 6,7
7	Singgaringan (*Mystus nigriceps*)	2,59 ± 0,09	20,0 ± 4,1
8	Lundu (*Mystus gulio*)	2,02 ± 0,12	15,7 ± 4,4
9	Lais lampok (*Cryptopterus limpok*)	1,20 ± 0,08	45,1 ± 7,6
10	Lele (*Clarias* spp)	1,02 ± 0,04	106,5 ± 39,1
11	Kakapar (*Peristolepis fasciatus*)	0,30 ± 0,003	18,9 ± 8,4
12	Lainnya	0,04	-
	Total	100	585.8

Source: Rupawan (2006).

Most of fish collected from the river are sold in the village market. The average household has about 4-5 beje and could harvest about 500-1.200 kg fish per season. Generating an income of about Rp. 1,3- 3,7 million/beje/season "Beje" has been developing by few farmers. The number of bejes is declining as water quality has deteriorated since the MRP.

2.2.1 Rubber based Farming Systems

Rubber is a common crop found in the hydro-topographical type C and D areas on mineral soils and in only a few locations is it planted on shallow peat. Rubber trees are planted on deep peat (peat depth > 3 m) only around Mintin and some areas further north in Jabiren Raya in Pulang Pisau district. The total area under rubber in the EMRP area is 33,536 hectares[7]. Rubber is planted and managed exclusively by smallholders and a total of 17,626 households depend on it.

The rubber based farming system is principally found in six sub-districts: Kapuas Timur, Kapuas Barat, Mantangai, Kahayan Hilir, Pandih Batu, and Jabiren Raya. The largest rubber area is found in sub district Kahayan Hilir with 10.332 hectare, this is more than 30% of the planted area in the EMRP.

Of the total area under rubber in the EMRP, 58% is productive. Of the unproductive area 29% is immature (< 5 years) and 13% are unproductive trees that require replanting. On average 1.90 hectare (between 0.67-3.11 ha) is planted per household. The average tree density is 635 trees per hectare, which is considerably higher that the recommended density of 475 trees per hectare. Trees are family owned and most farmers inherited the trees from their parents who planted local clones (seedlings collected from forests). These local clones have low productivity but are adapted to the local soil constraints and flooding condition. Before planting the field is cleared via slash and burn by which the ash supplies nutrients to the seedlings. The smallholder farmers seldom apply inorganic fertilizers to their rubber trees.

[7] Dinas Perkebunan (Statistik Perkebunan Kalimantan Tengah Tahun 2007)

In the Barito Selatan district the average production of dried latex is 943 kg.ha^{-1}. In Kapuas the average yield is 1,200 kg.ha^{-1}, for Pulang Pisau this is 720 kg.ha^{-1} (see also Table 8). The yield difference is mainly related to the water table, in the areas with regular flooding the yields tend to be lower.

Also in the rubber based system the smallholders do not depend on the rubber yield alone for their livelihood. In addition food crops, mainly rice and vegetables for household consumption are grown. During the first five years, when the rubber is still immature, rice is intercropped with the rubber seedlings. Rice is harvested once a year and is consumed by the household members. Yields are not enough to fulfil the household annual requirement, so additional rice must be bought.

In transmigration areas, especially in Pulang Pisau (subdistrict Maliku and Panding Batu), there is a trend to convert rice fields to rubber estates. The rubber is regarded a better and securer source of income.

Farmers tap rubber every two days. The collected latex is coagulated using formaldehyde-acid to form “slab”. The daily slab production is about 10 – 30 kg depending on the clone and local conditions (flooding). Farmers do not process the slab but sell it at their convenience to middlemen at the village or district level (see Figure 4).

Table 8: Rubber cropping conditions grown by smallholder plantation in the EMRP. [8]

District / Sub- district	Immature Tree Area (ha)	Mature Tree Area (ha)	Unproductive Tree Area (ha)	Total Area (ha)	Production* (ton)	Yield (kg/ha)	No. House -holds	Average area per house-hold (ha)
Barito Selatan								
Jenamas	29.5	42	5	76.5	39.61	943	60	1.28
Dusun Hilir	68	53.5	7.5	129	50.46	943	108	1.19
Kapuas								
Kapuas Kuala	0	0	0	0	0	0	0	-
Kapuas Timur	809	1827	719	3355	2192.4	1200	2817	1.19
Kapuas Barat	970	1924	516	3410	2308.8	1200	2015	1.69
Kapuas Hilir	78	225	185	488	270	1200	728	0.67
Kapuas Murung	260	920	785	1965	1104	1200	1100	1.79
Basarang	542	359	112	1013	430.8	1200	485	2.09
Pulau Petak	50	50	45	145	60	1200	187	0.78
Mantangai	955	3390	664	5009	4068	1200	3186	1.57
Pulang Pisau								
Kahayan Kuala	40	0	0	40	0	0	40	1.00
Kahayan Hilir	2233	7436	663	10332	5353.92	720	3325	3.11
Maliku	576	45	3	624	32.4	720	423	1.48
Pandih Batu	1423	1839	223	3485	1324.08	720	1237	2.82
Jabiren Raya	1002	1303	320	2625	938.16	720	1142	2.30
Sebangau Kuala	680	0	0	680	0	0	620	1.10
Palangka Raya								
Sebangau	135.8	19.2	4.8	159.8	12	625	153	1.04
Total	**9851.3**	**19432.7**	**4252.3**	**33536.3**	**18184.63**	**13791**	**17626**	**1.90**
Proportion	29%	58%	13%	100%	-	-	-	-

