No.

Ministry of Agriculture and Fisheries (MAF)
Government of the Democratic Republic of Timor-Leste

THE STUDY
ON
COMMUNITY-BASED INTEGRATED WATERSHED MANAGEMENT IN LACLO AND COMORO RIVER BASINS
IN
THE DEMOCRATIC REPUBLIC OF TIMOR-LESTE

FINAL REPORT

Volume I: Main Report

MARCH 2010

JAPAN INTERNATIONAL COOPERATION AGENCY

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Composition of Final Report

Volume I Main Report

Volume II Watershed Management Planning Guidelines

Volume III Annexes

PREFACE

In response to a request from the Government of Timor-Leste, the Government of Japan decided to conduct a study on Community-based Integrated Watershed Management in Laclo and Comoro River Basins in Timor-Leste, and entrusted the study to the Japan International Cooperation Agency (JICA).

JICA selected and dispatched a study team headed by Mr. Yoji Mizuguchi of Nippon Koei Co., LTD. and consists of the above mentioned company between November 2005 and February 2010.

The team held discussions with the officials concerned of the Government of Timor-Leste and conducted field surveys at the study area. Upon returning to Japan, the team conducted further studies and prepared this final report.

I hope that this report will contribute to the promotion of this project and to the enhancement of friendly relationship between our two countries.

Finally, I wish to express my sincere appreciation to the officials concerned of the Government of Timor-Leste for their close cooperation extended to the study.

March 2010

Izumi Takashima,
Vice-President,
Japan International Cooperation Agency

March 2010

Mr. Izumi TAKASHIMA
Vice President
Japan International Cooperation Agency
Tokyo

Dear Sir,

LETTER OF TRANSMITTAL

We are pleased to submit herewith the Final Report on the Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins in the Democratic Republic of Timor-Leste. The study aimed to assist the Ministry of Agriculture and Fisheries (MAF) in managing and protecting the Laclo and Comoro River basins in a proper and sustainable manner formulating a community-based integrated watershed management plan (CBIWMP) for the same river basins and enhancing the capacity of MAF, especially the National Directorate of Forestry.

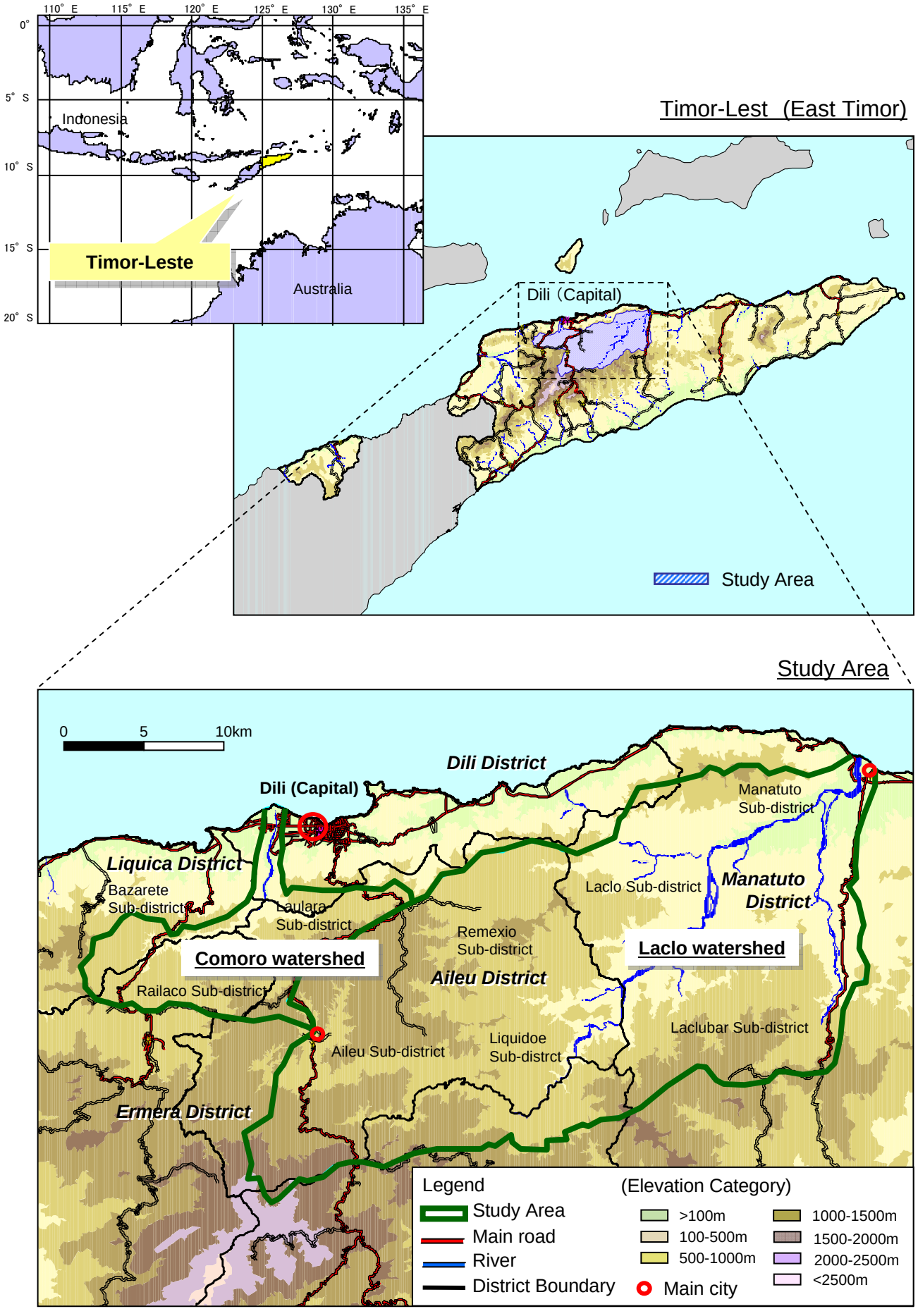
Although the concept of community-based forest or watershed management is still new in Timor-Leste, we believe that the CBIWMP can be the effective tool for the MAF to attain sustainable forest and watershed management under the current conditions of Timor-Leste. In fact, the effectiveness of the programs/sub-programs proposed in the CBIWMP was proven in the course of the pilot projects implemented in partnership with NGOs from January 2008 to September 2009.

We therefore do hope the CBIWMP, especially the five-year management plan proposed in the CBIWMP, will be shared with the high level authorities of the government and other potential funding institutions so that the MAF can get the necessary support to implement the CBIWMP as soon as possible.

Finally, we would like to express our deep appreciation and sincere gratitude to all the officials and persons who extended their assistance and cooperation to the JICA Study Team, in particular Ministry of Agriculture and Fisheries, especially National Directorate of Forestry, MAF District Offices in Ermera, Aileu and Manatuto, Halarae Foundation, USC-Canada Timor-Leste, and communities in the target villages. We also acknowledge your agency and Embassy of Japan in Timo-Leste for their kind support and valuable advices in the course of the Study.

Very truly yours,

Yoji Mizuguchi
Team Leader
The Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basin



Location Map

Photographs taken during the Study on Community-Based Integrated Watershed Management in Laclo and Comoro River Basins in Timor-Leste

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Summary

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1. Introduction

1.1 Background: Between 1972 and 1999, the forest cover of the Democratic Republic of Timor-Leste (Timor Leste) had decreased by 24% in total, equivalent to a rate of about 1.1% per annum. At present, forests in the country cover only about 35% (or 0.5 million ha) of its total land area (1.5 million ha). Both Laclo and Comoro watersheds have a significant value for people in Timor-Leste. The former is the catchment of one of the largest irrigation systems in the country, while the latter has a source of the domestic water for Dili City in its area. However, forest degradation has progressed in both watersheds mainly due to the prevalence of illegal cutting, firewood collection, wild fires and cattle grazing.

1.2 Authority: In accordance with the Scope of Work (S/W) on the Study on Community-based Integrated Watershed Management in Laclo and Comoro River Basins (the Study), which was signed by Japan International Cooperation Agency (JICA) and the Ministry of Agriculture, Fisheries, and Forestry (MAFF) on April 28, 2005, a study team (the Study Team) was formed and assigned to undertake the Study

1.3 Objectives of the Study: The objectives of the Study are to:

i) develop a community-based integrated watershed management plan (CBIWMP) for the Laclo and Comoro River basins;

ii) prepare watershed management guidelines for the Ministry of Agriculture and Fisheries (MAF, formally known as MAFF) and National Directorate of Forest (NDF) to plan and implement a watershed management plan in other basins; and

iii) develop the capacities of the counterpart personnel for watershed management through on-the-job training in the course of the Study.

1.4 Target Area of the Study: The Study targets the Laclo River basin (approximately 130,000 ha) and Comoro River basin (approximately 30,000 ha), which extends over five districts, namely, Dili, Aileu, Manatuto, Ermera, and Liquica.

1.5 Schedule of the Study: The Study consists of two phases: Phase 1 for the preparation of draft community-based integrated watershed management plan, and Phase 2 for implementation of the pilot projects. The study started in November 2005 and ends in March 2010, although it had an eight-month break in 2006 due to internal turmoil in the country.

2. Overall Framework of the Watershed Management Sub-sector

2.1 National Development Plans: The existing national and sector development plans relating to watershed management are the: i) National Development Plan (2002), ii) Millennium Development Goal (2004), iii) National Priorities (every year since 2007), and iv) Annual Action Plan of MAF (every year since 2005). Among others, the National Priorities plan indicates the priority areas that the government focuses on in the year. The National Priorities for 2010, which are currently being finalized by the government, set seven priorities: i) road and water, ii) food security, iii) human resource development, vi) access to justice, v) social services and decentralized service delivery, vi) good governance, and vii) public safety. One of the goals under food security is sustainable and efficient forest resource management.

2.2 Existing Policies: The existing policy documents of MAF are the i) Policy and Strategic Framework of MAFF (2004), ii) Forest Policy (2007), iii) National Food Security Policy (2006), and iv) National Water Resource Policy (drafted in 2004). These are the major government policies

relating to watershed management in the country. The lack of policies and strategies is one of the issues to be urgently tackled in the GoTL.

The Policy and Strategic Framework of MAFF (2004) was prepared to attain the objectives of the National Development Plan. The main aim of the policy is to strengthen the capacity of rural communities to secure their short- and long-term livelihoods from agriculture, forestry and fishery resources by managing natural resources in a sustainable manner.

The forest policy is aimed at the sustainable management of forest resources and watersheds, which is supported by six policy objectives, namely, i) protection of forests, ii) community participation in forest development, iii) watershed conservation, iv) afforestation and land restoration, v) forestry sector institutional development, and vi) development of a private sector business environment.

2.3 Existing Legislative Set-ups: Preparation of a legislative framework of the country is still on-going. The laws/decrees relating to watershed management are the i) Charter of the Ministry of Agriculture and Fisheries (Decree No. 18/2008), ii) Forest Management Decree (Draft), and iii) Real Estate Law (Law No. 1/2003).

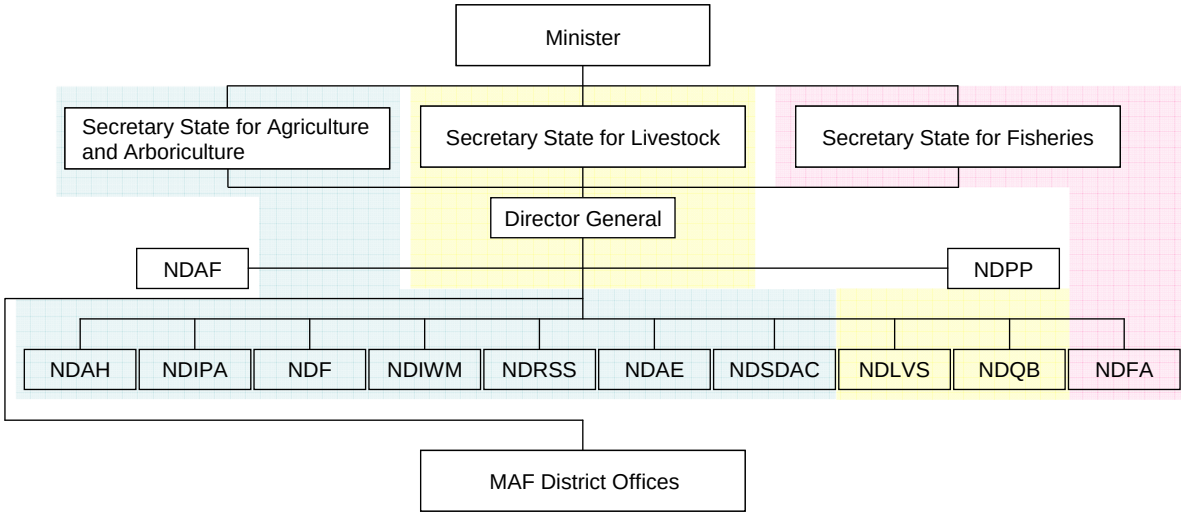
(1) The Charter of the Ministry of Agriculture and Fisheries (Decree No. 18/2008) gives the organic structure of the ministry and tasks and functions of the respective directorates in the organic structure of MAF.

(2) The Forest Management Decree was prepared in 2008 and is now on the verge of being approved by the parliament, as of December 2009. The draft decree stipulates that communities can claim access, use and management rights to forest resources in the village on condition that the communities enter into a Draft Community Forest Management Agreement with NDF. The Draft Community Forest Management Agreement can be upgraded into either an Interim Community Forest Management Agreement or a Long-term Community Forest Management Agreement. The interim agreement will be renewable without limit, subject to assessments to be made every three years, while the long-term agreement is effective for a minimum term of 25 years, although the performance of communities under this agreement shall be assessed every five years.

(3) The Real Estate Law (Law No. 1/2003) was issued to address the complicated situation of land tenure after the independence. It defines the private ownership over real estate in the country. Three types of ownership, i.e., i) private real estate, ii) public real estate, and iii) state's private real estate, are defined in the law. Although private ownership over the land was recognized by this law, there is still a need to come up with another set of laws and/or regulations to clarify the way of registration of privately-owned lands.

2.4 Organizations of MAF:

(1) Organizational Structure of the Ministry: At present, the MAF is composed of one Minister, three Secretaries of State, one General Director, 12 National Directorates, and 12 district MAF offices. The NDF is put under the supervision of the Secretary of State for Agriculture and Arboriculture, together with the National Directorate of Agriculture and Horticulture (NDAH), National Directorate for Industrial Plants and Agribusiness (NDIPA), and National Directorate for Support to the Development of Agricultural Communities (NDSDAC).



Organizational Structure of MAF (2009)

(2) Number of the Staff in the Ministry: The ministry has made its effort to recruit new permanent and temporary staff for the last eight years. In particular, the number of total staff in 2009 became about three times (1,816 staff) as many as that in 2005 (675 staff) since the GoTL recruited a number of extensionists (extension workers) and forest guards in 2008/2009. Although the number of field staff has drastically increased to enable government extension services to reach the village level, the capacity of the field staff is still limited to provide adequate services.

(3) Organizational Structure and Number of Staff of NDF: NDF has five departments, namely, i) Department of Planning and Strategy, ii) Department of Protected Areas and National Parks, iii) Department of Rehabilitation and Reforestation, iv) Department of Production and Utilization of Forest Resources, and v) Department of Protection and Management of Forest Resources. NDF has a total of 62 staff in the central office and 42 staff in the MAF district offices. The NDF staff consists of 52 technical officers, 42 forest guards, and 10 administration or other staff.

(4) Organizational Structure and Number of Staff of MAF District Office: The MAF established its territorial delegations in each district in the country to provide its services to the village level. The MAF district office headed by District Director consists of three departments, namely i) Department for Technical Support, ii) Department for Agriculture Extension, and iii) Department for Administrative Support. The number of the staff in the district offices concerned with the study area (i.e., Aileu, Ainaro, Lequica, Ermera, Manufahi, and Manatuto) is 384 in 2009.

(5) Major Tasks of Extensionists and Forest Guards: The MAF recruited a number of extension workers (so-called "extensionists" in Timor-Leste) and forest guards in 2008/2009. Although they are expected to fulfill the following tasks and functions, many of them are new graduates from vocational schools or used to be local community members.

Extensionist:

1. Promote development of the agriculture, forestry, livestock and fisheries sectors
2. Provide services relating to agriculture, forestry, livestock and fisheries
3. Coordinate with relevant directorates in MAF to support MAF's programs
4. Involve farmers in the development of the agriculture, forestry, livestock and fisheries sectors

Forest Guard:

1. Protect forests and forest products
2. Protect forests from forest fires

3. Raise public awareness of forest functions in communities in and around forests
4. Prepare necessary documents
5. Report the progress of the work to the supervisor
6. Coordinate with relevant directorates in MAF to support the MAF's programs

There is a need to enhance the capacities of the field staff so as to enable them to provide adequate services to rural communities.

(6) Equipment and Facilities: Generally, the equipment and facilities in MAF/NDF are insufficient. In particular, the lack of transportation facilities or limited mobility in the district office is one of the drawbacks that have hindered the extension works or protective activities of MAF.

2.5 Budgets and Expenditures of MAF and NDF

(1) Budget and Expenditure of MAF: The annual budget of MAF will have ranged from US$33.9 million to US$12.8 million from 2009 to 2012. The planned budget in 2009 is about three times as much as those planned from 2010 to 2012. About 50% of the budget in 2009 (approximately US$16 million) was spent for purchase of tractors for distribution to local farmers as well as the MAF district offices. About US$11~12 million will be spent for salary/wages and goods/services in office operations. The ministry has limited budget for project activities, in general.

(2) Budget and Expenditure of NDF: The planned budgets for NDF from 2009 to 2012 ranges from US$730,000 to US$769,000. All the budgets are expected to be used for "salary & wages" and "goods and services."

2.6 Current Capacity Gap of NDF and District MAF Offices

The JICA Study Team assessed the capacity gaps of NDF and the concerned district MAF offices as compared with their expected roles and tasks in the implementation of the watershed management activities in the target areas in 2006. The assessment revealed that not only had they hardly have any experience in watershed management and protection, but also in making a watershed management plan, so far. By and large, the staff of NDF, especially those in the district MAF office, has limited knowledge of and experience in watershed management. There is a need to incorporate an intervention to develop/enhance the capacities of MAF, especially NDF, in the proposed watershed management plan.

3. Present Conditions of the Laclo and Comoro River Watersheds

3.1 Natural Conditions

(1) Location: The area of Timor-Leste is approximately 14,874 km^2, with the total length of 265 km and a maximum width of 97 km. To the North lies the Banda Sea and to the South lies the Timor Sea. The country has varied of topography, dominated by the Ramelau Mountain range in the center of the island of Timor. More than half of the lands have over 40% slopes.

(2) Climate: Timor-Leste is under the monsoon type climate, which is characterized by a clear distinction between the wet and dry seasons. The length of dry season largely varies from 2-3 months to 10-11 months. In the target watersheds, a relatively shorter dry season (5-6 months) occurs in the upper Comoro watershed, while the longest dry season (7-9 months) is experienced at the mouth of the Laclo River. Average annual rainfall in the country varies from 573 mm at Manatuto to 2,500 mm in the central-western mountains. The coastal sides in the Laclo watershed and northwestern part of the Comoro watershed have the lower precipitation (500-1000mm), while the southwestern edges of the upper Laclo watershed have the higher precipitation (2,000-2,500mm).

(3) Hydrology: The catchment area of the Laclo River from the intake of the Laclo irrigation system is 1,386 km^2, with eight tributaries in the river system. Based on the records kept between

1952 and1974, the average monthly stream flow of the Laclo River is 29.3 m^3/sec, with the lowest discharge of 8.1 m^3/sec in September, and the highest one of 69.8 m^3/s in March. The catchment area of the Comoro watershed starting from the edge of the urban area of Dili City is 212 km^2, with four tributaries. The mean monthly stream flow of the Comoro River is 2.99 m^3/sec. The flow decreases to less than 0.5 m^3/sec from July to November and increases to 12.3 m^3/sec in March.

(4) Water Users: The Laclo River supplies irrigation water to the Laclo irrigation system located along its main stream. About 600-700 ha of lowland rice fields are presently supported by the system. On the other hand, the Bemos River, which is one of the tributaries of the Comoro River, supplies drinking and domestic water to large parts of Dili City.

(5) Topography: The elevation of the Laclo watershed ranges from sea level to 2,512 m above at the southwestern edge of the watershed, while that of the Comoro watershed is from sea level to 1,410m above at the western edge. About half of the area is classified as the lands between 15% and 40% slopes and about one-fourth of the same are with more than 40% slopes.

(6) Geology: Geologically, Timor island belongs to the Australian continental plate, of which the bedrocks are mainly sedimentary calcareous. The parent materials of the watersheds consist of limestone in the southern Laclo watershed and phyllite in the upper Laclo and Comoro watersheds. Phyllite materials in the watersheds (between the coast and the central mountains at elevation approximately 1,000m above sea level) are rather geologically fragile, thus easily eroded when exposed to air after surface soil erosion.

(7) Present Land Use and Vegetation Covers: The present land use and vegetation covers were assessed by analyzing LANDSAT images taken in 2003 and the aerial photos taken in 2002, along with the ground truth survey undertaken in 2007. The vegetation and land use types in the watersheds were classified into eight classes as shown below.

Present Land Use in the Target Watersheds

Land use class	Comoro watershed		Laclo watershed		Total	
	(ha)	(%)	(ha)	(%)	(ha)	(%)
1. Forests						
1-1: Closed forest (natural)	2,185	10.8	4,998	3.8	7,183	4.7
1-2: Medium forest (natural)	4,062	20.1	28,556	21.8	32,618	21.6
1-3: Woodland (natural)	1,978	9.8	17,103	13.0	18,991	12.5
2. Shrub land	6,094	30.2	46,457	35.4	52,551	34.7
3. Grassland	1,777	8.8	13,068	10.0	14,485	9.8
4. Coffee plantation	2,680	13.3	779	0.6	3,458	2.3
5. Bare land	1,185	5.9	16,098	12.3	17,283	11.4
6. Sandbar/River bed	183	0.9	2,940	2.2	3,122	2.1
7. Paddy Field	69	0.3	1,174	0.9	1,242	0.8
8. Settlements	0	0.0	36	0.0	36	0.0
Total	20,212	100.0	131,118	100.0	151,330	100.0

Source: JICA Study Team

(8) Dominant Forest Types: The forests in the target watersheds can be further divided into ten forest types, as follows: i) river side forest, ii) natural forest in the protected area, iii) Eucalyptus woodland, iv) Casuarina woodland, v) Eucalyptus open woodland, vi) Tamarindus and Acacia woodland, vii) Falcata & coffee plantation, viii) Casuarina & coffee plantation, ix) other plantations (Teak, Gmelina), and x) shrubs) based on the human interventions and natural conditions (climate, soils and hydrology).

(9) Landslides: The landslides/slope failures are concentrated in the Laclo watershed, especially in the upper part of Ue Coi, Sumasse, Eraibanaubere, Malikan and Lohun sub-watersheds.

(10) Protected Areas: Three protected areas designated by the UN Transitional Administration in East Timor (UNTAET) Regulation No. 2000/19 may overlap with the target watersheds, although there is no clear boundary of the protected areas on the ground as well as on the map. The areas that could overlap with the protected areas are located at the edges of the watersheds.

3.2 Socio-Economic Conditions

(1) Administrative Situation: Seven districts or 14 sub-districts are geographically related to the watersheds. At the suco level, 73 sucos in total are geographically related to the target watersheds fully or partially. Out of the 73 sucos, 42 are fully covered by the target watersheds.

(2) Demography: According to the 2004 census, there are 82,429 people living in the 73 sucos in and around the target watersheds. The average annual population increase between 2001 and 2004 in the Comoro watershed is estimated at 5.8 % per annum, while that in the Laclo watershed is estimated at 1.9% per annum.

(3) Land Tenure Status: Land tenure status in the country is still unclear and quite complex even though Timor-Leste is a very tiny country. Although the Real Estate Law (Law No. 1/2003) defines three types of land ownership, the actual registration has yet to be implemented in most of the target watersheds. In general, rural communities believe that almost all the lands in villages must belong to them or their clan group. The way of land management varies with the locations. Villages in Laclubar Sub-district allow landless or poor communities to use unused private or communal lands for shifting cultivation without charge, while the irrigated rice fields in the Laclo River irrigation system are rented out to tenant-farmers.

In many cases, although there is no written document, village authorities and communities generally memorize the boundaries and ownership of lands that belong to the community (both communal and private lands). Even despite the massive resettlement programs experienced during the Indonesian period, the traditional customary land tenure still remains strong and lands are regarded as properties belonging to a community or a kinship group (clan) who traditionally manage them.

(4) Major Crops and Productivities: The predominant annual crops in the concerned districts in the target watersheds are maize, followed by paddy (lowland rice), cassava, other tubers, vegetables, and beans. The productivities of major staple crops in the districts, which are 0.5~1.5 ton/ha for maize and 3.0~4.1 ton/ha for cassava to name few, are still very low if compared with those in Indonesia. Although extensive farming with low input application is one of the farmers' risk aversion strategies under the vulnerable conditions, it has kept them remaining at the subsistence level in their livelihoods.

(5) Vegetables: Ermera, Aileu and Ainaro are the major vegetable production areas in the target watersheds. These districts have areas with high altitude where it is suitable to grow various kinds of vegetables. Major vegetables produced in the watersheds are mustard, cabbage, tomato, pumpkin, carrot, cucumber, snow pea, and spinach.

(6) Coffee: Coffee has been the sole export product of Timor-Leste since the mid-nineteenth century. Among others, Ermela District is the most productive area for coffee beans, accounting for around 60% (or about 5,000 tons) of the total production in the country, followed by Manufahi, Liquica and Ainaro. Although the total production in the country has been slightly decreasing since 2007, these four main districts still share 96% (or about 9,200 ton) of total production in the country in 2009. However, the yields of coffee in the country are very low due to excessive canopy cover of overgrown shade trees, overage and poor maintenance of existing coffee trees. At present, the average yield is estimated at 0.27 ton/ha, which is about two third of that in Indonesia (402 kg/ha) and only one-fifth of that in Vietnam (1,235 kg/ha).

(7) Fruits and Other Industrial Trees: Major fruits produced in the target watersheds are avocado, mango, banana, citrus, papaya, and jackfruit, but most of them seem to be produced on a small scale. Likewise, there are a few industrial/tree crops, such as palm tree, candlenut, and coconut, grown on a small scale in and around the watersheds.

(8) Farming Practices: Shifting cultivation is a common farming system found in the country as well as the watersheds. Maize, cassava, sweat potato, taro, pumpkins, and beans are main crops planted under shifting cultivation. The size of plot may vary from 0.5~1.0 ha depending on the availability of farm laborers. When a rural household operates shifting cultivation in his/her own area (privately-owned), they generally use the area for two years until the time when they cannot control weeds. Once he/she judges that it is hard for them to control weeds, a new area is opened and burned for farming. The rotation cycle varies with the number of fertile lands owned by a household.

(9) Major Issues on Agricultural Production: Major issues that rural communities in the watersheds face on agricultural production are drought/unstable rainfall, pests and diseases (including damages caused by rats and other animals), lack of seeds, and lack of other farm inputs.

(10) Livestock Management: In Timor-Leste, animals are generally possessed as assets for rural farmers (as literally "live-stock") for wedding, funeral, traditional ceremony, education, or any emergency events. A total of about 6,900 heads of cattle and buffalo and about 18,000 heads of the same are raised in the Comoro and Laclo watersheds, respectively. Although the number of livestock in Comoro is lower than that in Laclo, the animal population density in Comoro is slightly higher.

The method of rearing animals is rather extensive, especially in hilly/mountainous areas, because of a shortage of labor force for livestock management. One-day grazing in rangelands with native grasses is the major rearing practice in the watersheds. Feeding fodder trees to animals is not commonly observed, except in villages near coffee plantations.

(11) Major Issues on Animal Raising: Owing to the seasonal fluctuation of renerating productivity in natural grasslands that are generally used for herding, animal feed, especially the nutritious variety, are scarce during the dry season and most of animals face a shortage of feeds at the end of the dry season. Natural grassland could not maintain the present level of grass production since the grazing pressure is not under control. In fact, partially deteriorated pastures are often observed in steep and fragile slopes in the watersheds. On the other hand, an invasion of unusable and poisonous weed, namely, Chlomolaena has also caused the reduction of herding places for animals. The said weed has a vigorous reproductive ability in natural grassland and has gradually expanded its coverage in the watersheds.

(12) Food Security: Low crop production is underlying reason for the critical food shortage in the country. This is also true in the target watersheds. It is often reported that communities in the rural areas have faced a chronic food shortage between November and March in general[1]. The agricultural statistics data in 2008 also suggests that the districts, except Manatuto and Manufahi, were not able to produce sufficient cereals (rice and maize) to meet the demand of the population in the districts. Another survey conducted by the JICA Study Team in 2006 revealed that almost all the sucos in the watersheds faced a shortage of food from July to March, in which the peak months are two to three months from December to February.

(13) Forests and Non-Timber Forest Products: Forests and non-timber forest products (NTFPs) are important resources for people living in hilly and mountainous areas as either cash income or subsistence food during the food shortage periods. Ai ru (Eucalyptus deglupta) and Ai bubur (Eucalyptus alba) are common forest resources collected and sold as timber and firewood. Tua mutin (local wine), honey and bamboo are the major NTFPs commonly used for sale in the target watersheds.

(14) Marketing Conditions: The market survey conducted by the JICA Study Team in 2006/2007 revealed that marketing of many agricultural commodities in the watersheds was still at small-scale or individual level, and therefore, most of these were not much competitive as well as

[1] East Timor Human Development Report 2002

attractive to the buyers. Low production, lack of access to market and low market demand are considered as the major problems on marketing of agricultural products.

(15) Household Economy: The main sources of income for rural households in the watersheds are farming, livestock and firewood collection. At present, there is no statistical data showing the income level of households in the area. The village profile survey gives some indications about the levels of household economy in the watersheds. The average monthly income of households in the Comoro and Laclo watersheds are estimated at US$23.4/month (equivalent to US$0.8/day) and US$31.6/month (equivalent to US$ 1.1 /day), respectively.

(16) Village Society: A village in Timor-Leste is called "suco". Each suco has several sub-villages (*aldia*), which can be further divided into a couple of kinship groups (called *lisan*), organized by descendants from a single male ancestor (the "founder of the clan"). Each *aldia* has one chief (*chef de aldia*) and each *lisan* also has one elder leader (*lianain*) and other elders.

During the Portuguese regime, the traditional hierarchy headed by *liurai/datu* (small king in the area) had been placed and maintained as chef de suco by the colonial government. *Liurai* functioned as a village chief supported by hamlet chief (*chef de aldia*), *lianain* and other elders. An Indonesian village organization system was introduced in 1975 along with the Indonesian invasion. In many villages, *liural* lost power over the village, and instead, a new village structure replaced the traditional institution. After the independence in 2002, a new community organizational system was institutionalized by Decree-Law No. 5/2004 (Law on Community Authorities). At present, a village is led by chef de suco (Chief of village) with the council of village. Although the official structure of the village was already installed, the traditional decision-making/mediation process still strongly remains in the communities.

(17) Traditional Customs: Maintaining the connection with ancestors as well as spiritual substance is a critical aspect in the daily life of many Timorese, especially those living in rural areas. Many rural villages have sacred (*lulic*) sites, which are sacred clan houses (*uma lulic*), and other particular places, such as hilltops with ancestral birthplaces or graves, particular rocks (the symbol of mother earth), trees, springs, lakes, bogs and rivers. These places are considered connected with supernatural forces.

Tara Bandu means "to hang prohibition" in the literal sense of the words. It is one of ritual prohibitions, which usually applies to the harvest of agricultural products, cutting of trees, or collecting of forest products and hunting or fishing. Implementation of Tara Bandu requires a large public ceremony with animal sacrifice, following a public meeting that determines particular sanctions or fines for illegal activities (such as cutting trees, theft of products/livestock, or even sexual misconduct). In the ceremony, prohibitions and sanctions are announced to the villagers and a symbol (*horok*) is hanged in strategic locations to remind community members of the prohibitions.

3.3 Current Watershed Management Activities

(1) Government Initiatives: NDF has undertaken development of demonstration plots for reforestation and agroforestry/soil conservation techniques or distribution of seedlings to rural communities. In the target watersheds, about 30 ha of demonstration plots (for either reforestation or agroforestry techniques) were developed and about 95,000 seedlings of timber and agroforestry species were distributed to rural communities in 2006/2007. The government's activities relating to watershed management are still limited mainly due to shortage of budget and limited knowledge.

(2) Past and Ongoing Donors' and NGOs' Initiatives: The following organizations undertook or have undertaken watershed management-related activities in the target watersheds.

- UNOPS
- AusAID

- PADRTL
- World Vision
- Care International
- OISCA
- USC Canada Timor-Leste

3.4 Issues on Watershed Management

(1) History of Degradation: The JICA Study Team assumed that the deforestation and forest degradation started in the Portuguese colonial era, when major valuable forest resources (e.g., sandalwood) in the country were exploited and many natural forests were opened for coffee plantation. At the time, though, there seemed to be few illegal cutting or wildfires caused by rural communities due to the strong leadership of the village chiefs. During the Indonesian occupation, the deforestation had accelerated through the extensive forest fires mainly caused by the Indonesian army, large-scale commercial logging by the authorized companies, expansion of shifting cultivation, and illegal cutting by local communities. One of the reasons why illegal cutting expanded is the weakening of the customary rules in the village along with the waning of the leadership of village chiefs.

(2) Current Issues on Watershed Management: At present, there is no threat to convert the existing forests into open land or other types of land use on a large scale like before. Nevertheless, many parts of the watersheds are still in degraded condition or even getting worse than during the Indonesian time. Major issues currently affecting the watersheds are: i) intensive firewood collection, ii) frequent forest fires, iii) over-grazing, iv) slow natural recovery due to unfavorable climatic conditions, v) shifting cultivation, and vi) lack of land use plan/guidelines for proper watershed management. These issues might be caused directly or indirectly by the following factors.

a. Limited livelihood opportunities,
b. No alternative energy source,
c. Lack of law enforcement,
d. Lack of legislation,
e. Limited capacity of MAF,
f. Lack of guidelines, and
g. Disruption of customary rules.

3.5 Lessons Learned from the Past Natural Resource/Community-Based Projects:

An Oxfarm Study Report[2] reveals some lessons obtained from the following past natural resource management and/or community-based projects implemented in the country.

a. Involvement of community leaders
b. Share of project information and limitation with local people
c. Involvement of women
d. Enhancement of ownership of local people
e. Improvement of facilitator's skills
f. Setup of realistic targets and indicators
g. Start from small-scale project activities
h. Deployment of sufficient numbers of experienced male and female staff

[2] Study on Lessons Learned in Implementing Community Level Agriculture and Natural Resource Management Projects in Timor-Leste, 2004 (Oxfarm)

i. Maintenance of flexibility and responsibility
j. Enhancement of the capacities of project staff, local partners and communities
k. Enhancement of coordination and information-sharing among projects

4. Basic Concepts of Community-Based Integrated Watershed Management Plan

4.1 Definition of Watershed Management in the CBIWMP

Given the current capacity of the GoTL and the primary aim of the study, which is to propose a framework wherein the GoTL would work hand-in-hand with local communities for the protection and management of the target watersheds, the Study Team defined watershed management in this watershed management plan as "to promote measures and activities that local communities could participate in and undertake for the improvement of watershed functions." Consequently, this watershed management plan does not propose a large-scale infrastructure to reduce the sedimentation or any river control work in the mainstream of the rivers. Rather, the plan would propose small-scale or non-structural measures whose aim is to prevent further degradation of the watersheds.

4.2 Goal and Objective: The ultimate goal of the CBIWMP is "to protect and improve watershed environment of the target watersheds". The primary objective, meanwhile, is "to attain sustainable and integrated watershed management by balancing proper land and forest management with poverty alleviation in a watershed".

4.3 Basic Approaches: To achieve the goal and objective, the following four basic approaches are employed in the preparation and implementation of the watershed management plan in consideration of the existing related policies, the recent trend on watershed management, and various suggestions given by local stakeholders and international experts in the country.

(1) Maintaining the functions of the watersheds: Both target watersheds have the critical function of providing water to the downstream users, either people living in Dili or farmers relying on the Laclo River irrigation system in Manatuto. Thus, the maintenance of the inherent functions of the watersheds, especially the stable supply of quality water to the downstream reaches of the rivers, is set as one of the basic approaches to be emphasized in the watershed management plan.

(2) Improving livelihoods of local people: Living standards of rural households in the watersheds are generally poor. In particular, those living in mountainous/hilly areas in the Laclo watershed have suffered from chronic food shortage. The poor in mountainous/hilly areas heavily depend on shifting cultivation and firewood collection for their daily food as well as livelihoods. Thus, the watershed management plan has to address the needs of the poor who have limited opportunities, except firewood collection and shifting cultivation, to secure daily food and cash income. Unless the livelihood condition of the poor is improved, it would be difficult to ease human pressures to forest resources in the watersheds.

(3) Promoting community-based natural resource management suitable for Timor-Leste: Community-based natural resource management (CBNRM) is a bottom-up approach to integrate conservation of natural resources with rural development. The basic principle of CBNRM does not only allow local people to use natural resources in their locality but also encourages them to manage and protect those resources in a sustainable manner.

The forest policy of MAF also recommends community participation in forest management. However, its concept needs to be adjusted in the context of Timor-Leste, in consideration of the present government's capacity (weak capacity), legislative set-ups (limited legislative support and regulatory framework), socio-economic conditions in rural area (poor and limited food materials), and historical changes in resource management in the country. In other words, the concept of

CBNRM should be tailored to the country, especially the target watersheds, by taking the following aspects into account.

a. Establishment of local rules as basic principles of CBNRM
b. Utilization of traditional regulatory system
c. Security of sources of income/food for local people
d. Involvement of local communities as managers of their resources

(4) Establishing an institutional framework for implementation of CBNRM: In order to realize the concept of CBNRM in the country, an institutional model where the Government of Timor-Leste and local communities can work collaboratively for watershed management is to be established. The institutional arrangements, such as community organization, awareness-raising about CBNRM, capacity development of government staff and local communities at the village level and establishment of inter-divisional cooperation will be required.

4.4 Guiding Principles on Land Use and Management in the Watersheds: It is necessary to clarify the recommendable land use and management suitable for the respective geographical features in the target watersheds since there is no guideline or regulation for MAF/NDF to use for determining the proper land use in the target watersheds at present. Hence, a zoning method is employed in order to i) maintain the inherent functions of the target watersheds; ii) promote sustainable management of agricultural and forested lands; and iii) ensure livelihoods of local households living in the watersheds by allowing them to use existing and potential agricultural lands in a sustainable manner. As a result of zoning, the target watersheds are divided into four zones, namely Protection-Zone (P-Zone), Special Management Zone (SM-Zone), Sustainable Use Zone (SU-Zone) and Community/Production Zone (C-Zone). The areas for each zone are presented below.

Areas of Each Zone in the Watersheds

(Unit: ha or %)

Watershed	P-Zone		SM-Zone		SU-Zone		C-Zone		Total	
	ha	%	ha	%	ha	%	ha	%	ha	%
Comoro	4,769	24	6,226	31	7,426	37	1,790	9	20,212	100
Laclo	17,996	14	37,803	29	55,963	43	19,357	15	131,118	100
Total	22,765	15	44,029	29	63,389	42	21,147	14	151,330	100

Source: JICA Study Team

Each zone has the respective land management guides. Land users as well as planners should take into account the following guidelines in determining the land use of each zone in the target watersheds.

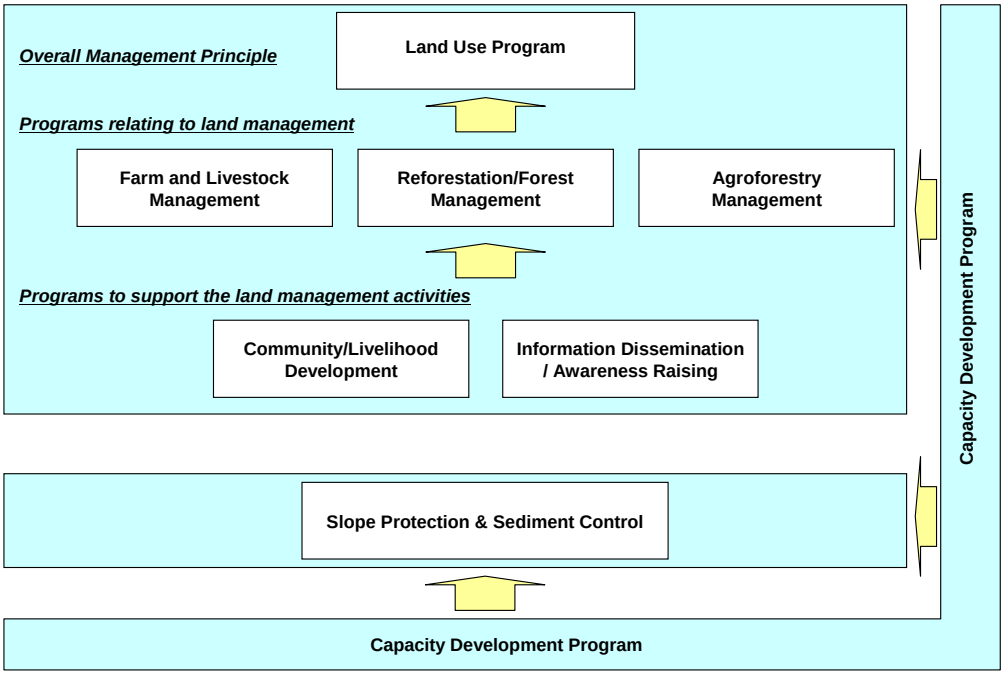
Land Use and Management Guidelines in Each Zone

Zone	Guiding Principles
Protection Zone (P-Zone)	Areas covered with dense forest or with more that 55% slopes are classified as protection zone. Those designated as protected area or judged critically important are also classified into the same zone. In the P-Zone, land uses and economic activities, except those allowed by UNTAET No. 19, are prohibited due to its critical functions and environmental value. Hence, areas under the P-Zone need to be managed as protected forests.
Special Management Zone (SM-Zone)	Medium closed forests and areas with slopes between 40% and 55% are classified as Special Management Zone. Coffee plantations with more than 55% slopes are also classified into the same zone. The areas under SM-Zone can be used for production purposes, but need to be used and managed as forest due to its vulnerability to soil erosion. Hence, tree crops-based farms and/or production forests, such as i) firewood forests, ii) coffee plantations with shade trees, iii) orchards of fruit trees, and iv) production forests of valuable trees, are the possible land uses in this zone.

Zone	Guiding Principles
Sustainable Use Zone (SU-Zone)	Areas within a range of 15% ~ 40% slope or those covered with sparse forests are classified as Sustainable Use Zone. The basic idea of this zone is to allow the rural community to use areas for production purposes while maintaining land productivity. Hence, the areas can be used for farming but should be managed in a proper manner by applying soil conservation measures, or introducing agroforestry as well as silvo-pastoral techniques.
Production / Community Zone (C-Zone)	Areas that do not belong to the above-mentioned zones are categorized into Production/Community Zone. In general, these are flat to gently sloping land and with less vegetation cover (bushes, grasslands, and bare lands). Because of their features, the areas can be used for socio-economic development by local communities with a few restrictions.

5. Overall Watershed Management Plan

5.1 Overall Structure of the CBIWMP: To achieve the goal and objective of the watershed management plan, a total of eight programs are proposed. These programs are broadly grouped into three components, namely, i) land management component, ii) river management component, and iii) overall supporting component, as shown below.



Overall Structure of the CBIWMP

5.2 Land Use Planning Program:

(1) Objectives: The main objective of the land use planning program is to enable MAF/NDF and local communities to manage and use forests and natural resources in the watersheds in line with the land use and management principles proposed in the preceding section.

(2) Strategies: Since local communities will have the main responsibility for management of forest and natural resources in the village, the land use and management principles need to be understood by local communities and translated into the future land use plan at the village level. Participatory land use planning (PLUP), which has been used in other Asian countries as a planning tool for community-based forest management, is proposed as the scheme to design the optimum land use on a micro or suco level.

(3) Proposed Sub-program: The Participatory Land Use Planning Sub-program is the sole sub-program under the Land Use Program. The outlines of the sub-program are as follows.

Outline of the Participatory Land Use Planning Sub-program (PLUP-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to assist local communities in developing a future land use plan with local rules on natural resource management considering the land use/management principles, current land use, traditional land ownership, and any issues that community members/villagers face in managing their lands.
Target Area	All the sucos in and around the watersheds need to prepare their future land use plan and local rules on natural resource management. However, priority should be given to: i) sucos. whose territories are located within the critical catchment in the Comoro watershed; and ii) sucos whose territories overlap with those in the Protection Zone.
Implementing Agencies	NDF and the MAF district offices are the main implementing organizations. Forest guards assigned to the respective villages should be involved in the implementation of the sub-program. Local NGOs/facilitators that have experience in participatory planning should be hired for implementation of the sub-program.
Major Activities	The following steps are to be taken. Step 1: Preparation for the sub-program Step 2: Participatory assessment of the target suco Step 3: Group formation and work planning Step 4: Assessment of the present land use Step 5: Discussion on future land use options and future land use mapping Step 6: Preparation of village regulations, including local rules on natural resource management Step 7: Consultation with community members in the suco Step 8: Agreement with MAF/NDF Step 9: Tara Bandu ceremony Step 10: Monthly monitoring of the implementation of the regulations

5.3 Reforestation/Forest Management Program

(1) Objectives: The aims of the Reforestation and Forest Management Program are to rehabilitate the degraded forests and increase the forest cover in the target watersheds by supporting rural communities in producing, planting and tending seedlings and protecting natural forests in their localities.

(2) Strategies: The following five strategies/approaches are taken into account in planning the sub-programs under the program.

a. Application of a community-based approach
b. Due consideration to the community needs
c. Strengthening of MAF/NDF's capacity to support the community
d. Development of capacities of rural communities
e. Use of local materials, knowledge and customary practices

(3) Proposed Sub-programs: The following three sub-programs are proposed under the program. The outlines of the sub-programs are summarized in the following tables.

a. Tree Planting Promotion Sub-program (TPP -SP)
b. Seedling Production Sub-program (SP-SP)
c. Forest Management Planning Sub-program (FMP-SP)

Outline of the Tree Planting Promotion Sub-program (TPP-SP)

Items	Descriptions
Objective	The ultimate goal of this sub-program is to directly contribute to the improvement of the watershed functions of the target watersheds. Hence, the sub-program aims to reforest bare lands and rehabilitate/improve degraded forests in the target watersheds, especially in the P-Zone and SM-Zone, by encouraging rural communities to plant seedlings in their localities in a strategic as well as proper manner.
Target Area	The lands with less vegetation covers, especially bare lands, shrubs and grasslands, and sparse forests in the watersheds are to be targeted by the sub-program. Particularly, sucos located in the P-Zone and SM-Zone, should be prioritized.
Implementing Agencies	NDF and the concerned MAF district offices are responsible to implement the sub-program. Local NGOs or facilitators should be hired for the field activities. The forest guards and extensionists should be involved in technical support to rural communities in the field.
Major Activities	The sub-program can be combined with the succeeding sub-program, Seedling Production Sub-program, if rural communities are willing to produce seedlings by themselves and the natural conditions in the suco allow them to establish community nurseries. The major activities to be carried out under the sub-program would be: i) guidance on selection of tree species and plantation sites, ii) a series of hands-on training courses on planting and tending seedlings along with the establishment of demonstration plots, iii) distribution of seedlings, iv) determination of planting plots, v) technical assistance in planting and tending seedlings in the individual plots, vi) development of village regulations and revival of Tara Bandu, and vii) monitoring and validation of plantations.

Outline of the Seedling Production Promotion Sub-program (SPP-SP)

Item	Descriptions
Objective	The sub-program aims to promote seedling production at the suco level as it is considered that producing seedlings at the community level would be more effective and efficient in the facilitation of reforestation in the target watersheds.
Target Area	In principle, this sub-program is to be combined with TPP-SP. Sucos located in the P-Zone and SM-Zone will be prioritized among sucos in the target watersheds. However, not all sucos where TPP-SP is introduced may be able to engage in seedling production, as the sub-program requires lands and sources of water for establishment of nurseries and a number of labors should be involved in nursery operations.
Implementing Agencies	NDF and the concerned MAF district offices are responsible for the sub-program. The forest guards and extensionists assigned for target sucos should be involved in field activities. Local NGOs and facilitators should be hired for implementation.
Major Activities	Like in the case of the TPP-SP, hands-on training and technical and material assistance to rural communities would be the major activities. All activities relating to nursery operations such as nursery establishment, seedling production and seedling distribution, will be undertaken by rural communities as part of the hands-on training courses. The following tree species will be produced. 1. Timber species: Mahogany, Teak, Grevillea, Casuarina, Sandal wood 2. Multipurpose species: Leucaena, Tephrosia, Calliandra, Petai, Mangium acacia 3. Fruits species: Rambutan, Mango, Orange, Longan, Avogado, Jack fruits, Bread fruit 4. NTFPs species: Cinnamon, Clove, Candle nuts

Outline of the Forest Management Planning Sub-program (FMP-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to assist rural communities in preparing the Draft Community Forest Management Agreement.
Target Area	All the sucos in the target watersheds should go through the process of this sub-program when the Forest Management Decree is effective. However, the priority should be given to sucos that have dense forests and/or are P-Zone in the territories.
Implementing Agencies	NDF and the concerned MAF district offices are responsible for the sub-program. Particularly, the district forest officers in the MAF offices are to be involved in the planning process. Local NGOs and facilitators should be hired for organization of the meetings and preparation of the documents.

Item	Descriptions
Major Activities	Local NGOs with the NDF and MAF district offices will organize discussions with local communities for the preparation of the following items. They will be used for acquisition of the Draft Forest Management Agreement with the results of PLUP-SP. a. Preparation of a list of families, groups and individuals who have access to the forests b. Determination of objectives of forest management based on the types and conditions of the forests c. Determination of sustainable harvesting arrangements d. Formulation of forest protection and conservation measures e. Determination of roles and functions of all relevant local authorities

(4) Implementation Procedures: The following steps will be commonly taken in the course of the sub-programs at the village level.

Step 1: Guidance to the target village
Step 2: Participatory assessment
Step 3: Group formation and planning
Step 4: Implementation, monitoring and evaluation

5.4 Farm and Livestock Management Program

(1) Objectives: The program aims to stabilize and increase agricultural production to ensure food security and secure livelihoods at the household level by improving present farm and livestock management.

(2) Strategies: The following five strategies/approaches are set to achieve its objectives.

a. Optimization of farm and livestock management considering agro-ecological features
b. Utilization of local resources and technologies
c. Introduction of Farmer Field Schools
d. Capacity development of MAF extension staff
e. Cooperation with existing development initiatives (on-going projects)

(3) Proposed Sub-programs: The following four sub-programs are proposed under the program. The outlines of the sub-programs are summarized in the following tables.

a. Community-Based Seed Extension Sub-program (CBSE-SP)
b. Home Garden Sub-program (HG-SP)
c. Grazing Control with Protein Bank Sub-program (GCPB-SP)
d. Animal Feed Preservation Sub-program (AFP-SP)

Outline of the Community-Based Seed Extension Sub-program (CBSE-SP)

Item	Descriptions
Objective	The principal objective of the sub-program is to ensure food security at the household level and eventually at the village level by increasing the production of staple food crops through i) the provision of quality seeds including improved varieties introduced by Seeds of Life (SoL) and ii) the provision of training on improved farming practices.
Target Area	Areas producing coffee and upland crops are mainly targeted. In particular, sucos that depend on shifting cultivation or upland farming are prioritized.
Implementing Agencies	NDAH is the main implementing agency. Local NGOs/facilitators should be hired for hands-on training on the proposed farming techniques especially in the initial years.
Major Activities	The sub-program will introduce quality seeds of improved and local varieties of staple food crops into communities with a series of hands-on training courses on improved farming

Item	Descriptions
	practices. The following activities will be undertaken in the course of the sub-program. a. Development of demonstration plots b. Hands-on Training / Farmer Field Schools c. Provision of quality seeds d. Sharing of quality seeds e. Combination with other sub-programs

Outline of the Home Garden Sub-program (HG-SP)

Item	Descriptions
Objective	The major objective of the sub-program is to improve nutrient conditions of rural households, especially those who mainly practice shifting cultivation and face chronic food shortage, through the introduction of vegetable production in backyards or any fallow lands. Diversification of crops produced by local communities is also another aim of the sub-program so that they could have additional source of income.
Target Area	This sub-program aims to support sucos which are significantly dependent on shifting cultivation with no/little options to gain income. Among others, those facing chronic food shortage should be prioritized.
Implementing Agencies	NDAH is the main implementing agency. Local NGOs/facilitators should be hired for implementation of the sub-program at the suco level in the initial several years. The MAF district officers and extensionists should be involved in the field extension activities.
Major Activities	Development of demonstration plots, training courses or FFSs on vegetable production and provision of farm materials are the major activities of the sub-program.

Outline of the Grazing Control with Protein Bank Sub-program (GCPB-SP)

Item	Descriptions
Objective	The major objective of the sub-program is to control the unregulated free grazing practice by introducing a strategic land use concept and encouraging local communities to change their animal rearing system from free-grazing to stall-feeding.
Target Area	Coffee producing and upland crop producing areas are generally targeted by the sub-program. In particular, sucos which are presently under high animal pressure should be prioritized.
Implementing Agencies	NDL is the main implementing agency. The National Directorate of Research & Specialist Services (NDRSS), NDF, and the MAF district offices should coordinate with NDL in the implementation of the sub-program. Local NGOs/facilitators should be hired for field operations of the sub-program, especially in the initial several years.
Major Activities	The following activities will be undertaken at the *aldeia* level in a participatory manner. - Determine how to graze animals in their territory by defining areas to be protected from animals, those to be used under controlled animal grazing, and areas to be used freely; - Determine how to keep livestock. e.g., making a fence around the protected areas or tie-keeping; and - Establish a demonstration plot for protein banks (which are areas planted with productive legume-based fodders for alternative as well as supplementary feeds during the dry season) Based on the experiences in the ongoing MAF's and NGOs' activities, the following species are recommended for protein banks. - Gamal (Glyrucudua maculate); - Lantoro (Leucaena leucocephala); - Calliandra calothyrsus; - Mucuna pruriens; and - Pennisetum purpureum. Introduction of the biological control measure against invading harmful weeds (*Chromolaena odorata)* should also be discussed with rural communities.

Outline of the Animal Feed Preservation Sub-program (AFP-SP)

Item	Descriptions
Objective	The sub-program aims to improve the nutrient conditions of animals, especially during the dry season, by introducing a feed preservation system to produce high quality feeds.
Target Area	The sub-program can be introduced in areas with sufficient animal feed materials in the target watersheds. Thus, paddy-producing areas that are abundant in paddy straw, are therefore considered as potential sites in terms of the availability of resources.
Implementing Agencies	NDL is the main implementing agency. Local NGOs/facilitators should be hired for the field demonstration at the suco level, especially in the initial several years.
Major Activities	The sub-program will introduce feed preservation systems, namely silage and hay. Hands-on training courses or FFSs at the demonstration plots are the major activities of the sub-program. The sub-program will establish two or three demonstration plots per *aldeia* and organize a series of hands-on training courses there. As in the case of the other sub-programs, the materials used in the training courses will be provided for local people who take part in the training.

(4) Implementation Procedures: The following are overall steps to be taken in the implementation of the proposed sub-programs.

Step 1: Employment of NGOs/facilitators to assist target sucos
Step 2: Consultation with the target sucos
Step 3: Organization of community members
Step 4: Preparation of detailed work plans by assisting agencies and working groups
Step 5: Exposure visits
Step 6: Implementation of the sub-program
Step 7: Hands-on training courses

5.5 Agroforestry Management Program

(1) Objectives: The main objective of the Agroforestry Management Program is to realize sustainable land management while also maintaining agricultural outcome and land productivity. The program recommends land management techniques especially for those classified as Special Management Zone (SM-Z) and Sustainable Use Zone (SU-Z).

(2) Strategies: The following five strategies are kept in mind in the planning and implementation of the program.

Along these lines, the strategies to be taken in this program are set as follows:

a. Dissemination of the techniques through demonstration of actual effects;
b. Utilization of experiences that other projects have gained;
c. Strengthening of MAF's capacity to continuously support communities;
d. Use of local materials and knowledge;
e. Introduction of acceptable techniques/options; which are
   - low inputs (cost/laborers/others),
   - effective in soil erosion or improvement of soil fertility,
   - site-specific,
   - productive, and
   - less maintenance.

(3) Proposed Sub-programs: The following two sub-programs are proposed under the program. The outlines of the sub-programs are summarized in the following tables.

a. Sustainable Upland Farming Promotion Sub-program (SUFP-SP)
b. Coffee Plantation Rehabilitation Sub-program (CPR-SP)

Outline of the Sustainable Upland Farming Promotion Sub-program (SUFP-SP)

Item	Descriptions
Objective	The main aim of this sub-program is to introduce/promote sustainable upland farming techniques suitable for sloping areas. The techniques handled by the sub-program are the soil conservation measures and agroforestry techniques that have been introduced in the country to a larger or lesser extent.
Target Area	The areas classified as SM- and SU-Zones should be the main target areas for the sub-program. Among other things, sucos that have limited livelihood options other than shifting cultivation or upland farming are prioritized.
Implementing Agencies	NDF and the concerned MAF district offices are the main implementing agencies. They should coordinate with the NDIPA (National Directorate of Industrial Plants and Agribusiness) of MAF in the implementation of the sub-program. Local NGOs or facilitators should be hired, especially for the initial several years, for implementation of the sub-program.
Major Activities	The establishment of the demonstration plots and conduct of the hands-on training courses are the major activities of the sub-program. In the demonstration plots, local NGOs/facilitators together with the MAF district office will organize a series of hands-on training courses or FFSs on the following techniques: - Compost making - A-frame making - Delineation of contour lines - Application of soil conservation measures - Land preparation including application of compost - Seed selection - Sowing and planting - Farm management - Harvesting ad post-harvesting

Outline of the Coffee Plantation Rehabilitation Sub-program (CPR-SP)

Item	Descriptions
Objective	This sub-program aims to rehabilitate and improve the existing old and unproductive coffee plantations in the watersheds to maintain the functions of the target watersheds.
Target Area	Communities that grow coffee in the watersheds are targeted by the sub-program.
Implementing Agencies	The MAF district offices and NDIPA, together with NDF, are the main implementing agencies. Local NGOs or facilitators will be hired for implementation, especially for the initial several years of the sub-program. The extensionists and the relevant district officers should be involved in the field activities.
Major Activities	Provision of a series of hands-on training courses or FFSs on the rehabilitation of the aged coffee plantations and the expansion of new coffee plantation are the major activities of the sub-program. The same process and approach that other agriculture-based sub-programs employ are also taken for the sub-program, which means that i) group organization at the *aldeia* level, ii) development of demonstration plots at the *aldeia* level, and iii) organization of the hands-on training courses or FFSs at the demonstration plots. The techniques to be introduced in the hands-on training courses are: i) rejuvenation of old coffee trees, ii) pruning of branches, iii) planting of seedlings of shade and coffee trees, iv) management of new plantation, and v) capping of coffee trees. In order to encourage coffee farmers to apply/replicate the rejuvenating techniques, a five-year rotation system should be introduced so that coffee farmers can secure their income from coffee plantation even after rejuvenation.

(4) Implementation Procedures: The sub-programs proposed in the program should be implemented in accordance with the following steps:

Step 1: Consultation with target sucos
Step 2: Organization of community members
Step 3: Participatory planning
Step 4: Exposure visit
Step 5: Development of demonstration plot
Step 6: Organization of hands-on training courses/Farmers Field Schools (FFSs)
Step 7: Expansion of activities

5.6 Slope Protection and Sediment Control Program

(1) Objectives: The main objective of the Slope Protection and Sediment Control Program is to minimize the inflow of sediment in the mainstreams of Laclo and Comoro Rivers. Specifically, the sub-program aims: i) to protect the slopes along roadside/hillsides from further landslides/failures, ii) to control the sediment flow in the tributaries, iii) to prevent river bank erosion, and iv) to prevent the progress/expansion of initial gullies in the upper part of the watersheds.

(2) Strategies: Provision of appropriate measures in accordance with the current situations of Timor-Leste and the target watersheds is the primary concept of the program. Specifically, considerations are given to the following:

a. Focus on sources of sediment
b. Introduction of acceptable/viable measures
c. Introduction of assessment studies to design optimum measures
d. Collaboration with the Directorate of Road, Bridge and Flood Control of the Ministry of infrastructure
e. Continuous monitoring and maintenance after construction

(3) Proposed Sub-programs: The following four sub-programs are proposed under the program. The outlines of the sub-programs are summarized in the following tables.

a. Slope Protection Sub-program (SP-SP)
b. Sediment Flow Control Sub-program (SFC-SP)
c. Riverbank Protection Sub-program (RP-SP)
d. Initial Gully Control Sub-program (IGC-SP)

Outline of the Slope Protection Sub-program (SP-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to protect slopes along roadsides and hillsides from further failures and soil erosion so as to reduce the sediment inflow in the mainstreams.
Target Area	The areas targeted by the sub-program are where soil erosion, slope failures and landslides take place along the principal roads and in hillsides.. The potential sites seem to be in the upper parts of the Ue Coi, Sumasse, Eraibanaubere, Malikan and Lohun Rivers in the Laclo watershed and along the Anggou River in the Comoro watershed.
Implementing Agencies	The main implementing agency is DRBFC, while NDF is responsible for vegetation works. The district offices concerned should coordinate with DRBFC and NDF in the implementation of the sub-program.
Major Activities	The following slope protective measures could be used alone and probably in combination with each other to generate a synergetic effect. Structural Measures - Gabion (wire retention works)

Item	Descriptions
	- Open water channel works - Wet/Dry masonry retention work Biological Measures - Tree branch wattling - Contour rock walls with tree/grass plantation - Contour tree/grass plantation

Outline of the Sediment Flow Control Sub-program (SFC-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to construct check dams on tributaries to reduce sediment flow and stabilize the sediment on the riverbed.
Target Area	This sub-program should target tributaries where sediment has been deposited by landslides/slope failures or those where riverbed erosion has taken place. In particular, the upper parts of the Ue Coi, Sumasse, Eraibanaubere, Malikan and Lohun Rivers in the Laclo watershed as well as the Anggou River in the Comoro watershed have high potentials.
Implementing Agencies	The sub-program is to be implemented by DRBFC in coordination with its concerned district offices.
Major Activities	The following control works could be used alone and probably in combination with each other to generate a synergetic effect. Structural Measures - Gabion check dam - Masonry check dam (mortar covered)

Outline of the Riverbank Protection Sub-program (RP-SP)

Item	Descriptions
Objective	The objective is to prevent the progress of riverbank erosion by the construction of physical facilities in combination with the vegetative works.
Target Area	Rivers where bank erosion has taken place and riverine facilities/infrastructure/local properties are threatened should be the subjects for the sub-program. The focus should be put on the downstream area of the Laclo River since the riverbank erosion is commonly observed and has been becoming a threat for the surrounding communities in the area.
Implementing Agencies	DRBFC is the main implementing agency, while NDF should be responsible for the vegetative works. The district offices should coordinate with these agencies in the implementation of the sub-program.
Major Activities	The following riverbank protective measures could be used alone and probably in combination with each other to generate a synergetic effect. Structural Measures - Gabion revetment - Wet/Dry masonry revetment Biological Measures - Wooden water flow control works - Tree branch wattling

Outline of the Initial Gully Control Sub-program (IGC-SP)

Item	Descriptions
Objective	The sub-program aims to prevent the progress or expansion of gullies at an initial stage in the upper parts of the watersheds, in collaboration with local communities residing in the area.
Target Area	This sub-program should target sucos located on the hilly/sloping area in the upper parts of the watersheds, where the initial gullies are commonly found. In general, the sub-program can be introduced to all sucos in the upper parts of the Laclo and Comoro watersheds, but those considered high potential for soil erosion.
Implementing Agencies	NDF should be the main responsible agency for implementation of the sub-program. The concerned MAF district offices and extensionists should coordinate with NDF in the field activities. However, local NGOs/experts will be required for the design and training on the application of the soil conservation measures.

Item	Descriptions
Major Activities	Capacity development of local communities is the requisite activity for implementation of the sub-program. Thus, the organization of hands-on training courses on tree branch wattling will be the major activity of the sub-program.

(4) Implementation Procedures: The sub-programs are classified into two types: public works-type sub-programs and community-based development-type sub-program. The former covering three sub-programs will be implemented through the government's initiative, while the latter will be implemented in coordination with local communities. The major works to be undertaken in the public works-type sub-programs are:

Step 1: Assessment of soil movements;
Step 2: Basic design of the facilities;
Step 3: Implementation, monitoring and evaluation; and
Step 4: Supervision and maintenance of the facilities.

On the other hand, the following are the major works to be undertaken for implementation of the IGC SP.

Step 1: Procurement of NGO/experts
Step 2: Consultation about the sub-program
Step 3: Identification of potential areas
Step 4: Organization of working groups
Step 5 Participatory planning
Step 6: Hands-on training
Step 7 Assistance in replication of the techniques on a voluntary basis

5.7 Community Development/Livelihood Development Program

(1) Objectives: This program aims to attain the improvement/development of livelihoods of communities in the watersheds, while giving due attention to maintaining natural environment/resources in the respective localities. The specific objectives of the program are to: i) improve quality of life and sustain benefits derived from natural resources through the promotion of rural energy development; and ii) diversify sources of income through the provision of income-generating opportunities.

