

# **Trees, Resilience And Livelihood Recovery In The Tsunami-Affected Coastal Zone Of Aceh And North Sumatra (Indonesia): Rebuilding Green Infrastructure With Trees People Want**

Report - Meulaboh visit, 8-15 March 2006

ISRI, LRPI, ICRAF

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## **Visit objectives:**

1. Assess potential sites and beneficiaries for the ReGrIn action activities and monitoring,
2. Consult line agencies and other NGOs
3. Preliminary characterisation of locations, including soils, landuse and marketing in
4. office co-ordination, joint planning

## ***Agronomic and technical assessments***

### **I. Introduction**

This field visit to Meulaboh is targeted to assess the potential sites and beneficiaries for the next ReGrIn actions. Information gather during the visit is then discussed among the team (ICRAF, LRPI, ISRI, Field staff) in order to decide zones, sites (village level), and plan for the actions, according to the work plan established previously in Bogor, with the full team.

Before assessing the field, a solid discussion to determine the zones of action was under taken with the full team. As results, two determinant zones were defined (same as what ISRI has reported):

- (i) Zone A: those areas affected by the tsunami waves, regardless whether the waves also damaged houses and other amenities. The changes that may have happened included increase in sodium, other cation and other organic and inorganic substance concentrations, capping of soil surface with mud and/or decapping of the surface.
- (ii) Zone B: those coastal areas unaffected directly by tsunami.

During the visit, LRPI team consist of two researchers (agronomist and socioeconomist) and one permanent field staff. The focus of LRPI tasks are assessing the constraint and potential development of the tree crops in the targeted sub-district of Aceh Barat Distric (Johan Pahlawan, Merebo, Samatiga, and Arongan Lambalek).

Beside the field visit and discussion with the key informans (keuchik, farmers, field officials), discussion was also done with Head of Dinas Kehutanan dan Perkebunan, Staff of Badan Rehabilitasi dan Rekonstruksi NAD and Nias (BRR), and staff of Dinas Pertanian.

### **II. Results**

#### **A. Potential Commodities**

Table 1 describes the relative role of several annual commodities (annual crops) in West Aceh with the total area is 25, 7 ha and 27, 2 thousand ton. Hevea rubber, palm oil, cocoa,

coffee and aracca nut are the main commodities cultivated by farmer. Sagu with quite large area more as a natural plant. Fruits plants such as durian and rambutan are also quite large cultivated by farmer.

Table 1. Area and production of tree crops in West Aceh, 2005.

| No    | Commodity   | Area (ha) | Production (Ton) |
|-------|-------------|-----------|------------------|
| 1     | Rubber      | 16.207,00 | 11.649,92        |
| 2     | Oil palm    | 3.892,00  | 13.518,55        |
| 3     | Coconut     | 2.995,00  | 1.392,46         |
| 4     | Cocoa       | 367,50    | 47,96            |
| 5     | Coffee      | 532,50    | 175,65           |
| 6     | Areca palm  | 506,00    | 161,26           |
| 7     | Clove       | 19,00     | 0,60             |
| 8     | Nutmeg/pala | 62,00     | 13,54            |
| 9     | Kapok       | 85,00     | 18,35            |
| 10    | Sagu        | 923,00    | 213,83           |
| 11    | Others      | 146,00    | 17,41            |
| Total |             | 25.735,00 | 27.209,53        |

Rubber plant is generally cultivated by farmer by self-supporting system without using recommended technology. Planting material used is generally unselected seedling. Plant maintenance is carried out in minimum effort without any fertilizer input. In small proportion rubber plant was developed by nucleus estate and smallholder (NES) as well as export commodity extensification and rehabilitation development pattern (PRPTE) using recommended technology. Rubber areas in four Sub-Districts of West Aceh were established on peat soil. Figure 1 depict rubber plant with unselected seedling (a) and improved rubber planting material (b).



(a)



(b)

Figure 1. Rubber plant with unselected seedling (a) and improved planting material (b) planted on peat soil

Oil palm is relatively new commodity in this region. In the form of smallholder, oil palm is initially cultivated by smallholder in the form of nucleus estate and smallholder. During conflict, transmigrants either local or javanese were migrate from the transmigration areas and abandon the land and the plant without enough maintenance. After condition of security is conducive, systematically the farmer, come back to their home and land and try to rehabilitate the plant. Palm oil plant have started to be maintained (Figure 2).



Figure 2. Palm oil plant start to be rehabilitated after 5 years abandoning

Coconut, generally west african tall type is cultivated traditionally by farmer. These kinds of plant play an important role as source of income for smallholder, mainly for those who live in the coastal areas. In the 1980-s, government has also developed hybrid coconut through export commodity extensification and rehabilitation development program and has been planted arroud 346 ha. Eventhough this variety is continually been cultivated but then the role of the plant as source income of farmer has decreased because of the price of coconut is remaining low. The intention of farmers to develop coconut plant are remain low. The effort to use the side product such as shell charcoal, coconut fiber, coconut water and others has not been exploited yet. Figure 3 describes of coconut plant in this region.



Figure 3. Coconut plant cultivate traditionally by farmer

Other crops potential to be developed in this region are cocoa and areca nut. Cocoa is commonly cultivated as an intercrop with coconut and as a backyard/home garden plant. Areca nut is cultivated by farmer as border plant separate the land one to each other. This kind of plant is also developed as backyard plant. (Figure 4)

Beside crops that has been mentionned above, fruit trees, seuch as durian and rambutan are also potential to be developed by smallholder. These fruit trees are commonly appropriate for the villages that geographically close to the city as the market, such as Johan Pahlawan, Sama Tiga and Meureubo. Nipah and Sago palms are also planted in the areas, however due to still limited use of the palms, its development is still limited.



(a)



(b)

Figure 4. Cocoa plant (a) and areca nut (b) potential to be developed by farmer

## **B. Potential Villages**

The main important results of the visit are also the determination of villages per Sub-district, where the most next field activities will be carried out. The characteristics of those villages at each sub-district are presented in annex 1.

### **5. Arongan Lambalek Sub-District**

#### ***1.a. Arongan Village (Zone A)***

This village is one of the most severely damage village in West Aceh. Minor part of the village population are still living in the area, however most of them are now living in the relocation area or in other village close to the “old” village of Arongan.

The coastal area is dominated by local tall coconut trees and before Tsunami farmers planted cocoa under coconut trees. This multistrata system is considered as a good system for farmers. As the solar intensity under old tall coconut is more than 50%, then it is still recommendable to plan cocoa under coconut. Tsunami damaged the cocoa trees, and left mainly only coconut in the coastal area. This area is potential to be considered for the improvement of coconut + cocoa intercropping. Other coastal tree crops maintained by villagers are sago and nipah.

Discussion with the peoples in the area indicated that rubber is also an important tree crop for the farmer in Arongan. This commodity grows mainly in swampy area, which is a large area in Arongan.

As indicated by ISRI report, coconut yield is low and the price of coconut was very low (Rp. 300 per seed; or Rp 1800/kg of dry coconut or copra). As far as there is no local processing facility for coconut, the price will be still very low. This low price is relatively similar before and after Tsunami. Solar dried coconut (copra) produced in this area is sell to Banda Aceh. Farmers expected a support on post harvest technology for coconut rather than support on coconut planting materials.

