

- Stabilization of denuded slope area is to be done by vegetative barrier on the contour at three to four meters vertical intervals before any option is applied.
- Re-vegetation is the option most commonly applied to non-arable land. The success rate of reforestation is high but cost per hectare is also high.

### Problem Solving Approach

The main goal of watershed management over time is to restore an undisturbed vegetative cover.

- Time may not be an option, intervention is required to accelerate growth of vegetative cover;
- Natural re-generation may not be an option, if the soil moisture and nutrient status have been changed due to degradation; and
- An undisturbed vegetative cover may not be an option, if land is used for agriculture, grazing, fuel wood or fodder production, in which case a vegetative/cultural farming or combination of intervention is required.

### 3) Recommended Approach to Watershed Development in East Timor

This is a complex issue in East Timor related to increasing soil & moisture loss, land degradation, sedimentation, and irregular stream flows in major rivers and poverty that can be understood in physical planning process.

- **Flooding and Sedimentation**  
With this watershed management there is a possibility of reducing flood/flush flood and sediment damage downstream by means of land use changes, rehabilitation and reforestation in the upper watershed of East Timor.
- **Cost Sharing and Cost Recovery**  
Various subsidies and compensation schemes may be required for the adoption of a conservation measure and the realization of a sustainable future for East Timor.
- **Rural Infrastructure**  
Improved access to market may improve income and may induce farmers for conservation oriented farming

## 3.9 Fisheries

### 3.9.1 Indonesian Times

According to the statistics in East Timor in Figures (1997), there were 9,066 fishermen and 2,027 canoes in East Timor in 1997(see Table H-1). In addition to these, there were 160 fishing boat with inboard engine. It was told that, in those days, the fishermen from Sulawesi were engaged in the fishery in East Timor and considerably contributed to the fishery production. These Indonesian fishermen were based at some of the inlets adjacent to Dili, as well as at Tibar

in Liquica. For estimating scale and size of East Timor's own fishing fleet and fishermen's population, it will be needed to try to assess the contribution by Sulawesi fishermen in the statistics.

Table 5.4.9 in the above statistics show the marine fishery production volume and amount were 2,400 tons and 4,241 million Rp in 1997. The Study Team strongly feels that a total of 2,400 tons is underestimate, when considering on a scale of the fishing fleet. If dividing the production amount by the number of full-time fisherman, which should show the maximum amount per fishermen anyway, the result is 1.05 million Rp for a year, namely 87,000Rp for a month on average that includes production costs. This figure is apparently too small when comparing with average living costs shown in Table 11.1.2 of the statistics, which says average monthly expenditure per capita was 26,980 Rp in 1997. Probably an actual level of fishery production at that time may be a few times more than 2,400 tons.

According to the interview with a former fishery officer in the Indonesian times, numbers of fishing vessels were counted for statistics upon visiting beaches. By organizing fisher's groups, number of fishers was also checked repeatedly by the officers. Compared with these, estimate on landing volumes of fish could be more difficult as it needs more survey resources. Thus, by the reason mentioned above, the fishery production statistics are discarded in Table H-1.

### **3.9.2 Recovery Process**

#### **1) Urgent Recovery and Sector Development**

Around two years have passed since the post referendum violence in 1999, but mostly in all of the coastal aldeias, the numbers of fishing canoe appear not to recover to the previous level. Although in some sucos such as Sau in Manatuto and Dato in Liquica, the Study Team could find a few fishers who were able to get new canoes or ketintings by applying the loan from Small Enterprises Program (Phase I) or by getting financial assistance from the relatives, these cases are still exceptional. Under such situation, the current Chinese grant aid for the fishing gears is expected to considerably accelerate this recovering process.

So far, most of the aids for the fishery sector in East Timor since September 1999 have been oriented towards urgent recovery of the destructed fishing equipment and materials. Some are however aimed to develop the sector, as shown in case of boat building projects in Hera and a dried fish program in Biqueli, Atauro. In this regard, an interesting program is presently going to be prepared with guidance of the Baucau Diocese, where a small enterprise to be organized by the locals is planned to establish so that they can operate a cold storage and manage fish distribution and other fishery activities. Though further details are needed to know the nature of this program, it is understood it aims self-sustenance of the people involved.

## 2) Official Aids

Followings give information on the official aids that include hard project components for the fishery sector that have been undertaken so far or under preparation for implementation.

### a) Fishing Gears from AusAID

Fishing gears supplied by the assistance from Australian Agency for International Development (AusAID) were said to have a total volume equivalent to seven 20-foot containers. The fishing gears were donated by Australian fishermen and delivered to six districts; Viqueque, Lautem, Covalima, Oeccusi, Manufahi and Dili. This project had been undertaken from August 2000 to April 2001.

As it was promptly implemented at earliest stages after the post referendum violence, this project undoubtedly performed its urgent role for rehabilitation in some parts of the sector, though not a few numbers of recipients had shown dissatisfaction by claiming they were given second-handed gears. Although, from its nature, the project was not originally aimed to develop the sector, fishing traps and others included might also have given the fishers some hints on design and construction of the gears they had not used.

### b) Boat Building Project (Phase I)

Assisted by AusAID. Based on design of the canoes being built in Betio Shipyard in Kiribati, three units of canoes, two kind of single hull (10.1m and 7.1m OAL) and one catamaran (5 m), were built at the boatyard of Hera Fishing Port in 2000.

The canoes in Betio Shipyards were originally designed with a technical assistance of FAO, and these canoes have been generally accepted at the atolls in Kiribati because of their high seaworthiness. After phase (I) of the Boat Building Project was completed, phase (II) was started, where however a different type of vessel was adopted as mentioned under. No plan seems to be formulated to build the canoes of Betio type presently. Thus the prototypes built by phase (I) are not expected to widely use in the near future.

### c) Boat Building Project (Phase II)

Assisted by Iceland Development Agency (ICEIDA). By the technical instruction of an Indonesian naval architect, training for boat building was started at the boatyard of Hera Fishing Port from the end of June 2001, and nine months were planned for the project implementation in total. Boats to plan to build were of planked or FRP hull, 11 vessels in total. Planks are said to be able to purchase in Dili, but other materials such as paints and glass fiber materials need to import from Surabaya. Total cost to build a canoe was expected to be seven to eight million Rp, though a FMES officer said that cost down might be possible.

Phase (II) was once suspended in end of August 2001 due to lack of building materials.

Resumed after a short intermission, the project was terminated around in end of September after training 14 trainees and building five vessels of 7m to 8.7 m OAL. These five vessels have a straight keel structure and planked hull, with FRP coating laid on bow and others for waterproof. A shape of the vessels is common and similar to one of the Indonesian boat prototypes (see (6) of Figure H-2). The instructor said that a boat of this size could be completed with 14 to 28 man-days usually if it is built in commercial basis. As building materials, planks of 0.5 cu.m or more are needed, as well as some glass fiber mats, adhesive, metal screws, paints and others.

The phase (II) was aimed to perform training of boat building. By this reason, it would be difficult to learn about building costs based on results of the project. Some further trials will be needed to develop a small open deck vessel, by reasons mentioned later, so as to replace dugout canoes that have been widely used in East Timor. A developed prototype should be able to build in a lower cost so that fishers can afford.

#### d) JICA Cooperation

##### (1) Raising Ermera Carp Hatchery

Technical cooperation for raising Ermera carp hatchery was undertaken by JICA expert from January 2001 to August 2001. Outline of the cooperation is shown below;

##### Rehabilitation of Gleno Fishery Facilities

- Procurement of necessary materials
- Rehabilitation of nursery
- Rehabilitation of in-door hatchery
- Rehabilitation of other related facilities

##### Technology Transfer on Raising In-door Fishery

- Securing adult fishes
- Raising adult fishes
- Monitoring of adult fishes
- Measures for fish diseases
- Harvesting of ovum
- Monitoring of hatching
- Transportation techniques
- Raising edible fishes
- Production of feed crops
- Introduction of adult fish species

##### (2) Recovery Program for Village Based Economic Activities in East Timor

Recovery program for village based economic activities in East Timor has been undertaken by JICA from February 2001 to February 2001, in order to achieve economic autonomy of rural people under the participatory approaches for reconstruction and development at the reconstruction and development stages of East Timor. Implementation of the program has been done by Yayasan HAK, which is one of the local NGOs, at the sites of Alas sub-district in Manufahi district and Laivai and Luro sub-districts in Lautem.