(2) Strategies: Participatory or people-leading is the center approach for this program. Rural communities should be the ones who make decisions and formulate an action plan for their livelihood improvement activities. In order to make the program activities practical, coordination with the existing similar projects and activities should be facilitated. Lessons learned and best practices gained through the implementation of similar projects can be used for the sub-program. Finally, due consideration should be given to the "appropriateness" and "relevancy" of technologies in identifying livelihood options.

(3) Proposed Sub-programs: Two sub-programs, namely, Rural Energy Development Sub-program and Income-Generating/Cost-Saving Sub-program, are proposed as the sub-programs under the program.

Outline of the Rural Energy Development Sub-program (RED-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to reduce the volume of firewood exploitation in the target watersheds through the introduction of the improved cooking stoves.
Target Area	The sub-program can be implemented in all sucos in the target watersheds since they fully rely on firewood for cooking and lighting. However, those with high population density are prioritized.
Implementing Agencies	NDF in coordination with the State Secretariat for Energy Policy are responsible for the sub-program. Local NGOs/facilitators should be hired for actual implementation in the field. The concerned MAF district offices and forest guards should also be involved so that they would learn to implement the field works.
Major Activities	The major activities of the sub-program are to: i) organize local households into groups, ii) prepare work plans, iii) organize a series of hands-on training on techniques relating to improved cooking stoves, and iv) assist local households in the introduction of the techniques. The possible options that can be introduced in the target watershed are: firewood type, coffee skin/wood residue type, and solar cooker.

Outline of the Income-Generating/Cost Saving Sub-program (IG/CS-SP)

Item	Descriptions
Objective	This sub-program is aimed at the provision of opportunities for local communities to acquire technologies for development of alternative livelihood options to earn cash income or reduce living expenses.
Target Area	The sub-program will be implemented in all sucos in the target watersheds. The priority will be given to those that are highly dependent on forest resources for their livelihood.
Implementing Agencies	The sub-program will be implemented under the initiative of NDF in coordination with relevant directorates of MAF. The MAF district offices concerned, especially extensionists, should also be involved in the field activities since community support is one of their tasks. Local NGOs/groups and individuals should also be hired for implementation of the sub-program as facilitators and resource persons for training.
Major Activities	Livelihood options should stem from ideas from local communities; these will vary with the needs and willingness of communities. The participatory assessment of the potential livelihood options will be one of the steps taken by the sub-program in addition to the same activities as proposed for the RED SP. Hence, the major activities are: i) participatory assessment of potential livelihood options, ii) group organization, iii) work planning, iv) hands-on training, and v) assistance in management of the livelihood options. Possible income-generating/cost-saving livelihood options are i) farm resource-based, ii) livestock-based, iii) forest resource-based, iv) skills-based, and v) others,

(4) Implementation Procedures: The overall procedures for implementation of the sub-programs proposed under the program are:

a. Arrangement of facilitators
b. Consultation meetings
c. Group formation
c. Exposure visit
d. Implementation of major activities of the sub-program
e. Monitoring and evaluation

5.8 Information Dissemination and Awareness-Raising Program

(1) Objectives: The main objective of this program is to increase the level of awareness and understanding of all the stakeholders about i) the necessity of forest and watershed management and ii) basic concepts and major activities of the proposed programs/sub-programs proposed in the watershed management plan.

(2) Strategies: The program needs to target a wide range of stakeholders as possible. Since stakeholders may have different visions and different lifestyles, different approaches may be required. It is necessary to use the optimum means/media to increase opportunities to get necessary information across to all the stakeholders. The program should also aim at enhancing the capacities of key players in information dissemination and creating materials/resources used for raising public awareness.

There is a possibility that rural communities/households may misunderstand the implication of the concepts of the programs/sub-programs. Hence, the program should address the dissemination of information about the programs/sub-programs in addition to those related to watershed management.

(3) Proposed Sub-programs: The following two sub-programs are proposed under the program. The outlines of the sub-programs are summarized in the following tables.

a. Public Awareness Campaign Sub-program
b. Environmental Education Sub-program

Outline of the Public Awareness-Raising Sub-program (PAC-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to enhance the knowledge/understanding among local communities living in the target watersheds of the necessity for sustainable forest and watershed management through public awareness-raising activities/campaigns at the village level.
Target Area	All sucos in the watershed should be covered. Priority should be given to those where deforestation and forest degradation has progressed due to frequent forest fires, intensive firewood collection and unregulated shifting cultivation.
Implementing Agencies	NDF, together with the National Directorate for Research and Specialist Services (NDRSS), should be the main implementing agencies. The concerned MAF district offices and forest guards/extensionists should be involved in the campaign activities in the field. NDF should coordinate with other relevant directorates under the State Secretary for Environment and the State Secretary for Natural Resources, Mineral and Energy Policies in the preparation of materials for public raising campaigns.
Major Activities	The main activities of the sub-program are the: i) assessment of the current conditions of the villages; ii) development of awareness-raising campaign materials; iii) initial contact with the target villages; iv) organization of workshops with the target groups; and v) post-evaluation. For the materials preparation, the following topics/themes may be addressed. - Future scenarios with and without proper watershed management - Who is responsible for watershed management? - Effect of forest fire and firewood collection - Mechanism of watershed degradation - Necessary actions for improvement of watershed environment - Options to minimize use of firewood - Informative guides to soil conservation and agroforestry techniques - Informative guides to management of afforestation trees and agroforest trees/crops - Importance of the village regulation - Basic concepts of watershed management plan - Basic concepts of PLUP-SP - Guides to farm and livestock management techniques

Outline of the Environmental Education Sub-program (EE-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to raise the awareness of children about watershed and natural resource management by introducing an environmental education curriculum into the education programs in primary and secondary schools in the target watersheds.
Target Area	The education curriculum and teaching materials will be used in primary and secondary

Item	Descriptions
	schools in the watersheds.
Implementing Agencies	The Directorate of Education of the Ministry of Education, Culture, Youth, and Sports is responsible for the application of the curriculum. NDF together with NDRSS will coordinate with the Directorate of Education to produce educational materials (e.g., textbooks, other materials, etc.) about the Laclo and Comoro watersheds. Local NGOs/facilitators will be hired for the preparation of education materials as well as program/curriculum.
Major Activities	In order to develop the education curriculum on watershed management for primary and secondary school curricula, the following activities are to be undertaken. - Preparation of a teacher's handbook on environmental education. - Preparation of materials for education - Development of the curriculum for environmental education - Development of teacher training courses

(4) Implementation Procedures: The overall procedures for implementation of the sub-programs under this program include the following steps:

a. Assessment of needs for public awareness campaigns
b. Preparation of work plan
c. Coordination with other organizations
d. Implementation of the sub-programs

5.9 Capacity Development Program

(1) Objectives: The main objective of this program is to lay the foundation of the capabilities of stakeholders in the watershed-related sectors so that the sustainable and integrated watershed management envisioned in this plan could be achieved.

(2) Strategies:

There are numerous activities related to the capacity development of MAF/NDF as well as other relevant organizations. However, the program should focus on the following aspects:

a. Existing systems for watershed management;
b. Capacity of human resources; and
c. Equipment and materials.

(3) Proposed Sub-programs: The following three sub-programs are proposed under the program. The outlines of the sub-programs are summarized in the following tables.

a. Watershed Management-related Institutional Development Sub-program
b. Capacity Development Sub-program
c. Mobility Improvement Sub-program

Outline of the Watershed Management-related Institutional Development Sub-program (WMID-SP)

Item	Descriptions
Objective	The basic aim of this sub-program is to bridge the gap between the forthcoming Forest Management Decree and the implementation of the sub-programs proposed in the watershed management plan. The main objective of the sub-program is to prepare a set of guidelines for the implementation of the sub-programs under the Land Management Component in compliance with the Forest Management Decree.

Item	Descriptions
Target Area	The guidelines should exclusively aim at the implementation of the watershed management plan, although the basic concept of the procedures can be generalized for other districts in the country.
Implementing Agencies	NDF is responsible for the preparation of the guidelines. International expertise should be hired to draft and finalize the guidelines.
Major Activities	This sub-program can start as soon as the Forest Management Decree is drafted in its final version. In order to come up with the guidelines, the following activities are to be carried out. - Situation analysis - Preparation of draft guidelines - Monitoring and revision

Outline of the Capacity Development Sub-program (CD-SP)

Item	Descriptions
Objective	The main objective of the sub-program is to enable the staff of the MAF and relevant directorates to fulfill their tasks and responsibilities for the implementation of the sub-programs in the watershed management plan.
Target Groups	Target groups of this sub-program are staff of the relevant government offices, especially those who are directly involved in the implementation of the programs.
Implementing Agencies	MAF will have the overall responsibility for development of the training curriculum, in coordination with the relevant ministries and directorates. However, the support from donors and international organizations is likely a must for the implementation of the sub-program in the current circumstances of the country.
Major Activities	A working team composed of the staff from the relevant directorates and ministries will be organized in the beginning. The team, including a capacity development specialist, will conduct the following activities: - Training needs assessment of the staff - Development of training programs - Preparation for training courses - Organization of training - Evaluation The topics addressed in the training courses are enumerated in Chapter 5 in the main report.

Outline of the Mobility Improvement Sub-program (MI-SP)

Item	Description
Objective	The objective of this sub-program is to enhance the mobility of the concerned district MAF offices so as to enable them to visit sucos more often and easily implement the sub-programs of the watershed management plan.
Target Groups	This sub-program targets NDF and the MAF district offices of four districts, namely, Aileu, Liquica, Ermera, and Manatuto.
Implementing Agencies	MAF is responsible for the procurement of the transportation facilities.
Major Activities	An inventory of transportation equipment is to be undertaken at the relevant MAF district offices and NDF. Simultaneously, the current status of the equipment is to be reviewed. Based on the inventory of transportation equipment and the planned sub-programs, MAF should identify the requirements of each office.

(4) Implementation Procedures: Each sub-program will follow different procedures. The steps to be taken for the respective sub-programs are outlined below.

WID-SP is to be implemented in accordance with the following steps:

a. Hire an international NGO/consultant to help MAF/NDF;
b. Review the Forest Management Decree and watershed management plan;
c. Prepare a set of guidelines for implementation of the sub-programs under the Land Management Component;

d. Consult with other stakeholders about the guidelines;
e. Finalize the procedures; and
f. Undertake the necessary process to issue the guidelines as a ministerial order/ordinance.

Meanwhile, the implementation procedures relating to CD-SP are outlined below:

a. Hire a competent NGO/consultant to help MAF;
b. Assess training needs of the governmental staff involved;
c. Prepare training courses for the respective sub-programs;
d. Identify optimum resource persons and training modules for each course;
e. Arrange and prepare training sessions (materials, tools, venues, food and snacks);
f. Conduct training courses; and
g. Get feedback from participants.

Lastly, the steps for MI-SP are as follows:

a. Make an inventory of the transportation facilities for the four MAF district offices;
b. Review the planned sub-programs;
c. Assess and identify additional transportation facilities (4WD and motorbike) necessary for implementation of the sub-programs;
d. Procure the facilities in accordance with government regulations; and
e. Manage and maintain the facilities properly.

6. Implementation Mechanism

6.1 Overall Outlook for the Implementation Methods

(1) Basic Concepts in Implementation: In principle, it is proposed that the watershed management plan be implemented by using the following approaches so that MAF/NDF can maximize the available opportunities and resources in the country.

i) Participatory: to encourage potential funding organizations in the country to participate in the implementation of the watershed management plan;
ii) Flexible: to allow external funding organizations to implement any part of the programs, as long as the selected sub-programs are suitable to the selected areas and implemented in an appropriate manner; and
iii) Phased: to implement the watershed management plan in several phases in accordance with the capacity level of the GoTL.

(2) Implementation by MAF/NDF: MAF/NDF will be the executive body for the watershed management plan, although the proposed watershed management plan is too large and integrated for MAF to handle thoroughly as compared to the current capacity level of the ministry. In order for MAF to use its budget effectively and wisely, the priority areas and sub-programs need to be identified to come up with a phased development/management plan which would help MAF/NDF secure the necessary budget and work for watershed management in a strategic manner.

(3) Implementation by External Financial Organizations: One of the potential uses of the watershed management plan is as a guidebook on community development or forest protection for the organizations that are currently working or will work in the target watersheds., The plan can be used to find out the development needs or interventions required in the watersheds. Thus, the succeeding section indicates the suitable areas for all the 21 sub-programs and some recommended combinations of the sub-programs, so that potential users can have some ideas on what can be done in the respective sucos in the target watersheds.

6.2 Implementation Methods on the Government's Initiatives

(1) Priority Area: The target watersheds are divided into 14 sub-watersheds and the river mouths of the Comoro and Laclo Rivers. After the evaluation of the 14 sub-watersheds in terms of i) soil erosion potential, ii) necessity of watershed protection, iii) poverty level, and iv) accessibility to the district capital, two sub-watersheds, Bemos sub-watershed and Noru sub-watershed, are selected as the most priority areas in the Comoro and Lacclo watersheds, respectively.

(2) Priority Sub-programs: The 21 sub-programs proposed in the watershed management plans are evaluated in terms of i) urgency, ii) effectiveness, iii) relevance, iv) cost, v) sustainability, and vi) benefit to households. In addition, the "implementability" of all the sub-programs (ease of implementing the sub-program) under the current conditions in Timor-Leste is evaluated for all the sub-programs. A total of 12 sub-programs are classified as high or medium priority and implementable with/without the assistance from local NGOs/experts.

Evaluation of the Sub-program in Terms of "Priority" and "Implementability"

Implementa-Bility <1	Priority of Sub-program		
	High priority	Medium priority	Low priority
Class 1	TPP-SP, CRP-SP		
Class 2	SPP-SP, PLUP-SP, CBSE-SP, HG-SP, SUFP-SP, GCPB-SP, IG/CS-SP, CD-SP	IGC, PAC-SP	AFP-SP
Class 3		RED-SP, EE-SP, SP-SP, SFC, RBP-SP,	WMID-SP, FM-SP, MI-SP

Note: <1 Class 1: Sub-programs that can be implemented by MAF without any external support, Class 2: Sub-programs that can be implemented by MAF with support from local NGOs, and Class 3: Sub-programs that can be implemented only with support from international organizations.
Source: JICA Study Team (2009)

(3) Order of Implementation of Sub-watersheds and Sub-programs: Given the current capacity of MAF/NDF, the JICA Study Team suggests that MAF/NDF should focus on two sub-watersheds for the next five years. Although it should be reviewed as the GoTL gains its capacity and experience over the course of time, the order of the sub-watersheds for implementation of priority sub-programs is determined as follows:

Order of Implementation of the Sub-watersheds

Priority	Comoro watershed	Laclo watershed
1st Priority	Bemos SW	Noru SW
2nd Priority	Buamara SW	Lohun SW
3rd Priority	Balele SW	Monofunihun SW
4th Priority	Anggou SW	Eraibanaubere SW
5^{5h} Priority	-	Liubani SW, Ue Coi SW
6^{6h} Priority	-	Sumasse SW, Malikan SW
7th Priority	-	Daioli SW, Manotahe SW

Source: JICA Study Team (2009)

On the other hand, the priority sub-programs should be implemented in accordance with the following rules.

i) Participatory Land Use Planning Sub-program (PLUP-SP) should be implemented ahead of the other land management-related sub-programs.

ii) Capacity Development Sub-program and Public Awareness Campaign Sub-program can be implemented simultaneously with PLUP-SP.

iii) More than three sub-programs should not be implemented in the same suco at the same time.

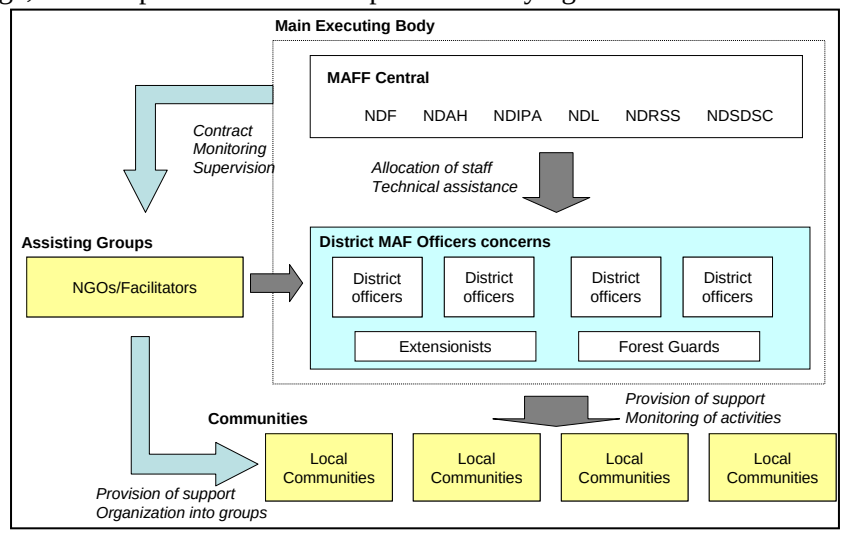
6.3 Implementation Methods for Other External Organizations: For the organizations that intend to implement similar activities in the target watersheds, the suitability of the sub-programs to the respective sucos in the target watersheds and the compatibility of the sub-programs are evaluated as given in Tables 6.2 and 6.3, respectively, in the main report. These evaluations will help implementers to identify the optimum options in any part of the target watersheds.

6.4 Institutional Framework for Implementation

(1) Initial Organizational Set-ups for Implementation: In consideration of the capacity of MAF/NDF as well as other directorates, it is recommended that an organizational set-up for implementation should be developed in a phased manner as MAF enhances its capacities. At the initial stage, MAF is the sole government organization to be involved in the framework for project implementation. At this stage, the emphasis should be placed in laying the foundation for community-based natural resource management in the target watersheds.

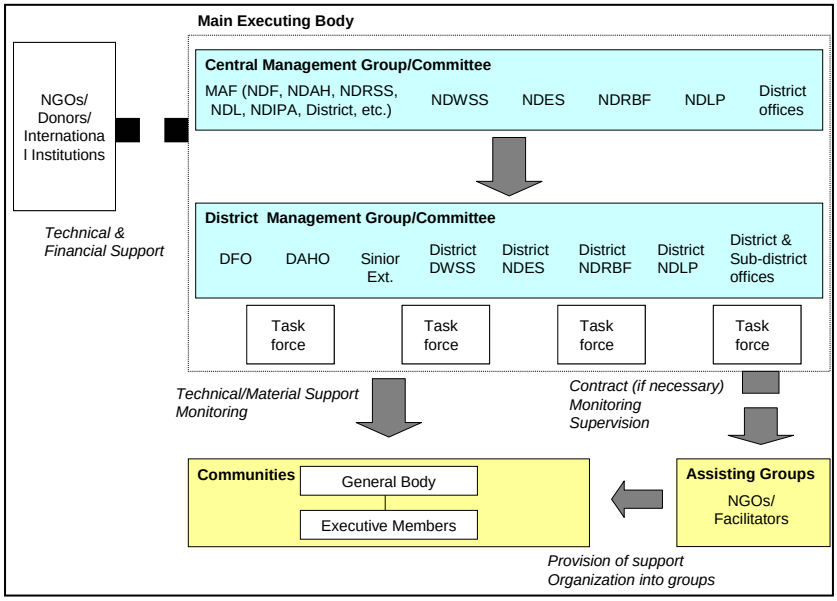
The establishment of two management groups in the ministry is proposed. An overall management group at the central level and field working teams at the field level are to be established in MAF.

In addition to government organizations, NGOs or facilitators should be hired for the implementation.



Proposed Institutional Framework at the Initial Stage

(2) Organizational Set-Ups for Implementation at the Mature Stage: After having extensive experience in community-based watershed management, the main executing body can expand/evolve its framework to include other ministries and directorates related to watershed management, such that the same body can literally manage the watersheds in an integrated manner. It is proposed that a multi-disciplinary organization be established at both central and district levels at the mature stage, where all the stakeholders related to the water sector can coordinate to achieve the goal of the watershed management plan.



Proposed Institutional Framework at the Mature Stage

(3) Relevant Legislative and Policy Framework: The following legislative documents and policies need to be referred to in the implementation of the watershed management plan, in order that the management plan can be in line with the direction of the government.

- UNTAET Regulation No. 17
- UNTAET Regulation No. 19
- Forestry Policy
- Forest Management Decree (when it is enacted)
- Land Law (when it is enacted)
- Land Use Policy (when it is enacted)

(4) Necessary Arrangements and Coordination: MAF/NDF should coordinate and link with any useful sources and organizations to tap all available resources and expertise for smooth and effective implementation of the watershed management plan. PARDTL and USAID projects, and other NGOs' activities are the possible sources to make linkages with. In addition, there may be a need to develop/prepare government documents to bind and orient relevant government directorates and offices toward the same direction at the beginning of the implementation of the plan.

6.5 Implementation Schedules of the Sub-programs: An implementation schedule for the overall watershed management plan has not been prepared since it is unrealistic to set a timeframe and assume that MAF/NDF could implement the entire management plan in a given period of time. Instead, the implementation schedule of each sub-program is prepared as presented in Annex E in Annexes.

6.6 Indicative Cost Estimates: Likewise, the total cost required for the overall watershed management plan was not estimated, but the costs for the respective sub-programs at the recommended scale are estimated as compiled in Annex F.

7. Five-Year Management Plan for the Priority Sub-watersheds

7.1 Target Sub-watersheds: Two sub-watersheds, Bemos sub-watershed in the Comoro watershed and Noru sub-watershed in the Laclo watershed, are selected as the target sub-watersheds for the five-year management plan. The total area of Bemos sub-watershed is about 4,400 ha covering five sucos, while Noru sub-watershed has six sucos in its territory of about 12,900-ha.

7.2 Work Plan of Major Activities

(1) Identification of Potential Sub-programs: Based on the lessons learned from the pilot projects implemented by the JICA Study Team between 2008 and 2009, three priority sub-programs are identified for each suco in the priority sub-watersheds. The prioritization was undertaken by examining the suitability of the sub-programs as well as the natural and social conditions of the priority sub-watersheds.

Tentatively Selected Sub-programs

Sub-watersheds	Sub-programs	No. of sucos
Bemos	TPP-SP & SPP-SP	1
	CBSE-SP	3
	HG-SP	2
	SUFP-SP	4
	GCPB-SP	1
	IG/CS-SP	1
	CDC-IGC	1
Noru	TPP-SP & SPP-SP	1

Sub-watersheds	Sub-programs	No. of sucos
	CBSE-SP	6
	SUFP-SP	6
	IG/CS-SP	5

Source: JICA Study Team (2010)

It is noted that the sub-programs for the target sucos should be selected by the local communities themselves at the beginning of the five-year plan. Therefore, the identification of the potential sub-programs at this moment should be deemed as tentative selection for planning.

(2) Detailed Scope of Works: The five-year management plan is broadly composed of three parts: i) preparatory work, ii) implementation of the identified sub-programs, and iii) evaluation of the sub-programs. The outlines of the scopes of works for the five-year management plan is presented in Table 7.1 in the main report, while the detailed work plans of the 12 sub-programs are presented in Annex D in Annexes.

7.3 Implementation Schedule: The implementation schedules for the priority sub-watersheds are shown in Figures 7.1 and 7.2 in the main report.

7.4 Estimated Indicative Cost: The indicative cost for the entire five-year management plan is estimated at about US$1.49 million, while those for the sub-programs related to Bemos and Noru sub-watersheds are estimated at US$0.66 million and US$0.74 million, respectively. Tables 7.2 in the main report show the indicative estimated costs for the entire five-year management plan and those related to the respective sub-watersheds.

7.5 Organizational Structure for Implementation: The same organization set-up as proposed in the initial stage is proposed for implementation of the five-year management plan.

8. Conclusions and Recommendations

8.1 Conclusions: The implementation of the following activities is crucially important to promote proper and sustainable forest and watershed management:

a. Implementation of the five-year management plan in the priority sub-watersheds,
b. In particular, implementation of PLUP-SP in the priority sub-watersheds, and
c. Development of the capacity of the district forest officers and forest guards in the concerned MAF district offices to implement the priority sub-programs, especially PLUP-SP.

It is also important to establish a platform where the relevant stakeholders could discuss the major issues on watershed management as well as necessary actions to be taken for its achievement and sustainability. Such institutional arrangement could encourage the stakeholders to take a multi-disciplinary approach and lead to the formulation of the relevant policies, such as the Watershed Management Policy, Integrated Water Resource Management Policy, and Land Use Management Policy.

8.2 Recommendations: In order to enhance the capacities of MAF/NDF to prepare and implement a community-based integrated watershed management plan, the five-year management plan should be executed as soon as possible. Towards this end, MAF/NDF should:

a. Arrange the necessary budget for implementation of the five-year management plan;
b. Coordinate with international organizations to tap their resources as well as expertise for implementation of the five-year management plan and any part of the watershed management plan;

c. Share the ideas and contents of the watershed management plan as well as the five-year management plan with the national directorates in MAF;

d. Assist rural communities in the sucos where the pilot projects were implemented in continuing the sub-program activities to enhance their capacity for implementation and create the role models for the priority sub-programs; and

e. List competent NGOs that can take on the tasks of implementing the sub-programs.

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Abbreviation

Abbreviation	Formal term
ADB	Asian Development Bank
AFMET	Alliance of Friends for Medical-care in East-Timor
AFP-SP	Animal Feed Preservation Sub-program
ALGIS	Agricultural Land Use GIS
ARP	Agricultural Rehabilitation Project
A.U.	Animal Unit
CBIWMP	Community-Based Integrated Watershed Management Plan
CBNRM	Community-Based Natural Resource Management
CBSE-SP	Community-Based Seed Extension Sub-program
CCF	Christian Children's Fund
CCT	Coperative Café Timor
CD-SP	Capacity Development Sub-program
CPR-SP	Coffee Plantation Rehabilitation Sub-program
C-zone	Production/Community zone
DRBFC	Direction of Road, Bridge and Flood Control
EE-SP	Environmental Education Sub-program
ETLLP	East Timor Land Law Program
ETTA	East Timor Transitional Administration
FALINTIL	Armed Forces of National Liberation of East Timor
FAO	Food and Agriculture Organization
FMD	Forest Management Decree
FMP-SP	Forest Management Planning Sub-program
FFS	Farmers' Field School
GCPB-SP	Grazing Control with Protein Bank Sub-program
GIS	Geographic Information System
GoTL	Government of Timor-Leste
GTZ	German Agency for Technical Cooperation
HG-SP	Home Garden Sub-program
ICS	Improved Cooking Stove
IGC-SP	Initial Gully Control Sub-program
IG/CS-SP	Income Generating / Cost Saving Sub-program
IPM	Integrated Pest Management
JICA	Japan International Cooperation Agency
MAF	Ministry of Agriculture and Fisheries
MDG	Millemium Development Goal
MI-SP	Mobility Improvement Sub-program
MOE	Ministry of Education
MOI	Ministry of Infrastructure
NDAH	National Directorate of Agriculture and Horticulture
NDES	National Directorate of Environmental Services
NDF	National Directorate of Forestry

Abbreviation	Formal term
NDIPA	National Directorate for Industrial Plants and Agribusiness
NDLBVM	National Directorate of Livestock Breeding and Veterinary Medicine
NDLP	National Directorate of Land and Property
NDP	National Development Plan
NDRSS	National Directorate of Research and Special Services
NDSDAC	National Directorate for Support to the Development of Agricultural Communities
NDWSS	National Directorate of Water Supply and Sanitation
NFSP	National Food Security Policy
NGO	Non Governmental Organization
NSD	National Statistics Directorate
NTFP	Non-Timber Forest Product
NVS	Natural Vegetative Strips
O&M	Operations and Maintenance
OISCA	Organization for Industrial, Spiritual and Cultural Advancement
PAC-SP	Public Awareness Campaign Sub-program
PADRTL	Programa de Apoio ao Desenvolvimento Rural em Timor Leste / Portugal Agriculture Cooperation
PLUP-SP	Participatory Land Use Planning Sub-program
PPMT	Pilot Project Monitoring Team
PRA	Participatory Rural Appraisal
PREDP	Participatory Rural Energy Development Programme
P-zone	Protection Zone
RBP-SP	River Bank Protection Sub-program
RDP	Rural Development Programme
RED-SP	Rural Energy Development Sub-program
RRA	Rapid Rural Appraisal
SIP	Sector Investment Plan
SFC-SP	Sediment Flow Control Sub-program
SLM	Sustainable Land Management
SM-zone	Special Management zone
SoL	Seeds of Life
SP-SP	Slope Protection Sub-program
SPP-SP	Seedling Production Promotion Sub-program
SUFP-SP	Sustainable Upland Farming Promotion Sub-program
SU-zone	Sustainable Use zone
S/W	Scope of Work
SW	Sub-watershed
SWOT	Strength, weakness, opportunities, optiones and threats
TL	Timor-Leste
TPP-SP	Tree Plantation Promotion Sub-program
UNTAET	United Nations Transitional Administration in East Timor
UNDP	United Nations Development Programme

Abbreviation	Formal term
USAID	United Stated Agency for International Development
USLE	Universal Soil Loss Equation
WB	World Bank
WFP	World Food Programme
WMID-SP	Watershed Management Institutional Development Sub-program

Exchange rate

1 US dollar = 91.79 yen (as of December 2009)

Unit

km^2	Square kilometer
Ha	Hectare
m^2	Square meter
m^3	Cubic meter

Terminology

Term	Definition
Aldeia	Sub-village
Chefe de Aldeia	Chief of sub-village
Chefe de Suco	Chief of village
Datu	Chief of village during the Portuguese colonial era
Extensionist	Extension worker
FFS（Farmers' Field School）	Farmers' field school
Lia nain	Traditional leader
Lisan	Kinship group
Liurai	Small king
Lulic	Spirit
Suco	Village
Suco Council	Village council
Tara Bandu	Customary village regulations
Uma lulic	Sacred house

Main Text

Chapter 1 Introduction

1.1 Background

Between 1972 and 1999, the Democratic Republic of Timor-Leste (Timor-Leste) had reduced its forest cover at a rate of 1.1 % per annum or by 24 % in total. At present, forests in the country cover only about 35 % (or 0.5 million ha) of the total land area (1.5 million ha). Deforestation has further caused soil erosion, land slides and flash floods, which eventually affected the lives of people residing within river basins. But ironically, it is reported that deforestation/watershed degradation has been mainly caused by human activities, such as i) forest fires, ii) tree cutting for firewood collection, iii) shifting cultivation, and iv) uncontrolled illegal logging. Furthermore, what made this problem difficult to solve was that the said activities were mainly undertaken by poor upland farmers who subsist on forest and farm products generated by such activities. Due to the insufficient institutional set-ups and weak capabilities of the government organizations, it was difficult for Timor-Leste to take up necessary actions for proper watershed/forest management in the country. Among others, lack of legislative set-ups, lack of staff in the government i.e., the Ministry of Agriculture and Fisheries (MAF) and the National Directorate of Forestry (NDF), and lack of staff's capabilities were quite critical.

The Laclo River basin, which is a target watershed of the Study, is one of the most deteriorated watersheds in the country due to the prevalence of wildfire, illegal cutting, fuel wood collection, and cattle grazing in the upper part of the watershed. The lower part of the basin is also known as the major rice production area in the country. Therefore, the restoration of watershed's functions, namely, reduction of sedimentation, stabilization of river flow, etc., is urgently required for maintaining rice production in the country. On the other hand, the Comoro River basin has another important value. One of the main sources of domestic/urban water supply for Dili City is located in it. Nevertheless, the watershed of Comoro River has been gradually deteriorating due to shifting cultivation and illegal cutting. There is also an urgent need to prevent the Comoro watershed from further degradation for the sake of people living in Dili. Although both of them are looked upon as critical watersheds, there is no management plan prepared at present.

Under such circumstances, the Government of Timor-Leste (GoTL) officially requested the Government of Japan in July 2004 to conduct a development study on community-based integrated watershed management of the Laclo and Comoro River basins (the Study). In response to the official request, the Japan International Cooperation Agency (JICA) dispatched a preparatory study team for the requested development study in April 2005. Through a series of discussions between the preparatory study team and MAF, both bodies agreed on the implementation of the said study and signed its Scope of Work (S/W) on April 28, 2005.

A study team (the JICA Study Team) was consequently formed based on the S/W and dispatched in November 2005 to execute the 1st field work. Although there was one year break in 2006 due to the internal disturbance taking place in Dili, the Study Team drafted and submitted a watershed management plan to MAF/NDF in January 2008. In order to verify the effectiveness and viability of the draft watershed management plan, the Study Team had implemented part of the draft watershed management plan in partnership with the NGOs, in both river basins from January 2008 to September 2009. Based on the results of the pilot projects, the Study Team prepared the final report in March 2010.

1.2 Objectives

The main objectives of the Study are to:

i) develop a community-based integrated watershed management plan (CBIWMP) for Laclo and Comoro River basins;

ii) prepare watershed management guidelines for the MAF and NDF to plan and implement a watershed management plan in other basins; and
iii) develop the capacities of the counterpart personnel for watershed management through on-the-job training in the course of the Study.

1.3 Scope of the Study

1.3.1 Expected Outputs

The following outputs are expected to be produced in the course of the Study.

i) CBIWMP for the Laclo and Comoro River basins
ii) Watershed management planning guidelines, which will be used by MAF/NDF for planning purposes

1.3.2 Target Areas for Each Output

The Study for community-based integrated watershed management plan targets the Laclo River basin (approximately 130,000 ha) and Comoro River basin (approximately 30,000 ha), which extends over five districts, namely, Dili, Aileu, Manatuto, Ermera, and Liquica. Meanwhile, the watershed management guidelines can be used for formulating a watershed management plan in other watersheds in the country.

1.4 Work Schedule

The Study has been implemented for over 53 months from November 2005 to March 2010, in spite of about eight months break in 2006 due to the internal turmoil. The Study is composed of the following two phases

Phase 1: Preparation of Draft Watershed Management Plan

- 1st Field Work (Nov 2005 & Feb 2006):	Collection of existing data and information
- 1st Home Work (May 2006):	Compilation of the results of village profile survey
- 2nd Field Work (Jan – Mar 2007):	Preparation of watershed management plans
- 3rd Field Work (Aug – Nov 2007):	Preparation of draft I/Ps for pilot projects
- 2nd Home Work (Dec 2007):	Preparation of Interim Report

Phase 2: Implementation of Pilot Projects and Preparation of Watershed Management Planning Guidelines

- 4th & 5th Field Works (Jan 2008 – Mar 2009):	Implementation of pilot projects
- 6th Field Work (May 2009 – Dec 2009):	Implementation and evaluation of pilot projects and preparation of draft watershed management planning guidelines
- 3rd Home Work (Jan 2010):	Preparation of Draft Final Report
- 7th Field Work (Feb 2010):	Presentation of Draft Final Report
- 4th Home Work (Mar 2010):	Preparation and submission of Final Report

1.5 Counterpart Agency

The main counterpart agency for the Study is the NDF, which used to be called the National Directorate of Coffee and Forestry (NDCF). The MAF, which is also formally called the Ministry of Agriculture, Forestry and Fisheries (MAFF), has the overall responsibility for the implementation of the Study.

(1) Planning Stage

At the beginning of the Study, MAF designated more than ten counterparts and organized a working team to co-work with the JICA Study Team for the preparation of the draft watershed management plan. Although all the counterparts were not assigned to work for the study on a full-time basis, a total of 15 counterparts were involved in the field survey, meetings, and presentation of the draft watershed management plan.

Counterparts Assigned for the Study from November 2005 to December 2009

Counterparts	Responsibility/Position [<1]
Francisco Inacio Castro Araujo	Chief of Department of Production and Forest Product Utilization, NDF
Vicente S. Soares	Chief of Watershed Management Section , NDF
Fernando C. Araujo	Responsible of Forestry Statistic Data, Monitoring and Evaluation, NDF
Joao D.M. Dos Reis	Responsible of Protection and Forest Guard, NDF
Marcelino Pereira	Forestry Staff, Aileu MAF
Mario Alves	Forestry Staff, Manatuto MAF
Vildito J. X. Maia	Forestry Staff, Manatuto MAF
Fernando Barros	Forestry Staff, Manatuto MAF
Eduardo F. Martins	Forestry Staff, Ermera MAF
Jose Americo	Coffee and Plant Staff, Ermera MAF
Joao Rodrigues	Staff, NDAH, Aileu
Boaventura Fatima Soares	Staff, NDAH, MAF
Fernando Salsinha	Staff, NDAH, MAF
Mario Lemos	Staff, NDF(Coffee), MAF
Domingos Mook	Staff, ALGIS, MAF

Note: NDCF was renamed NDF in 2008 when the organization of MAF was changed.

(2) Pilot Project Implementing Stage

MAF re-organized the counterparts into a monitoring team specifically for monitoring the pilot projects in October 2007, so that they could take part in the implementation of the pilot projects as one of their tasks. The counterparts, except Mr. Joao Rodrigues and Domingos Mook, were officially assigned to a monitoring team named the Pilot Project Monitoring Team (PPMT). There have been some replacements/changes in the members of the PPMT. As of December 2009, a total of ten counterparts worked for the PPMT as shown below.

<u>PPMT for Comoro Watershed</u>	
PPMT Officer	Mr. Fransisco Ignacio Castro Araujo (NDF)
Forest Management Officer	Mr. Fernando C. Araujo (NDF)
District Coordinator	Mr. Eduardo F. Martins (Ermera District)
District Coordinator	Mr. Jose Americo (Ermera District)
District Coordinator	Mr. Marcelino Pereira (Aileu District)
<u>PPMT for Laclo Watershed</u>	
PPMT Officer	Mr. Vicente S. Soares (NDF)
Forest Management Officer	Mr. Joao D.M. Dos Reis (NDF)
District Coordinator	Mr. Fernando Barros (Manatuto District)
District Coordinator	Mr. Vildito J.X. Maia (Manatuto Distict)
District Coordinator	Mr. Mario Alves (Manatuto District)

However, some of the members, especially those from the central offices, were not able to participate in the monitoring activities often as they are preoccupied by their original tasks in their mother units.

1.6 Composition of Final Report

This Final Report is composed of three volumes: Volume 1: Main Report (or CBIWMP), Volume 2: Watershed Management Planning Guidelines, and Volume 3: Annexes.

Volume 1: The Community-based Integrated Watershed Management Plan (CBIWMP) consists of seven chapters. Chapter 1 gives the general background of the Study. Chapter 2 introduces the overall picture of the relevant sectors related to watershed management in the country. In Chapter 3, the present natural and socio-economic conditions of the Laclo and Comoro watersheds were assessed. At the same time, historical changes of watershed environment and current issues on watershed management were analyzed. Based on the assessment of the present conditions, the objectives and basic approaches of the CBIWMP were developed as discussed in Chapter 4. Chapter 5 describes the overall watershed management plan composed of eight programs to attain the goal of the CBIWMP. Chapter 6 introduces the mechanisms for implementation of the CBIWMP, while Chapter 7 proposes the five-year management plan targeting the priority areas in the target watersheds. The last chapter, Chapter 8, gives the conclusions and recommendations for the implementation of the watershed management.

On the other hand, Volume 2, consisting of the watershed management guidelines, is composed of five chapters. The first chapter describes the objectives and usage of the guidelines. In Chapter 2, the basic concepts of community-based watershed management are introduced. Chapters 3 and 4 present how to prepare an overall watershed management plan and simple five-year management plan, respectively. The last chapter, Chapter 5, shares some lessons learned and good practices obtained through the pilot projects implemented by the JICA Study Team from January 2008 to September 2009.

Volume 3: Annexes, which gives detailed data/information used for making the CBIWMP, the five-year management plan, and the watershed management planning guidelines, comprise of the following parts.

Composition of Annexes Attached to Final Report

Annex	Title/Content
Annex A	Estimation of Erosion Potentials
Annex B	Result of Market Survey
Annex C	Typical Designs for Proposed Countermeasures of Slope Protection and Sediment Control Sub-program
Annex D	Detailed Work Plans for the Sub-programs
Annex E	Implementation Schedules of the Sub-Programs in the Watershed Management Plan
Annex F	Estimated Costs of the Sub-Programs in the Watershed Management Plan
Annex G	Results of Rapid Rural Assessment (RRA) Survey at the Target Villages
Annex H	Operation Guidelines for the Pilot Project Monitoring Team under the JICA Study
Annex I	Results of Evaluation of the Pilot Projects

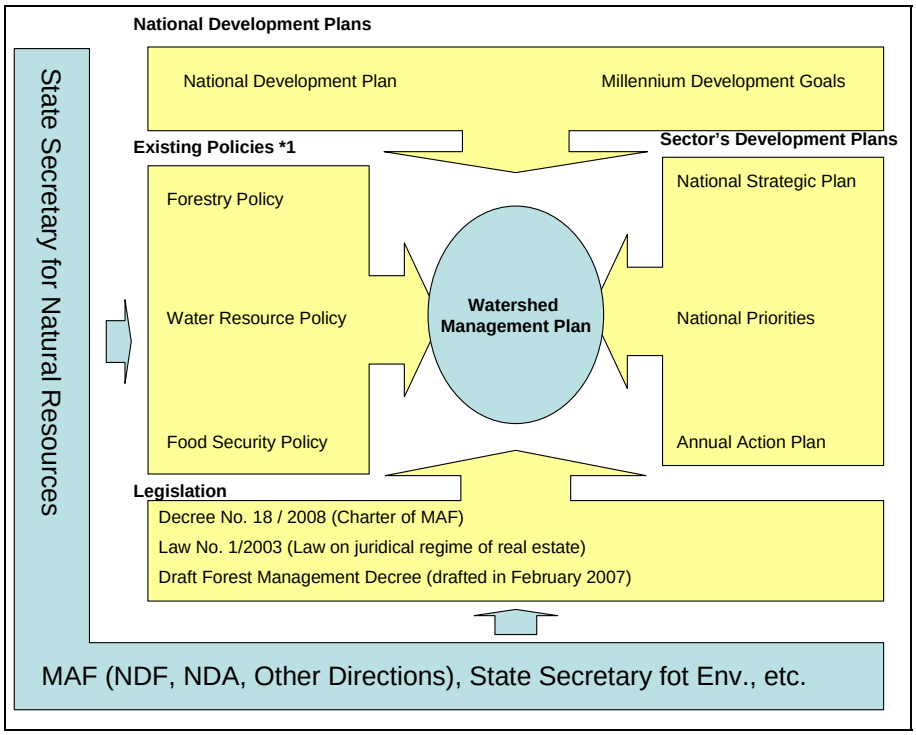
Chapter 2 Overall Framework of the Watershed Management Sub-sector

2.1 Overall Framework

Watershed management is currently under the jurisdiction of MAF, specifically under the NDF, in accordance with the Government Decree No. 18/2008 (Decree-Law No. 18/2008 of June 19 on the Charter of the MAF).

Because of its nature, sustainable watershed management could not materialize through the endeavor of a single direction/sector; it requires inter-sectoral or inter-disciplinary collaboration so as to address a wide range of issues that cause watershed degradation. Consequently, several sectors/ministries related to water resources should be involved in watershed management.

It is also essential that a watershed management plan be in line with the national and sectoral development plans, existing policies and legislation related to the forestry and watershed sectors. The figure below shows the plans, policies, and legislation referred to in the preparation of the watershed management plan.



Overall Picture of the Watershed Management Plan Within Existing Plans and Policies

2.2 Development Plans on National and Sector Levels

2.2.1 National Development Plan

The National Development Plan (NDP) was prepared for setting outlines of the government's objectives for economic development and poverty reduction in 2002. The NDP presented long-term development visions based on the National Vision for 2020, development strategy of the country to achieve the visions, and plans for the relevant sectors from 2002 to 2007. The visions, strategies and plans of the following sectors were covered by the NDP:

i) Social and human development (educating and health);
ii) Agriculture, fishery and forestry;
iii) Natural resources and environment;
iv) Industry, trade and the private sector; and
v) Infrastructure.

The vision, goals and policy directions given to the agriculture, fishery and forestry sector in NDP are as follows:

Vision: Agriculture, Fishery and Forestry Sector

By 2020, East Timor will have sustainable, competitive and prosperous agricultural, fisheries and forestry industries that support improved living standards for the nation's people

Goal: Agriculture, Fishery and Forestry Sector

- achieve food security and improve food self-sufficiency:
- diversify agricultural production and increase export earnings by the sector:
- develop agriculture predominantly on the basis of an integrated farming systems approach:
- facilitate agro-industrial development leading to increased processing and value-adding in-country
- improve the quality of agricultural commodities produced in the nation:
- manage agriculture, fisheries and forestry resources in a way that supports sustainable production: and
- increase rural incomes, generate employment in rural areas and, consequently, reduce poverty and improve the welfare of rural communities.

Strategic Policy Directions: Agriculture, Fishery and Forestry Sector

a) Establish effective and efficient technical support services to assist farm communities to increase food, livestock and vegetable production;
b) Introduce and develop new and adaptable technologies such as new cultivars and other inputs to enhance farm productivity;
c) Promote and develop diversification of agriculture through identification of potential niche markets for East Timor farm commodities in the region and in Europe and North America;
d) Maintain and improve the existing irrigation systems for rice, along with other crops including horticulture and legumes;
e) Promote the development of a sustainable fishing industry targeting both domestic and export market;
f) Create services to assist farmers to develop and improve animal production;
g) Develop and implement an extensive vaccination and sanitation campaign to prevent disease and improve animal production;
h) Rehabilitate and improve infrastructure, including irrigation systems, silos, roads and markets;
i) Promote crop rotation as critical in crop production systems to maximize profitable use of agricultural land, thereby increasing farm incomes and improving soil structure;
j) Increase coffee production through the systematic renovation of coffee plantations by pruning, or replacement of old trees with new Arabica plants and, where appropriate, by expanding the area of plantings;
k) Promote, develop and improve production from tree crops such as candlenut and coconut for both domestic and export markets; and
l) Develop and expand the reforestation program to increase forest cover and the production of commercially valuable trees for timber industry.

The government is currently preparing the sector development strategies and renewing the NDP. Accordingly, the new plan will be finalized in 2010.

2.2.2 Millennium Development Goals of Timor-Leste

After Timor-Leste became a member of the United Nation in 2002, the country formally acceded to adopt the Millennium Declaration passed by 189 countries in 2000, which further evolved to be globally known as the Millennium Development Goals (MDGs). The Millennium Development Goal Report of Timor-Leste was prepared by the GoTL in collaboration with the United Nation Country Team in 2004. The report showed the government's commitment to the international communities to work toward attaining the objectives set forth by the MDGs. Particularly, eight development goals were set under the MDGs of Timor-Leste as shown below.

Millennium Development Goals of Timor-Leste

Development Goal	Target
No. 1: Eradicate extreme poverty and hunger	Target 1: Reduce by half, between 1990 and 2015, the proportion of people whose income is less than one dollar a day (indicative goal; 14% of the population)
	Target 2: Reduce by half, between 1990 and 2015, the proportion of people who suffer from hunger (indicative target; 31% of the population)
No. 2: Achieve universal primary education	Target 3: Ensure that, by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling
No. 3: Promote gender equality and empower women	Target 4: Eliminate gender disparity in primary and secondary education preferably by 2005 and all levels of education no later than 2015
No. 4: Reduce child mortality	Target 5: Reduce by two-thirds, between 1990 and 2015, the under-five mortality rate
No. 5: Improve maternal health	Target 6: Reduce by three-quarters, between 1990 and 2015, the maternal mortality ration
No. 6: Combat HIV/AIDS, Malaria and Other Diseases	Target 7: Stop the spreading speed of HIV/AIDS by 2015
	Target 8: Eliminate the incidence of malaria and other major diseases by 2015
No. 7: **Ensure environmental sustainability**	**Target 9:** **Integrate the principles of sustainable development into country profiles and programs and reverse the loss of environmental resources**
	Target 10: Reduce by half, by 2015, the proportion of people without sustainable access to safe drinking water
	Target 11: By 2020, achieve a significant improvement in the lives of at least 100 million slum dwellers
No. 8: Partnership for development	Target 16: In cooperation with developing countries, develop and implement strategies for decent and productive work for youth

Source: Millennium Development Goal Report of Timor-Leste (2004)

One of the indicators set for Development Goal No. 7 shown above is to protect forests from degradation to maintain the current forest cover until 2015. Hence, reforestation of deforested areas and sustainable management of forests and natural resources for sustainable watershed management will contribute to achieve one of the millennium development goals of Timor-Leste.

2.2.3 MAF's Policy and Strategic Framework

The "Policy and Strategic Framework of MAF" was finalized in September 2004 to attain the objectives of the NDP. The main aim of the said policy was to strengthen the capacity of rural communities to secure their short- and long-term livelihoods from agriculture, forestry and fishery resources by managing natural resources in a sustainable manner. The following specific objectives were set for the agriculture, forestry and fishery sectors, respectively.

Sector Objectives, MAF Policy and Strategic Framework

Agriculture sector

- Increase food production,
- Improve food quality,
- Improve animal production,
- Support the development of agricultural industries for domestic and export markets,
- Provide effective agricultural planning based on improved data,
- Provide and appropriate legislative and regulatory framework, and
- Greatly increase the amount and quality of information services to farmers in the upland and dry lowland areas, which will require increased effort directed to capacity building

Forestry Sector

- Set in place a firm national forest policy, forest law, and accompanying regulations,
- Address the issue of forest degradation with an integrated, watershed-based approach to land management cooperation with other arms of MAFF, rural communities and NGOs, and
- Strengthen institutional capacity and to obtain the necessary forest resource data on witch to base resource management

Fishery Sector

- Improve marine resource planning and management
- Develop a fisheries policy and legal and regulatory framework that supports the development of both commercial and subsistence fisheries and ensures the sustainable management of the resource bases,
- Encourage and support the private sector to develop an offshore fishery and to provide facilities for production, storage, processing and distribution of local fish supplies, and
- Strengthen the local capacity to plan and manage fish resources in a sustainable way.

Source: Policy and Strategic Framework (2004), MAF

2.2.4 Sector Investment Plan (SIP)

The SIP was the action plan to support the implementation of the MAF's policy and strategic framework from 2004/5 to 2008/9. Since it was developed by the former administration in 2004 and 2005, the current government regards it as outdated. Accordingly the current government is preparing the national sector strategies to replace the SIP.

2.2.5 National Priorities

Having taken office in August 2007, the new government regime identified the national priorities to recover the country from the crisis of 2006 so that the government as well as the development partners could focus their efforts on the priority area. The national priorities for 2008 were shared with the international organizations and donors in the development partners meeting in February 2008. The achievements made by the government as well as donors in accordance with the national priorities were monitored periodically in the development partners meetings.

Likewise, the government identified seven priority areas, namely i) Agriculture and Food Security, ii) Rural Development, iii) Human Resource Development, iv) Social Protection and Social Services, v) Security and Public Services, vi) Clean and Effective Government, and vii) Access to Justice, as the national priorities for 2009. Moreover, it has coordinated with the international organizations and donor to address the priorities areas.

The national priorities for 2010 are currently being finalized by the government. According to the draft 2010 National Priorities Matrix, it would have seven priorities: i) road and water, ii) food security, iii) human resources development, iv) access to justice, v) social services and decentralized service delivery, vi) good governance, and vii) public safety. One of the goals under food security would be the sustainable and efficient forest resource management. Hence, it is considered that the implementation of this CBIWMP would be in line with the national priorities in 2010.

2.2.6 Annual Budget Plan and Annual Action Plan of MAF/NDF

The annual budget plan and annual action plan of MAF show the fiscal budget of the ministry, capital projects planned under the ministry, major activities planned by donors and NGOs, and planned programs of the respective directorates. The following table gives the programs planned by NDF for FY 2009.

Programs Planned by NDF in 2009

Program	Objectives
1. Production and use of forest commodities	Increase the quality of wood and develop commercial wood with economic value, in particular for the rural community that depends on the forest
2. Protection of forest resources	Increase the capacity of forest guards and involve the community in the implementation of forest activities, so as to facilitate the sustainable management, preservation and maintenance of the forest and watersheds
3. Protected areas and national parks	Supply detailed preliminary data on the value of biodiversity and tourism as a launching pad for 15 protected areas, by way of collaboration between community and the civil society
4. Rehabilitation and reforestation	Plant trees, restore degraded land, recover watersheds, protect the coastline, maintain and develop wood resources for generating energy, make handicraft, grow fruit and other non-wood commodities to complement agriculture and horticulture

Source: General Budget of the State and State Plan for 2009, GoTL

Among others, the programs of "protection of forest resources" and "rehabilitation and reforestation" will be similar with those proposed in this watershed management plan.

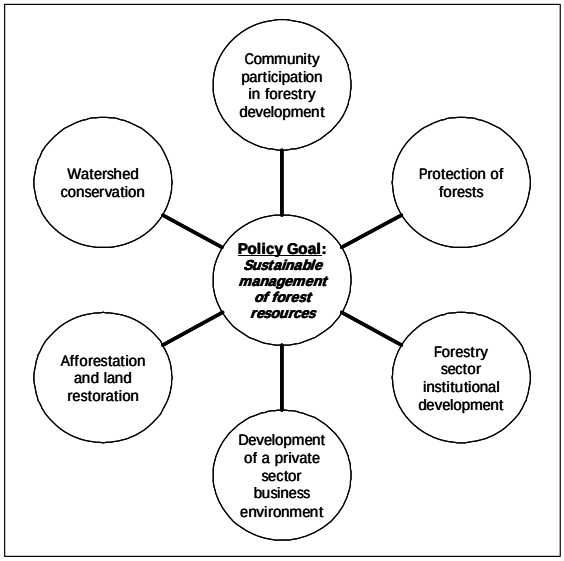
2.3 Existing Policies

The lack of the policies and strategies in the government is one of the urgent needs to be addressed. With regard to watershed management, the following government policies have been either approved or drafted as of December 2009.

- Forestry Policy
- Food Security Policy
- National Water Resource Policy (draft)

2.3.1 Forest Policy

The forestry sector policy was approved by the government in 2007. The policy is composed of one goal and six policy objectives. The goal of forestry sector is the sustainable management of forest resources and watersheds to provide environmental, social and economic benefits to the people in Timor-Leste. The goal is expected to be achieved through attaining the six policy objectives supported by a series of realistic strategies and enacting the new forest legislation. The figure at the right shows relationships between the goal and the policy objectives under the forest policy.



Goal and Six Objective of Forestry Sector

Six Policy Objectives and their Outlines

Objectives	Descriptions
Protection of Forests	To effectively protect the ecological integrity and biological composition of not less than 70 percent of the area of forests by 2020 (Protection of forests)
Community Participation in Forestry Development	To harmoniously and effectively involve forest communities and other private sector groups and to award long-term land use rights to all forest-dependant communities by the end of 2010
Watershed Conservation	To conserve watersheds in a long-term and sustainable manner, focusing on the restoration of 10 critically degraded watersheds, not later than 2020
Afforestation and Land Restoration	To afforest and restore degraded lands in order to produce 50 percent of the nation's sawn timber supply from locally grown forest plantations by 2040
Forestry Sector Institutional Development	To develop and maintain a private business environment for profitable forest ownership and the management, production, utilization and marketing of forest products, especially for the alleviation of poverty amongst rural communities
Forestry Sector Institutional Development	To develop managerial, technical & administrative capacity and maintain/develop forestry sector institutions in order to at least double the number of staff holding tertiary qualifications in forestry and natural resources management by 2010 and to increase management, operational and extension staff by 150 percent over the same period.

Source: Forest Policy (2007), MAF

2.3.2 National Food Security Policy (NFSP)

The NFSP was drafted by MAF in July 2005 and officially issued in November 2006. The main aims of the policy are to:

i) address the fact that large number of population are suffering from hunger or malnutrition – food insecurity;
ii) implement a number of individual initiatives to attain the objectives of the NDP and the Poverty Reduction Strategy, the MAF Policy and Strategic Framework, National Nutrition Strategy, and forthcoming National Disaster Risk Management Plan;
iii) share the NFSP amongst key stakeholders such as international donors, NGOs, and GoTL; and
iv) urge a way of reconstruction from largely destroyed in the events of 1999.

Addressing four direct issues (i.e., insufficient access, insufficient supply, unstable supply and ineffective utilization) that have caused food insecurity in Timor-Leste, the food security policy set five objectives as listed below:

i) Promotion of agricultural and food production;
ii) Promotion of support services and infrastructure;
iii) Promotion of fisheries and other income-generating activities;
iv) Establishment of a food security information system, management of food crises, and safety nets for vulnerable groups; and
v) Improvement of food utilization and nutrition.

Each policy objective has supporting strategies to achieve the respective objectives as shown below.

Policy Objectives and their Strategies

Objectives	Descriptions
Promotion of agricultural and food production	Improved seed supply Promotion of improved and sustainable farming systems Expansion, proper maintenance and management of irrigation schemes Promotion of home gardening and permaculture systems Livestock development Promotion of cash-crop production
Promotion of support services and infrastructure	Promotion of agricultural research and extension Promotion of farmers' and community organizations Establishment of a rural finance scheme Promotion of agricultural and food marketing, processing and trade Improvement of rural infrastructure through Cash-for-work / Food-for-work programs
Promotion of fisheries and other income-generating activities	Promotion of fisheries and aquaculture Promotion of employment and income generation and public employment schemes
Establishment of a food security information system, management of food crises, and safety nets for vulnerable groups	Early warning, vulnerable and food security information Disaster preparedness and management Safety nets for vulnerable groups
Improvement of food utilization and nutrition	Improvement of food safety and quality, processing and preservation

Source: Food Security Policy (2006), MAF

2.3.3 National Water Resources Policy (Draft)

The National Water Resources Policy was drafted in 2004 in the course of the Integrated Water Resource Management Project funded by ADB. The draft policy defined the "Water Vision", which was consistent with the "Development Vision" specified in NDP, as:

"The people of Timor-Leste together will enjoy:

a. Access to safe, adequate, and affordable sources of water for drinking, sanitation, and other household purposes;
b. Sufficient water to provide for food security, the requirements of industry and employment, and other human needs;
c. Freedom from threats of loss of life, property and livelihood as a result of floods, droughts and other water-related disasters; and
d. A water environment that sustains healthy aquatic ecosystems and fisheries."

The overall goal of the national water resources management is set as:

"To ensure the management of the Nation's water resources in an efficient, equitable and sustainable manner, meeting the social and economic needs of present and future generations of Timorese, protecting the bio-physical environment, and fostering the national and cultural values of the people."

To achieve the overall goal, the draft policy set the following seven groups of policies, according to the four key goals for management of natural resources (i.e., efficiency of resource use, equity of resource use, resource sustainability, and public health and safety) and three key aspects of management (i.e., the knowledge base, institutional arrangements, and financial arrangements).

a. Policies to ensure public health and safety
b. Policies to ensure equity of water resource use

c. Policies to ensure sustainability of water resources
d. Policies to ensure efficiency of water resource use
e. Policies on institutional arrangements for water resources management
f. Policies on financial arrangements for water resources management
g. Policies on the knowledge base

As listed above, it widely covers the issues related to water resources. Among others, the third policy group (sustainability of water resources) clearly states that water resources will be developed and managed in the context of watershed condition, vegetation cover and land use, and other aspects of the bio-physical environment, and a multi-disciplinary approach to planning and management will be used. Furthermore, the fifth policy group also stipulates that mechanisms for coordination among water sector stakeholders shall be established and maintained, particularly including concerned government institutions.

An inter-ministerial steering committee with participation of the water-related ministries[1] was established in the course of the said ADB study to oversee the progress of policy-making. When the draft policy is finally approved by the council, the same kind of institutional arrangement is supposed to be established. The draft policy was translated into Portuguese and submitted to the Council of the Ministers. However, it has yet to be approved by the Council, although no major revision is required in its contents.

2.4 Current Legislative Setups

2.4.1 Overall Progress of Legislative Setup

(1) Awareness on Law or Justice

"A Survey of Citizen Awareness and Attitudes Regarding Law and Justice in East Timor" published by the Asian Foundation in 2004[2] provided diagnosis of how dispute resolution currently functions in Timor-Leste, perceptions of law and justice, and the needs and demands of citizens. The following are some highlights from the report, which are related to watershed management.

Extracts from "A Survey of Citizen Awareness and Attitudes Regarding Law and Justice in East Timor "

- **Customary law**: people are most comfortable and familiar with traditional customary rules, though the Timor-Leste has both traditional ***adat*** process and the formal legal system, while the applicable legal system remain unsettled, people are generally aware that a formal level system exists. However it is constrains about socialization of the formal law, even about basic rights as of human being.
- **Authority**: majority of Timorese regard the authority of ***chefe do Suco*** or ***liurai*** and the traditional ***adat*** process. Over 80% of answers recognize the traditional community leader as responsible for maintaining law and order – not police!
- Land: land disputes are the most common legal issues by citizens and many of them believe the traditional adat process (including the village head) is the best way to seek remedy if family-to-family discussion fails.

[1] Ministry of Development and Environment (Subsequently, it was split into the Ministry of Natural Resources, Minerals, and Energy Policy and the Secretary State of Environmental Management.), MAFF, the Ministry of Health, and the Ministry of Transport, Communications and Public Works (It was also split into the Ministry of Public Works and the Ministry of Transport and Communication.).

[2] The Asian Foundation, with the assistance of USAID, conducted the interview survey sampling over 1,400 interviewees in all districts

- Woman and the Law: a majority of the citizen feels that women should be able to hold land, attaining equal rights for men and women. Opposition to women's land right is strongest among younger men and rural residents.
- Communication: while radio is the most widespread reach of communication tools in Timor-Leste, it still fails to reach much of the population. Other information source relies on Face-to Face contact, such as the chefe do suco, neighbors, or community member.

Source: A Survey of Citizen Awareness and Attitudes Regarding Law and Justice in East Timor" (2004), the Asian Foundation

As described above, the report pointed out that the traditional customs and practices likely remain effective, although the constitution and other supporting laws/regulations have been installed in the country since its independence.

(2) Overall Legislative Set-ups Related to Watershed Management

Preparation of a legislative framework of the country as well as the sector is still on-going. The following laws/decrees related to watershed management have been either drafted or enacted as of December 2009.

- Charter of the MAF (Decree No. 18/2008)
- Forest Management Decree (Draft)
- Real Estate Law (Law No. 1/2003)
- Land Law (under discussion in the GoTL)

2.4.2 Charter of the MAF

The charter of the MAF (Decree No. 18/2008) gives the organic structure and the tasks and functions of the respective directorates under the MAF. It incorporates the recent changes in the structure from 2003 when the ministerial decree (Decree No. 4/2003) on the organic structure of the Ministry of Agriculture, Forestry and Fisheries (so-called "Organic Law of MAF") was issued. The tasks and functions of the directorates relating to watershed management are presented in Table 2.1, and those of NDF are listed below.

Tasks and Functions of NDF

a. Participate in setting and applying policy for forests, hunting, beekeeping, and aquatic resources in inland waters, and propose the measures necessary for realizing it;
b. Coordinate and support the execution of forestry policy, within the context of the National Forestry Strategy, specifically in the fields of forestry regulation and protection, production, transformation and marketing of forestry products, as well as beekeeping, hunting, aquatic resources in inland waters;
c. Coordinate, gather, and analyze forestry data and information for use in planning and decision-making;
d. In collaboration with the NDPP and other services, prepare the national plan for forest management and the adoption of legislation on the matter;
e. Ensure and enforce execution of forestry legislation and of the national forestry management plan;
f. Encourage measures, within the context of the national forestry management plan, for reforestation and the protection of endangered or weakened forest species, with the objective of expanding forested space and the production of commercially valuable trees for the wood industry;
g. Promote campaigns to raise awareness of the population, local communities, and the public at large concerning the need to conserve the country's forestry assets;
h. Promote structural prevention in the aspects of information and education, prevention of and fighting against forest fires, and deployment of actions and programs aimed at appropriate prevention of forest fires;
i. Assist in conceptualizing and defining parks and forest reserves and promoting legislation for their management;
j. Participate, in coordination with other services, in drawing up the national plan for water resource management;
k. Take measures and oversee the rational use of water resources;

l. In coordination with other services, ensure the quality of water resources, taking effective measures along with the appropriate services to prevent and eliminate factors that cause degradation and pollution;
m. Formulate a manual on watershed management and one on agroforestry;
n. Impose sanctions for the commission or omission of contraventions in the forestry and water resource sector;
o. Define, designate and implement parks, reserves and protected areas overseeing the environmental areas with the Ministry;
p. Establish accountability of the various agents and an appropriate organization of forestry services;
q. Promote improvements in competitiveness of the industries making up the various forestry segments;
r. Perform the other tasks derived from the Ministry's incumbencies in the area of forestry, watersheds, and water resources; and
s. Present an annual report on activities.

Source: Decree-Law No.18/2008 of June 19 Charter of the Ministry of Agriculture and Fisheries

2.4.3 Forest Management Decree (Draft)

The final version of the Forest Management Decree was prepared and submitted to the GoTL for approval in June 2008. Accordingly, the draft law is on the verge of being approved by the parliament as of December 2009. The draft law is composed of 14 chapters as listed below.

Contents of Forest Management Decree (Draft)

Chapter	Title
Chapter 1	Preliminary Matters
Chapter 2	Administration – Roles and Function of Government Entities
Chapter 3	Forest Management Budgeting and Revenue
Chapter 4	Forest Area Demarcation, Inventories, and Management Plans
Chapter 5	Forest Resource Ownership Rights
Chapter 6	Community Rights and Responsibilities
Chapter 7	Allocation Procedures for Community Forest Resource Use Rights
Chapter 8	Private Sector Forest Resource Rights
Chapter 9	Protected Areas
Chapter 10	Protection of Forest Resources
Chapter 11	Forest Fire Protection
Chapter 12	Compliance and Enforcement
Chapter 13	Dispute Resolution
Chapter 14	Final Orders

Source: Draft Forest Management Decree (2007), MAFF

The draft decree specifies that the state shall hold in public trust all forest resources in the country, although the property ownership right to own trees planted on private land may be secured. The decree also stipulates that communities can claim access, use and management rights to forest resources. Thus, forests naturally grown on private lands or those planted by communities on state land remain properties of the village as long as they comply with the related clauses of the decree and any other relevant laws, regulations, guidelines and community-forest management agreement.