[8] Dinas Perkebunan (Statistik Perkebunan Kalimantan Tengah Tahun 2007)

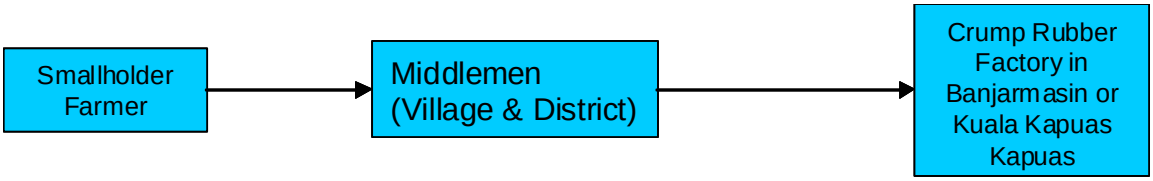

Figure 4: Marketing channel of Rubber Product (Slab) in Mantangai

The slab is sold to village or district middleman, who then sell the slab to the rubber factory in Banjarmasin or Kuala Kapuas. When the slab is sold to Banjarmasin the share for the farmer is 55% whereas the share is 58% when it is sold to the factory in Kuala Kapuas.

A farmer in block A reported to harvest about 20-25 kg rubber (slab) daily or 100-115 kg weekly. With the price of rubber of about Rp. 5.000/kg (it varies depending on quality), a household could harvested about 500 kg/month or earn about Rp. 2.500.000/month. Harvesting frequency differs between regions: in the drier uplands of harvesting is done every two day because production is lower than in the swamp areas (Farmer interview in South Kalimantan, 2008).

Because tapping rubber is conducted early morning, time for other activities is available. Farmers use this time for on farm and off farm activities such as working the rice fields, collecting grass for feed, collecting fish, construction work, transportation, and making rattan handicrafts.

The livestock component in the rubber dominated systems is very limited. In transmigration areas some household raise goats and chickens as additional income generating activity.

Challenges in the Rubber Farming Systems

Rubber has been a successful commodity for years and has seen ups and downs in the market: in early 2008 it is expanding with the increasing demand for rubber. Farmers turn to the local government to assist in establishing new and rehabilitating old rubber plantations. In this smallholder dominated systems key issues relate to productivity and income generation. The key issues are in these systems are:

- Low yields
- Limited farm diversification
- Poor access to markets

Low Yield

The use of low yielding clones and old trees, less productive trees, traditional management and poor tapping practices all contribute to a low productivity. Yields can be improved by introducing high yielding clones and improved management practices. The scope to increase production is present given that the average yields of dried latex in the National Rubber Estate at Barito Selatan are 1,300 kg per ha compared to the range of 623 – 1200 kg per ha in the EMRP area. To lift productivity improving farm management via improved varieties and soil and water management is a key issue that must be addressed.

Limited Farm Diversification

As with the rice based systems, on-farm and off-farm diversification is important, and given the lower labour requirements, this is more important for rubber based farming systems. Improving skills of the rural population to find employment outside farming will require educational and training programs (see socio-economic report). The absorption capacity of the urban economy in the region is however also limited.

Marketing Mechanisms

Perhaps the most important issue for the farmers is the market. Prices of rubber product are volatile and farm gate prices are controlled by middleman and rubber factories. Although slab can be stored and put on the market by farmers at their convenience, they cannot take advantage from this because of limited price information and their poor bargaining position.

2.2.2 Coconut Farming Systems

This farming system is found in the coastal areas of the EMRP area: Kahayan Kuala and Kapuas Kuala, Pandih Batu and Sebangau Kuala sub-districts (Table 9). The coconut farming system is developed from the rice based farming system. Rice field were converted via intercropping (*sorjan*) to the coconut system. This transition takes about 5 to 10 years.

In the EMRP area 24,495 hectare of coconut is grown, of which 76% are mature plants. The majority of these trees are a local late variety that needs replanting after 20 - 30 years.

Table 9: Coconut cropping in the EMRP Area, Year 2007

District/sub district	Immature Plant Area (ha)	Mature Plant Area (ha)	Unproductive Plant Area (ha)	Total Area (ha)	Production* (ton)	Yield (kg/ha)	No. House-holds	Average area per house-hold (ha)
Barito Selatan								
Jenamas	21	26	2	49	26.94	1036	304	0.16
Dusun Hilir	11	21	1	33	21.76	1036	84	0.39
Kapuas								
Kapuas Kuala	760	3485	700	4945	4120	1200	2475	2.00
Kapuas Timur	85	220	48	353	264	1200	178	1.98
Kapuas Barat	45	185	35	265	222	1200	375	0.71
kapuas Hulu	7	32	19	58	38.4	1200	235	0.25
Kapuas Hilir	38	158	55	251	187.2	1200	520	0.48
Kapuas Murung	189	284	42	515	340.8	1200	558	0.92
Basarang	430	975	119	1524	1170	1200	1048	1.45
Pulau Petak	75	154	46	275	184.8	1200	417	0.66
Mantangai	65	312	65	442	374.4	1200	560	0.79
Pulang Pisau								
Kahayan Kuala	1628	9970		11598	13673.15	1350	3964	2.93
Kahayan Hilir	20	191	14	225	257.85	1350	400	0.56
Maliku	29	52	22	103	70.2	1350	442	0.23
Pandih Batu	491	1228	174	1893	1657.8	1350	1628	1.16
jabiren Raya	11	13	5	29	17.55	1350	58	0.50
Sebangau Kuala	225	1315	297	1837	1775.25	1350	979	1.88
Palangka Raya								
Sebangau	48	45	7	100	46.35	1030	526	0.19
Total	**4,178.0**	**8,666.0**	**1,651.0**	**24,495.0**	**24,448.5**	**-**	**14,751.0**	**1.66**
Proportion	17%	76%	7%	100%	-	-	-	-