In the other side, the price of rubber (about 50% of dry rubber content) was Rp 6500/kg where price of rubber with 100% DRC in Medan was Rp 15000/kg. It means that farmers received 87% of the factory gate price, or equivalent of 74% of the fob price. This level of farmer gate price is relatively good, taking into account the condition of the current infrastructure in Aceh. Cost of rubber transport (truck capacity of 12 tonnes) from Meulaboh to Medan was Rp 415/kg. This preliminary observation need to be detailed and developed with more appropriate sample villages and farmers.

Farmers in Arongan have long experiences as tapper in PTP-NES area (located in Batee). Rubber in NES project is clonal rubber, but rubber belong to the farmers is mainly originated from unselected seedling with very low potential productivity (planned in the component 2).

### **1.b. Kubu Village (Zone A)**

Kubu village located close to Arongan village. The farmers in this area was relatively wealthy farmers due to the income from tree crops, mainly hybrid and local coconut, cocoa planted under coconut, clonal and local seedling rubber and from other annual crops such as Nilam (*Patchuli*). Clonal rubber was introduced in the 80-ies through PRPTE project and the hybrid coconut was introduced by Smallholder Coconut Development Program in 1982 (SCDP). Tsunami damaged most of hybrid coconut, clonal rubber and all cocoa plantations.

Planting distance of cocoa planted under hybrid coconut was 3m x 3m, and at each coconut interrows (8m x 9m) two rows of cocoa was planted. The cocoa seed was originated of PTPN II, in Medan.

Due to the good price of rubber and cocoa (Rp 8000-10000/kg), farmers in this village are very motivated to re-establish their tree crop based system. They are ready to work together with the group and expected a support from ReGrin activities. Considering their experiences in the past, they interested in planting rubber and cocoa but less coconut. Farmer in this area has initiated them selves to grow coconut seedlings, collected from the local coconut. They know that the fruit collected from hybrid coconut can not be used as planting material.

Information regarding the marketing of rubber is relatively similar to that in Arongan village. Concerning Nilam, farmers still grow these crops due to existing demand in this village (and in Aceh in general). Price of 1 litre of Nilam oil is Rp 180.000 that can be produce from 625m<sup>2</sup> of land. Nilam is commonly planted as intercrop under other annual cash crops and tree crops.

### **1.c. Seunebok Teungoh (Cot Gajah Mati) Village (Zone B)**

The road pass through this village will be the main road connecting Meulaboh and Banda Aceh. The re-location area for the peoples of Arongan and other villages is located nearby this village (Village Soak Biduk) (see ISRI report).

The main tree crops in this village are coconut (local as well as hybrid), rubber, and cocoa. There are expectations from certain villager to plan oil palm. As in Kubu village, the hybrid coconut and clonal rubber were introduced by government project (SCDP and PRPTE). However, more local variety trees are cultivated by farmers. Rubber planted in swampy dominated by peat soil and in upland mineral soil area. All ex-PRPTE rubber areas were located in the upland area.

Farmers in this villages were informed that Dinas Kehutanan dan Perkebunan will provide rubber planting materials to be planted in their farm. Information from key informan indicated that there were many farmer groups established before tsunami. However the activities of these farmer groups are very limited, related to the establishment of new tree crop based systems.

Not as in Kubu village, hybrid coconut grows in this area showed a nutrient deficiency (most likely Mg and S), with yellow leaves homogeneously distributed in the parcel. At least observation from the visit, the productivity of the hybrid coconut was not better than that of local coconut. Farmers cultivated also cocoa under coconut, however the growth performance of cocoa was not very satisfying. This may be due to the lack of maintenance,

especially fertilisation application. This also due to the low price of coconut, that can not compensate the cost of inputs, for maintaining the farm.

Government, through BRR plan to provide farmers a rubber plantation or other tree crop plantation (oil palm) in the relocation areas. Most likely, the area originally secondary forest is partly swampy area, dominated by peat soil with different peat depths. Land preparation was on going.

Farmers in this areas plant *Jatropha curcas* (*physic nut*) or locally known as Jarak Pagar, as live fencing. At the national level, this plant is now very famous for the production of raw material for biodiesel. The fruit beared by the *Jatropha* plant was apparently not very encouraging.

The price of rubber in this village was less than that of in Arongan. The price ranged from Rp. 3000 to 5000/kg depend on the quality and the dry rubber content. Farmer informed that they interested in planting rubber clones, however the planting material is not available in the areas. Farmers who planted rubber clone, bought the planting materials from Medan.

#### **1.d. Rimba Langge Village (Zone B)**

The village is located about 5 km from **Seunebok Teungoh**. The important point appear in this village is that since 1995, Dinas Kehutanan dan Perkebunan has planted budwood garden for about 3 ha and consisted of 9 clones, distributed in 9 blocks of planting. This budwood garden was purified by Sungai Putih team and was used as sources of buds for clonal planting material production. However, due to social and political conflicts in the past, those budwood gardens were abandon and the budwoods were not harvested correctly.

One block of RRIC 100, was never harvested due to grafting problem (low level of succeed). Rubber trees in this block are now look like a high density plantation. The diameter of the plants range from 7 to 15cm. It seem that the rehabilitation of this budwood garden is not interesting due to the bad condition of the garden, and may be the clones are no more up to date. Not far from the budwood garden, rootstock nursery was also established. The nursery was abandon too.

Discussion with official of the Dinas indicated that there is a plan of Dinas to reestablish rubber nursery (4 ha) in Rimba Langge in 2006. The product of the planting materials will be distributed to other sub-districts of West Aceh, for rubber development. This is a good sign that the ReGrin project can collaborate with Dinas to support farmers to access to high yielding rubber clones.

Rimba Langge village is close to rubber NES area, located in Batee Puteh. This means that technology developed in NES may be transferred partly indirectly to farmers (farmers as employee of NES project). Rubber buyer in NES project may also buy rubber from this village, so that the price is expected to be similar to NES, as far as the quality is similar.

## **2. Samatiga Sub-District**

### **2.a. Cot Seumeureng Village (Zone B).**

This village is one of the rubber producing area in West Aceh, however no clonal rubber was observed in this village. As in other areas, farmers informed that good planting materials of rubber and other tree crops are not available in the village. Cocoa is also commodity interested by farmers. Local initiative to plan oil palm was also observed, but as in other area, the growth performance of oil palm was not satisfying. The maintenance

was limited, the plants bearing fruit are very limited. As reported by ISRI, this village is used as refugee area.

The price of rubber was Rp 7000 (DRC of 56%), and cocoa ranged between Rp8000-12.000/kg beans. Oil palm is still less develop in this area, even certain farmers started to plan oil palm in a limited area. Wild pig is the most difficult pest to control in this area. The team has to take into account this pest when we start to develop tree crops.

### **2.b. Paya Lumpat Village (Zone B)**

Part of the village was affected by Tsunami, but mostly not. Road access to the village is well maintained, so transports is not a problem. This village is considered by many farmers in West Aceh as well developed village based on agriculture (food crops as well as tree crops) production. Irrigated rice field is one of the main source of income for farmers.

Rubber, pinang, cocoa, and coconut are dominant tree crops producing sources of income for farmers. Various fruit trees (durian, rambutan, manggosteen, langsung) are planted under agroforestry systems. Nipah and Sago are also found in many areas. However, farmers seem not very interested in developing those last two commodities.

Clonal rubber has been introduced in this village by “progressive” farmers who know the productivity of the clonal rubber is better than that of local seedlings. They also have enough financial capital to establish clonal rubber and have access to planting materials (buy from Medan and mostly rubber trader).