Any community that claims the forest resource use right in the territory of the village shall first enter into the draft community forest management agreement with NDF. Communities can further request NDF through the District Forest Office to upgrade the draft agreement to either interim or long-term community forest management agreement. Communities without official land registration as community land or community property land[3] can only enter into the interim agreement, which. shall be renewable without limit, subject to assessments to be made every three years.

[3] The term will be defined in the land law, which has been in the process of approval by the council of ministers.

Those who have community land property rights to their area and a positive assessment of an interim community forest management agreement by NDF can convert the interim agreement to a long-term community forest management agreement for a minimum term of 25 years. The performance of communities under the long-term agreement shall also be assessed every fifth year.

The terms and conditions of community forest management agreement are given in Table 2.2 and summarized below.

- The forest areas and resources that are included in the area shall be accurately identified in the agreement.
- A map at a scale of at least 1:25,000 showing the forest areas and resources available in the area shall be included in the agreement.
- The nature of the access, use and management rights granted to the community shall be specified in the agreement.
- Families, groups or individuals within the community shall be specified in the agreement.
- The rules and procedures on access and use of the resources, which were developed by the community, shall be incorporated in the agreement.
- Relevant information related to inter-community agreements shall be included in the agreement.
- Sustainable harvesting arrangements shall be specified
- Any protection or conservation arrangements shall be included.
- Benefit-sharing mechanisms shall be included.
- The roles and functions of all relevant local authorities, forest guards, district forest offices, NDF, and other government authorities shall be spelled out.

2.4.4 Real Estate Law (Law No. 1/2003)

The Real Estate law was prepared to address the complicated situation of land tenure after the independence of the country. It defined the ownership over the real estate in the country pursuant to Section 54 of the Constitution (General principles in relation to private property). Three types of ownership were given in the law, namely:

i) Private real estate;
ii) Public real estate; and
iii) State's private real estate.

The law defined private real estate as "the rural and urban immovable assets that can be the object of legal business under the owners of national private persons", while public real estate and state real estate were given the following definitions:

a. Public real estate: immovable assets used for public and the mineral resources of soils and sub-soils that are subject to specific legislation; and
b. State's private real estate: all real estates owned by the Portuguese State as of 7 December 1975 and those that are acquired by the State by virtue of law or juridical business.

Although private ownership over land was recognized by this law, there is still a need to come up with another set of laws and regulations to clarify the method of registration of lands.

2.4.5 Land Law (Under discussion in the GoTL)

Legislation set-up regarding land tenure system had been supported by the Land Law Program with the assistance of USAID from June 2003 to March 2006. The program drafted the following laws/decrees that can support new legislation on land tenure in the country.

a. Decree-Law on Leasing of State Property
b. Decree-Law on Land Dispute Mediation
c. Property System, Land Transfer and Registration, Pre-Existing Land Rights and Title Restitution Act

Of these, laws on leasing and state property and the land dispute mediation were already approved by the parliament. However, the law on land rights and title restitution is still held by the government and has yet to be enacted, although it was drafted in 2005.

2.5 Current Status of Government Organizations Related to Watershed Management

2.5.1 Ministry of Agriculture and Fisheries (MAF)

(1) Organizational Structure

At present, the MAF is composed of one Minister, three Secretaries of State, one General Director, 15 National Directorates, and 12 district MAF offices. The secretary of state oversees the national directorates of the ministry, while the general director is responsible mainly for the administrative matters of the ministry. NDF is put under the supervision of the Secretary of State for Agriculture and Arboriculture, together with the National Directorate of Agriculture and Horticulture (NDAH), National Directorate for Industrial Plants and Agribusiness (NDIPA), and National Directorate for Support to the Development of Agricultural Communities (NDSDAC). The organization chart of the ministry is presented in Figure 2.1.

(2) Number of MAF Staff

The following table shows the numbers of MAF staff in 2002, 2005 and 2009. The government has made effort in recruiting new permanent and temporary staff for the last eight years. In particular, the number of total staff in 2009 became about three times as many as that in 2005 since the GoTL recruited a number of extensionists (extension workers) and forest guards in 2008/2009. Although the number of the field staff has drastically increased to make the government extension services available at the village level, the capacity of the field staff is still limited to provide adequate services.

Changes in Number of MAF Staff since 2002

Year	Permanent Staff	Temporary Staff	Total
2002/2003	109	4	113
2005/2006	289	386	675
2009/2010	329	1,487	1,816

Source: Directorate of Administration, MAF

The status of the staff in the ministry in 2009 is given below.

Number of MAF Staff in each Status

Status/Level	L1	L2	L3	L4	L5	L6	L7	Total
Permanent	5	34	75	132	61	21	1	329
Temporary	108	337	668	261	78	20	-	1,472
Political appointment	-	3	1	4	1	9	4	22
Total	**113**	**374**	**744**	**397**	**140**	**50**	**5**	**1,823**

Source: Directorate of Administration, MAF

Level 1 and 2 are applied to forest guard, and those of Level 3 to Level 5 are qualified as technical staff and officers who area the majority in MAF. Level 6 and 7 are mainly working in managerial positions.

2.5.2 National Directorate of Forestry (NDF)

(1) Organizational Structure

As MAF reorganized its organizational structure in 2008, the National Directorate of Coffee and Forestry was also reorganized NDF. At present, NDF has five departments, namely, i) department of planning and strategy, ii) department of protected areas and national parks, iii) department of rehabilitation and reforestation, iv) department of production and utilization of forest resources, and v) department of protection and management of forest resources. The present organizational structure of NDF is presented in Figure 2.2.

(2) Number of NDF Staff

The number of NDF staff in the central office is given below.

Number of NDF staff in 2009

Status/Level	Technical Officer	Forest guard	Administration	Total
Central	46 (23 permanent and 23 temporary)	11 (6 permanent and 5 temporary)	5	62

Source: Directorate of Administration, MAFF

In addition to the staff working at the central office, there are officers related to the forestry sector at the MAF district office. The following table shows the number of the forestry staff in the MAF district offices concerned with the Study area.

Number of Forestry-related Staff in the Concerned MAF District Offices in 2009

Status/Level	Technical Officer	Forest guard	Others (Nursery)	Total
Aileu District	1	5	0	6
Ainalo District	1	5	1	7
Liquica District	1	5	3	9
Ermera District	1	5	0	6
Manufahi District	1	5	0	6
Manatuto District	1	6	1	8
Total	6	31	5	42

Source: Directorate of Administration, MAFF

(3) Equipment

According to the Directorate of Administration in MAF, NDF possesses the following equipment/facilities at present.

Equipment Possessed by NDF

Items	Quantity
4 WD vehicle	4
Motor cycle	33
Computer (Desk top type)	7
Radio call system	7

Source: Directorate of Administration, MAF

2.5.3 MAF District Office

(1) MAF District Office

The MAF established its territorial delegations in each district in the country to provide its services at the village level. The main tasks of the MAF district office are to orient, coordinate with, and support farmers, and to promote and develop community-based farming and fishing. The district office headed by a District Director consists of three departments, namely i) department for technical support, ii) department for agriculture extension, and iii) department for administrative support. The organizational structure of the district MAF office is presented in Figure 2.3.

(2) Number of District MAF Staff Related to the Study

The number of the staff in MAF District offices related to the Study in 2009 are summarized in the table below.

Number of staff (Permanent) in MAF district office in 2009

District	Agriculture/crop	Livestock	Forestry	Irrigation	Fisheries	Coffee& Plant	Extension	Administration	District Director	Total
Aileu	5	2	6	0	1	1	19	4	1	39
Ainaro	10	5	7	1	1	2	24	7	1	58
Liquica	4	3	9	1	0	1	24	2	1	45
Ermera	7	3	5	0	2	2	33	3	1	56
Manufahi	7	2	6	1	1	1	36	3	1	56
Manatuto	11	3	7	2	3	1	34	2	1	64

Source: MAF district offices

Each district office has a number of extensionists and forest guards, who were recently hired in 2008/2009. The major tasks given to them are presented below.

Major Tasks of Extensionists and Forest Guards

Staff	Tasks
Extensionist	1. Promote development of agriculture, forestry, livestock and fisheries sectors 2. Provide services relating to agriculture, forestry, livestock and fisheries 3. Coordinate with relevant directorates in MAF to support MAF's programs 4. Involve farmers in the development of agriculture, forestry, livestock and fisheries sectors
Forest Guard	1. Protect forests and forest products 2. Protect forests from forest fire 3. Raise public awareness of forest functions in communities in and around forests 4. Prepare necessary documents 5. Report the progress of the work to the supervisor 6. Coordinate with relevant directorates in MAF to support MAF's programs

Source: MAF

(3) Equipment

District MAF offices possess the following equipment and facilities in 2008.

Equipment in MAF district offices

District	Vehicle	Motor cycle
Aileu	1	7
Ainaro	1	7
Liquica	1	5
Ermera	1	7
Manufahi	1	3
Manatuto	1	4

Source: Directorate of Administration, MAF

At present, the numbers of 4-WD vehicles and motor bikes are not sufficient for them to accomplish their tasks. Lack of transportation facility or limited mobility of the district office is one of the drawbacks that affect the extension works of MAF.

2.5.4 Budget and Expenditure of MAF and NDF

The general budget plan of MAF from 2009 to 2012 is summarized as follows.

Budget Plan of MAF for the Next Four Years

Unit: '000 US Dollar ($)

Item	2009	2010	2011	2012
Budget				
1. Salary and wages	4,350	4,343	4,382	4,421
2. Goods and services	6,270	6,873	7,490	8,152
3. Minor capital (Equipment)	15,928	221	229	237
4. Capital and development	6,411	1,494	110	10
5. Transfer payments	1,000	0	0	1,00
Expenses (Total expenditures)	**33,914**	**12,931**	**12,211**	**12,820**

Source: General Budget of State 2009, Ministry of Finance (2009)

In 2009, MAF planned to spend about US$33 million, of which US$16 million were expected to be spent for purchase of tractors distributed to local farmers as well as MAF district offices. Those planned for the next three years from 2010 to 2012 will be one third of those planned in 2009. Apart from the general budget, MAF also secures US$1 million for community development fund every year.

On the other hand, the budget for NDF will be maintained at the same amount from 2009 to 2012 as shown below.

Budget Plan of NDF for the Next Four Years

Unit: '000 US Dollar ($)

Item	2009	2010	2011	2012
Budget				
1. Salary and wages	240	241	242	243
2. Goods and services	490	502	514	526
3. Minor capital (Equipment)	0	0	0	0
4. Capital and development	0	0	0	0
5. Transfer payment	0	0	0	0
Expenses (Total expenditures)	**730**	**743**	**756**	**769**

Source: General Budget of State 2009, Ministry of Finance (2009)

2.5.5 Current Capacity Gap of NDF and Concerned MAF District Offices

In 2006, the JICA Study Team assessed the capacity gaps of NDF and the concerned MAF district offices as compared with their expected roles and tasks in the implementation of watershed management activities in the target watersheds. The results of the assessment are shown in Table 2.3.

The assessment revealed that apart from lack of experience in watershed management and protection, they have, so far, no experience in preparing a watershed management plan of implementing the watershed management activities.. Generally, the staff of NDF, especially those in the MAF district office, has limited knowledge of and experience in watershed management. In addition to the limited experience in watershed management, the following factors have hindered NDF from fulfilling its tasks.

- Lack of legislative set-ups for NDF to manage forest resources
- Limited number of staff in both central and district offices
- Limited capacity and experience of the staff
- Lack of guidelines and regulations that NDF can use for guiding rural communities toward sustainable forest and land management
- Lack of facilities and equipment, especially transport equipment
- Lack of budget to carry out the protective as well as restoration works in the field

Although NDF has recently improved its enforcement activities against timber cutting and firewood collection by strengthening the function of the check points along the national roads coming to Dili, it has yet to control illegal activities thoroughly due to the above-listed factors.

Hence, the Study Team judges that the watershed management plan should include the enhancement of the capacities of MAF and NDF in order to fulfill their tasks and functions related to watershed management in general as well as to the implementation of the watershed management plan in particular.

2.5.6 Other Related Government Organizations

As described in Section 2.1, sustainable watershed management requires inter-sectoral or inter-disciplinary collaboration to address a wide range of issues that cause watershed degradation. In the present organization set-ups in Timor-Leste, the following ministries and/or directorates are related to watershed/water resources, which need to be involved in management of the target watersheds.

- Directorate of Water Supply and Sanitation under the Ministry of Infrastructure
- National Directorate of Environmental Management and Services under the State Secretary for Environment Management and Services
- Directorate of Road, Bridge and Flood Control under the Ministry of Infrastructure

Chapter 3 Present Conditions of the Laclo and Comoro River Watersheds

3.1 Natural Conditions

3.1.1 Location

Timor-Leste contains the eastern half of the island of Timor, the enclave of Oecusse and the islands of Ataúro and Jaco. The area of TL is approximately 14,874 km^2 with a total length of 265 km and a maximum width of 97 km. To its north lies the Banda Sea and to the south lies the Timor Sea. The country has varied topographic conditions, dominated by the central mountain range of Ramelau in the center of the island of Timor. The peak of Mount Tatamailau is the highest point (2,963 m above sea level) of the country. More than half of the lands have over 40% slopes. Figure 3.1 shows the location of the target watersheds.

3.1.2 Climate

Timor-Leste is under the monsoon type climate which is characterized by clear distinction between wet and dry seasons. Northwest monsoon winds prevail from December to March, bringing the principal wet season to most parts of the country. The dry season is caused by southeast trade winds which prevail from May until October except for the south coast and southern slopes where the wet season persists until July.

The duration of dry season largely varies in Timor-Leste: from 2-3 months to 10-11 months. In the target watersheds, relatively shorter dry season (5-6 months) are observed in the upper Comoro watershed. The longest dry season (7-9 months) is experienced at the mouth of the Laclo River. Figure 3.2 shows the lengths of dry seasons in the watersheds.

In Timor-Leste, the average annual rainfall varies from 573 mm at Manatuto to 2,500 mm in the central-western mountain. The coastal sides in the Laclo watershed and northwestern part of the Comoro watershed have the lower precipitation (500-1000mm), while the southwestern edges of the upper Laclo watershed have the higher precipitation (2,000-2,500mm). Annual rainfall patterns in the watersheds are shown in Figure 3.3.

Rainfall is characterized by a tropical strong shower. Heavy downpours often increase surface runoff and cause soil erosion/landslides being combined with steep terrain. Cyclone has not been recorded since January 1993 when 400 houses were destroyed in Timor-Leste. However, strong winds occasionally hit the watersheds in January, destroying houses and farm crops. Monthly rainfall distribution and annual average at each district are tabulated below.

Monthly Rainfall Distribution and Annual Average at District Capital

(Unit: mm)

District central	Jan	Feb	Mar	April	May	June	July	Aug	Sept.	Oct.	Nov	Dec	Average	Elevation (m)
Dili	156	125	147	115	74	43	22	17	15	26	70	138	940	0~100
Aileu	326	248	179	108	3	33	7	8	5	190	184	225	1,514	900
Manatuto	116	118	84	57	38	23	12	1	6	11	27	80	573	0~60
Gleno	325	220	267	163	135	47	28	26	20	92	185	256	1,765	700

Source: ALGIS, based on the data between 1962 and 1974 except for Dili (1953-1999) and Aileu (2004-2005).
Although there is available rainfall data at the rainfall stations of MAF between 2006 and 2009, it was not taken into consideration due to lack of reliability.

The average temperatures are largely affected by the altitude since there is little temperature variation on either a diurnal or a seasonal basis under the tropical climate conditions in

Timor-Leste. Annual average temperatures vary between 25-27^{o}C near the coast and below 21^{o}C at the highest elevation (southwestern Aileu, elevation above 1,000m).

3.1.3 Hydrology

(1) Laclo Watershed

The catchment area of Laclo River (from the intake of the Laclo irrigation system) is 1,386 km^2 with a maximum elevation of 2,512 m above sea level. The average monthly stream flow of Laclo River is 29.3 m^3/sec with the lowest discharge of 8.1 m^3/sec in September and the highest one of 69.8 m3/s in March, based on the records kept between 1952 and1974[1]. The hydrology network of the Laclo River is largely divided into eight tributaries, namely:

- Downstream part of the main stream of Laclo River: From the mouth of Ue coi River to the sea.
- Sumasse River: Starting from 5 km south of the mouth of Laclo River, going approximately 20 km southward toward Laclubar town, with Bobo River connected to western side.
- Ue Coi River: Starting approximately 10 km southwest from the mouth and going about 20 km southward. The southern edge of the watershed is the northern hill of Batara village in Laclubar.
- Lihubani River: Starting approximately 15 km southwest from the mouth and going about 20 km westward.
- Lohun River: Starting approximately 25 km southwest from the mouth and going about 20 km westward.
- Noru River: Starting approximately 30 km from southwest from the mouth and going about 20 km westward. The main stream is divided into Coimai and Hatomero branches.
- Eralibanaubere River: Middle part of the main stream of Laclo River starting from the mouth of Noru River to those of Daisoli and Monofunifun rivers. Main branches are rivers of Orlaquiric, Hatoarabau, Karama, Aibeli, Haru and Malikan.
- Malikan River: Major branch of Eralibanauber River, starting approximately 10 km from the mouth and going about 10 km westward.
- Daisoli River: Starting at the same location of Monofunihun River and going westward approximately 20 km, covering the peak of watershed, 2,512 m height from the sea level.
- Monofunihun River: Starting at the north of Turiscai Town and going west approximately 20 km covering Aileu district center.
- Manotahe River: Major branch of Monofunin River, starting about 20 km from the mouth and going 5 km westward. The main river is divided into the Malubui, Kulalan, and Liurai Rivers.

(2) Comoro Watershed

The catchment area of Comoro watershed starting from the edge of the urban area of Dili City is 212 km^2 with the highest peak at 1,410 m above sea level (asl). The mean monthly stream flow of Comoro River is 2.99 m^3/sec. The flow decreases to less than 0.5 m^3/sec from July to November and rises to 12.3 m^3/sec in March. As shown in Figure 3.4, the watershed has four tributaries, namely:

[1] Source: Timor AGRI. Mean values in 23 years from 1952 to1974.

- Downstream of the main stream of Comoro River: From the confluence of Bemos and Betete Rivers to the sea.
- Bemos River: Starting from 8 km south of the mouth of Comoro River, going approximately 13 km eastward. The river is surrounded by 700-800 m mountains on the north and 1,200-1,300 m mountains on the south.
- Balele River: Starting from 8 km southwest from the mouth of Bemos River, going approximately 8 km toward east.
- Buamara River: Starting from the same point as Anggou River and going approximately 10 km toward southwest.
- Anggou River: Starting from Railaco Village which is approximately 3 km west of the mouth of Balele River and going approximately 8 km westward.

Bemos River is one of the water sources in Dili City. Data/records of the Directorate of Water Supply and Sanitation showed that the river discharge at the intake site ranges from 197 lit/sec. in the dry season to 282 lit/sec. at the onset of the rainy season (October/November).

(3) Sub-watersheds Classification

The Laclo and Comoro watersheds are divided into 11 sub-watersheds and five sub-watersheds, respectively, in accordance with the hydrological networks. Figure 3.4 shows the sub-watersheds in the target watersheds, while the following table gives the areas of each sub-watershed.

Sub-watersheds in the Laclo and Comoro watersheds

Watershed	Sub-watershed	Area (ha)	%
Laclo	Downstream of Laclo	6,183	4.1
	Sumasse	16,765	11.1
	Ue Coi	8,778	5.8
	Lihubani	16,966	11.2
	Lohun	17,161	11.3
	Noru	12,852	8.5
	Eraibanaubere	13,528	8.9
	Malikan	5,630	3.7
	Daisoli	12,487	8.3
	Monofunihun	14,316	9.5
	Manotahe	6,450	4.3
Comoro	Downstream of Comoro	737	0.5
	Bemos	4,391	2.9
	Balele	9,325	6.2
	Buamara	3,452	2.3
	Anggou	2,307	1.5
Total		151,330	100

Source: JICA Study Team

3.1.4 Major Water Uses in and around the Watersheds

The waters of the Laclo River are used for the Laclo irrigation system located along the main course of the river. About 600-700 ha of lowland rice fields are presently irrigated by the waters of the river. Besides, there are traditional irrigation systems along the main stream of Laclo River especially in the lower part of the watershed.

Water supply for Dili is the most important use in the Comoro river basin. Bemos River, which is one of the tributaries of Comoro River, supplies drinking and domestic water to about 30 % of the total population in the city as shown below.

Average Daily Water Production of Major Sources of Water Supply to Dili

(Unit: lit/sec)

Source	Volume of production	Average	Share (%)
Bemos Intake	**150-250**	**200.0**	**27.9**
Malao Intake	15-150	82.5	11.5
Bemori Intake	20-160	90.0	12.5
Benamauk Intake	10-150	80.0	11.1
Bore holes in Comoro	150-180	165.0	23.0
Bore holes in Kuluhun	42-52	47.0	6.6
Bore holes in Bidau	20-30	25.0	3.5
Bore holes in Becora	20-28	24.0	3.3
Bore hole in Bedori	3-5	4.0	0.6
Total	430-805	717.5	100.0

Source: Original data are given by National Directorate of Water Supply and Sanitation (Arranged by the JICA Study Team)

3.1.5 Topography

(1) Laclo Watershed

The elevation of the Laclo watershed ranges from the sea level to 2,512 m at the southwestern edge of the watershed which is a part of the Daituto protected area. The topographic characteristics of the watershed are summarized as follows.

i) Eastern upper/medium stream of the watershed (Laclubar area)
The peak of southern boundary of the watershed with approximately 1,100-1,400 m high divides the country into different climatic zones. Villages located in lower hilly areas with an altitude of 500-1,000 m are surrounded by the higher mountains of 700-1,200m asl. The slopes on the surrounding hills are generally steep, especially those along the southern edges of the watershed (more than 60 %).

ii) Mouth of Laclo River (Manatuto district capital)
A floodplain created by Laclo River is surrounded by hills at a height of approximately 100-500 m above the sea level. The gradient of the hill is lower compared to the upper/middle stream of the watershed.

iii) Northwestern part of the watershed
The mountains at heights of 1,000-1,200 m create the boundaries of the watershed with ridges southward. Hilltops are generally steep and relatively flat highlands at 700-900 m above sea level are also found.

iv) Southwestern part of the watershed (Aileu district capital)
The elevation ranges between 900 and 1200 m in the valley and 2,500 m at the peak. These are the highest parts of the watershed. Hilltops are steep, but the valley bottom has a large flat plain with paddy fields.

(2) Comoro Watershed

The elevation of the watershed ranges from the sea level to 1,410 m at the west edge of the watershed. The watershed is formed by two valleys surrounded by the steep mountains of 1,000-1,300 m elevation on the south and those of 700-800 m on the north. Railaco Valley formed by Anggou and Boera Rivers has elevation between 450-650 m while Bazartete is 920 m high.

(3) Slopes

The distribution of slope degrees in the watersheds is presented in Figure 3.5, and summarized below.

Degree of Slopes in the Laclo and Comoro Watershed

(unit: ha)

Watershed / Decree (%)	0 ~ 8	8 ~ 15	15~25	25~40	40~55	55<
Laclo watershed	9,988	17,885	30,566	40,114	19,731	12,844
Comoro watershed	630	1,716	3,677	6,897	4,388	2,904
Total	10,618	19,601	34,233	47,011	24,119	15,748

Source: JICA Study Team

3.1.6 Soils

The soils in the watershed are generally thin and with low water-holding capacity. According to the soil map produced by ALGIS as shown in Figure 3.6, the Laclo and Comoro watersheds are largely covered with three soil types: Haplustolls, Humitropepts, and Xerochrepts.

Distribution of Soil Types in the Watersheds

Soil Classification	Comoro watershed		Laclo watershed		Total	
	(ha)	(%)	(ha)	(%)	(ha)	(%)
Chromusterts	0	0.0	7,015	5.3	7,015	4.6
Fluvaquents	0	0.0	637	0.5	637	0.4
Haplustolls	**0**	**0.0**	**42,181**	**32.2**	**42,181**	**27.9**
Humitropepts	**6,121**	**30.3**	**37,389**	**28.5**	**43,510**	**28.8**
Pelluderts	0	0.0	2,364	1.8	2,364	1.6
Tropaquepts	191	0.9	1,043	0.8	1,234	0.8
Tropofluvents	698	3.5	3,304	2.5	4,002	2.6
Ustifluvents	248	1.2	0	0.0	248	0.2
Ustropepts	234	1.2	1,059	0.8	1,293	0.9
Xerochrepts	**12,519**	**61.9**	**32,219**	**24.6**	**44,738**	**29.6**
Others	201	1.0	3,908	3.0	4,109	2.7
Total	**20,212**	**100.0**	**131,118**	**100.0**	**151,330**	**100.0**

Source: ALGIS

The middle of the Laclo watershed and the western parts of the Comoro watershed are covered with Humitropepts characterized by deep soils with dark color containing rich organic matters. The southeastern part of the Laclo watershed and the northern side of Laclo River along the Lihobani River catchment are covered with Haplustolls developed under forested conditions. Xerochrepts type, which has pale-colored soils with low cation contents, is found in the northern part and south-western edge of the Laclo watershed and major parts of the Comoro watershed. Along the Sumasse and Ue Coi Rivers, patches of vertisols with reddish and rather drained characteristics (Chromusterts) are dominant. Trofluvents and Fluvaquents (those are recent alluvial soils) are found along Sumasse River and on floodplains in the northern side of Laclo River near Manatuto.

Soil depth is largely influenced by vegetative conditions. The effective depth of soil under vegetation with tall trees (>10m) is often more than 1 meter. The soils in open forest with dispersed trees or with limited vegetative cover, which are commonly found on steep slopes, hilltops and top of ridge, are shallow with reddish and unproductive laterite.

In the upper Sumasse watershed in the Laclo watershed, where little vegetative cover remains, rill erosion is commonly found on the steep slopes. Signs of gully and sheet erosion, which causes gully erosion on tributaries/streams and sedimentation in the main rivers, are also occasionally found in the upstream of both watersheds.

3.1.7 Geology

Geologically, Timor Island belongs to the Australian continental plate of which the bedrocks are mainly sedimentary calcareous. The distribution of geological types in the watersheds is presented in Figure 3.7, and summarized below.

Distribution of Geological Type in the Watersheds

Geology Formation	Geology Age	Lithology	Laclo watershed		Comoro watershed		Total	
			ha	%	ha	%	ha	%
Aileu Formation	Permian	Phyllite, Schist, Amphibolite, Slate, some volcanic rocks,	53,623	40.9	19,668	97.3	73,291	48.4
Ainaro Formation	Pleistocene	Conglomerates, sand, clay	2,040	1.6	544	2.7	2,584	1.7
Aitutu Formation	Triassic	Calcilutite, marl, calcareous shale, calcarenites	8,630	6.6	-	-	8,630	5.7
Alluvial	Holocene	Loose sediments, clay to boulders,	5,368	4.1	-	-	5,368	3.5
Cribas Formation	Permian	Shale, Claystone, Siltstone, Sandstone, Calcarenites	1,235	0.9	-	-	1,235	0.8
Lolotoi Formation	pre-Premian	Phyllite, Schist, Gneisses	20,004	15.3	-	-	20,004	13.2
Maubisse Formation	Permian	Reefal Limestones,	29,546	22.5	-	-	29,546	19.5
Wailuli Formation	Jurassic	Lower part sandstone, shale, siltstone, limestone.	10,671	8.1	-	-	10,671	7.1
Total			131,117	100.0	20,212	100.0	151,329	100.0

Source: ALGIS

The parent materials of the watersheds consist of limestone in the southern Laclo watershed and phyllite in the upper Laclo and the Comoro watersheds. Phyllite materials in the watersheds (between coastal and the central mountains at the elevation approximately 1,000 m) are rather geologically fragile, thus easily eroded when exposed to air due to the surface soil erosion.

3.1.8 Vegetation and Forest Covers

(1) General Background

A study made by George A. Bouma and Halina T. Kobryn in 2004 estimated the total area of forests and woodlands in the country in 1999 at 801,700 ha. The same study concluded that between 1972 and 1999, a total of 114,000 ha of closed forest and 78,000 ha of woodland were converted to open land or other types of land use such as agricultural land or settlement.

The study also pointed out that the main cause of forest degradation in Timor-Leste was attributed to large scale deforestation that took place between the 1970's and 1990's and exploited valuable woods of natural forests in the country.

(2) Current status of the vegetation in the watershed

The vegetation and forest conditions in the watersheds were assessed by using landsat images and aerial photos taken in 2003 and 2002, respectively. Furthermore, a forest survey was carried out in January 2007 to verify the present vegetation and forest covers in the watersheds.

As a result, the vegetation and land use types in the watersheds were classified into eight classes as shown below.

Category of Vegetation and Land Use

Category of Vegetation and Land use	Criteria of categorization
1. Forests	
1-1: Closed forest (natural)	Canopy closure : > 70%
1-2: Medium forest (natural)	Canopy closure : 30 - 70 %
1-3: Woodlot (natural)	Canopy closure : 15 - 30 %
2. Shrub land	Dominated by shrubs
3. Grassland (including grazing lands and upland farms)	Dominated by grass (No woody vegetation)
4. Coffee plantation	Coffee with shade tree (Casuarina/Falcata)
5. Bare land (including grazing lands and upland farms)	No vegetation or burned grassland
6. Sandbar/River bed	
7.Paddy field	
8. Settlements	

Source: JICA Study Team

Figure 3.8 shows the present land use and vegetation map covering the watersheds. Areas distributed to each land use/vegetation class are presented in Table 3.1, and summarized as follows:

Areas of Each Land Use Class in the Watersheds

Land use class	Comoro watershed		Laclo watershed		Total	
	(ha)	(%)	(ha)	(%)	(%)	(ha)
1. Forests						
1-1: Closed forest (natural)	2,185	10.8	4,998	3.8	7,183	4.7
1-2: Medium forest (natural)	4,062	20.1	28,556	21.8	32,618	21.6
1-3: Woodland (natural)	1,978	9.8	17,103	13.0	18,991	12.5
2. Shrub land	6,094	30.2	46,457	35.4	52,551	34.7
3. Grassland	1,777	8.8	13,068	10.0	14,485	9.8
4. Coffee plantation	2,680	13.3	779	0.6	3,458	2.3
5. Bare land	1,185	5.9	16,098	12.3	17,283	11.4
6. Sandbar/River bed	183	0.9	2,940	2.2	3,122	2.1
7. Paddy Field	69	0.3	1,174	0.9	1,242	0.8
8. Settlements	0	0.0	36	0.0	36	0.0
Total	20,212	100.0	131,118	100.0	151,330	100.0

Source: JICA Study Team

(3) Dominant Forest Types in the Watersheds

Although forests in the watersheds are generally grouped into three classes as shown above, there are some variations in its structures/constituent species even in the same category mainly because of history of human interventions and natural environment (climate, soils, groundwater, and hydrology). The forest survey conducted in January 2007 clarified the dominant forest types and their features in terms of tree size, estimated density and volume in the watersheds as summarized in the tables below. Detailed results of the forest survey are presented in Table 3.2.

Forest Type and Main Tree Species

Vegetation type	Forest type	Main tree species
Closed forest	River side forest	*Acacia leucopea, Dipterocarpus sp.*
	Natural forest in the protected area	
Medium forest	Eucalyptus woodland	*Eucalyptus alba, Eucalyptus urophylla*
	Casuarina woodland	*Casuarina equisetifolia*
Woodland	Eucalyptus open woodland	*Eucalyptus alba, Eucalyptus urophylla*
	Tamarindus and acacia woodland	*Tamarindus indica, Acacia leucopea*
Plantation	Falcata and coffee plantation	*Paraserianthes falcataria, Mangifera indica*
	Casuarina and coffee plantation	*Casuarina equisetifolia*
	Other plantations (Teak, Gmelina)	*Tectona grandis, Gmelina arbolea*
Shrubs	Shrubs	Some indigenous shrubs

Source: JICA Study Team

Tree Size, Estimated Density and Volume of Each Forest Type

Type of forest	Average		Average volume per tree (m^3/tree)	Average tree density (trees/ha)	Average estimated volume (m^3/ha)
	DBH* (cm)	Height (m)			
Tamarindus & Acacia woodland	21.9	6.6	0.13	169	21.97
River side forest	24.3	10.4	0.27	250	67.50
Eucalyptus woodland	21.8	13.4	0.44	330	145.20
Casuarina woodland	34.1	20.4	1.23	289	355.47
Casuarina & Coffee plantation	25.8	28.0	0.97	304	294.88
Falcata & Coffee plantation	53.4	20.5	2.52	119	299.88

Note: DBH means "diameter at breast height".
Source: JICA Study Team

Among others, eucalyptus woodland widely extends from dried lower hills to humid high mountains in the watersheds, although there are some variations in species and size, and density of the trees. It is also noted that coffee plantation with overgrown falcata trees is a distinctive vegetation in the watersheds, especially in the Comoro watershed. It is commonly found in the area with more than 600 m asl in the entire Comoro watershed and southern parts of the Laclo watershed.

Detailed descriptions of each forest type are given in Table 3.3, and some of the features are highlighted below.

a. Closed Forest- River side forest

The river side forest is composed of indigenous trees (e.g., *Acacia leucopea* and *Dipterocarpus indicus)*, which tend to form a closed canopy, and other indigenous shrubs. This type of forest seems to be rather intact or protected by rural communities. Cutting, grazing and other activities are not likely common practices in the said location.

b. Closed Forest- Natural forest in the protected areas

Natural forests distributed in the mountainous area designated as protected area by UNTAET No. 2000/19 are categorized as closed forests. This type of forest is less exploited or disturbed due to its remoteness.

c. Medium Forest- a) Eucalyptus forest

There are two dominant local species of eucalyptus in the watershed, *Eucalyptus alba* and *Eucalyptus urophylla*. Eucalyptus forest extends from mountain slopes in the higher elevation to dried low lands. Tree size, density, and the extent of degradation vary with their topography, soil conditions and intensity of human uses.

d. Medium Forest- b) Casuarina forest

Forests dominated by *Casuarina equisetifolia* are mainly distributed in the downstream of Laclo River and on mountain slopes in Laclobar. Along Lalco River, Casuarina woodlands form riparian forests either on river banks or sandbanks are made up of sediments from the upstream. Although Casuarina forests along Laclo River are located close to communities, there is no sign of cutting trees observed at all.

e. Woodland- a) Eucalyptus open woodland

Main species are *Eucalyptus alba* and/or *Eucalyptus urophylla* in this type. It is distributed from lower hills with a gentle slope to highlands with a steep slope. The ground is covered with wild grasses which can be used for grazing in some locations.

f. Woodland- b) Tamarindus and Acacia woodland

The woodland composed of *Tamarindus indica, Dipterocarpus indicus, Acacia leucopea* with some indigenous shrubs, etc., is distributed on hill slopes located in the downstream of Laclo River. Due to the severe climatic conditions that affect vegetation, the growth of ground cover (grasses and small shrubs) is generally poor.

g. Plantation- a) Falcata and Coffee plantation

Coffee plantations mixed with Falcata (*Paraserianthes falcataria*) trees were found in mountain slopes in the entire Comoro watershed and the southern and south-western parts of the Laclo watershed. In many locations, Falcata trees are over-aged (probably more than 50 years) and more than 20 meter high with wide and closed canopies. In general, this type of coffee plantations can be classified as closed forest in terms of the canopy closure.

h. Casuarina and Coffee plantation

Coffee plantations mixed with Casuarina trees are mainly distributed in the western part of Laclo River watershed. They are found on hills surrounding the Aileu basin and on mountain slopes along the watershed boundary between the Camoro and Laclo watersheds. Because of its resistance to strong wind and drought, Casuarina was introduced to serve as a shade tree in this area instead of Falcata, since the latter cannot grow well under such conditions.

i. Other plantations

In addition, plantations of timber trees, such as Teak (*Tectona grandis*), Gmelina (*Gmelina arborea*) and Eucalyptus (*Eucalyptus spp.)* are also found in the watersheds though its scale and area are limited. Teaks planted in the watershed are sometimes damaged by grazing animals (buffalo and cattle) as shown in the picture.

j. Shrubs and grasslands

Shrubs were commonly found on the foot of hills in the western part of the Laclo watershed. They are mainly composed of indigenous trees. The average height of shrubs is less than 3 m. In many areas, shrubs are used for grazing animals, such as cattle, baffalo and goats. Grasslands on steeper stony fans also support animal grazing. *Corypha utan* grassland is commonly found in flat floodplains.

3.1.9 Landslides and Soil Erosion

(1) Current Status of Landslides in the watersheds

The current status of landslides in the watersheds was assessed by the interpretation of aerial photographs taken in 2002 and a field reconnaissance survey conducted in January 2007. As a result, a landslide/slope failure distribution map was prepared as shown in Figure 3.9. The following table shows the status summary.

Number and Size of Landslide/Slope Failures in the Watersheds

Watershed	Sub-watershed	Landslides/Slope Failures	
		No.	Area (ha)
Laclo	Downstream of Laclo	0	0.0
	Ue Coi	4	8.9
	Sumasse	7	104.6
	Lihubani	6	1.0
	Daisoli	8	1.5
	Monofunihun	1	1.1
	Manotahe	0	0.0
	Noru	2	1.0
	Eraibanaubere	15	11.1
	Malikan	10	49.3
	Lohun	3	93.6
Sub-total		**56**	**272.1**
Comoro	Downstream of Comoro	0	0.0
	Bemos	0	0.0
	Balele	1	1.5
	Buamara	0	0.0
	Anggou	1	2.8
Sub-total		**2**	**4.3**
Total		**58**	**276.4**

Source: JICA Study Team

The landslides/slope failures in the Study area are concentrated in the Laclo watershed, especially in the upper part of Ue Coi, Sumasse, Eraibanaubere, Malikan and Lohun sub-watersheds. The current conditions of soil movement in both watersheds observed through the field survey are summarized below:

a. Laclo watershed

In the Laclo watershed, a number of shallow landslides (depth<1.0m) are observed along the road, mainly due to improper slope protection works (steep and/or without protective measures) during road construction. Deep landslides (depth>1.0m) are commonly found in hilltops along the upper part of Sumasse River and Ue Coi River. The hilltops are covered with less vegetation and have weathered shale rock with a steep slope.

Sheet and gully erosion is commonly found along tributaries in the middle and upper Laclo watershed. The collapse of limestone-based fluvial terrace (H>15m) is also observed along Sumasse River.

In the lower Laclo watershed, the control of sedimentation in Sumasse River is an urgent issue, since siltation in the intake and canals of the Laclo irrigation system has adversely reduced the efficiency of the system. Flashfloods in Sumasse River also threaten farmers in the lower Laclo watershed as the floods often change the river course and erode the river bank adjacent to their farms. It seems that soils deposited from landslides, gully erosion of tributaries, and collapse of fluvial terraces in the middle and upper watershed are the main sources of sedimentation in the river.

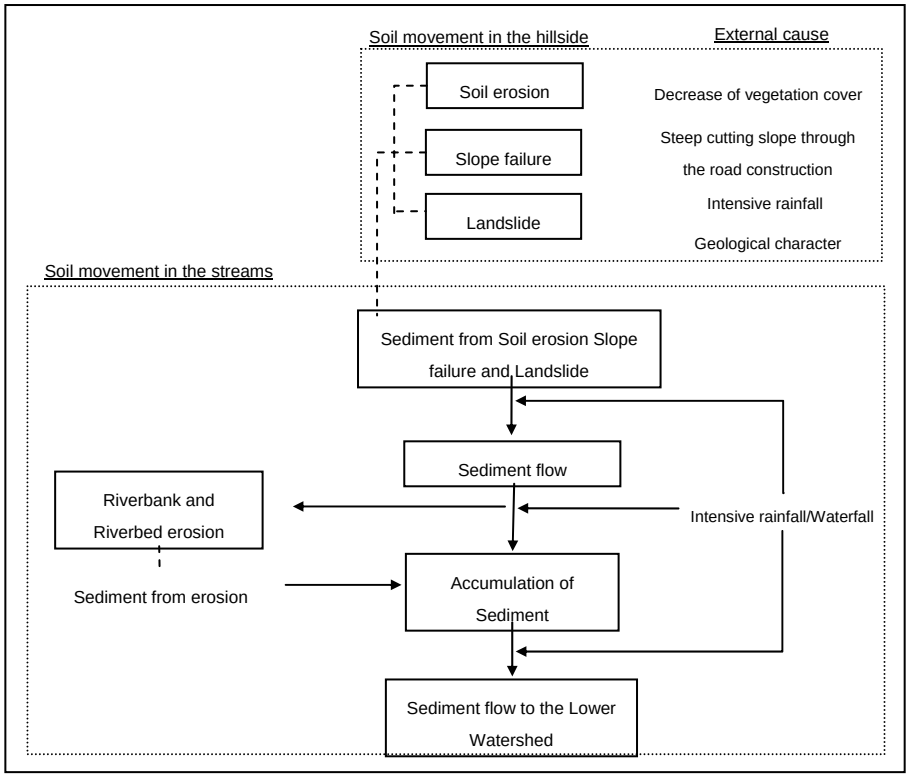
b. Comoro watershed

In the upper Comoro watershed, the sub-recent fluvial soils, which are rather geologically fragile, are distributed around Railaco sub-district in Ermera. In fact, some shallow landslides are observed in slopes along the river in this area. As compared with the Laclo watershed, the size of landslide is relatively small (height<1.0 m). The shallow landslides are mainly located along the roads due to improper slope cut during construction of the roads, which is similar to what are observed in the Laclo watershed.

Sheet and gully erosion was also found in the upper tributaries of the watershed and some of these were located close to the water sources of the communities.

(2) Mechanism of soil movement in the watersheds

Based on the field reconnaissance survey, the mechanism of sediment flow in the watersheds is illustrated below.



Mechanism of Soil flow in the Watershed

The above figure indicates that the main source of sediments in the watersheds is divided into three types: i) soil erosion including riverbank and riverbed erosion, ii) slope failures and iii) landslides. These are caused by various factors such as decrease of vegetation cover, steep cutting slope during road construction, intensive rainfall and its geological character. At the same time, the sediment itself further accelerates the production of sediment. When it flows down with a heavy rain, the flow with sediments erodes riverbanks and/or riverbeds downstream in the basin. Thus, sediments are accumulated in the lower watershed along the main river streams.

(3) Current Status of Soil Erosion

The potentials of surface soil erosion in the watersheds were roughly estimated by using the Universal Soil Loss Equation (USLE) method. Since all the data and information required for the USLE estimation were not available in the country, the estimation was made on several assumptions. Details of the method and assumptions made are described in Annex-A in Annexes.

It is difficult to directly evaluate the values/data of the estimated soil erosion potentials since they are based on a rough estimate without any field validation and reliable data/value as calculation factors.

Therefore, in order to make a relative evaluation of the results of USLE, the values/data for the estimation were classified into five, namely, i) severe, ii) high, iii) moderate, iv) low, and v) very

low. Five-grading classification method was employed by splitting the total range of the data into five classes as shown below.

Criteria for Evaluation of Potentials of Soil Erosion

Potential level	Very low	Low	Moderate	High	Severe
Estimated amount of annual soil loss by USLE calculation (t/ha/yr)	0-250	250-500	500-750	750-1,000	1,000-

Source: JICA Study Team

Based on the above criteria, soil erosion potentials were estimated at suco (term used to define a village in Timor-Leste) and watershed levels as shown in Figure 3.10. The following table also shows its summary.

Potentials of Soil Erosion in the Watersheds

Watershed	Unit	Potential level of soil erosion					
		Very low	Low	Moderate	High	Severe	Total
Comoro	ha	13,225	398	457	477	5,654	20,212
	%	65.4	2.0	2.3	2.4	28.0	100
Laclo	ha	75,031	6,362	5,635	5,279	38,810	131,117
	%	57.2	4.9	4.3	4.0	29.6	100
Total	**ha**	**88,256**	**6,760**	**6,092**	**5,756**	**44,464**	**151,329**
	%	**58.3**	**4.5**	**4.0**	**3.8**	**29.4**	**100**

Source: JICA Study Team

As shown above, about 28 % of the Comoro watershed and 30 % of the Laclo watershed are considered highly susceptible to surface soil erosion. It is essential to introduce soil erosion control measures as well as proper land use and management in those highly potential areas.

3.1.10 Protected Area

Fifteen protected wild areas throughout the country were designated under Regulation No. 2000/19 as shown below.

Protected Areas Specified under Regulation No. 2000/19

No.	Name of Location	Remarks
1	Jako Island	Total area of the island together with surrounding rocks, reefs and other surface and sub-surface features
2	Tutuala Beach	Beach and the adjacent forest, an area of approximately 25,000 ha
3	Cristo Rei Beach and Hinterland	
4	**The summit of Tata Mailau Mountain**	**Approximately 20,000 ha including all elevations of Tata Mailau Mountain above 2,000 meter and the surrounding forest**
5	The summit of Sadoria Mountain	All elevations on Sadoria Mountain above 2,000 meter and surrounding forest
6	The summit of Malobu Mountain	All elevations on Malobu Mountain above 2,000 meter and surrounding forest
7	**The summit of Mount Diatuto**	**Approximately 15,000 ha including the surrounding forests**
8	**The summit of Mount Fantumasin**	**Approximately 4,000 ha including the surrounding forests**
9	The Riverlet Clere Sanctuary	Approximately 30,000 ha
10	The Tilomar Reserve	Approximately 12,800 ha
11	The Lore Reserve	Approximately 11,000 ha

No.	Name of Location	Remarks
12	The Monte Mundo Perdido	Approximately 25,000 ha
13	The summit of Monte Matebian	Approximately 22,000 ha including all elevations of Monte Matebian above 2,000 meter and the surrounding forest
14	The Monte Cablaque	Approximately 18,000 ha including the surrounding forest
15	The Manucoco Reserve	Approximately 4,000 ha

Source: Regulation No. 2000/19, MAFF

Because the demarcation survey for these protected areas has not been conducted yet, there are no clear boundaries showing the extent of the areas in the field as well as on the maps. However, according to the Directorate of National Parks and Protected Area in NDF, part of Mount Diatuto may overlap with the southern part of Laclo watershed. Likewise, part of Mount Fantumasin and the north-eastern slope of Tata Mailau Mountain overlap with the western part of Comoro watershed and the western part of Laclo watershed, respectively.

According to the regulation, any kind of human activities which might cause deterioration of its vegetation, such as building temporary/permanent structure and roads, hunting, taking plants, agriculture and animal grazing, are prohibited within the protected wild areas. However, the following activities are permitted in the same areas: 1) harvesting non-forest products, 2) selective grazing, 3) use of non-endangered animal/plant for religious/cultural ceremonies, and 4) traditional tree harvest at the elevation below 2,000 m,.

3.1.11 Other Critical Areas

A catchment of Bemos River in the Comoro watershed, especially the area from the water intake of the water supply system for Dili City, are quite crucial for people living in Dili since the said river supplies about 30% of the city's water demand as described in Section 3.1.4. Hence, the emphasis should be given to such a catchment in the planning and implementation of this watershed management plan.

The water intake is located at latitude 8° 37′ 34″ S and longitude 125° 33′ 40″ E on Bemos River. Figure 3.11 shows the location of the water intake and the catchment of Bemos River. The present land use in the catchment is shown in the following table.

Areas of Each Land Use in Bemos Catchment

Land use class	Bemos Catchment		Comoro watershed	
	(ha)	(%)	(ha)	(%)
1. Forests				
1-1: Closed forest (natural)	396	15.7	2,185	3.8
1-2: Medium forest (natural)	763	30.3	4,062	21.8
1-3: Woodlot (natural)	102	4.0	1,978	13.0
2. Shrub land	895	35.5	6,094	35.4
3. Grassland	150	6.0	1,777	10.0
4. Coffee plantation	148	5.9	2,680	0.6
5. Bare land	67	2.7	1,185	12.3
6. Sandbar/River bed	0	0.0	183	2.2
7. Paddy Field	0	0.0	69	0.9
8. Settlements	0	0.0	0	0.0
Total	2,521	100.0	20,212	100.0

Source: JICA Study Team

3.2 Socio-economic Conditions

3.2.1 Districts, Sub-districts and Sucos

Figure 3.12 shows the districts, sub-districts and sucos located in and around the watersheds. A total of seven districts or 14 sub-districts are geographically related to the watersheds as shown below.

Numbers of Districts, Sub-districts and Sucos in and around the Watersheds

Watershed	District	Sub-district related	No. of Sucos covered		Area covered (ha)
			Fully/mainly	Partially	
Comoro	Dili	Domo Alexio, Vera Cruz	0	2	1,733
	Liquica	Bazartete	0	4	4,917
	Ermera	Railaco	5	4	8,064
	Aileu	Laulara, Aileu	4	5	5,498
Sub-total	4 Districts	6 Sub-districts	9	15	20,212
Laclo	Dili	Metinaro	0	2	710
	Ainaro	Maubisse	2	3	6,445
	Manufahi	Turiscal	1	4	7,007
	Aileu	Aileu, Laulara, Liquidoe, Remexio	22	7	59,888
	Manatuto	Laclubar , Laclo, Manatuto	8	6	57,068
Sub-total	5 Districts	10 Sub-districts	33	22	131,118
Grand total	7 Districts	14 Sub-districts	42	31	151,330

Source: JICA Study Team
Note; Since some of villages are covered by both watersheds, the grand total of suco of "Partially covered" are lower than those obtained by just adding up the figures of the respective watersheds.

As shown in the table above, a total of 73 sucos are geographically related to the watershed either fully or partially. Out of 73 sucos, 42 fully overlap with the watersheds.

3.2.2 Demography

The current demographic conditions in and around the watersheds were estimated based on the statistics data in 2004 and 2007[2]. The results of the estimation is presented in Table 3.4, and summarized below. Figure 3.13 also shows the estimated population density of each suco in 2004. In the estimation, sucos where the overlap with the watersheds is less than 100 ha were not included. Additionally, those in the Dili district were not counted, since its population is quite large and most of them likely live outside the watersheds.

[2] Data in 2004 is the 2004 Census of Population and Housing done by NSD, while that in 2007 Registration of Annual Population 2007.

Population in the Sub-District in and around the Laclo and Comoro River Basins

Watershed	Sub-districts	Households (2004) *1	Population (2004) *!	Households (2007) *1	Population (2007) *!	Population increase rate
		(No. of HHs)	(No. of persons)	(No. of HHs)	(No. of persons)	(% / annum)
Comoro	Bazartete	1,955	10,436	2,330	12,530	6.3
	Railaco	1,720	9,293	1,706	9,905	2.1
	Laulara	1,081	5,448	1,160	6,032	3.5
	Aileu	495	2,558	596	3,309	9.0
Sub-total	4 Sub-districts	5,251	27,735	5,792	31,776	4.6
Laclo	Maubisse	840	3,687	4,001	21,395	7.6
	Turiscal	582	3,152	321	1,573	4.0
	Aileu	3,492	17,166	1,354	6,280	2.6
	Laulara	287	1,397	1,967	10,576	3.7
	Liquidoe	1,312	5,819	913	4,780	9.0
	Remexio	1,860	9,493	634	4,006	8.3
	Laclo	1,774	7,558	1,966	10,431	19.2
	Laclubar	1,297	6,159	1,604	7,183	-1.7
	Manatuto	1,013	4,218	1,883	9,257	30.0
Sub-total	9 Sub-districts	12,457	58,649	14,643	75,481	8.8
Whole watersheds<1	13 Sub-districts	16,926	82,429	19,518	102,375	7.5

Source: *!: The 2004 Census of Population and Housing (2004), DNS
*2: Registration of Annual Population 2007,DNS
Note: <1 Since several sucos are covered by both watersheds, the figures of the whole watersheds are lower than those obtained by just adding up the figures of the respective watersheds.

In 2007, a population of 102,375 resided in sucos related to the watersheds except those in Dili. In comparison with 2004, the populations in the Comoro and Laclo watersheds have increased by 4.6% and 8.8%, respectively.

3.2.3 Land Tenure Status

(1) Overview of Current Land Tenure Status of the Country

Land tenure status in the country is still unclear and complex even though Timor-Leste is considerably small. Although the land law (Law No. 1/2003) classified the land ownership into three types, namely, i) private; ii) state private, and iii) public domain, no actual classification/registration has been implemented on the ground, mainly due to lack of legislation on land registration.

In fact, the "East Timor Land Law Program" (ETLLP) supported by USAID drafted a law related to land registration (entitled as "Juridical Regime of Immovable Property-Part III: Property and Transfer Systems, Land Registration, Pre-Existing Rights and Title Restitution.") in 2004/2005. However, the drafted law is still put on hold by the government and is yet to be finalized. Since this law is the most essential part for the implementation of land registration, it is important to facilitate the process of its enactment. Accordingly, the drafted law on land rights and title restitution proposes to classify the land titles into the following types:

- Public land-Public domain (roads, ports, etc.);
- Public land-Private domain (school yards, government-related building yards, etc.);
- Private land-Communally-owned; and
- Private land-Individual owned.

It is noted that the draft law suggested that the land ownership in rural areas be granted to the community and be managed by them in accordance with its customary rules/norms as land ownership in rural areas was complex[3].

(2) Customary Land Tenure System in Rural Areas

In addition to the fact that almost all the lands in rural areas are still unregistered[4] and governed by a customary law, the traditional customary system which is highly diversified from village to village makes the situation difficult to understand. In Manatuto sub-district, most of the irrigated rice fields in the Laclo River irrigation system[5] are owned by large-sized land owners and rented to tenant farmers. Meanwhile many farmers in Sucos Maneria and Sananain in Laclobar sub-district, Manatuto, practice shifting cultivation in communal land or private lands owned by other farmers without charge.[6].

In many cases, village authorities and communities are generally knowledgeable of the boundaries and the ownership of lands that belong to the community (both communal and private lands), though no written document exists. Despite the massive resettlement programs experienced during the Indonesian period, the traditional customary land tenure still remains strong[7] and the lands are regarded as the properties belonging to a community or a kinship group (a clan) who traditionally manage them.

The status of lands in community is generally classified into communal lands (those belonging to community) and individual / private lands (those belonging to individual households in customary laws).

i) Communal land
Communal land is managed by community leaders. It comprises sacred places (e.g., sacred forests, sacred water sources, sacred house and grave sites) and lands that are not owned privately. According to an Oxfam study report as well as interviews with the staff of some NGOs (Halarae, USC Canada, and Care), communal lands are also used for shifting cultivation as well as upland farming by community members including outsiders (migrants).

ii) Individual/Private land
Individual/private lands are those that have been inherited from the respective ancestors. These lands are marked with trees, rocks, natural contours, ancestral graves, or distinctive plants, and are acknowledged by village authorities as well as community members[5]. Those lands are generally used for farming (garden/upland farm/lowland rice), house yards, forests, reserve for future upland farms and coffee plantations, and are often rented to other community members in the village for temporary farming without charge.

Based on a case study undertaken by ETLLP, the ownership patterns and possible transactions of the lands in a community are assumed as shown below.

[3] The information was obtained from the Team Leader of ETLLP.

[4] Of an estimated 200,000 land parcels in Timor-Leste as a whole, less than 25% have ever been formally registered in either the Portuguese or Indonesian era (Source: Report on Research Findings, Policy Options and Recommendations for a Law on Land Rights and Title Restitution (ETLLP, 2004))

[5] The information was given by the Japanese expert of the Laclo River irrigation project. Accordingly, one third of irrigated lands are occupied by big landowners and a tenant farming system has already been structured in the area.

[6] USC Canada has implemented agroforestry and reforestation projects in those villages in Laclobar sub-villages from 1997.

[7] The Customary Use and Management of Natural Resources in Timor Leste (OXFAM, 2003)

Land Ownership and Possible Transactions by Land Use Categories

Type of Land	Level of Ownership	Sale of Lands	Can be Rented?	Can be Lent?
House yard	Individual	Highland: No Coast: Maybe Yes	Highland: No Coast: Maybe Yes	No
Unused land	Community	No	No	Yes (Outsiders may use but not own.)
Upland farm / Shifting cultivation	Individual, clan group, Community	No	No: Suco members Yes: Suco outsiders	Yes (No payment by suco members)
Rice field	Individual, clan group,	Yes (payment in cash or cattle)	Yes (payment in cash or portion of harvest)	Same as rental
Fruit trees	Individual	No	No	Yes: no payment
Sacred sites	Community	No	No	No

Source: Report on Research Finding, Policy Options and Recommendations for a Law on Land Rights and Title Restitution, 2004

There seems to be a clear rule and understanding in each community. It is therefore recommended that the status of land ownership and management rules be discussed more and studied in the implementation of the watershed management plan at each suco, so that the current systems can be taken into account.

(3) Land Classification in the Study Area

As described in the sections above, there are no information/data showing the status of land classification of the watersheds at present.

3.2.4 Current Situations of the Agriculture Sector in and around the Watersheds

As there was no agricultural statistics giving details of its agricultural conditions at village level, the agricultural conditions of the target watersheds were basically outlined based on the information on district level. The village profile survey conducted between December 2005 and March 2006 also gave indications to understand characteristics of agricultural activities at village level. The following information, reports and statistical data were used for assessment.

- Statistics data of annual crops in 2004/2005
- Livestock Population in Timor-Leste 2004-2005
- Statistics data of coffee from 2000-2006
- The 2001 Survey of Suco
- Village profile survey conducted in 2005/2006
- FAO/WFP Crop and Food Assessment (2003)

(1) Agricultural Conditions in the Watersheds

Overviews of agricultural conditions in the districts geographically related to the target watersheds are highlighted below.

Agricultural Overview by District

District	Overview
Aileu	The district produces mainly maize and cassava, while rice is less important. The district is also a big producer of vegetables and fruits. Main livestock are chicken, pigs and goats. Maize production is sometimes affected by the delay and lack of rain at the beginning of the growing season, especially in Remexio and Liquidoe sub-districts. Problems with rodent infestation are also reported in many areas. In 2003, coffee, vegetables and fruits, which are income-generating commodities for many farmers, were affected by drought.
Ermera	The district produces maize, cassava and to a lesser extent, rice. Maize output is usually reduced when a severe drought takes place. During the drought in 2003, the population has already reverted to coping strategies such as increasing cassava consumption and/or increasing sales of fuel wood. Main livestock are horses, buffaloes and goats. Coffee production is an important cash crop and 29,000 hectares are under the crop often on steep slopes. More than 60 percent of organic coffee in the country is produced from coffee plantations in this district.
Liquica	The district is not an important food crop-producing area, relying mainly on coffee as a source of income. The district can be divided into two production zones: the uplands where coffee is produced, and the lowlands where maize is cultivated. There is limited rice cultivation, which is only around the Maubara sub-district. Main livestock are buffaloes, cattle and goats. This district is a chronically food deficit area. In 2003, the coastal area was dryer than usual and maize production was below average. Extensive logging for fuel wood sale was noted as a clear indication that farmers are looking for additional income.
Ainaro	The district produces mainly maize, and to a limited extent, rice and coffee. In the uplands, several high value horticultural crops (Irish potatoes, carrots, beans and cabbages) are grown. Main livestock are cattle, pigs and goats. Drought affected maize production while rice cultivation is ongoing.
Manufahi	The district produces maize in all four sub-districts, but rice production is predominant in Betano and in the sub-district of Same. The district also produces beans, vegetables, fruits and other horticulture crops, and to a limited extent, coffee and candlenut. The main livestock are cattle, buffaloes and goats. In 2003, maize production was lower than average due to drought, especially in Alas sub-district.
Manatuto	Manatuto is the only district that extends from the north coast to the south coast, encompassing all the agro-ecological zones in the country. In the northern part of the district, rice is extensively grown (5,000 hectares) due to the rehabilitated irrigation schemes recently. Approximately 300 hectares are used for a second rice crop with planting in late April/May. In the central uplands, subsistence agriculture is practiced based on maize intercropped with cassava, beans, pumpkins and other crops. Rice is also cultivated on a small scale in rain-fed areas of Natarbora, closer to the south coast. At higher altitudes, coffee is also cultivated to a limited extent. Main livestock are buffaloes, pigs and goats. The level of maize and rice production in 2003 were satisfactory, even though the shortage of rain has affected the northern coastal areas.

Source: FAO/WFP Crop and Food Assessment (2003)

(2) Food Crops Produced in the Watersheds

The predominant annual crops in the districts related to the watersheds are maize, followed by paddy (lowland rice), cassava, other tubers, vegetables, and beans. Planted/harvest areas and production of major crops in the districts in 2007/2008 are shown below. The data for other food crops are included in Table 3.5.

Harvest Areas and Production of Major Crops Produced in the Districts in 2007/2008

Watershed/ District	Paddy				Maize				Cassava			
	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)
Comoro												
Liquica	310	310	465	1.5	1,320	957	1,436	1.5	523	520	1,820	3.5
Ermera	1055	1055	1,371	1.3	2,096	1,982	1,586	0.8	630	625	2,313	3.7
Dili	0	0	0	0	1,257	1,257	1,886	1.5	332	332	1,129	3.4
Comoro/Laclo												
Aileu	776	776	931	1.2	1,726	1,506	753	0.5	843	840	2,940	3.5

Watershed/ District	Paddy				Maize				Cassava			
	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)
Laclo												
Ainaro	1,958	1,958	2,937	1.5	3,840	2,442	1,221	0.5	870	868	2,604	3.0
Manufahi	2,500	2,500	3,750	1.5	5,284	5,108	6,130	1.2	920	915	3,752	4.1
Manatuto	3,450	3,450	5,175	1.5	5,700	5,700	8,550	1.5	545	540	1,998	3.7

Watershed/ District	Sweet Potatoes				Soy bean				Peanuts			
	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)	Plntd (ha)	Hrvstd (ha)	Prod. (ton)	Yield (t/ha)
Comoro												
Liquica	126	121	290	2.4	39	35	28	0.8	87	83	75	0.9
Ermera	250	247	618	2.5	22	22	15	0.7	40	40	36	0.9
Dili	53	43	99	2.3	16	13	9	0.7	19	19	19	1
Comoro/Laclo												
Aileu	130	126	340	2.7	116	110	66	0.6	60	54	65	1.2
Laclo												
Ainaro	325	323	840	2.6	85	81	57	0.7	90	90	99	1.1
Manufahi	287	280	664	2.3	98	91	109	1.2	153	129	155	1.2
Manatuto	253	247	568	2.3	35	35	28	0.8	30	27	27	1

Note: "Plntd ha" indicates "Planted Ha". "Hrvstd ha" means "Harvested Ha."
Source: NDAH, 2008, MAF

The yields of crops are still very low as compared to the average yields in Indonesia[8] due to lack of irrigation facilities, poor quality of seeds, limited farm input application, low soil fertility, and extensive farming practices. Although extensive farming with low input application is one of the farmers' risk aversion strategies under the current circumstances surrounding them, it has kept them at subsistence level.

(3) Vegetables Produced in the Watersheds

The districts in the watershed produce a variety of vegetables. Statistical data for major vegetables are available in Table 3.5, while total production of the vegetables is summarized in the table below. Among the districts, Ermera, Aileu and Ainaro are major production areas.

Vegetable Production in the Districts in 2007

Watershed	District	Total Production (ton)	Major Produce (Relatively Higher than Others)
Comoro	Liquica	525	pumpkin, spinach,
	Ermera	1,294	pumpkin, cabbage, mustard, tomato
	Dili	667	mustard, spinach, kang kung
Comoro/Laclo	Aileu	1,722	garlic, cabbage, mustard, carrot, snow pea, cucumber
Laclo	Ainaro	3,124	onion, garlic cabbage, carrot, mustard, potato, chili
	Manufahi	638	cabbage, kang kung, spinach,
	Manatuto	1,013	chili, long bean, pumpkin, kang kung, spinach

Source: NDAH, MAF (2008)

[8] e.g. as compared to 4.7 ton/ha for paddy and 3.6 ton/ha for maize in Indonesia, 2007 (Source: http://www.bps.go.id/releases/)

(4) Coffee Production in the Districts

Coffee has been the sole export product of Timor-Leste since the mid-nineteenth century. However, the yields of coffee in the country are very low due to the age of coffee trees, excessive shade from overgrown shade trees, crowed coffee plants and poor maintenance[9]. The following table shows the areas planted, production and yields of coffee in the districts from 2007 to 2009. Ermela district is leading the production of dry beans which is around 60% of the total production in the country, followed by Manufahi, Liquica and Ainaro. Although the total production in the country has been slightly decreasing since 2007, these four main districts still share 96% of the total production in the country in 2009. Average annual yield of coffee in Timor-Leste during 2007 and 2009 is 266 kg/ha as calculated from the figures in the table. It is noted that this is two thirds of the yield in Indonesia (402 kg/ha) but only 22% of that in Vietnam (1,235 kg/ha) [10].