*) in dried coconut (copra)[9]

[9] Dinas Perkebunan (Statistik Perkebunan Kalimantan Tengah Tahun 2007)

On average households in the coastal region have 1,66 ha coconut but the range is large (0.16 to 2.93 hectare per household). In Kahayan Kuala, with an area of about 11,598 hectare of coconut, the largest holdings are found. In this area 80% of households are coconut farmers. As with the other farming systems, coconut farming is combined with other crops. Several combinations are found but coconut – rice or combined with coffee, banana or other tree crops are common combinations.

Farming practices in the coconut system are traditional and farmers use local low yielding varieties and little or no inputs. The yields of dried coconut in the area are between 1,030 – 1,200 kg.ha^{-1} annually which is considerably lower than yield of high yielding varieties with yields up to 3,000 kg per year.

Coconut is planted on 3-4 m wide beds and becomes productive after 5 years. On smaller beds, less than 2 m wide, it may take 8 years before trees become productive. Yields per tree are 4-5 nuts every 20 days. The maximum production of 6-7 nuts every 20 days is obtained from trees of 15 – 40 years old. Given a tree density of 120 trees per hectare yields per hectare can range from 720 to 840 nuts every 20 days (1080-1260 nuts every month). With an average price of Rp.750,-, per nut a farmer may receive Rp.810.000 – Rp.945.000 per hectare per month.

During the first years of establishing coconut fields intercropping with rice is often done. Rice yields are difficult to estimate because they are highly variable depending on the spacing and age of the coconut trees. A rough estimate of rice yield is 2.1-2.8 ton.ha^{-1} in monoculture rice and approximately 1 ton per ha in intercropped field. Rice yield declines as the shading effect of the coconut trees increases. But when coconut trees are spaced at 15 m, rice can be grown even between mature trees. With tree spaced 10 m or less apart rice yield drop considerably and after 5 to 6 years farmers generally stop rice cultivation.

Farmers apply no inorganic fertilizers to the coconut trees. In fields intercropped with rice the trees are treated with compost, mainly organic material removed from the rice fields in the dry season.

Coconuts are collected every 20 days and are usually sold at Rp.750 per nut. The nuts are sold to village market or to village middleman and are transported by water, river and sea, to Banjarmasin. Some households process the nuts to dried coconut (copra) and to coconut oil. Dried coconut is sold at Rp.4,000 per kg; and coconut oil at Rp.5,500 per bottle. For 1 kg copra about 3-5 nuts are needed and for 1 litter coconut oil about 16-20 nuts are required.

Besides growing rice, some households grow secondary crops (cassava) and vegetables. These crops can be grown under coconut trees aged up to 5 or 6 years. Other cash crops that are intercropped with coconut are coffee and banana. Livestock raised include chickens (free range), ducks and goats. Livestock is sold at the weekly market. Roof material from nipah and baskets etc. from reeds (*purun*) add to cash income.

Fishing is in some cases perhaps the main livelihood. In any case it is a critical source of protein and income for the local people. Fish are collected from the river, are matured in cages (*keramba*), or trapped using traditional fish capture ponds (*beje*). A *keramba*, usually made from bamboo (2 m. long, 1,5 m. wide and 1 m. high), is used to mature fish and can provide additional income of about Rp. 5-15 million ha year.

Most of fish collected from the river are white fish like tambakan (*Helostoma*

temminckii), baung (*Mystus nemurus*), singgaringan (*Mystus nigriceps*), lundu (*Mystus gulio*), Lais lampok (*Cryptopterus limpok*) and are sold in village markets. *Beje* are constructed by some farmers, however public consultations held by the Master Plan highlighted that the number of *beje* has declined significantly after canals of the MRP were dug. Before the MRP, *beje* production of local fish or black fish like sepat (*Trichogaster pectoralis, Trichogaster trichopterus*), haruan/gabus (*Chana striata*), papuyu (*Anabas testudineus),* and lele (*Clarias* spp) could be up to 1-2 ton per harvest. The average number of *beje* per household is 4-5 and provides a harvest of about 500-1.200 kg per season.

Challenges in Coconut Farming System

Because this is mainly a smallholder system the key issue relate to productivity and income generation. The list includes:

- Low yields
- Lack of alternative enterprises
- Inadequate farmer skills
- Primary product processing
- Poor access to markets

The yields in smallholder farming are generally low. Although labour requirements are relatively low the coconut farming systems is no exception. The root causes of the low productivity are threefold: late-maturing variety, old trees, and low external inputs. No clear recommendations for the coconut systems are available and most improvements are based on local experience. Management and fertiliser trials providing basic information to farmers are lacking.

Value added activities like copra production are important to increase income at the farmhouse level. Besides options for scaling up local processing of coconut, fishery activities are important in the coastal areas. Notably, shrimp culture or tambak and fish ponds or “beje” are found in the south of Blocks C and D (Sebangau Kuala, Kahayan Kuala, Pandih Batu and Kapuas Kuala sub-districts). In contrast, in Basarang sub-district, livestock, poultry and ruminants contribute to a diverse livelihood strategy. In coastal areas, swiftlet bird's nest (*sarang burung walet*) provide an additional source of income, although the initial investment in the housing is too high for most local farmers.