The growth performance of clonal rubber planted in this village is “relatively good” considering the low maintenance that farmers bring to. Visit from clonal rubber (mixed clones) planted on peat soil and well drained (about 10 and 1 years old) indicated that clonal rubber is also potential to be planted in the peat soil (peat depth not more than 1m). Farmers seem very satisfy with the yield they collected from the clonal rubber. Water management through drainage will be the most important infrastructure to be prepared when using peat soil area for rubber plantation.

It is also found that plant uprooting on clonal rubber is not an important issue in peat area. A one year old clonal rubber (planted from two whorls planting material) growth showed that there is tendency if the plant density is low, then the risk of uprooting will increase. The clone canopy (light canopy) and density (high, up to 600 trees/ha) will be an important criteria for establishing clonal rubber on peat soil. The potential clones will be PB 260 and IRR 104.

A farmer has planted seedling 6-8 months ago. These seedlings is potential to be improved as clonal planting material by grafting. The owner agreed that the ReGrin team will demonstrate how to improve his seedlings to be clonal rubber. Follow up action will be carried out by field team to graft the “root stock” with PB 260 clone.

The marketing of tree products, especially rubber is not a big problem. Village level traders are available. The price of rubber was Rp 6500, comparable to that we found in Arongan and other areas. It means that farmer has received fair price.

Many farmer plan to open new land for establishment of rubber plantation. The problem they are facing is access on the good rubber planting materials. This village is potential to be considered as one of the ReGrin site action for supporting planting materials of tree commodities (rubber, cocoa). Farmers are very antusiastic to participate on the ReGrin program. They expect that the program will be started soon.

## **2.d. Desa Aloe Raya and Cot Selamat Village (Zone A and partly Zone B)**

The most important agriculture activity is based on annual food crops. However tree crops products (coconut, rubber and some cocoa) is also important. No clonal rubber was found in Aloe Raya, but certain farmers has started in Cot Selamat. The small existence of clonal rubber indicating that no rubber government project was introduced and not enough local initiative was developed to promote clonal rubber. Most farmers agreed that availability of planting materials are the most important constraint on the development of clonal rubber in most areas in West Aceh. However, the experience of farmers in managing local rubber will be a good step to introduce clonal rubber to improve the productivity.

In the mineral soil, not affected by Tsunami, farmers has started to plant oil palm but with minimum maintenance. Results of this minimum management, the oil palm not producing any fruit, even the age has reach more than 4 years. Farmers are also planted fruit trees such as durian, langsat, and rambutan, especially as home garden. Clonal rubber belong to a trader yields about 40 kg of coagulated latex (slab) per day compared to 25kg/day from local seedling rubber.

Farmers informed that one of the most crucial problem in establishing new tree crops based system is damage of wild pig (close to forest) or buffalo (close to habitation). Fencing is the considered as one good method to protect trees from damage, however the cost of fencing is high.

Considering of the farmers interest and experience in tree crops, Cot Selamat will be more relevant to be selected as ReGrin site.

### **1. Johan Pahlawan Sub-District**

Johan pahlawan is the closest Sub-District to Meulaboh. Horticulture (fruit trees) will be an interesting activity for farmers, due to the close existing market in Meulaboh. The access of transportation is not important issues. Type of soil (dominated by peat, swampy area) is important issue in tree crops development.

### **3.a. Suak Nie and Suak Raya Villages (Zone A)**

The main area in those two closest villages are swampy peat soil. Local rubber is the most common tree crop along the main road. This local rubber, mainly monoculture, is old and low productive, however as the important source of income for farmers. As reported by ISRI, water table is shallow and peat depth vary from 0,5 to 3 m. Due to water drainage, the peat soil declining and rubber root release from soil, affecting the strength performance of rubber tree to stand.

Many support activities related to relief the peoples of Aceh (NGOs, Government, BRR) present in this area. Mostly are house and road constructions, annual food crops development and partly provision of planting materials of various fruit trees.

The ReGrin activities may be link to the present activities organised by NGOs as well as Government, in order share the experience and the resources (materials and expertise).

### **4. Meureubo Sub-District**

#### **4.a. Gunung Kleng (Zone A)**

Similar to other rubber areas in West Aceh, rubber in this area is also found on peat soil. Farmers usually prepared drainage surrounding their plantation. Most local rubber is old and low productive. Potential of rubber wood is never considered in replanting of old rubber

area. This may be due to the lack of information or market. We think that in a hectare of old rubber areas, number of timbers can be produced is more than 50 m<sup>3</sup>. Farmers in this area are interested in developing rubber and cocoa. Farmers not started to plan clonal rubber due to lack of various basic needs (financial, technical, planting material availability).

A group of farmer have received assistant from an NGO on the development of seed of annual food crops (long beans). They also interested in developing perennial tree crop planting materials.

Marketing of rubber is, as in other area in West Aceh, is not a big issue. Farmer received a fair price from trader. A share tapping is also present in this area, with 1:2 share system (1/3 for owner, 2/3 for tapper). Tapping system practiced by farmer is 4-5 tapping days per week.

Considering the experience and the expectation of farmers, this area is interesting to be supported on tree crop planting material (rubber, cocoa) for ReGrin activity.

#### **4.b. Peunaga Cot (Zone A)**

This village is close to Gunung Kleng. The farmer practices for rubber and other annual crops are similar. Rubber is the main source of income, beside coconut, from tree crop. As in other area, rubber in this area is also planted on peat area. In some areas Nipah and Sago are present, but not manage by farmers. Some farmers use Sago as duck feed.

There is local initiative to establish local coconut nursery in this area. In the coastal area, an activity on planting coconut and ketapang trees was organised by forestry department.

In the further area, certain farmers start to plant oil palm. This is logic because next to this village, an oil palm plantation belong to Socfin (private company) has a palm mill in Nagan Raya (the District in Shouthern part of West Aceh), and can buy fresh fruit from farmers. No nursery farmer who sell planting materials (for rubber, oil palm and others) is available in the area.

Transportat access to the village is good, but to the tree crop field (rubber, oil palm) is still limited (only by bike or motor cycle). Marketing of tree product is similar to other areas, and for rubber is good.

#### **4.c. Buloh/Balee Village (Zone B)**

This transmigration village was not affected (zone B). Plantation crops included rubber, oil palm, and cocoa. The access to these village is limited, due to the limited human resources in the ReGrin project and taking into account the targeted villages, then in this first phase of field activities, these villages will not be considered as sample village for nursery support and farmer organization building.

## **Market assessment for major tree crops and institutional setup**

### **I. Introduction**

Tree crops such as rubber, cocoa, coconut palm and others play an important role in economic activities as a source of cash income for most of the farmer in the tsunami affected coastal zone in both Aceh and Nias. Physical damage of the trees also had an effect to the marketing system of the product. Actors in the marketing mechanism are facing problems to rebuild the marketing institution to achieve efficient marketing system. One way to improve the system is by redesigning the overall system to be a good

marketing system. Under good marketing system, all of the actors of the system will get benefit proportional to their contributions to the system. The expected outputs of the new marketing system are good price, improved product quality, increase market share, the role commodities becoming economically more important and better welfare of farmers and communities especially in the tsunami-affected zone.

General objective of the study is to get clear understanding about marketing mechanism for selected tree crops in the tsunami-affected zone pre and post tsunami as a basis for setting-up and reviving the market mechanism for selected tree crops.