Area planted, Production and Yields of Coffee from 2007 to 2009

Year / District	Area (Ha)	Production (ton)			Yield* (ton/ha)
		Cherry	Parchment	Dry Bean	
2007					
Liquica	6,266	10,648	1,936	1,898	0.31
Ermera	30,705	36,072	6,559	6,430	0.21
Aileu	1,434	2,294	417	409	0.29
Ainaro	5,024	5,520	1,004	984	0.20
Manufahi	6,310	12,729	2,314	2,269	0.37
Manatuto	NA	NA	NA	NA	NA
Total	**49,739**	**67,263**	**12,230**	**11,990**	**0.25**
2008					
Liquica	6,466	13,015	2,366	2,320	0.37
Ermera	30,510	44,095	8,017	7,200	0.26
Aileu	1,434	2,805	510	500	0.36
Ainaro	5,124	6,749	1,227	1,203	0.24
Manufahi	6,310	10,732	1,951	1,813	0.31
Manatuto	NA	NA	NA	NA	NA
Total	**49,844**	**77,395**	**14,072**	**13,036**	**0.28**
2009					
Liquica	6,768	4,371	2,185	1,530	0.32
Ermera	30,740	14,304	7,152	5,006	0.23
Aileu	1,434	1,004	502	351	0.35
Ainaro	5,024	3,587	1,793	1,255	0.36
Manufahi	7,310	4,260	2,130	1,491	0.29
Manatuto	NA	NA	NA	NA	NA
Total	**51,276**	**27,525**	**13,763**	**9,633**	**0.27**

Note: Yield is obtained by dividing production of parchment with production area.
Source: NDIPA, MAF (2009)

There is an urgent need to renew or rehabilitate the aged coffee plantations to improve their yields. According to data in 2006, a total of 27,940 ha of coffee plantations are left unproductive in the districts in and around the watersheds.

[9] Overview of the Coffee Sector in Timor-Leste (2004), Oxfam
[10] Source: Coffee planting and harvesting in "Tropical Products: World Market & Trade", The United States, Department of Agriculture, 2004

Area of Unproductive Coffee Plantations in the Districts in 2000 and 2006

Crops	2000			2006		
	Total area	Unproductive area		Total area	Unproductive area	
Districts	(ha)	(ha)	(%)	(ha)	(ha)	(%)
Ermera	25,713	16,286	63	29,225	17,125	59
Liquica	6,455	3,977	62	6,756	3,126	46
Aileu	896	371	41	1,134	384	34
Ainaro	4,662	3,090	66	5,024	3,145	63
Manufahi	5,027	3,032	60	7,310	4,160	57
Manatuto	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
Total	42,753	26,756	63	49,449	27,940	57

Source: NDF, MAF(2006)

(5) Fruits and Other Industrial Crops

Major fruits produced in the country are avocado, mango, banana, citrus, papaya, and jackfruit. Most of them seem to be produced on a small scale throughout the country. Liquica, Ainaro, and Manatuto are relatively abundant areas, especially for avocados, mangos and bananas, respectively.

Harvest Areas and Production of Major Fruits Produced in the Districts in 2007

Watershed/	Avogado		Mango		Banana		Citrus		Papaya		Jackfruit	
Districts	Ha	ton	Ha	ton	ha	ton	ha	ton	ha	ton	ha	ton
Comoro												
Liquica	78.5	910.6	43.65	294.64	24.4	658.8	26.05	161.51	9.9	185.6	23.85	160.9
Ermera	15.96	185.1	34.13	230.38	20.1	542.7	24.75	153.45	25.2	567	9.78	66.02
Dili	0.53	6.15	11.03	74.45	6.7	201	5.25	32.55	1.8	45	4.4	29.7
Comoro/Laclo												
Aileu	8.13	94.31	75.09	506.84	15.2	410.6	22.68	140.62	1	22.5	18.9	127.58
Laclo												
Ainaro	53.55	621.2	138.17	932.65	10.3	309	23.55	146.01	4.3	80.6	11.25	75.94
Manufahi	16.35	189.7	91.43	617.12	11.2	336	8.09	50.15	8.3	186.8	16.11	108.74
Manatuto	43.56	505.3	48.6	328.05	37.3	1,119	8.51	69.1	1.9	42.8	0	0

Source: NDAH, MAFF (2008)

With regard to industrial/tree crops, few plantations such as palm tree, candlenut and coconut were grown in and around the watersheds as shown below.

Major Industrial Crops planted in the Districts in 2004/2005

Watershed/	Coconut		Vanilla		Bitternut		Candle nut		Oil Palm	
District	Ha	Ton	Ha	Ton	Ha	Ton	Ha	Ton	Ha	Ton
Comoro										
Liquica	294	30	24	2	5	0	25	5	0	0
Ermera	13	5	36	2	6	2	7	1	0	0
Dili	21	9	0	0	52	5	6	2	0	0
Comoro/Laclo										
Aileu	19	9	0	0	4	1	167	18	13	5
Laclo										
Ainaro	62	31	0	0	192	28	279	104	0	0
Manufahi	351	274	0	0	468	49	210	86	89	1
Manatuto	238	34	0	0	694	8	162	44	1	0

Source: NDICAB, MAF (2009)

(6) Farming Practices

a. Shifting Cultivation

Shifting cultivation is a common farming system practiced in the country as well as in the target watersheds. During the village profile survey, almost all the villages answered that they were engaged in shifting cultivation in their territories. Maize, cassava, sweat potato, taro, pumpkins, and beans are the main crops planted under shifting cultivation. The sizes of plots vary from 0.5 ~ 1.0 ha depending on the availability of farm laborers.

Farming practices applied under shifting cultivation are: i) land preparation (including slashing and burning), ii) seedling/planting, iii) weeding and iv) harvesting. Land preparation is a laborious and time-consuming work that usually requires three to four months from May/June to the onset of the rainy season (September/October). Planting starts soon or one month after land preparation, which is around October/November. In January and February, farmers are busy in weeding, and then start harvesting products between March and April/May, which is the end of the rainy season.

When a rural household operates shifting cultivation in his/her own area (privately-owned), they generally use the area for two years until the time when they can no longer control weeds. Once he/she judges that it is hard for them to control weeds, a new area is opened and burned for farming. The rotation cycle varies with the number of fertile lands held by a household. It is also commonly found that a family who has limited lands uses a land owned by other families without charge on the condition that a lessee should use such an area only for one year and should not plant any perennial crops except cassava.

b. Maize

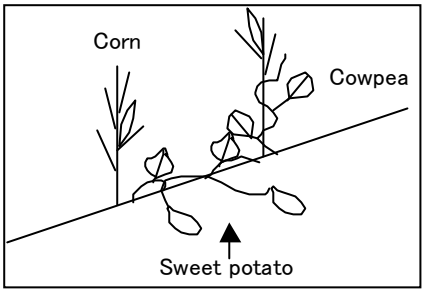
Farmers in hilly/mountainous areas grow maize in their permanent/fixed farms to secure their staple food. There seem to be two ways of cropping maize, mono cropping and mix cropping with other upland crops (cassava, taro, pumpkins, and beans). In either case, no irrigation or farm input is applied. The farming calendar of maize farming is illustrated as follows:

Farming Calendar of Maize Farming

Month	10	11	12	1	2	3	4	5	7	8	9
Maize		↑ Land preparation and					↑ Harvesting				

Source: Village Profile Survey (2006), JICA Study Team

In mixed cropping fields, farmers maximize use of the area by planting maize (as a standing crop) mixed with cowpeas (as a climbing crop) and pumpkin/sweet potato (as a creeping crop), as illustrated in the right figure. It has also some effects against soil erosion, since crops create two/three-story canopies and reduces the impact of raindrops on soils.



Mix cropping in upland fields

c. Lowland Rice

Aside from upland crops farming, there are lowland rice fields, especially in Manatuto. Based on the results of the village profile survey, the farming calendar of lowland rice under rainfed condition is illustrated as follows:

Farming Calendar of Lowland Rice Farming

Month	10	11	12	1	2	3	4	5	6	7	8
L. Rice		Land preparation	Transplanting			Harvesting					

Source: Village Profile Survey (2006), JICA Study Team

In general, the use of farm inputs is very low due to economic constraints and limited access to inputs. Likewise, the majority of lowland rice farmers use their own seeds saved from the harvest in the preceding season[11]. In the watersheds, the major rice-producing areas are located along the downstream reaches of Laclo River and in a flat basin in the upper part of the Laclo watershed. Most of the areas are dependent on traditional irrigation systems. Hence, the production is often affected by climatic conditions.

d. Coffee

Timor-Leste has a long history on coffee farming. In fact, coffee was first introduced in the country in the early 19th century. After the large scale damage of coffee trees due to an epidemic of coffee rust, the country introduced a local natural cross breed between Arabica and Robusta varieties, called Hybrido de Timor. It is presently a predominant variety in the country.

At present, almost all the coffee plantations in the watersheds are under the closed canopy of shade trees (Falcata or Casuarina). In general, no management activity such as pruning, fertilizing, and watering is undertaken and since most coffee trees are so aged that the productivity is generally low. The peak harvesting season is between July and August, although it ranges from May/June to August/September depending on elevation.

It is reported that Falcata shade trees in Ermera and Liquica have been damaged by a gull rust disease (*Uromycladium tepperiarum*). In fact, many shade trees in the watersheds exhibit signs of infection (gulls on branches). Falling shading trees in coffee plantations is one of the major issues for coffee farmers to tackle in addition to rehabilitation of the aged plantations. This is also a critical issue on watershed management as coffee plantations composed of Falcata have a closure canopy equivalent to that of closed or medium forest. In other words, the maintenance of coffee plantations, such as replacement of Falcata trees and rehabilitation of aged coffee trees, means protecting the same size of thick forest coverage. NDF, with the assistance of external organizations (e.g., CCT and PADRTL), conducted some trial interventions of replacing Falcata trees with other tree species.

(7) Major Issues on Agricultural Production

Major issues that farmers/villagers in the watersheds face on agricultural production are drought/unstable rainfall, pests and diseases (including damages from rats and other animals), lack of seeds, and lack of other farm inputs. Major issues in each suco in and around the watersheds are presented in Table 3.6, and summarized below.

[11] Rice Marketing Survey Report (2004), JICA

Major Issues on Farming

Watershed	Sub-district	Villages	Major issues on farming		
			Issue 1	Issue 2	Issue 3
Comoro	Bazartete	4 sucos	Drought	Unstable rainfall	-
	Railaco	9 sucos	Lack of extension	No information	Poor irrigation facilities
	Laulara	8 sucos	Unstable rainfall	Drought	Damage by rats/animals
	Aileu	1 sucos	Plant diseases	Shortage of rainfall	-
Laclo	Aileu	11 sucos	Plant diseases	Shortage of rainfall	Lack of inputs (seeds)
	Liquidoe	7 sucos	Shortage of rainfall	Pests and diseases	Soil erosion
	Remexio	8 sucos	Pests and diseases	Unstable prices	Others
	Laclubar	6 sucos	Seasonal changes	Pests and diseases	Low production
	Laclo	4 sucos	Pests and diseases	Seasonal changes	Low soil fertility
	Manatuto	4 sucos	Low soil fertility	Shortage of rainfall	Lack of irrigation

Source: Village Profile Survey (2006), JICA Study Team

(8) Soil Conservation Practices

"No tillage" and "mix cropping" are the main soil conservation practices that local farmers usually apply in their farms. Some of them also apply a stone-wall terracing method. There is no mulching or other conservation measure observed in the watersheds, except in villages assisted by NGOs or international organizations. In communities assisted by the external organizations, bench terracing, contour mulching, and alley cropping are demonstrated.

3.2.5 Current Situations of Livestock Management in and around the Watersheds

(1) Number of Animals

In Timor-Leste, animals generally serve as assets of rural farmers (as literally "live-stock") for wedding, funeral, traditional ceremony, education, or any feast events. The number of animals in and around the watersheds compiled by MAF in 2004/2005 is presented in Table 3.7, and summarized below.

Animal Population in the Districts in the Watersheds in 2004/2005

Unit: Head

District	Sub-distiict	Cattle	Buffalo	Horse	Goat	Sheep	Pig
Comoro							
Aileu	Laulara, Aileu	1,605	816	277	78	1,128	988
Ermera	Railaco	1,935	465	628	2	288	2,291
Liquica	Bazartete	1,809	292	2,145	9	392	6,960
Total	-	5,349	1,573	3,050	89	1,808	10,239
Laclo							
Aileu	Aileu, Liquidoe, Remexio, Laurala	4,978	1,194	1,512	44	1,260	2,412
Ainaro	Maubisse	981	664	1,419	126	2,198	3,697
Manatuto	Laclubar, Laclo, Manatuto	4,419	4,001	4,100	2,591	2,073	7,733
Manufahi	Turisai	581	394	236	47	991	639
Total	-	10,959	6,253	7,267	2,808	6,522	14,481

Source: MAF (2005)

Despite the fact that the total number of each livestock in Comoro is lower than that in Laclo, the animal population density in Comoro is higher than in Laclo, as the indicator of A.U.[12]/area shows in Table 3.7. The same table suggests that some sucos in the target watersheds may face high animal population pressure on the existing pasture areas within their territories. Observation based on the field reconnaissance survey conducted by the Study Team also supports the suggestion. The

[12] A.U.: animal unit; It should be noted, however, that the A.U./area differs from one sub-district to another, depending on physical and economic conditions.

signs of tread pressure in grasslands as well as sparse forests were often found in the reconnaissance survey in the Laclo watershed.

(2) Rearing and Management Practices

The manner of rearing animals is rather extensive, especially in hilly/mountainous areas because of a shortage of labor force for livestock management. Current practices for animal raising are outlined below.

Current Practices for Animal Raising

Animal	Manner of Raising
Cattle	One-day grazing or rope-tied rearing
Buffalo	
Goat/Sheep	
Horse	
Pig	Rearing in the yard around the house

Source: JICA Study Team

One-day grazing in rangelands with native grasses is the major rearing practice in the watersheds. Feeding fodder trees to animals is not commonly observed, except in villages near coffee plantations. In those villages where animals are tied with rope throughout the year to prevent them from damaging coffee plantations, households need to feed them during the dry season.

(3) Issues on Animal Raising

Natural grassland and woodland are used as essential bases for animal production in Timor-Leste. Owing to seasonal fluctuation of vegetative productivities in natural grassland, feed materials for animals, especially nutritiously valuable feeds, are scarce during the dry season and most animals experience a shortage of feeds at the end of the dry season. Since the present animal raising is not directly related to any animal produce (e.g., milk, daily products, or meat), incentive for rural households to improve animal management is very low. As a result, seasonal malnutrition and extensive animal care have lowered the effect by vaccination.

Natural grassland could not stably maintain the present level of grass production if the grazing pressure is not controlled properly. In fact, partially deteriorated pastures are often observed in steep and fragile slopes in the watersheds. On the other hand, invasion of the unusable and poisonous weed, i.e., Chlomolaena, has also caused the reduction of herding places for animals. The said weed has a vigorous reproductive ability in natural grassland and has gradually expanded its coverage in the watersheds. At present, MAF attempts to biologically control the weed using a special fly, which has been used in Papua New Guinea for eradication of the said weed. According to MAF staff, it may take around five years until expected results appear in the experimental plot, provided that the land is properly managed during that period.

Although the extensive and uncontrolled grazing is not a direct cause of watershed degradation, countermeasures that can minimize its adverse effects should be examined and mapped out since such practice negatively affects the recovery of vegetation covers in the watersheds.

3.2.6 Food Security

Low crop production is underlying the critical food shortage issue in the country. It is reported that local communities in rural areas have faced chronic food shortage between November and March in general[13]. The estimated food balance between production of rice and maize and their minimum requirement to avoid food poverty (i.e. 2100 calories/day) are shown in Table 3.8, and summarized in the next table.

[13] East Timor Human Development Report 2002

Food Balance between Production and Demand between 2002 and 2004

(1) Rice Unit: ton

District	2003-04			2004-05			2007-08		
	Min. Require -ment*1	Production *2	Gap	Min. Require -ment*1	Production *2	Gap	Min. Require -ment*2	Production *2	Gap
Aileu	2,431	566	-1,865	2,515	860	-1,655	2,937	605	-2,332
Ainaro	3,378	1,219	-2,159	3,479	1,300	-2,179	3,626	1909	-1,717
Dili	10,661	60	-10,601	11,509	91	-11,418	12,536	0	-12,536
Ermera	6,599	723	-5,876	6,844	1,131	-5,713	7,882	891	-6,991
Liquica	3,483	385	-3,098	3,636	629	-3,007	4,090	302	-3,788
Manatuto	2,457	3,793	1,336	2,435	7,165	4,730	2,945	3,364	419
Manufahi	2,884	975	-1,909	2,981	4,807	1,826	3,257	2,438	-819

(2) Maize Unit: ton

District	2003-04			2004-05			2007-08		
	Min. Require -ment*3	Production	Gap	Min. Require -ment*3	Production	Gap	Min. Require -ment*3	Production	Gap
Aileu	3,079	2325	-754	3,186	3055	-131	3,720	753	-2,967
Ainaro	4,278	2,925	-1,353	4,407	3,330	-1,077	4,593	1,221	-3,372
Dili	13,504	1088	-12,416	14,577	1260	-13,317	15,879	1,886	-13,993
Ermera	8,358	2445	-5,913	8,669	1,120	-7,549	9,984	1,586	-8,398
Liquica	4,412	2378	-2,034	4,606	3690	-916	5,181	1,436	-3,745
Manatuto	3,112	3,525	413	3,084	6,900	3,816	3,730	8,550	4,820
Manufahi	3,654	5363	1,709	3,776	8,574	4,798	4,125	6,130	2,005

Note: *1Minimum per capita consumption of milled rice is estimated at 66 kg based on the estimation by Directorate of National Statistics (DNS) and World Bank (2008) with the addition of the proportionally estimated amount for post harvest loss.
*2Milling rate of 65% is applied.
*3Minimum per capita consumption of milled maize to avoid food poverty is estimated at 84 kg, including the post harvest loss of 25%, based on the estimation by DNS and World Bank (2008) with the adjustment of the consumption of corn flour to grains on calorie basis and with the addition of the proportionally estimated amount for post harvest loss.

Source: The 2001 Suco Survey; The 2004 Census of Population and Housing; MAF; NDS and World Bank (2008): Timore-Leste: Poverty in a Young Nation; and FAO/WFP: Crop and Food Supply Assessment Special Report (2003).

The above tables show that the production of cereals in the districts is not sufficient against the minimum requirement of communities except in Manatuto and Manufahi. This is also confirmed based on the results of the village profile survey. Almost all the surveyed sucos responded that a shortage of food started from July to September and lasted until March, with the most critical period between November and February. The severity of the food shortage seems to differ among the sucos as shown in the next table. In principle, the peak shortage months in the mountainous/hilly and remote sub-districts (e.g., Laulara, Remexio, and Liquidoe) are longer than those located in low/flat areas and those close to the city.

Situation of Food Shortage

Watershed	Sub-district	Villages	Total months	Peak month
Comoro	Bazartete	4 villages	Sept – Feb (6 months)	Dec – Jan (2 months)
	Railaco	9 villages	Oct – Feb (5 months)	Dec – Feb (3 months)
	Laulara	8 villages	July – Mar (9 months)	Nov – Feb (4 months)
	Aileu	1 village	Dec – Jan (2 months)	Dec – Jan (2 months)
Laclo	Aileu	11 sucos	Sep – Feb (6 months)	Dec – Jan (2 months)
	Liquidoe	7 sucos	Aug – Feb (7 months)	Nov – Jan (3 months)
	Remexio	8 sucos	Sep – May (9 months)	Oct – Apr (7 months)
	Laclubar	6 sucos	Oct – Mar (6 months)	Oct – Jan (4 months)
	Laclo	4 sucos	Sep – Feb (6 months)	Dec – Feb (3 months)
	Manatuto	4 sucos	Oct – Apr (7 months)	Jan – Feb (2 months)

Source: Village Profile Survey (2006), JICA Study Team

Food security refers not only to the availability of food but also to nutritional status. Malnourishment is widely observed especially with women and children. WFP estimates that more than 30 percent of women suffer from chronic energy deficiency[14]. In more general terms, many households are heavily dependent on cassava and other tuber crops during lean seasons. Given this situation, FAO/WFP urges the need to intake a wide variety of other foods such as vegetables, fish or other animal products.[15] However, their availability is still limited.

3.2.7 Forests and Non-Timber Forest Products (NFTPs)

NTFPs are important resources for people living in hilly and mountainous areas as sources of either cash income or subsistence food during the food shortage periods. The village profile survey clarified major forests and NTFPs used for cash income in the watersheds. The results are shown in Table 3.9, and summarized below.

Major Forests Products and NTFPs for Cash Income

Watershed	Sub-district	Villages	Forest products (usage of woods)	Non-timber forest products
Comoro	Bazartete	4 villages	Ai ru (timber & firewood) Ai na, Ai nitas (timber)	Rattan, Flower
	Railaco	9 villages	Ai ru, Ai bubur (timber & firewood)	Honey, Bamboo, Tua metan
	Laulara	8 villages	Ai ru, Ai bubur (timber & firewood)	Tua metan, Bamboo
	Aileu	1 village	-	Bamboo
Laclo	Aileu	11 sucos	Ai ru, Ai bubur (timber & firewood)	Honey, Bamboo
	Liquidoe	7 sucos	Ai ru, Ai bubur (timber & firewood)	Honey, Bamboo
	Remexio	8 sucos	Ai ru (timber & fence), Ai bubur (timber & firewood), Ai na, Teak (Timber)	Honey, Bamboo
	Laclubar	6 sucos	Ai ru, Teak (Timber) Ai buur (timber & firewood) Candlenut (oil)	Honey, Candlenut
	Laclo	4 sucos	Ai bubur (timber & firewood)	Honey, Sago
	Manatuto	4 sucos	Teak, Gewanm (timber)	Honey

Source: Village Profile Survey (2006), JICA Study Team

"Ai ru" (*Eucalyptus deglupta*) and "Ai bubur" (*Eucalyptus alba*) are common forest resources collected and sold as timber and firewood. Some sucos in the Laclo watershed also harvest teak for timber. It is also noted that one village in Laclubar produces candlenut in their territory. On the other hand, "Tua mutin" (local wine) and bamboo are commonly sold in the Comoro watershed, while honey and bamboo are the major NTFPs used in the Laclo watershed. In particular, honey is the sole NFTP harvested in the Manatuto district.

Accordingly, the excessive firewood collection after the independence in 2002 is often reported as one of the direct causes of forest degradation in the country[16], especially in the target watersheds. The rough estimation made by the Study Team also suggested that significant deforestation could take place in the future if the current trend on firewood collection is maintained along with the rapid population increase. The results of the estimation are given in Section 3.6 of this report.

3.2.8 Marketing Conditions

The market survey found that marketing of many agricultural commodities in the watersheds is still at small-scale or at individual level. Hence, agricultural activities are done for subsistence purposes

[14] WFP: http://www.wfp.org/country_brief/indexcountry.asp?country=626
[15] FAO/WFP *Special Report :Crop and Food Supply Assessment Mission to Timor-Leste* ,June 2003
[16] e.g., Project Proposal for Capacity Building in and Mainstreaming of Sustainable Land Management in Timor-Leste, UNDP (2006), Forest Policy, MAF (2007), etc.

in general. The following can be considered as core problems on the marketing of agricultural commodities, regardless of the produce.

- Low production
- Lack of access to market (in terms of transportation and communication)
- Low demand for domestic products

In the target watersheds, there are major produce marketed to other districts, i.e., coffee in Ermera and Liquica, vegetables in Aileu, and local rice in Manatuto, while some commodities, such as maize and onions, flow into the watersheds from other districts (e.g., Baucau and Bobonaro) especially in lean seasons. Annex-B in Annexes shows an overall picture of domestic production and distribution. Staple crops, i.e., rice and maize, are mainly for home consumption. When farmers have surplus or need some cash, they sell their produce. Most of the farmers rely on weekly bazaars nearby communities to sell produce, which includes surplus crops, leafy vegetables and fruits.

The GoTL together with donors and NGOs has been making various kinds of attempts to explore marketing potentials of several commodities such as Bali cattle, vanilla and candlenuts for exports in addition to coffee. In the watersheds, the vanilla production was introduced in Liquica and Aileu while candlenut production was also been demonstrated in Manatuto. Potentials of these commodities need to be further examined.

Marketing conditions are delineated in Annex -B and summarized in the table below.

Marketing Conditions of Major Commodities

Conditions		Major Constraints	Narrative Summary
Common Conditions		Low production	Food security at household level is more critical than earning money through marketing.
		Lack of access to market	Farmers face difficulty to access markets due to high transportation costs.
		Low demand for domestic products	Low purchasing power in district. High competition with imported goods in terms of quality and quantity
Commodity Specific	Rice	Low milling rate Poor storage techniques	Poor drying, threshing by beating and use of non-uniform grains are the causes. Traditional storage containers are subject to insect/mice infestations
	Maize	Poor storage techniques Little perception on marketing*	Traditional storage containers are subject to insect/mice infestations. Little traditional use of downstream products* is observed
	Fruits and Vegetables	Inconsistency of quality (e.g. size & appearance)	Some products have higher quality than others; enhancing quality could lead to higher values in markets.
	Coffee	Inconsistency of quality	This is due to lack of understanding of quality issues and extension services.
	Other Potential Crops e.g., Vanilla	Lack of knowledge of production and value-adding	Basic knowledge is missing, although efforts are being made. There is a need to examine the possibility of production and value-adding.
	Livestock	Limited feed resources Lack of local processing	Grazing in dry season sometimes causes land use problem. There are little capacities of local entities for meat processing *.

Source: Annex B of Draft Final Report, JICA Study Team
* Added based on the preliminary findings in the Interim Report of The Study on Project for Promotion of Agribusiness in Timor Leste.(August 2009)

3.2.9 Socio-economic Conditions of Sucos in and around the Watersheds

The current socio-economic situations of sucos in the watersheds were further assessed based on data of the 2001 Survey of Suco and results of the village profile survey conducted by the JICA Study Team in 2005/06.

(1) Accessibility

Accessibility to suco, which is related to the opportunity of villagers to market their farm products or to receive any external support given by either government or donor- or NGO-funded projects, was assessed in terms of the remoteness and ease in reaching a passable road. The distances between i) suco and the district capital, and ii) suco and Dili were used for evaluation of the remoteness, while the ease in reaching a passable road is analyzed by the "time taken to access a passable road[17]". Table 3.10 shows the accessibility of each suco in and around the watersheds, and the following table shows its summary.

Distances from Village to District Capital and/or Dili (Remoteness)

Basin	Sub-district	No of sucos surveyed	to district capital (km)			to Dili (km)		
			Ave	Max	Min	Ave	Max	Min
Comoro	Bazartete	4 sucos	20	40	4	33	53	16
	Railaco	9 sucos	6	10	0.3	45	50	35
	Laulara	5 sucos	10	23	0.2	17	31	7
	Aileu	1 sucos	12	-	-	42	-	-
	Sub-total		11	40	0.2	32	53	6
Laclo	Aileu	11 sucos	11	36	0.0	52	67	42
	Liquidoe	7 sucos	7	14	0.1	42	46	40
	Remexio	8 sucos	15	25	5	34	46	12
	Laclubar	6 sucos	19	40	2	125	143	87
	Laclo	4 sucos	10	30	0.5	91	111	83
	Manatuto	4 sucos	9	25	0.2	74	83	66
	Sub-total		12	40	0.0	64	143	12

Source: 2001 Survey of Suco and Village Profile Survey by the JICA Study Team (2006)

Time Taken to Reach a Passable Road (Ease to Reach a Passable Road)

Basin	Sub-district	No. of sucos surveyed	Time taken to get to a passable road (min)		
			Ave	Max	Min
Comoro	Bazartete	4 sucos	8	15	5
	Railaco	9 sucos	6	15	2
	Laulara	5 sucos	25	60	4
	Aileu	1 sucoe	3	-	-
	Sub-total		10	120	2
Laclo	Aileu	11 sucos	20	61	3
	Liquidoe	7 sucos	127	300	5
	Remexio	8 sucos	113	240	3
	Laclubar	6 sucos	91	180	1
	Laclo	4 sucos	106	300	1
	Manatuto	4 sucos	14	45	3
	Sub-total		76	300	1

Source: 2001 Survey of Suco

There is no significant difference in the distance from sucos to district capitals among the sub-districts. On average, the distance to the district capital is about 11 km, and villages are generally located within a radius of 40 km from the capital. The Comoro watershed is closer to Dili than the Laclo watershed is. The former is the upper watershed of the capital city and the

[17] 2001 Survey of Suco (2001), ETTA, ADB, WB and UNDP

distance from the capital city to the villages within its territory range from 6 km to 50 km. In fact, many marketable commodities produced in the Comoro watershed are mainly transported to and sold in Dili. In the latter, the locations of villages in Manatuto district, especially in Laclubar sub-district, are more than 60 km away from the capital.

Almost all the villagers in the Comoro watershed can get to passable roads within 15 minutes, except for those in two villages (Mada beno and Tohumeta) in Laulara sub-district, where it takes from half an hour to an hour to access the passable roads. In the Laclo watershed, a half of the villages (20 villages out of 40) are 40 to 300 minutes away from the passable roads. In particular, villages in Liquidoe, Remexio, Laclubar and Laclo sub-districts are isolated from all-weather roads.

(2) Household Economy

The main sources of income of rural households in the watersheds are farming, livestock raising and firewood collection. At present, there is no statistics datum showing the income level of households in the target watersheds. According to the Millennium Development Goals Report (2004), about 40 % of the total population of the country is below the national poverty line (US$ 1.65 in PPP: Purchasing Power Parity). The Human Development Report in 2006 also reports that majority of the poor live in the rural areas of the country. The poorest in rural areas are those with small land holdings and few or no livestock, or those who live in areas that are prone to flooding or soil erosion.

The village profile survey also gives some indications on the levels of household economy in the watersheds. The average monthly income of village was estimated by using the results of the village profile survey and adopting the following formula.

Ave monthly income = A x D/(D+E+F) + B x E/(D+E+F) + C x F/(D+E+F)

Where:

A Average monthly income of upper class households;
B Average monthly income of middle class households;
C Average monthly income of lower class households;
D Number of surveyed households of upper class;
E Number of surveyed households of middle class; and
F Number of surveyed households of lower class

(The data listed above were collected during the village profile survey. Original data are presented in the Report on Analyses of Village Profile Survey prepared by the Study Team in August 2006.)

Results of the estimation are presented in Table 3.10 and summarized below.

Average Household Income in the Watersheds

(Unit: US$ / household/month)

Basin	Sub-district	No. of Sucos Surveyed	Estimated Average Monthly Income
Comoro	Bazartete	4 sucos	1.7
	Railaco	9 sucos	34.2
	Laulara	5 sucos	10.8
	Aileu	1 sucos	77.5
	Sub-total		23.4
Laclo	Aileu	11 sucos	89.8
	Liquidoe	7 sucos	8.4
	Remexio	8 sucos	16.9
	Laclubar	6 sucos	2.6
	Laclo	4 sucos	9.1
	Manatuto	4 sucos	7.5
	Sub-total		31.6

Source: Village Profile Survey (2006), JICA Study Team

The average monthly incomes of households in the Comoro and Laclo watersheds are estimated at US$23.4/month (equivalent to US$0.8/day) and US$31.6/month (equivalent to US$1.1/day), respectively. Only villagers in two sub-districts (Railaco and Aileu) seem to be able to earn monthly income beyond the national poverty level (US$1.0/day). The average incomes of those in other villages are estimated to be less than US$1.0/day. Although these are figures estimated by using a conventional method, the result gives an indication that the economic status of the majority of households in the watersheds is probably quite low. Figure 3.14 shows the average income level of each suco in and around the watersheds.

(3) Natural Disasters

According to the village profile survey, some villages in and around the watersheds have often been damaged by floods, landslides, land degradation, and forest fires. The potentials of those natural disasters were evaluated based on the recent trend and incidence of events[18]. The villages were classified into four classes as follows:

i) Class 1: Occurrence of event is “frequent and increasing”. (critically severe)
ii) Class 2: Occurrence of event is “frequent” or “less frequent but increasing”. (severe)
iii) Class 3: Occurrence of event is “less frequent” or “frequent but decreasing”. (less severe)
iv) Class 4: No event has occurred

Results of the classification are presented in Table 3.11 and summarized below.

Trends of Occurrence of Natural Disasters in and around the Watersheds

(Unit: No. of sucos)

Basin	Type of Disasters	Class 1	Class 2	Class 3	Class 4	No Answer	Total
Comoro	Flood	2	2	5	10	0	19
	Landslide	2	1	12	1	0	19
	Land degradation	3	2	7	5	2	19
	Forest fire	3	0	14	2	0	19
Laclo	Flood	7	3	6	24	0	40
	Landslide	10	11	11	8	0	40
	Land degradation	11	5	19	5	0	40
	Forest fire	8	4	19	9	0	40

Source: Village Profile Survey (2006), JICA Study Team

[18] Detailed methodology of evaluation is described in the Report on Analyses of Village Profile Survey prepared by the JICA Study Team in August 2006.

Figures from 3.15 to 3.18 show the difference in severity of the disasters among sucos in and around the watersheds. The following sections give some highlights.

a. Flood
Four villages in the Comoro watershed and ten villages in the Laclo watershed were classified as either class 1 or class 2. Among others, the situation in Laclo sub-district seemed worse. In fact, three villages (Suco Laco Mesak, Suco Uma Naruk, and Suco Uma Kaduak) reported that they have often had floods and the frequency has increased.

b. Landslide
Landslide is a common problem/event found in the watersheds. In the Comoro watershed, there were three villages of which situation is beyond the threshold level (either class 1 or 2), while a total of 21 villages in the Laclo watershed are considered highly subject to landslide. At sub-district level, Bazartete, Laclubar, Laclo and Manatuto sub-districts were considered as "landslide-prone districts". Among others, Bazartete and Laclo showed the higher potential

c. Land Degradation
Laulara and Bazartete sub-districts in the Comoro watershed and Liquidoe, Laco and Manatuto sub-districts in the Laclo watershed were evaluated as "the districts where land degradation is common and presently progressing". At village level, five villages in the Comoro watershed and 16 villages in the Laclo watershed were under critical conditions (either class 1 or class 2).

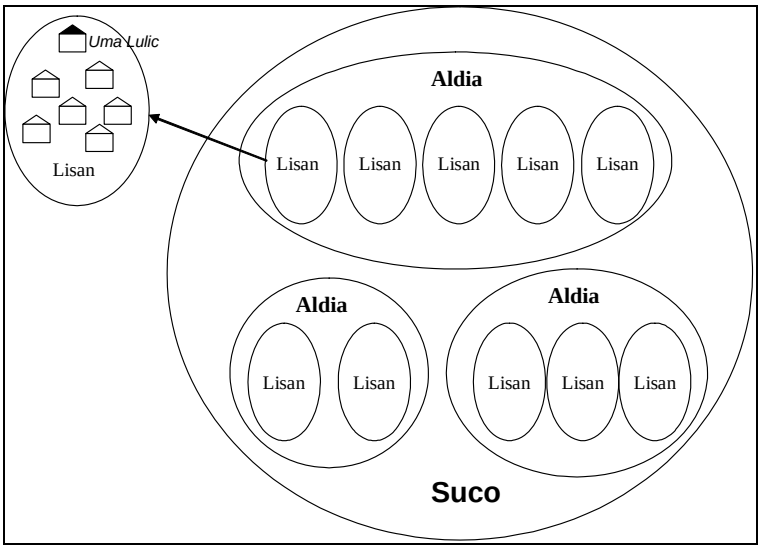
d. Forest fire
Forest fires took place mainly in the sub-districts of Bazartete (Liquica district) and Manatuto (Manatuto district). This seemed to be related to the number of cattle/buffalo and the manner of management of the herding area for animals. Frequent forest fire is considered as one of the direct causes of deforestation and forest degradation in the target watersheds.

3.2.10 Village Society

(1) Structure of Village

A village in Timor-Leste is called "suco". Each suco has several sub-villages (*aldia*), which can be further divided into a couple of kinship groups (called *lisan*), organized by descendants from a single male ancestor (the "founder of the clan"). Each *aldia* has one chief (*chef de aldia*) and each *lisan* also has one elder leader (*lianain*) and other elders. Generally, *lisan* occupies a certain/specific territorial area with identifiable boundaries/land marks[19]. In a sense, *lisan* is the minimum unit with a strong relationship in the village.

[19] The Customary Use and Management of Natural Resources in Timor Leste (OXFAM, 2003)



Structure of Village (Conceptual Illustration)

(2) Village Organization

During the Portuguese regime, the traditional hierarchy headed by *liurai/datu* (small king in the area) had been placed and maintained as chef de suco by the colonial government. *Liurai* functioned as a village chief supported by hamlet chief (*chef de aldia*), *lianain* and other elders. Since the chiefs of hamlets as well as elders had a close linkage with *liurai*, the decision making process in the village was more direct and simple.

An Indonesian village organization system (UU No. 5 Tahun 1974 tentang Pokok Pemerintahan di Daerah) was introduced in 1975 along with the Indonesian invasion. In some villages, *liural* was assigned as the chief of village (*kepala desa*), but also in some villages, *liural* lost power over the village since a new structure replaced the traditional institution. During this regime, the Indonesian government often intervened in the selection of chief of village (*kepala desa*) by either appointing the chief or selecting candidates.

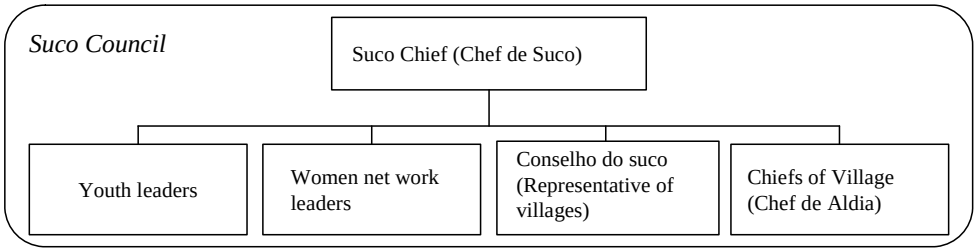
In April 2004, a new community organization system was institutionalized by Decree-Law No. 5/2004 (Law on Community Authorities). The law defined the constitution of suco and functions of the members of community authorities. The present organization of suco is as follows:

Village Organization

Suco Council:	Suco chief (chef de suco) Heads of the villages (aldeias) comprising the suco Two women Two young people (one male and one female) One elder (male or female)

Source: Decree-Law No. 5/2004 on Community Authorities

According to the village profile survey, a typical organizational structure of sucos in the watersheds is envisaged as follows:



Typical Village Organizational Structure
Source: Village Profile Survey (2006), JICA Study Team

Although the official structure of the village was already installed, the traditional decision-making/mediation process strongly remains. Several existing documents and on-going projects[20] report that *chef de suco* cannot make decisions without consultation with village elders (*lianain* and elders).

(3) Functions of Community Authorities

The Law on Community Authorities (Decree-Law No. 5/2004) defines the functions of chef de suco, chef de aldeia and council of suco as follows:

Functions of Community Authorities

Authority	Roles and Functions
Chef de Suco	➢ to lead activities of the community ➢ to carry out activities related to welfare of inhabitants, environment of suco, and other public affairs. ➢ to coordinate the implementation of decisions made by the suco council ➢ to establish mechanisms of coordination and articulation between the suco and competent authorities at all levels of the government ➢ to provide for the creation of grassroots structure for the resolution and settlement of minor disputes among villages (aldeias)
Chef de Aldeia	➢ to be a member of the suco council ➢ to implement those decisions approved by the suco council ➢ to provide the suco chief with elements necessary for articulation with ministries and local administration ➢ to provide for the creation of grassroots structures for the settlement and resolution of minor disputes that may emerge in the village ➢ to promote respect for the law ➢ to ensure the creation of mechanisms for the protection of domestic-violence victims ➢ to promote consultations and discussions among the village inhabitants on all issues related to community life and development ➢ to conduct any other business related to its functions
Council of Suco	➢ to hold ordinary meetings on a monthly basis or special meetings whenever requested by the Chief ➢ to make decisions by consensus or majority rule ➢ to invite one or more members of the *katuas* council in the meetings to share and exchange opinions

Source: Decree-Law No. 5/2004 on Community Authorities

Furthermore, the major functions of village customary leaders (*lia nain*/elders) are considered as follows:

[20] The Customary Use and Management of Natural Resources in Timor Leste (Oxfam, 2003),
Study on Lessons Learned in Implementing Community Level Agriculture and Natural Resource Management Projects in Timor-Leste (Oxfam, 2004)
Interviews of PARCIC, USC Canada, Halarae, and Care International.

Functions of Village Leaders

Customary leaders	Roles and Functions
Lia Nain	To resolve problems in aldia and suco in a customary manner To connect with *lulic* and deliver the information To conserve the traditional customs To be responsible for customary ceremonies

Source: Village Profile Survey (2006), JICA Study Team

3.2.11 Traditional Customs

(1) Inheritance System

Individual inheritable rights are usually passed through the male line with some exceptions in other districts (Bobonaro, Manufai, and Covalima). In the patrilineal system, women can never hold any property rights other than usufruct acquired through a husband's property right. However, in case a family has an only daughter, a father may negotiate with a groom/suitor to move to the bride's father's land in lieu of a bride-price, or may give land to a couple to supplement the suitor's inherited land.

(2) *Lulic* or Sacred Places

Maintaining the connection with ancestors as well as spiritual substance is a critical aspect of the daily lives for many Timorese, especially those living in rural areas. Many villages in rural areas have sacred (*lulic*) sites, such as sacred clan houses (*uma lulic*), and other particular places (e.g., hill tops with ancestral birthplaces or graves, particular rocks, trees, springs, lakes, bogs and rivers). These places are considered linked with supernatural forces, and hence, special rituals are required prior to entering such places. Hence, they often express their reverence through ritual worship of such sacred sites.

(3) Tara Bandu

Tara bandu means "to hang prohibition" in the literal sense. It is one of the ritual prohibitions, which usually applies to the harvest of agricultural products, cutting of trees, or collecting of forest products and hunting or fishing. Implementation of *tara bandu* requires a large public ceremony with animal sacrifice, following a public meeting that determines particular sanctions or fines for illegal activities (such as cutting trees, theft of products/livestock, or even sexual misconduct). In the ceremony, prohibitions and sanctions are announced to the villagers and a symbol (horok) is hanged in strategic locations to remind community members of the prohibitions and publicly announce them to other villages.

An offender against the ban is to be fined along with an animal sacrifice. The concept of *tara bandu* is widespread throughout the country, but its application is not prevalent at present.

(4) Changes in Tenure System on Natural Resources

Tenure system on natural resources has been significantly affected by the Indonesian occupation[21]. Many communities/households were uprooted from their ancestral territories and placed on others' ancestral lands. The customary regulations controlling access to natural resources and other person's property were also disregarded by the Indonesian government. Once the customary control system was removed, the local communities started to cut/harvest forests freely with or without payment since there were no sanctions imposed

[21] The Customary Use and Management of Natural Resources in Timor Leste (OXFAM, 2003)

3.3 Current Watershed Management Activities undertaken by NDF

3.3.1 Reforestation

NDF has established demonstration plots of valuable timber species (*Caliandra. Casuarina junghniana, Bognia sp, Leucaena, Gmelina arborea, Tectona grandis, Artocarpus integra, Swietenia macrophilla*) and also provided seedlings to local communities for promoting reforestation activities, although the attempt is still on a small scale. The following table shows the accomplishments made for the last three years in and around the watersheds.

Accomplishments made by NDF between 2203/04 and 2006/07

Watershed	District	2003/2004		2004/2005		2005/2006 (estimation)		2006/2007 (target)	
		(ha)	(no)	(ha)	(no)	(ha)	(no)	(ha)	(no)
Comoro	Ermera	2	6,664	-	-	-	-	-	-
	Liquica	2	5,331	-	-	-	-	-	-
	Dili	3	4,270	-	-	-	-	4	13,400
Laclo	Aileu	2	5,011	3	3,300	2	6,700	4	13,400
	Ainaro	2	6,664	2	3,332	2	6,700	4	13,400
	Manatuto	2	6,500	2	6,638	2	6,700	4	13,400
	Manufahi	2	6,664	2	6,664	2	6,700	4	13,400
Total		**15**	**41,104**	**9**	**19,934**	**8**	**26,800**	**20**	**67,000**

Note: A: Demonstration of plantation (ha), B: Distribution of seedlings to the community (Number of seedling)
Source: NDF

NDF has involved local communities in the development of demonstration plots by taking the following steps:

a. NDF determines the location of a demonstration plot through discussions and agreements with community leaders;
b. Community members who want to work in the plot are organized into groups;
c. The plot is fenced to protect it from livestock and wildlife;
d. The group plants seedlings at a space of 2 m x 3 m; and
e. The participating households receive allowance as incentive.

In some locations, the demonstration plots were neither fenced nor managed properly by district MAF or the community. As a result, planted trees were damaged by freely grazing animals, such as buffalos and cattle. Hence, NDF has shifted its emphasis from the establishment of demonstration plots to distributions of seedlings. The delivery of seedlings is in general welcomed by rural communities, whose preferences are: 1) shade trees for coffee, 2) timber wood trees, 3) NTFP trees, and 4) firewood. The planting season in the watersheds is from December until the end of February.

3.3.2 Commercial Plantation

There is no commercial plantation established since the independence.

3.3.3 Agroforestry Development by NDF

The agroforestry section of NDF has also worked with rural communities to demonstrate agroforestry species and practices. According to the 2004 Annual Report of NDF, the establishment of demonstration plots of agroforestry species and distribution of seedlings were the main activities. The achievements made in 2004/2005 are tabulated below.

Agroforestry Development by NDF in 2004/05

(1) Distribution of Seedlings

Watershed	District	Species	Plants (no.)
Comoro	Dili	Mahagony, Gmelina,Saria, Casarina, Sandalwood	9,274
	Ermera	Casuarina, Mahagony, Gmelina, Mimoza,Tanjerina,Aiata, Rambutan,Ainanas,Kulu ho Teak,	8,545
	Liquica	Mahagony, Gmelina, Saria,	9,700
-	Other Districts *	Gmelina, Kulu, Candlenut, Mahagony Klampis/Caesalpinia sp., Sengon buto, Sandalwood, Café,Kulu kaza	42,193
Total (Nation-wide)			69,712

Note*: Other districts contain Bobonaro, Covalima, Baucau, and Ambeno.
Source: "ANUARIO FLORESTAL 2004-2005" (Annual Report), MAFF/NDF, 2005

(2) Establishment of Demonstration Plots

Watershed	District	Planned seedlings	Species	Area (ha)
Comoro	Dili	10,000	Sterculia nut,aimatan dukur,	2
	Ermera	17,000	Casuarina, Mahagony, Gmelina, Citrus	3
	Liquica	19,000	Mahagony, Candlenut, Antocarpus integra, Gmelina, Casuarina	6
Ambeno	Other Districts *1	78,263.	Candlenut, Aimatan dukur, Water apple air, Cafe, Casuarina, Kulu jaka, Mahagony, Gmelina, Samatuku, saria	14
Total (Nation-wide)		113,263		25

Note: Other districts contain Bobonaro, Covalima, Baucau, and Ambeno.
Source: "ANUARIO FLORESTAL 2004-2005" (Annual Report), MAFF/NDF, 2005

3.4 Past and On-going Interventions Undertaken by Donors/International Organizations in Relation to Watershed Management

The following table shows the outlines of the past and on-going projects undertaken in and around the watersheds.

Past and On-going Projects Undertaken by NGOs and International Organizations

Donor and Project Name	Implementation Methods	Major Component	Extension and Technical Support	Location
CARE Timor-Leste/ International *1	Direct operation by CARE Timor Leste Implemented project by 78 organized community-based project in 12 villages	Agroforestry (587 ha) Reforestation (70 ha)	Training of trainers in demonstration farm by village	Laclubar Sub district, Manatuto district
Field findings: Some terrace farms on the slope were not used for cultivation. It seemed to be left as fallow.				
OISCA/OISCA Timor Leste	OISCA-TL itself trains village youths without charge at the agriculture training center constructed by OISCA.	Two-week lecture and on-farm training on: - farming skill of fruit trees and vegetables; - usages of agri-tools - compost making, etc	Contracted or self teachers engaged in training at the center. Trainees were selected by OISCA in coordination with communities. Over 250 youths have received the training.	Training center in Liquica.
Field findings: On-farm technical training on vegetables and fruit trees was implemented.				
AMCAP UNOPS/UNDP *1	A local NGO was contracted for the implementation. 13 self-reliance	Integrated village development activities in the project focusing on agroforestry and nursery development to attain natural environmental	Contracted with the NGO to engage in the extension and technical supports	Aileu and Manatuto districts, Natural conservation component is currently on-going at

Donor and Project Name	Implementation Methods	Major Component	Extension and Technical Support	Location
	groups organized for natural resource management	conservation.		Soibada, and Laclubar sub district, Manatuto
Field findings: Continuous activities by villagers' groups or individual farmers were found. - Villagers' groups were producing seedlings of several species of trees, fruits and coffee at their nursery for AMCAP project. - One farmer constructed terraces and grew maize and other crops, but the growth of crops was poor. - Reforestation site established by a group of farmers were fenced with bamboo to protect it from animals. - Reforestation in the church land showed high mortality because of lack of adopted technologies (selection of species, transplanting, animal grazing).				
PARCIC (PARC Inter-people's Cooperation)	Direct operation (two Japanese and five national staff) by PARCIC in cooperation with YAYASAN HAK (National NGO)	Assisted coffee producers' groups in the operation of: coffee processing, selling coffee beans through fair trades and development of supplementary livelihood improvement activities	Direct technical support, community's operation and capacity development such as study tour or demonstration	Maubisse sub district, Ainaro district
Findings: - Coffee producers' groups are well-managed by the respective group leaders. - Subsistence farming (crop production) is important for food security. - Increase of income from coffee production did not directly link with the improvement of their livelihood. - Sales of each coffee producers group were not enough to register the organization as a cooperative according to the clause stated in the cooperative law.				
PWJ (Peace Winds Japan)	Direct operation in coordination with churches to organize communities into a coffee group (133 HHs)	Assisted coffee producers' in their operations: such as production, processing, and selling coffee parchment as high quality products to improve livelihoods.	Direct technical support for community's operation and capacity development such as study tour or demonstration	Letehofo sub district, Ermera district
Findings: - Subsistence farming (crop production) is important for food security. - Increase of income from coffee production did not directly link with the improvement of their livelihood. - MAFF is distributing coffee seedlings to farmers without charge.				
WV (World Vision) for Food Security Project in Aileu	Direct operation by international and national staff	Assisted communities in the improvement of their livelihoods through a multi-sector approach, which includes i) increasing production of animal protein, ii) subsistence crops, and iii) reforestation	Direct technical support for community's operation and capacity developments at the WV training center	Aileu district
AUSAID/ Portuguese Cooperation (Seed of Life Project)	Direct operation by employed national staff and villagers hired from surrounding villages.	Provided farm inputs and materials, i.e., seeds, bulbs, slips, seedlings, etc to increase production of staple crops and improve essential nutrition.	Extension and technical support through distribution of produced materials, on-farm training of hired villagers	Laulara sub district, Aileu district
Findings: Improved but open-pollinated varieties of paddy, maize, cassava, sweat potato and peanut are the target crops. Productivity under the current farming practices and storage-ability of products are researched. The project has researched post-harvest and weed control practices to improve household food security.				
USC Canada	Direct operation by employed national staff to provide materials and technical assistance to the villagers groups in the target community.	Provided technical assistance and material supports to improve the livelihoods, i.e. seed, seedlings for agriculture, livestock, fishery and small-scale manufacturing by the women's groups.	Extension and technical support through workshops and field training to the villagers groups	Laclo sub district, Laclobar sub district
PADRTL	Direct operation by the national staff to	Technical assistance and material support for coffee	Extension and technical support	Aileu district, Ermera district,

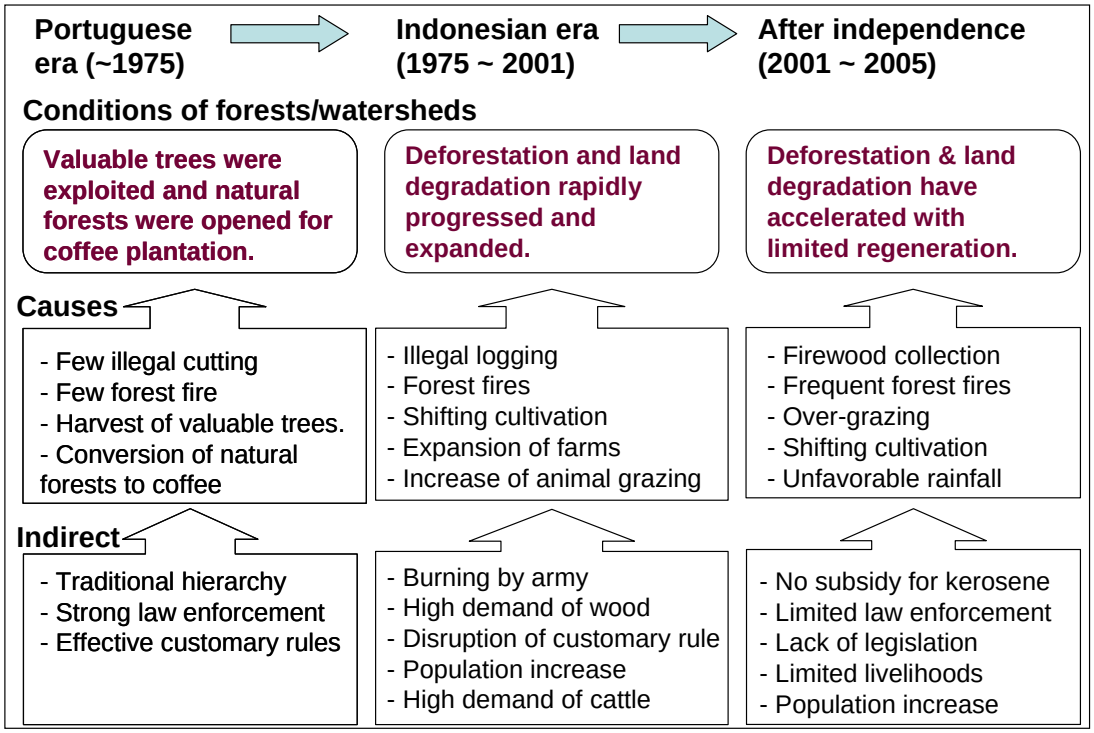
Donor and Project Name	Implementation Methods	Major Component	Extension and Technical Support	Location
	provide technical assistance to the villagers groups in the target community	(new shade trees) and tree crops (vanilla), contour ridge cultivation of vegetables.	through demonstration and on-farm training to the villagers groups	Same district
ARP-III*	Direct operation by the employed national staff to provide materials and technical assistance to the villagers groups in the target community.	Provided technical and material supports on upland farming and agroforestry practices to achieve stable food production i.e. making terraces, contour ridge farming, provision of seeds and seedlings	Extension and technical support through workshops, demonstration and on-farm training to the villagers groups	Baucau district, Dili district, Liquica district, Manufahi district
Sustainable Land Management (SLM) / UNDP	Direction operation by UNDP in partnership with MAF NDF	Provided assistance for mainstreaming SLM into national policies, plans and legislation; the development of human resources and institutional capacities; knowledge management; formulation of National Action Program.	Extension and technical support through guidelines training manuals, workshops, and data base management	Support to policy institution with some pilot projects probably in Liquica and Losparos districts.
RDP-II	Collaboration operation and support to MAF and Ministry of Infrastructure by the international and national staff	Provided assistance in development of 1) institutional capacities of MAF and Ministry of Infrastructure; 2) agricultural extension system; 3) agribusiness; 4) community livelihood; 5) watershed and forest management; and 6) rural infrastructures.	Extension and technical support through recruitment of extension workers and training and pilot projects	Bobonaro and Covalima Districts and their adjacent districts

Note: The Projects with asterisk were already completed.
Source: CARE, OISCA, UNDP (Haralae), PARCIC, PWJ, World Vision, USC Canada, PADRTL, ARP-3

3.5 Issues on Watershed Management

3.5.1 History of Degradation

There was no specific document that clearly depict why forests in the country as well as the watersheds were degraded and when deforestation started. Based on analyzed data and information obtained from existing documents and reports as well as interviews with local people, the Study Team assumed that severe deforestation started in the Portuguese era. The following illustration shows the historic changes in forests in the country, as assumed by the Study Team.



Historic Changes in Forests and Watersheds in the Country

In the Portuguese colonial times, most of the valuable trees (such as sandalwood) were exploited and many natural forests were opened for coffee plantations, although illegal activities by rural communities were rather minimal because of strong law enforcement and limited market demand for wood[22].

The deforestation or forest degradation was further expanded during the Indonesian occupation due to the extensive clearing, frequent forest fires, large-scale commercial exploitation, and prevailing illegal cutting. Disruption of customary rules by implementing a resettlement program[23] and replacing traditional village organizations with the Indonesian system also accelerated the deforestation[24].

3.5.2 Current Issues on Watershed Management

As described in the aforementioned section, it was considered that the large-scale deforestation took place in the past. Some parts of the watersheds seem to be recovering from deforestation but many are still either under degraded conditions or even getting worse. Major issues currently affecting the watersheds are:

- Intensive firewood collection;
- Frequent forest fires;
- Over-grazing;
- Slow natural recovery due to unfavorable climatic conditions;
- Shifting cultivation; and
- Lack of land use plan.

[22] Information obtained through interviews to the NGOs Halarae and Care International.

[23] This was also one of the measures to minimize the anti-government activities by cutting connections between local people and anti-government rebels based in the forests.

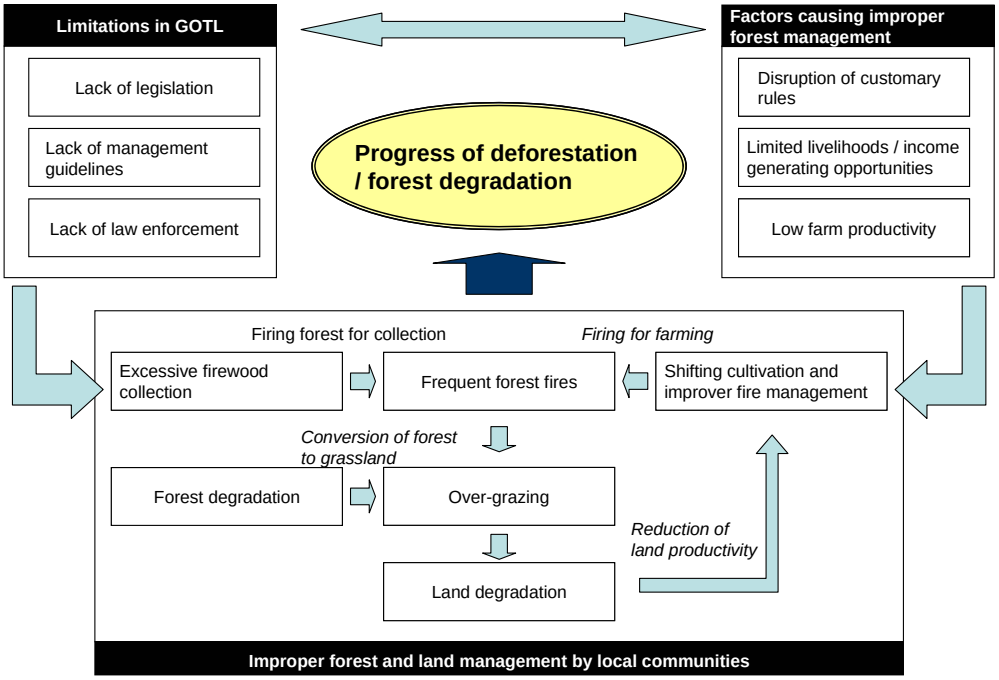
[24] The results of RRA survey conducted in August/September 2007 supported this assumption. Three villages out of the four target villages pointed out that the large scale deforestation started in the Indonesian era.

These issues are interlinked with one another. For instance, it is assumed that frequent forest fires are closely interrelated with firewood collection and shifting cultivation. Furthermore, burned areas are often used for animal grazing, which makes vegetation recovery longer and difficult. In addition, unfavorable climatic conditions (limited rainfall in the northern part of the watersheds and strong wind on top of mountains) also hinder natural regeneration.

Further analyses concluded that these issues may be caused directly or indirectly by the following factors (root causes):

a. Limited livelihoods;
b. High demand of firewood (no alternative energy source);
c. Lack of law enforcement
d. Lack of legislation
e. Limited capacity of MAF
f. Lack of guidelines; and
g. Disruption of customary rules.

The following figure gives an overall picture of forest and watershed degradation in the target watersheds.



An Overall Picture of Forest Degradation in the Watersheds

3.6 Assessment of Firewood Consumption for the Next 10 Years

Firewood is the most prevailing source of energy in the target watersheds. In fact, most of residences in Dili and Aileu as well as Manatuto are using firewood for cooking, lighting and heating. Collection of firewood either for self-consumption or marketing is often reported as one of the main causes of forest degradation, although there is no report or document that clearly shows such relation between firewood collection and forest degradation in Timor-Leste. In order to assess the human pressure on the forests in the target watersheds, the Study Team roughly estimated the

volume of wood consumed for firewood for ten years from 2007 to 2016 estimating the population increase during the same period.

3.6.1 Estimated Firewood Consumption

Based on the results of the market survey conducted by the JICA Study Team in January 2007, the per capita consumption of firewood was estimated at about 0.71 cubic meter per annum, which is slightly higher than the estimates done by another JICA Study in 2003[25] and UNDP in 2006[26].

Assuming that the population will increase with an annual growth rate of 3% per year, which is the average rate between 2001 and 2004, and 100% of households in the watersheds use firewood at the same consumption rate (0.71 m3/year/person), a total of 745,655 m^3 of wood would be consumed as firewood in the target watersheds for the next ten years.

Prospect of Firewood Consumption until 2016

Watershed	District	Per capita consumption	Annual requirement			Accumulated for 10 years
			in 2007	in 2010	in 2016	
		(cu.m/person/yr)	(cu.m /yr)	(cu.m /yr)	(cu.m /yr)	(cu.m)
Comoro	3 districts	0.71	21,231	25,216	35,571	278,554
Laclo	6 districts	0.71	42,949	45,379	50,660	467,101
Total	8 districts	0.71	64,180	70,595	86,231	745,655

Source: JICA Study Team

3.6.2 Influence on Forests in the Watersheds

The estimates of the firewood consumption for the next ten years are further compared with the natural increments of the forests in the target watersheds to see how severe the firewood collection would influence the natural forests in the watersheds. The natural increment in wood biomass is estimated based on the results of the forest survey carried out by the JICA Study Team in January 2007.

Estimated Over-cutting/Excessive Cutting of Firewood from Natural Forests

Watershed	Total Area of Forests	Average Volume	Deforestation				Deforesta-tion Rate
			in 2007	in 2010	in 2016	for 10 years	
	(ha)	(cu.m/ha)	(ha /yr)	(ha /yr)	(ha /yr)	(ha)	(%/10 yrs)
Comoro	6,040	111.7	135	177	278	2,025	33.5
Laclo	45,586	112.0	121	172	258	1,930	4.2
Total	51,626	-	256	349	536	3,956	7.7

Source: JICA Study Team

The results suggest, as given above, that firewood collection would accelerate forest degradation if the situation remains. A total of 3,956 ha of forests might be cleared from 2007 until 2016 only due to firewood collection. The estimation indicates that over 30% of existing forests in the Comoro watershed might be cleared only by firewood collection during the same period.

3.7 Lessons Learned from the Past Natural Resource/Community-Based Projects

Between 2000 and 2004, several community-based projects had been implemented in and around the watersheds. Lessons learned that can be drawn from those projects could be useful to identify

[25] The JICA Study on Integrated Agricultural Development in East-Timor (2002) estimated the per capita consumption at 0.5 cu. m/person.

[26] The Assessment Report on Participatory Rural Energy Development Program (PREDP) in Timor-Leste (2006) estimated that one household consumes about 5-10 kg of firewood per day. Assuming the specific gravity of wood is 0.95 and the average number of family is 4.7, the per capita consumption is estimated at 0.61 cu. m/year.

any factors for failure as well as success. An Oxfam Study Report[27] gave some lessons obtained from the past community-based projects as highlighted below.

a. Involve community leaders

Community leaders (*chef de suco, chef de aldia, adats,* and *lianain*) and sub-district administrator play key roles at the community level in the aspects of information sharing, conflict resolution and mobilization of villagers. Without the support of the leaders, it may be difficult for projects to promote community-based activities. There are also many cases where the current *chef de suco* is not actually a respected local authority. Therefore, projects should approach not only community officials (*chef de suco* and/or *chef de aldia*) but also traditional leaders (*lianain* and elders), since the support from said the said leaders is requisite for community-based natural resource management.

b. Share project information and limitation with local people

Basic project information should be provided repeatedly, especially when discussing project input policies so as to reduce the occurrence of misunderstandings.

c. Involve women

Women's participation in rural development activities in the country is generally low. In fact, there are traditional gender barriers in the country, such as, i) dominance of men in decision-making; ii) lower social status; iii) limited role that women undertake; and vi) dual roles that women have in the house and fields. Due attention should be paid to ensure that women can have the opportunity to speak, such as by using local language, convening women's meetings and making provisions for childcare and meals.

d. Promote ownership of local people

There were farmer groups organized during the Indonesian times. These groups were generally for distribution of government funding. Therefore, community members sometimes tend to have expectations from the term of "community organization" that would be a body to receive an input or incentive of collective activities. It is important to promote self-reliance and community ownership from the start of the project planning rather than ensuring their participation by giving incentives.

e. Improve facilitator's skills

Project staff should have sufficient facilitation, analytical and negotiation skills to ensure that project activities are in line with community priorities based on the present social and physical conditions of the site.

f. Set realistic targets and indicators

The targets of the project should be determined based on the present capabilities of the stakeholders and available resources. In particular, a community-based natural resource management project needs a long-term timeframe for community members to understand the project and to receive some benefits from the resources that they manage.

g. Start project activities at small scale

Adequate resources and timeframe should be allotted for capacity building in a project. Starting a new project with small pilot activities and then scaling up based on the evaluation of results is also an effective strategy for developing capacity of the project staff and adapting the project to actual situations.

h. Deploy sufficient numbers of qualified and experienced male and female staff

[27] Study on Lessons Learned in Implementing Community Level Agriculture and Natural Resource Management Projects in Timor-Leste, 2004 (Oxfam)

Effective community involvement depends on the number, skills and attitude of field staff. The most effective field staffs found were those with experience as extension agents during the Indonesian period. In addition, many projects recognized the necessity of having women field staff to effectively involve women community members in project activities. .

i. Be flexible and responsive

A project should be flexibly managed so that it can be responsive to unforeseen problems and can adjust its design in order to maintain the quality of results.

j. Need more training for project staff, local partners and communities

Many projects have found that greater levels of capacity development and technical assistance are needed for project staff, local partners (NGOs) and community members than initially expected. Training should be designed based on the educational level of the persons, especially with regard to literacy, language and the level of formal education attainment.

k. Need more coordination and information sharing among projects

Coordination and information sharing between development organizations including government, NGOs, donors, and the church is among the key issues to be addressed in future. Lack of coordination has led to overlaps and gaps in activities and inefficiencies as well as conflicting use of human and financial resources.