Major activities of the program are given below;

Phase-I

- Assessment of community people's needs
- Distribution of production materials to farmers and fisheries in the community
- Distribution of other necessary materials
- Group organization of community peoples

Phase-II

- Construction of community hall for farmer and fishery group
- Training on fund management for farmer and fishery group
- Training on organic farming (manure production, traditional farming systems, etc.)
- Building of fishing boat at Dili by Atauro ship's carpenter, and implementation of technical transfer on ship building to the local peoples
- Fishery cultivation
- Showing the films on agriculture and fishery activities, and exchange of view
- Assistances for agricultural and fishery productions
- Distribution of production materials to farmers and fisheries in the community
- Monitoring and evaluation works for implemented activities

Phase-III

- Showing the films on agriculture and fishery activities, and exchange of view
- Expansion of outcomes to other areas
- Holding of workshops on economical development of community peoples

e) Fishing Gears from People's Republic of China

On 19 July 2001, the fishery equipment and materials equivalent of three million US\$ were handed over to ETTA from the People's Republic of China. It is said a total volume of the cargo is equivalent of 72 or some 20-foot containers, and includes 300 units of 15 PS outboard motors, 1,500 rolls of gillnets of various mesh size, three metric tons of line, 250 units of 2.5 cu.m and 350 units of 180 liters insulated containers, 200 lifejackets and other assorted materials. FMES drafted an action plan to deliver the equipment and materials to fisher's groups, and had hold meeting with the groups in West Dili, Liquica, Manatuto, Baucau, Suai, Los Palos and others during June to July 2001. 90 percent of the equipment and materials were delivered to fisher's groups in all 10 coastal districts by end of December 2001. It is said that remaining 10 percent is kept for contingency as of arch 2002.

300 units of 15 PS outboard motors may have a strong impact on the fishery production, as these outboard motors will immediately motorize around 30 percent of the present fishing fleet in East Timor, if the total is estimated as around 1,000 canoes. The process of motorization will have to be carefully monitored in view of accompanied fuel oil demand and maintenance facilities.

### 3) NGOs Activities

NGOs, such as Save the Children, Timor Aid and Peace Winds Japan, have been involved in the effort to recover the fishery sector under finance from ODA or themselves. Financed by a UNHCR part of Quick Impact Project, Save the Children worked for supply of outboard motors (8PS), canoes and some fishing gears for the fisher's groups in Metinaro (Dili) and Maubara (Liquica) in November 2000. In case of Metinaro, in addition to these, brackish water ponds situated in the target aldeia were repaired. Timor Aid has been involved in the above two boat building projects in Hera Fishing Port.

### 3.9.3 Present Fishery Situation

#### 1) Coastal Sucos

The Study Team counted a total number of suco in East Timor as 498, and number of the coastal sucos as 109, though these numbers need to be reviewed in the further study, as the suco boundary is still not settled, especially in the coastal area in Covalima. Through out the Village Survey (Suco Survey) in the village level during May to July 2001, among these 498 sucos, 106 sucos were surveyed in total, which include 46 coastal sucos, with 43 percent coverage for total coastal sucos. Among these 46 coastal sucos, 31 sucos reported they have full-time or part-time fishermen (see Table H-2). Although in these 31 sucos, three inland sucos, such as Raihun of Covalima and Lalisuk of Oecussi, are included, these are deemed as coastal sucos in this report.

#### 2) Fish Landing Sites

To supplement the Village Survey (Suco Survey), the Study Team has conducted a preliminary study in several aldeias in different sucos (see Table H-5). Among these landing spots, some observations were made on berthing places for fishing vessels in the selected aldeias. Generally the landing sites are situated in broad sand beaches for requirement to berth canoes as shown in the photos in Table H-5. Exceptional cases should be listed as well; for fishermen in Suco Maquili in Atauro, only rocky beach in front of the aldeia is available for berthing their canoes. It was observed that fish landing sites are usually used by the same fisher's group(s), and thus it is usually possible to find the same canoes in any specified landing sites, which may give us some advantages for collecting statistic data or other study purposes. Generally the Study Team did not see any fishery supporting facilities in the landing sites visited.

Among 31 sucos holding fishermen, five sucos reported there are fishery- supporting facilities in their suco. In Com in Lautem and Tibar in Liquica, there exists jetty or wharf in good condition (see Table H-3 and Table H-5). The jetty and a storage house in Tibar were said to be once administered under the port authority in the Indonesian times, and partly used by fishing vessels. Currently it appears not to be used by them. No sucos reported fuel station, ice plant or cold storage. In Benunuk, Dili, a few fisher groups share a 110 sq.m building that is

used for fish handling and net loft. This building was constructed in the Indonesian times and repaired recently with assistance from a NGO.

In addition to the above, there is a fishing port in Suco Hera, Dili, which was not covered by the Village Survey (Suco Survey). According to a study report<sup>9</sup> by JICA, Hera Fishing Port was built in 1990 and once had usual fishing port facilities that include fish market, fish quality laboratory, storage, ice plant (17 ton/day), fuel oil tank (10 ton), and freshwater tank (250 ton), as well as a private boatyard and boat repairing shop with a slipway in the adjacent areas. Most of these shore-based facilities were destructed at the post referendum violence. Presently most part of the port is being used by PKF for returning military vehicles and it is said that the port will be returned to under the full administration of Dili district or FMED in September 2002. Recovering of the port however started already. The ice plant is going to be renewed and will have a capacity of 44 tons of flake ice per 24 hrs. ADB will assist to renovate some of the port, which the Study Team learns appears to be going to cover repairs mainly for civil works such as breakwaters and dredging of the port basin.

### 3) Fishermen

For 46 surveyed coastal sucos, 31 sucos reported 2,032 fishermen in total of full-time and part-time operators (see Table H-4), and 15 coastal sucos reported they have no fishermen. It is noted eight of these 15 sucos are from Dili district (see Table H-2). It is usual the fisherman's population does not distribute as the total population distributes, and hence results would be incorrect if a proportion of "46 sucos to 2,032 fishermen" to "109 sucos to total fishermen" is applied. The Study Team assumes the rest of East Timor has the proportionally same distribution as the fisherman's population in the 36 surveyed sucos subtracting 10 sucos in Dili district. Thus, can be roughly estimated 350 fishermen for Dili district (Main Island), and 4,700 for the other districts. When estimating Atauro in the same way, for five sucos in this island, a 230 fishermen is given. According to the preliminary study, Biqueli, another suco in Atauro, shows most active fishing and higher ratio of fishermen to households, and the Study Team feels it is probable the number of fishermen in the island can be doubled or more. Thus, in total of East Timor, fishermen of 5,000 to 5,500 are estimated.

Numbers of fishermen to numbers of households in the surveyed sucos are averaged as 14 percent (see Table H-4). From this average, it is understood the major population in the coastal sucos substantially depends on the agriculture or others for their livelihood, and other than a case of Atauro, it can be said there is no "fishery village" in East Timor. However, this situation does not mean so-called subsistence fishery is dominant in this sector. As a matter of fact, generally the fishermen interviewed think fishing is one of the measures for cash income, which also tells us there exists considerable consumer's demand for fish. It should be noted, for keeping livelihood, people require both of crops production for subsistence and sources for cash income for purchasing usual commodities.

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<sup>9</sup> "Projects Background Study for the Fishery Sector in East Timor", JICA, August 2000.

#### 4) Household Economics

Among the 1,800 households sampled in the household survey, 27 households reported they operated fishery more than once in the last year. In average, they catch fish on 154 days and earn 7.0 million Rp a year. 68 percent of the catch is sold to traders or markets.

Two cases for full-time fisherman's household were studied by brief interview. Case (a) owns land and home garden and cultivates crops for self-consumption. Case (b) appears to own no land.

|                       | <u>Case (a)</u>                                 | <u>Case (b)</u>                      |
|-----------------------|---|--------------------------------------|
| Family members        | 7 including 5 children<br>(eldest 23, job less) | 4 including 2 children<br>(eldest 7) |
| Fishery sales         | 50,000 to 200,000 Rp/day                        | 500,000 to 1,500,000 Rp/month        |
| Fishery costs         | 30,000 Rp/trip                                  | 30,000 Rp/trip                       |
| Household expenditure | 1,500,000 Rp/month                              | 800,000 Rp/month                     |

#### 5) Fishing Vessels

Majority of the fishing fleet in East Timor is dugout canoes. Occasionally, mainly depending on landing sites, canoes with plank-built gunwale to heighten it are observed. The later also have bottom made by hollowing a tree-trunk. These canoes have double out-riggers with single or double beam to support out-riggers. Trees to be used for main hull appear to be various. For an example, a newly built canoe observed in Dato, Liquica, is made of kapok tree. It was said the canoe will have an around five years life. Most of the unused old canoes left on beach have small or large holes on the bottom that seems to be a reason to abandon these.

In total, 708 canoes were reported in the 31 sucos (see Table H-4). Some district fishery officers commented the number of Bucoli in Baucau might be overestimated. Later this comment was found based on a confused understanding on boundaries of the relevant sucos. Meanwhile, based on observation in an aldeia in Seical, the Study Team deemed the reported number in this suco was questionable. However, a number of 110 canoes in Seical was confirmed later to show probably an actual level of the fleet.