## **II. Methodology**

### **A. Approach of the Study**

The combination of institutional and SCP (structure, conduct, performance) approach was used in this study. There are three main levels taken into account in applying SCP analysis: (1) the structure of the market, (2) the conduct of the market, and (3) the performance of the market. Some concepts of the theory of institutional economics (transaction cost) and the marketing channel (structure, conduct and performance) approach were integrated in analysis. Two steps carried out in market structure analysis. *Firstly*, the general picture of the channel system was determined by the actors or intermediaries involved in the market. *Secondly*, competitiveness by using criteria relating to barriers to entry and exit, product quality, and distribution of market information.

The most important issue of market structure analysis was to sketch the channels of distribution. Marketing channels was defined as the flow of products from the place of production to the place of ultimate consumers. The structure of marketing channels was used to determine the relationships between different actors in the markets. The process of price formation was determined by the following elements: market power, bargaining skills, and some specific transaction characteristics like quality of product, volume of sales per transaction, and sales location. In general, a trader who was considered as a leader had high market power on setting: prices in the market, quality of product are related to consumers' preferences, and volume of sales expresses the difference between wholesale and retail prices. This difference signified the bearing of assembly or distribution costs by those involved. Finally, sales location directly affects the price of a product, as transport costs were significant.

### **B. Data Collection and Analysis**

Data and information on existing marketing system of selected tree crops both pre and post tsunami were collected from farmers to traders and to exporters in each level. The general pictures of marketing system and socio-economic importance on each potential commodity were explored by interviewing some key informants from NGO's, related government officers, local leader (keuchik), extension service officers and some chief of farmer group. Types of data and information needed as well as data collection method and source of information were presented in Table 2.

Table 2. Market parameters, data collection method, and source of data and information

| No | Parameters/Aspects   | Data Collection Method                     | Source of Data/Information  |
|----|--|--|---|
| 1  | Market channel   | Rapid rural appraisal                      | Extension workers   |
| 2  | Market actors  | Rapid rural appraisal                      | Extension workers   |
| 3  | Type of products and quality   | Rapid rural appraisal<br>Field observation | Extension worker, Farmers   |
| 4  | Farm gate price  | Detailed survey                            | Farmers, Traders  |
| 5  | Factory gate price   | Detailed survey                            | Processor   |
| 6  | Trader gate price  | Detailed survey                            | Farmer<br>Trader  |
| 7  | Transportation cost  | Detailed survey                            | Trader, Farmer,<br>Transportation agencies,<br>Extension officer          |
| 8  | Loading and unloading cost   | Detailed survey                            | Trader, Transportation agencies, Extension officer                        |
| 9  | Retribution cost   | Detailed survey                            | Trader  |
| 10 | Fluctuation of commodities price   | Secondary data                             | Processor, Trader, Extension officer                                      |
| 11 | Marketing margin   | Detailed survey                            | Marketing actors  |
| 12 | Processing facilities  | Secondary data                             | Extension officer, NGOs   |
| 13 | Infrastructure facilities  | Secondary data                             | Extension officer, NGOs   |
| 14 | Marketing days in rural areas  | Secondary data                             | Extension officer, NGOs   |
| 15 | National and international supply and demand for selected tree crops product | Secondary data                             | International commodity organisation, Directorate General of Estate, NGOs |

A survey was carried out to collect data and information of existing marketing system in two regions tsunami-affected districts namely West Aceh (Aceh) with selected sub-districts (Table 3). Sample of villages in each sub-district were purposively taken representing the level of damage, which is classified as zone A (tsunami-directly affected), and zone B (tsunami-indirectly). Sample of farmers and traders as well as key informants in each location were determined according to marketing channels exist in the area.

Both primary and secondary data were collected. Primary data were collected through survey with both individual and group interview. While secondary data and other information were obtained from several related institution and NGOs. A technique of desk study, brainstorming, knowledge acquisition and group discussion were carried out to design a new marketing system. Data and information were analysed by marketing margin and economics institution analysis focusing on transaction cost.

The report that presented below describes the marketing mechanism of several tree crops in the tsunami-affected zone in West Aceh, while Nias is still to be surveyed in the next step.

Table 3. Location of marketing assessment survey

| Tsunami-Affected Districts | Selected Sub-Districts                                | No of Sampled Villages | Remarks               |
|----------------------------|---|------------------------|-----------------------|
| West Aceh (Meulaboh)       | Meurebo, Johan Pahlawan, Sama Tiga, Arongan Lambalek. | 10 – 20%               | Based on damage-level |

### C. Results and Discussion

#### 1. Marketed Products Form

Farmer in this region produce of each cultivated commodity in the form of simple primary product. Rubber commodity produce and sale by farmer in the form of cup lump with various qualities mainly in term of dry rubber and dirt content. Latex drips from the trees due to tapping process are collected in the coconut cup and then coagulate naturally. In each 3-5 days, the coagulated rubber (cup lump) is collected by farmer to be sold. The cup lump is then soaked in the water by collected trader. Figure 5 shows the quite clean cup lump (a) and dirty cup lump (b). These products are used as a raw material in the crumb rubber industry.

A quite clean raw rubber material is generally used directly as raw material to crumb rubber industry, while dirty one is then first cleaning up by remilling factory before send to the crumb rubber factory. In this region is absolutely no farmer habit to collect of raw rubber material in the form of fresh latex to be processed to sheet or other latex primary product.

Product of coconut plant is marketed in the form of both “kelapa butiran” and “kopra”. Kelapa butiran in smaller proportion to kopra is marketed for local consumption in Meulaboh and vicinity, while kopra is used as a raw material in coconut oil factory in Bireun and Medan. Before tsunami, farmer process coconut to be kopra in special smoked house. Tsunami destroyed all smoked house and then farmer try to dry the coconut by using sunlight (Figure 6).



Figure 5. Raw rubber material produces by farmer. A quite clean cup lump (a) and dirty cup lump (b)

The prices of coconut both for kelapa butiran and kopra are not give an incentive to farmer further to develop this commodity. The existing plant is a relatively old tree cultivated traditionally without any maintenance. Therefore, coconut is cultivated by farmer more like traditional commodity rather than commercial commodity.



Figure 6. Coconut drying process by using sunlight. Coconut directly split in two pieces (a), split in two pieces after removal of the fibre (b)

Cocoa bean is removed from the ripped cocoa fruit and the clean up from the phlegm before drying in the sunlight (Figure 7a). Farmer does not know yet about fermentation process of cocoa bean. All the farmer produce in this region just produce unfermented cocoa bean. Hence, ripped areca nut fruit removal from the fibre and then spilt in two pieces before drying directly in sunlight (Figure 7b). Beside cocoa and areca nut, in small number farmer in this region also produce nutmeg. The processing of the product just dry directly in sunlight and then marketed.

Palm oil cultivated by farmer just to produce fresh bunch directly send to the oil palm factory. Several big estate have established palm oil factory to process fresh bunch produce by their own estate and also offer buying fresh bunch produced by smallholder in the area. Other product produce by farmer in the region is kinds of fruits such as durian and rambutan mainly for local consumption.



Figure 7. Drying process in the sun-light for cocoa bean (a) and areca nut bean (b)

## **2. Actors and Chain of Marketing System**

Marketing of the selected tree crops products in this region is still follow the traditional system using dominant role of intermediaries in various levels. Farmers as producer of the products connected to the factories or exporters by traders from village traders to big

traders in district level those who have access to factories or exporters. Cooperative marketing pattern by using group of farmer or other institution has not been introduced and implemented yet. Traditional system in the marketing of agricultural products is mainly characterized by strong relationship between farmer and village traders or collectors.