Chapter 4 Basic Concepts of the Community-Based Integrated Watershed Management Plan

This chapter presents the basic concepts of the CBIWMP including its overall goal and basic approaches and the proposed land use guidelines in the target watersheds.

4.1 Issues and Constraints to be Addressed

As indicated in Section 3.5, the following are considered the current direct causes of watershed degradation:

- Firewood collection;
- Frequent forest fires;
- Over-grazing;
- Slow natural recovery due to unfavorable climatic conditions;
- Shifting cultivation; and
- Lack of land use/management plan or guideline.

These issues are closely interlinked with each other as presented in Section 3.5. Under the circumstances, coping with only a single issue, such as “reduction of shifting cultivation”, “forest fire prevention”, or “reduction of firewood collection”, may not be very effective in reversing the current trend of watershed degradation. A holistic approach that can tackle these issues in a multifaceted manner is necessary.

4.2 Definition of Watershed Management in the CBIWMP

As the watersheds have several functions, such as stable supply of clean water, control of water run-off, and production of forest and non-timber forest products, an understanding of watershed management also varies with its objectives or aims. For instance, reduction of sediment flow must be the main objective of watershed management for the water users in the Laclo irrigation system, while flood mitigation might be more important for local communities residing in the downstream area of the Comoro River. Naturally, the interventions/measures to be proposed in the watershed management plan need to be adjusted depending on its objective. If the plan merely aims at the reduction of sediment flow in the Laclo River, the plan might need to take into account the construction of a large infrastructure along the main stream to reduce the sedimentation. The emphasis of the study might have been put on river control measures if the main aim of the study was the flood control of the Comoro River.

Given the current capacity of the GoTL and the primary aim of the study, which is to propose a framework wherein the GoTL would work hand-in-hand with local communities for the protection and management of the target watersheds, the Study Team defined watershed management in this watershed management plan as “to promote measures and activities that local communities could participate in and undertake for the improvement of watershed functions.” Consequently, this watershed management plan does not propose a large-scale infrastructure to reduce the sedimentation or any river control work in the mainstream of the rivers. Rather, the plan would propose small-scale or non-structural measures whose aim is to prevent further degradation of the watersheds. The Study Team determined the objectives and basic approaches and mapped out the proposed interventions of the watershed management plan keeping the above definition in mind.

As the capacity of the government and economic conditions of the country are enhanced and improved, the definition of watershed management together with the watershed management plan should be reviewed and re-examined to satisfy the latest needs in the target watersheds.

4.3 Goal and Approaches

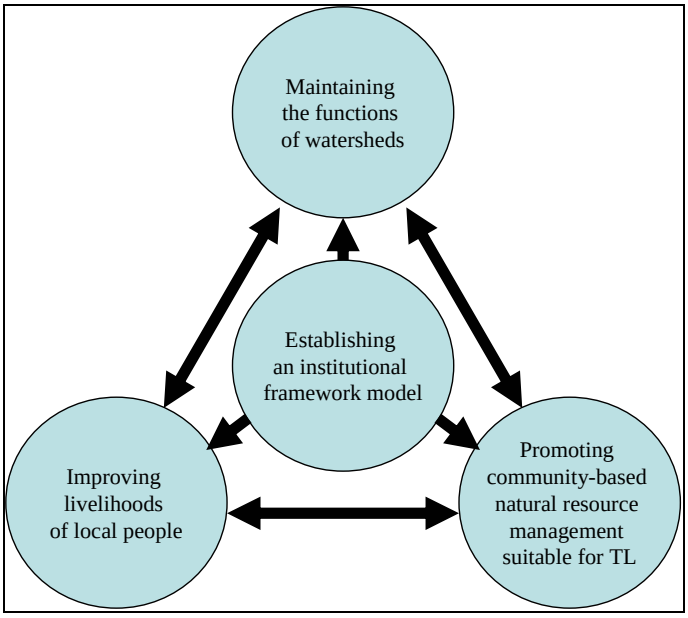
4.3.1 Goal and Objective

The target watersheds have a significant value for people in Timor-Leste namely, a source of domestic water for Dili and irrigation water for one of the largest rice production areas in the country. Because of their values, both watersheds are categorized by the government as critical watersheds to be properly managed. Hence, the ultimate goal of the management plan is "to protect and improve watershed environment in the target watersheds". Meanwhile, the main objective of the management pan is set in consideration of the current natural and social conditions of the target watersheds as well as the capacities of the stakeholders, namely:

> "To attain sustainable and integrated watershed management by balancing proper land and forest management with poverty alleviation in the watersheds."

4.3.2 Basic Approaches to be taken

To achieve its goal, the watershed management plan takes the following basic approaches, after considering the existing related policies, a recent trend on watershed management[1], the present conditions of the target watersheds, and various suggestions given by local stakeholders and international experts in the country.



Basic Approaches of the CBIWMP

(1) Maintaining the functions of the watersheds

In general, a watershed under proper management is supposed to have the following functions in the areas within its river basin;

- Stable supply of clean water to the downstream;
- Control of water run-off;
- Area for producing agricultural and forest products;
- Habitats of bio-diversity; and

[1]The New Generation of Watershed Management Progammes and Project, FAO Forestry Paper No. 150 (2006)

- Reduction of carbon dioxide (at a global scale).

These functions are generally attributed to forests in the upstream part of the watershed. Once deforestation takes place, a watershed would lose its functions, which would further cause socio-economic damage to people living within its river basin. Since both target watersheds have a critical function of providing water to the downstream users, such as people living in Dili[2] or farmers relying on the Laclo River irrigation system in Manatuto[3], the Study Team believes that maintaining the inherent functions of the watersheds, especially the stable supply of quality water to the lower reaches of the rivers should be one of the basic approaches to be taken by the watershed management plan. In concrete terms, the following threats that have caused watershed degradation should be addressed in the watershed management plan:

- Sediment deposition and flow in tributaries;
- Slope failure/landslides and gully erosion mainly along roads;
- Deforestation especially in critical catchments;
- Degradation of dense/medium/sparse forests;
- Forest fires; and
- Improper land use / unsustainable land management in sloping lands.

(2) Improving livelihoods of local people

The living standards of rural households in the watersheds are generally low. As described in sub-section 3.2, most of those living in the watersheds, except in the Railaco and Aileu sub-districts, are considered poor and are living below the national poverty line. In particular, those living in mountainous/hilly areas in the Laclo watershed have suffered from chronic food shortage. The poor in mountainous/hilly areas heavily depend on shifting cultivation and firewood collection for their daily food requirements and their livelihood. Thus, the watershed management plan should address the poor who have limited opportunities except firewood collection and shifting cultivation in securing their food on a daily basis and acquiring cash income. Unless their livelihood condition is improved, it would be difficult to ease human pressures on forest resources in the watersheds. Improving livelihoods may vary with potential or available resources in villages, but in general the following issues should be addressed:

- to improve agricultural productivity;
- to minimize seasonal risk of crop failures;
- to promote market-oriented agriculture (if potential resources are available); and
- to improve malnutrition.

(3) Promoting community-based natural resource management (CBNRM) suitable for Timor-Leste

Community-based natural resource management is a bottom-up approach to integrate conservation of natural resources with rural development involving community mobilization/organization, institutional development, and monitoring the use of natural resources. The basic principle of CBNRM does not only allow local people to use natural resources in their locality but also encourages them to manage and protect those resources in a sustainable manner. CBNRM has been

[2] It is roughly estimated that about 30 % of the population in Dili (or about 49,000 persons based on the 2004 Population Census) may use the water from the watershed.

[3] About 1,100 ~ 1,300 tons of rice may be produced annually in the irrigated rice fields of about 600 ~ 700 ha under the Laclo Irrigation System.

widely adopted in several countries as a main tool for sustainable forest management. The forest policy of MAF also stipulates that community participation in forest management is one of the strategic objectives of the sector.

However, its concept needs to be adjusted in the context of Timor-Leste, in consideration of the present government's capacity (weak capacity), legislative set-ups (limited legislative support and regulatory framework), socio-economic conditions in the rural area (poor and limited foodstuff), and historical changes in resource management in the country. In other words, the concept of "CBNRM" should be tailor-fitted to the country, especially the target watersheds, by taking the following aspects into account:

a. Establishment of local rules as the guiding principles of CBRNM
Although the Forest Management Decree is in the process of approval in the parliament, it would take some time for the decree to be literally effective on the ground as there is still a need to develop its implementation procedures. Thus, it is believed that the GoTL would still have difficulty in regulating people's activities due to such insufficient legislative set-ups coupled with the weak law enforcement of the government.

The development and installation of the local rules on natural resource management with the traditional ceremony (so-called Tara Bandu ceremony) would be effective in orienting rural communities toward the sustainable forests and natural resources management as revealed in the pilot project implemented by the JICA Study. There should be a process whereby rural communities can discuss and prepare their own rules on natural resource management with the guidance and facilitation of NDF and local NGOs/facilitators.

b. Utilization of traditional regulatory system
The traditional village regulations/by-laws, which are commonly called "Tara Bandu" in Timor-Leste, should be utilized to make the local rules effective at the village level. All the communities in the country used to observe the respective traditional regulations/by-laws in the village during the Portuguese era. Although the Tara Bandu system does not function at present as discussed in Chapter 3, many communities are still familiar with such a system and seem to want the revival of this traditional regulating system as a means to improve the governance of the village. Thus, the local rules on natural resource management could become more effective if they are incorporated into the Tara Bandu system as proven by the pilot project implemented by the JICA Study Team.

c. Security of sources of income/food for local people
In order for the local people to accept the CBNRM concept, their livelihoods need to be secured while they are engaging in the protection and management of natural resources in the village. A watershed management plan to be developed shall focus not only on forest protection but also on livelihood improvement of the local people.

d. Involvement of rural communities as managers of their resources
Involvement of rural communities in decision-making processes on natural resource management is the basic principle of community-based natural resource management. Although the land ownership in rural areas is still uncertain in the country, all communities in mountainous and hilly areas regard the existing forests within the village as their own properties. It is therefore important that a watershed management plan needs to secure their indigenous acquired right to forest resources to motivate them in protecting and managing lands and forests in a sustainable manner.

(4) Establishing an institutional framework for the implementation of CBNRM

In order to promote the concept of CBNRM in the country, an institutional model wherein the GoTL and rural communities can work for watershed management collaboratively shall be

established. The institutional arrangements, such as forming a community-based organization, awareness-raising about CBNRM, capacity development of rural communities at the village level and establishment of inter-divisional cooperation, and capacity development of the government staff will be required.

Ideally, an inter-sectoral/multi-disciplinary framework at the government level needs to be established to deal with the complex and cross-sectoral issues on watershed management as discussed in Section 4.1. However, it seems that it is still too early for the GoTL to develop such multisectoral coordination. Therefore, focus should be given initially to the setting-up of an internal task team within MAF and making it operational so that MAF could take a firm grip of the issues on watershed management as a leading agency. The task team of MAF can be a prototype of a multi-disciplinary framework for watershed management in the future. Once the capacity of MAF develops, the task team can evolve into an inter-ministerial framework/organization with the participation of all the relevant stakeholders.

4.3.3 Validity of the Basic Approaches

The objective and basic approaches of the watershed management plan were made based on the current natural and socio-economic conditions of the country as well as the capacity level of the stakeholders, mainly MAF and NDF. Naturally, once these conditions change in the future, the basic concept and proposed interventions of the watershed management plan should also be reviewed and re-examined. In other words, the effectiveness of this watershed management plan should be reviewed through time. In particular, the following factors/points should be kept in mind when MAF/NDF checks the validity of the watershed management plan:

- Effectiveness of the traditional/customary norm (Tara Bandu) on natural resource management (whether or not the traditional/customary norm on natural resource management is still acceptable to rural communities);
- Income-generating opportunity including employment opportunities in rural areas (whether or not the employment of income-generating opportunities in the rural areas is still limited);
- Government's policy on land ownership (whether or not the government recognizes their acquired land tenure right especially in rural areas);
- Population density in rural areas (whether or not rural communities still have enough lands to set aside existing forests for protection purposes); and
- Any drastic changes of the external factors such as timber market, domestic and international food supply, etc.

4.4 Guiding Principles on Land Use and Management in the Watersheds

4.4.1 Objectives

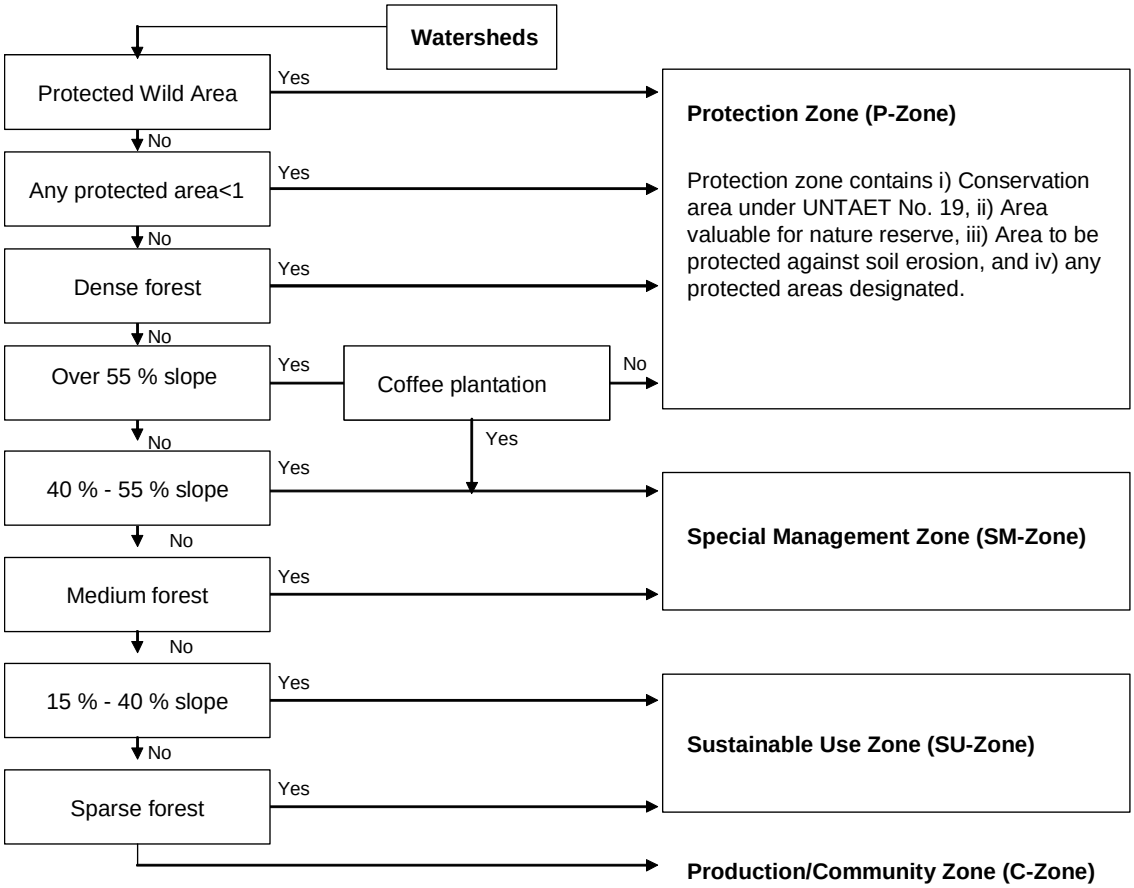
The target watersheds have various geographical features, and therefore, the land management methods should vary with the present conditions in the area. However, no guideline is available for MAF/NDF to determine proper land use and management in the watersheds. The guidelines/principles that prescribe the recommended land uses suitable for the respective geographical features and present land uses need to be clarified and shared among the stakeholders, especially NDF, so as to identify the priority areas/activities for watershed management and also guide rural communities to use their lands in a proper and sustainable manner. Consequently, the Study Team proposes to prepare the guidelines/principles on land use and management of the target watersheds in accordance with the respective geographical features and the present land uses in the area.

4.4.2 Methodologies for Formulation of Guiding Principles

A zoning method was employed to determine the recommended land uses in the target watersheds. "Zoning" is known as one of the land classification systems; it divides a certain area into several parts with different management guides/practices suitable to the respective geographical features. Because of its nature, the zoning system has often been used for land use planning, environmental management, and management of a large watershed with different topographic conditions. In this management plan, the aims of zoning are to:

i) maintain and/or enhance the watershed functions of the target watersheds;
ii) promote sustainable management of agricultural and forested lands; and
iii) ensure livelihoods of local households living in the watersheds by allowing them to use existing and potential agricultural lands in a sustainable manner.

The following zoning procedures were developed by examining the land use planning guidelines in Indonesia and other tropical counties and by assessing the present land use in the watersheds.



<1 Any protected areas: the area is designated as a protected area by the government or communities.

Flow of Zoning

4.4.3 Land Use Principles of the Target Watersheds

As a result of zoning, the target watersheds were divided into four zones namely, Protection-Zone (P-Zone), Special Management Zone (SM-Zone), Sustainable Use Zone (SU-Zone), and

Community/Production Zone (C-Zone) as presented in Table 4.1 and Figure 4.1. The following table also shows the areas of each zone in the target watersheds.

Areas of Each Zone in the Watersheds

(Unit: ha or %)

Watershed	P-Zone		SM-Zone		SU-Zone		C-Zone		Total	
	ha	%	ha	%	ha	%	ha	%	ha	%
Comoro	4,769	24	6,226	31	7,426	37	1,790	9	20,212	100
Laclo	17,996	14	37,803	29	55,963	43	19,357	15	131,118	100
Total	22,765	15	44,029	29	63,389	42	21,147	14	151,330	100

Source: JICA Study Team

The Comoro watershed has about 4,800 ha of P-Zone (or 24% of the area), while about 18,000 ha (or 14% of the area) is categorized as the same zone in the Laclo watershed. SM-Zone and SU-Zone, which are dominant in both watersheds, account for about 70% of the target areas. Each zone has land use and management guidelines/principles as outlined in the following paragraphs. Land users shall determine the proper land use in compliance with these guiding principles described below.

a. P-Zone

P-Zone is the area where any land uses and economic activities except those allowed by UNTAET No. 19 are prohibited since it has critical functions and environmental values. The following areas are categorized as P-Zone:

- Area designated as the wild protected area in UNTAET No. 2000/19 (2000);
- Micro- or sub-watershed where a source of water supply to cities and villages is located;
- Area where a large-scale land slide takes place;
- Area covered with dense forest; and
- Area with more than 55% slope (except coffee plantation).

Because of its environmental values, the areas under P-Zone shall be managed as protected forests.

b. SM-Zone

Medium forests and areas with slopes between 40% and 55% are classified as SM-Zone. Coffee plantations with more than 55% slope are also classified into the same. The areas under SM-zone can be used for production purposes but need to be used and managed as forest due to its vulnerability to soil erosion. Hence, tree crop-based farms and/or production forests, such as i) firewood forests (maintaining existing medium forests), ii) coffee plantation with shade trees, iii) orchards of fruit trees, and iv) production forests of valuable trees, are the possible land uses in this zone.

c. SU-Zone

Areas within a range of 15% ~ 40% slope or those covered with sparse forests are classified as SU-Zone. The basic idea of this zone is to allow the rural community to use the areas for production purposes while maintaining the land productivity. Hence, the areas can be used for farming but should be managed in a proper manner by applying soil conservation measures or introducing agroforestry and silvo-pastoral techniques. In the case of sparse forests, the present stock of trees or canopy cover should be maintained. In concrete terms, the following activities will be allowed:

- Upland farming with appropriate soil conservation measures;
- Firewood forests;
- Production forests;

- Tree crop-based farming (coffee and orchards);
- Animal grazing with silvo-pastoral practices; and
- Shifting cultivation with a sufficient fallow period (more than 10 years).

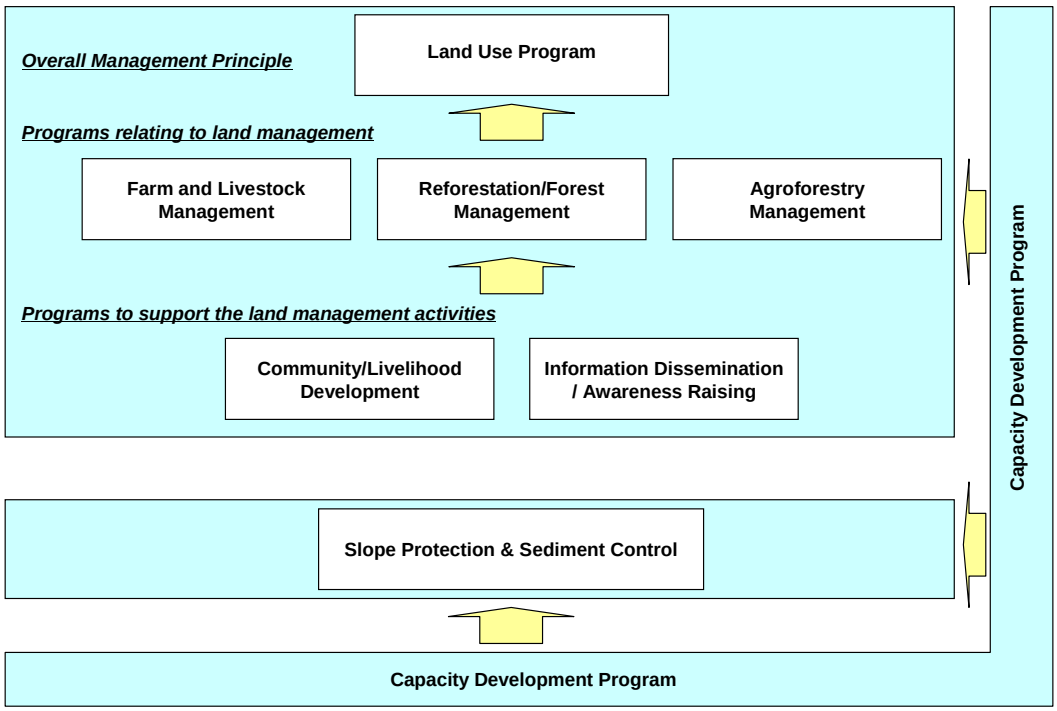
d. C-Zone

Areas that do not belong to the above-mentioned zones are categorized into C-Zone. In general, they are flat to gently sloping and with less vegetation cover (bushes, grasslands, and bare lands). Because of its features, the areas can be used for socio-economic development by rural communities with a few restrictions. Upland farms, grazing lands, paddy fields, and firewood forests are the possible land uses in this zone to name a few.

Chapter 5 Overall Watershed Management Plan

A total of eight programs are proposed in the CBIWMP to achieve its goal and objectives and to realize the zoning presented in Chapter 4 as the guiding principles in land use and management of the target watersheds.

The eight programs are broadly grouped into three components, namely, i) land management component, ii) river management component, and iii) overall supporting component.



Overall Structure of CBIWMP

Under the land management component, a total of six programs are proposed. Land Use Planning Program, which is the core program of the watershed management plan, aims to promote proper land use in the watersheds while securing livelihoods of rural communities residing in the watersheds. Three land management-related programs: i) Farm and Livestock Management Program, ii) Reforestation/Forest Management Program, and iii) Afforestation/Silvopastoral Management Program, are proposed to assist rural communities in ensuring the implementation of the land use plan developed by rural communities in the Land Use Planning Program. Furthermore, two programs, i) Community/Livelihood Development Program and ii) Information Dissemination / Awareness-Raising Program are proposed to support the programs related to land management.

Slope Protection and Sediment Control Program is proposed under the River Management Component to control the volume of sediment in the main river and protect river banks from bank erosion.

Capacity Development Program is also proposed for the Overall Supporting Component with the aim of developing the capacities of the concerned stakeholders in implementing the watershed management plan.

5.1 Land Use Planning Program

5.1.1 Objectives

Although the land use and management principles or results of zoning provide a macro level land use plan in the target watersheds, there is still a need to develop a land use plan at the suco level so as to enable rural communities to translate such ideas into practice on the ground. The main objective of the land use planning program is therefore to enable MAF/NDF and rural communities to manage and use forests and natural resources in the watersheds in line with the land use and management principles proposed in Chapter 4.

5.1.2 Strategies

Since rural communities will have the main responsibility for management of forests and natural resources in the village, the land use and management principles need to be understood by rural communities and translated into the future land use plan at the village level. The participatory land use planning (PLUP), which has been used in other Asian countries as a planning tool for community-based forest management, is proposed as a scheme to design the optimum land use on a micro or suco level. The PLUP allows rural communities who actually reside in the village to determine the future land use in their territory so that their needs as well as land and forest management practices could be incorporated into a micro plan. Such an arrangement in the PLUP is indispensable for making a practical future land use plan.

5.1.3 Participatory Land Use Planning Sub-program (PLUP-SP)

PLUP-SP is the sole activity to be undertaken under this program. The sub-program aims to help rural communities develop a future land use plan with local rules on natural resource management in the village in consideration of the present land use as well as the land use and management principles. Through the planning process, communities can identify optimum and sustainable land uses, strengthen their capacity to manage natural resources in a sustainable manner, and create land and resource use regulations that are environmentally sound and acceptable to the present social conditions in the target watersheds.

(1) Objective

The main objective of the sub-program is to assist rural communities in developing a future land use plan with local rules on natural resource management considering the land use/management principles, current land use, traditional land ownership, and any issues that community members/villagers face in managing their lands. The future land use plan and local rules will be compiled into the village regulations/by-laws so as to make the rules effective.

(2) Target Area

All the sucos in and around the watersheds need to prepare their future land use plan and local rules on natural resource management. However, priority should be given to:

a. sucos whose territories are located within the critical catchment in the Comoro watershed; and
b. sucos whose territories overlap with the Protection Zone.

In particular, special attention should be given to sucos which are located within the critical catchment in the Comoro watershed. Figure 5.1 shows the necessity of the sub-program in all the sucos in and around the target watersheds.

(3) Implementing Agencies

NDF and the MAF district offices are the main implementing organizations. Forest guards assigned to the respective villages should be involved in the implementation of the sub-program since their tasks are closely related to the implementation of the local rules to be prepared under the sub-program. The district and sub-district administrative offices should also be involved in the finalization of the village regulations/by-laws for smooth endorsement. As the sub-program requires a series of discussions among community members, local NGOs/facilitators that have experience in participatory planning should be hired for the implementation of the sub-program.

(4) Implementation Procedures

The PLUP is to be implemented in accordance with the following steps:

a. Step 1: Preparation for the sub-program

In the preparatory stage, the following activities are to be undertaken:

- Procurement of NGOs/facilitators;
- Guidance to NGOs/facilitators and the MAF district officers, including forest guards;
- Preparation of a working plan;
- Analyses of existing socio-economic data of target sucos; and
- Guidance to rural communities of the target suco.

b. Step 2: Participatory assessment of the target suco

MAF/NDF together with NGOs/facilitators will assist rural communities in the target suco in assessing the present conditions of their localities. The assessment using the participatory planning tools will be carried out to clarify, but not limited to, the following aspects:

- Village boundaries, present land use, major resources, and locations of sub-villages/hamlets in the target suco;
- Socio-economic and institutional conditions of the target suco;
- Past and present land and natural uses; and
- Any conflicts over land and natural resource uses.

c. Step 3: Group formation and work planning

A working team composed of the council members and major land owners of the suco will be organized. The working group will develop an overall work plan of the sub-program and its annual work plan for the next 12 months with the assistance of local NGOs/facilitators.

d. Step 4: Assessment of the present land use

The working group will be assisted by NDF and local NGOs/facilitators to prepare a present land use map using the resource map that they would prepare in the participatory assessment and the aerial photo maps covering the target suco[1]. The present land use map to be prepared should include the boundaries of the suco and aldeias, major landmarks (e.g., rivers/creeks, roads, suco office, school, church, spring, etc.), boundaries of the present land use types (e.g., dense forest, medium/sparse forest, grassland, area for shifting cultivation, permanent farm, coffee plantation, etc.), and other major natural resources.

e. Step 5: Discussion on future land use options and future land use mapping

Local NGOs/facilitators, together with NDF, will encourage the working group to discuss i) current land and resource management practices, ii) major causes of forest and land

[1] Aerial photo maps covering the entire country are available in electronic form from ALGIS, MAF.

degradation, iii) possible future land use, and iv) proposed land and resource management practices. As a result of the discussion, a list of land use and resource management options will be prepared.

A future land use map of the village will be prepared by using aerial photo maps with the boundaries of the land use types defined in the present land use map. In the process of the future land use planning, the working group will demarcate the areas for protection and production forests, permanent upland farms, animal grazing, shifting cultivation, reforestation and others. Based on the maps prepared by the communities, local NGOs or NDF shall finalize the future land use map at a scale of 1:25,000 using GIS software.

e. Step 6: Preparation of village regulations, including local rules on natural resource management

At the same time, the local rules on natural resource management will be discussed among the members of the working group. At the start of the discussions, the village rules/norms that the target suco used to follow during the Portuguese era will be discussed. Based on the village rules used during the said era, the working group will draft the local rules on the use and management of natural resources in the village. The group will further discuss other clauses in the regulations, such as general regulations in the village, persons/groups responsible for the implementation of the regulations in the village, and fines and penalties to be imposed, so that the regulations can be used as the village regulations literally. The draft regulations shall be prepared in writing.

f. Step 7: Consultation with community members in the suco

The village regulations with the future land use map will be presented by the working group to all communities in the target village. This is an important process for the working group and other community members as well. The former can deepen their understanding of the village regulations, while the latter can also reconsider their daily activities and have an idea on what they are supposed to do in the future.

g. Step 8: Agreement with MAF/NDF

The village regulations will be submitted to NDF through the MAF district office with an endorsement of the concerned district and sub-district administrative offices. NDF will also sign the regulations either as an approving authority or endorser so that the target village can use the regulations as a basis for the use and management of forest resources in its territory.

h. Step 9: Tara Bandu ceremony

Tara bandu ceremony will be organized with the presence of the leaders of the neighboring villages as well as the relevant organizations in the government. In the ceremony, the village leader will announce the village regulations on the future land use map in their traditional way.

i. Step 10: Monthly monitoring of the implementation of the regulations

The working group, together with the local NGOs/facilitators and the MAF district office, should organize a meeting every month to monitor the implementation of the regulations on a monthly basis. In the meeting, the group will discuss any breaches or cases taking place in the village and the necessary actions to be taken about such cases. Through such continuous meetings and discussions, the members of the working groups are expected to develop their governance capacity.

5.2 Reforestation and Forest Management Program

5.2.1 Objectives

Deforestation or forest degradation mainly caused by frequent forest fires and collection of firewood and wooden poles is an on-going issue on watershed management in the target watersheds as discussed in Chapter 3. Although there is no reliable data to indicate the pace of forest degradation or deforestation, the forest resources in the target watersheds has been constantly decreasing with the increase in population since 2002.

Under these circumstances, the aims of the Reforestation and Forest Management Program are to rehabilitate the degraded forests and to increase the forest cover in the target watersheds by supporting rural communities in producing, planting and tending seedlings, and protecting natural forests in their localities. The program also gives due attention to the capacity development of rural communities to enable them to prepare themselves for the Draft Community Forest Management Agreement, which will be one of the arrangements to be made by NDF and rural communities, as proposed in the draft Forest Management Decree (FMD).

5.2.2 Strategies

In the formulation of the Reforestation and Forest Management Program, the following key concepts are kept in mind:

Practicable: Techniques and options proposed by the program should be easily adopted and practiced by rural households. The techniques introduced may be further modified or adjusted to the local conditions in the course of the program;

Profitable: Tree species and activities proposed by the program should generate visible profits/benefits for rural households both in the short- and long-terms; and

Sustainable: Activities proposed by the program can be maintained by rural households in a self-sustained manner without depending on external support.

The key concepts listed above are the bases in the formulation of the program. Furthermore, the following strategies/approaches are taken into account in planning the sub-programs under the program:

1) Application of a community-based approach;
2) Due consideration to the community needs;
3) Strengthening of MAF/NDF's capacity to support the community;
4) Development of the capacities of rural communities; and
5) Use of local materials, knowledge, and customary practices.

(1) Application of community-based approach

As indicated in Chapter 4 "Basic Concepts of the Watershed Management Plan", the community-based approach is the core principle that the program should follow. As it literally means, rural communities should be responsible for the maintenance, management and use of seedlings planted and existing forest resources in their localities. Hence, community participation is indispensable for making the program practicable and sustainable, especially under the current conditions of Timor-Leste, wherein the capacity of the government is very weak.

The NDF has taken a top-down approach in its reforestation program so far. It has just provided seedlings to rural communities or developed plantations by hiring local households but with minimal consultation prior to the activities. The limited involvement of rural communities in reforestation and forest management activities resulted in poor management of the seedlings provided/planted by the government programs. It is therefore quite important to foster a sense of

ownership of the seedlings planted among the people in rural communities so that they would maintain and protect the seedlings/trees on their own initiative. In principle, the more involved rural communities are in the decision-making processes of the program, the higher the sense of ownership they have about the program.

(2) Due consideration to the community's needs

In general, reforestation and forest management cannot generate visible benefits in a short period of time. Because of its nature, rural communities would likely show little interest in reforestation and forest management activities, especially in case that a program does not include a scheme to pay labor wages. Hence, this program needs to give due consideration to the needs and demands of rural communities to generate certain benefits for the communities. Selection of fruits and industrial and value-added trees as tree species for reforestation is one of the options to be taken into account.

(3) Strengthening of NDF/MAF's capacity to support the community

Although MAF has recently recruited a number of extensionists and forest guards at the district level, many of them are new graduates or local household members having minimal experience in reforestation and forest management. In addition, the staff members of the MAF district offices and NDF have also minimal experience in community-based forest and natural resource management in the field. As they are crucial stakeholders for ensuring the sustainability of the program, their capacities need to be strengthened in the course of the program. It is therefore important to create opportunities whereby the government staff concerned could learn during the implementation of the program.

(4) Development of capacities of rural communities

The program should also focus on the enhancement of capacities of rural communities since they are responsible for the protection and management of forest resources at the village level. A training scheme for rural communities should be introduced in the program. Since many members of rural households are illiterate and isolated from public services, merely displaying a demonstration plot or conducting lectures might not be effective in imparting the techniques to these communities. It is therefore essential that a training scheme proposed in the program should provide opportunities for rural communities to practice and experience the techniques/skills related to forest management and observe the results of what they have done in the course of the training. The Farmer Field School[2], which has been widely used as an extension tool in the field of agricultural extension, can be introduced in the program to transfer technologies and skills to rural communities in an effective manner.

(5) Use of local materials, knowledge, and customary practices

In order to enhance the practicability of the program, it is important to incorporate local materials, knowledge, and customary rules/practices into the program. The technologies and designs of plantation could then be adjusted to suit local knowledge and resources in the target watersheds.

(6) Reforestation in a strategic manner

Under the existing government-initiated reforestation programs, NDF has just distributed seedlings to rural communities without monitoring where the seedlings were planted by rural communities. Although the said existing government activities may have contributed to the restoration of forest covers on a certain level, the impact would not be substantial as compared to the inputs made for

[2] The Farmer Field School (FFS) originated in the promotion of integrated pest management (IPM) system in the 1980s. FFS has been promoted as a tool for participatory learning and experimentation all over the world with the hope that it is the remedy for agricultural extension system.

the activities. Ideally, reforestation should be undertaken strategically to achieve the future land use plan/design of the watersheds.

It is crucial that reforestation or the planting of seedlings should be based on the needs to improve vegetation cover at the respective locations in terms of watershed management. The following table shows the expected functions of forests in each type of land categorized by zoning in Chapter 4.

Expected Functions of Forests

Type of land	Purpose to plant trees
P-zone Slope: more than 55%	1. To prevent slope failure and surface soil erosion 2. To enhance the water harvesting capacity 3. To create habitats for diversified ecosystem
SM-zone Slope : 40~55%	1. To prevent slope failure and surface soil erosion 2. To enhance the water harvesting capacity 3. To produce coffee and valuable forest resources
SU zone Slope : 15~45%	1. To prevent surface soil erosion 2. To produce coffee, fruits, industrial trees, fodders, and forest resources 3. To graze animals
C-zone Slope : less than 15%	1. To produce coffee, fruits, industrial trees, fodders, and forest resources 2. To graze animals 3. To produce organic matters for farm lands

Source: JICA Study Team (2010)

The needs for reforestation in the target watersheds are further assessed based on the functions of each zone as shown below.

Needs for Reforestation by Zone and Present Land Use

Zone	Present Land Use and Vegetation Cover				
	Bare land [1)]	Shrub & grassland [1)]	Sparse forest	Medium forest	Dense forest
P-zone	Reforestation (with timber/indigenous trees)	Reforestation (with timber /indigenous trees)	Enrichment planting	Enrichment planting	Protection
SM-zone	Reforestation (with timber/leguminous /coffee trees)	Reforestation (with timber/leguminous /coffee trees)	Enrichment planting	Enrichment planting Protection	-
SU-zone	Reforestation (with any type of trees)	Reforestation (with any type of trees)	Enrichment planting	-	-
P & C-zone	Reforestation (with any type of trees)	Reforestation (with any type of trees)			

Note: 1) It includes grazing land and upland farms.
Source: JICA Study Team (2009)

The above-mentioned guidelines should be taken into account in the planning and implementation of the activities of the program.

5.2.3 Proposed Sub-Programs

The following three sub-programs are proposed under the program:

a. Tree Planting Promotion Sub-program (TPP -SP);
b. Seedling Production Sub-program (SP-SP); and
c. Forest Management Planning Sub-program (FMP-SP).

(1) TPP -SP

a. Objectives

The ultimate goal of this sub-program is to directly contribute to the improvement of the watershed functions of the target watersheds. Hence, the sub-program aims to reforest bare lands and

rehabilitate/improve degraded forests in the target watersheds, especially in the P-Zone and the SM-Zone, by encouraging rural communities to plant seedlings in their localities in strategic as well as proper manners.

b. Implementing agencies

NDF and the concerned MAF district offices are responsible for implementing the sub-program. Local NGOs or facilitators should be hired for the field activities. The forest guards and extensionists should be involved in technical support to rural communities in the field.

c. Target areas

The lands with less vegetation covers, especially bare lands, shrubs and grasslands, and sparse forests in the watersheds are to be targeted by the sub-program. Since there is no suco without such lands, the sub-program can be implemented in all sucos in the watersheds. Among others, sucos located in the P-Zone and the SM-Zone, should be prioritized. Figure 5.2 shows the priority sucos for the sub-program.

d. Major Activities

The sub-program can be combined with the succeeding sub-program, Seedling Production Sub-program, if rural communities are willing to produce seedlings by themselves and the natural conditions in the suco allow them to establish community nurseries. In case the TPP-SP is implemented alone, the major activities to be carried out under the sub-program would be: i) guidance on the selection of tree species and plantation sites, ii) a series of hands-on training courses (field farmer schools: FFSs) on planting and tending seedlings along with the establishment of demonstration plots, iii) distribution of seedlings, iv) determination of planting plots, v) technical assistance in planting and tending seedlings in the individual plots, and vi) development of village regulations along with the revival of *Tara bandu*. The outlines of the major activities are further given below.

i) Guidance on the selection of tree species and plantation sites

As a first step, the following technical guidelines should be shared with rural communities so that they can plant the optimum tree species at the right places in a proper manner. One- or two-day technical guidance will be organized at the suco level.

Summary of Technical Guidelines for Tree Planting

Slope	Existing vegetation and land use by land owner	Density of planting	Tree species
>40 % (P-zone and SM-zone)	Vegetation: Bare land, Grass land Land use: Fallow, Upland farming field, Grazing land	Reforestation Distance between trees (m) 2.5 x 2.5 or 3.0 x 3.0 Density of planting: 900 ~ 1,600 trees/ha	1. Timber species (main species): Mahogany, Teak , Grevillea 2. Fast growing and fodder tree species (subordinate species): Leucaena (Ipil-ipil), Tephrosia, Calliandra, Mangium acacia
	Vegetation: Medium forest, Sparse forest Land use: Forest to fetch fuel woods, poles, etc. grazing land	Enrichment planting Distance between trees (m): 4.0 x 4.0 or 5.0 x 5.0 Density of planting: 400 ~ 625 trees/ha	
15-40 % (SU-zone and C-zone)	Vegetation: Bare land, Grass land Land use: Fallow, Upland farming field, Grazing land	Reforestation Distance between trees (m) 2.5 x 2.5 or 5.0 x 5.0 Density of planting: 900 ~ 1,600 trees/ha	1. Timber species: Teak , Sandalwood 2. Fast growing and fodder tree species: Leucaena (Ipil-ipil), Tephrosia, Calliandra, Mangium acacia 3. Industrial plant: Clove, Cinnamon, Candle nuts, Coffee, Petai
	Vegetation: Medium forest, Sparse forest Land use: Forest to fetch fuel woods, poles, etc. grazing land	Enrichment planting Distance between trees (m): 4.0 x 4.0 or 5.0 x 5.0 Density of planting: 400 ~ 625 trees/ha	
<15% (C-zone)	Land use: Residential area	Distance between trees (m) Fruit trees: 5.0 x 5.0 ~ 7.0 x 7.0 Other trees: 3.0 x 3.0 ~ 5.0 x 5.0 Density of planting: 400 ~ 900 trees/ha	1. Fast growing and fodder tree species 2. Industrial plant 3. Fruit trees: Rambutan, Longan, Mango, Orange, Avocado [1)], Jackfruits [1)], Breadfruits [1)]

Note: 1) These fruit tree species can grow only in humid areas.
Source: JICA Study Team (2009)

In the course of the technical guidance, rural communities should discuss the conditions of their lands and determine tree species suitable for the respective lands with facilitation of local NGOs/facilitators.

ii) Hands-on training courses on tree planting

In order for rural communities to go through the process of reforestation and practice all the techniques and skills necessary for planting and tending seedlings, a series of hands-on training courses or field farmer schools (FFSs) should be organized at demonstration plots developed at strategic locations in the target suco. The training courses/FFSs should cover, but not limited to the following topics:

- Assessment of land condition;
- Land preparation (clearing);
- Delineation of contour lines;
- Application of soil conservation measures;

- Designing, measuring and sticking;
- Hole-digging and refilling;
- Planting seedlings; and
- Tending (weeding, shading, and mulching).

iii) Distribution of seedlings

The sub-program will also distribute seedlings to rural households who participate in the training courses so that they can replicate the techniques and plant seedlings in their own plots. Although the number of seedlings to be distributed should be determined based on the capacity of rural communities, it is considered that more or less 200 seedlings per family should be the maximum. The same species planted in the demonstration plots should be distributed to the individual members in principle, since they are supposed be selected based on the site conditions of the target suco.

iv) Determination of planting designs

Prior to planting seedlings in the individual plots, rural communities should discuss where and how they would plant seedlings reviewing the technical guidelines introduced at the start of the sub-program. Local NGOs as well as forest guards and extensionists should also guide them on the proper selection of planting designs and methods according to the site conditions of the individual plots.

v) Technical assistance in planting and tending seedlings in the individual plots

Likewise, local NGOs and forest guards/extensionists should provide technical assistance in planting seedlings in the field so that community members could plant seedlings in their own plots properly.

vi) Monitoring and evaluation

The monitoring team consisting of the local NGOs and forest guards/extensionists should conduct monitoring to check the survival of trees planted by the group members. It shall be done by selecting sample members at the rate of 10% of total number of households who received and planted seedlings. The team shall visit the site where the members planted to measure its location (longitude and altitude) using GPS and check whether the planted trees are alive or not, then record it in the monitoring sheet. The results shall be reported at the annual evaluation and monitoring workshop to be shared among the group members for their further discussion on planning the activities in the coming seasons.

(2) Seedling Production Promotion Sub-program (SPP-SP)

a. Objective

There may be certain local needs for planting trees in rural communities. However, the current MAF's capacity to produce seedlings is limited to meet the total demand for seedlings, since there are only two large-scale nurseries in the country. Although MAF plans to establish an additional five nurseries all over the country in the future, it is uncertain when the plan will materialize. In addition, there is no plan to establish a government nursery in the target watersheds. Hence, the sub-program aims at the promotion of seedling production at the suco level as the production of seedlings at the community level is considered more effective and efficient in facilitating reforestation in the target watersheds. If this sub-program is combined with TPP-SP, rural communities might enhance a greater sense of ownership about seedlings planted in their own plots.

b. Implementing agencies

NDF and the concerned MAF district offices are responsible for the sub-program. The forest guards and extensionists assigned for target sucos should be involved in field activities. Since the

capacity of MAF/NDF as well as their field staff is still too limited to implement this sub-program at present, local NGOs and facilitators should be hired for its implementation.

c. Target areas

In principle, this sub-program is to be combined with TPP-SP. Sucos located in P-Zone and SM-Zone will be prioritized among sucos in the target watersheds as shown in Figure 5.3. However, not all sucos where TPP-SP is introduced can necessarily engage in seedling production, as the sub-program requires lands and sources of water for the establishment of nurseries and a number of laborers should be involved in nursery operations for more than six months. Hence, the target sites should be selected among the sucos targeted by TPP-SP based on the following conditions:

- Willingness of rural communities;
- Availability of lands and water sources for nurseries; and
- Accessibility to other potential sucos.

On the other hand, the sub-program can be introduced alone in a suco which has less potential areas for reforestation but whose neighboring sucos are in need of planting trees.

d. Major Activities

Like in the case of TPP-SP, hands-on training and technical and material assistance to rural communities would be the major activities to be carried out by the sub-program. As a venue for hands-on training and the place for seedling production, a community nursery should be established in each aldeia in the target suco. Rural households who are willing to take part in the sub-program will practice all activities in nursery operations. They will also be entitled to receive seedlings produced in the nursery for planting. The following table gives the major activities to be undertaken by rural communities in the sub-program.

Activities of Seedling Production Sub-program

Activities	Contents
1. Nursery establishment	1-1. Designing of the nursery 1-2. Land preparation of the nursery 1-3. Collection of local materials for nursery establishment 1-4. Establishment of the nurseries
2. Seedlings production	2-1. Collection of seeds of trees 2-2. Preparation of soils and composts and filling of soils into pots 2-3. Sowing of seeds into pots 2-4. Maintenance works (watering, shading and weeding) 2-5. Monitoring and recording of the number of seedlings
3. Seedling distribution	3-1. Land preparation of plantation (clearing, hole digging and applying manures) 3-2. Distribution and transportation of the seedlings 3-3. Recording of the seedlings delivered

Source: JICA Study Team

The above-mentioned activities will be carried out as a part of hands-on training courses or FFSs on the same activities.

e. Tree Species to be produced

In principle, tree species to be produced in the sub-program will be selected by rural communities at the start of the sub-program. However, the following species are recommended as tree species suitable to the natural conditions in the target watersheds and consistent with the needs of rural communities.

Recommended Tree Species Produced in the Community Nursery

Tree species
1. Timber species
Mahogany, Teak, Grevillea, Casuarina, Sandalwood
2. Multipurpose (Leguminous) species
Leucaena, Tephrosia, Calliandra, Petai, Mangium acacia
3. Fruits species
Rambutan, Mango, Orange, Longan, Avocado*, Jackfruits*, Breadfruit*
4. NTFPs species
Cinnamon, Clove, Candle nuts

*These fruits species can be grown only in humid areas.

(3) Forest Management Planning Sub-program (FMP-SP)

As described in Chapter 3, the FMD is currently in the approval process in the government. Once the decree is enacted and effective, rural communities that have natural forests within suco boundaries should exchange the community forest management agreement with NDF to secure the right to use forest resources. This sub-program is proposed with the aim of assisting rural communities in complying with the provisions of the FMD.

a. Objective

The main objective of the sub-program is to assist rural communities in preparing the Draft Community Forest Management Agreement. Some of the arrangements required for making the agreement are actually part of the activities undertaken in PLUP-SP, such as identification of forests, preparation of a forest map, and preparation of rules/procedures on access and use of natural resources, to name a few. Hence, the focus of the sub-program will be put on the arrangements/activities that PLUP-SP does not cover.

b. Implementing agencies

NDF and the MAF district offices concerned are responsible for the sub-program. Specifically, the district forest officers in the MAF district offices concerned are to be involved in the planning process. Local NGOs and facilitators should be hired to facilitate the discussions and preparation of the documents.

c. Target areas

All the sucos in the target watersheds should go through the process of this sub-program when the FMD becomes effective. However, priority should be given to sucos that have dense forest and/or P-Zone in the territories. Figure 5.4 shows the priority sucos for the sub-program.

d. Main Activities

The FMD would require the following activities for the acquisition of the Draft Forest Management Agreement:

a. Assessment of the present conditions of forests and woodlands in the suco;
b. Preparation of a map showing the forests to be managed by rural communities;
c. Preparation of a list of families, groups and individuals who can gain access to the forests;
d. Determination of objectives of forest management based on the types and conditions of the forests;
e. Determination of rules and procedures on access and use of forest resources;
f. Identification of necessary management activities/operations to maintain the forests;
g. Determination of sustainable harvesting arrangements;
h. Formulation of forest protection and conservation measures; and
i. Determination of roles and functions of all relevant local authorities.

Among the items listed above, items a), b), e) and part of f) will be discussed and undertaken in the course of PLUP-SP. Consequently, the remaining items need to be discussed between/among rural communities and MAF/NDF with facilitation of local NGOs/facilitators to develop a Draft Community Forest Management Agreement. The agreement is to be signed by the representatives of the target suco and witnessed by the local authorities as well as the district forestry officer prior to the submission to NDF.

e. Coordination with Other Sub-programs

There is no one who has gone through the above-mentioned process in the country and therefore the activities proposed in the sub-program are completely new to the staff of MAF and NDF, not to mention, the rural communities. Hence, coordination with the sub-programs relating to capacity development of the government staff and public awareness-raising is indispensable for the smooth implementation of this sub-program.

The terms and conditions of the Draft Community Forest Management Agreement as well as the process of making it should be shared among the stakeholders. The staff of NDF and those of the MAF district offices should be guided properly in the whole process of making the agreement as part of their on-the-job training (OJT).

5.2.4 Implementation Procedures

As suggested in sub-section 5.2.2, the sub-programs under Reforestation/Forest Management Program are implemented through a community-based approach. Although there might be slight differences or changes, the following steps will be commonly taken in the course of the sub-programs at the village level.

Step 1: Guidance to the target village

Prior to the full involvement of rural communities in the sub-program activities, a series of meetings and guidance should be organized to disseminate the information on the sub-programs to community members to deepen their understanding and thus, ensure their cooperation with these sub-programs.

Step 2: Participatory assessment

In this step, the communities will go through a participatory planning process, such as mapping, self-analyses, and ranking, etc., to assess the current situation in their territories. In the assessment, they will analyze: i) distribution of forests by type, ii) current use of forest resources, iii) extent of forest degradation, iv) current issues on forest and land management, and v) necessary interventions to reduce the degradation and improve the situation.

Step 3: Group formation and planning

Right after the participatory assessment, the beneficiaries' groups exclusively for the sub-program will be organized. The group composed of 20 members will be organized in each aldeia. The communities in each aldeia should select 20 individuals/families who are willing to take part in the activities of the sub-program for group formation.

The members of the groups with the assistance of local NGOs/facilitators and NDF and the MAF district offices will prepare two types of work plans for implementation of the sub-program namely, i) an overall work plan, and ii) an annual work plan for the coming 12 months.

Step 4: Implementation, monitoring, and evaluation

The communities will implement the sub-program in accordance with the annual work plan prepared in the previous step. Local NGOs/facilitators and NDF together with the MAF district office, will provide technical assistance and guidance to the beneficiaries' groups so that they can implement the sub-program in a proper manner. Periodic monitoring is a major task of NDF and the MAF district offices to keep the sub-program on the right track.

On the other hand, the members of the beneficiaries' groups should evaluate and review their performance every 12 months and prepare the annual work plan for the next 12 months based on the evaluation. The overall work plan should also be revised as the need arises.

5.3 Farm and Livestock Management Program

5.3.1 Objectives

Upland farming and shifting cultivation are the predominant agricultural production systems found in the watersheds. The productivity of the farming system is far from adequate and is easily affected by the fluctuation of rainfall. Consequently, the majority of farmers in the watersheds have often suffered from food shortage during the pre-harvest season from November to February. Food deficiency often causes a lack of seeds for the next cropping season, which further causes the prolonged food shortage. In addition, the limited availability of animal feed or herding area during the dry season is another problem that rural households have commonly encountered. Under such circumstances, this program aims to stabilize and increase agricultural production to ensure food security and secure livelihoods at the household level by improving the present farm and livestock management.

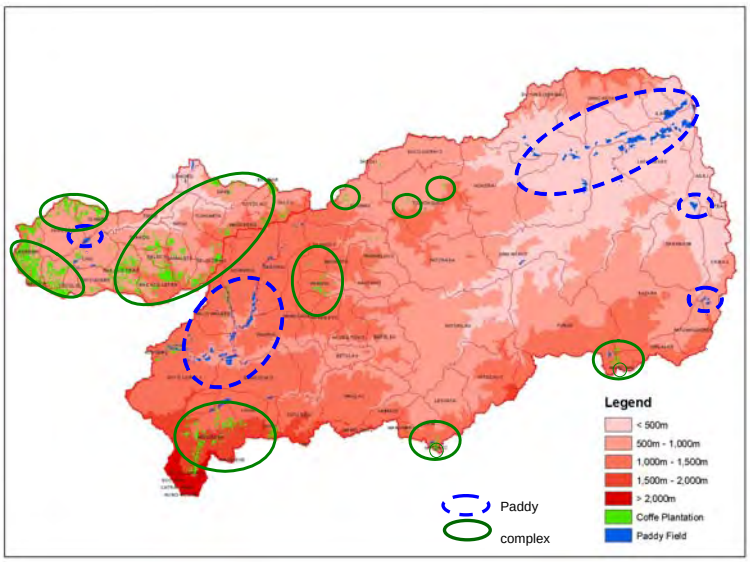
5.3.2 Strategies

In order to attain its objective, the following strategies were set:

- Optimization of farm and livestock managements considering agro-ecological features;
- Utilization of local resources and technologies;
- Introduction of FFSs;
- Capacity development of MAF extension staff; and
- Collaboration with existing development initiatives (on-going projects).

(1) Optimization of farm and livestock management considering agro-ecological features

The target watersheds have a wide range of geographic and climatic features. Although the present farm and livestock management system has been developed in accordance with local conditions over the years, it could be made more productive and sustainable by optimizing it under the particular conditions. Thus, the current agricultural management systems were broadly assessed to identify the optimum agriculture and livestock management options in the target watersheds. The Study Team broadly classified the current agricultural management systems in the target watersheds into the following three types according to the major products produced under the current situation:



Distribution of the Agricultural Management Systems in the Watersheds

i) Paddy complex;
ii) Coffee complex; and
iii) Upland.

Each management system was characterized as shown below.

Characteristics of Agricultural Management Types in the Watersheds

Type of agricultural management		Elevation	Slope	Rainfall	Irrigation	Proportion of Pasture	Major crop production and livestock management practices
I	Paddy Complex	Low-Middle	Mainly 0-40% (esp.< 15%)	Mainly 1,000-2,000 mm	Partial	38%	-Upland farming (shifting and permanent cultivation) with paddy field -Free animal grazing with a number of large-sized ruminants, i.e., buffalo and cattle
II	Coffee Complex	Middle-High	Mainly 15-40%	Mainly >2,000mm	×	22%	-Upland farming (shifting and permanent cultivation) with coffee plantation, -Free animal grazing with mainly small-sized ruminants or occasionally picketing some large-sized ruminants
III	Upland	Middle-High	Mainly 15-40%	Mainly 1,500−2,000mm	×	20%	-Upland farming (mainly shifting cultivation) -Free animal grazing with all types of animals but few large-sized animals

Source: JICA Study Team (2007)

The following table shows the number of sucos for each agricultural management system in the watersheds.

Number of Sucos for Each Agricultural Management System

Watershed	Sub-district	Total villages	No. of Village		
			Paddy Complex	Coffee Complex	Upland
Comoro	Bazartete	4	0	3	1
	Railaco	9	0	9	0
	Laulara	8	0	3	2
	Aileu	1	0	1	0
Laclo	Aileu	11	6	4	1
	Liquidoe	7	0	1	6
	Remexio	8	0	2	6
	Laclubar	6	0	1	5
	Laclo	4	3	0	1
	Manatuto	4	2	0	2

Source: JICA Study Team (2007)

Furthermore, the strengths, weaknesses, opportunities and threats (SWOT) of each management type were analyzed as shown in Table 5.1. The Study Team identified the necessary interventions to improve each agricultural management system based on the SWOT analysis.

Interventions to be examined

Type	Necessary Interventions
Paddy Complex	Stabilization of paddy production Improvement of a linkage between crop production and livestock management Improvement of animal rearing/raising system
Coffee Complex	Rehabilitation of aged coffee plantations Introduction of new/other cash crops Introduction of vegetables farming Introduction of quality seeds
Upland	Introduction of agroforest/silvo-pastoral management systems Introduction of new/other cash crops

Type	Necessary Interventions
	Introduction of vegetables farming Introduction of quality seeds Introduction of irrigation systems

(2) Utilization of local resources and technologies

In the watersheds, there are some indigenous resources and technologies that could be used and maximized to improve the current management systems. For example, there seem to be springs that could serve as water sources for small-scale vegetable production in the watersheds. Another example is that animal wastes and crop residues, which are hardly used at present, could be used for making compost for soil improvement. This program explores various resources and techniques available in the local conditions and utilizes them for implementation. The sub-program should identify the potential resources and techniques available in the respective localities and propose to use such resources and techniques for the improvement of the current farming and livestock management practices, under the agricultural management systems in the target watersheds.

(3) Introduction of Farmer Field Schools

Provision of farm inputs and development of demonstration plots have been the main agricultural extension methods in the country, especially during the Indonesian times. Under such methods, the techniques demonstrated in the demonstration plots seem to have not been fully acquired by rural communities, although the communities seem to have often enjoyed the materials distributed by the government. In order to ensure technology transfer on a community level in Timor-Leste, it is believed that the extension method should have a scheme where local communities could actually practice the techniques/skills in farming.

Farmers' Field School (FFS), which was first introduced as an extension tool to promote integrated pest management (IPM) in 1989, is well-known as an effective tool to empower local farmers involved in the training courses since they could go through all the processes and gain the knowledge by practicing the techniques and experiencing the results from application of the techniques. Farmers who participate in FFSs are expected to be the role models for other community members in the village. The existence of a role model would be of great effectiveness, since community members could easily envisage their future from this role model in the village. Although the FFSs method or organization of a series of hands-on training courses is rather time-consuming and laborious, it is believed to be the most dependable way under the current circumstances of Timor-Leste.

(4) Capacity Development of MAF Extension Staff

While MAF recruited and deployed a number of extensionists at the suco levels to strengthen its extension services for rural communities, many of the new recruits are either new graduates or local people in villages, and their capacities are too limited to provide the effective extension services to rural communities. Hence, capacity development of the MAF district staff, especially extensionists, shall be a requisite input to be made by the program so as to ensure its sustainability and make these extensionists capable of implementing the program in the future.

It is therefore necessary for the district staff as well as extensionists to take part in the implementation of the program while their roles and responsibilities would be less in the initial stage of the program's implementation. They are expected to develop their capacities to implement the activities in the program through OJT. The more they develop their capacities, the more important role they will play in the program implementation. In the long run, the activities introduced by the program are expected to be part of their routine extension works.

(5) Cooperation with existing development initiatives

The proposed sub-programs are to be harmonized with development initiatives made by other donors and international organizations. There are on-going agricultural development interventions undertaken by the GoTL, international organizations, and local NGOs in the watersheds. Knowledge and technologies introduced by those on-going projects could be used for the formulation of the sub-programs/options of the program. The following table shows the major activities undertaken by the on-going projects/programs in the target watersheds.

Major On-going Development Initiatives in the Target Watersheds

Supporting Entity	Relevant Activities	Major Target Districts in the Study area
Seeds of Life	Research and on-farm demonstration trials on improved varieties of maize, cassava, sweet potatoes, rice and peanuts.	Liquica, Aileu and Manufahi, etc.
JICA	Agribusiness named as One Village One Product or SIPI (Suco Ida Produti) Manatuto Irrigation and Rice Cultivation Project	Liquica Manatuto
PARDTL	Technical extension on the following agricultural techniques: i) coffee production, agroforestry, terracing, horticulture production, and industrial tree production	Ermera and Aileu
OISCA	Training on horticultural crops, livestock feeding, and agricultural machines	Training Center is located in Liquica. Participants are not specified. In general selected participants can come to the training center. It also dispatches trainers to communities.
USC-Canada	Home garden, terracing, agro-forestry and stall feeding and livestock	Manatuto
CCF	Food Security Program (home garden)	Manatuto

Source: Interview Results and JICA Study Team Progress Report (1)

5.3.3 Proposed Sub-programs

The following four sub-programs are proposed under the program:

a. Community-Based Seed Extension Sub-program;
b. Home Garden Sub-program;
c. Grazing Control with Protein Bank Sub-program; and
d. Animal Feed Preservation Sub-program.

In addition to these sub-programs, two sub-programs, i.e., Small-Scale Irrigation/Reservoir Development Sub-program and Marketable Vegetable Production Sub-program, were conceptualized as medium- or long-term sub-programs. However, they were not listed in this report as proposed interventions because: i) MAF currently puts its emphasis on the rehabilitation or development of large-scale irrigation systems in lowland areas[3]; and 2) production of marketable vegetables, such as high-value vegetables, is still too risky for many farmers in the target watersheds due to poor road conditions and limited agricultural production facilities in the area.

[3] According to National Directorate for Irrigation and Water Management, its focus for irrigation development tends to be more than 50 ha, which was based on the criterion under Agricultural Rehabilitation Programme funded by World Bank. For upland farming, it intends to deal with the establishment of check dams, which is proposed as the program of Slope Protection and Sediment Control. They are also interested in setting up tanks for water harvesting. But this requires feasibility studies in both technical/resource and economic aspects. And arguably it requires accumulating farm lands which is very difficult in the current situation. If the community has determined and actualized new land use and the needs and feasibilities are confirmed, such intervention could be implemented. With these many assumptions, scale irrigation / reservoir is proposed for medium- and long-term intervention at this time.

Outlines of the sub-programs proposed for the immediate and short-term activities are highlighted below.

(1) Community-based Seed Extension Sub-program

a. Objectives

The principal objective of the sub-program is to ensure food security at the household level and eventually at the village level by increasing the production of staple food crops (e.g., maize, cassava, sweat potato) through i) the provision of quality seeds including the improved varieties introduced by MAF/Seeds of Life (SoL) and ii) the provision of training on improved farming practices. It is noted that no fertilizer or agrochemical is required for producing even the improved varieties as these varieties introduced by SoL are accustomed to the prevailing farming practices in Timor-Leste. This sub-program targets upland staple crops since they are the main crops in the target watershed.

b. Implementing agencies

NDAH is the main implementing agency. Local NGOs/facilitators should be hired for facilitating the field demonstration at the suco level in the initial years.

c. Target areas

Areas classified as Type II (Coffee complex) and Type III (Upland) in Section 5.2 are mainly targeted. Type I (Paddy complex) could also be targeted although may not be major in light of the purpose of watershed management. The priority areas for implementation are identified with the dependency on upland crops as presented in Figure 5.5. In particular, the areas/sucos facing food shortage were prioritized.

d. Main activities

The sub-program will introduce quality seeds of improved and local varieties of staple food crops into communities with a series of hands-on training courses (training courses conducted through FFSs) on improved farming practices, such as compost making, seed preparation, and line planting. The major activities in the course of the sub-program are further explained below.

i) Development of demonstration plots

In the targeted suco, NDAH with the assistance from local NGOs/facilitators will first develop demonstration plots at the aldeia level after the organization of participating community members into a beneficiaries'/producers' group at the same level. The size of a demonstration plot should be at least 0.05 ha for each crop so as to produce and secure seeds for the next cropping. The more types of seeds the sub-program introduces, the wider the demonstration plots should be. In principle, the demonstration plot should be developed at the plot owned by a core member of the group.

ii) Hands-on Training/FFSs

Hands-on training (FFSs) on improved farming practices is the core activity in the sub-program. Core and other participating members of the groups will practice improved upland farming techniques in the demonstration plots, such as compost making, land preparation, seed preparation, line planting, harvesting/post-harvesting, and seed preservation. In order for them to fully acquire the techniques, two rounds of training courses or FFSs should be required for the same members. In particular, in case the weather condition does not allow the sub-program to have good harvest from the demonstration plots, another round of FFSs should be organized so that the groups secure the quality seeds enough for them to use for the next cropping.

iii) Provision of quality seeds

In coordination with MAF and SoL, the sub-program will provide participating farmers with the same types and volumes of quality seeds as used in the demonstration plots, so that all participants can practice the techniques that they have learned through hands-on training/FFSs courses. Once they acquire the improved farming techniques and save quality seeds of the improved varieties, they could produce a sufficient volume of upland crop constantly.

iv) Share of quality seeds

In order to expand the sub-program's effects and activities, it is necessary to introduce a mechanism, in which participating farmers could share their surplus (seeds) with other farmers who are not members of the groups or eligible for FFSs and improved seeds in the sub-program. To do so, the target village including non-members should discuss how all communities could benefit from the sub-program. Introduction of a revolving seed banking system[4] should be discussed as one of the options. Local NGOs/facilitators together with NDAH and the MAF district offices should assist rural communities in the discussions of this issue.

v) Combination with other sub-programs

This sub-program could be combined with Sustainable Upland Farming Promotion Sub-program, which is one of the proposed sub-programs under Agroforestry Management Program. It is actually recommended that the training course or FFSs on the improved farming practices should include the soil conservation measures (e.g., bench terracing and contour composting). Such combination could make their farming activities more effective and sustainable. The results of the pilot project implemented by the JICA Study also suggest the same conclusion.