Once in the Indonesian times, FRP fishing boats, it is said 24 boats in total, were built at Hera Fishing Port. These boats, in three classes of "Bonito", "Tasi Diak" and "Loro Sa'e", were equipped with a diesel engine of two to three cylinders. The three-cylinder type has an output of 37.9 Kw/2,800 rpm. It is told that ones still operated at present are eight Bonito class in Atauro, Baucau and Liquica, five Tasi Diak class and one Loro Sa'e class in Atauro. The remains are idled due to engine trouble but it is said hull conditions are good.

For the details of types of the fishing vessels in East Timor, reference will be made to Figure H-2.



## 6) Fishing Seasons

Because of north-west (NW) monsoon usually observed during November to April and south-east (SE) monsoon during June to October, the sea conditions of East Timor changes considerably through year. According to the results of the Village Survey (Sucos Survey), the Study Team assumed regional difference on the effects of winds and divided the whole coast to three areas; northeast coast (Lautem, Baucau, Manatuto), northwest coast (Dili, Liquica, Oecussi), and south coast (Viqueque, Manufahi, Covalima). For these three areas, was counted number of sucos that reported which month is "good" for fishing (see Figure H-1.1). It appears that northeast and south coast have good season in July/August to October, and northwest coast has bad season in these months on the contrary. It also appears whether month is "good" or not is based on the weather conditions (see Figure H-1.2).

As another factor to decide fishing seasons, interviewed fishermen in the northwest area said large pelagic fishes migrate to the south in SE monsoon season. They reasoned it by their observation that large fishes, as predator, follow sardine and other small pelagic fishes that also migrate to the south in this season.

## 7) Fishing Methods and Gears

The main fishing gears are gillnets and hand line. Other than these, those observed were beach seine, casting nets, and fish traps. These were observed occasionally at communities in the northern coast. A set of circled embankments of several hundreds meters in total span was also observed at tideland near Gilimanu, Metinaro, Dili District. By availing tidal range, it is used for trapping fish in a similar way to stationary nets. In addition to these fishing, ones reported were diving catch to use spear with rubber band that is mainly practiced in Atauro, shell collection on beach made mostly by women, and traditional method to catch lobsters on beach at night time by using iron rod. Despite of the sea conditions that can be rather rough seasonally, it seems that efforts to introduce fishing gears of such varieties have been made at least locally for a long time.

## 8) Fishery Production

For estimates of the current level of fish catch in East Timor, due to total lack of the statistical data, it is required to know number of canoes, average fishing trip days, and average catch of canoe per trip. From the results of a series of the site survey in the coastal sucos, the Study Team strongly feels that these factors, especially average fishing trip days and catch of canoe per trip, may differ considerably by the sucos, mostly depending on the weather conditions and access to the urban markets, like those in Dili, Baucau, Los Palos, Viqueque, Same and other populous towns. Therefore it has to be considered the estimate of fishery production from the results of the village Village Survey (Sucos Survey) should be avoided in despite of its good coverage (42 percent for the coastal sucos).

Since fishery information on the enough number of households was not obtained from the household survey, the current level of fish catch is estimated from the weekly food consumption that was included in the household survey.

Weekly Fresh Fish and Salted Consumption in Sampled 1,800 Households

(unit: kg)

| Code | Name        | HH Reported | Purchase | Produced | Others | Total |
|------|-------------|-------------|----------|----------|--------|-------|
| 1021 | Tuna        | 57          | 0.03     | 0.01     | 0.00   | 0.04  |
| 1022 | Small Fish  | 187         | 0.09     | 0.02     | 0.00   | 0.11  |
| 1023 | Other Fresh | 247         | 0.15     | 0.04     | 0.01   | 0.20  |
| 1024 | Salted      | 68          | 0.06     | 0.00     | 0.00   | 0.06  |
|      | Total       |             | 0.33     | 0.07     | 0.02   | 0.41  |

Source: TLSMS, 2002

This consumption rate, 0.41kg/week/household, suggests around 3,800 tons of fish is produced in East Timor.

#### 9) Marketing of Fish

Most of the interviewed fishermen based near populous town or city told that fish traders visit their landing sites to buy their catch. It appears that, for landing sites between Liquica and Manatuto, traders from Dili visit them, and between Manatuto and Baucau, traders from Baucau City come to their sites. Fishermen in Manatuto told traders visit them both from Dili and Baucau. Fishermen at Betano in Manufahi district said no traders visit them and they market the catch to Same when the transport is available. Where fresh foods markets of its own scale exist and are opened daily are Dili (3 places), Manatuto (1), Baucau (2), Los Palos (1) and others. The market of Liquica is said to open twice in week.

By results of observations by the team, the fish traders show different scales of business. In some cases, traders carry a plastic bucket and use minibus to trip to landing sites and then retail fish at markets in Dili or other populous town. In others cases in Santana, Dili, traders put stalls at the beach and buy fish landed, and then retail these directly at the stalls, or wholesale these to other traders or peddlers (carrier with a pole). The smaller fish is traded in a bunch that holds five to ten pieces of fish, depending on size, and larger ones are in piece. Weighing scale was not used in all cases observed in landing sites and retail markets, except a few cases in the markets of Dili. Ice is used occasionally, especially for transport of fish from Atauro. Ice in a small plastic bag, around one kilogram, is sold for 1,000Rp that is produced by private firms in Alor, Dili, by using small freezers. It was observed once at Akait beach in Dili that such ice bags, with contained in larger old rice bags, fully loaded on a one-ton pickup, were shipped to Atauro.

Fishermen and fish traders have difficulties to transport fish especially in the remote areas due to ineffective and expensive transport. A round trip to Dili by minibus or middle size bus costs a passenger 30,000Rp and some 4 hours from Manatuto, 40,000Rp and one full day from Baucau, and 80,000Rp and two days from Los Palos.

To see geographical difference of fish consumption (where fish is eaten), the average by sucos of the weekly fish consumption, based on the household survey, are shown in Figure 3.7-1. Fresh fish is consumed more in populous region of the north coast. In the uplands, excepting Bobonaro District, less or no fresh fish is consumed. In case of salted or canned fish, the upland districts consumes these preserved fish products in equivalent level, or more in case of Ermera, to the coastal districts. In both cases, there is no trace of the consumption shown in Manufahi and Viqueque, even though some populous regions were sampled in these two districts.

Canned fish, all of which is imported, is considerably consumed especially in the uplands. The average that purchased by 1,800 households reaches to 0.10kg/week/household, in a 0.6 conversion rate to raw fish weight, which is equivalent of small fish consumption. Although, in many cases, consumption of canned fish does not reflect demands of fish as staple food, as it is occasionally consumed for its taste, the contrast with fresh fish consumption, as shown in Figure 3.7-1, may tell that canned fish is substituted for fresh fish in the uplands, as well as salted fish.

#### 10) Aquaculture

It is reported that in the Indonesian times, brackish water pond of 23.6 ha, freshwater pond of 109.6 ha and paddy field of 119.6 ha were operated to culture fish. (East Timor in Figures, 1997) Six carp hatcheries, "National Ponds", were also once operated by the government in Same, Viqueque, Gleno, Lospalos, Baucau and Maliana. Recently the Gleno station, which was implemented by JICA support, resumed to produce fingerlings of common carp with a monthly target of 10,000 to 20,000 pieces. Two stations in Same and Viqueque are planned to rehabilitate further more.

#### 11) Fishery Administration

FMED has following four working units; Policy and Planning, Monitoring, Control and Surveillance, Industry and Development, and Resource and Assessment. Presently FMED holds 18 proper staffs. Among these 18 staffs, eight staffs are based at the district offices and under duties of the district administration. The districts where the fishery district officer is not assigned as of July 2001 are Manufahi, Covalima, Ainaro, Aileu and Ermera.

For setting up the fishery administration policy in East Timor and providing the new government with guidelines to undertake development projects in the fishery sector, "Fish for the Future: A Strategic Plan for the Fisheries of East Timor" was prepared by Fisheries and Marine Environment Service (FMES), DAA, early in 2001 and endorsed by Mr. Mari Alkatiri, Cabinet Member for the Department of Economic Affairs, on 31 May 2001. As clearly declared in its title, this strategy place a priority on realization of the sustainable development of the fishery resource so that it can be utilized to a maximum extent for a longer time. Under this policy, the strategy says, while larger boats will not be licensed until the fishery resources are assessed, smaller boats or canoes equipped with outboard motor of 15 PS or less, the majority of fishing fleet in the fishery sector in East Timor at present, will not require license. The strategy

supplements that fishing control for the 15 PS-or-less fisheries will be entrusted to the local communities.