Village traders or collectors give financial or daily needs support to farmers as glue in transaction process. As a feedback, farmers have to sell their products to the related village traders or collectors those who have given them the support. Fluctuation of the production and price of the product might occur all over the year due to climatic condition or marketing situation and affected the income of the farmers. In the condition, that farmer has no income in the certain of period then the village traders or collectors lend farmers some amount of money.

Village traders or collectors mainly have no adequate capital to operate their business. In this case big traders in district level put village traders or collector to be their partner or agent in several villages. Big traders give some amount of capital to village traders or collector. All transaction run in the form of informal system based on trust building. Based on the system transaction cost reduce in the low level due to low cost of information, negotiation and enforcement. The relationship among farmer, village traders or collectors and big traders hence form of certain institution. The institution has a multiple purposes for not only commodities transaction but also serving financial services and insurance for farmer. By using the system life security or the farmers could be maintained.

Marketing channels of the products in the region have a relatively same pattern with small variation due to differences of characteristics of the products. According to the marketed products the channel of marketing can be depicted as shown in Figure 8.

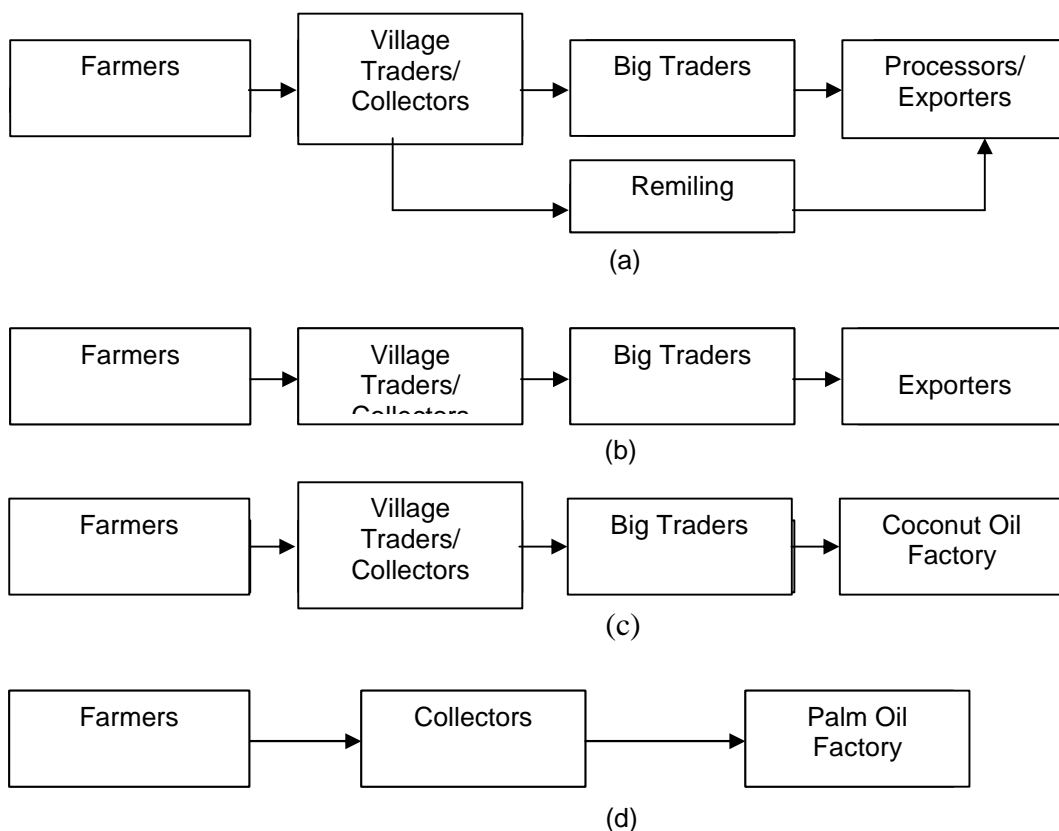


Figure 8. Marketing channel of the products. Rubber (a), cacao bean, nutmeg, areca nut (b), coconut (c), palm oil (d)

Processors/exporters for rubber and exporters for cacao bean, nutmeg, areca nut mainly located in Medan and vicinity. Coconut oil factory located in Bireun (East Aceh) and Medan, while palm oil factory mainly located in the neighbouring district Nagan Raya.

### **3. Farm gate Price and Market Situation**

Farm gate price of selected tree crops products in this region is shown in the Table 4. Farm gate price of the product is depending on the quality of the product. Rubber is marketed in the form of cup lump with dry rubber content varied from 45 to 60% with varied dirt content. Cup lump with 52% of drc is bought by village traders in Rp 6200 per kg or Rp 11.923 per kg dry rubber. If the fob price of SIR 20 in Medan at that time is Rp 17.480 then the farmers receive 68.2 % FOB price.

Table 4. Farm gate price of selected tree crops products in the region

| No | Marketed Products | Average Farm gate Price (Rp) | Unit                                |
|----|-------------------|------------------------------|-------------------------------------|
| 1  | Rubber            | 6.500                        | Kg wet cup lump with drc 52%        |
| 2  | Cocoa bean        | 9.000                        | Kg wet bean with water contents 12% |
| 3  | Coconut           | 300                          | Unit Ripped Fresh fruit             |
| 4  | Palm Oil          | 450                          | Kg fresh bunch                      |
| 5  | Areca nut         | 3.000                        | Kg dry nut with water content 8%    |

Farm gate price of rubber is quite low. This phenomenon is expected due to quality of raw rubber material produced by farmer is still low. Other reason is that bargaining power of farmer against village traders is also relatively low. The farmer is highly dependent financially support to the village traders. The product of smallholder rubber is much segmented market because of very low productivity and small land holding.

Orientation of the price of all marketed products in the region is highly dependent to market situation in Medan. All cup lump produce by farmer in the region sell to crumb rubber factory located in Medan and vicinity. Cocoa bean, areca nut, nutmeg are also sell to exporters in Medan. Even though fresh-bunch of palm oil is processed in the factory in Nagan Raya but the product of oil palm is also marketed or exported through Medan.

Tsunami was mainly destroying the road infrastructure between Meulaboh and Banda Aceh but not too much affected to the line of Meulaboh and Medan. Based on the fact it is true that tsunami was nit affected so much on marketing mechanism for selected tree crops in the region.

### III. Preliminary Conclusion

The main commodity that potential to be developed in West Aceh according to the existing roles and interest of the farmer are rubber, coconut, cocoa, palm oil and fruits. Ten villages in four sub-districts have been selected for the first phase of field activities, especially related to the tree crop development support and farmer organisation.

Farmer produced a primary raw material to be either a raw material for factory or exported and consume locally. Market mechanism for the selected tree crops product in the region is base on traditional system that takes place on dominant role of intermediaries. Farmer receives a quite low farm gate price on the product due to low quality of the product produce by farmer.