Prices of coconut and processed coconut are subject to the considerable variation. Coconut oil competes with palm oil. The smallholder farmers have a weak bargaining position and prices are kept low by the middlemen. Collective marketing of products via farmers association at the village level or via establishing farmer co-operatives are possible options to strengthen their position.

The skills of the farmers are also a major bottleneck for coconut farming. Knowledge transfer via extension programs is currently lacking.

2.2.3 Oil Palm Farming Systems

In contrast to rubber and coconut oil palm farming system in the EMRP are generally establish by larger companies. Currently 23 companies have a permit, of which 7 companies covering an area of 115,000 hectares the local proposal permit is still pending. The remaining 15 companies have a permit from the local government cover and area of 221,119 hectares. Currently 7 companies are prepared the nursery and started the preparations for planting. Six are located in Kapuas (Block A and B); and one is located in Pulang Pisau (Block C) (Table 10). So far no company has

obtained the final permit.

Table 10: Estate Plantation Companies in the EMRP Area.

District	Local Proposals		Location Permits		Business Permit	
	Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
Pulang Pisau	3	60,000	0	0	6	106,000
Kapuas	4	55,000	0	0	8	99,130
Barito Selatan	0	0	0	0	1	15,989
Total	7	115,000	0	0	15	221,119

Source: SK Governor of Central Kalimantan No.525.26/1800/E1 Tgl.26 November 2007

The oil palm planted in blocks A and B of Kapuas district are located on shallow to medium deep peat, whereas in Pulang Pisau district the seedlings are planted on medium to deep peat.

A few months after planting the seedlings require lime and fertiliser. Severe problems are most likely to occur during the dry season (July – September) as drought and fire risk increase dramatically. In block C a drain was made to flush out acid water, which will reduce the lime requirements but increases fire risk. Estates have the obligation to control fires and are establishing fire teams. Wells and pumps are considered for irrigation during the dry season and secure water supply for fire fighting.

Starting oil palm estates provide labour to local people on a daily basis, skilled and management positions are many occupied by non local people. It is unclear how labour requirements will develop. No mills are yet established in the region and the location and access to mill will to a large extent determine options for smallholders to start small-scale oil palm plots. Plans are being developed to build a mill in the south of block C.

Challenges in the Oil Palm Farming Systems

As plantations are mostly found on peat area where soil constraints will affect and limit the growth and yield of oil palm, high external inputs to overcome these constraints must be planned and applied. Low pH (below 4) and low nutrient content are the main constraints in the peat area. Liming and fertilizer applications are important options. High application of inorganic fertilizers may impact water quality around the estate area.

Fire risk is a major problem that needs to be addressed because areas between rows are cleared and the surface will dry faster. Planting legume cover crops between rows will be difficult because the low acidity limits growth of such cover crops.

Community development must be arranged to align community and the estate needs. The estate may establish a rice processing unit and could and buy part of the farmers rice products. Farmers' access to the mill could open opportunities for small scale oil palm production. Access to and price setting at the mill should be regulated in such a manner that smallholders are not excluded or marginalised.

2.3 Livestock Mixed Farming Systems

A mixed farming system is found the EMRP area, especially in transmigration areas. The system is found in scattered household of Basarang, Selat, Kapuas Kuala, Pandih Batu and Maliku sub-districts. The system consists of livestock and food crops.

A typical example of the system is found in Warnasari Village, Kapuas Kuala sub-district. Here households raise chickens, which are sold as four weeks old chickens (DOC) for meat and egg production. On average, a household raises 25 – 30 chickens. The revenue cost ratio (R/C) of DOC production is 1.48; of egg production is 1.32; of meat production is 1.08. Interrelation between livestock and crop food production is in supplying feed from rice husk or cassava for the livestock.

Basarang, Pandih Batu and Maliku sub-districts have a strong position in raising cattle and goats. Number of livestock per household is 2 cattle and 2-5 goats. Cattle is raised using traditional practises. Feed is mainly grass which cut in a rotation system. Manure is used to fertilise crop in the home garden (vegetable and fruits). Fodder quality is poor and livestock receives little if any veterinary care. Revenues from livestock systems are however attractive and provides some additional income to local farmers (Table 11).

Table 11: Contribution of Livestock to Farmers' Income in the EMRP Area.

Activity	Revenue (Rp)	Cost (Rp)	Income (Rp)	Percentage (%)
1. Livestock				
- Cows (2)	9,600,000	8,680,000	920,000	11.2
- Chickens (10)	826,000	654,000	172,000	2.1
2. Vegetable Crops	11,243,000	4,191,770	7,051,000	86.6
Total	**21,669,750**	**13,525,000**	**8,143,980**	**100.0**

Source: Widjaja dan Firmansyah in Utomo *et al.* (2004). Pengembangan ternak di Lahan pasang surut Kalimantan Tengah. Makalah pada Lokakarya Pengelolaan Lahan Pasang Surut di Kalimantan Tengah. BPTP Kalteng. 2004.

Cattle are provided via government aid in a revolving fund program. This program was not able to continue because mortality rates were high and farmers lost interest.

Challenges in the Livestock Mixed Farming Systems

The importance of livestock in the EMRP is currently limited. Mainly transmigrant farmers are involved in livestock farming and for this group it is an important source of cash used for the education of children, religious ceremonies and the like. A cow ("Bali" strain) represents a value of 7-8 million rupiah; a bull is about 4.5 million rupiahs. Prices for "Brahman" cattle are higher at around 10-15 million rupiah. Although prospects of this system seem good and can contribute to an increase in household income, the system remains important to only a limited number of households. Initial investments are high and without government support farmers do not have the financial capacity to buy livestock. No local breeding is done, all cattle are sold and new animals are provided by the government.