As a result, the strategy is focused mainly on the ecologically sustainable development of fishery resources and related issues, and the lesser concern is given to the present situation where the fishery sector is laid on. Probably by this reason, in the strategy, no analysis was given on the problems that are observed widely in the sector at present, other than the post referendum destruction of canoes and fishing gears. Apparently, since long before the referendum there have existed the present problems, which include short life and low seaworthiness of canoes, some ineffective fishing gears, difficult marketing of catch due to lack of transport infrastructure, foreseeable over exploitation of high-valued species like rock lobster. And now since the referendum, the sector has additionally borne new difficulties; that is to say, higher costs than in the Indonesian times to get fuel oil, fishing gears and "ketintings" (long-tail outboard motors), mainly because these were changed from domestic products to imported ones. These new factors will be however excluded from the Study Team's consideration, as these should be one of the necessary price for the state independence.

#### **3.9.4 Demand and Supply Analysis**

One of the ways to evaluate potential or possible demand of fish may be found if the production level is considered to have to meet to the population scale in East Timor in aspect of fish's contribution to animal protein. Such potential demand can be evaluated by basing on the food balance data given by FAO if the following assumptions are reasonable. Rough estimates show that, if fish's contribution to animal protein in Indonesia (5.9g/day/person, average of 1989 to 1999) is assumed, 14,000 tons to 16,000 tons of fish, in sardine conversion and in round fish bases, will be needed to satisfy the demand from 750,000 to 850,000 population a year. Likewise, if fish's contribution in Fiji (8.7g/day/person) is assumed, 21,000 tons to 24,000 tons of fish will be needed.

Although the balance of animal protein, that is, the balance of consumption of meat, fish and milk products, should depend on conditions of the primary industry and traditional diet in a country or region and hence comparison with or analogy from other countries should be made carefully, it can be said at least that an actual demand of East Timor should be somewhere among these rough estimates, and hence that the present level of fishery production in East Timor, that is very roughly estimated in a range of a few or several thousands tons, or 3,800 tons if based on the fish consumption trends, seems not likely to be able to satisfy its potential demand at all.

Fishery resource and its potential yields are another unknown factor. At this stage where any data for even first approximate estimates are not available, reference to tropical island countries of similar natural conditions might be a possible way to get a hint how much anyhow East Timor can produce fish. An average of fishery production in some tropical island countries is 80 kg per capita in 1998 as shown below. In case of East Timor, it would be of "several" kg per capita.

### Fisheries in Some Tropical Island Countries (1998)

| Country         | Population (person) | Fish Production (ton) |
|-----------------|---------------------|-----------------------|
| Micronesia      | 113,000             | 15,388                |
| Marshall Island | 62,000              | 400                   |
| Kiribati        | 86,000              | 33,858                |
| Solomon         | 416,000             | 58,554                |
| Fiji            | 790,000             | 23,101                |
| Maldives        | 263,000             | 118,183               |
| Comoro          | 531,000             | 12,500                |
| Seychelles      | 79,000              | 17,790                |
| Mauritius       | 1,160,000           | 12,026                |
| Average         | 388,900             | 32,400                |

Source: ODA Statistics, MOFA, the Japanese Government, 2000,  
Fishery Statistics, FAO, 2000

Although fishery production strongly depends on the available marine resources, marketability and historical role of the fishery sector in a country, as shown in the remarkable difference between Marshall Island and Maldives in the following table, it can be said a production level of “a few or several thousands tons” in East Timor is too low in comparison with its primary particulars as an island nation and a scale of the population.

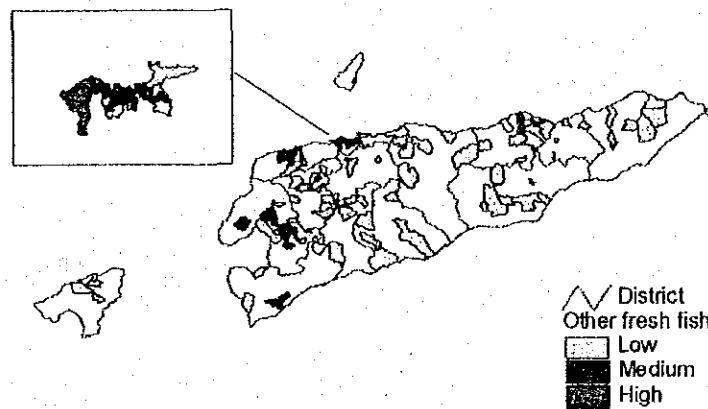
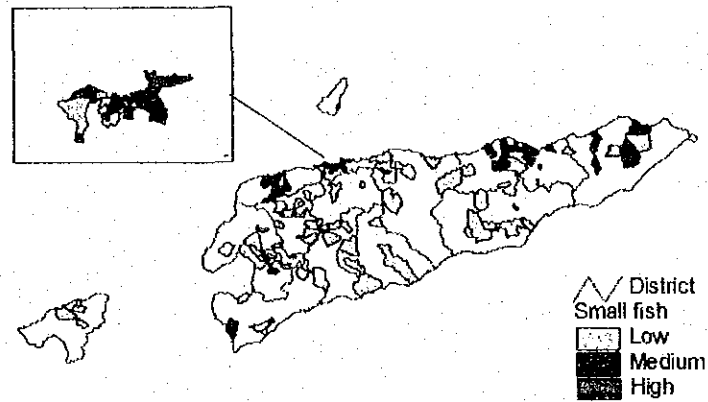
### **3.10 Rural Agro-Industry**

#### **3.10.1 Coffee Industry**

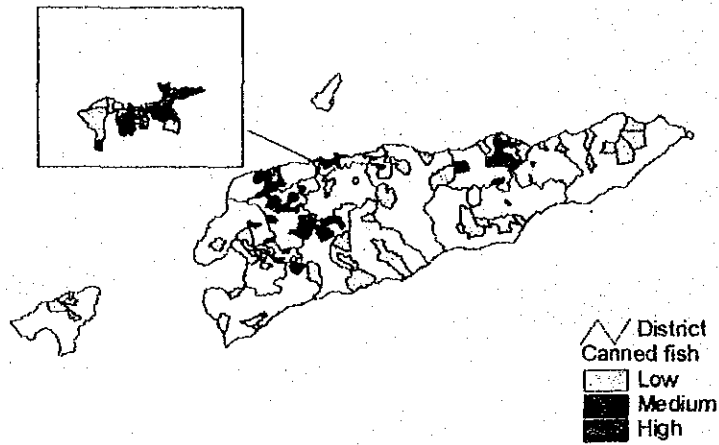
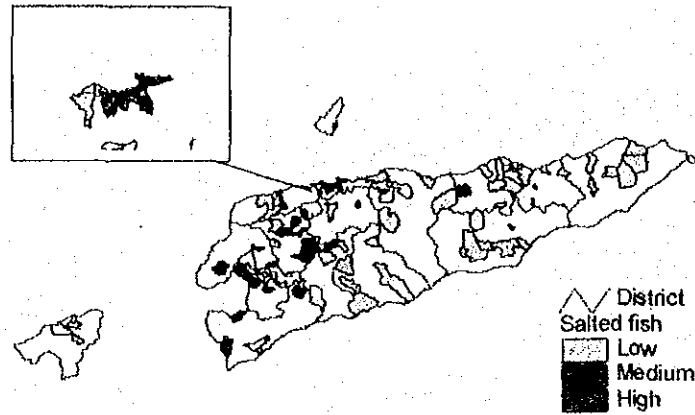
Coffee is the second largest commodity market in the world in value terms and its export is a multi-billion dollar business. In East Timor, Arabica coffee in the early to late 19th century was planted in large private plantation owned by Portuguese companies and some was also planted on land owned by Chinese business men and the coffee was exported mostly to Makassar in Indonesia<sup>10</sup>. Since most of the coffee in East Timor is still afforest coffee and the organic certification largely determines the price, there is little push as yet to make it more productive per hectare by using any fertilizer or organic inputs. It is estimated that the highlands of East Timor have 47,784 ha of coffee trees and 45,972 farmers in 1997. Coffee business operating everywhere in the world are subject to similar types of risk including weather and other production risk, and marketing risk. It is reported that NCBA (National Cooperative Business Association) will purchase 20,925 ton of cherry for US\$0.117 per kg and 18,800 coop members will on average receive about US\$148 per member in total annual payments in 2001. For the vast majority of farm families living in the highlands of East Timor, coffee represents over 90 percent of their annual cash income.

<sup>10</sup> According to the National Development Plan, it is reported that coffee in East Timor was responsible for more than 90 percent of export income during Indonesian time. Since 1999, however, the world price of coffee has slumped to historic lows, while inadequate control and poor crop husbandry typify the local industry.