Annex 1. Summary of the characteristics of Sub District and possible location for nursery activity and soil and plant monitoring (combined with ISRI report).

| Sub District and village           | Zone    | Soil             | Main Tree Commodities and other features  | Nursery and/or soil monitoring  |
|------------------------------------|---------|------------------|---|---|
| <b>Arongan Lambalek</b>            |         |                  |   |   |
| Arongan                            | A       | Mineral          | Coconut, cocoa, rubber  | ? No  |
| Kubu                               | A       | Mineral          | Coconut, cocoa, rubber  | ? Nursery support: rubber and cocoa   |
| Cot Gajah Mati (Seunebok Teungeuh) | B and A | Mineral and peat | Coconut, cocoa, rubber, durian, sawo (khirni; <i>Manilkara kauki</i> ), rambutan, mango | ? Nursery support: rubber and cocoa<br>? Hybrid coconut nutrient deficiency rectification |
| Rimba Langgeh                      | B       | Mineral          | Coconut, cocoa, rubber, durian, rambutan  | ? Nursery support: Rubber, cocoa  |
| <b>Samatiga</b>                    |         |                  |   |   |
| Cot Simereung                      | B       | Peat             | Rubber , coconut, cocoa, durian, sawo, rambutan, manggo                                 | No  |
| Cot Slamet                         | A       | Peat             | Idem  | ? Nursery support: Rubber and cocoa   |
| Paya Lumpat                        | B       | Peat             | Rubber , coconut, cocoa, durian, rambutan,  | ? Nursery support: Rubber and cocoa<br>? Soil and plant monitoring                        |
| Swak Seumaseuh                     | A       | Mineral          | Lagoon area, most people killed   | No  |
| <b>Johan Pahlawan</b>              |         |                  |   |   |
| Suak Nie                           | A       | Peat             | Rubber, durian, manggo, sawo (khirni)   | ? Nursery support: fruit trees<br>? Soil and Plant Monitoring                             |
| Suak Raya                          | A       | Peat             | Idem  | ? Fruit trees nursery   |
| Johan Pahlawan/ Meulaboh           | A       | Peat             | Manggo, rambutan, durian, sawo  | ? Fruit trees nursery   |
| <b>Meurebo</b>                     |         |                  |   |   |
| Gunung Kleng                       | A/B     | Mineral          | Rubber, cocoa, oil palm   | ? Nursery support: Rubber, cocoa<br>? Soil and plant monitoring                           |
| Buloh/Balee                        | B       | Mineral          | Idem  | No  |
| Peunaga Cot                        | A/B     | Mineral          | Idem  | ? Nursery Support: rubber, oil palm   |

## Spatial Analysis

The general objective of this trip was to select potential site to be used as the primary location for ReGrin project activities. Three components were involved: tree nursery, soil monitoring and spatial analysis. Spatial analysis activities in the trip were focused on assessment of the quality of available spatial dataset to support ReGrin activity for West Aceh, reflection on several necessary spatial data that might be needed down the project line, and collecting GPS sample point of various type of land cover/land use in the vicinity of selected sites to be used in remote sensing analysis.

On the first days, by comparing our data with field survey that conducted by Eri, we figured out several errors on the village map that we currently have. While the village location is mostly correct, almost all of it was mistakenly named. Since the errors were unsystematic, we found it difficult to correct it without any references available. The original source of the village map is BPS (Biro Pusat Statistik), the data it self was downloaded from RSGIS Forum website. This will be the primary thing to be fixed once we are back in Bogor office. On the same day we have a discussion on the tsunami affected zoning system. Previous assumption to divide the tsunami-affected area into 3 zones (*affected, partly affected, not affected*) was proved to be difficult to be implemented in the field. Based on simplicity and to avoid possible bias in the field we decided to merge the *affected* and *partly affected*. In this way we only recognized 2 zone, tsunami-affected zone and none affected zone. Spatial datasets derived from remote sensing data just one day after tsunami support this decision. The data clearly showed the tsunami-affected area on the coastal zone of West Aceh. The size of the effected area in West Aceh District is more than 14000 Ha.

The next couple of days were used to visit some potential location to be used as ReGrin site. The criteria were mostly based on the availability of tree-crops commodity in the area, farmers (quick) response on project activity, and village condition before and after tsunami. Soil sample were taken on most of the location visited. GPS points of the potential site along with several training sample of vegetation cover were also taken. In the 5<sup>th</sup> day of the survey, we were able to select eleven sites along coastal zone of West Aceh. The site Location is showed in figure 1.

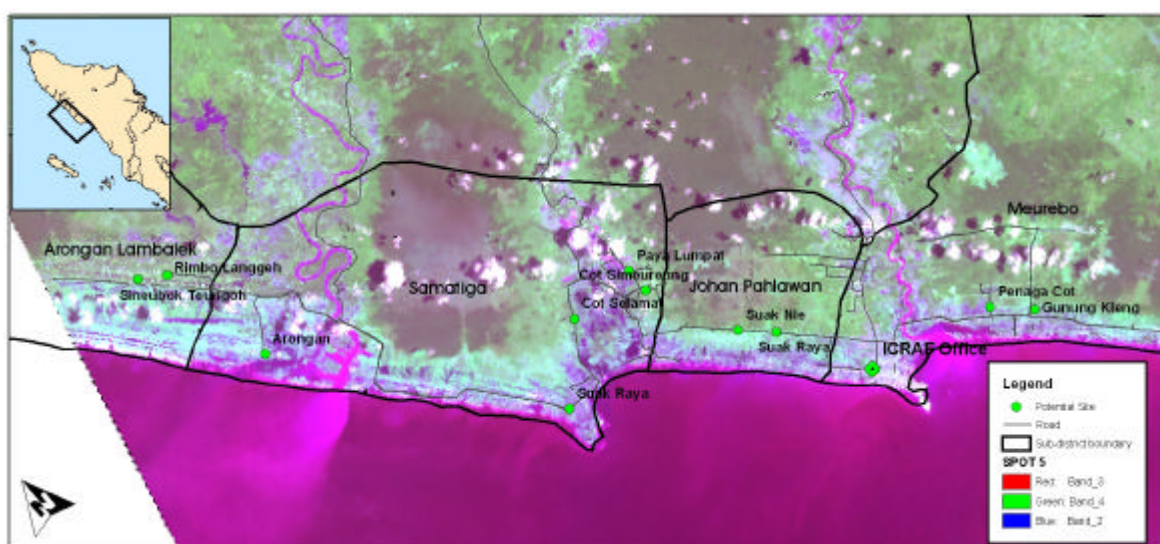


Figure 1. Potential site location on Aceh west coast

We also differentiate several major land cover/land use patterns in the area of interest. In the coastal zone and tsunami-affected area the major land cover are mostly bare/cleared land, combined with patches of coconut tree and rice field. In the mainland, the land use is dominated by various type of rubber. Generally it can be classified into three types of

rubber: *rubber agroforest*, *old rubber in the peat dome*, and *simple monoculture rubber*. *Rubber agroforest* is where rubber trees are combined with several others crops, such as coffee and cacao. *Old rubber in peat dome* is basically the same as simple monoculture rubber, but due to soil characteristic, it formed a unique spectral signature on satellite image. Rubber tree in this classis usually very old and, according to some farmer, has existed since the Dutch ages. By looking at the tree structure, one can easily tell that this type of land use represent a very extensive type of land management *Simple monoculture rubber*, on the other hand, represent the type of rubber tree that are managed intensively. Below is the figure of the three rubber types.



Figure 2. Various type of rubber garden; old rubber in peat dome (upper left/right panel), simple monoculture (lower left panel) and rubber agroforest (lower right panel)

Spatial analysis activity within the next couple months will be focused on the provision and updating of available data especially village level data and processing of remote sensing data to produced land cover /landuse maps of the study area. Another part of activity will focus on the making of poverty mapping over the study area of ReGrin Project.