Integration of livestock to existing farming systems (either rice based or tree crop farming systems) is a viable option to increase household income. But how to integrate livestock into the traditional cropping systems is not clear as farmers currently lack the capabilities to make the transition. Research institutes and local governments should address this opportunity to facilitate the farmers to access finance for integrating livestock in their system.

Chapter 3 Strategies and Action

Agriculture in the EMRP area faces considerable challenges - about two-thirds of the total area is dominated by peat soils and the mineral soils have extensive areas of (potential) acid sulphate soils. The prospects and sustainability of agriculture largely depends on proper management of the area's biophysical assets (i.e. the 'wise use' of peatland and improved management of land and water resources) and proper investments in human assets (e.g. agriculture, education and health services). The challenge is to identify specific rural development needs and opportunities and to focus investments in areas where there greatest impact will be achieved. The basis of this analysis is provided by the existing smallholder farm systems that are driven by both subsistence and commercial purposes. At a larger scale, oil palm production is about to expand but at present no productive estates or mills are established in the area.

With agriculture being the main source of jobs and income for the rural population, increasing agricultural productivity through intensification and diversification of farming systems and development of new agricultural areas is at the core of improving livelihoods of these people.

Biophysical constrains to agricultural development are mainly related to the presence of (deep) peat and acid sulphate soils. In general peat and acid sulphate soils are marginal lands requiring special treatment and management. With appropriate and effective land, water and input management, it is however possible to achieve reasonable yields on these soils.

Apart from the biophysical constraints that require specific skills and knowledge, people face various legal and socio-economic problems. Land tenure including land conflicts related to access to conservation areas and to new developments such as oil palm estates are major limitation for families to invest in the land. Most farmers have limited access to financial institutions and depend upon moneylenders with high interest rates. Many of the poor are dependent upon the *ijon* system (where a loan is repaid with a share of a crop) and village cooperatives are typically not functional. Micro-credit programs have also failed in the past. Market access limits income through high transportation costs, especially for villages with no road access, distance to markets and limited knowledge of market prices.

In general, agricultural skills and knowledge and access to finance and markets remain limited prompting the need for an improvement and redirection of the extension services. Improvements will need to focus not only on the number of extension workers but also their technical capabilities. Improved access to finance and market opportunities will have to be supported by an appropriate institutional and physical infrastructure. To enhance productivity, the upgrading of land and water management infrastructure and practices is a prerequisite.

To make all this work different approaches will be required for the Dayak, Banjarese and transmigration villages. Each group tends to have different cultural and technological backgrounds and farming practices, but also tend to live in different physical environments. Strategies for the revitalization of agriculture in the area

should be designed based on the specific needs of the three main farming systems and the different socio-cultural contexts found in the EMRP area.

Different strategies tailored to the main farming systems are provided in Tables 12-17 below. In general land and water management improvements are a prerequisite for improving agricultural productivity. Assuming these are achieved, improving the skills of farmers remains a key issue. Current practices are based on local experiences, but the exchange of knowledge between farmers is limited. Farmer field schools linked to research networks and strengthening of extension services could be developed. This would also involve a reorientation of field research away from experimental plots to on-farm research. Major investments in agriculture should be focused on the more fertile mineral soils of the area. Greater access to markets through improved infrastructure and better market information to farmers to ensure higher prices for produce are required. Intensification to improve yields in existing rice and tree-based farm systems and diversification of farm systems are strategies with the greatest potential for successful outcomes.

Table 12: Strategies and Actions for Development of Lowland Rice-based Farming Systems in the EMRP Area.

Farming System	Dominant Crop	Intervention Zone	Principal Livelihoods	Strategy for Development	Actions
Rice based	Lowland rice	Zone VI Dadahup	Lowland rice (mostly local variety and few modern variety), banana, citrus, vegetables, livestock (chicken and goat), local fish, off-farm work (construction work)	**Intensification:** • Integrated Crop Management (ICM) and introducing High Yielding Varieties (HYV) • Reduce yield loses • Improving on farm water management	• Training and demonstration of ICM and post harvest management • Provide or promote local seed producers for HYV • Allocation of subsidized fertilizers and lime • On-farm research on specific fertilizer recommendation and variety yield test • Provide extension officer • Helping farmer for rice field construction (land levelling) • Revitalize "water use farmer group" (P3A)
				Diversification: • Shifting from brown to white rice • Integration of livestock (chickens / goats) • Raised beds for fruit trees	• Promote local rice processor • Promote partnership between "farmer group" and BULOG • Revolving livestock grant for farmers • Providing fruit tree seeding/clone (banana and citrus)
				Increased Farm Size: • Increasing harvesting area • Increasing Cropping Index	• Promote UPJA (Unit Pengelolaan Jasa Alsintan/Mechanization Service Management Unit)
				Increased off-farm income: • Promote household agro-processor	• Training for value-added fruit tree product • Rural credit for processing unit
Rice based	Lowland rice	Zone VIII Palingkau	Lowland rice, rambutan, coconut, vegetables.	**Intensification:** • Intensify local variety • Reduce yield loss	• Allocation of subsidized fertilizers and lime • Training and demonstration of post harvest management • Provide extension officers
				Diversification: • Processing rambutan and coconut	• Promote household to diversifying fresh rambutan/coconut to other product
				Increased Farm Size: • Increasing farm size through mechanization	• Promote UPJA (Unit Pengelolaan Jasa Alsintan/Mechanization Service Management Unit)
				Increased off-farm income: • Promote local agro processor	• Promote village-based rice processor
Rice based	Lowland rice	Zone IX Handil Rakyat (Kapuas Kuala)	Lowland rice (local and modern variety), coconut, vegetables, off-farm work (construction work)	**Intensification:** • Integrated Crop Management (ICM) and introducing HYV • Reduced yield lose	• Training and demonstration of ICM and post harvest management • Provide or promote local seed producers for HYV • Allocation of subsidized fertilizers and lime • On-farm research on specific fertilizer recommendation and variety yield test • Provide extension officer • Helping farmer for rice field construction (land levelling)
				Diversification: • Shifting from brown to white rice producer • Integration of livestock (chicken and goat) • Raised bed for fruit trees	• Promote local rice processor • Promote partnership between "farmer group" and BULOG • Revolving livestock grant for farmers • Providing fruit tree seeding/clone (coconut)
				Increased Farm Size: • Increasing harvesting area • Increasing Cropping Index	• Promote UPJA (Unit Pengelolaan Jasa Alsintan/Mechanization Service Management Unit)
				Increased off-farm income: • Promote household agro-processor	• Training for value-added fruit tree product • Rural credit for processing unit