**Figure 3.9-1 Weekly Fish Consumption in Sampled Households  
(Small Fish and Other Fresh Fish)**



**Figure 3.9-2 Weekly Fish Consumption in Sampled Households  
(Salted and Canned Fish)**



Current situation of coffee industry comprising as biggest agro-industry in East Timor under the assistance by USAID, AusAid and Portuguese Government as;

#### 1) USAID

|                          |   |
|--------------------------|---|
| Name of Project          | : The East Timor Coffee Project, one field of activity assisted under the TERADP (Timor Economic Rehabilitation and Development Project)  |
| Period                   | : 1st Phase : 1994-1999 and 2nd Phase : Mid of 2001- End of 2002  |
| Project Cost             | : 1st Phase US\$9.5 million and 2nd Phase US\$7.8 million   |
| Implementing Institution | : NCBA (National Cooperative Business Association)  |
| On-going Activity        | : NCBA/East Timor buys unprocessed coffee from organized 18,800 coop members in the highlands of central Timor. This raw produce called "cherry" is then processed, dried, sorted, packed and exported to buyers worldwide. |

The NCBA coffee cooperative is the single largest employer in East Timor, employing 300 full time staff and 3,900 seasonal workers. The cooperative buys about 35 percent of all coffee produced in East Timor and is the largest exporter/foreign currency earner in East Timor, generating an estimated US\$4.1 million in coffee export sales in 2001. Robusta and Arabica coffee varieties were first planted on East Timor by the Portuguese on 1815 and about 45,000 ha of coffee trees are now planted. NCBA informs that the vast majority of farm families living in the highlands of East Timor depend over 90 percent of their annual cash income and the coop will purchase 20,925 ton of cherry for US\$ 0.117 per kilogram equivalent to about US\$148 per member in total annual income. There is little push as yet to make it more productive per hectare by using any fertilizer inputs, even organic inputs, which can bring the brand so called "organic Timor coffee".

#### 2) AusAID and Portuguese Government

Assistance by AusAID concentrating on quality and marketing, and Portuguese Government on multiplying high quality seedlings and processing facility will be continuously studied.

### 3.10.2 Vanilla Production and Processing

NCBA (National Cooperative Business Association), through its cooperative operations in Indonesia, is the largest exporter of vanilla bean in the world. To reduce income risk to coffee farmers because of international commodity, NCBA has started a vanilla bean production and extension training activity. Small-scale planting in East Timor indicates that the island can produce high quality vanilla since it requires a very unique climate and growing environment like as coffee. In 2001, NCBA plans to ship approximately 400 kg of good quality processed vanilla beans with expected US\$ 10.0/kg. There is a small start but significant potential in East Timor. USAID plans to assist vanilla production promotion additionally under the TERADP.



### 3.11 Rural Conditions

#### 3.11.1 Rural Economic Conditions

East Timor is one of the poorest countries in South-East Asia; and the rural areas are the poorest parts of East Timor. Over 30 percent of rural households live below the poverty line (i.e., one US\$ per day). Poor health, housing, education, transportation, communication and energy conditions characterize the region. This grinding poverty manifests itself in many ways. Infant mortality rates at 20 per 1,000 are 2.4 times that of Eastern Asian Countries<sup>11</sup>; and average life expectancy of 46.7 years for men and 48.4 years for women is 30 percent below the Eastern Asia averages<sup>12</sup>.

#### 3.11.2 Present Zonal Situation in East Timor

East Timor is divided into three regions: East, Central and West. The Eastern Region is comprised of four districts, namely Lautem, Baucau, Viqueque, and Manatuto. The Central Region contains six districts, which are Liquica, Dili, Ermera, Aileu, Ainaro and Manufahi. The Western Region has three districts, Covalima, Bobonaro and Oecussi. A profile of the regions is presented below;

#### Regional Profiles

| No.     | District | Population | Percentage of Population(%) | Sucos with Electricity (%) | Secondary Schools | Hospitals |
|---------|----------|------------|-----------------------------|----------------------------|-------------------|-----------|
| 1.      | Lautem   | 49,213     | 7                           | 23                         | 7                 | 1         |
| 2.      | Baucau   | 93,368     | 13                          | 19                         | 22                | 1         |
| 3.      | Viqueque | 54,315     | 7                           | 15                         | 10                | 1         |
| 4.      | Manatuto | 32,598     | 4                           | 44                         | 6                 | 0         |
| East    |          | 229,494    | 31                          | 25                         | 45                | 3         |
| 5.      | Manufahi | 35,500     | 5                           | 13                         | 10                | 0         |
| 6.      | Dili     | 128,490    | 18                          | 79                         | 23                | 2         |
| 7.      | Aileu    | 30,146     | 4                           | 14                         | 8                 | 1         |
| 8.      | Ermera   | 84,510     | 11                          | 3                          | 9                 | 0         |
| 9.      | Ainaro   | 36,969     | 5                           | 6                          | 5                 | 0         |
| 10.     | Liquica  | 43,406     | 6                           | 14                         | 5                 | 0         |
| Central |          | 359,021    | 49                          | 22                         | 60                | 3         |
| 11.     | Bobonaro | 62,273     | 8                           | 7                          | 10                | 1         |
| 12.     | Covalima | 42,506     | 6                           | 7                          | 9                 | 1         |
| 13.     | Oecusse  | 44,517     | 6                           | 11                         | 6                 | 1         |
| West    |          | 149,296    | 20                          | 8                          | 25                | 3         |
| Total   |          | 737,811    | 100                         | 20                         | 130               | 9         |

Note: For "Sucos with Electricity", the East, Central, West totals are averages.

<sup>11</sup> Human Development Report, 1997 UNDP

<sup>12</sup> Reconstruction and Development, East Timor, May 2001

The Central Region is the most heavily populated containing 49 percent of the national population, followed by the Eastern Region with 31 percent and finally the Western Region with 20 percent. The same pattern applies to schools with the most in the Central Region, followed by the East and then the West. All regions are about equally represented in regard to medical facilities. Access to electricity varies widely between districts. At the high end, in Dili 79 percent of homes have electrical power; while in Ermera electricity reaches only three percent of the population.

### **3.12 Agricultural and Fishery Organizations**

As per the village survey (suco survey), most of the villages reported that organization or associations exist in their communities. Reported organizations are: farmers' associations (58 percent of villages surveyed), water users' associations (11 percent), drinking water associations (two percent), livestock organizations (eight percent), fishermen's groups (18 percent) and traders' organizations (four percent). No organization on agro-forestry was reported. However, it is well known that organizations exist in the coffee areas. The organizations have highest membership at 14 members for the water users' associations and lowest at four members for the livestock organizations.

These associations have for its organization unit the traditional self-reliant organizations called *Kelompok Tani*. They serve as starting blocks or basic units of higher-level organizations such as cooperatives, water users' associations, livestock organizations and fishery associations that are top-down initiatives of the government-the transitional one at present and during the past Indonesian time.

#### **3.12.1 Farmers' Associations**

There were 540 farmers' associations in the 51 villages surveyed or an average of 11 groups village. Each of the farmers' associations has an average membership of 12 farmers. Their collective or cooperative activities are focused on the acquisition or purchase of agricultural inputs, group production activities that includes land preparation and transplanting, and marketing of agricultural products.

Being formed from the experiences on tradition organizations for self-reliant, these farmers' associations are made the nucleus organizations of larger organizations formed for other but related purposes in the village. Be it in community affairs or activities such as repair or construction of conveyance canal sections that shall benefit one or more villages, hamlets or neighborhood.

### **3.12.2 Water Users' Associations**

There were 106 water users' associations in 13 villages surveyed or an average of 11 associations per village. Each association has at least 14 members, the largest membership in all the organizations surveyed. Besides, the normal irrigation activities and similar to the farmers' associations, their collective or cooperative activities also includes the acquisition or purchase of agricultural inputs, group production activities that includes land preparation and transplanting, and marketing of agricultural products.

The group activates the WUA during the cleaning and maintenance of the river intakes and irrigation canals prior to the initial delivery of water at the outset of the wet season and also in the construction of traditional irrigation system, those constructed through community initiatives without government support.

### **3.12.3 Fishery Organizations**

There are 164 fishermen's groups in 24 villages surveyed or an average of seven groups per village. Each has a membership of seven fishermen. The groups are involved collectively or cooperative manner in almost all aspects of the fishery activity: acquisition of credit or loan, purchases of inputs such as fishing gears and equipment, undertaking of collective or group fishing, and marketing of fish catch.

Some information during the field visits indicated that the Indonesian government initiated the organizations of fishermen's organization during their time. It was a basic requirement before the community could avail of fishing gears and equipment. Although a top-down approach to development, it gave the fishermen group the opportunity to work harmoniously together. Even after the Indonesians have left, existence of beneficiary organizations in the fishery sector persisted. Substantial assistance programs of the transitional administration and non-government organizations (NGO such as Timor AID, 'Save the Children', and AusAID) had been provided to these organizations.

### **3.12.4 Other People's Organizations**

Other organizations were also reported to exist in rural East Timor. Those included livestock organizations, traders' associations and other special interest groups. 12 of the villages surveyed reported the existence of 70 livestock organizations. That is six organizations in each village with an average membership of five livestock farmers. Among its activities included group management of animal herds and collective marketing of animals.