## **Soils perspective:**

### **I. GENERAL OBSERVATION**

In a general discussion at ICRAF office in Meulaboh, the team (ICRAF, ISRI, LRPI) agreed that the most sensible area classification, as far as agriculture is concerned is dividing the area into two zone:

Zone A: Those areas affected by the tsunami waves, regardless whether the waves also damaged houses and other amenities. The changes that may have happened included increase in sodium, other cation and other organic and inorganic substance concentrations, capping of soil surface with mud and/or decapping of the surface.

Zone B: Those coastal areas unaffected by tsunami.

## 1. Arongan Lambalek Sub-District

### 1.a. Arongan Village

Arongan village is one of the most severely damage village with almost 100% house destruction. Because of the total devastation, the 162 survivors of 323 people prior to tsunami, will be relocated to Seunebok Teungeuh (Cot Gajah Mati).

This coastal area is dominated by coconut. Other tree crops include banana, papaya, and cocoa. However, due to the very low price (Rp. 300 per seed; or Rp 1800/kg of dry coconut or kopra) and long (about 6-8 years) vegetative stage, there seem to be no incentive for farmers to replant and improve coconut. After relocation, Arongan will be considered as secondary farmland in addition to other land in the relocation area. Farmers explained that the soil in the village was much better after tsunami.

The soil, in general, is sandy. There was no more sign of salinity problem as indicated by soil electric conductivity (EC) of <0.02 mS/cm. Standing water in swampy area, about 300 m from the coastal line, had salinity of 2.4 mS/cm, may be due to occasional high tide influence.

### 1.b. Kubu Village

Like Arongan, Kubu village is another devastated area caused by tsunami (zone A) as indicated by almost 100% residential damage. The survivors will also be relocated in Cot Gajah Mati village. During the tsunami, the sea wave was as high as 5 m. Plants such as cocoa was washed away or died because of salinity, but most coconuts survived.

As in other villages, farmers believe that soil fertility is better now than then. Soil texture is loam in the 0 – 20 cm layer and sandy loam in 20 – 40 cm layer.

### 1.c. Seunebok Teungoh (Cot Gajah Mati) Village

The area closest to the coastal line was affected by tsunami whereby cacao plants had been totally vanished while less than half of rubber trees survived. Other parts of the village were unaffected (zone B) and will become relocation area of about 650 people from four villages, including 120 from Arongan. According to the villagers, each relocated family will be entitled to 2 ha land, including home garden; to be provided by BRR.

The non affected area we visited was under the program of hybrid coconut development around 1982 and currently about 50% of the coconut stands are of the hybrid variety. The local coconut looks healthy in general, while the hybrid shows the symptom of nutrients (most possibly Mg and S) deficiency. This could have been caused by, traditionally, no fertilization for local coconut and to lack of incentive to fertilize with the very low coconut price. Perhaps, if cacao is planted under the coconut trees, the coconut could receive fertilizer excess/residue of what normally added to cacao.

*Melastoma sp.* an indicator plant for acid, infertile soils is dominant in this coconut farms. The soil is mineral soil with sandy loam texture in the 0 – 20 cm and sandy in the 20 – 40 cm layer. The EC was zero mS/cm in drinking well water, and almost undetectable in the soil samples.

The Imam Mukim (head several, in this case 8-16 villages), Mr. Sid Intan, indicated that there is a Kebun Entres (the clone source) in the nearby Rimba Langgeh. When we visited, we found out that the upper stem source has been abandoned for a long time, but perhaps, could be rehabilitated for nursery activity.

#### 1.d. Rimba Langgeh Village

The soil condition in this village is similar to that of Desa Seunebok Teungoh, with mineral soil and dominated by hybrid coconut and rubber. The 'entris' clone source (as mentioned in part 1.c.) has been abandoned for many years. We were told by a person from the District Plantation Service that there was 9 clones of quality rubber in the nursery, but at this point, there is no record to show the position of each clone in the nursery.

### 2. Kecamatan Samatiga

#### 2.a. Cot Seumeureng Village.

This is unaffected village (zone B) and has become the refugee area with barracks. Rubber is the main vegetation, all originated from bare root. However, the people understand the superiority of clone rubber and a villager believe that the take-up will be very quick had the clone rubber been introduced. Mr. Arjun Kamil from Agricultural Service in Meulaboh believed that farmers even will replace their existing rubber if clone rubber planting material is available.

With the existing rubber trees, they sell rubber at Rp. 7000/kg. One person (farm laborer) can tap about 10 kg rubber for which he or she gets 30% share.

Cocoa has a good price of Rp 8,000 to 12,000/kg. The main problem is lack of quality seedling although this will be one of the most perspective commodities.

Oil palm is rare, although there is a small oil palm garden in the village. The plants leaves are yellowish because of lack of weeding and perhaps also nutrient deficiency. Marketing is the biggest problem for oil palm in this Sub District as well as in Sama Tiga and Johan Palawan. As far as oil palm marketing, it seems that only Meurebo Sub District is benefited because of closeness to plantation that process crude palm oil.

The soil is peat with the depth of about 25 cm. The underlying layer is mineral with sandy loam texture.

#### 2.b. Paya Lumpat Village

This village is about 1 km from Cot Seumeureng village and belongs to Zone B. Home gardens, of multistrata type, dominated by coconut, cocoa, rambutan, and durian. In the farm, the main commodity is local rubber. We were informed that there were farmer(s) already planted clone rubber, currently having different growth stages and that the latex production of the clone is much higher than that of traditional one. The soil is shallow peat (50 – 65 cm depth) with sapric peat on the surface and hemic in the subsurface layer.

#### 2.d. Desa Aloe Raya

This village belongs to zone A with the tsunami wave height of about 5 m. Sea mud at home garden had a thickness of 60 cm. EC of the mud was 2.74 mS/cm (1:2 H<sub>2</sub>O). Almost all plants, except for coconut, died because of tsunami. The soil condition is now improving and even more fertile than prior to tsunami.

#### 2.e. Cot Selamat Village

Part of Cok Selamat village belongs to zone A and other part to zone B. Most of the affected area was paddy fields along the stream. In the last season, vegetative rice performance was good, but most seeds were empty. Vegetation at home garden is a

mixture of various perennials and on farm were old rubber. The zone B has mineral soil with sandy loam texture on soil surface.

### **3. Johan Pahlawan Sub-District**

#### **3.a. Suak Nie and Suak Raya Villages**

These villages was washed by about 4 m tsunami waves and deposited about 20 cm mud. The remains of the mud is only about 1 cm currently because most have been infiltrated into soil profile or have disappeared because of mixture with top soil. The dominant soil is peat with depth varies from 0,5 to 3 m. The level of the peat maturity is sapric on the top and hemic in subsurface layers. Water table was about 30 cm and EC was 0,01 mS/cm. The main vegetation is old rubber trees. Farmers have started to replant pineapple in these villages.

### **4. Meureubo Sub-District**

#### **4.a. Desa Gunung Kleng**

Gunung Kleng village was covered by 2-3 m muddy sea water during the tsunami and was capped by about 20 cm thick mud, although now the mud has mixed with the soil. The soil is mineral soil with sandy loam texture on top and sand in the deeper layer. We observed a very thriving peanut plants, although little indication of active root nodules. Farmers explained that peanuts, corn, string bean etc., grow better than before tsunami. Prior to tsunami, rubber and cacao was dominant, but the sea water, although flowed to the village with much dissipated power, killed all cacao plants because of (presumably) salinity problem. Farmers expressed their willingness to plant cacao again, but they could not obtain (afford) good planting materials.