Table 13: Strategies and Actions for Development of Upland Rice-based Farming Systems in the EMRP Area.

Farming System	Dominant Crop	Intervention Zone	Principal Livelihoods	Strategy for Development	Actions
Rice based	Upland rice	Zone VII Lamunti	Upland rice, cassava, vegetables (sweet corn, *bengkuang*, cucumber, longbean, chili pepper), fruit trees (jack fruit, rambutan), livestock (free-range chicken and goat) off-farm work (construction work)	**Intensification:** • Integrated Crop Management and introducing HY upland rice variety • Use certified vegetable seeds	• Training and demonstration of IPM • Provide or promote local seed producers for upland rice HYV • Training for seed increase (vegetables)
				Diversification: • Shifting to mixed upland farming	• Change to vegetable-rice • Livestock integration (chicken, goat, cattle) • Grown value-added product (cassava and oil seed)
				Increased Farm Size: • Increasing harvesting area • Controlled burning	• Use mechanization for land preparation (controlled burning) • Promote farmers to recycle slashed biomass for compost as fertilizer substitution.
				Increased off-farm income: • Promote local agroprocessor	• Promote village industry (cassava processor, tofu/tempe)

Table 14: Strategies and Actions for Development of Rubber Tree-based Farming Systems in the EMRP Area.

Farming System	Dominant crop	Intervention Zone	Principal Livelihoods	Strategy for Development	Activities
Tree crop based	Rubber	Zone I and II Block E	Rubber, fish catching, waged rubber tapping	**Intensification:** • Plant regeneration of unproductive rubber trees • Use high yielding (locally specific) clones • Apply balance fertilization	• Provide high yielding rubber clones • Promote farmers or farmers group to prepare their own seedling by introducing rubber high yielding scion. • Training and demonstration of good rubber practices.
				Diversification: • Shifting to mixed upland farming • Increase product quality	• Promote farmer to develop a farm area for food crops and cash crops. • Increase farmer knowledge for quality improvement.
				Increased Farm Size: • Increasing planting area • Controlled burning	• Provide rural credit for new plating and regeneration. • Reduce burning on land preparation
				Increased off-farm income: • Reduce market chain	• Promote collective/village latex collector.
Tree crop based	Rubber	Zone II Mantangai	Rubber, fish catching, hired labour (rubber tapping)	**Intensification:** • Plant regeneration of unproductive rubber trees • Use high yielding (locally specific) clones • Apply balance fertilization • Control Fire hazard	• Provide high yielding rubber clones • Promote farmers or farmers group to prepare their own seedling by introducing rubber high yielding scion. • Training and demonstration of good rubber practices. • Collective action for controlling fire hazard in dry season (esp. peat area)
				Diversification: • Benefiting river for fishery • Increase product quality	• Promote farmer to develop a floating fish cage. • Increase farmer knowledge for quality improvement (latex)
				Increased Farm Size: • Increasing planting area • Controlled burning	• Provide rural credit for new plating and regeneration. • Provide rural credit for floating fish cage construction. • Reduce burning on land preparation
				Increased off-farm income: • Reduce market chain • Promote local agro processor and collector	• Promote collective/village latex collector. • Promote local fish processor.
Tree crop based	Rubber	Zone II Jabiren Raya	Rubber, rice, fruits (jack fruit, local durio), rubber tapping	**Intensification:** • Plant regeneration of unproductive rubber trees • Use high yielding (locally specific) clones • Apply balance fertilization • Control Fire hazard	• Provide high yielding rubber clones • Promote farmers or farmers group to prepare their own seedling by introducing rubber high yielding scion. • Training and demonstration of good rubber practices. • Collective action for controlling fire hazard in dry season (esp. peat area)
				Diversification: • Diversify fruits product. • Increase product quality	• Training farmer for processing fruits to a value-added product. • Rural credit for processing unit. • Increase farmer knowledge for quality improvement (latex)
				Increased Farm Size: • Increasing planting area • Controlled burning	• Provide rural credit for new plating and regeneration. • Reduce burning on land preparation
				Increased off-farm income: • Reduce market chain • Promote local agro processor	• Promote collective/village latex collector. • Promote household capacity on diversify their fruit products.