(2) Home Garden Sub-program

a. Objectives

The major objective of the sub-program is to improve nutrient conditions of rural households, especially those who mainly practice shifting cultivation and face a chronic food shortage, through the introduction of vegetable production in backyards or any fallow lands. Diversification of crops produced by rural communities is also another aim of the sub-program so that they could have an additional source of income by the sub-program.

As vegetable production tends to be done by women in the back yard, the sub-program could also contribute to the enhancement of the capacities of women in the village. Women, who generally tend to be less involved in social and economic activities in the village, could earn cash income and/or save expenditures for their families through this sub-program.

b. Implementing agencies

NDAH is the main implementing agency. Local NGOs/facilitators should be hired for the implementation of the sub-program at the suco level in the initial several years. The MAF district officers and extensionists should be involved in the extension activities in the field.

c. Target areas

This sub-program aims to support sucos which rely on the limited number of crops for food intake. In other words, sucos which are heavily dependent on food crop production with no/little options to gain income are to be targeted. Thus, sucos in Type III (Upland) are generally eligible for this sub-program.

Among others, those facing a chronic food shortage should be prioritized. Additionally, the accessibility to marketing centers or potential buyers for vegetables should further be considered in the selection of the target villages. Those who have access to the

[4] The initial idea of the seed bank is a pool of seeds deposited by the groups, where even non-members can borrow seeds from but have to return the same amount to it after harvesting.

markets/outlets will have more potential of earning cash income, and will continue the sub-program activities using their earnings after the government support. The potential area for the sub-program is shown in Figure 5.6.

d. Main activities

Development of demonstration plots, training courses or FFSs on vegetable production and provision of farm materials are the major activities of the sub-program.

Establishment of demonstration plots

A demonstration plot will be established in each aldeia by the beneficiaries' or producers' group to be organized for the sub-program at the same level. Assuming that around 20 households per aldeia participate in the sub-program, the size of a demonstration plot would be around 900 m^2 (30 m x 30m), including the area for a nursery.

Organization of hands-on training / FFSs

Like in the case of the other sub-programs, a series of training courses or FFSs on vegetable production, such as compost making, land preparation, seed preparation, crop rotation, farm management, and seed collection will be organized at the demonstration plots.

Vegetable production is suitable during the dry season in general, but the sub-program will organize the training courses or FFSs both during dry and rainy seasons. In the former season, several types of vegetables are produced, while beans are the major crops grown in the demonstration plots to recover the soil fertility and secure food crops for the members' families.

Provision of farm inputs

The sub-program will provide the same types and amounts of vegetable seeds to the members so that they could also produce the same vegetables using the techniques that they have learned in the demonstration plots.

Importance of extensionists' work

From empirical evidence in the pilot projects implemented by the JICA Study in 2009, it would take time for local people who have no or little experience in producing vegetables to acquire the techniques and eventually replicate them in their own farms. Thus, there is a need to strengthen the capacities of the extensionists to help and encourage the beneficiaries' group members to produce vegetables.

(3) Grazing Control with Protein Bank Sub-program

a. Objectives

Free-grazing has been the prevailing animal rearing system in Timor-Leste. However, the area suitable for stock farming is limited as compared to the expected number of animals, especially large-sized ruminant animals in the target watersheds. As the carrying capacity of natural grasslands and forests is insufficient to support animals, free-grazing practice has often caused land degradation or prevention of natural regeneration of forests in the animal populated areas in the watersheds. The major objective of the sub-program is therefore to control the unregulated free grazing practice by introducing a strategic land use concept and encouraging rural communities to change the animal rearing system from free-grazing to stall-feeding.

b. Implementing Agencies

NDL is the main implementing agency. The National Directorate of Research and Specialist Services (NDRSS), NDF, and the concerned MAF district offices should coordinate with NDL in the implementation of the sub-program. Local NGOs/facilitators should be hired for field operations of the sub-program especially in the initial several years.

c. Target areas

Type II (Coffee complex) and Type III (Upland) in the watersheds are generally targeted by the sub-program. In particular, sucos which are presently under high pressure due to grazing animal should be prioritized as shown in Figure 5.7. For the area of Type I (Paddy complex), another approach should be taken. The utilization of the paths between and around paddy fields for fodder trees/crops production and the installation of paddy straw silage are proposed as the major options.

d. Main Activities

The following activities will be undertaken at the aldeia level in a participatory manner:

- Determine how to graze animals in their territory by defining areas to be protected from animals, those to be used for controlled animal grazing, and those to be used freely;
- Determine how to keep livestock, e.g., making a fence around the protected areas or tying them up; and
- Establish a demonstration plot for protein banks (which are areas planted with productive legume-based fodders as alternative and supplementary feeds during the dry season).

Based on the experiences in the existing MAF's and NGOs' activities, the following species are recommended for protein banks:

- Gamal *(Glyrucudua maculate)*;
- Lantoro (*Leucaena leucocephala);*
- *Calliandra calothyrsus;*
- *Mucuna pruriens; and*
- *Pennisetum purpureum.*

The sub-program will provide the participating farmers with necessary inputs (e.g., seeds/seedlings) and technical assistance in the development and management of protein banks, while the farmers will offer lands and laborers necessary for the sub-program.

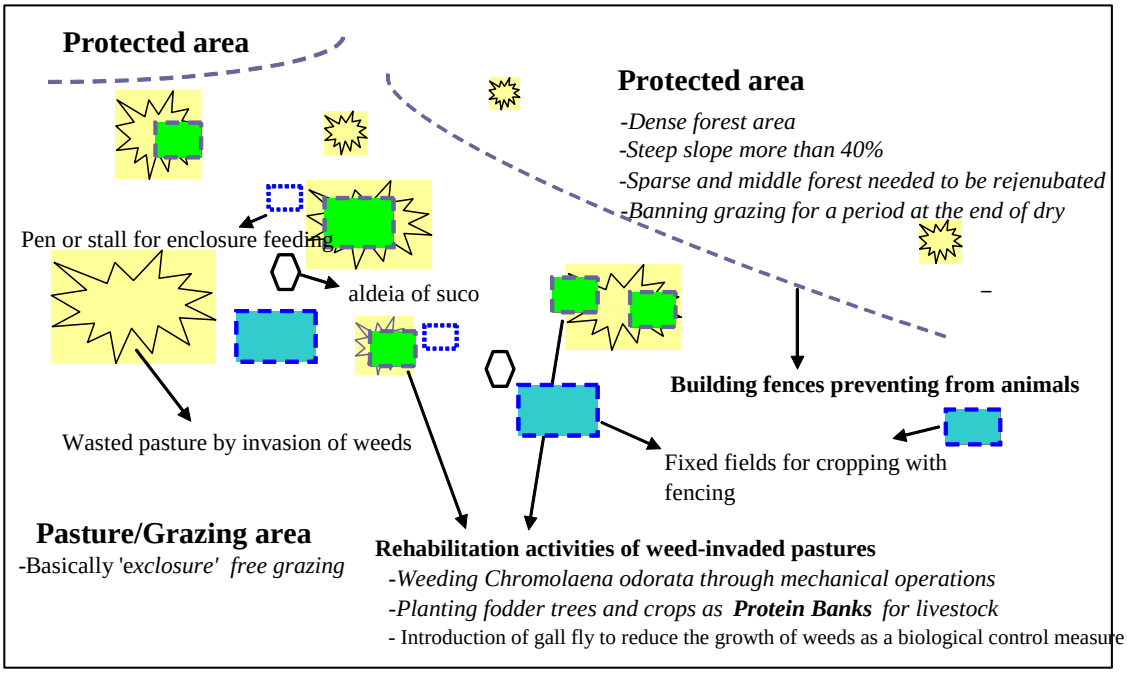
e. Option to be considered

The sub-program should also consider how to rehabilitate degraded or waste pasture lands covered with an invading harmful species named *Chromolaena odorata.* Mechanical weeding prior to the establishment of the protein bank is one of the measures against this weed. Another option is a biological control method using the natural enemy of weeds namely, a gall fly (*Cecidochares connexa*). This method does not require much input as compared to mechanical weeding. However, the following activities should be undertaken:

- Identify the sites for multiplication insectaries (demonstration plots) for the fly in consultation with NDRSS;
- Assist the community in the collection of galls (larvae of fly) in MAF's insectaries multiplication and inoculation at the demonstration plots;
- Assist in the maintenance and protection of the demonstration plots;
- Enhance the community's awareness regarding the biological control method so as to protect the demonstration plots from wild fires; and
- Assist in the inoculation of galls at other areas.

The empirical evidence in Timor-Leste indicates that it may take about five years for this biological control to be effective[5]. It is also required during this period that the demonstration plots and their surrounding areas can be protected from wildfire. Hence, a consensus with communities on these conditions prior to the introduction of this measure is a pre-requisite for the sub-program. Capacity development of the MAF district officers and extensionists is also crucial in ensuring the effect of the biological control, especially in case government support for the measure is less than five years.

Biological control is not necessarily implemented separately from mechanical weeding with the establishment of protein banks, but rather should be combined if rural communities agree with the idea. The following figure illustrates an image of controlled grazing by the application of both measures.



Grazing Control with Protein Banks and Waste Pasture Rehabilitation by Gall Fly

(4) Animal Feed Preservation Sub-program

a. Objectives

The sub-program aims to improve the nutrient conditions of animals especially during the dry season by introducing a feed preservation system to produce high quality feeds. Because of its nature, this sub-program should be regarded as a supplementary sub-program to Grazing Control with Protein Bank Sub-program.

b. Implementing agencies

NDL is the main implementing agency. Local NGOs/facilitators should be hired for the field demonstration at the suco level especially in the initial several years.

c. Target areas

The sub-program can be introduced in areas with sufficient animal feed materials in the target watersheds. In this context, the sucos in Type I (paddy complex) that are supposed to be

[5] Interview with staff of NDRSS, MAF

abundant in paddy straw are considered as the potential sites in terms of the availability of resources.

Furthermore, the areas under high pressure due to grazing animals should be prioritized. Figure 5.8 gives the priority sucos in the target watersheds.

d. Main activities

The sub-program will introduce feed preservation systems, namely silage and hay. Hands-on training courses or FFSs at the demonstration plots are the major activities of the sub-program. Since hay making and silage making are likely labor-intensive, there is a need to encourage mutual cooperation among participants. The sub-program will establish two or three demonstration plots per aldeia and organize a series of hands-on training courses there. Like in the case of the other sub-programs, the materials used in the training courses will be provided for local people who take part in the training. The prerequisite for introducing this sub-program is the availability of fodder crops/trees in the target areas. Hence, it is highly recommended that this sub-program should be combined with Grazing Control with Protein Bank Sub-program, which has the component of fodder crop/tree production.

5.3.4 Implementation Procedures

The following are overall steps to be taken to implement the proposed sub-programs:

Step 1: Employment of NGOs/facilitators to assist target sucos

Under the current circumstances, the involvement of NGOs/facilitators will be requisite especially in the initial several years. Since the sub-programs require active participation of communities, facilitation skills and familiarity with local conditions will be important qualifications of NGOs/facilitators in addition to their technical capability.

Step 2: Consultation with the target sucos

It is necessary to organize consultation meetings with villagers at the target sucos to discuss possible interventions, (i.e., type of sub-program), its size, period of the selected sub-program, participants from sucos, and roles and responsibilities of the communities. The meetings will be organized by NDAH/NDL with the assistance of NGOs/facilitators. Other stakeholders, such as the MAF district officers, extensionists, and NDF will also participate in the meetings as observers.

Step 3: Organization of community members

Local NGOs/facilitators will assist rural communities in selecting core farmers and other participating farmers, who shall be organized into a working or beneficiaries' group at the aldeia level. NGOs/facilitators together with NDAH/NDL are to provide necessary guidance/orientation for participating farmers, so that they could understand why they have to be organized and what activities they would do as a working or beneficiaries' group and so on. The groups will be assisted in the preparation of rules/regulations for group management and in the selection of the respective representatives. The rules/regulations could refer to:

- Acquisition and deprivation of the membership;
- Role of the members and their representatives;
- Frequency of internal meeting among members and coordination meeting with supporting agencies; and
- Profit sharing at a demo plot among members.

Step 4: Preparation of detailed work plans by assisting agencies and working or beneficiaries' group

The working or beneficiaries' groups will prepare two types of work plans namely, an overall work plan and an annual work plan, with the assistance of local NGOs/facilitators. The

overall work plan will specify all the activities planned in the sub-program with timeframe as well as responsibility of the activities, while the annual work plan will specify the same information but only for the next 12 months.

The work plans should be used for the monitoring and evaluation of the sub-program. The MAF district officers and extensionists with the groups should monitor and evaluate the performance of the sub-program since they would be the field implementer of the sub-programs in the future.

Step 5: Exposure visits

Local NGOs/facilitators should take some members of the working or beneficiaries' groups to sucos or areas where the same or similar activities have been carried out successfully, so that the groups can gain a whole picture of the sub-program and see the role model for themselves.

Step 6: Implementation of the sub-program

Local NGOs/facilitators, together with the relevant directorates of MAF and the MAF district offices, will implement the major activities described in the preceding sections in a participatory manner.

Step 7: Hands-on training courses

Local NGO/facilitators will organize a series of hands-on training courses or FFSs in the demonstration plots. Each sub-program will also provide the materials used in the training courses for participating farmers with the aim of helping/encouraging them to replicate the techniques that they have learned from the training courses.

5.4 Agroforestry Management Program

5.4.1 Objectives

About 60% of the land in the country has slopes of over 25%, and the majority of rural households use such sloping areas for farming. Improper land management on sloping lands or upland farming without application of soil conservation measures leads to surface soil erosion. Land degradation caused by soil erosion lowers crop productivity and eventually results in a shortage of food, which further often accelerates the conversion of forests to upland farms by rural households to secure the sustenance of their families. Hence, the introduction of proper land management techniques is important for not only reducing sedimentation in the rivers but also maintaining and improving the living conditions of rural households in hilly and mountainous areas.

Agroforestry is a sustainable land management and agricultural production system (including animal and fish production) compatible with environmental protection. It aims to harmonize the characteristics of trees with those of crops or other forms of agriculture to complement each other. It is also well known as a system that can work in marginal lands, especially in hilly/mountainous areas. Because of the geographic conditions of the watersheds, agroforestry is one of the requisite interventions to be taken to manage land resources in the target watersheds in a sustainable manner.

The main objective of Agroforestry Management Program is to realize sustainable land management while maintaining agricultural outcome and land productivity. The program shall provide recommended land management techniques especially for those classified as SM-Zone and SU-Zone.

5.4.2 Strategies

The following aspects should be kept in mind in promoting agroforestry techniques in the watersheds;

a. Acceptance;

b. Sustainability; and
c. Effectiveness.

Along these lines, the strategies to be taken in this program are set as follows:

a. Dissemination of the techniques by demonstrating actual effects;
b. Utilization of experiences that other projects have gained;
c. Strengthening of MAF's capacity to continuously support communities;
d. Use of local materials and knowledge; and
e. Introduction of acceptable techniques/options such as:
   - low inputs (cost/laborers/others),
   - effective in soil erosion or improvement of soil fertility,
   - site specific,
   - productive, and
   - less maintenance.

(1) Dissemination of the techniques by demonstrating actual effects

Although agroforestry system is effective in improving agricultural production and soil fertility of the land, it would be more or less the first experience for many farmers to practice such techniques/options. Naturally, many of them would hesitate to introduce such techniques in their farms at the start. Thus, the program will take the same approach that many NGOs and other assisting organizations have taken to disseminate a new technology, which is "to start from a small-scale pilot activity and disseminate it by demonstrating actual effects to the surrounding farmers/rural households". Doing a small-scale activity also becomes a good opportunity for the staff of MAF district office (district forest officers and extensionists) and NDF to develop their capacities to provide technical support with regard to agroforestry techniques.

(2) Utilization of experiences that other projects have gained

The Agricultural Rehabilitation Project funded by World Bank had assisted MAF/NDF in promoting upland farming technologies over the years. PARDTL supported by the Portuguese Government also has a long experience in assisting coffee farmers in the improvement of coffee plantations. There are also other interventions done by international and local NGOs to assist rural communities in developing models of agroforest/upland farms. In order to make the design of the program practical and effective, the program will use as many experiences including lessons learned and good practices gained through these other projects as possible.

(3) Strengthening of MAF's Capacity

The enhancement of MAF's capacity is essential for ensuring the sustainability of the project. It is necessary for rural communities to have continuous guidance and technical support in the application of agroforest techniques in their own farms. Without enhancement of the capacity of the staff in the MAF district offices concerned, especially extensionists and district forest officers, the sustainability of the techniques introduced by the sub-program, particularly in the post-program period, would be in question.

(4) Use of local materials and knowledge

Local materials and knowledge should be used and incorporated into the proposed agroforestry practices so that rural households/communities could accept agroforestry techniques without any difficulties.

(5) Introduction of acceptable techniques/options

Considering the current socio-economic conditions of rural communities in the target watersheds, the techniques proposed by the program should ideally satisfy the following conditions so that they would be widely accepted by rural communities:

a. Less capital input;
b. Less maintenance;
c. Not time-consuming;
d. Suitable to site conditions;
e. Effective in soil conservation / improvement of soil fertilities;
f. Productive or contributes to the increase of farm productivity; and
g. Quick return (the techniques that can generate the outcome in short period of time).

However, the techniques proposed may not necessarily meet all the requirements mentioned above. It is therefore important to brief rural communities on the techniques introduced and allow them to examine whether they could introduce and apply such techniques to their village based on their current capacity and locality prior to the actual introduction in the field.

5.4.3 Proposed Sub-programs

Two sub-programs namely, i) Sustainable Upland Farming Promotion Sub-program, and ii) Coffee Plantation Rehabilitation Sub-program are proposed in this program.

(1) Sustainable Upland Farming Promotion Sub-program

a. Objectives

The main aim of this sub-program is to introduce/promote sustainable upland farming techniques suitable for sloping areas. The techniques handled by the sub-program are the soil conservation measures (e.g., bench terrace, contour band, contour composting, etc.) and agroforestry techniques (e.g., alley cropping, boundary planting, introduction of fruit/industrial trees in the farm, etc.) that have been introduced in the country to a larger or lesser extent.

b. Implementing Agencies

NDF and the MAF district offices concerned are the main implementing agencies. They should coordinate with National Directorate of Coffee, Industrial Corps and Agribusiness (NDCICA) of MAF during the implementation of the sub-program. Local NGOs or facilitators should be hired especially for the initial several years of implementation of the sub-program.

c. Target areas

Although this sub-program can be applied to almost all sucos in the watersheds except rice-based farming areas, those classified as SM-Zones and SU-Zones should be the main target areas for the sub-program. Among other things, sucos that have limited livelihood options other than shifting cultivation or upland farming are prioritized. The potential areas/sucos for the sub-program are presented in Figure 5.9.

d. Major activities

The establishment of the demonstration plots for the sustainable upland farming techniques and the conduct of the hands-on training courses or FFSs on the same techniques are the major activities of the sub-program. In principle, the hands-on training courses should target the selected number of rural households to keep the training courses effective. Each aldeia

will organize a beneficiaries' group with 20~30 community members who are willing to participate in a series of training courses[6].

Having located the demonstration plots with the beneficiaries' groups, local NGOs/facilitators together with the MAF district office will organize a series of hands-on training courses or FFSs, which cover but not limited to the following:

- Compost making;
- A-frame making;
- Delineation of contour lines;
- Application of soil conservation measures;
- Land preparation including application of compost;
- Seed selection;
- Sowing and planting;
- Farm management; and
- Harvesting and post-harvesting.

e. Upland farming techniques and models to be introduced

Soil and water conservation measures and agroforestry techniques that have been already applied in the country as well as in other Asian countries are referred to for designing the possible farm management models. In fact, the practices recommended by ARP and those presented in the guidebook prepared by NDF[7] were fully referred to. The possible techniques/measures that can be introduced by the sub-program are outlined as below.

a. Soil and Water Conservation Measures

Techniques	Description	Slope range	Specification	Remarks
Contour mulching	Place weeded vegetation on contours.	Advisable to apply it to areas with 0-25% slopes.	Every 12 m (0-25%) Every 6 m (25-40%)	In case the slope is steep, the soil conservation effect becomes low.
Contour composting	Make shallow trenches along contours and place weeded vegetation and crop residues on trenches.	It can be applied on slopes from 0-40%, but its effect might be less on slopes more than 25%.	Every 12 m (0-25%) Every 6 m (25-40%)	It is one of the low-cost techniques required.
Natural vegetative strips (NVS)	Establish 40-100 cm strips of natural grasses, weeds, bushes and small trees on contours.	It can be applied on slopes from 0 to 40%, but it is advisable to apply it to those with 0-25% slope.	Every 12 m (0-25%) Every 6 m (25-40%)	Farmers might hesitate to apply it, since strips can be hiding places for rats.
Contour hedgerow	Construct small bunds/mounds along contours and plant multipurpose shrubs/trees.	15-40%	Every 12 m (15-25%) Every 6 m (25-40%)	Construction and maintenance of hedgerow are laborious. It is advisable to apply it if farmers are willing to maintain it.
Contour rock walls with tree/grass planting	It is one of the traditional methods to control soil erosion. Put rocks and make rock walls along contours. Continue to add/maintain rock walls until level terraces form. Plant trees at the base of rock walls.	All slope	Every 20 m (0-15%) Every 10 m (10-25%) Every 5 m (25-40%)	Construction of walls is laborious, but effective in controlling soil erosion. It is advisable to apply it if farmers are willing to maintain it.

[6] The results of the pilot projects implemented by JICA Study in 2009 revealed that the number of the participants that can be handled in a training session is up to 20~30 members.

[7] Source: Livro Orientasaun Tecnico Floresta, NDF(2006)

Techniques	Description	Slope range	Specification	Remarks
Bench terrace	Cut and level slopes along contours. Construct a small mound at the edge of terraces to prevent water from washing over the front and eroding slope cut of terraces.	All slopes	Dependent on slopes (but advisable to keep the height of terrace to less than 1 m)	Several NGOs tried it in the watersheds. Due to heavy burden in maintenance of terraces, many of them were abandoned after the end of NGO's interventions.

b. Agroforestry practices

Techniques	Description	Slope range	Specification	Remarks
Alley cropping	Establish rows of multi-purpose shrubs/trees at a space of 1 x 2 m and plant annual crops between the rows.	Advisable to apply it to slopes of 0-25% if used alone	Applied at an interval of 15-20m	It can be combined with other SWC techniques, such as contour composting.
Multi-story system	Plant several types of crops/trees that have different height and characteristics, and develop a multi-layered forests/plantation. Coffee plantation with shade trees in the country is one of the examples.	All slopes	Random planting Inter cropping	Designs and patterns of the system vary with trees and crops introduced.
Inter cropping system	Plant annual crops in open woodland or newly established forest. Use the open space until trees establish their canopy.	All slopes	Space of trees is dependent on the woodland.	Basically, the land is managed as forest land. Hence, farming is a short-term activity.
Tree boundary	Plant multi-purpose trees / "live-fence" trees on boundaries of farms	All slopes	1 x 2 m interval	At present, many farmers fence their permanent farms with branches/poles of trees.

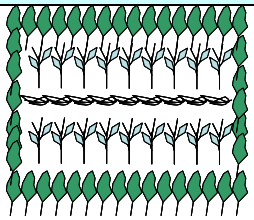
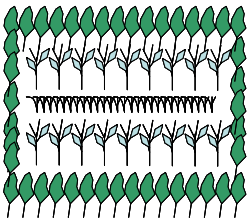
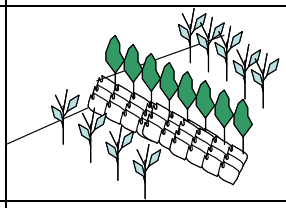
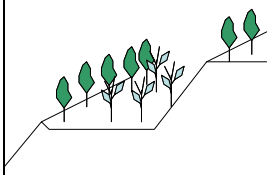
c. Farming Practice

Techniques	Description	Slope range	Specification	Remarks
Mulching	Spread slashed/cut weeds/unwanted plants between crops to cover surface of soils.	All slopes	-	It should be combined with other SWC measures.
Cover cropping	Plant cover crops (e.g., velvet grass) after harvesting maize.	All slopes	-	- ditto -
Contour farming	Plant crops along contours	All slopes	-	- ditto -
Minimum tillage	Less cultivation	All slopes	-	Traditionally, farmers do not cultivate their farms.
Application of organic materials	Apply organic fertilizers such as manure, crop residues, and weeded vegetation.	All slopes	-	The effectiveness against soil erosion is very low. It should be combined with other SWC measures.

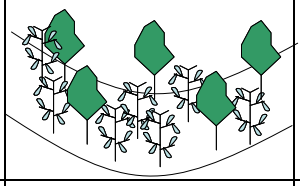
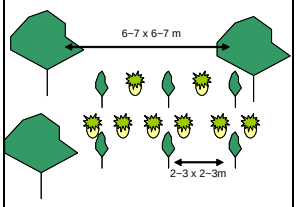
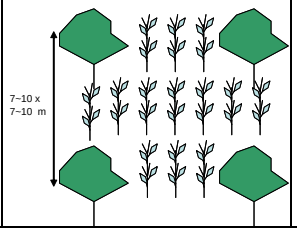
Source: JICA Study Team (2009)

The above-listed measures/techniques can be used independently, but will be more effective if combined with other measures. Although a final design should be made by farmers in the field, land management models suitable for the watersheds are recommended hereinafter.

a. Annual Crop-based Model

Model	Suitable slope	SWC / Agroforesty techniques	Drawing	Major crops/tree species
Model A-1: Annual crops with contour composting	Upland with 0~40% slope	- Contour mulching/composting by weeded grasses or other residues (12 m/6 m interval) - Cover cropping / mulching - Contour cropping - Tree boundary - Organic fertilizer application - Minimum tillage		Crops: Maize, Cowpea, Cassava, Sweet potato, etc. Tree species: Neem tree, Casuarina, Ziziphus mauritiara
Model A-2: Annual crops with NVS	15-25%	- Natural vegetation strips (40-100 cm width at every 12 m/6 m) - Cover cropping / mulching - Contour cropping - Tree boundary - Organic fertilizer application - Minimum tillage		Crops: Maize, Cowpea, Cassava, Sweet potato, etc. Tree species: Neem tree, Casuarina, Ziziphus mauritiara
Model A-3: Annual crops with contour rock wall	25-40%	- Contour rock wall - Tree/grass planting at the base of rock walls - Cover cropping / mulching - Tree boundary - Organic fertilizer application - Minimum tillage		Crops: Maize, Cowpea, Cassava, Sweet potato, etc. Tree species: Ipil-ipil, Gmelina
Model A-4: (optional) Annual crops with bench terrace	25-40%	- Construction of bench terrace with planting trees / grasses at the edge of terrace - Construction of small canals - Cover cropping / mulching - Tree boundary - Organic fertilizer application - Minimum tillage		Crops: Maize, Cowpea, Cassava, Sweet potato, etc. Tree species: Ipil-ipil, Gmelina

b. Agroforest-based Model

Model	Suitable slope	SWC / Agroforesty techniques	Drawing	Major crops/tree species
Model T-1: Coffee/Cacao plantations	All slopes	- Planting coffee/cacao (2 x 3 m) - Planting shade trees (10 x 20 m) - Cover cropping / mulching - Tree boundary - Organic fertilizer application		Tree crops: Coffee/Cacao Tree species: Casuarina, Ipil-ipil, Gmelina
Model T-2: Mix cropping of tree crops	All slopes	- Planting short-term crops (lower layer) - Planting med-term trees (medium layer): (2.0~6.0x2.0~6.0 m) - Planting long-term trees (higher layer):(6~7 x 6~7 m) - Cover cropping / mulching - Contour cropping - Tree boundary - Organic fertilizer application		Lower layer (short-term) Pineapple, Ginger, Yam Medium layer (Medium term): Cinnamon, Vanilla, Banana Higher layer (Long term): Tamarind, Candlenut, Teak, Avocado, Mahogany, Sandalwood, Jackfruit
Model T-3: Orchards/Tree crops initially mixed with annual crops	All slopes	- Inter cropping with tree crops/orchard crops Orchard (7~10 x 7~10m) Trees (2~3 x 2~3 m) - Cover cropping / mulching - Tree boundary - Organic fertilizer application - Minimum tillage		Crops: Maize, Cowpea, Cassava, Sweet potato, etc. Tree species: Mango, Jackfruit, Cashew, Candlenuts, Avocado, Orange, Sandal wood, etc.

Source: JICA Study Team (2009)

The following species which have shown its suitability to the target watersheds in the past and on-going activities are recommended as potential species to be used for the above-mentioned models.

- Live fence: Neem tree, Casuarina, Ziziphus mauritiara
- Trees/Shrubs planted at the edge of terrace: Gamal (*Gliricidea maeulata*), Ai diik (*Eritrina spp.*), Napier grass, Vetiver grass, Wild caramabola
- Fruits: Mango, Jackfruit, Avocado, Orange
- Tree crops: Coffee, Cacao, Cashew, Clove, Cinnamon, Candlenut, Sandal wood.

(2) Coffee Plantation Rehabilitation Sub-program

As described in Chapter 3, about 30~60% of the existing coffee plantations in the country are currently too old to produce coffee cherries. It is also reported that about 90% of Albizia used for shade trees for coffee are infected by a gall rust disease and about 5% of the same are trees either standing dead or lying in decay on the forest floor due to the infection of the disease[8]. The existing coffee plantation has almost the same functions with those of dense forests because of its thick and multi-layered canopies. The old coffee plantations or unproductive coffee plantations might be converted to other land uses such as upland farm, unless the productivity of the plantations will be improved.

[8] An assessment of the condition of East Timor's Albizia coffee-shade and its potential for commercial salvage (2006), USAID

a. Objectives

This sub-program aims to rehabilitate and improve the existing old and unproductive coffee plantations in the watersheds to maintain the functions of the target watersheds.

b. Implementing Agencies

The MAF district offices concerned and NDIPA together with NDF are the main implementing agencies. Local NGOs or facilitators will be hired for implementation especially for the initial several years of the sub-program. The extensionists and the district's relevant officers should be involved in the field activities. Since PARDTL is the preceding project and has long experience in the same field, coordination with PARDTL should be considered.

c. Target Areas

Communities that grow coffee in the watersheds are targeted by the sub-program. Figure 5.10 presents the target areas for the sub-program.

d. Pre-conditions of the Sub-program

Changing the shade trees from Alvizia to other species is a critical issue to be addressed by the government to maintain the existing coffee plantations. Nevertheless, there are several difficulties in promoting such activities in the target watersheds under the current circumstances of Timor-Leste, to wit:

- There is no information about the present status of the shade trees;
- There seems to be no local knowledge or technique (device) to cut a big tree safely;
- Replacing shade trees may cause damage to currently standing coffee trees underneath; and
- If coffee farmers are attracted by selling shade trees as timber wood, Albizia shade trees might be exploited widely.

From both technical and environmental points of view, it is therefore believed that cutting and replacing diseased Alvizia trees with another species would not be easy to do for the government as well as rural communities. There should more studies or researches to identify the way to conduct such activities under the current situation in Timor-Leste. Hence, this sub-program focuses on the promotion of the techniques to rehabilitate and improve the old coffee plantations on a suco level.

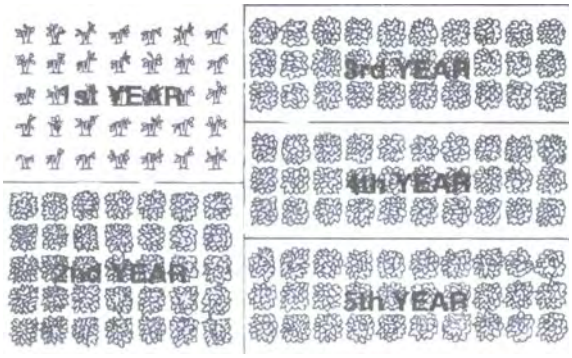
e. Main activities

Provision of a series of hands-on training courses or FFSs on the rehabilitation of the old coffee plantations and the expansion of new coffee plantations is the major activity of the sub-program. The same process and approach that other agriculture-based sub-programs employ are also taken for the sub-program. This means: i) group organization at the aldeia level, ii) development of demonstration plots at the aldeia level, and iii) organization of the hands-on training courses or FFSs at the demonstration plots. The techniques to be introduced in the hands-on training courses are: i) rejuvenation of old coffee trees, ii) pruning of branches, iii) planting of seedlings of shade and coffee trees, iv) management of new plantation, and v) capping of coffee trees.

It would take some time for rural communities to follow and replicate the techniques introduced by the sub-program, since they need to cut the standing trees which are their major sources of cash income. Hence, the sub-program should be implemented at least for three years, so that rural communities could see the actual changes/results in the demonstration plots and thus, generate interest in the application of the techniques in their own farms.

f. Promotion of a rotation system for application of rejuvenation

Although they may have interest in the application of the rejuvenating technique after seeing the actual results in the demonstration plots, they may hesitate to apply the technique in their coffee plantations since the cutting of coffee trees must be considered as a risk of losing their source of income. In order to ease their risk and worry, a 5-year rotation system should be introduced for those who are interested in the application of the technique. The following steps should be taken in a participatory manner:



i) Identify the target coffee plantation with overage coffee trees and/or unproductive coffee plantations;
ii) Divide the plantation into five blocks so that an owner can maintain his/her income from the coffee plantation as shown in the next drawing;
iii) Rejuvenate old coffee trees in the parcel for the 1st year in August/September and plant coffee seedlings and shade trees in November/December of the same year (at the onset of the rainy season);
iv) Maintain the 1st year parcel and do the same activities in the 2nd parcel in the 2nd year; and
v) Cut the top of the rejuvenated and planted coffee trees when they are at the height of 1.5 meter in the parcels.

5.4.4 Implementation Procedures

The sub-programs proposed in this program should be implemented in same participatory manner and in accordance with the following steps:

Step 1: Consultation with target sucos

NGOs/facilitators together with NDF/NDIPA and the MAF district offices concerned should have consultation meetings with the target suco to discuss possible interventions (i.e., type of sub-program, its size, expected period of the selected sub-program, and roles and responsibilities of the community).

Step 2: Organization of community members

Like the Farm and Livestock Management Program, local NGOs/facilitators will assist villagers (or participating villagers) in the formation of a beneficiaries' group for each aldeia. Likewise, NGOs/facilitators will assist the beneficiaries' groups in the selection of representatives of the groups and in the preparation of rules/regulations of the groups.

Step 3: Participatory planning

Local NGOs/facilitators together with NDF will assist the beneficiaries' groups in assessing the present conditions of their locality. In particular, the following are to be discussed, so that the beneficiaries' groups will understand the necessity of the sub-program:

- Natural conditions (land use, resource use, and ownership of land and resources);
- Issues on farming (land degradation, coffee farming, and livestock management); and
- Livelihood potentials,

The beneficiaries' groups will be further assisted by NGOs/facilitators in the preparation of work plans for sub-program implementation. Two types of work plan namely, an overall work plan for the entire period and an annual work plan for the next 12 months will be prepared. Both work plans will specify the activities planned together with the time schedule, responsible bodies, and necessary inputs to be made.

Step 4: Exposure visit
Local NGOs/facilitators should take some of the members of the beneficiaries groups to sucos or areas where the same or similar activities have been carried out successfully, so that the beneficiaries' groups can deepen their understanding of the ideas of the sub-program and learn something from the role model.

Step 5: Development of demonstration plot
In accordance with the action plan prepared, the demonstration plots will be established in collaboration with core farmers of the beneficiaries groups. NDF will just provide necessary materials and technical assistance in developing demonstration plots, while core farmers, who are the owners of the demonstration plots, and other participants should provide laborers for the establishment of the demonstration plots. Local NGOs/facilitators together with the MAF district offices will train core farmers on agroforestry practices/options proposed by the sub-programs.

Step 6: Organization of hands-on training courses/FFSs
Local NGOs/facilitators will organize a series of hands-on training courses or FFSs in the demonstration plots in collaboration with core farmers. NDF/NDCICA with the concerned MAF district offices will also provide necessary materials for participating members so that they could practice and the techniques that they gain through FFSs in their respective farms.

Step 7: Expansion of activities
If other community members show interest in applying the introduced techniques/options, NGOs and NDF will encourage them to join the beneficiaries' groups. The beneficiaries' groups will be assisted in the organization of another round of FFSs for the new members. In case the new members find difficulty in joining the existing group due to difference of ethnicity, a new beneficiaries' group might be organized. NGOs and NDF will assist them in taking the same processes as the first members have.

5.5 Slope Protection and Sediment Control Program

5.5.1 Objectives

The principal objectives of the Slope Protection and Sediment Control Program are to prevent the progress of landslides/slope failures and to control the sediment flow in the upper part of the watersheds so as to minimize the inflow of sediment in the mainstreams of the Laclo and Comoro Rivers.

5.5.2 Strategies

Providing appropriate measures in accordance with the current situation in Timor-Leste and the target watersheds is the primary concept of the program. Specifically, the following considerations are given importance:

a. Focusing on sources of sediment;
b. Introduction of acceptable/viable measures;
c. Introduction of assessment studies to design optimum measures;
d. Collaboration with the Directorate of Road, Bridge and Flood Control (DRBFC) of the Ministry of Infrastructure; and
e. Continuous monitoring and maintenance after construction.

(1) Focusing on sources of sediment

Aiming to minimize the sediment inflow into the mainstreams in an effective and efficient manner, the program focuses on coping with sediment at the source. By doing this, the measures introduced will be reasonable, and more importantly, feasible and realistic under the current situation of the country.

(2) Introduction of Acceptable/Viable Measures

Measures to be proposed in this program should be technically acceptable and viable in the country, so that the implementing agencies could make use of them without any difficulties. Hence, due consideration is given to its cost and appropriateness of technologies introduced. In order to cope with small gullies in the upper part of the watersheds, the community-based soil erosion control should also be considered in this program, where rural communities would carry out soil and water conservation works mainly based on the vegetative measures in the initial-stage gullies.

(3) Introduction of Assessment Studies

Although this program proposes four sub-programs to be implemented, there is still a need to assess the present condition of landslides and sediment flow on a micro-watershed level to design the measures appropriately according to the site-specific conditions. Hence, an assessment study as described in the succeeding sub-section (sub-section 5.5.4) is to be undertaken prior to the actual implementation of protective/control measures.

(4) Collaboration with the DRBFC of the Ministry of Infrastructure

There is no law/decree that indicates a government body responsible for the control of slope failures/landslides in the country. The DRBFC is the sole organization in government that has engaged in slope protection and river management works (e.g., the construction of revetment facilities, gabion check dams, removal of soils, etc.) so far, although its focus has been put on the main national road or the main streams of the large rivers. In consideration of its long experience in engineering works, it is believed that DRBFC should be the main actor in this program among the organizations of the GoTL.

On the other hand, NDF has more experience in the application of the vegetative measures, such as terracing, wattling, and agroforestry practices, and small-cum-simple structure measures. Thus, it could be the responsible body for such vegetative or small-scale measures.

(5) Continuous Monitoring and Maintenance after Construction

Periodic monitoring and maintenance of the introduced protective and control measures are indispensable for keeping them effective. DRBFC should be responsible for the monitoring and maintenance of the measures in cooperation with NDF and rural communities.

5.5.3 Proposed Sub-programs

(1) Slope Protection Sub-program

A number of roads have been constructed in the watersheds, but most of them were constructed without slope protective measures due to budgetary constraints and limited capacity of DRBFC. Improper management of cutting slope as well as construction of roads without a proper drainage system is one of the causes of soil erosion, slope failures, and landslides in the watersheds, especially along the major roads. In addition, slope collapse is also commonly found in hillsides in the watersheds.

a. Objectives

The main objective of the sub-program is to protect slopes along roadsides and in hillsides from further slope failures and soil erosion so as to reduce the sediment inflow in the mainstreams.

b. Target Areas

The areas where soil erosion, slope failures, and landslides took place along the principal roads and in hillsides are targeted by the sub-program. There seem to be potential sites in the upper parts of Ue Coi, Sumasse, Eraibanaubere, Malikan, and Lohun Rivers in the Laclo watershed and along Anggou River in the Comoro watershed.

c. Implementing Agencies

The main implementing agency is DRBFC, while NDF is responsible for vegetative works. The concerned district offices should coordinate with DRBFC and NDF in the implementation of the sub-program.

d. Measures to be taken

The following slope protection measures could be used alone and probably in combination with each other to generate a synergetic effect. Typical designs of the measures are presented in Annex C in Annexes.

Slope Protection Measures to be taken

Counter measures	Measures	Applicable Slope(Degree)	Description	Specification	Remarks
Structural Measures	Gabion retention work	Applicable to the site with relatively fragile foundation. It can be applied to stabilize slopes below 45°.	Put a layer of gabion (wired structure containing the stones inside) to cover the slope from the base.	The maximum height of the structure is 4.0 m.	It is the method used frequently for slope protection in the country.
	Open water channel works	It can be applied to slopes below 45°where soil erosion is caused by concentration of the surface water flow.	Dig channels in the slope and put gravels at the base of channels. Then line channels with concrete to drain surface water in the slope.	-	Data on water discharge of the tributary are required in planning of the facility.
	Wet/dry masonry retention work	At the site with rigid foundation. It can be applied to the cutting slopes.	Put layers of stones with/without mortar to cover the slope from the base.	The maximum height of the structure is 2.0 m. In case of wet masonry, weep holes should be set every 1 m^2 for drainage.	-
Biological measures	Tree branch wattling	It can be applied to slopes up to 45°, but it is advisable to apply it to those below 30°	Make fences with tree branches/stakes (1~2 feet) along the contours and construct small mounds behind the fences.	It is desirable that branches used for fences have a capability to sprout out.	It can be combined with other retention works such as gabion and wet/dry masonry.
	Contour rock walls with tree/grass plantation	It can be applied to slopes up to 45°, but it is advisable to apply it to those below 30°	Make rock walls along contours. Maintain rock walls until level terraces form. Then plant trees and grasses on terraces and at the base of rock walls.	Maximum height of rock wall is 50 cm	-ditto-
	Contour tree/grass plantation	Up to 20°	Construct small bunds/mounds along contours and plant multipurpose shrubs/trees.	Interval of plantation depends on the slope	Recommended species: Gamal, Ziziphus mauritiana and Ipil-ipil

Source: JICA Study Team (2009)

(2) Sediment Flow Control Sub-program

There are landslides/slope failures on a relatively large scale (over 10 ha) commonly found in the upper Laclo watershed. Two major works namely, control works (e.g., drainage works for the control of ground water and counterweight embankment) and restraint works (e.g., ground anchor) are suggested as possible means against such large-scale landslides. While

they are effective in controlling landslides/slope failures, their application is also believed to be not necessarily realistic under the current conditions where many of them are located in remote areas without any access road. Therefore, the emphasis should be put on controlling sediment flow by constructing check dams on tributaries rather than directly preventing such landslides.

a. Objectives

As mentioned above, it is important to control the sediment flow in tributaries to reduce the inflow of sediment into the mainstreams. In addition, river bed erosion needs to be prevented. Under the circumstances, the main objective of the sub-program is to construct check dams on tributaries to reduce the sediment flow and stabilize the sediment on the riverbed.

b. Target areas

This sub-program should target tributaries where sediment has been deposited by landslides/slope failures or those where riverbed erosion has taken place. In particular, the upper parts of Ue Coi, Sumasse, Eraibanaubere, Malikan, and Lohun Rivers in the Laclo watershed as well as Anggou River in the Comoro watershed have high potentials.

c. Implementing agencies

The sub-program is to be implemented by DRBFC in coordination with its concerned district offices.

d. Measures to be taken

The following measures are proposed to be undertaken. Typical designs of the proposed measures are also presented in Annex C in Annexes.

Measures to Control Sediment Flow

Counter measures	Measures	Applicable Site	Description	Specification	Remarks
Structural measures	Gabion check dam	Applicable to the site with relatively fragile foundation. It is also advisable to install this measure to the catchment whose total area is less than 30 ha.	Put a gabion check dam perpendicularly to the water flow from the upstream	The effective height of structure is 3.0 m. The foundation is excavated at least 1.0 m in depth to provide adequate basal anchorage.	-
	Masonry check dam (mortar covered)	For the relatively narrow stream with small particle sediment in the riverbed	Put a masonry check dam perpendicularly to the water flow from the upstream	The maximum height of the structure should be 1.0 m.	River discharge of the tributary is to be measured to design the facility.

Source: JICA Study Team (2009)

It is noted that a front apron check dam (at the downstream side) needs to be constructed with the proposed check dams so as to prevent riverbed erosion by spilled water from its spillway.

(3) Riverbank Protection Sub-program

a. Objectives

The objective is to prevent riverbank erosion from progressing by constructing physical facilities in combination with the vegetative works.

b. Target areas

Rivers where the riverbank erosion has taken place and the riverine facilities/infrastructure/local properties are threatened should be targeted by the sub-program. The focus should be put on the downstream area of the Laclo River where riverbank erosion

is commonly observed and has been becoming a threat for the surrounding communities in the area.

c. Implementing agencies

DRBFC is the main implementing agency, while NDF should be responsible for the vegetative works. The district offices concerned should coordinate with these agencies in the implementation of the sub-program.

d. Measures to be taken

The following measures are proposed as these have been proven effective in the country.

Measures to Prevent Riverbank Erosion

Counter measures	Measures	Applicable Site	Description	Specification	Remarks
Structural works	Gabion revetment	Applicable to sites with relatively fragile foundation.	Put a layer of gabion to cover the riverbank from the base.	The recommended maximum height is 4.0 m. The foundation is excavated at least 1.0 m in depth from the riverbed to provide adequate basal anchorage.	Almost similar to retention work. DRBFC has already implemented gabion revetment in the lower Comoro watershed.
	Wet/dry masonry revetment	At sites with rigid foundation.	Put layers of stones with/without mortar to cover the riverbank from the base.	At the site with rigid foundation. The maximum height of the structure is 3.0 m. In the case of wet masonry, weep holes should be set every 1 m^2 for drainage.	-
Biological works	Wooden water flow control works	For streams with gravel and stones in the riverbed	Put the log-nails as fence diagonally to check water flow.	The recommended diameter of the log is 10-20 cm.	-
	Tree branch wattling	For streams with small particle sediments and gravel in the riverbed	Put the fence in the base of riverbank with tree branches.	Size of fence is below 0.4 m in height.	-

Source: JICA Study Team (2009)

Annex C shows typical designs of the above-mentioned measures.

(4) Initial Gully Control Sub-program

In the upper parts of the target watersheds, gully erosion often takes place during the rainy season due to poor vegetation cover and fragile geological features. In the beginning, a gully is small and narrow, but it progresses as time goes by and eventually erodes the surrounding farmlands and rural roads in the village. Although some gullies in the upper part have already progressed and gotten out of control at the community level, some of them are still at the initial stage and could be handled by using local resources. Therefore, due attention should be given to the prevention of the progress/expansion of gullies at an early stage in the upper parts of the watersheds.

a. Objectives

The sub-program aims to prevent the progress or expansion of gullies at an initial stage in the upper parts of the watersheds in collaboration with rural communities who reside in the area. Control of initial gullies could not only protect farms and roads in the village from damage but also reduce the sediment inflow into the main stream of the major rivers.

b. Target areas

This sub-program should target sucos located on the hilly/sloping area in the upper parts of the watersheds, where the initial gullies are commonly found. In general, the sub-program can be introduced to all sucos in the upper parts of the Laclo and Comoro watersheds, but those considered with high potential for soil erosion based on the results of the village profile survey in Chapter 3 could be prioritized.

c. Implementing agencies

Since the sub-program aims to introduce the small-scale soil and water conservation works that can be handled by rural communities, it is believed that NDF should be the main responsible agency for the implementation of the sub-program. The concerned MAF district offices and extensionists should coordinate with NDF in the field activities. However, local NGOs/experts will be required for designing and training on the application of the soil conservation measures.

d. Main activities

Capacity development of rural communities in the target suco is the requisite activity for the implementation of the sub-program, as local households are its main implementers. Hence, like in the case of the other programs under the Land Management Component, the hands-on training courses on the relevant techniques will be the main activities of the sub-program.

e. Measures to be taken

The following measures are proposed to focus in the sub-program. A typical design of the proposed measures is also presented in Annex C.

Measures to Control Initial Gully

Counter measures	Measures	Applicable Site	Description	Specification	Remarks
Biological measure	Tree branch wattling	Applicable to places where the necessary materials such as fallen trees can be found in the surrounding area. For areas with relatively small particle sediments in the riverbed.	Make wattlings with tree branches/stakes (1~2 feet) perpendicularly to the upstream	The effective height of structure is 0.5-1.0 m.	It is also advisable to cover the surface of the area with grasses (e.g., king grass) so as to protect the area from surface erosion.

Source: JICA Study Team (2009)

5.5.4 Implementation Procedures

The above-mentioned sub-programs are classified into two types namely, public works type sub-programs and community-based development type sub-program. The former, covering three sub-programs (Slope Protection Sub-program, Sediment Flow Control Sub-program and Riverbank Protection Sub-program), will be implemented on the government's initiative, while the latter, which is Initial Gully Control Sub-program, will be implemented in coordination with rural communities. As the main implementers of the former are not the same as that of the latter, the implementation procedures shall not be the same and shall vary with the type of the sub-programs as described below.

(1) Public works type sub-programs

The following are the overall steps to be taken for implementation of the captioned sub-programs.

Step 1: Assessment of soil movements

Firstly, it is recommended that DRBFC and its concerned district offices identify potential micro-watersheds to implement the sub-programs using aero-photo maps covering the target

watersheds and data obtained through the village profile survey. Secondly, the same should make a field reconnaissance to assess the overall conditions of soil movements, such as landslides, soil erosion, and sediment flow in the potential micro-watersheds. The items to be surveyed through field reconnaissance are as follows.

Items to be confirmed through assessment of soil movement

Item to be assessed	Type of Soil Movements		
	Slope failures	Sediment on riverbed	Riverbank erosion
Location of the site	✓	✓	✓
Size (e.g., height, width, depth, and slope) of the soil movement	✓	-	✓
Riverbed gradient	-	✓	-
Volume of sediment deposited in/around	✓	✓	✓
vegetation cover (type and density of vegetation) in/around	✓	✓	✓
Type and size of sediment particle	✓	✓	✓
Areas or facilities to be protected from soil movement	✓	✓	✓

Note ✓: To be confirmed, -: No need for survey
Source: JICA Study Team (2009)

Simultaneously, if there are existing protective facilities/measures in the micro watershed, the conditions of the facilities (e.g., the necessity of repair and current capacity of the facility) should be investigated so as to determine the scope of the works in relation to repair/improvement of existing facilities and/or installation of new facilities. To be more specific, the following procedures should be followed in the survey:

i) To identify and record the locations and types of existing facilities/measures for slope protection and sediment control by field observation;
ii) To verify and record the current capacities of the facilities (e.g., length, height, and width) and the necessity of its repair; and
iii) To measure and record the protected area or the volume of sediment stabilized by the facilities.

Protective measures suitable for the micro-watersheds will be determined based on the results of the assessment survey.

Step 2: Basic design of the facilities
DRBFC will make the basic design of the proposed measures/facilities by using the data collected through the assessment survey and an additional topographic survey. Based on the results of the basic design, DRBFC can estimate materials and laborers necessary for the construction of the proposed measures / facilities.

Step 3: Implementation, monitoring, and evaluation
Basically, implementation of the protective/control measures is to be contracted out to local contractors. The main roles of DRBFC are to select contractors in accordance with the government regulations and to supervise and manage the construction works. DRBFC should advise local contractors to hire as many rural households as possible in the construction works as casual laborers.
As for the vegetative works, NDF should be responsible for implementing the activities. NDF will contract out the works to local contractors or hire rural communities to implement the works in coordination with the MAF district office.

Step 4: Supervision and maintenance of the facilities

Protective measures/facilities constructed are to be maintained mainly by DRBFC with the support of NDF. Rural communities should also be involved especially in the maintenance of the vegetative works. Involvement of rural communities can contribute to the generation of an additional source of income to rural households and might be able to enhance their awareness on the importance of sediment control.

(2) Community-based development type sub-program

The following are the overall steps to be taken for the community-based development type sub-program namely, Check Dam Application for Initial Gully Control.

Step 1: Procurement of NGOs/experts

As described in the former section, local NGOs will be required for designing the soil and water conservation works and training on the related techniques for rural communities. Hence, NDF will hire local NGOs or experts who have experience in the application of the vegetative measures as well as implementation of training courses.

Step 2: Consultation about the sub-program

NDF with the assistance from local NGOs/experts will organize a consultation meeting with rural communities to enable them to understand the outlines and activities of the sub-programs. The topics to be discussed during the workshop are as follows:

a. Objectives of the sub-program;
b. Outline of the sub-program; and
c. Expected outputs from the sub-program.

Step 3: Identification of potential areas

NDF with the assistance of local NGOs will conduct the resource mapping using the aerial photo maps covering the target suco. Resource mapping is one of the tools which is often used as PRA/RRA. After the workshop, NDF, together with local NGOs, will identify the locations of the potential areas on the resource map.

Step 4: Organization of working groups

Having selected community members who are willing to participate in the sub-program, NDF and local NGOs will organize a working group at each aldeia. Each group will select a leader, a co-leader, and a secretary and determine the roles and responsibilities of the group's members.

Step 5: Participatory Planning

With the aim of deepening the understanding of the sub-program activities among the group members and scheduling the activities in consideration of the existing agricultural and other cultural activities in the village, a workshop on work planning will be organized with the participation of the beneficiary members.

Step 6: Hands-on training

A series of hands-on training courses on the application of soil and water conservation measures will be organized for the working groups at the potential plots selected in Step 3. The soil and water conservation measures demonstrated in the training courses should be as simple as rural communities can apply using materials that are locally available. The following topics should be covered by the training courses:

- Guidance on techniques of soil conservation against the gully erosion;
- Design of the demonstration plot;
- Cleaning and compaction of the foundation;

- Installation of structures;
- Backfill at the base of structures;
- Planting of king grass; and
- Maintenance of the plots.

Step 7: Assistance of replication of the techniques on a voluntary basis

In parallel with the hands-on training courses, NDF with the assistance of NGOs/experts will provide technical assistance to members or other community members who intend to apply the soil and water conservation measures in their areas to prevent the progress of gullies.

5.6 Community Development/Livelihood Development Program

5.6.1 Objectives

Improvement of rural communities' livelihoods is one of the key elements necessary to attain the objective of the watershed management plan, since the causes of watershed degradation are closely related to the lifestyle or economic activities of rural communities. This program aims to attain the improvement/development of livelihoods of communities in the watersheds, while giving due attention to maintaining the natural environment/resources in the respective localities. The specific objectives of the program are:

- to improve quality of life and sustain benefits derived from natural resources through the promotion of rural energy development; and
- to diversify sources of income through the provision of income-generating opportunities.

The rationale of the first objective is supported by the fact that rural energy is one of the basic needs of rural communities, while firewood collection is one of major causes of watershed degradation. The second objective can be justified by the fact that the present livelihoods of communities in the watersheds are so limited that the majority of them are forced to live below the subsistence level.

5.6.2 Strategies

Participatory or people-leading is the central approach for this program. Although the possible livelihood options are enumerated in this section, it is the community that makes decisions and formulates an action plan for the respective livelihood options. In other words, livelihood development should not be just to provide "prepackaged livelihood options" to communities, but to enable them to find out alternative livelihoods and to prepare themselves to put into action their own ideas.

Similar attempts have been undertaken by several donor or NGO-supported projects, such as Rural Development Program II (by GTZ/EU), One Village One Product (by JICA) and Haburas Area Development Program (by World Vision), to develop/support livelihoods of rural communities in the country. Not only can they be sources of information (e.g., lessons learned and best practices) for the program, but they can also be utilized by resource persons or any experts on specific livelihood options. Hence, collaboration with these projects could be useful in attaining the objectives of the program.

Due consideration should be given to the "appropriateness" and "relevancy" of technologies in identifying livelihood options, since they are closely related to the sustainability of livelihood activities. In other words, "resources available in the locality", "existing technologies", and "an appropriate size of initial investment and O&M costs" are the important points to discuss in the determination of livelihood options.

5.6.3 Proposed Sub-programs

In line with the objectives above, the program proposes the following two sub-programs: i) Rural Energy Development Sub-program; and ii) Income-Generating/Cost-saving Sub-program. Although the following sub-sections present potential livelihood options that rural communities can engage in, there should be a series of exercises with community members to identify/determine an optimum option and prepare its development plan.

(1) Rural Energy Development Sub-program

The following two alternative energy sources or technologies have already been introduced and proven effective in the reduction of firewood consumption by the existing studies and projects on rural energy development in the country:

- Improved cooking stove (ICS); and
- Biogas plant.

In terms of technical simplicity and applicability, the introduction of improved cooking stoves is considered more suitable and sustainable than the biogas plant. This does not mean that biogas plant cannot be introduced as an alternative source to firewood. In fact, the government has been promoting biogas development even on a pilot basis. It is however expected that there would be some difficulties in the introduction of such an option because of the following concerns:

- Establishment of a biogas plant is still capital intensive, which requires substantial financial and material support from government agencies for implementation;
- The capacity of communities for maintenance is still in question. It may pose the poor management of the plant and shorten its lifetime; and
- Free grazing is the prevailing animal rearing system in the target watersheds. Under such a system, it would be difficult for communities to collect animal manure. It would take time for them to change their management practice from free grazing to stall feeding.

It is therefore suggested that this option should be regarded as a mid- or long-term option, and the improved cooking stoves should be selected as the proposed option of the sub-program.

a. Objectives

The main objective of the sub-program is to reduce the volume of firewood exploitation in the target watersheds through the introduction of improved cooking stoves. The improved cooking stoves should be those applicable to as well as sustainable in the current conditions of the target watersheds.

b. Implementing agencies

NDF, in coordination with the State Secretariat for Energy Policy, is responsible for the sub-program. Local NGOs/facilitators should be hired for actual implementation in the field. The MAF district offices concerned and forest guards should also be involved in the field works, so that they would learn to implement the field works.

c. Target areas

The sub-program can be implemented in all sucos in the target watersheds since they fully rely on firewood for cooking and lighting. However, those with high population density are prioritized.

d. Major activities

The major activities of the sub-program are to: i) organize local households into groups, ii) prepare work plans, iii) organize a series of hands-on training on techniques relating to

improved cooking stoves, and iv) assist local households in the introduction of the techniques. In the hands-on training courses, the sub-program should cover, but not limited to the following topics:

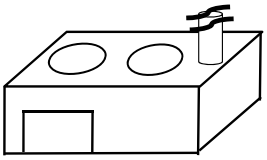
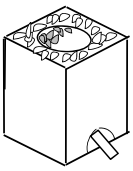
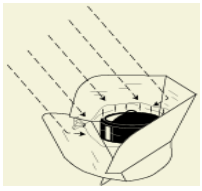
- Purpose of the use of the improved cooking stoves;
- Expected benefits from the use of the improved cooking stoves;
- Selection of an improved cooking stove suitable for the area;
- Introduction / establishment of the selected cooking stove;
- Operation and maintenance of the cooking stove; and
- Repair of the cooking stove.

On the other hand, assistance to local households in the introduction of techniques will mainly focus on the operation and maintenance and repair of the stove.

e. Improved cooking stoves introduced

The following table gives the possible options that can be introduced in the target watersheds with the notes on potential areas/constraints for application.

Possible Types of Improved Cooking Stoves to Introduce in the Target Watersheds

Type of ICS	Experience in Timor- Leste	Potential Area or Constraints
Firewood Type		
Ceramic: Ceramic pots are used for the core parts of cooking stoves. The core parts are surrounded with clay mixture made of red soils, water, and fine soils. A pole of bamboo could be used as a chimney. **Brick:** Instead of ceramic pots, bricks can be used. This should also be supported with the mixture clay or cement. 	The women group of Bila-bala Oraria in Manatuto produces ceramic pots at a cost of US$15-20. Brick type is also often found in Dili. One brick is sold at US$0.25. One small size plot could be made with 30 bricks but for 2 plots more than 60.	In principle, most of the villages in the watersheds can be targeted, but the priority should be given to sucos with high population density. Highlands where temperatures are low and thus people need direct firing to warm family members may not be suitable for introduction. Possibility of producing mixture clay in locality should also be examined.
Coffee Skin / Wood Residues Type		
An opened 5-gallon can with a hole for firing is used as a cooking stove. The inside is stuffed with coffee skins/wood residues. One piece of firewood is used only for initial ignition. 	Some communities such as Suco Becora in Dili have been using this type of a cooking stove. One can is sold at US$2 to 5.	Possible to apply this stove to the areas where the coffee skin or wood residues are available, e.g. in the vicinity of coffee processing or carpentry factories.
Solar Cooker*		
This is made by pasting a reflective material, such as aluminum foil, onto corrugated cardboard in a pentagonal shape. When completely unfolded, it measures about 1 by 1.3 m. 	University of Timor-Leste has studied the possibility of applying this stove. The cost estimate is around US$15.	The potential area for introduction is where the strong sunlight is available e.g. in the lowland area of Manatuto. Possible constraint to the introduction is the procurement of materials.

Source*: Patricia McArdle (2007). ""My Solar Cooker Epiphany" in the Solar Cooker Review and the figure is from http://www.solarcookers.org/basics/how.html

(2) Income-Generating/Cost-saving Sub-program

a. Objectives

This sub-program is aimed at the provision of opportunities for rural communities to acquire technologies for the development of alternative livelihood options to earn cash income or reduce living expenses. Participating households are expected to run some of the livelihood options or to replicate some of the techniques that they have learned through the hands-on training courses organized by the sub-program.

b. Implementing agencies

The sub-program will be implemented under the initiative of NDF in coordination with the relevant directorates of MAF and other ministries. The MAF district offices concerned, especially extensionists, should also be involved in the field activities since community support is one of their tasks. Local NGOs/facilitators should also be hired to implement the sub-program as facilitators and resource persons for training.

c. Target areas

The sub-program will be implemented in all sucos in the target watersheds. Priority will be given to those that are highly dependent on forest resources for their livelihoods.

d. Major activities

Livelihood options should stem from ideas from rural communities as these will vary with the needs and willingness of communities. The sub-program should put due attention to the identification and selection of the potential livelihood options suitable for the target sucos in a participatory manner. Hence, the participatory assessment of the potential livelihood options will be one of the steps taken by the sub-program in addition to the same activities as proposed by the Rural Energy Development Sub-program. The major activities are: i) participatory assessment of potential livelihood options, ii) hands-on training, and iii) assistance in the management of the livelihood options.

Participatory assessment of potential livelihood options

The participatory assessment is to be made by NGOs/facilitators with rural households. The participants of the session will be selected by village leaders (e.g., chef de suco) in consideration of gender balance and representation of vulnerable/uncovered groups. The aim of the participatory assessment is to enable rural households to:

i) identify available/potential resources in their locality;
ii) outline possible livelihood development options based on the resources; and
iii) identify necessary actions to be taken for implementation.

Major topics to be discussed in the assessment session are:

i) Explanation of the watershed management plan and its objective;
ii) Objectives of the livelihood development program;
iii) Assessment of available resources (natural, social, physical, human, and financial resources) in the area;
iv) Potential livelihood options that can be developed based on the resources;
v) Identification (or prioritization) of possible livelihood options considering the availability of raw materials and technologies, economic impacts on beneficiaries, initial investment cost, etc.; and
vi) Further steps to be taken (preparation of rules, group formation, etc.).

Hands-on training courses

A series of hands-on training courses for the group members will be organized by NGOs/facilitators with the MAF district offices. Topics or subjects to be handled by the training courses will vary with the livelihood development options. Training subjects might include: i) essential techniques of livelihood options selected by the community; iii) business and financial management (e.g. bookkeeping), and iii) other relevant techniques such as advertisement and packaging of the products.

Assistance in the management of the livelihood options

After hands-on training courses, the beneficiaries' groups or the individual members may start the implementation of the livelihood options following what they have learned through the training courses. NGOs/facilitators together with extensionists should assist them in the operation and management of the livelihood options from time to time.

e. Possible income-generating/cost-saving livelihood options

The following table shows the possible options suitable for upland considering i) existing technologies, ii) locally available resources, and iii) appropriate size of initial investment and operation and maintenance cost[9].

Possible Income Generating/Cost-saving Livelihood Options

Type of resources	Income generating	Cost-saving
Farm-based	Coffee packaging Banana, potato and cassava chips Fried peanuts Preserved product making	Manual corn sheller operation Manual coffee peeler operation Pedal paddy thresher operation Preserved products making
Livestock-based	Poultry raising	Dried meat
Forest-based	Honey Herbs and medical plants Wild nuts production	Bamboo or latten furniture
Skill-based	Tais making Handicraft	Cloth repairing/ making
Others	Kiosk operation Salt making	Candle making

Source: Developed based on Assessment Report on Participatory Rural Energy Development Programme (PREDP) Timor-Leste, April 2006, UNDP

There are a number of on-going interventions made by international and national NGOs to support/improve livelihoods of rural communities in the country. Some of them have generated substantial benefit to rural communities as highlighted below.