Soil water EC was between 0,7 to 1 mS/cm. Logged surface water had EC of 2,04 mS/cm, while surface soil salinity was <0.2 mS/cm. Well water, with water level of about 1.2 m below soil surface and a distance of about 300 m from the coastal line, had EC as high as 0.75 mS/cm. Vegetative rice growth was good but in the later stage it had mostly empty seeds.

#### **4.b. Peunaga Cot Village**

The village was also affected by 2 – 3 m tsunami wave and 10 – 20 cm mud after tsunami. The soil is mineral soil with sandy loam on the soil surface and sandy in the lower layer. Soil water EC was 0,3 mS/cm, while that of surface water about 0,05 mS/cm. The dominant vegetation was (old) rubber. The string bean and cucumber grew well.

#### **4.c. Buloh/Balee Village (Not visited)**

This transmigration village was not affected (zone B). Plantation crops included rubber, oil palm, and cocoa.

Summary of the observation and possible placement of research under the EU-ICRAF framework is presented in Table 1.

Table 1. Summary of the Sub District features and possible location of nursery activity and soil and plant monitoring.

| <b>Sub District and village</b>    | <b>Zone</b> | <b>Soil</b>      | <b>Main Tree Commodities and other features</b>   | <b>Nursery and soil monitoring</b>  |
|------------------------------------|-------------|------------------|---|---|
| <b>Arongan Lambalek</b>            |             |                  |   |   |
| Arongan                            | A           | Mineral          | Coconut, cacao, rubber  | No  |
| Cot Gajah Mati (Seunebok Teungeuh) | B and A     | Mineral and peat | Coconut, cacao, rubber, durian, sawo (khirni; <i>Manilkara kauki</i> ), rambutan, mango | Hybrid coconut nutrient deficiency rectification<br>Rubber and cacao nursery near relocation area |
| Rimba Langgeh                      | B           | Mineral          | Idem  | Rubber nursery  |
| <b>Samatiga</b>                    |             |                  |   |   |
| Cot Simereung                      | B           | Peat             | Rubber, cocoa, durian, sawo, rambutan, manggo   | No  |
| Cot Slamet                         | A           | Peat             | Idem  |   |
| Paya Lumpat                        | B           | Peat             | Idem; clonal rubber was newly planted with other org. facilitation                      | Soil and plant monitoring   |
| Swak Seumaseuh                     | A           | Mineral          | Lagoon area, most people killed   | Nursery tbd near relocation site.   |
| <b>Johan Pahlawan</b>              |             |                  |   |   |
| Suak Nie                           | A           | Peat             | Rubber, durian, manggo, sawo (khirni)   | Nursery<br>Soil and Plant Monitoring  |
| Suak Raya                          | A           | Peat             | Idem  | Nursery   |
| Johan Pahlawan/ Meulaboh           |             |                  | Manggo, rambutan, durian, sawo  | Home garden nursery   |
| <b>Meurebo</b>                     |             |                  |   |   |
| Gunung Kleng                       | A/B         | Mineral          | Rubber, cocoa, oil palm   | Nursery<br>Soil and plant monitoring  |
| Buloh/Balee                        | B           | Mineral          | Idem  | Nursery<br>Soil and plant monitoring  |
| Peunaga Cot                        | A/B         | Mineral          | Idem  |   |

## II. SOIL MONITORING WORK PLAN

The soil-related undertakings can be categorized into two activities:

### a. Soil assessment – effect of Tsunami on soil properties

The “Soil Assessment” will produce land suitability maps of selected tree crops at 1:25,000 scale for four Sub Districts (Arongan Lambale, Samatiga, Johan Pahlawan, and Meurebo) in West Aceh Districts and at 1:100,000 for Banda Aceh, Aceh Jaya, Aceh Besar, and West Aceh Districts. Land suitability guidelines in English and Indonesian languages will

accompany these maps. The protocol of this activity is elaborated in ISRI proposal: "Assessment of Soil Damage and Land Suitability Evaluation for Tree Crops Post Tsunami Calamity".

b.1. Evaluation of the dynamics of soil properties and tree crop response (transects)

As appear in Table 1, this activity will be conducted in zone A and zone B, on mineral and peat soils:

| Soil Type | Zone | Subdistrict    | Village,  | Options of 3 Commodities                        |
|-----------|------|----------------|---|---|
| Peat      | B    | Samatiga       | Paya Lumpat<br><i>CP: Said Ismail</i>                               | Rubber, Cacao, Rambutan, Khirni, Manggo, Durian |
|           | A    | Johan Pahlawan | Suak Nie<br><i>CP: Baharudin</i>                                    | Rubber, Cacao, Rambutan, Khirni, Manggo, Durian |
| Mineral   | A    | Meurebo        | Gunung Kleng<br><i>CP: M.Yatim, Zulkifli, Maksum atau Ali Basya</i> | Rubber, cacao, oil palm, fruit trees            |
|           | B    | Meurebo        | Buloh/Balee   | Rubber, cacao, oil palm, manggo, khirni, durian |

CP: Contact person

As explained by farmers, salinity is not a problem anymore and that soil fertility is even better now in most places. Therefore monitoring of soil EC will be minimal. Instead, analysis will be focused on the nutrient composition of the affected versus unaffected soil and from the affected versus initial soil fertility based on reconnaissance survey data produced in early 1990s.

This activity will test 3 fertility management treatments:

- (i) Control (no fertilization) as practiced by the majority of farmers. Besides being a control, this plot is important for monitoring of soil fertility dynamics under natural condition.
- (ii) Application of locally available organic fertilizer(s)
- (iii) Fertilization using combination of chemical and locally available organic fertilizer(s)

Determination of nutrients requirement will be based on the results of soil nutrient analysis and calculation using a crop model. Treatments will be arranged in a randomized completely block design (RCBD) with five blocks and three replicates (trees) for each experimental unit. More replicates may be used for rubber, cacao, and oil palm. For horticultural crops, a home garden will be considered as a block.

Monitoring will be conducted on plant diameter and plant height every three months and on soil pH, CEC and the cation concentrations, exchangeable sodium percentage (ESP), electric conductivity, available P, total N, organic C, and selected micronutrients at the beginning of experiment and 2 years afterwards. For peat soils, the peat maturity with depths will be evaluated. Soil physical properties will be determined from soil pit at the beginning of the experiment.

## **b.2. Monitoring and nutrient management of hybrid coconut in Cot Gajah Mati village.**

Unlike the local coconuts, the hybrid coconut showed nutrient deficiency symptom. The color of hybrid coconuts leaves was yellow, most probably because of Mg and/or S deficiency. Although fertility management technology for coconut is not customary because of low coconut price, results of this experiment will be conveyed to the local agricultural services for their attention and action to assist farmers.

Initial soil properties will be observed from a soil pit, as well as from composite samples. Leave samples will also be collected for nutrient deficiency identification. Based on these data, nutrient requirement will be determined and organic and chemical fertilizer application will be designed.

Experimental design will be similar to that of part "b", but soil samples for analyses will be taken from 0-20 cm and 20-40 cm soil depths.