Table 14 (cont): Strategies and Actions for Development of Rubber Tree-based Farming Systems in the EMRP Area.

Farming System	Dominant crop	Intervention Zone	Principal Livelihoods	Strategy for Development	Activities
Tree crop based	Rubber	Zone V Jenamas	Rubber, rattan, fish (catching and beje), waged rattan harvesting	**Intensification:** • Plant regeneration of unproductive rubber trees on limited area (non flooded area) • Use high yielding (locally specific) clones • Apply balance fertilization • Control Fire hazard	• Provide high yielding rubber clones • Promote farmers or farmers group to prepare their own seedling by introducing rubber high yielding scion. • Training and demonstration of good rubber practices. • Collective action for controlling fire hazard in dry season (esp. peat area)
				Diversification: • Regenerate rattan field • Increase product quality • Benefiting existing Beje	• Rural credit for improving and regeneration of rattan fields • Increase farmer knowledge for quality improvement (latex and rattan) • Promote household or processing fish product from Beje.
				Increased Farm Size: • Increasing planting area • Controlled burning	• Provide rural credit for new plating and regeneration for rubber and rattan • Reduce burning on land preparation
				Increased off-farm income: • Reduce market chain • Promote local agro processor	• Promote collective/village latex or rattan collector. • Protect rattan collector for appropriate wage system. • Promote household capacity on diversification of fish products.
Tree crop based	Rubber	Zone VI Dadahup	Rubber, rattan, fish catching, waged rubber tapping	**Intensification:** • Plant regeneration of unproductive rubber trees on limited area (non flooded area) • Use high yielding (locally specific) clones • Apply balance fertilization • Control Fire hazard	• Provide high yielding rubber clones • Promote farmers or farmers group to prepare their own seedling by introducing rubber high yielding scion. • Training and demonstration of good rubber practices. • Collective action for controlling fire hazard in dry season (esp. peat area)
				Diversification: • Regenerate rattan field • Increase product quality • Benefiting existing Beje	• Rural credit for improving and improve rattan fields. • Increase farmer knowledge for quality improvement (latex and rattan) • Promote household or processing fish product from Beje.
				Increased Farm Size: • Increasing planting area • Controlled burning	• Provide rural credit for new plating and regeneration for rubber and rattan • Reduce burning on land preparation
				Increased off-farm income: • Reduce market chain • Promote local agro processor	• Promote collective/village latex or rattan collector. • Protect rattan collector for appropriate wage system. • Promote household capacity on diversify their fish products.
Tree crop based	Rubber	Zone III Pandih Batu & Maliku	Rubber, upland rice, cassava, coffea, vegetables, livestock (chicken, goat and cattle), off-farm work (construction work)	**Intensification:** • Replanting of unproductive rubber trees • Use high yielding (locally specific) clones • Apply balance fertilization • Control Fire hazard	• Provide high yielding rubber clones • Farmers prepare their own seedling by introducing high yielding rubber • Training and demonstration of good rubber practices. • Collective action for controlling fire hazard in dry season (esp. peat area)
				Diversification: • Maintain field crop area (Lahan Usaha I) • Livestock integration	• Intensify food crop area for food and cash crop • Rural credit for livestock integration
				Increased Farm Size: • Increasing planting area • Controlled burning	• Provide rural credit for new plating and regeneration for rubber • Reduce burning on land preparation
				Increased off-farm income: • Reduce market chain • Promote local agro processor	• Promote collective/village latex or rattan collector. • Promote household industry for processing products (cassava, soybean)

Table 15: Strategies and Actions for Development of Coconut Tree-based Farming Systems in the EMRP Area.

Farming System	Dominant crop	Intervention Zone	Principal Livelihoods	Strategy for Development	Activities
Tree crop based	Coconut	Zone III Bahaur	Coconut, rice, fish (catching and beje)	**Intensification:** • Plant regeneration of unproductive coconut trees • Use high yielding (locally specific) variety	• Provide high yielding coconut seedling • Training and demonstration of good coconut practices.
				Diversification: • Shifting to mixed farming system • Shifting from nuts to copra or coconut oil • Promote coconut by-product • Livestock integration	• Introducing coconut-rice-fish or coconut-rice-shrimp farming system. • Extention for diversifying coconut by-product • Rural credit for livestock integration and development of "tambak"
				Increased Farm Size: • Increasing planting area	• Provide rural credit for new plating and regeneration for coconut
				Increased off-farm income: • Reduce market chain • Promote local agro processor	• Promote collective/village coconut product collector. • Promote household industry for processing a value-added coconut product • Provide local market for fish product.
Tree crop based	Coconut	Zone IX Kapuas Kuala	Coconut, rice, fish (catching and beje)	**Intensification:** • Plant regeneration of unproductive coconut trees • Use high yielding (locally specific) variety	• Provide high yielding coconut seedling • Training and demonstration of good coconut practices.
				Diversification: • Shifting to mixed farming system • Shifting from nuts to copra or coconut oil • Promote coconut by-product • Livestock integration	• Introducing coconut-rice-fish farming system. • Extention for diversifying coconut by-product • Rural credit for livestock integration
				Increased Farm Size: • Increasing planting area	• Provide rural credit for new plating and regeneration for coconut
				Increased off-farm income: • Reduce market chain • Promote local agro processor	• Promote collective/village coconut product collector. • Promote household industry for processing a value-added coconut product

Table 16: Strategies and Actions for Development of Oil Palm Tree-based Farming Systems in the EMRP Area.