The smallest group reported was the trader's associations. 40 of such associations are reported to exist in nine villages. At least four associations per village exist with a membership of four per association. Each, similar to the fishermen's group, are also involved in all aspects

of the trading business: acquisition of loan or credit, procurement of trading stocks and inventories, and group selling or marketing.

Besides those mentioned above, other organizations commonly found in the rural area are organizations for Timorese Women (OMT) and for Timorese Youth (OJT). However, these are new organizations and form part of the parallel structure organized by the CNRT. However, they are distinct and different organization from the political parties. Exclusively, they represent in those units of the parallel organizations of governance the interest and sentiments of the women and youth in the community.

### **3.13 Agricultural and Rural Infrastructures**

#### **3.13.1 Agricultural Infrastructures**

##### **1) Irrigation Facilities**

There are nearly 60 main irrigation schemes with 33,000 ha of irrigation potential area. Most irrigation schemes were established by Indonesian authorities (DPU: Department of Public Works) in the last two decades. Almost all the irrigation schemes have been found to be functionally insufficient due to negligence of under-investment, engineering maintenance and rehabilitation works. Canals are filled with sediments and grass, so that irrigation water can not run through the canal. Many irrigation facilities such as intake and diversion gates have been damaged or lost, so that the irrigation water rush down to the canals without flow control, damage the canal lining and create the landslide (see Table I-2 ).

The recent condition of irrigation facilities is classified as follows;

- **Serious Damaged**  
This category is an irrigation system whose entire irrigation area is a sleeping area because water can not be collected and the main intake facilities have been destroyed. Damage of the main facilities is significant, and it is expected that the intake dams will be broken if the main facilities are not rehabilitated urgently. In the case of the breakage of the intake dam the whole area will become a sleeping area.
- **Light to Medium Damaged**  
Minor-medium damage occurred on headwork, intake, key-structure or main canal; or canals are medium-serious blocked; some facilities lost or damage; system capacity obvious reduced.
- **Unaffected**  
No damage occurred on headwork, intake, key-structures and main canal; despite minor block on canals, irrigation system is generally in normal physical condition, and will keep in function in following 2-3 years if proper operation and maintenance work normally carried out.

## 2) Access Road (Farm to Market Road)

There are main access roads which links villages/irrigation area and national & district roads with asphalt pavement, gravel pavement and no pavement. The road width of national & district road are very narrow, so that only four or five tons trucks can pass through. Moreover, there are many damaged portion due to the landslide along those roads by heavy rain and the rehabilitation of such damaged portion are currently carried out by Department of Infrastructure, PKF, TFET and Government of Japan (see Figure I-2). There are no lateral roads inside of the irrigation area.

The rehabilitation and construction of access road except for national & district roads are implemented by the community empowerment project (CEP) under the agriculture rehabilitation project (ARP) funded by TFET and CFET. According to the inventory by DAA, the total required length is approximately 110 km. 54 km out of 110 km have already been rehabilitated up to the fiscal year 2000 and the rest have also already been implemented till December, 2001. The implemented and proposed access road program are shown in Table I-8.

### 3.13.2 Rural Infrastructures

#### 1) Water Supply and Sanitation

The rural water supply and sanitation works are mainly carried out by four NGOs, namely Bia Hula, PROBEM, FORTE and HTO, funded by various international aid. Their activities and information are shown in Table I-3 to I-6.

They provide the rehabilitation of pipeline, construction of new facilities such as hand pump, pipeline, water distribution tank and public fountains, providing equipment, materials and personnel to effect emergency repairs in the field of water supply. This is being performed in conjunction with the UNTAET district administrations. The water supply system has been partially restored in the main towns of 13 districts by May 2000 and the rehabilitation works are still continued seeking the donor's assistance.

On the other hand, they provide the rehabilitation/construction of family latrines and school toilets in the field of sanitation.

#### 2) Electrification

The present power source is diesel generators in the country.

There is no electricity in the rural area except for main towns in 13 districts. Even the main towns has limited electricity supply from 18:00 to 24:00 at night or supplied on whole days alternately. The rural electrification is currently carried out by the Department of Infrastructure (see Figure I-3).

### **3.14 Present Environment Conditions**

#### **3.14.1 Social Environment**

##### **1) Population, Health and Income**

The present population of East Timor is about 738,000 people. The gross domestic product (GDP) per capita was estimated at US\$ 304 in 1999. The major factor affecting mortality has been identified as physical catastrophes, epidemics, drought, wars, slavery, and economic pressure.

The basic health system completely collapsed during post referendum events. Situation is under control now in Dili and surrounding areas with the active help from UN Transitional Authority. Malaria, tuberculosis, respiratory tract infections, diarrhea diseases and mal nutrition are the major communicable diseases.

##### **2) Education**

In 1999 pre-referendum period, there were 114 junior and senior schools with 32,197 students. There were six universities and most of them situated in Dili. Many of them were destroyed in October 1999. The schools and universities need re-construction and rehabilitation.

#### **3.14.2 Biological/Ecological Environment**

##### **1) Vegetation and Land Use**

According to forest information prepared by "Timor Timor Dalam Angka, 1997 : BPS", the bushed forest accounts about 76.0 percent. The extensive secondary vegetation and grasslands reflect widespread past deforestation for hunting, cultivation, and livestock grazing.

##### **2) Forestry**

Analysis of satellite images from 1999 indicates that 16 percent of East Timor is dense forest, whereas 19 percent is sparse forest, woodland or mixture small fields and secondary forest. As a matter of fact forest has decreased from 1972 satellite information when 321 thousand hectare or 25 percent to 207 thousand hectare or 16 percent in 1999. In the last 27 years the forest has decreased by about 30 percent over that period.

The most important tree species in East Timor are Sandal Wood (*Santala album*), Jati (*Tectona grandis*), Kayu merah (*Pterocarpus indicus*), Mountain ru/Cemara (*Casurina junghuhniana*), Poplar gum/Hueh (*Eucalyptus alba*), Jemuju (*Pedocarpus imbricatus*), Fiji longan /Kayu sapi (*Pometia pinnata*), and Levan /Leban (*Vitex pinnata*).

### 3) Soil and Land Resources

#### a) Soil & Soil Erosion

East Timor soils have less clay and lower water holding capacity. They are mostly 20-30 cm. deep over the island, except where lake deposit or marine clay. Erosion is predominant everywhere, especially in the north and southern mountains. The land is cultivated by swidden (shifting/slash and burn) agriculture, which accelerates soil erosion. The actual amount of soil loss is not known but assumed to be very high (about 26 ton/ha/year). The normal acceptable soil erosion loss is about 10 ton/ha/year.

#### b) Critical Soils

The critical soils are classified according to slope of land (>45 percent), soil erodibility, and rainfall intensity. In East Timor, total critical land is about 482 thousand hectare. Between 2003 and 2007, the rehabilitation target by the Division of Forestry is for 161 thousand hectare. Reforestation activity is reserved for 45 thousand hectare and 116 thousand hectare reserved for re-greening.

#### c) Marine and Coastal Ecosystems

Considerable oil and gas reserve are known to exist in the Timor Sea. There are creeks in the vicinity of Viqueque where oil naturally seeps to the surface. The future commercial exploitation of oil and gas is likely to pose environmental hazards.

East Timor has deposits of minerals (gold, copper, chromium, and iron) and clay, graphite and phosphates (Monk et al. 1997). Mining of these minerals may have environmental impacts that could be affecting marine and coastal ecosystems. Erosion of hillsides or unwise agricultural practices, threaten coastal biotopes with sedimentation. Erosion and deposition rates should be monitored in coastal areas. Environmental guideline for marine and coastal use should be implemented very soon.

#### d) Environmental Conservation Zones

The most important issue in East Timor is the loss of natural habitat and decline of biological diversity. This was also discussed in the study on Urgent Rehabilitation Plan in East Timor (Aug. 2000), which has been undertaken by JICA. Study Team proposed the following revised conservation zones;

- Proposed conservation zones (July 1995)
- Protected wild areas (UNTAET/2000)
- Mountain reserve (UNTAET/Reg./2000)
- Conservation coral zone(July 1995)
- Mangrove conservation (JICA/2001)
- Soil conservation & watershed management (JICA/2001)

### 3.15 GIS and Database Design

#### 3.15.1 Organization of GIS

GIS section, which is positioned as Division of Geography and Cadastre in MAF, is an independent organization and consists of five systems engineers.

#### 3.15.2 Current Progress of Database

The data of GIS consists of mapping information and attribute information. These information are mainly used for a thematic mapping for planning and design of agricultural sector development, and current progress on these activities are as follows;

##### 1) Map Database

Thematic map required for agricultural development plan/design are;

- Land use map
- Soil map
- Inclination classification figure, altitude and slope map
- A river present condition map, watershed map
- Road present condition map
- Administration community map
- Topographical map
- Geologic map
- Institution position map

As for the above-mentioned topical map and data creation, almost all of them were carried out up to August 2001. Now, the data of the created topical map are utilizing within GIS database. However, a topographical map is not processed yet. Since other donor's organizations committed to produce and it is still under processing, GIS section of DAA has not received any topographical map.