Livelihood Activities Implemented by NGOs

Activities	NGO/Project	Narrative
Coffee processing	Peace Winds Japan, PARCIC	Both NGOs focus on improving the quality of coffee through periodic training on harvesting and processing coffee.
Micro finance	CCF	CCF provides micro credit to women's groups in communities through its branches and affiliated community organizations. Businesses that the receivers have engaged in are kiosk operation, vegetable marketing, rental of motor bikes, etc.
Soap making	AFMET	The project aims to help rural households practice washing hands. It also helps people save cost for buying soaps since many households currently spend a certain proportion of income for purchasing soaps.
Food processing Chips & dried vegetable	USC Canada	The NGO provides communities with training on food processing. It offers solar driers to produce dried vegetables for food preservation.
Aquaculture	World Vision	Fingerlings are provided to rural households to raise fishes for consumption. This activity could be introduced in sucos where water is available. Crop residues are used for feed.

Source: Interviews made by the JICA Study Team (2007)

[9] *Assessment Report on Participatory Rural Energy Development Programme (PREDP)* Timor-Leste, April 2006, UNDP

f. Attention to be paid

The experiences gained through the pilot projects implemented by JICA Study in 2009 suggest that due consideration should be given to the following issues in the implementation of the sub-program:

- The sub-program, unlike others, needs to enhance the capacity of the beneficiaries group in financial management. A financial expert/trainer is a requisite input for the sub-program;
- One round of training course is not sufficient for rural communities to fully acquire new techniques; the follow-up activities will be necessary several times in the course of the sub-program; and
- Since many livelihood options require a series of intensive training courses for the trainees to acquire the techniques/skills for operation and management of the options, the number of the beneficiaries group should be around 10 persons.

5.6.4 Implementation Procedures

The overall processes/procedures for implementation of the sub-programs proposed in this section are summarized below.

Step 1: Arrangement of facilitators

Prior to the first contact with communities, facilitation teams should be organized. Since facilitators are to be in a fair position to all participants in the workshops/training courses, it is necessary to outsource facilitators from external organizations. Local familiarity and gender balance should be considered when the facilitation teams are formed.

Step 2: Consultation meetings

Local NGOs/facilitators and NDF will organize a consultation meeting with rural communities in the target village to enable them to grasp the outlines and activities of the sub-programs. The topics to be discussed during the workshop are as follows:

a. Objectives of the sub-program;
b. Outline of the sub-program; and
c. Expected outputs from the sub-program.

Step 3: Group formation

Local NGOs/facilitators and NDF will assist rural communities in selecting the households who will take part in the sub-program activities, especially hands-on training courses. The participating households will be selected at the aldeia level. For the Rural Energy Development Sub-program, each aldeia will organize a beneficiaries' group composed of around 20 members, while around ten members should be selected for the Income-Generation/Cost-Saving Sub-program. The beneficiaries' groups will select its representatives among its members and discuss the rules and regulations of the groups and its members with facilitation of NGOs/facilitators as well as the district officers.

Step 4: Work planning

Local NGOs/facilitators and NDF will assist the beneficiaries groups in making an overall work plan and an annual work plan for the activities planned in the sub-program.

Step 5: Exposure visit

NGOs/facilitators and NDF with the MAF district offices will take some members of the beneficiaries' groups to sucos/areas where the same or similar activities as the sub-programs plan to do, so as to help them deepen their understanding of the activities and the expected outputs of the sub-programs.

Step 6: Implementation of the sub-program activities
Local NGOs/facilitators and NDF will implement the major activities described in Section 5.6.3 in a participatory manner.

Step 7: Monitoring and evaluation of implemented livelihood options
The beneficiaries' groups with the assistance of NGOs/facilitators and NDF will monitor the activities and performance of the livelihood options on a monthly basis. Specifically, in the case of Income Generating/Cost Saving Sub-program, the group leaders with the assistance of extensionists and NGOs/facilitators will examine the account book and cash on hand of the groups and afterwards, discuss among the members the results of this examination and any issues/concerns in the operations of the livelihood options. Through such continuous discussions, the beneficiaries' groups are expected to develop their own capacities in operating the livelihood development options in a proper and sustainable manner. In the monitoring activities, the emphasis should be put on financial management or bookkeeping by the groups. Proper financial management is indispensable for maintaining transparency in the usage of the group's funds. It would be quite difficult for any community-based groups to maintain its organization without maintaining transparency in financial management.

Once the groups could keep and maintain their account books properly, they could further use it for decision-making in the operation of the livelihood options. The MAF district offices in coordination with NDF and relevant ministries and directorates should provide further assistance to the groups in wisely and properly utilizing the surplus in the group fund. Local NGOs or external facilitators/experts will be hired for this purpose.

5.7 Information Dissemination and Awareness-Raising Program

5.7.1 Objectives

Enhancement of public awareness about the importance of watershed management plays a vital role in the implementation of the watershed management plan. Without changing the ideas and understanding of rural communities and households who actually decide land/resource use in the watersheds, it would be quite difficult to shift the environmentally downward trend to an environmentally sound one. Since there is no legal base that allows MAF/NDF to control the current activities of rural households at present, the enhancement of public awareness is the crucial means that can encourage rural households to regulate their daily activities. In addition, the watersheds should be managed not only by households/communities residing in the upper part of the watersheds but also by those living in the downstream area. Both sides need to understand a causal relationship between activities in the upper watershed and those in the lower.

It is also important to make rural communities in the target watersheds, especially in the target sucos, understand the concepts and outlines of the watershed management plan for the efficient implementation of the plan. In general, it would take time for rural communities to understand the sub-programs proposed for the respective villages. It is therefore recommended that the information of the sub-programs be disseminated to the respective target sucos prior to the actual implementation.

In this connection, the main objective of this sub-program, Information Dissemination and Awareness-Raising Program, is to increase the level of awareness and understanding of all the stakeholders about i) the necessity of forest and watershed management, and ii) basic concepts and major activities of the proposed programs/sub-programs proposed in the watershed management plan.

5.7.2 Strategies

Firstly, the Information Dissemination and Awareness-Raising Program needs to target not only rural households living in mountainous/hilly areas, but also those in lowland areas and students

studying in schools. Since these stakeholders have different needs or different visions, several media and modules need to be used for disseminating information to enhance their awareness depending on the type and level of the stakeholders. One of the strategies employed for the program is to use optimum means/media to increase opportunities to get the necessary information across to all stakeholders.

Secondly, the program should aim at developing the capacities of key players in information dissemination. Under the current conditions in the country, face-to-face communication is the best way to deliver information and develop awareness among the stakeholders. Consequently, the capacities of persons in charge of delivering information need to be developed.

Thirdly, it is also important to create resources for raising public awareness. This includes the establishment of demonstration plots (under the other sub-programs), preparation of leaflets/handbooks for rural households, and preparation of textbooks for teaching watershed-related environment subject matter in schools.

The activities proposed in the sub-programs under the Land Management Component would likely be the first subject for information dissemination and awareness-raising for most of the communities in the target watersheds. There is a possibility that rural communities/households may misunderstand the implication of the concepts of the programs/sub-programs. Hence, the program should also address the dissemination of information about the programs/sub-programs in addition to those related to watershed management.

5.7.3 Proposed Sub-programs

The program proposes the following two sub-programs:

a. Public Awareness Campaign Sub-program (Information dissemination activities using appropriate media such as brochure, pamphlet, movie or drama/picture show at the village); and
b. Environmental Education Sub-program (Environmental education at primary and secondary schools in the watersheds in coordination with the National Directorate of Education).

(1) Public Awareness Campaign Sub-program

a. Objectives

The main objective of the sub-program is to enhance the awareness of the necessity of sustainable forest and watershed management among rural communities living in the target watersheds through public awareness-raising activities/campaigns at the village level.

Additionally, the sub-program aims to encourage rural communities to deepen their understanding of the basic concepts and major activities of the proposed programs/sub-programs in parallel with the implementation of the respective sub-programs.

b. Implementing Agencies

NDF, together with the National Directorate for Research and Specialist Services (NDRSS), should be the main implementing agencies. The MAF district offices concerned and forest guards/extensionists should be involved in the campaign activities in the field. NDF should coordinate with other relevant directorates under the State Secretary for Environment and the State Secretary for Natural Resources, Mineral and Energy Policies in the preparation of materials for public awareness-raising campaigns. It would be necessary for NDF to coordinate with the Ministry of Education if the sub-program needs to involve teachers or students in the activities or tie up with the Environmental Education Sub-program.

For the preparation of the campaign materials and organization of information dissemination workshops on the ground, local NGOs/facilitators should be hired until NDF and the MAF district offices are capable of doing such activities.

c. Target areas

All sucos in the watershed should be covered. The priority should be given to those where deforestation and forest degradation has progressed due to frequent forest fires, intensive firewood collection, and unregulated shifting cultivation.

d. Main Activities

The main activities of the sub-program are: i) assessment of the current conditions of the villages, ii) development of awareness-raising campaign materials, iii) initial contact with the target villages, iv) organization of the workshops with the target groups, and v) post-evaluation.

i) Assessment of the current conditions of the villages

At first, the main theme and topics to be addressed in the campaigns should be determined on the basis of the current situation of rural communities and the major threats to forests in the target watersheds. NDF and local NGOs/facilitators will assess the present conditions of the target watersheds after reviewing Chapter 3 of this report and the other reports submitted by the JICA Study Team.

ii) Development of awareness-raising campaign materials

One of the effective means for raising awareness is to distribute informative materials such as pamphlets, posters, leaflets, and small booklets on the relevant topics on watershed management or the proposed programs of the watershed management plan. The use of an audio-visual media (e.g., picture-story show, movie or drama show[10]) is also an effective way of conveying the messages to a wide range of people at an affordable cost. The types of material should vary with the target groups and/or topics discussed in the campaigns. The target groups for the sub-program are broadly categorized into three types: i) public, ii) adults, and iii) children. The following matrix shows the suggested themes/topics to be discussed and the media appropriate for the respective target groups.

[10] The audio-visual can be used under the current conditions of Timor, where every suco office owns a DVD player with TV monitor.

Media Appropriate for the Respective Target Groups and Topics/Themes

Main theme/Contents	Possible materials to be developed by the target group		
	i) Public	ii) Adults	iii) Children
Future scenarios with and without proper watershed management	Poster	Movie, drama show	Movie, picture book, drama show
Who is responsible for watershed management?	Leaflet	Movie, drama show	Movie, picture book, drama show
Effect of forest fire and firewood collection	Poster, leaflet	Movie	Movie, Picture book
Mechanism of watershed degradation	Poster, Leaflet	Movie	Movie, Picture book
Necessary actions for the improvement of watershed environment	Poster, leaflet	Movie	Movie, Picture book
Options to minimize use of firewood	Leaflet	Movie	-*
Informative guides to soil conservation and agroforestry techniques	Leaflet	Movie	-
Informative guides to management of afforestation trees and agroforest trees/crops	Leaflet	Movie	-
Importance of village regulation	Leaflet	Movie	Movie, Picture book
Basic concepts of Watershed Management Plan	Leaflet	Movie	-
Basic concepts of Participatory Land Use Planning sub-program	Leaflet	Movie	-
Guides to farm and livestock management techniques	Leaflet	Movie	-

Note*: The PAC activities for the respective theme do not target children.
Source: JICA Study Team (2009)

To have a general idea of the materials for public awareness campaigns for forest and watershed conservation, NDF with the assistance of NGOs/facilitators will collect and review the existing materials used for public awareness campaigns for the same purpose in and outside the country. Having reviewed the existing materials, NGO and NDF will develop the public awareness campaign materials considering the present literacy level, development needs, and other socio-economic conditions in the target watersheds.

iii) Initial contact with the target villages

NDF will have a consultation meeting with the target village to explain and agree with them on the outlines and work schedule of the sub-program.

At the same time, a questionnaire survey will be conducted to evaluate the current awareness level of forest and watershed degradation issues among rural communities in the village. The results of the survey are to be used to evaluate the effectiveness of the sub-program activities.

iv) Organization of the workshops

A total of three workshops will be organized in the target village using the materials developed in the steps above. One session should target children, while the rest will target adults in the village. In all the sessions, local NGOs/facilitators should play a facilitator's role in the workshops with the assistance of the district forest officers and/or forest guards assigned to the target village. NDF and local NGOs/facilitators should also coordinate with teachers of the primary or secondary school in the village for the workshop with children.

Additionally, one of the sessions for adults should cover the topics related to the sub-programs to be implemented in the village.

v) Post-evaluation

After the workshops, NDF with the assistance of NGOs/facilitators will conduct a post-evaluation questionnaire survey. The post-evaluation questionnaire survey will be designed to gauge the effectiveness of the sub-program by comparing the people's awareness level on forest and watershed management before and after the workshops. The survey should be as simple as the district officers or forest guards could carry out alone in the future.

(2) Environmental Education Sub-program

Watershed management should be a task with a long-term view since it would take time to change the views of rural households and to restore the vegetation cover in mountainous/hilly areas. It is, therefore, important to enhance the awareness of the next generation, especially students in primary and secondary schools. This sub-program aims to promote environmental education activities relating to watershed management at primary and secondary schools in the watersheds.

a. Objectives

The main objective of the sub-program is to raise the awareness of children about watershed and natural resource management by introducing an environmental education curriculum into the education programs in primary and secondary schools in the target watersheds.

b. Implementing Agencies

The Directorate of Education of the Ministry of Education, Culture, Youth, and Sports is responsible for the application of the curriculum. NDF together with NDRSS will coordinate with the Directorate of Education to produce educational materials (e.g., textbooks, other materials, etc.) about the Laclo and Comoro watersheds. Local NGOs/facilitators will be used for the preparation of education materials as well as program/curriculum.

c. Target areas

The outlines of the education materials developed could be applicable not only to schools in the watersheds but also to those outside the watersheds or in other districts in the country. However, the education curriculum and teaching aids will be exclusively used for teaching in primary and secondary schools in the watersheds.

d. Main Activities

In order to develop the education curriculum on watershed management for primary and secondary school curricula, the following activities are to be undertaken.

Activities for Environmental Education Sub-program

Activities	Description
Preparation of a Teacher's Handbook on environmental education.	The handbook should be concise, but should contain not only the information about the target watersheds but also that of national environmental issues and watershed degradation in the country.
Preparation of materials for education	A textbook and other materials to be used for education should be produced.
Development of curriculum on environmental education	A watershed-related environmental education curriculum for students in primary and secondary schools in the watersheds should be developed. The curriculum should put the specific focus on watershed management of the Comoro and Laclo watersheds.
Development of teacher training courses	An in-service training course should be developed for teachers to familiarize themselves with watershed-related environmental education curriculum. Exposure visits will also be organized to enhance teachers' understanding about watershed management activities.

Source: JICA Study Team

5.7.4 Implementation Procedures

The overall procedures for implementation of the sub-programs under this program are described below.

(1) Assessment of Needs for Public Awareness Campaigns

NDF and the MAF district offices with the assistance of local NGOs/facilitators will assess the needs of information dissemination and/or public awareness-raising in the field of watershed management by reviewing the reports submitted by the JICA Study Team. Subjects/themes to be addressed, target groups, possible means to disseminate information, and available resources that can be used for public awareness campaigns will be discussed/determined.

(2) Preparation of Work Plan

NDF together with NGOs/facilitators will prepare a work plan for the sub-program that specifies the activities to be undertaken, their timeframe, responsible persons, and materials necessary for the activities. Target areas for the sub-programs should also be determined in the preparation of the work plan.

(3) Coordination with Other Organizations

NDF will coordinate with relevant directorates (e.g., NDRSS) and the relevant ministries (e.g., Ministry of Economy and Development, Ministry of Education and Secretary of State for Natural Resources) in the preparation of the materials or curricula to be used in the sub-programs namely, those for raising public awareness and environmental education.

(4) Implementation of the Sub-programs

NDF together with NGOs/facilitators will implement the sub-programs in accordance with the work plan prepared. The work plan will also be used for monitoring the progress of the sub-programs. At the end of every fiscal year, NDF will prepare and submit an accomplishment report to National Director of NDF with outputs produced by the sub-programs.

5.8 Capacity Development Program

5.8.1 Objectives

Successful and sustainable management of the target watersheds significantly depends on how the implementing agencies and other relevant organizations fulfill their respective responsibilities in implementing the proposed sub-programs in the watershed management plan. As reviewed in Chapters 2 and 3, the legislative set-ups and the capacities of the watershed-related sectors in the country are still insufficient to implement the sub-programs without any external support. The enhancement of the capacities of the relevant government organizations and their staff is essential for ensuring the effectiveness and sustainability of the watershed management plan.

The main objective of this program is therefore to lay the foundation of the capabilities of the stakeholders in the watershed-related sectors so that sustainable and integrated watershed management envisioned in this management plan could be achieved.

5.8.2 Strategies

As stated above, capacity development is a key toward successful implementation of the watershed management plan. There must be many things to do with respect to capacity development of MAF/NDF. However, the program should focus on those necessary for the implementation of the sub-programs/programs of the watershed management plan. Specifically, emphases are given to the following aspects:

i) Existing systems for watershed management;
ii) Capacity of human resources; and
iii) Equipment and materials.

(1) Existing Systems for Watershed Management

As indicated in the former sub-section, there is a need to establish necessary legislation/ordinance that can support the implementation of the watershed management plan legally and administratively. One of the most important legislation systems related to the watershed management plan is the FMD, which is in the process of approval in the Parliament as of December 2009. As it just defines the overall framework of forest management in the country, there will be a need to develop a set of implementation procedures/guidelines to put the decree into practice when it is enacted. Considering its importance, the program should put its focus on the preparation of the procedures for the implementation of the sub-program under the framework of the FMD.

(2) Capacity of Human Resources

It is considered in general that the capabilities of the MAF staff including its extensionists are too limited to implement the sub-programs from the technical viewpoint. Although the actual implementation of the sub-programs could be outsourced to NGOs or other external experts initially, it is necessary for MAF to become capable of implementing such activities in the long run.

(3) Equipment and Materials

In addition to the limited capacities of the staff, the lack of equipment and materials is also a severe issue especially for the MAF district offices concerned. Due consideration should be given to the organizational capacities of MAF and its district offices in terms of equipment/facilities available in the organization.

5.8.3 Proposed Sub-programs

The program is composed of three sub-programs, which are as follows:

a. Watershed Management-related Institutional Development Sub-program;
b. Capacity Development Sub-program; and
c. Mobility Improvement Sub-program.

(1) Watershed Management-related Institutional Development Sub-program

The aim of this sub-program is to bridge the gap between the forthcoming FMD and the implementation of the sub-programs proposed in the watershed management plan. As the new decree just indicates an overall framework of forest management in the country, MAF/NDF needs to develop a set of guidelines for the implementation of the sub-programs in compliance with the new decree. Once such a set of guidelines are legalized, NDF/MAF could have support from the GoTL in the implementation of the watershed management plan.

a. Objectives
The goal of the sub-program is to prepare a set of guidelines for the implementation of the sub-programs under the Land Management Component in compliance with the FMD.

b. Implementing Agencies
NDF is responsible for the preparation of the guidelines. International experts should be hired to draft and finalize the guidelines.

c. Target areas

The guidelines should exclusively aim at the implementation of the watershed management plan, although the basic concept of the procedures can be generalized for other districts in the country. It is not advisable to use them for other watersheds in the country without any modification/adjustment since site conditions vary from one district to another.

d. Main Activities

This sub-program can start when the FMD is drafted as the final version. In order to come up with the guidelines, the following activities are to be carried out.

Activities for Watershed-related Institutional Development Sub-program

Activities	Description
Situation Analysis	NDF with the assistance of a competent expert who has significant experience in community-based forest management will carefully review i) the current situation of the sector; ii) the Forest Management Decree (FMD); and iii) the watershed management plan.
Preparation of draft guidelines	To collect and gather a wide range of opinions and suggestions from the users of the FMD and those who are familiar with the situation of the country, NDF with the competent expert will organize a participatory meeting before and after the preparation of the draft guidelines. A set of the guidelines in line with the FMD will be drafted by NDF with the assistance of the expert based on the suggestions given in the meetings.
Monitoring and Revision	The guidelines will be compiled as a ministerial order/ordinance. NDF should review the guidelines from time to time during the implementation of the watershed management plan and, if necessary, it should be amended in accordance with site conditions. The international expert will assist NDF in reviewing and revising the implementation procedures.

Source: JICA Study Team

(2) Capacity Development Sub-program

a. Objectives

The main objective of the sub-program is to enable the staff of MAF and relevant directorates to fulfill their tasks and responsibilities for the implementation of the sub-programs in the watershed management plan.

b. Implementing Agencies

The sub-program will focus on the knowledge, techniques, and skills exclusively required for the implementation of the sub-programs in the watershed management plan since the respective ministries/directorates are supposed to develop the training curriculum for their staff. Hence, MAF will have the overall responsibility for development of the training curriculum in coordination with the relevant ministries and directorates. But the support from donors and international organizations is necessary for the implementation of the sub-program under the current circumstances of the country.

c. Target groups

Target groups of this sub-program are the staff of the relevant government offices, especially those who are directly involved in the implementation of the programs.

d. Main Activities

It is advisable for the relevant ministries/directorates to organize a special working team and to hire a training/capacity development specialist for the preparation and implementation of the training curricula for the staff of the respective offices at the start of the sub-program. After it is organized, the working team, together with a training/capacity development specialist, will conduct the activities described below.

Activities for Capacity Development Sub-program

Activities	Description
Training needs assessment	Assess the training needs of the staff of the directorates concerned by conducting a questionnaire survey as well as workshops; and Review the past and on-going activities related to capacity development.
Development of training curricula	List the existing resource persons and training materials that can be used for capacity development; and Develop curricula for the staff of the directorates concerned.
Preparation for training	Recruit resource persons; and Develop training materials.
Implementation of training	Train the staff of NDF, NDAH, NDIPA, NDSDAC, and NDRBFC.
Evaluation	Organize a workshop with the participation of the staff to be involved in the implementation of the watershed management plan; and Prepare of a completion report.

Source: JICA Study Team (2009)

e. Main Topics to be addressed

Capacity development/training curricula for the staff are supposed to vary with their specific roles and responsibilities in their respective directorates, within the framework of the watershed management plan. For instance, the main roles and responsibilities of the management staff in NDF would be overall monitoring of the plan, coordination with other organizations, and technical and administrative support to field staff, while the MAF district offices should be responsible for the application of technical assistance and guidance to rural households. Given this understanding, the Study Team identified the topics to be addressed in the training curricula to be developed in the sub-program for the staff from the relevant organizations.

Training Subjects identified for Government Staff

Target groups	Subjects	Methods	To be organized by
NDF and District Forest Officers	Forest Management Decree Watershed management plan (Orientation) Concept of CBNRM Project monitoring and evaluation Report writing Preparation of TOR for NGOs/facilitators and evaluation Preparation of Draft Forest Management Agreement Preparation of a budgetary plan	Workshop	MAF (NDF), International NGOs, Consultants
District Forest Officers and Forest Guards	Participatory planning methods Agroforestry and soil conservation techniques Participatory land use planning Public awareness campaign methods Facilitation skills	Workshop and OJT	MAF (NDF), NGOs, Consultants
NDAH, NDIPA, NDSDAC and District Crop Officer	Watershed management plan (Orientation) Project monitoring and evaluation Report writing Preparation of TOR for NGOs/facilitators and evaluation Preparation of a budgetary plan	Workshop	MAF (NDAH/ NDIPA), International NGOs, Consultants
District Crop Officer, District Coffee Officer, and Extensionist	Improved farming practices Agroforestry and soil conservation techniques Vegetable farming Seed multiplication Stall feeding and silage making Management of pasture lands (control of harmful weeds) Rejuvenation, pruning, and other techniques for management of coffee trees	Workshop and OJT	MAF (NDAH), NGOs
Teachers	Functions of watersheds and forests Causes of watershed and forest degradation Natural disasters and their causes Importance of watershed/forest conservation	Workshop	MAF (NDF), NGOs

Target groups	Subjects	Methods	To be organized by
NDRBFC and its district officers	Watershed management plan (orientation) Project monitoring and evaluation Report writing Methods for assessment of potentials for soil erosion, Landslide and Sediment in the micro watershed Concept of and techniques for Slope Protection and Sediment Control Program	Workshop and OJT	MPW, International NGOs, Consultants

Source: JICA Study Team

(3) Mobility Improvement Sub-program

A shortage of transportation facilities is one of the difficulties that have made the watershed management activities of MAF/NDF ineffective in the target watersheds. As indicated in Chapter 2, the number of 4WD and motor bikes in the MAF district offices is insufficient. This sub-program aims to assist MAF in improving its mobility so that the district officers and forest guards of the MAF district offices concerned could often visit rural communities in the watersheds.

a. Objectives

The objective of this sub-program is to enhance the mobility of the concerned MAF district offices so as to enable them to visit sucos more often and easily implement the sub-programs of the watershed management plan.

b. Implementing Agencies

MAF is responsible for the procurement of the transportation facilities.

c. Target groups

This sub-program targets NDF and the MAF district offices of four districts namely, Aileu, Liquica, Ermera, and Manatuto.

d. Main Activities

An inventory of office equipment is to be undertaken at the above-mentioned offices. Simultaneously, the current status of the equipment is to be reviewed. Based on the inventory of office equipment and the sub-programs planned, MAF should identify the requirements of each office. The following are suggested guides for assessment.

Guideline for Assessment of Needs for Facilities/Equipment

Facilities/equipment	Guideline
Motor bike	One unit each for forest guards assigned to the watersheds
4WD Pick-up	One unit for Watershed Management Division in NDF

Source: JICA Study Team

After installation of the facilities, each office has to manage and maintain those facilities properly.

5.8.4 Implementation Procedures

Each sub-program will follow different procedures. The steps to be taken for the respective sub-programs are outlined below.

(1) Watershed-related Institutional Development Sub-program

This sub-program is to be implemented in accordance with the following steps:

a. Hire an international NGO/consultant to help MAF/NDF;
b. Review the FMD and watershed management plan;
c. Prepare a set of guidelines for the implementation of the sub-programs under the Land Management Component;

d. Consult with other stakeholders about the guidelines;
e. Finalize the procedures; and
f. Take the necessary process to issue the guidelines as a ministerial order/ordinance.

(2) Capacity Development Sub-program

Likewise, the sub-programs should be implemented in accordance with the following steps:

a. Hire a competent NGO/consultant to help MAF;
b. Assess training needs of government staff involved;
c. Prepare training courses for the respective sub-programs;
d. Identify optimum resource persons and training modules for each course;
e. Arrange and prepare training sessions (materials, tools, venues, food and snacks);
f. Conduct training courses; and
g. Get feedback from participants to evaluate the training courses.

(3) Mobility Improvement Sub-program

As described in Sub-section 5.8.3, this sub-program will follow the steps described below.

a. Make an inventory of the transportation facilities of the four MAF district offices;
b. Review the planned sub-programs;
c. Assess and identify additional transportation equipment (4WD and motorbike) necessary for the implementation of the sub-programs;
d. Procure the equipment in accordance with government regulations; and
e. Manage and maintain the equipment properly.

Chapter 6 Implementation Mechanisms

6.1 Implementation Methods

6.1.1 Basic Concepts in Implementation

Given the current context of Timor-Leste, in which necessary legislative set-ups are lacking and the capability of the government is weak, technically as well as financially, the JICA Study Team expects that it would take a long time for MAF to implement the overall watershed management plan thoroughly. Thus, an implementation plan for the overall watershed management plan is not developed in this management plan, as the preparation of an implementation plan for the overall watershed management plan seems meaningless at this time.

In principle, the Study Team proposes to implement the watershed management plan in line with the following concepts so that MAF/NDF could maximize the available opportunities and resources in the country:

i) Participatory: to encourage potential funding institutions or organizations in the country to participate in the implementation of the watershed management plan;
ii) Flexible: to allow the external implementers or funding institutions to implement any parts of the programs/sub-programs as long as the selected sub-programs are suitable to the selected areas and they are implemented in a proper as well as participatory manner as specified in Chapter 5; and
iii) Phased: to implement the watershed management plan in several phases in accordance with the capacity level of the GoTL.

The concept of "Flexible" is basically applied to the external implementers or funding institutions, such as donor agencies, international NGOs, and international research institutes, while the concept of "Phased" is the basic guideline when MAF/NDF implements the watershed management plan.

(1) Implementation by MAF/NDF

The watershed management plan which targets about 160,000 ha and proposes a total of 21 sub-programs is too large and too integrated for MAF to handle under the current circumstances. On the other hand, MAF should implement the watershed management plan in a strategic manner so as to utilize government funds in an efficient and effective manner. The priority areas and the priority sub-programs need to be identified for MAF/NDF to come up with a short-term management plan which would be required for them to secure the necessary budget and invest in the management of the target watersheds strategically and effectively.

(2) Implementation by External Financial Institutions/Organizations

One of the potential uses of the watershed management plan is as a guidebook for organizations, which are working or will work in the target watersheds for community development or forest protection to determine the development needs or interventions required in these watersheds. The background of this idea is the expectation that some international organizations (NGOs, private companies, donor agencies, and research institutes) might be interested in the implementation of parts of the watershed management plan or in working in some sucos introducing the sub-programs proposed. Thus, the succeeding section proposes the suitable areas/sucos for all the 21 sub-programs and the recommended combinations of the sub-programs, so that the users could have ideas on what they can do in their respective sucos in the target watersheds.

6.1.2 Implementation Methods on the Government's Initiatives

(1) Prioritization of the Target Watersheds

As explained in Section 3.1.3, the target watersheds are composed of 16 sub-watersheds, of which two sub-watersheds are the river mouths of the Comoro and Laclo rivers. In order to identify the priority sub-watersheds where the GoTL would focus its investment on, the necessity of watershed management in the sub-watersheds except those of river mouths is evaluated in terms of i) soil erosion potential, ii) necessity of watershed protection, iii) poverty level, and iv) accessibility to the district capital.

Sub-watersheds in the Target Watershed

Basin	Sub-watershed	Area (ha)	Sub-districts related	Sucos related
Comoro	Bemos	4,392	Dili, Laurala (Aileu)	Dare, Tohumeta, Talitu, Cotolau, Madabeno
	Balele	9,326	Aileu, Laulara (Aileu), Dom Alexio (Dili), Railaco (Ermera), Bazartete (Liquica)	Seloi Craic, Fatisi, Deleco, Samalete, Taraco, Fahilebo, Tibar, Ulmera
	Anggou	2,307	Railaco (Ermera), Bazartete (Liquica)	Matata,, Leorema
	Buamara	3,451	Railaco (Ermera)	Fatuquero, Lihu, Railaco Craic, Railaco Leten,Tocoluli
Laclo	Ue Coi	8,776	Laclubar (Manatuto)	Batara, Funar
	Sumasse	16,764	Laclubar, Manatuto (Manatuto)	Fatumaquerec, Manelima, Orlalan, Sanana'in, Alili, Aiteas, Cribas
	Lihubani	16,970	Remexio (Aileu), Metinaro (Dili), Laclo (Manatuto)	Acumau, Suco-liurai, Tulataqueo, Duyung (Sereia), Sabuli, Hohorai, Lacumesac
	Daisoli	12,486	Aileu, Liquidoe (Aileu), Maubisse (Ainaro)	Banduato, Fatubosa, Lahae, Lausi, Betulau, Fatu-besi, Maubisse, Suco Liurai
	Monofunihun	14,317	Aileu, Liquidoe (Aileu)	Aisirimou, Fahiria, Saboria, Seloi Malere, Acubilitoho, Manucasa, Namoleso
	Manotahe	6,450	Aileu (Aileu)	Hoholau, Suco Liurai
	Noru	12,851	Liquidoe, Remeixio (Aileu)	Fahisoi (Liquidoe), Fadabloco, Fahisoi (Remexio), Faturasa, Hautoho, Maumeta
	Eraibanaubere	13,526	Liquidoe (Aileu), Turiscai (Manufahi)	Bereleu, Faturilau, Fatucalo, Lesuata
	Malikan	5,630	Maubisse (Ainaro), Turiscai (Manufahi)	Manelobas, Maulau, Caimauc, Liurai, Manumera, Matorec
	Lohun	17,162	Laclo (Manatuto)	Uma Naruc

Source: JICA Study Team

The evaluation criteria and the indicators used for evaluation are shown below.

Evaluation Criteria for Prioritization of Sub-watershed

Evaluation points	Criteria	Indicators	Rating	Data sources
Soil erosion potential	Results of USLE	Average potential soil loss classes in the sub-area <1	5-point: Class 5 4-point: Class 4 3-point: Class 3 2-point: Class 2 1-point: Class 1	Results of USLE
Necessity of watershed protection	Area of P-Zone and SM-Zone	Proportion of the two zones in the total area of the sub-watershed	5-point: 80-100% 4-point: 60-80% 3-point: 40-60 2-point: 20-40 1-point: 0-20%	Zoning map
Poverty level	Average income of household	Average monthly income per household	5-point: US$0 - 10 4-point: US$10 - 20 3-point: US$20 - 30 2-point: US$30 - 40 1-point: >US$40	Village profile survey
Accessibility	Distance from the district capital	Drive time from the district capital to the sub-watershed	5-point: 0-1 hours 4-point: 1-2 hours 3-point: 2-3 hours 2-point: 3-4 hours 1-point: >4 hours	Village profile survey

Note: <1 The criteria used for classification are described in Sub-section 3.1.9 in this report.
Source: JICA Study Team

Based on the results of the evaluation given in Table 6.1, the following sub-watersheds are identified as the priority areas for immediate action.

Priority Sub-watersheds for a Short-Term Management Plan

Basin	Sub-watershed	Area (ha)	Sub-districts related	Sucos related
Comoro	Bemos	4,392	Dili, Laurala (Aileu)	Dare, Tohumeta, Talitu, Cotolau, Madabeno
Laclo	Noru	12,851	Liquidoe, Remeixio (Aileu)	Fahisoi (Liquidoe), Fadabloco, Fahisoi (Remexio), Faturasa, Hautoho, Maumeta

Source: JICA Study Team

(2) Prioritization of the Sub-programs

On the other hand, the sub-programs proposed in the watershed management plan are also evaluated in terms of the following criteria. They are set in consideration of the objectives of the watershed management plan and current situation of the country.

a. Urgency: Does the sub-program need to be urgently implemented to improve watershed environment?

b. Effectiveness: Is the sub-program expected to generate positive impact on the watershed environment or the local communities in the watershed in a short period of time?

c. Relevancy: Are the purposes and activities of the sub-program relevant to the goal of the watershed management plan?

d. Affordability: Is the cost required for the sub-program reasonable as compared with the current government budget or financial capacity of rural communities?

e. Sustainability: Can the effect generated by the sub-program be sustained even after the implementation of the sub-program?

f. Benefit to households: Does the sub-program profit rural households?

A three-point rating system is employed for the evaluation of the sub-programs as shown below.

Results of Prioritization of the Sub-programs

Sub-program <1	Criteria <2						Total score
	Urgency	Effectiveness	Relevancy	Affordability	Sustainability	Benefit	
PLUP-SP	3	3	3	3	3	2	17
TPP-SP	3	3	3	2	3	3	16
SPP-SP	2	3	3	2	2	3	15
FMP-SP	1	2	3	2	2	1	11
CBSE-SP	2	3	3	2	2	3	15
HG-SP	2	3	3	2	2	3	15
GCPB-SP	3	3	3	1	2	3	15
AFP-SP	1	2	2	2	2	2	11
SUFP-SP	3	3	3	2	2	2	15
CRP-SP	3	2	3	2	3	2	15
GC-SP	3	3	3	1	2	3	15
RED-SP	2	2	2	2	2	1	11
IG/CS-SP	2	3	3	2	2	3	15
SP-SP	3	3	3	1	2	1	13
SFC-SP	3	3	3	1	2	1	13
IGC-SP	3	3	3	2	2	1	14
RBP-SP	3	3	3	1	2	1	13
PAC-SP	3	3	3	2	2	1	14
EE-SP	2	2	3	2	2	1	12
WMID-SP	1	2	2	2	3	1	11
CD-SP	3	2	3	2	3	1	15
MI-SP	2	2	2	1	2	1	10

Note: <1 PLUP-SP: Participatory Land Use Planning Sub-program, TPP-SP: Tree Planting Promotion Sub-program, SPP-SP: Seedling Production Promotion Sub-program, FMP-SP: Forest Management Planning Sub-program, CBSE-SP: Community-Based Seed Extension Sub-program, HG-SP: Home Garden Sub-program, GCPB-SP: Grazing Control with Protein Bank Sub-program, AFP-SP: Animal Feed Preservation Sub-program, RED-SP: Rural Energy Development Sub-program, IG/CS-SP: Income-Generating / Cost Saving Sub-program, SP-SP: Slope Protection Sub-program, SFC-SP: Sediment Flow Control Sub-program, IGC-SP: Initial Gully Control Sub-program, RBP-SP: River Bank Protection Sub-program, PAC-SP: Public Awareness Campaign Sub-program, EE-SP: Environmental Education Sub-program, WMID-SP: Watershed Management Institutional Development Sub-program, CD-SP: Capacity Development Sub-program, MI-SP: Mobility Improvement Sub-program

<2 In the rating system, 3 points is to be given to the sub-programs classified as "High", 2 points to "Medium", and 1 point to "Low", respectively.

Source: JICA Study Team

The sub-programs are classified in accordance with the total scores given to the respective sub-programs, namely,

- High priority sub-programs: over 15 points (more than 2.5 points/criterion on average)
- Medium priority sub-programs: 12~15 points (2.0~2.5 points/criterion on average)
- Low priority sub-programs: below 12 points (below 2.0 points/criterion on average)

They are further evaluated in terms of implementability under the current context of Timor-Leste.

Class 1: Sub-programs that can be implemented by the GoTL without any external support

Class 2: Sub-programs that can be implemented by the GoTL with support from local external experts/NGOs

Class 3: Sub-programs that can be implemented only with support from international organizations

The results of the evaluation are shown below.

Results of Evaluation of the Sub-Programs in Terms of "Implementability"

Class	Sub-program		
	High priority	**Medium priority**	**Low priority**
Class 1	TPP-SP, CRP-SP		
Class 2	SPP-SP, PLUP-SP, CBSE-SP, HG-SP, SUFP-SP, GC-SP, IG/CS-SP, CD-SP	CDC-IGC, PAC-SP	AFP-SP
Class 3		RED-SP, EE-SP, SP-SP, SFC-SP, RBP-SP,	WMID-SP, FM-SP, MI-SP

Source: JICA Study Team

Furthermore, the sub-program that requires coordination with other ministries should also be set aside from the list of the priority sub-programs and regarded as those to be implemented in the long-term management plan. Among the 21 sub-programs, four sub-programs, i.e., Slope Protection Sub-program, Sediment Flow Control Sub-program, River Bank Protection Sub-program and Environmental Education Sub-program, need coordination with the Ministry of Infrastructure or Ministry of Education for implementation.

As a result, a total of 12 sub-programs are classified as high or medium priority and implementable with/without the assistance from local NGOs/experts. The succeeding chapter, Chapter 7, gives a five-year management plan for implementing the 12 sub-programs in the priority sub-watersheds.

(3) Implementation plan

a. Implementing Order of the Target Sub-watersheds

Given the current capacity of MAF/NDF, the JICA Study Team judges that two sub-watersheds would be the maximum where MAF/NDF can implement the priority sub-programs for five years. Although it should be reviewed after the GoTL has improved its capacity and experience, the order of the sub-watersheds for implementation of the priority sub-programs is determined as follows.

Implementing Order of the Sub-watersheds

Priority	Comoro watershed	Laclo watershed
1st Priority	Bemos SW	Noru SW
2nd Priority	Buamara SW	Lohun SW
3rd Priority	Balele SW	Monofunihun SW
4th Priority	Anggou SW	Eraibanaubere SW
5th Priority	-	Liubani SW, Ue Coi SW
6th Priority	-	Sumasse SW, Malikan SW
7th Priority	-	Daioli SW, Manotahe SW

Source: JICA Study Team

b. Implementing Order of the Priority Sub-programs

In general, each and every priority sub-program will be implemented in accordance with the respective procedures described in Sections 5.1 to 5.8. As for the implementation plan of the 12 priority sub-programs as a whole, the following rules should be taken into account in their implementation.

i) Participatory Land Use Planning Sub-program (PLUP-SP) should be implemented ahead of the other land management-related sub-programs, such as Tree Planting Promotion Sub-program, Community-Based Seed Extension Sub-program, and Sustainable Upland Farming Promotion Sub-program.

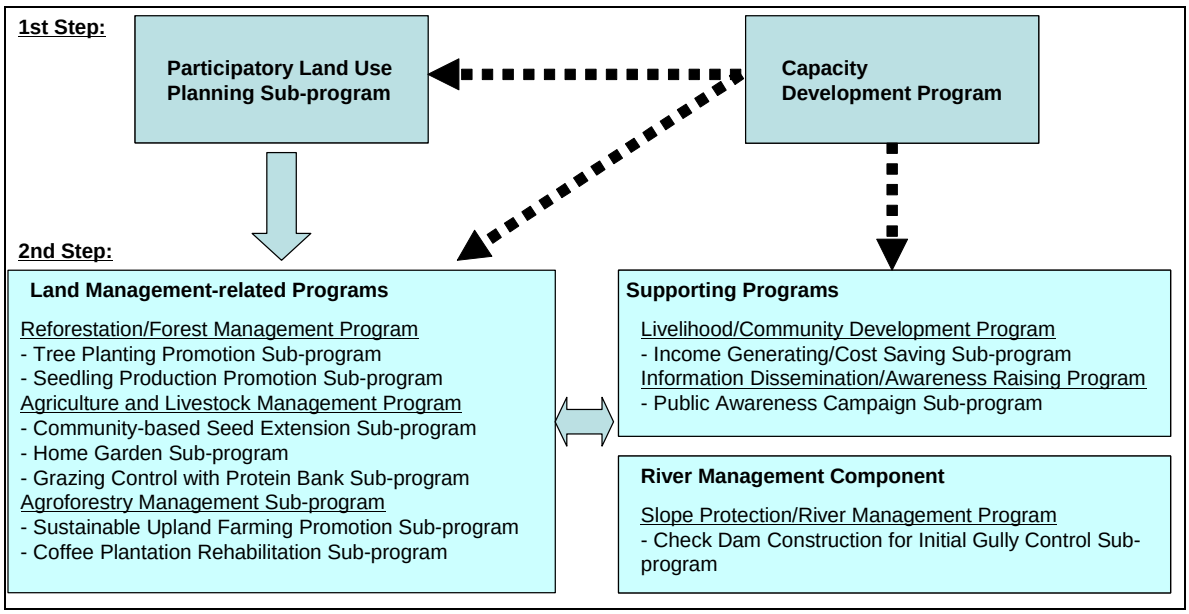
ii) Capacity Development Sub-program can be implemented simultaneously with PLUP-SP.

iii) Income-Generating/Cost-Saving Sub-program and Public Awareness-Raising Sub-program can be implemented simultaneously with the land management-related sub-programs.

iv) More than three sub-programs should not be implemented in the same suco at the same time. The capacity of local communities in the suco is not sufficient in general. However, Public Awareness-Raising Sub-program and Capacity Development Sub-program should not be counted since they do not require any work from community members.

v) In principle, the sub-programs should be selected by rural communities among the priority sub-programs as a first step. After PLUP-SP, rural communities will discuss which sub-programs are the most effective for them to realize the future land use map. In the field, there will be a need to lead them to select not only the sub-programs that would directly benefit them but also those that would contribute to improving the watershed environment. Furthermore, they should be assisted in selecting the optimum sub-programs based on the resources available in the localities when selecting those related to agriculture management and livelihood development activities. By doing so, the communities can achieve the sustainable management of land and forest resources while maintaining/improving their livelihoods.

A general flow of implementing the 12 priority sub-programs is shown in the following flowchart.



Implementation Order of the Sub-programs

6.1.3 Implementation Methods by Other External Organizations

(1) Suitable Areas/Sucos for Implementation of the Respective Sub-programs

Based on the conditions for identification of the target sucos for the respective sub-programs discussed in Sections 5.1 to 5.8, the potential sucos for the sub-programs except those of Capacity Development Program are identified as shown in Table 6.2.

(2) Recommended Combination of the Sub-programs

The sub-program can be implemented separately but can also be combined with other sub-programs to complement one another. Based on the experiences of the pilot projects implemented by the JICA Study in 2009 and the assessment of the natures of the respective sub-programs, the compatibility of the sub-programs is examined as shown in Table 6.3.

6.2 Institutional/Organizational Framework for Implementation

This section gives a proposed institutional framework for implementation of the watershed management plan. The proposed organizational set-ups for implementation, necessary arrangements to be made, and important government legislative documents to be in place are discussed.

6.2.1 Organizational Set-ups for Implementation

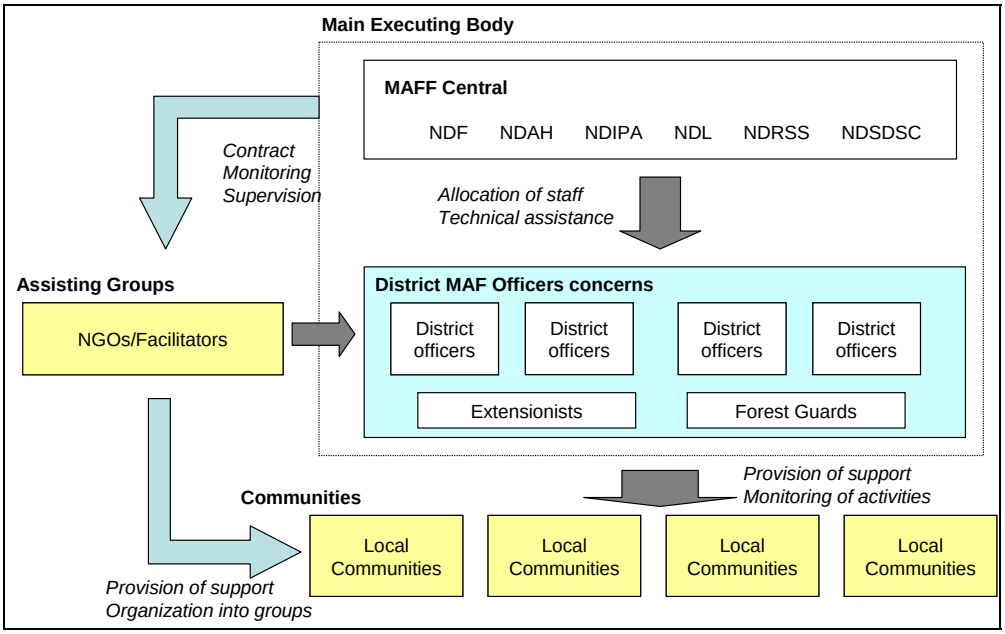
Ideally, the watershed management plan is to be implemented in a multi-sectoral/ministerial way. But such an idea is still too early to introduce in the country considering the current capacities and experiences of the relevant government organizations. It is therefore recommended that an organizational set-up shall be established in a phased manner as MAF enhances its capacities over the course of time. The following sections give the proposed organizational set-ups at the initial and mature stages.

(1) Proposed Structure at the Initial Stage

At the initial stage, MAF is the sole government organization to be involved in the framework for project implementation, and therefore, the management plan will be handled by MAF, especially NDF. At this stage, the emphasis should be put on making the foundation of community-based natural resource management in the target watersheds. Consequently, due attention should be given to the following aspects:

- Involvement of communities or beneficiaries' groups in sub-program implementation; and
- Establishment of a working group that manages and monitors the implementation of the management plan within MAF.

An overall management group at the central level and field working teams at the field level are to be established in MAF. In addition, the employment of local NGOs or facilitators will be required in implementing field activities, such as facilitating community organization and conducting hands-on training. Furthermore, there should be external technical assistance from international NGOs, donors, and international institutions for effective implementation. An overall picture of the proposed institutional framework for implementation at this stage is presented as follows.



Proposed Institutional Framework at the Initial Stage

The following table gives the organizations that will be involved and the major tasks and functions of the relevant groups and other stakeholders in the proposed structure.

Organizations involved and Functions of the Stakeholders in the Structure

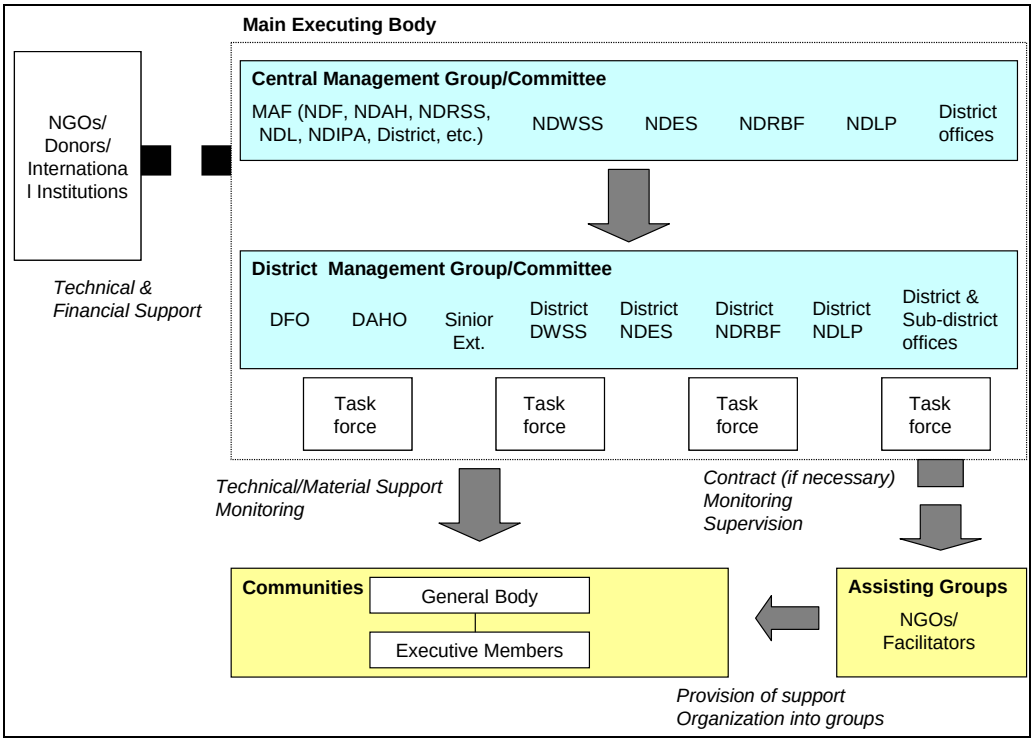
Stakeholders	Organizations involved	Major tasks and functions
Overall Management Group	-NDF -NDAH -NDL -NDRSS -NDIPA -MAF District Offices	- Formulate a five-year management plan and annual work plan - Manage and monitor the progress of programs/sub-programs implemented - Facilitate the coordination between/among national directorates of MAF - Make administrative arrangements for implementation (e.g., allocation of staff and budget) - Employ/hire NGOs/facilitators - Coordinate with external organizations (if necessary)
Field Working Team	-District forest officer/s -District crop officer/s -District livestock officer/s -District coffee and industrial crop officer/s -Extensionists -Forest guards -Staff from the watershed management division in NDF	- Formulate an annual work plan - Manage programs/sub-programs at the field level - Coordinate with NGOs/facilitators - Monitor and supervise activities of NGOs/facilitators - Coordinate with the central organizations to seek any support for implementation - Solve any issues that NGOs/facilitators would face during the implementation of sub-programs In particular, extensionists and forest guards are expected to fulfill the following specific functions: - Co-work with NGOs and facilitators in the field - Assist NGOs/facilitators in the implementation of the field works, such as organization of meeting, conduct of training, and monitoring of the accomplishment - Participate in any meetings between NGOs/facilitators and rural communities - Learn how to organize a meeting, how to conduct training, and how to solve issues among rural communities - Report any negligent acts made by NGOs/facilitators
Assisting Group	-NGOs -Facilitators -Experts	- Encourage rural households to organize a beneficiaries' group - Help rural communities/groups organized to develop rules/regulations relating to sub-project implementation - Develop the capability of rural communities/groups

Stakeholders	Organizations involved	Major tasks and functions
		organized to implement a sub-program - Coordinate with the field working team - Assist rural communities or beneficiaries' groups organized in the planning, implementation, and monitoring of a working plan for a sub-program
Suco Council	Council of suco	- Select participating members and organize a beneficiaries'/working group - Approve/make a final decision on any important matters for implementation (e.g., working plan, management of earnings, etc.) - Exchange an agreement with MAF (if necessary)
Participating members of Beneficiaries' Group/Working Group of Suco	-	- Prepare rules/regulations necessary for management of a group and implementation of sub-program - Develop an overall work plan and an annual work plan for a sub-program - Assist members of beneficiaries'/working groups in the implementation of the working plan - Facilitate the participation of group members in sub-program activities
External Organizations (International NGOs / Donors / International Institutions)	-	- Provide financial and technical assistance to MAF in the implementation of sub-programs - Develop/enhance the capabilities of relevant directorates of MAF

Source: JICA Study Team

(2) Framework at the Mature Stage

After having extensive experience in community-based watershed management, the main executing body will expand/evolve its framework by including other ministries and directorates related to watershed management, so that the same body could literally manage the watersheds in an integrated manner. In fact, the current issues on watershed management are quite complex; a comprehensive approach with the involvement of other relevant organizations is necessary for tackling all the issues. In particular, sediment control needs to be dealt with in coordination with the Ministry of Public Works as sedimentation into the main stream of Laclo River has severely affected the operations of the irrigation system in the downstream. It is therefore proposed that a multi-disciplinary organization, where all the stakeholders related to the water sector can coordinate to achieve the goal of the watershed management plan, be established at both central and district levels. The following figure shows the proposed framework at the mature stage.



Proposed Institutional Framework at the Mature Stage

The proposed institutional framework at the mature stage will be composed of three parts, namely, i) central management group, ii) district management group, and iii) assisting organizations (if required) and communities. Since the proposed executive bodies are inter-ministerial, it should be authorized by the government so that the groups could function as substantial organizations. The national directorates to be involved in the framework and the respective roles/responsibilities of the management groups at both levels are outlined below.

Roles and Responsibilities of the Organizations at the Mature Stage

a. Central Management Group/Committee

Participating Organizations	Roles/Responsibilities
- National Directorate of Forestry - National Directorate of Agriculture and Horticulture (NDAH) - National Directorate of Irrigation and Water Use Management - National Directorate of Livestock Breeding and Veterinary Medicine (NDLBVM) - National Directorate of Research and Specialist Services (NDRSS) - National Directorate of Industrial Plants and Agribusiness (NDIPA) - National Directorate of Water Supply and Sanitation (NDWSS) - National Directorate of Environmental Services (NDES) - Directorate of Road, Bridge and Flood Control (DRBFC) - National Directorate of Land and Property (NDLP) - District MAF Offices - District Administrative Offices	1. Discuss policy/legislative issues on watershed management. 2. Approve and give authorizations to any plans prepared for watershed management of the Comoro and Laclo watersheds. 3. Monitor management activities in the target watersheds. 4. Provide necessary advice and support to the relevant organizations involved in watershed management. 5. Encourage the relevant organizations to allocate budget necessary for implementing activities planned. 6. Coordinate the member organizations to facilitate collaborative watershed management.

b. Regional/District Watershed Management Group/ Committee

Participating Organizations	Roles/Responsibilities
- NDF (Division of Watershed Management) - District MAF Office - District Office of NDRBF - District Office of NDES - District Office of NDLP - District and sub-district administrative offices - Extensionists - Forest guards - NGOs - Rural communities	1. Prepare an implementation plan on sub-programs. 2. Discuss any issues on watershed management. 3. Organize field working teams who are responsible for management and implementation at the field level. 4. Supervise, monitor and evaluate the management activities implemented by the assisting organizations (NGOs/facilitators) or communities. 5. Coordinate the member organizations to implement the management activities planned. 6. Prepare an annual accomplishment report every year.

Source: JICA Study Team

At the matured stage, extensionists and forest guards will pay a vital role in the implementation of the plan. They are expected to function as field facilitators, or at least as field assistance so that the GoTL will not need to hire NGOs/external facilitators for implementation. In particular, it is expected that the following works might be handled either by extensionists or forest guards.

Expected Roles that might be performed by Extensionists and Forest Guards

Extensionsts / Forest Guards	Expected roles
Extensionist	Trainer of hands-on training under HG-SP Trainer of hands-on training under GCPB-SP Trainer of hands-on training under CBSE-SP Trainer of hands-on training under SUFP-SP Trainer of hands-on training under IG/CS-SP
Forest guard	Facilitator for the meetings under PLUP-SP Trainer of hands-on training under TPP-SP Trainer of hands-on training under SPP-SP

Source: JICA Study Team

It is noted that the proposed institutional framework should not be a venue for the government to provide its top-down order to local government offices or field implementers, but be a platform for the stakeholders to exchange their respective ideas/concerns on watershed management. It can also provide a good opportunity for the stakeholders to manage conflicts on the use of natural resources through mutual dialogues. It is envisaged that discussions among the stakeholders can facilitate their understanding of the watersheds as well as the situation of the respective stakeholders, and eventually it would help them to take collaborative actions for watershed management.

The roles and responsibilities of the players/implementers at the community level are the same as those specified in the former sub-section.

6.2.2 Relevant Legislative and Policy Frameworks

The relevant legislative documents (e.g., law, decree, and regulations) and policies need to be referred to in the implementation of the watershed management plan, so that the management plan can be in line with the direction of the government. At present, the following documents shall be taken into account:

- UNTAET Regulation No. 17;
- UNTAET Regulation No. 19; and
- Forestry Policy.

Furthermore, the following documents may need to be referred to when they are officially enacted or issued by the government;

- Forest Management Decree (FMD);

- Land Law; and
- Land Use Policy.

In particular, the FMD and Land Law will be the basis for a watershed management plan. The watershed management plan should be reviewed so as to make it consistent with these new laws.

6.2.3 Necessary Arrangements and Coordination

Ideally, MAF/NDF should coordinate and link with any useful sources and organizations to tap the available resources and expertise for the smooth and effective implementation of the watershed management plan. PARDTL, USAID project and other NGOs' activities are the possible sources to make linkages with.

Besides, there may be a need to develop the following government documents to bind and orient the relevant government directorates and offices toward the same direction:

- Ministerial order/instruction on the implementation of the watershed management plan for a target watershed; and
- Ministerial order/instruction on coordination among the relevant organizations in the implementation of the watershed management plan.

NDF should be responsible for the preparation of the necessary binding documents as the lead directorate in MAF for the implementation of the watershed management plan.

6.3 Implementation Schedules of the Sub-programs

An implementation schedule for the overall watershed management plan is not prepared since it is unrealistic to set a timeframe and assume that MAF/NDF could implement the watershed management plan for all the target watersheds in a given period of time. Instead, the implementation schedule of each sub-program is examined on the basis of the following assumptions:

a. A sub-program will cover three sucos for one cycle of implementation[1];
b. One suco holds five aldeias[2];
c. MAF needs to procure local NGOs/facilitators prior to the field activities;
d. Local NGOs/facilitators will organize consultation meetings with rural communities and carry out the participatory assessment survey using PRA/RRA tools; and
e. The sub-programs with hands-on training courses will organize two rounds of hands-on training courses/FFSs for the same members, so that the participating households could acquire the techniques handled by the training courses.

A total of 21 implementation schedules of the respective sub-programs are prepared as shown in Annex E in Annexes.

6.4 Indicative Cost Estimates

Likewise, the total cost required for the overall watershed management plan is not estimated, but the costs for the respective sub-programs at the recommended scale are estimated as compiled in Annex F in Annexes. In the estimation, the following conditions and assumptions are used:

[1] The number of sucos handled by one cycle of the sub-program was determined based on the experiences gained through the pilot project implemented by the JICA Study in 2009.
[2] Based on Table 3.4

a. The costs are estimated based on the prevailing prices in December 2009;
b. One cycle of sub-program covers three sucos in general;
c. For the sub-programs with the hands-on training scheme, the sub-program would involve a total of 100 members/suco in one cycle assuming that one beneficiaries' group is organized at the aldeia level with participation of 20 members per group;
d. US dollar is the currency used;
e. Price escalation is not considered;
f. The major components of cost breakdown are: i) direct material and labor cost, ii) remuneration/cost for hired staff, iii) cost for facilities for project implementation, iv) administration cost (project management cost), and v) physical contingency;
g. Direct material and labor cost is composed of costs for materials, laborers, and other direct expenses;
h. Cost of hired staff is derived from the expenses for experts/specialists and/or facilitators;
i. Cost of facilities for project implementation covers mainly those for transportation such as rental of vehicles and purchase of motorbikes;
j. Physical contingency is 5% of the direct expenses, which are i) direct (material) cost, ii) remuneration/cost of hired staff, and iii) cost of facilities for project implementation; and
k. Administration cost or project management cost is estimated at 10% of the same.

The following table shows the estimated total costs, projected periods, and unit scopes of the 21 sub-programs.

Estimated Costs and Scopes of the Sub-programs

Sub-program	Total cost, US$	Period, months	Coverage
Participatory Land Use Planning Sub-program	55,000	24	3 sucos
Tree Planting Promotion Sub-program	72,000	27	3 sucos
Seedling Production Promotion Sub-program	100,000	27	3 sucos
Forest Management Planning Sub-program	6,000	4	3 sucos
Community-based Seed Extension Sub-program	79,000	33	3 sucos
Home Garden Sub-program	77,000	22	3 sucos
Grazing Control with Protein Banks Sub-program	112,000	44	3 sucos
Animal Feed Preservation Sub-program	49,000	15	3 sucos
Sustainable Upland Farming Promotion Sub-program	133,000	36	3 sucos
Coffee Plantation Rehabilitation Sub-program	90,000	36	3 sucos
Slope Protection Sub-program	132,000	21	1 catchment (8 walls)
Sediment Control Sub-program	100,000	21	1 catchment (10 checkdams)
River Bank Protection Sub-program	90,000	22	1 catchment (180 m)
Initial Gully Control Sub-program	172,000	13	3 sucos
Rural Energy Development Sub-program	56,000	24	3 sucos
Income Generation/Cost-saving Sub-program	109,000	48	3 sucos
Public Awareness Campaign Sub-program	80,000	23	4 sucos
Environmental Education Sub-program	85,000	29	14 schools
Watershed-related Institutional Development Sub-program	64,000	20	-
Capacity Development Sub-program	121,000	12	-
Mobility Improvement Sub-program	61,000	-	8 motorbikes 1 4WD vehicle

Source: JICA Study Team

Chapter 7 Five-Year Management Plan for the Priority Sub-watersheds

A five-year management plan is prepared for the priority sub-watersheds selected in the preceding chapter. As discussed in Chapter 6, this five-year management plan would be the first step for MAF/NDF to protect and manage the target watersheds in a strategic manner. The five-year plan comprises the following five sections: i) target sub-watersheds, ii) proposed major works, iii) implementation schedule, iv) indicative cost estimates, and v) organizational set-ups for implementation.

7.1 Target Sub-watersheds

As discussed in Chapter 6, the following two sub-watersheds are selected as the priority areas in the target watersheds. Figure 7.1 shows the locations of the priority sub-watersheds.

Selected Priority Sub-watersheds

Basin	Sub-watershed	Area (ha)	Related Sub-districts	Related Sucos
Comoro	Bemos	4,392	Dili, Laurala (Aileu)	Dare, Tohumeta, Talitu, Cotolau, Madabeno
Laclo	Noru	12,851	Liquidoe, Remeixio (Aileu)	Fahisoi (Liquidoe), Fadabloco, Fahisoi (Remexio), Faturasa, Hautoho, Maumeta

Source: JICA Study Team

Hence, this five-year management plan will target a total of 11 sucos, i.e., five in the Bemos sub-watershed and six in the Noru sub-watershed.

7.2 Major Activities

7.2.1 Identification of Potential Sub-programs

One of the lessons gained from the pilot projects implemented by the JICA Study in 2009 is that more than three sub-programs should not be implemented in the same suco simultaneously, since the capacity of rural communities is still generally limited. For the preparation of the five-year management plan, the Study Team needs to identify three priority sub-programs for each suco in the priority sub-watersheds. To identify the potential priority sub-programs suitable to the respective sucos in the priority sub-watersheds, the suitability of the priority sub-programs, except Participatory Land Use Planning Sub-program, Public Awareness Raising Sub-program, and Capacity Development Sub-program, is examined. For the initial examination, the results of the identification of the potential target sucos for the respective sub-programs are fully used. (Please refer to Table 6.2.)

Suitability of the Priority Sub-program

a. Bemos Sub-watershed

Sub-program	Dare	Tohumeta	Talitu	Cotulau	Madabeno
TPP-SP	4	3	5	5	4
SP-SP <1	4	3	5	5	4
CBSE-SP	2	3	4	3	2
HG-SP	2	3	4	3	2
SUFP-SP	2	2	2	2	4
CRP-SP	3	5	3	4	3
GC-SP	4	2	4	4	4
IG/CS-SP	2	3	4	3	2
CDC-IGC	-	3	2	1	3

b. Noru Sub-watershed

Sub-program	Fahisoi (Liquidoe)	Fadabloco	Fahisoi (Remexio)	Faturasa	Hautoho	Maumeta
TPP-SP	5	4	4	3	4	5
SP-SP <1	5	4	4	3	4	5
CBSE-SP	2	3	2	3	2	2
HG-SP	2	3	2	3	2	2
SUFP-SP	2	1	1	1	2	1
CRP-SP	3	4	5	5	5	5
GC-SP	4	5	4	5	4	4
IG/CS-SP	2	3	2	3	2	2
CDC-IGC	3	3	3	3	3	3

Note: Class 1: Highly suitable, Class 2: Moderately suitable, Class 3: Marginally suitable, Class 4: Less suitable, Class 5: Non-suitable
<1 SP-SP can be considered as one of the activities of TPP-SP.
The sub-programs in shade are considered suitable, and those in bold are evaluated as the potential target sub-watersheds in consideration of the natural and social conditions of the villages.
Source: JICA Study Team (2010)

In addition to the results of the suitability assessment, the climatic conditions and accessibility to the major markets (e.g., district or sub-district capital), and social background are also taken into account in the identification of the priority sub-programs. As a result, the following are tentatively selected as the potential sub-programs.