Farming System	Dominant crop	Intervention Zone	Principal Livelihoods	Strategy for Development	Activities
Tree crop based	Palm Oil	-	Oil-palm	**Intensification:** • Use high yielding varieties • Access to processing plants (mills)	• Provide high yielding seedlings • Training and demonstration of good management practices. • Training and demonstration of good palm oil practices. • Legally binding agreements to guarantee access
				Diversification: • Livestock integration	• Promote/demontrate “sawit-sapi”
				Increased Farm Size: • Partnership farmer and palm oil estate	• Provide economic farm size per household • Promote farmers to form a management in a cooperative
				Increased off-farm income: • Access to off-farm activities	• Provide oppotunity locally for individual or group to handling/transport FFB to mills and CPO to shipping location

Table 17: Strategies and Actions for Development of Livestock-based Farming Systems in the EMRP Area.

Farming System	Dominant crop	Intervention Zone	Principal Livelihoods	Strategy for Development	Activities
Livestock-based	Cattle and vegetables	Zone IX Basarang	Cattle, vegetables (chilli pepper, mustard greens), fruit trees (cempedak, rambutan, sallaca), pineapples, rubber	**Intensification:** • Improving feed system & fodder quality	• Training and demonstration of good livestock practices. • Training farmer for preparing alternative feeding resources
				Diversification: • Shifting to mixed farming system • Promote fruit product diversification	• Promote cattle-vegetable-fruit farming system. • Extension for diversifying fruit product diversification (pineapple, rambutan, jack fruit)
				Increased Farm Size: • Increasing livestock population	• Training farmers to start breeding programs • Provide rural credit for livestock breeding
				Increased off-farm income: • Reduce market chain • Promote local agro processor	• Provide local livestock market • Promote household industry for processing a value-added fruit product

Annex I - Rice Specific Information

The table below shows information on rice varieties adapted to swamp lands, their characteristics and yield potential:

Name of Variety	Harvest Age (days)	Yield Potential (t/ha)	Rice Taste	Resistance to Pests and Diseases			
				WCk	HDB	BCk	Blas
Barito	140-145	3	Dry	T-1	AT	-	-
Mahakam	135-140	3-4	Dry	P-1,2,3	AT	-	-
Kapuas	127	4-5	Half dry	T-1	AT	-	-
Musi	135-140	4,5	Dry	T-2	T	-	T
Sei Lilin	115-125	4-6	Dry	AT-2	-	-	AP
Lematang	125-130	4-6	Dry	T-1	-	-	AT
Lalan	125-130	4-6	Dry	T-1,2,3	-	-	T
Banyuasin	115-120	4-6	Soft	T-3	-	T	T
Batanghari	125	4-6	Dry	T-1,2	T	-	T
Dendang	125	3-5	Soft	T-1,2	-	AT	AT
Indragiri	117	4,5-5,5	Half dry	T-2	T	-	T
Punggur	117	4,5-5	Half dry	T-2,3	-	-	T
Margasari	120-125	3-4	Half dry	AT-2	-	-	T
Martapura	120-125	3-4	Half dry	AP	-	-	T
Air Tenggulang	125	5	Dry	T-1,2,3	T	-	T
Siak Raya	125	5	Dry	T-IR26	-	T	T
Lambur	120	4	Soft	AT-3	-	-	T
Mendawak	115	4	Soft	AT-3	-	-	AT
Fatmawati	105-115	6-7	Soft	AT-2,3	T	-	-
Ciherang	116-125	5-6	Soft	T-2,3	T	-	-
Digul	115-125	5-6	Dry	T-2,3	AT	-	-
Tajum	120-130	4	Dry	T-1	AT	-	-
Progo	125	4,5-5	Dry	T-1,2	AT	-	-
Cisokan	110-120	4,5-5	Dry	T-1,2,3	AT	-	-
IR36	110-120	4-4,5	Dry	T-1,2	AP	-	AT
IR42	135-145	4,5-5,5	Dry	T-1,2	T	-	-
IR64	115	5	Soft	T-1,2	AT	-	-
IR66	110-120	4,5-5	Half dry	T1,2,3	AT	-	T
Tapus	127	4,5	Dry	T	T	AT	T
Alabio	135-140	2-2,5	Half dry	P	-	-	-
Nagara	140-170	2-2,5	Half dry	-	AT	-	-
Batang Piaman	125	4,4	Dry			-	T
Batang Lembang	125	4,1	Dry			-	T

T = high tolerance; AT = medium tolerance; AP = low tolerance; P = not tolerance; WCk = Wereng coklat; 1,2,3 = Biotipe 1,2,3; HDB = Hawar daun bakteri; BCk = Bercak coklat.

Source: Review of Balittra (Indonesian Swamps Agriculture Research Institute)

Bappenas
Secretariat
Inpres 2/2007

Jl. Taman Suropati
No.2,
Jakarta 10310

www.bappenas.go.id

Bappeda
Central
Kalimantan
Secretariat Inpres
2/2007

Jl. Diponegoro 60,
Palangka Raya
73111,
Kalimantan Tengah

www.kalteng.go.id

Royal
Netherlands
Embassy

Jl. H.R. Rasuna
Said Kav. S-3,
Kuningan
Jakarta 12950

indonesia.nlembassy.org

Euroconsult
Mott MacDonald

S. Widjojo Centre, lt. 3
Jl. Sudirman Kav. 71
Jakarta 12190

www.euroconsult.mottmac.com

Deltares | Delft
Hydraulics

P.O. Box 177
2600 MH Delft
The Netherlands

www.wldelft.nl