##### 2) Attribute Database

Attribute information is numerical information, which linked with the map information on GIS. The international organization such as World Bank, UNDP and ADB started data collection through Village Survey (Suco Survey), a census, statistics information, etc., and the attribute information is now being processed as a database. Hereafter, as soon as it is created, it will be provided for GIS section as Database. Moreover, agricultural statistics information belongs to agricultural section of DAA, although many of this information exist and recorded in a computer system, this data must be edited for using by GIS is needed.



### 3.15.3 GIS and Database Format

It was determined in the GIS committee in Dili that Arc/view 3.2, which U.S. ESRI developed will be applied as a GIS common software. According to this determination, the database of GIS will be processed according to the application employed on Arc/view.

### 3.16 Present Problem and Constraints

This section summarizes the current East Timor problems and constraints facing in the fields of agriculture, forestry, and fishery, although the details of them have been mentioned in previous paragraph.

#### 3.16.1 Agriculture Sector

- High surface soil erosion from catchment basin

During the onset of the rainy season where the soil is not protected by vegetative cover, the impact of rainfall bombardment on the surface soil would create erosion from the mountain down to the hills and finally to affect the irrigation systems in the lowlands. Sheet erosion will start and will continue to develop into rill and gully erosion. Soil losses will be transported to major rivers and streams and deposited to low lying areas. When river channels overflow, it can create flash flooding endangering the life of the people, animals and destroy crops.

The continuing loss of tree cover in the uplands and lowlands is also decreasing the ability of lowland irrigation systems to operate efficiently. The current silt load in many streams is far to high for economic operation of irrigation systems and irrigation system viability remains in doubt for so long as the environment continues to degrade. Any system of increasing soil and land cover in the highlands with trees is going to be necessary before the continued successful operation of irrigation systems can be considered.

- Import of cheap price of foreign rice and undeveloped marketing systems for local rice

The major present constraint to increasing both maize and rice production is the importation of cheap foreign rice. This food importation policy destroys the market for both rice and maize and decreases the incentive of subsistence-oriented farmers to grow a surplus of either crop for sale. Any attempt to increase staple crops production is dependent on the economic benefits derived from selling them. The national production of rice and maize is likely to stagnate, or possibly decrease, if cheap imported rice floods the local market. Any food crop project activity designed to increase rice or maize production will be difficult to implement successfully so long as the production remains so uneconomic.

- Shortage of farming labor

Family labor shortage particularly at the beginning of the rice season both in single cropping, further more it becomes heavier for double and triple crop farmers. More than 80 percent of farmers suffer the shortage of family labor especially in land preparation, transplanting and then harvesting.

On the other hand, although it is considered that more than 80 percent of the population in East Timor is out of work. Since subsistence farmer's incentives for crop production increase seems to be low, it is reported that those farmers are not active to input more family labour and/or hired labour to their cultivation activities.

- Lack of farm inputs and high price

Input material such as high quality seeds, fertilizer, chemical, etc. are periodically in shortage, and their prices are expensive for the farmers. Furthermore purchase of hand tools is the biggest farm input investment. Under the situation, farm practices are mainly rely on manual and animal power. These conditions cause the delay of land preparation works together with shortage of labor.

- Poor post-harvest capacity/technology and facilities

Post harvest problems with maize and the inability of the average maize farmer to protect his maize crop after harvest from insect attacks is clearly a problem that is not difficult to correct in a technical sense (it needs air tight storage containers) but very difficult to implement on a national scale. With storage losses of over 25 percent annually, it is a problem that needs attention but one that is receiving very little. It makes no sense to only increase maize production if protecting the crop already harvested is the critical weak point. The effects of post-harvest operations for maize will also have an immediate impact on increasing farmers economic well being.

For rice farmers the most immediate problems is in getting the paddy rice milled efficiently. At least 50 percent of the paddy rice harvest is now being milled by women hand pounding it in the ancient and traditional manner. The output of this rice pounding (milling) is a rice of very poor quality and achieves well under 50-75 percent milled rice equivalent while a properly maintained and operated rice mill will give about 65 percent recovery of milled rice. Other post harvest rice operations including rice threshing are also inefficient and slow. There is scope to quickly and permanently increase rice production by mechanization of all post harvest operations.

- Ineffective land preparation works for rice cultivation

Slow and inefficient land preparation in East Timor is also a constraint to increasing rice planted area because of the delays in preparing rice fields for transportation. The whole system of land preparation needs to be overhauled if long-term sustainable increases in rice production are to be realized. The problem is not so serious in maize cultivation in terms of land preparation since a large majority of the maize crop is planted in slash and burn cultivation systems where land preparation is not so important. However, as mentioned in 3.14.2 "Biological/Ecological Environment", such cultivation methods will cause the acceleration of soil erosion. Therefore, in the future however it will become an important issue from view point of watershed environment.

- Lack of new high yielding bean variety

The lack of new higher yielding bean varieties is also constraining the ability of the present agricultural system to increase the supply of protein rich foods. If the present policy of under emphasizing the use of chemical fertilizers for food crops is continued, the importance on increasing biological nitrogen fixing plants will only become more important. Higher yielding and better nitrogen fixing bean plants will partially alleviate this problem but it will remain a long-term constraint, due to the existence of limited supply of nitrogen. A similar argument for nitrogen fixing tree crops in the household area will provide both increased animal fodder and a source of nitrogen for gardens.

- Farmer's destruction for use of chemical fertilizer

Local farmers do still not trust chemical fertilizers. They are often convinced that the increases in crop yield from chemical fertilizers will be countered by poor yields in subsequent years. There are still many bags of fertilizer left over unused from former times. This is a problem that will require long-term efforts to convincing farmers of the advantages of fertilizer use. If farmers do not adopt the use of fertilizers on a wider scale, the prospects of irrigation systems reaching satisfactory economic returns on the investment in infrastructure remain poor.

### 3.16.2 Livestock Sector

- Farmer's low awareness for seasonal feed availability

This is especially true for ruminant animals, although owners do not realize that insufficient feed late in the dry season reduces reproduction and lengthens maturity to marketable weights. Fallow fields provide main feed supply during dry season, and when the rice crop is planted, animals have to be herded into the nearby hills. Available supplemental fodder from napier grass (*Pennisetum*), lamtoro (*Leucaena*), *Sesbania*, tamarind and *Hibiscus tillaceus* are hardly used, nor intentionally planted for the purpose.

- Spread livestock diseases

There are reported disease outbreaks for hemorrhagic septicemia and foot and mouth disease for cattle, buffaloes and pigs; hog cholera; and Newcastle disease for chickens.

- Lack of veterinarians

This is limiting the establishment of mechanism for monitoring and surveillance and diagnostic confirmation of disease incidences, inspection of marketed meat and live animals, as well as sustained promotion of sound health practices for farmers.

- Inadequate extension services

Teaching farmers improved husbandry such as growing and feeding improved fodder, selection of breeding males, etc. cannot be effectively provided with limited personnel and transport facilities.

- Lack of slaughterhouses

In operational and/or lack of slaughterhouses, and the absence of supportive health inspection for live animals and meat puts undue risk to the consuming public.

- Lack of an integrated livestock development program

Except for the rehabilitation program, there is still no comprehensive livestock development program, drawn up in consultation with stakeholders and farmers; through the long-term and reflecting world market trends. At the same time, resources at National University of East Timor and Don Bosco are not integrated in mid- to a long-term development effort. These resources include their three functions of instruction, research and extension, and the trained graduates in Animal Science/Husbandry.

### 3.16.3 Forestry Sector

- No forestry activities under restricted budgets and forestry staff

There is no remarkable activity on Forestry Sector. Annual budget for forestry unit in 2000/2001 is only 10 percent of the total budget of the allocated agricultural sector (Agriculture Sector: US\$ 630,000 equivalent to 1.1 percent of total national budget)

- High rate of critical lands

There are many critical lands, which are accounted for 43 percent of all forest areas, especially outside forest area (private forest) shows 85 percent. These critical land should be rehabilitated in an early stage from the point of conservation for the national land.

- Uncertain forest boundary and potential

Inventory for forest in East Timor is not yet concluded, so there are no boundary posts. For that reason it is very difficult to manage the forest / boundary. Besides there are few forestry staff. (Number of civil servant for forestry: 348 staffs in 1995/1996. Presently number of staff is less than 30 staffs)

There are many commercial and useful tree species such as, Sandal-wood, Teak, Kayu Merah etc. However potential of forest is unknown because the forest inventory is not executed. Based on Indonesian map for tree stand (1980), there are 9.6 percent (Standing Volume more than 80 cu.m/ha) areas, 4.2 percent (Standing Volume 40-79 cu.m/ha) areas, 57.2 percent for grass land areas and 28.9 percent for bushed forest areas. Therefore production capacity is low.

- Forest burning due to no monitoring staff

Burning forests is very serious matter. The most unfortunate fire is the lighting into grass land (Alang-alang) to regenerate the withered grass as fodder for livestock, moreover be also found the lighting without intention in the mountainous area. Because under the old trees such as Eukali there are many natural seedlings as regenerated trees, they are almost

died by fire every year. If there is no burning, the forests will be regenerated easily and rapidly without planting activities.

- Shortage of Forest Products

Domestic demand of forest products is estimated roughly in the paragraph of 3.8.1 "Forestry". Between the demand of forest product and the actual production, the big difference is observed.

### 3.16.4 Fishery Sector

- Shortage of fishing vessels and lower seaworthiness of canoes

First, the dugout canoes, most available form of fishing vessels to the sector in East Timor at present, are insufficient. According to the Village Survey (Suco Survey), for 10 full-time fishermen, only six canoes are available. Secondly, due to lower seaworthiness of the canoes, fishing trip days or reachable fishing grounds are considerably limited. A full-time fisherman in Manatuto said for our interview in July 2001 that he could not sail from April to the date because of strong winds and high waves. Another fisherman in the same aldeia said he could sail four days in May and eight days in June. A height of gunwale, which is decided by a diameter of available tree, 50cm or some, is not enough in most cases, and this is the main reason to make these canoes much less seaworthy. Thirdly, dugout canoes with or without plank-built gunwale, which shows effort to heighten gunwale, have a short life, namely around five years. Though building cost, 2.0 million Rp to 2.5 million Rp, is relatively lower and hence investment may not give serious financial burden to fishermen, it should be noted a full tree of good size is consumed to build a dugout canoe every time.

- Undeveloped fishing gears

The main fishing gears are gillnet and hand line. It was observed many times that gillnets which fishers purchased recently were of a complete form, that is to say, a gillnet assembled in pre-designed buoyancy and shrinkage. These conditions to set a gillnet construction should however depend on conditions of fishing grounds to maximize its catch rate. Hand lines are generally used both for bottom fishing and trolling. That is to say, the fishing lines are not specialized to target fish species at all. This "common" use of hand lines also results in lower catch rate. In all the cases observed, a hand-made lure, attaching hen feathers, was used. At least for use of trolling, there should be many immediate ways to improve this gear.

Fishing methods in East Timor, when Study Team includes those practiced on beach, show a sort of varieties at least locally. However, in case of the canoe fishing, fishing gears other than gillnet and hand line, that is to say, such gears that can be practiced onboard small-scale boats as long line, surrounding net and "cast" net (a method to lay net flatly in the waters and retrieve it after attracting fish above the net by lighting or other measures), are generally not observed. This bias is resulted in mainly by the lower seaworthiness of the fishing fleet.

Long line, surrounding gillnet and cast net of a small-scale will have a development potential in East Timor as these have many precedents by small-scale fishing boats in neighboring countries. It would be difficult, however, to immediately introduce these methods to the present canoe fishery because of its limited loading capacity. A stationary type of Bagan fishery in Indonesia may fill requirements for this situation, as it does not need a larger size of boat and also is able to build, excepting netting construction, with locally available materials. However, the coastal oceanographic conditions in East Timor, high waves at open coast especially in dry seasons, few quiet inlets sheltered from open sea, and steep bottom topography in both north and south coast, make it generally difficult to install or moor simple structures like a stationary Bagan on sea bottom. In case of a movable Bagan, it will have to wait, like in case of long line and surrounding gillnet, the development of more seaworthy fishing boats.

#### - Undeveloped fish marketing

Marketing by fish traders has become general already. In Dili, some groups sell iced fishes and lobsters to hotels and restaurants by transporting these on pick-ups. However, these in an enterprise level are still exceptional, and the majority of the traders are individuals. Difficulties in fish transport due to the present ineffective infrastructures affects especially on their daily business. As shown in the fish stalls inside and outside of the markets in Dili, where fresh fish is not iced and loses its value late in afternoon, lack of the preservation measures are observed also especially on their business. Thus, these weaker, or less capitalized, traders represent such serious problems in both fish distribution and markets in East Timor.

Based on the results of the weekly fish consumption in the household survey, it is found that households having more purchasing power tend to buy fish than ones having less. This means fish is an expensive food in East Timor. Salted fish and canned fish are equally or more consumed in the uplands than the lowlands. This may be resulted in by lack of the preservation measures that prevents fresh fish distribution in the uplands

Once some parts of the beach of Akait and Lecidere in Dili were used by several open-air fish retail shops and temporal resident houses. As these areas were in the tourism zone, the shops were forced to transfer to the Comoro market and other places on 8 August 2001. Behind these shops in Akait beach, there are rusted remains of a barge, and this has been used for mooring Bonito class boats and other similar size boats from Atauro. Actually, most operators of the previous shops in the area appeared to come from the island. Thus it is supposed, if the shops needed to find alternative place, berthing facilities for Bonito class should have been accompanied with them.

### **3.16.5 Capacity Building**

One problem and constraint the country faces is the level and quality of the education or level of learning of its human resources.

- Low enrolment in secondary and high education level

The net enrolment in East Timor are: 71 percent boys and 70 percent girls in the primary levels; and 38 percent boys and 39 percent girls in the secondary level. These rates are relatively low compared with those of Indonesia of 75 percent.

Of those who completed the secondary level, only 20 percent go to higher education and this figure is very much lower than the 40 percent for the whole of Indonesia. It is considered that those who pursue higher education normally study outside of East Timor and in most cases find jobs outside of the country, like Indonesia, Malaysia, Singapore and Australia.

- Low awareness of parents for necessity of education

Another related problem is that seventy percent of parents in East Timor are uneducated. Due to their inability to understand the importance of education and because of the subsistence nature of their livelihood, they compel their sons and daughters to work in their farms and garden. Hence absenteeism is prevalent among students resulting to poor quality of education.

- Shortage of curriculum and materials for capacity building

The transitional government had a good understanding of these problems and it is allocating a large portion of the budget to education (20.1 percent). It must be noted, however, that it will take some time before its effect on the quality of human resource in East Timor is felt. At present the quantity of human resources could be enough but its quality shall be a problem. Therefore, there will be a need to supplement this deficiency by providing substantial training, orientation or capability build-up program in the rural area.

### 3.16.6 Environment

- Deforestation, soil-erosion and land slides

Deforestation is the single most environmental issue within East Timor. This causes soil erosion in the form of surface erosion and land-slides, and in the lower areas disastrous floods in rivers.

- Lack of environmental legislation

The lack of environmental legislation, and legislation to protect biological diversity do not exist. Further, following constraints have been recognized in East Timor.

- Institutional framework is required for handling environmental issues.
- National environmental policy is absent.
- Environmental priorities are not worked out.

East Timor has to set priorities for environmental legislation. Environmental laws covering nature conservation, pollution, coastal zone management, biodiversity are still

in their infancy. Legislation on Environmental Impact Assessment (EIA) is required. The success in integrated watershed management will influence million lives. This should include detailed information on deforestation and reforestation, agriculture and agro-forestry.

- Absence of information on biodiversity and environmental status

A National Integrated Coastal Zone Management Plan (ICZM) has to be worked out. There is great need for Solid Waste and Urban Pollution Management Plan for East Timor, especially for Dili. The absence of information on biodiversity and environmental status is a great handicap for future environmental management in East Timor.

### 3.16.7 GIS and Data Base

Preparation of the map information on GIS database has nearly completed. Moreover, attribute information is also processing as individual information by some foreign donors and MAF. By this reason, it is considered that there are no difficult problems about preparation and maintenance of data processing. The following problem towards in future are shown below;

- Shortage of GIS engineers

Many of the GIS engineers are presently organized by the overseas experts. There are very few Timorese GIS engineers. Then, training and education of engineer are requested strongly. This is not only the problem of MAF, but also widely whole East Timorese problem. If technical problems happen on system operation among the different agencies, the communication among the engineer is the most important. For this purpose, training of capable systems engineer is indispensable.

- Undeveloped maintenance of database and non-establishment of modification /correction methods

After the database was started, topical map or thematic maps are often requested to modify or to correct. Moreover, it may be asked for creation of new data. Then, as the solution methods, the "system management or operation manual" to meet to changing situation, should be decided in MAF.

- Undeveloped Operation Rule of Application Method

The opportunity to use the GIS should be given to all MAF staff. However, in order to use freely anytime by all staff concerned, the operation rule of the application method is needed.

- Restriction of free utilization of GIS

Open utilization of database is a principle. However, restriction of the information leak to the exterior is needed. It is necessary to consider about the popularization of the Internet or LAN. Private pass- word or some kind of coincidence for proper operation, etc. is needed to keep the system.