Tentatively Selected Sub-programs

Sub-watersheds	Sub-programs	No. of sucos
Bemos	TPP-SP & SPP-SP	1
	CBSE-SP	3
	HG-SP	2
	SUFP-SP	4
	GCPB-SP	1
	CPR-SP	1
	IG/CS-SP	1
	CDC-IGC	2
Noru	TPP-SP & SPP-SP	1
	CBSE-SP	6
	SUFP-SP	6
	IG/CS-SP	5

Source: JICA Study Team (2010)

It is noted that the sub-programs for the respective sucos should be selected by the local communities in the target sucos at the beginning of the five-year plan. Therefore, the identification of the potential sub-programs at this moment should be deemed as a tentative selection for purposes of planning.

7.2.2 Detailed Scope of Works

Table 7.1 gives the outline of the scope of works for the five-year management plan. The following sections give some highlights of the works:

(1) Preparatory work

Prior to the implementation of the identified priority sub-program, the following activities should be carried out as the preparatory works.

- Procurement of NGOs/facilitators/experts
- Guidance to the relevant government staff and NGOs/facilitators/experts hired
- Consultation with rural communities in the target sucos

- Participatory situation analysis (PRA/RRA) at the target sucos
- Guidance to rural communities in the target sucos on the overall work schedule

(2) Implementation of the Identified Sub-programs

At every target suco, PLUP-SP will be implemented first together with PAC-SP. Following PLUP-SP, local NGOs/facilitators with the MAF district office/NDF will confirm with the rural communities in the target sucos if they can implement the identified potential sub-programs based on the results of the participatory situation analysis and PLUP-SP. After the identification of the sub-programs, local NGOs/facilitators and MAF/NDF together with the rural communities will carry out the following activities:

- Organization of beneficiaries'/working groups
- Selection of leaders, co-leaders and core members; and development of regulations of the groups
- Exposure visit to the precursory suco/area
- Development of work plans
- Implementation of the planned activities (e.g., development of demonstration plots, organization of a series of hands-on training/FFSs, and provision of materials)
- Organization of an annual evaluation and planning workshop

Detailed work plans of the 12 sub-programs are given in Annex-D in Annexes.

(3) Final evaluation of the Sub-programs

In addition to the preparatory work, MAF and NDF will evaluate the results of the sub-programs at the end of the five-year management plan so that the lessons learned and good practices gained through its implementation will be used for the next five-year plan. For the evaluation, NDF and the MAF district offices will carry out the following activities:.

- Evaluation workshop with the beneficiaries'/working groups to evaluate the effectiveness of the activities and level of achievement of the expected outputs of the sub-programs
- Interviews with the members and non-members in the target sucos to assess the impacts and accomplishments made by the sub-programs

7.3 Implementation Schedule

An implementation schedule for the five-year management plan is developed in accordance with the following guidelines:

a. The sub-programs will be implemented in both sub-watersheds simultaneously;
b. In principle, the Participatory Land Use Planning Sub-program (PLUP-SP) should precede the other nine sub-programs;
c. Public Awareness Campaign Sub-program and Capacity Development Sub-program, which are not necessarily implemented after PLUP-SP, will be implemented simultaneously with PLUP-SP;
d. Not more than three sub-programs are implemented in the same suco simultaneously; and

e. All the sub-programs shall not necessarily be completed by the fifth year. Activities that cannot be completed by the fifth year should be programmed into the next five-year management plan.

The implementation schedules for the five-year plans in the priority sub-watersheds are shown in Figures 7.2 and 7.3.

7.4 Indicative Cost Estimates

The cost for the five-year management plan is estimated based on the unit costs for the respective priority sub-programs given in Chapter 5. In the estimation, the following conditions and assumptions are used.

General:

a. Each and every cost is estimated based on the current prevailing prices as of December 2009.
b. Price escalation is not considered in the estimation.
c. Physical contingency is 5% of the sum of the direct expenses, such as direct project costs, costs of hired experts and necessary facilities as well as equipment.
d. MAF's management cost, which covers fuel for transportation, travel allowance, etc., is estimated by assuming 10% of the sum of the direct expenses.

Sub-program:

a. In order to implement the sub-programs in a proper manner, the employment of external experts related to the respective sub-programs is proposed.
b. Allocation of site coordinators/field facilitators at each target suco is considered requisite for ensuring the quality of the sub-program. Rural communities need intensive support for them to function as the main implementers of the sub-program.
c. Transportation facilities, namely, 4WD vehicles and motor bikes, will be arranged through rental or purchase.

The indicative cost for the entire five-year management plan is estimated at about US$1.49 million as shown in Table 7.3. The same table also indicates that the costs for the sub-programs related to Bemos and Noru sub-watersheds are estimated at US$0.66 million and US$0.74 million, respectively. The following table shows the summary of the indicative cost for the five-year management plan.

Estimated Cost of the Five-Year Plan

(Unit: US$)

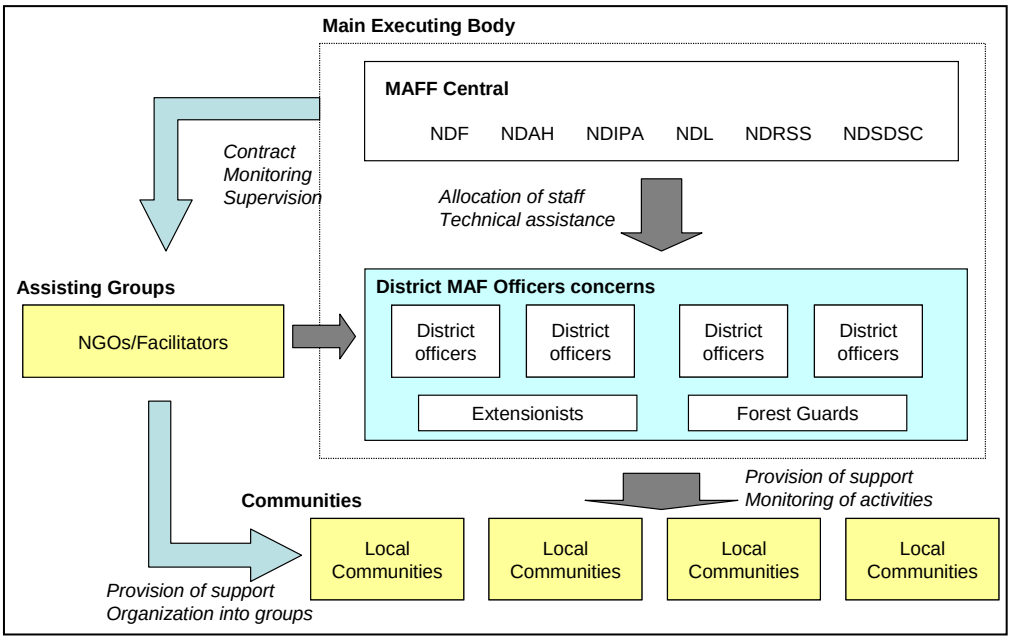
Items	Bemos	Noru	Total
1. Preparatory Works			
1.1 Guidance	525	525	1,050
1.2 Consultation with sucos	4,500	5,400	9,900
1.3 Situation analysis	3,250	3,900	7,150
2. Implementation of Sub-programs			
2.1 CD-SP	28,185	28,185	56,370
2.2 PLUP-SP	22,850	14,190	37,040
2.3 PAC-SP	13,055	7,975	21,030
2.4 SUFP-SP	58,200	85,200	143,400
2.5 IGC-SP	6,180	-	6,180
2.6 TPP-SP & SPP-SP	23,937	-	23,937

Items	Bemos	Noru	Total
2.7 GCPB-SP	48,325	-	48,325
2.8 CPR-SP	38,710	-	23,937
2.9 CBSE-SP	44,163	85,126	129,289
2.10 HG-SP	27,235	-	27,235
2.11 IG/CS-SP	20,005	122,430	142,435
3. Evaluation of Sub-programs	2,975	2,975	5,950
4. Cost of Hired Experts and Staff	505,090	738,180	1,243,270
5. Facilities/Transportation Cost	156,500	179,250	335,750
Sub-total	1,149,824	1,295,500	2,445,324
6. Management Cost (10%)	114,982	129,550	244,532
7. Contingency (5%)	57,491	64,775	122,266
Total	**1,322,298**	**1,489,825**	**2,812,123**

Source: Table 7.2 (JICA Study Team)

7.5 Organizational Structure for Implementation

As discussed in Chapter 6, the following organizational set-up is proposed for the implementation of the five-year management plan.



Organizational Structure Proposed for Five-Year Management Plan

An overall management group at the central level and field working teams at the field level are to be established in the proposed set-up. The following tables give the directorates and offices involved in the proposed structure and their roles and responsibilities in the implementation.

Organizations involved and Functions of the Stakeholders in the Structure

Stakeholders	Organizations involved	Major tasks and functions
Overall Management Group	-NDF -NDAH -NDL -NDRSS -NDCICA -MAF District Offices	- Formulate a five-year management plan and annual work plan - Manage and monitor the progress of programs/sub-programs implemented - Facilitate the coordination between/among national directorates of MAF - Make administrative arrangements for implementation (e.g., allocation of staff and budget) - Employ/hire NGOs/facilitators - Coordinate with external organizations (if necessary)

Source: JICA Study Team

In addition to the government organizations, local NGOs or facilitators/experts will be hired for the implementation of the sub-programs. The major roles of local NGOs and facilitators/experts are as follows:

- Encourage rural households to organize a beneficiaries' group;
- Help organized rural communities/groups to develop rules/regulations relating to sub-project implementation;
- Develop the capability of organized rural communities/groups to implement a sub-program;
- Coordinate with the field working team to assist organized rural communities/groups and monitor the progress; and
- Assist organized rural communities or beneficiaries' groups in the planning, implementation, and monitoring of the work plan for a sub-program.

Meanwhile, the suco leaders and participating community members in the target village shall also fulfill the following tasks:

- Select participating members and organize a beneficiaries'/working group;
- Approve/make a final decision on any important matters for implementation (e.g., working plan, management of earnings, etc.);
- Exchange an agreement with MAF (if necessary);
- Prepare rules/regulations necessary for management of a group and implementation of sub-program;
- Develop an overall work plan and an annual work plan for a sub-program;
- Assist members of beneficiaries'/working groups in the implementation of the working plan; and
- Facilitate the participation of group members in sub-program activities.

Chapter 8 Conclusions and Recommendations

8.1 Conclusions

(1) Implementation of the Watershed Management Plan

Considering the acute population increase and current trend in forest degradation in the target watersheds, the watershed management plan proposed in this report needs to be implemented for maintaining and protecting the forest cover in the target watersheds, especially the critical watershed for water supply to Dili city. In particular, the implementation of the following activities proposed in the watershed management plan is crucially important to promote proper and sustainable forest and watershed management.

a. Implementation of the five-year management plan in the priority sub-watersheds
b. In particular, implementation of PLUP-SP in the priority sub-watersheds
c. Development of the capacity of the district forest officers and forest guards in the concerned MAF district offices to implement the priority sub-programs, especially PLUP-SP

(2) Coordination among the Relevant Directorates and Organizations relating to Watershed Management

It is obvious that realizing an integrated watershed management requires a comprehensive and multi-disciplinary approach through coordination among the directorates and organizations relevant to watershed management. It is therefore important to establish a platform where the relevant stakeholders could discuss the major issues on watershed management as well as necessary actions to be taken for the achievement of sustainable watershed management. Such institutional arrangement could lead to the formulation of the relevant policies, such as Watershed Management Policy, Integrated Water Resource Management Policy, and Land Use Management Policy.

8.2 Recommendations

In order to enhance the capacities of MAF/NDF for preparing and implementing a community-based integrated watershed management plan, the five-year management plan should be implemented as soon as possible. Toward this end, MAF/NDF should:

a. Arrange the necessary budget for the implementation of the five-year management plan;
b. Coordinate with international organizations to tap their resources as well as expertise for the implementation of the five-year management plan and any part of the watershed management plan;
c. Share the ideas and contents of the watershed management plan as well as the five-year management plan with the national directorates in MAF and other ministries to coordinate the activities of the respective directorates/ministries towards the same objective;
d. Assist rural communities in the sucos where the pilot projects were implemented in continuing the sub-program activities to enhance their capacity for implementation and create role models for the priority sub-programs; and
e. List competent NGOs that can take on the tasks of implementing the sub-programs.

Chapter 8 Conclusions and Recommendations

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It is obvious that realizing an integrated watershed management requires a comprehensive and multi-disciplinary approach through coordination among the directorates and organizations relevant to watershed management. It is therefore important to establish a platform where the relevant stakeholders could discuss the major issues on watershed management as well as necessary actions to be taken for the achievement of sustainable watershed management. Such institutional arrangement could lead to the formulation of the relevant policies, such as Watershed Management Policy, Integrated Water Resource Management Policy, and Land Use Management Policy.

8.2 Recommendations

In order to enhance the capacities of MAF/NDF for preparing and implementing a community-based integrated watershed management plan, the five-year management plan should be implemented as soon as possible. Toward this end, MAF/NDF should:

a. Arrange the necessary budget for the implementation of the five-year management plan;
b. Coordinate with international organizations to tap their resources as well as expertise for the implementation of the five-year management plan and any part of the watershed management plan;
c. Share the ideas and contents of the watershed management plan as well as the five-year management plan with the national directorates in MAF and other ministries to coordinate the activities of the respective directorates/ministries towards the same objective;
d. Assist rural communities in the sucos where the pilot projects were implemented in continuing the sub-program activities to enhance their capacity for implementation and create role models for the priority sub-programs; and
e. List competent NGOs that can take on the tasks of implementing the sub-programs.

Tables

Table 2.1 Tasks and Functions of the Directorates of MAF relating to the Watershed Management

Directorates	Tasks and Functions of the Directorates
National Directorate of Forest (NDF)	a. Participate in setting and applying policy for forests, hunting, beekeeping, and aquatic resources in inland waters, and propose the measures necessary for realizing it; b. Coordinate and support the execution of forestry policy, within the context of the National Forestry Strategy, specifically in the fields of forestry regulation and protection, production, transformation and marketing of forestry products, as well as beekeeping, hunting, aquatic resources in inland waters; c. Coordinate, gather, and analyze forestry data and information for use in planning and decision-making; d. In collaboration with the NDPP and other services, prepare the national plan for forest management and the adoption of legislation on the matter; e. Ensure and enforce execution of forestry legislation and of the national forestry management plan; f. Encourage measures, within the context of the national forestry management plan, for reforestation and the protection of endangered or weakened forest species, with the objective of expanding forested space and the production of commercially valuable trees for the wood industry; g. Promote campaigns to raise awareness of the population, local communities, and the public at large concerning the need to conserve the country's forestry assets; h. Promote structural prevention in the aspects of information and education, prevention of and fighting against forest fires, and deployment of actions and programs aimed at appropriate prevention of forest fires; i. Assist in conceptualizing and defining parks and forest reserves and promoting legislation for their management; j. Participate, in coordination with other services, in drawing up the national plan for water resource management; k. Take measures and oversee the rational use of water resources; l. In coordination with other services, ensure the quality of water resources, taking effective measures along with the appropriate services to prevent and eliminate factors that cause degradation and pollution; m. Formulate a manual on watershed management and one on agroforestry; n. Impose sanctions for the commission or omission of contraventions in the forestry and water resource sector; o. Define, designate and implement parks, reserves and protected areas overseeing the environmental areas with the Ministry; p. Establish accountability of the various agents and an appropriate organization of forestry services; q. Promote improvements in competitiveness of the industries making up the various forestry segments; r. Perform the other tasks that derive from the Ministry's incumbencies in the area of forestry, watersheds, and water resources; and s. Present an annual report on activities.
National Directorate of Support to Agricultural Community Development (NDSACD)	a. To support definition of the national extension policy, formulation of its strategies, priorities and objectives, and to participate in drawing up plans, programs and projects for the respective area; b. In collaboration with all Ministry services, to establish a network of extension workers at the local level; c. Within the scope of rural extension, disseminate relevant information developed by the MAF Technical Directorates to famers;

Table 2.1 Tasks and Functions of the Directorates of MAF relating to the Watershed Management

Directorates	Tasks and Functions of the Directorates
National Directorate of Support to Agricultural Community Development (NDSACD)	d. To ensure implementation and continuity of rural development programs, in joint action with the Ministry having oversight; e. To establish mechanisms for coordination and implementation of the Agricultural Community Development Fund; f. To guarantee technical support for proposals approved within the scope of the Agricultural Community Development Fund and, in coordination with local authorities, follow up and monitor the implementation of projects; g. To present an annual report of activities; h. To perform the other tasks that may be assigned to it.
The National Directorate of Agriculture and Horticulture(NDAH)	i. To Contribute to formulating strategy, priorities and objectives and participate in drawing up plans, programs and projects within its areas; j. To support the socio-economic development of farmers with new cultivation techniques and policies for the sustainability of natural resources; k. To promote education and training in new farming techniques; l. To establish efficient technical support services and new technologies aimed at providing assistance to agricultural communities and targeting an increase in the production of foodstuffs, especially rice and corn; m. To promote and develop diversification in agriculture; n. To promote and support an increase in, and improved quality of, horticultural products, specifically through the introduction of improved or more productive seeds; o. To support farmers with new techniques and methods for raising fruit crops, as well as teaching modern techniques for treating and handling fruit crop production; p. To promote the use of mechanized equipment and post-harvest technologies; q. To impose sanctions for the commission of violations in the agricultural and horticultural sector; r. To perform other tasks that derive from the Ministry's incumbencies in the area of agriculture and horticulture; s. To present an annual report on activities.
The National Directorate of Industrial Plants and Agribusiness (NDIPA)	a. To participate in defining and applying policy on the production of coffee, perennial crops and herbs, as well as proposing the measures required for its protection and realization; b. To coordinate, gather, and analyze data and information on coffee, perennial crops and herbs for use in planning and decision-making; c. Ensure the adoption, enforcement and implementation of legislation on industrial crops; d. In cooperation with other services having jurisdiction, to foment with the private sector, cooperatives and NGOs the increased production and quality of coffee, by introducing new plants of the Arabica species and new growing, treatments and harvesting techniques; e. To foment expansion and development of industrial plants and medicinal or similar plants by the introduction of new plants or of new and more productive species; f. To promote the establishment of, and operate or monitor nurseries for industrial plants as a way of assisting and supporting growers in increasing and expanding the cultivation of such plants; g. To promote the education of farmers in modern farming techniques and methods;

Table 2.1 Tasks and Functions of the Directorates of MAF relating to the Watershed Management

Directorates	Tasks and Functions of the Directorates
The National Directorate of Industrial Plants and Agribusiness (NDIPA)	h. To identify, formulate, monitor and assess strategic programs and projects of interest to the MAF and issue opinions on their technical and economic feasibility; i. To collaborate with government agencies in the formulation of guidelines, policies, and strategies for action in the areas of rural credit and tax incentives; j. To Identify and facilitate the promotion of new agribusiness products and promote the search for new markets for such products; k. To Guarantee the gathering and handling of information from agro markets; l. To Produce technical and economic information from agricultural undertakings; m. To assist in the productive and industrial development of the agrarian sector; n. To monitor and propose appropriate measures for the development of the agricultural and food-producing sector; o. To perform other tasks that derive from the Ministry's incumbencies within its sphere of authority; p. To present an annual report on activities.
The National Directorate of Livestock Breeding and Veterinary Medicine (NDLBVM)	a. To support the setting of national livestock breeding and veterinary policy for the domestic sphere, and in coordination with the Ministry of Foreign Business for the international sphere, and ensure its implementation, control and enforcement; b. To participate in defining and applying policies for improving animal feeding practices, livestock breeding technologies and industry, sanitation, protection, and veterinary and public health; c. To production, artificial insemination, and animal reproduction; d. Improve livestock feeding practices and take measures for improved redistribution; e. To coordinate, gather and analyze data and information on livestock breeding for use in planning and decision-making; f. In collaboration with the NDPP and other services having jurisdiction, to draw up the national plan for animal management and the adoption of legislation on the matter; g. To promote the introduction and the development of new and adaptable technologies aimed at increasing animal production; h. To assist farmers in developing and improving animal production, including cattle, buffalos, swine, goats and poultry; i. To license establishments within the livestock breeding industry and perform periodic sanitary control, in coordination with the other services having jurisdiction; j. To create and maintain up to date a registry of the number of animals existing and of vaccinated animals in the country; k. To work to defend and protect the health of animal contingents, including pets, exotic animals, wild animals and species for hunting, providing sanitary oversight of their production and commercialization; l. To ensure sanitary control and certification for animals and animal-based products intended for exchange with other countries, in conjunction with other agencies; m. To assign, and inspect conditions for the maintenance of, health stamps, marks of identification, and export approval numbers to establishments and operators processing products of animal origin or intended for the feeding of animals;

Table 2.1 Tasks and Functions of the Directorates of MAF relating to the Watershed Management

Directorates	Tasks and Functions of the Directorates
The National Directorate of Livestock Breeding and Veterinary Medicine (NDLBVM)	n. To develop and implement wide-reaching vaccination campaigns and animal health campaigns for prevention and the management of sick animals and for improvements to animal production; o. Jointly with the Health Ministry, to accredit organizations, services and persons in the area of veterinary-medical interventions; p. To ensure official hygiene and health control, and control of conditions for activities involving production, transformation, and storage in processing farm and livestock products, including veterinary drugs; q. To ensure, in coordination with the agency responsible for veterinary investigation, the functioning of support centers for actions in the field of animal health and hygiene and other matters relating to the diagnosis of animal diseases and the inspection of wastes; r. To provide for the assessment, authorization, control and inspection of the sale and use of veterinary pharmacological and immunological drugs, pre-mixed medications, homeopathic remedies and others, and their raw materials, as well as products for veterinary use; s. To oversee the licensing of slaughterhouses and agro-industries, in coordination with the other services having jurisdiction; t. To ensure measures to promote animal health in slaughterhouse environments and locations where meat is sold; u. To impose sanctions for the commission of contraventions in the livestock breeding sector; v. To perform other tasks that derive from the Ministry's incumbencies in the area of livestock breeding and veterinary medicine; w. To present an annual report on activities.
The National Directorate of Research and Specialist Services (NDRSS)	a. To provide information and the transfer of agricultural knowledge and techniques; b. To develop specific programs to provide information to farmers; c. To support Ministry services with information on soil utilization and tendencies in agricultural production; d. To formulate educational and training programs tailored to extension learners; e. To perform other tasks that derive from the Ministry's incumbencies in the area of research and laboratories; f. To present an annual report on activities.

Table 2.2 Terms and Conditions of Community Forest Management Agreements

Terms and Conditions of Community Forest Management Agreements stipulated in the draft Forest Management Decree
All Community Forest Management Agreements shall: 1. be issued in a fair and transparent manner that complements, as far as practicable, traditionally agreed forms of access and use, and incorporating principals of Tara Bandu wherever appropriate; 2. consider the rights of access and use of all relevant communities, individuals and other legal entities prior to issuing a forest resource access and use right; 3. be consistent with any applicable national, regional, or district forest management plans then in effect, and any relevant Laws, Regulations or Guidelines; 4. identify accurately the forest areas and resources that are included in or effected by the rights granted; 5. include a map at a scale of at least 1:25,000 or as otherwise determined by the National Directorate, which clearly shows the forest areas and resources included or effected by the rights granted, and use on the ground markings that are recognizable by all stakeholders and appropriate for the areas in question; 6. specify the nature of the access, use and management rights granted to the community; 7. specify the families, groups, or individuals within the community that are included in the Community Forestry Management Agreement; 8. identify the individual or individuals from the community who are responsible for representing the community for the purposes of signing Community Forestry Management Agreements or entering into other agreements in the name of the community. 9. include the rules and procedures concerning access and use established by the community as described in Chapter 6 of this Decree; 10. include relevant information relating to inter-community agreements as described in Chapter 6 of this Decree; 11. describe the management objectives for the forest areas and resources included in the Community Forest Management Agreement; 12. include sustainable harvesting arrangements or plans for the forest resources included in the Agreement; 13. include any protection or conservation arrangements; 14. include benefit sharing mechanisms; 15. describe the roles and functions of all relevant Local Authorities, Forest Guardians, Forest Officials at the National, Regional and District levels, and other Government Authorities; and 16. contain any other necessary terms and conditions of the agreement, including, but not limited to, the process and standards for monitoring, making assessments, the limitation or revocation of rights, and making appeals.

Table 2.3 Capacity gaps of NDF and relevant organization in watershed management

a. Capacity Gaps in Planning

Steps to be taken	Organizations<1	C/Ps (NDF)	C/P (ALGIS)	C/Ps (District)
1. Preparation of present land use map				
1.1 Analyze latest satellite images	Limited	Very limited	Very limited	Very limited
1.2 Conduct a verification survey on the ground	Limited	Very limited	Limited	Limited
1.3 Analyze the results by using GIS	Limited	Very limited	Very limited	Very limited
2. Collection of natural and socio-economic information of the study area				
2.1 Collect the secondary data/information related to the study area	Very limited	Very limited	-	Very limited
2.2 Conduct an interview survey at the village level	Limited	Very limited	-	Very limited
2.3 Sort out the collected data and analysis the present conditions of the study area	Very limited	Very limited	-	Very limited
3. Identification of external factors that would affect the study area as well as the sector				
3.1 Review the policies and overall plans of the sector and the regional development plans of the study area	Limited	Very limited	Very limited	Very limited
3.2 Identify any external factors that would affect the land use (the way of resource management), livelihoods of local people, and natural environment in the study area	Very limited	Very limited	Very limited	Very limited
3.3 Prospect the future trends of the external factors and assess the influence from the changes to watershed environment	Very limited	Very limited	Very limited	Very limited
4. Analyses of Present Problems and Issues that the study area has				
4.1 Analyze causes of watershed degradation	Very limited	Very limited	Very limited	Very limited
4.2 Prepare a potential hazard map by overlaying the land use and vegetation map with other thematic maps (slope map, elevation map, soil map, village map, etc.)	Limited	Very limited	Very limited	Very limited
5. Formulation of basic concepts of watershed management				
5.1 Formulate basic concepts of a watershed management plan	Very limited	Very limited	Very limited	Very limited
5.2 Zone the study area (Make zoning of the study area) for future management	Very limited	Very limited	Very limited	Very limited
5.3 Exchange views on watershed management with local people	Limited	Very limited	Very limited	Very limited
6. Formulation of programs to manage the target watershed				
6.1 Draft development programs that can help to achieve the objectives and goals of the watershed management plan	Very limited	Very limited	Very limited	Very limited
6.2 Formulate an implementation plan of the development programs	Very limited	Very limited	Very limited	Very limited

Note: <1 MAF, NDF, and ALGIS

b. Capacity Gaps in Implementation

Steps to be taken	Organizations <1	C/Ps (NDCF)	C/P (ALGIS)	C/Ps (District)
1. Coordination				
1.1 Coordination with communities / community leaders	Limited	Very limited	-	Very limited
1.2 Coordination with other district offices	Fair	Limited	-	Fair
1.3 Coordination with other ministries	Limited	Limited	-	Very limited
1.4 Coordination with external supporters	Limited	limited	-	limited
2. Facilitation/Extension				
2.1 Facilitation of communities in managing forest in a sustainable manner	Very limited	Very limited	-	Very limited
2.2 Extension of policies and regulations	Limited	limited	-	limited
2.3 Participatory planning	Very limited	Very limited	-	Very limited
2.4 Conflict solving in community members	Very limited	Very limited	-	Very limited
2.5 General knowledge of livelihood development/community development	Very limited	Very limited	-	Very limited
3. Monitoring of work				
3.1 Co-work with NGOs	Limited	Limited	-	Limited
3.2 Report making	Very limited	Limited	-	Very limited
3.3 Monitoring of communities' as well as NGO's activities	Limited	Limited	-	Limited

Note: <1 MAFF, NDCF, and ALGIS

Table 3.1 Land Use and Vgetation in the Watersheds

(Unit : ha)

Watershed	District	Sub-District	Suco	Type of Land Use and Vegetation										Total
				Dense Forest	Medium Forest	Sparse Forest	Shrubland	Grassland	Coffe Plantation	Bareland	River Bed	Paddy Field	Settlements	
Comoro	Aileu	Aileu	Aisirimou	1	1	0	6	1	0	0	0	0	0	8
			Saboria	0	0	0	0	0	0	2	0	0	0	2
			Seloi Craic	259	199	15	234	16	154	121	0	2	0	1,002
		Laulara	Cotolau	78	173	20	248	46	46	16	0	0	0	627
			Fatisi	87	418	192	263	142	7	45	24	0	0	1,178
			Madabeno	289	151	68	299	69	52	16	0	0	0	945
			Talitu	105	278	22	340	42	82	41	0	0	0	910
			Tohumeta	47	73	281	215	124	4	21	1	0	0	767
		Remexio	Acumau	4	39	0	9	1	0	7	0	0	0	59
	Dili	Dom Aleixo	Comoro	9	15	181	5	61	0	0	39	16	0	326
		Vera Cruz	Dare	113	663	170	256	49	95	4	54	2	0	1,407
		Railaco	Deleco	85	100	8	58	2	74	5	0	0	0	332
			Fatuquero	80	240	20	310	25	48	25	0	0	0	748
			Lihu	66	356	117	772	122	244	95	29	49	0	1,849
			Matata	11	1	7	10	8	64	0	0	0	0	101
			Railoco Craic	184	150	29	437	63	278	8	0	0	0	1,150
			Railoco Leten	306	179	49	369	78	248	108	0	0	0	1,337
			Samalete	124	21	149	351	142	153	54	0	0	0	994
			Taraco	64	222	127	370	112	104	72	0	0	0	1,072
			Tocoluli	22	13	35	217	48	123	24	0	0	0	480
	Liquica	Bazartete	Fahilebo	48	262	139	580	267	165	374	18	0	0	1,852
			Leorema	46	49	127	155	244	558	6	3	0	0	1,188
			Tibar	112	289	204	284	49	8	23	12	0	0	981
			Ulmera	42	169	19	308	65	172	118	2	0	0	896
Sub-Total				**2,185**	**4,062**	**1,978**	**6,094**	**1,777**	**2,680**	**1,185**	**183**	**69**	**0**	**20,212**
Laclo	Aileu	Aileu Vila	Aisirimou	123	608	38	663	133	16	1,306	13	60	3	2,963
			Bandudato	61	598	183	731	184	0	1,172	62	64	0	3,056
			Fahiria	238	1,106	147	1,215	179	0	1,332	89	54	1	4,362
			Fatubosa	36	287	80	680	877	289	639	0	18	0	2,906
			Hoholau	0	0	0	77	23	0	0	0	3	0	103
			Lahae	7	62	122	314	332	16	460	1	34	0	1,349
			Lausi	4	26	14	101	180	47	134	3	7	0	516
			Saboria	121	630	34	525	73	2	736	38	49	0	2,207
			Seloi Craic	34	49	1	101	19	2	141	0	0	0	346
			Seloi Malere	37	132	27	383	99	33	531	0	20	31	1,293
			Suco Liurai	678	941	470	2,203	346	48	1,307	30	145	2	6,170
		Laulara	Cotolau	0	0	0	0	0	0	0	0	0	0	1
			Madabeno	32	15	3	92	38	1	30	0	0	0	211
			Talitu	1	8	0	3	1	0	5	0	0	0	18

Table 3.1 Land Use and Vgetation in the Watersheds

(Unit : ha)

Watershed	District	Sub-District	Suco	Type of Land Use and Vegetation										Total
				Dense Forest	Medium Forest	Sparse Forest	Shrubland	Grassland	Coffe Plantation	Bareland	River Bed	Paddy Field	Settlements	
Laclo	Aileu	Liquidoe	Acubilitoho	76	242	85	398	169	1	277	13	0	0	1,262
			Bereleu	62	506	156	1,007	321	3	605	0	0	0	2,660
			Betulau	15	112	51	234	110	0	312	4	0	0	839
			Fahisoi	137	45	159	286	40	59	72	1	0	0	799
			Faturilau	62	1,905	1,212	3,189	561	0	523	286	0	0	7,738
			Manucasa	72	153	48	330	58	0	113	3	0	0	778
			Namoleso	150	120	190	384	59	2	126	5	0	0	1,037
		Remexio	Acumau	64	422	59	911	281	27	754	0	0	0	2,517
			Fadabloco	56	214	200	703	240	16	332	3	0	0	1,764
			Fahisoi	61	128	88	404	207	7	500	0	0	0	1,394
			Faturasa	107	1,579	631	1,829	251	6	376	44	0	0	4,823
			Hautoho	129	399	231	553	117	3	81	9	0	0	1,522
			Maumeta	33	110	50	193	60	4	78	0	0	0	530
			Suco Liurai	43	797	65	1,001	21	5	436	0	2	0	2,371
			Tulataqueo	150	945	281	1,894	413	48	625	0	1	0	4,357
	Ainaro	Maubisse	Fatu Besi	41	233	69	491	174	0	299	50	0	0	1,357
			Manelobas	3	35	5	18	4	0	5	0	0	0	70
			Maubisse	1	7	0	10	4	0	24	0	0	0	46
			Maulau	168	851	161	1,602	592	0	665	1	0	0	4,040
			Suco Liurai	60	118	102	314	231	47	60	0	0	0	932
	Dili	Metinaro	Duyung (Sereia)	4	230	73	203	58	0	125	0	0	0	692
			Sabuli	1	7	5	3	0	0	1	0	0	0	17
	Manatuto	Laclo	Hohorai	56	638	1,480	1,817	839	2	255	15	0	0	5,104
			Lacumesac	4	329	3,523	5,314	2,223	0	258	415	367	0	12,433
			Uma Naruc	19	1,283	2,552	3,285	723	0	72	818	54	0	8,806
			Umacaduac	274	1,182	586	1,565	740	0	172	111	33	0	4,661
		Laclubar	Batara	526	2,712	723	2,088	203	12	141	77	0	0	6,482
			Fatumaquerec	162	814	63	677	33	0	40	34	2	0	1,826
			Funar	468	3,010	789	2,151	384	6	151	196	13	0	7,168
			Manelima	20	41	7	25	5	0	0	0	0	0	97
			Orlalan	154	355	84	504	146	28	18	0	0	0	1,288
			Sanana'in	46	896	1,247	1,586	87	0	16	105	32	0	4,014
		Manatuto	Ailili	0	0	120	601	113	0	19	138	0	0	992
			Aiteas	0	54	51	202	0	0	19	0	0	0	326
			Cribas	20	564	273	1,112	83	0	94	121	23	0	2,291
			Iliheu	2	19	175	578	325	0	181	115	185	0	1,580
	Manufahi	Turiscai	Caimauc	29	176	40	314	136	0	117	11	0	0	824
			Fatucalo	262	1,716	72	584	92	0	85	42	0	0	2,853
			Lesuata	54	716	81	569	141	0	84	53	0	0	1,698
			Liurai	33	385	104	410	266	26	146	36	7	0	1,412
			Manumera	1	9	3	31	73	1	43	0	0	0	161
			Matorec	1	35	0	1	0	23	0	0	0	0	60
Sub-Total				**4,998**	**28,556**	**17,013**	**46,457**	**13,068**	**779**	**16,098**	**2,940**	**1,174**	**36**	**131,118**
Total				**7,183**	**32,617**	**18,991**	**52,551**	**14,845**	**3,458**	**17,283**	**3,122**	**1,242**	**36**	**151,330**

Table 3.2 Results of the Forest Survey in the Watersheds

No. of plot	(1) Suco, (2) Location	Main trees	Average		Average volume per tree (m^3)	Estimated Tree density (trees/ha)	Estimated volume (m^3/ha)
			DBH	Height			
L-11	(1) Umanarue, (2) Hatu Motur	Tamarindus & Acacia woodland	25.5	6.8	0.17	138	24.00
L-12	(1) Umanarue, (2) Hatu Motur	Tamarindus & Acacia woodland	18.3	6.4	0.08	200	16.78
Average			**21.9**	**6.6**	**0.13**	**169**	**20.39**
C-7	(1) Madabenu (2) Lisimu	Casuarina & Coffee	22.9	27.9	0.57	288	164.77
C-8	(1) Madabenu (2) Lisimu	Casuarina & Coffee	15.9	19.6	0.20	413	80.68
C-9	(1) Darhai (2) Simpang Soloi	Casuarina & Coffee	38.7	36.4	2.14	213	454.73
Average			**25.8**	**28.0**	**0.97**	**304**	**233.39**
C-1	(1) Railaco Leten, (2) Samtali	Falcata & Coffee	54.8	20.0	2.36	131	309.35
C-3	(1) Tocolula, (2) Rialon	Falcata & Coffee	62.6	22.5	3.46	81	281.32
C-4	(1) Aileu	Falcata & Coffee	36.6	15.6	0.82	144	118.02
C-5	(1) Aileu	Falcata & Coffee	52.8	22.8	2.49	119	295.59
L-1	(1) Laclobar	Falcata & Coffee	73.1	22.5	4.72	81	383.60
C-2	(1) Railaco Leten, (2) Samtali	Falcata & Coffee	40.7	19.5	1.27	156	198.29
Average			**53.4**	**20.5**	**2.52**	**119**	**264.36**
L-6	(1) Lacmesoa (2) Macoloe	Casuarina	34.7	24.9	1.18	200	235.08
L-6 (2)	(1) Lacmesoa (2) Macoloe	Casuarina	39.8	28.9	1.80	163	292.13
L-7	(1) Aiteas (2) Rembor	Casuarina, local tree species	12.6	7.8	0.05	681	33.22
L-8	(1) Manukasak, (2)	Casuarina	49.3	19.9	1.90	113	214.00
Average			**34.1**	**20.4**	**1.23**	**289**	**193.61**
C-10	(1) Talitu, (2) Lubukuku	Eucalyptus	42.2	27.8	1.95	156	303.94
L-2	(1) Aikros, (2)	Eucalyptus	39.9	23.2	1.45	163	236.25
L-3	(1) Curibas, (2) Penanare	Eucalyptus	42.4	13.6	0.96	175	168.10
C-14	(1) Hulmera (2) Bilmo	Eucalyptus	28.3	20.2	0.63	225	142.50
C-12	(1) Hulmera (2) Bilmo	Eucalyptus	20.4	19.7	0.32	331	106.81
L-5	(1) Curibas, (2) karaudikur	Eucalyptus	30.2	17.0	0.61	150	91.27
C-17	(1) Fatokhun (2) Delboul	Eucalyptus	25.2	14.0	0.35	194	67.55
L-4	(1) Curibas, (2) Ailitikoan	Eucalyptus	25.7	11.3	0.29	225	66.14
C-15	(1) Fatukero (2) Kokoa	Eucalyptus	11.4	10.7	0.06	731	40.25
C-13	(1) Hulmera (2) Bilmo	Eucalyptus	12.4	11.4	0.07	419	28.61
L-10	(1) Carlilo, (2) Babuluk	Eucalyptus, local tree species	15.6	7.5	0.07	325	23.35
L-9	(1) Carlilo, (2) Orhua	Eucalyptus, local tree species	15.3	8.6	0.08	288	22.80
C-16	(1) Fatokhun (2) Delboul	Eucalyptus	9.5	7.7	0.03	644	17.40
L-14	(1) Labubu, (2) Mulolo	Eucalyptus, local tree species	15.1	7.1	0.06	250	15.86
L-13	(1) Labubu, (2) Mulolo	Eucalyptus, local tree species	9.5	7.2	0.03	613	15.69
C-11	(1) Talitu, (2) Lubukuku	Eucalyptus	5.5	6.9	0.01	394	3.19
Average			**21.8**	**13.4**	**0.44**	**330**	**84.36**
L-15	(1) Iliheu, (2) Labitin	River side forest	29.9	12.1	0.42	213	90.22
L-16	(1) Iliheu, (2) Labitin	River side forest	18.8	8.7	0.12	288	34.61
Average			**24.3**	**10.4**	**0.27**	**250**	**62.42**

Table 3.3 Forest Types in the Watersheds

Forest Type	Descriptions
Dense forest	The canopy closure is more than 70%. It is formed by the trees more than 10 m height having wide crowns enough to close the upper layer of the forests. This type of forest seems to be rather intact or protected by the rural community. Cutting, grazing and other activities are not practiced. The dense forest has key function to prevent soil erosion on the slope because the closed canopy reduces largely the direct sunshine and rain fall to the ground. Also it has the function to increase the biodiversity by providing the wild birds the locations to make a nest on the trees. The following types are found as dense forest in the watershed. **River side forest:** The river side forest is composed with indigenous tree (e.g., *Acacia leucopea* and *Dipterocarpus indicus),* which tend to form the closed canopy, and other indigenous shrubs. The average tree height is between 10-15 m and density is from 200 to 300 trees per hector. The volume are estimated from 30 to 90 m^3/ha. Under the canopy indigenous shrubs and grasses cover the ground. There are gaps in some places in which the pioneer shrubs (local name****) are dominant. **Natural forest in the protected areas:** Natural forests distributed in the mountainous area designated as a protected area by UNTAET No. 2000/19 are categorized as dense forests. This type of forest is less exploited or disturbed due to its remoteness. Part of Diatuto and Fantumasin mountains and around the summit of Tata Mailau mountain are located in the watersheds.
Medium forest	The canopy closure is between 30 -70 %. Most of the existing vegetation belongs to this classification. The tree size, density and canopy closure varies according to the range of human activities in the forest, e.g. cutting for firewood, grazing and shifting cultivation. Medium forest is classified into the following types. **Eucalyptus woodland:** There are two local species of eucalyptus dominant in the watershed, t *Eucalyptus alba* and *Eucalyptus urophylla*. Eucalyptus woodland extends from the mountain slope in the higher elevation to the dried low land. Tree size, density and extent of degradation vary with their topography, soil conditions and intensity of human uses. The height of tree ranges from 10 to 30 m with the density from 150 to 330 trees/ha and the volume per hector is estimated from 60 to 300 m^3/ha. The firewood used in the urban and rural households is mostly collected from this type of forests. **Casuarina woodland:** Forests dominated by *Casuarina equisetifolia* are mainly distributed in downstream of the Laclo river and on the mountain slopes in Laclobar. Along the Lalco river the Casuarina woodlands form riparian forests either on river levees or the higher river bed formed by sediments brought from the upstream. The height of tree ranges from 10-30 m with a density of 110-200 trees/ha. The volume per hector is estimated at 210-300 m^3/ha. Although most of the Casuarina woodlands along the Laclo river are located close to the community, there is no sign of cutting trees observed at all. It seems they have never been utilized for wood and/or firewood by rural people. These two types of wodlands are usually associated with some other trees, such as *Schleichera oleosa, Borassus flabellifer, Corypha elata, Vitex pinnata, Pometia pinnata, Ziziphus rotundifolia* etc.
Sparse forest	The canopy closure is below 30%. The canopy is open, partly covered by the main trees. The sunlight reaches the ground which is covered by grasses or sprouts of trees. This type of forest is classified as follows. **Tamarindus and Acacia woodland:** Main species are *Eucalyptus alba* and/or *Eucalyptus urophylla.* It is distributed from the lower hills with a gentle slope to highlands with a steep slope. The tree height ranges from 6 to 12 meters with the density from 250 to 730 trees/ha. The woodland with more than 600 trees/ha is composed of the dense sprouts and the regenerating trees which are generally smaller, less than 8 m height. The volume per hector is estimated between 3 to 40 m^3/ha. In the lowland, it is associated with other indigenous trees e.g. *Acacia leucopea and Dipterocarpus indicus*. The ground is covered with wild grasses which are used for grazing in some locations.

Forest Type	Descriptions
Sparse forest (cont'd)	**Tamarindus and Acacia woodland:** The woodland composed of *Tamarindus indica, Dipterocarpus indicus, Acacia leucopea* with some indigenous shrubs, etc., is distributed on the hill slope located in the downstream of Laclo river. The tree height is around six (6) meter at a density of 140-200 tree/ha. The estimated volume ranges from 15 to 25 m^3/ha. Due to the severe climatic conditions for vegetation growth, the growth of ground cover (grasses and small shrubs) is poor.
Plantation	Besides the natural forests above-classified, there are man-made plantations in the watersheds, which are coffee plantation and other timber trees plantation. Coffee plantation is further divided into two types, namely, a) coffee plantation with Falcata tree (*Paraserianthes falcataria*) and b) coffee plantation with Casuarina tree (*Casuarina equisetilolia*).
	Coffee plantation with Falcata (*Paraserianthes falcataria*): Coffee plantations shaded with *Paraserianthes falcataria* were found in the mountain slopes in the whole Comoro watershed and southern and south-western parts of the Laclo watershed. In many locations *P. falcatalia* were aged (probably more than 50 years), so that the height of Falcata was more than 20 meters height with a wide and closed canopy. In general, this type of coffee plantations can be classified into the dense forest in terms of the canopy closure. According to the results of the forest survey, DBH ranges from 35 to 75 cm and height from 20-22 m. Its density is from 80 – 160 trees/ha and the average volume is estimated around 260 m^3/ha. There are many reports that some Falcata trees in the Comoro watershed have been damaged by a disease of parasite (*Uromycladium tepperiarum*), which forms a gull on branches of trees and finally blights the trees. Falling shading trees in coffee plantation is one of major issues for coffee farmers to tackle since it has caused damage to coffee trees. This is also a critical issue on watershed management, since coffee plantations composed of Falcata have a closure canopy that must has an important function to protect sloping lands from degradation. Over-aged Falcata trees need to be replaced with other shade trees in a proper manner, which will not give adverse influence on the growth/productivity of coffee trees and function of the watersheds. Some trial interventions are being undertaken by replacing Falcata with other tree species e.g. *Calliandra eriophylla*. **Coffee plantation with Casuarina (*Casuarina equisetifolia*):** They were found on the hills surrounding Aileu basin and on the mountain slopes on the watershed boundary between the Camoro and Laclo watersheds. Because of the tolerance of strong wind and drought, Casuarina was introduced in this area instead of Falcata as a shade tree since Falcata can not grow well under such conditions. In the last several decades, Casuarina has adapted to the environment of Aileu showing well performance as a shade tree of coffee. In fact, it is the second "biggest" vegetation in the watershed in terms of tree size and estimated volume. The diameter ranges from 15 to 40 cm and height from 20 to 35 m which is higher than the Falcata. The density ranges from 210 - 400 trees/ha and the average volume is estimated at 230 m^3/ha. **Other plantation:** In addition, plantations with timber trees, such as eak (*Tectona grandis*), Gmelina (*Gmelina arborea*) and Eucalyptus (*Eucalyptus spp.)* were also found in the watersheds, though its scale and area were limited. Some of trees, especially Teak, seemed to have been rooted in the local environment in some parts of the watersheds.
Shrub and grassland	Shrubs were commonly found on the foot of hills in the western part in the lower reach of the Laclo watershed. The average height of shrubs is less than three meter. In many areas, shrubs are used for grazing animals, such as cattle, baffalo and goats. Grasslands on the steeper stony fans also support animal grazing. *Corypha utan* grassland is commonly found in the relatively flat floodplain.

Table 3.4 Demography in and around the Watersheds in 2007

(1) Comoro Watershed

Sub-district	Suco Name	Area of suco *1	No of Aldeia *2	Household 2007 *4	Population		Increase rate	Density
					2004 *3	2007 *4		
		(ha)	(No.)	(No.)	(persons)	(persons)	(% p.a.)	(persns/km2)
Bazartete	Leorema	682	10	1079	4,425	5,724	9.0	839.4
	Ulmera	688	9	573	2,420	2,956	6.9	429.6
	Tibar	1,998	4	479	2,571	2,655	1.1	132.9
	Fahilebo	3,889	3	199	1,020	1,195	5.4	30.7
Railaco	Lihu	1,865	4	163	1,228	857	-11.3	45.9
	Matata	865	4	230	1,395	1,313	-2.0	151.8
	Tocoluli	940	3	191	946	1,075	4.4	114.4
	Fatuquero	1,267	2	236	1,462	1,302	-3.8	102.8
	Railaco Leten	1,352	5	261	1,067	1,340	7.9	99.1
	Railaco Craic	1,895	4	198	1,180	1,220	1.1	64.4
	Samalete	1,000	3	220	1,193	1,673	11.9	167.3
	Deleco	334	2	78	293	478	17.7	143.2
	Taraco	1,068	2	129	529	647	6.9	60.6
Laulara	Cotalau	679	5	265	555	1385	35.6	203.9
	Talitu	2,283	4	206	2,097	1183	-17.4	51.8
	Madabeno	1,159	5	321	1,397	1573	4.0	135.8
	Tohumeta	765	3	142	602	717	6.0	93.8
	Fatisi	1,160	5	226	797	1174	13.8	101.2
Aileu	Seloi Craic	3,704	10	596	2558	3309	9.0	89.3
Bazartete	4 Sucos	7,257	26	2,330	10,436	12,530	6.3	172.7
Riilaco	9 Sucos	10,585	29	1,706	9,293	9,905	2.1	93.6
Laulara	5 Sucos	6,045	22	1,160	5,448	6,032	3.5	99.8
Aileu	1 Suco	3,704	10	596	2,558	3,309	9.0	89.3
Total (Except Dili)		**27,591**	**87**	**5,792**	**27,735**	**31,776**	**4.6**	**115.2**

Source: *1: ALGIS
*2: Ministrial Order No. 9/2004 (2004)
*3: The 2004 Census of Population and Housing (2004), NSD
*4: Registation of Annual Population 2007

Note: Data of Dili are not included in the estimation since its population is quite large and most of them likely live outside the watersheds.
Data of sucos whose overlap with the watersheds is less than 100 ha are not included.

Table 3.4 Demography in and around the Watersheds in 2007

(2) Laclo Watershed

Sub-district	Suco Name	Area of suco *1	No of Aldeia *2	Household 2007 *3	Population		Increase rate	Density
					2001*4	2007 *3		
		(ha)	(No.)	(No.)	(persons)	(persons)	(% p.a.)	(persns/km2)
Aileu	Asirimou	2,994	5	449	1,262	2,003	16.6	66.9
	Fatubosa	2,873	7	345	2,031	1,784	-4.2	62.1
	Lahae	1,375	5	201	512	926	21.8	67.4
	Saboria	2,223	3	154	699	727	1.3	32.7
	Fahiria	4,393	6	355	760	1,925	36.3	43.8
	Lausi	505	4	261	599	2,113	52.2	418.0
	Sucu Liurai	7,407	8	685	4,381	3,615	-6.2	48.8
	Bandudato	3,075	3	161	1,098	844	-8.4	27.5
	Hoholau	1,675	5	269	806	1,359	19.0	81.1
	Seloi Malere	1,303	6	525	2,460	2,790	4.3	214.1
	Seloi Craic	3,704	10	596	2,558	3,309	9.0	89.3
Laulara	Madabeno	1,159	5	321	1,397	1,573	4.0	135.8
Liquidoe	Bereleu	2,685	5	228	685	1,208	20.8	45.0
	Namoleso	1,045	4	237	1,209	1,160	-1.4	111.0
	Acubilitoho	1,272	3	236	975	935	-1.4	73.5
	Betulau	849	3	139	375	628	18.8	74.0
	Manucassa	784	2	125	443	574	9.0	73.2
	Fahisoi	803	3	242	1,464	1,121	-8.5	139.6
	Faturilau	7,791	2	147	668	654	-0.7	8.4
Remexio	Maumeta	535	3	113	362	837	32.2	156.6
	Tulataqueo	4,368	7	408	1,777	2,072	5.3	47.4
	Faturasa	4,819	4	256	1,538	1,408	-2.9	29.2
	Acumau	3,875	3	273	1,775	1,219	-11.8	31.5
	Hautoho	1,532	3	177	1,555	872	-17.5	56.9
	Fadabloco	1,771	7	374	927	2,204	33.5	124.4
	Suco Liurai	2,927	3	90	294	560	24.0	19.1
	Fahisoi	1,404	3	276	1,265	1,404	3.5	100.0
Maubisse	Suco Liurai	1,068	4	128	542	991	22.3	92.8
	Fatu-Besi	1,359	6	187	692	916	9.8	67.4
	Maulau	5,043	10	598	2,453	2,873	5.4	57.0
Turiscai	Caimauc	1,092	5	176	678	1,062	16.1	97.3
	Liurai	1,895	6	158	450	1,271	41.4	67.1
	Fatucalo	3,378	2	72	240	386	17.2	11.4
	Manumera	858	3	165	1,255	958	-8.6	111.7
	Lesuata	1,710	4	63	529	329	-14.6	19.2
Laclubar	Batara	6,473	4	415	1,609	2,089	9.1	32.3
	Oralalan	6,853	8	809	2,402	4,910	26.9	71.7
	Funar	9,224	4	299	1,078	1,486	11.3	16.1
	Fatumaquerec	7,972	3	273	505	1,183	32.8	14.8
	Sanana'in	4,004	4	170	565	763	10.5	19.1
Laclo	Lacomesac	13,167	5	429	2,167	1,770	-6.5	13.4
	Uma Naruc	8,795	4	266	434	1,192	40.0	13.6
	Umacaduac	9,769	3	692	3,261	3,146	-1.2	32.2
	Hohorai	5,118	4	217	1,696	1,075	-14.1	21.0
Manatuto	Aiteas	8,227	4	585	743	2,581	51.4	31.4
	Ailili	2,770	2	310	308	2,197	92.5	79.3
	Iliheu	1,642	4	466	1,286	2,175	19.1	132.5
	Cribas	9,771	5	522	1,881	2,304	7.0	23.6
Aileu	11 Sucos	31,527	62	4,001	17,166	21,395	7.6	67.9
Laulara	1 Suco	1,159	5	321	1,397	1,573	4.0	135.8
Liquidoe	7 Sucos	15,228	22	1,354	5,819	6,280	2.6	41.2
Remexio	8 Sucos	21,230	33	1,967	9,493	10,576	3.7	49.8
Maubisse	3 Sucos	7,471	20	913	3,687	4,780	9.0	64.0
Turiscai	5 Sucos	8,933	20	634	3,152	4,006	8.3	44.8
Laclubar	5 Sucos	34,525	23	1,966	6,159	10,431	19.2	30.2
Laclo	4 Sucos	36,849	16	1,604	7,558	7,183	-1.7	19.5
Manatuto	4 Sucos	22,410	15	1,883	4,218	9,257	30.0	41.3
Total (Except Dili)		**179,332**	**216**	**14,643**	**58,649**	**75,481**	**8.8**	**42.1**

Source: *1: ALGIS
*2: Ministrial Order No. 9/2004 (2004)
*3: The 2004 Census of Population and Housing (2004), NSD
*4: Registation of Annual Population 2007

Note: Data of Dili are not included in the estimation since its population is quite large and most of them likely live outside the watersheds.
Data of sucos whose overlap with the watersheds is less than 100 ha are not included.

Table 3.4 Demography in and around the Watersheds in 2007

(3) Whole Watersheds

Sub-district	Suco Name	Area of suco *1	No of Aldeia *2	Household 2007 *4	Population		Increase rate	Density
					2004 *3	2007 *4		
		(ha)	(No.)	(No.)	(persons)	(persons)	(% p.a.)	(persns/km2)
Bazartete	4 Sucos	7,257	26	2,330	10,436	12,530	6.3	172.7
Riilaco	9 Sucos	10,585	29	1,706	9,293	9,905	2.1	93.6
Aileu	11 Sucos	31,527	62	4,001	17,166	21,395	7.6	67.9
Laulara	5 Sucos	6,045	22	1,160	5,448	6,032	3.5	99.8
Liquidoe	7 Sucos	15,228	22	1,354	5,819	6,280	2.6	41.2
Remexio	8 Sucos	21,230	33	1,967	9,493	10,576	3.7	49.8
Maubisse	3 Sucos	7,471	20	913	3,687	4,780	9.0	64.0
Turiscal	5 Sucos	8,933	20	634	3,152	4,006	8.3	44.8
Laclubar	5 Sucos	34,525	23	1,966	6,159	10,431	19.2	30.2
Laclo	4 Sucos	36,849	16	1,604	7,558	7,183	-1.7	19.5
Manatuto	4 Sucos	22,410	15	1,883	4,218	9,257	30.0	41.3
Total (Except Dili)		**202,060**	**288**	**19,518**	**82,429**	**102,375**	**7.5**	**50.7**

Source: *1: ALGIS
*2: Ministrial Order No. 9/2004 (2004)
*3: The 2004 Census of Population and Housing (2004), NSD
*4: Registation of Annual Population 2007

Note: Data of Dili are not included in the estimation since its population is quite large and most of them likely live outside the watersheds.
Data of sucos whose overlap with the watersheds is less than 100 ha are not included.

Table 3.5 Harvest Areas and Production of Crops Produced in the Districts in 2007/2008

(1) Production Data of Potato, Mung bean and Beans

Watershed/ District	Potato (2008)				Mung bean (2008)				Beans (2007)		
	Plntd ha	Hrvstd ha	ton	Yield (t/ha)	Plntd ha	Hrvstd ha	ton	Yield (t/ha)	Plntd ha	ton	Yield (t/ha)
Comoro											
Liquica	32	30	66	2.2	5	5	3	0.6	167.5	93.8	5.6
Ermera	45	45	113	2.5	20	16	11	0.7	60	32.4	5.4
Dili	0	0			8	5	3	0.6			
Comoro/Laclo											
Aileu	312	305	702	2.3	NA	NA	NA	NA	1403.8	603.6	4.3
Laclo											
Ainaro	400	392	941	2.4	22	20	14	0.7	607.5	334.1	5.5
Manufahi	118	117	269	2.3	99	90	72	0.8	801.3	392.6	4.9
Manatuto	24	21	46	2.2	200	200	0.7	140	16.3	6.2	3.8

Note: NA: Data not available

Source: NDAH, MAF (2008)

(2) Production Data of Major Vegetables (2007)

Watershed/ District	Onion			Garlic			Cabbage			Mustard		
	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)
Comoro												
Liquica	3.3	20	6.6	2	15	3	5.5	70	38.5	26.3	58	152.5
Ermera	11.3	31	35	13.8	21	29	50	78	390	31.3	72	225.4
Dili	1.3	30	3.9			0	25	80	200	43.8	61	267.2
Comoro/Laclo												
Aileu	31.3	29	90.8	31.3	20	62.6	33.8	81	273.8	78.8	78	614.6
Laclo												
Ainaro	63.8	26	165.9	51.3	19	97.5	116.8	84	981.1	41.3	61	251.9
Manufahi	18.8	24	45.1	11.3	23	26	21.3	80	170.4	18.8	63	118.4
Manatuto	15	26	39	11.3	22	24.9	3.8	73	27.7	10	63	63

Watershed/ District	Carrot			Snow Pea			Pumpkin			Kang kung		
	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)	Cultivation area (ha)	Productivity (100kg/ ha)	Production (ton)
Comoro												
Liquica				21.3	25	53.3	26.3	64	168.3	2	30	6
Ermera	6.3	70	44.1	7.5	25	18.8	17.5	59	103.3	3.8	33	12.5
Dili				1.3	30	3.9	0	0	0	10	43	43
Comoro/Laclo												
Aileu	28.8	78	224.6	55	29	159.5	13.8	60	82.8	11.3	36	40.7
Laclo												
Ainaro	11.3	65	73.5	12.5	25	31.3	2.5	55	13.8	2.5	30	7.5
Manufahi	2.5	70	17.5	6.3	30	18.9	7.5	52	39	12.5	36	45
Manatuto					0		12.5	62	77.5	13.8	37	51.1

Table 3.5 Harvest Areas and Production of Crops Produced in the Districts in 2007/2008

(2) Production Data of Major Vegetables (2007)

Watershed/ District	Spinach			Potato			Tomtat			Chili		
	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)
Comoro												
Liquica	5	60	30	1	0.3	0.3	7	0.3	2.1	7	3.5	24.5
Ermera	13.8	48	66.2	98	2.8	274.4	11	1.9	20.9	0	0	0
Dili	10	59	59	0	0	0	7	1.1	7.4	6	9	54
Comoro/Laclo												
Aileu	10	55	55	0.3	1	0.3	0	0	0	0	0	0
Laclo												
Ainaro	6.3	48	30.2	708	2	1416	3	0.4	1.2	21	2.5	52.5
Manufahi	8.8	54	47.5	1	1.5	1.5	5	1.5	7.5	5	3.2	16
Manatuto	12.5	51	63.8	100	2.5	250	5	5	25	10	4.3	43

Watershed/ District	Long bean			Bittter gurd			Lettuce			Cucumber		
	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)	Cultivation area(ha)	Productivity (100kg/ha)	Production (ton)
Comoro												
Liquica	15	0.1	1.5	0.5	0.3	0.2	1	0.2	0.2	6.3	60	37.8
Ermera	0	0	0	0	0	0	0	0	0	11.3	66	74.6
Dili	10	1.5	15	4	1.5	6	5	1.5	7.5	0		0
Comoro/Laclo												
Aileu	0	0	0	0	0	0	0	0	0	17.5	67	117.3
Laclo												
Ainaro	2	0.4	0.8	2	0.3	0.6	32	0.2	0.6	0		0
Manufahi	2	1.5	3	5	1.5	7.5	0.1	0.1	0	12.5	60	75
Manatuto	156	2	312	2	1.2	2.4	4	0.3	1.2	5	65	32.5

Source: NDAH, MAF (2008)

Table 3.6 Major Crops Produced and Major Issues on Farming in and aound the Watersheds

Sub-district	Name	Major food crops			Major Cash Crops						Major Issues on Farming		
		Paddy	Maize	Tubers	Coffee	Beans	Vegetables	Fruits	Banana	Others *1	Problem 1	Problem 2	Problem 3
Bazartete	Leorema		Y	Y	Y		Y	Y	Y		Rainfall	Drought	
	Ulmera		Y	Y		Y	Y	Y	Y		Drought		
	Tibar		Y	Y	Y			Y	Y		-		
	Fahilebo		Y		Y		Y	Y	Y	Y	-		
Railaco	Lihu		Y	Y			Y	Y	Y		Poor irr. facilities		
	Matata		Y	Y			Y	Y	Y		Quality of seeds	Lack of extension	No information
	Tocoluli		Y	Y			Y	Y	Y		-		
	Fatuquero	Y	Y	Y			Y	Y	Y		Poor irr. facilities	Lack of extension	No information
	Railaco Leten		Y	Y		Y	Y				Lack of extension	Low productivity	
	Railaco Craic		Y	Y		Y	Y				Poor irr. facilities	Lack of extension	Lack of seeds
	Samalete		Y	Y							Lack of extension	Low productivity	
	Deleco		Y	Y			Y	Y			Lack of extension	No information	
	Taraco		Y	Y	Y						Lack of extension	No information	
Laulara	Cotalau		Y	Y			Y		Y		Unstable rainfall		
	Talitu		Y	Y		Y	Y	Y		Y	Lack of agri. tool		
	Madabeno		Y	Y		Y	Y	Y			Limited ranfall	Unstable rainfall	
	Tohumeta	Y	Y	Y			Y	Y	Y		Animals & rats	Forest fires	Plant diseases
	Fatisi	Y	Y	Y		Y	Y		Y	Y	Drought	Damage by rats	Unstable rainfall
Aileu	Seloi Craic	Y	Y	Y	Y	Y	Y		Y		Plant diseases	Lack of rainfall	
Bazartete	4 sucos	0	4	3	3	1	3	4	4	1	Drought	Rainfall	
Riilaco	9 sucos	1	9	9	1	2	7	5	4	0	Lack of extension	No information	Poor irr. facilities
Laulara	5 sucos	2	5	5	0	3	5	3	3	2	Unstable rainfall	Drought	Animals/Rats
Aileu	1 suco	1	1	1	1	1	1	0	1	0	Plant diseases	Lack of rainfall	
Total of Comoro		**4**	**19**	**18**	**5**	**7**	**16**	**12**	**12**	**3**			
Aileu	Asirimou	Y	Y	Y	Y				Y		Farming practice	Seed quality	Rainfed
	Fatubosa	Y	Y	Y	Y	Y	Y				Lack of rainfall	Plant diseases	Low soil fertility
	Lahae	Y	Y		Y		Y				Lack of rainfall	Plant diseases	
	Saboria	Y	Y	Y	Y	Y	Y		Y		Lack of rainfall	Plant diseases	Lack of seeds
	Fahiria	Y	Y		Y	Y					Low soil fertility	Heavy rainfall	
	Lausi	Y	Y	Y	Y	Y	Y		Y		Crops damage	Lack of rainfall	Lack of seed/input
	Sucu Liurai	Y	Y	Y	Y	Y	Y				Lack of rainfall	Plant diseases	Lack of extension
	Bandudato	Y	Y		Y			Y			Farming practice	Low yield	
	Hoholau	Y	Y		Y						Plant diseases	Rat attack	Lack of rainfall
	Seloi Malere	Y	Y	Y	Y	Y	Y				Lack of rainfall	Plant diseases	Lack of seeds
	Seloi Craic	Y	Y	Y	Y	Y	Y		Y		Plant diseases	Lack of rainfall	
Liquidoe	Bereleu		Y	Y	Y		Y	Y					
	Namoleso		Y	Y							Lack of food		
	Acubilitoho		Y	Y	Y	Y	Y	Y			Plant diseases	Pests	
	Betulau		Y		Y		Y	Y			Long drought	Low soil fertility	
	Manucassa		Y		Y		Y				Long drought	Plant diseases	
	Fahisoi		Y	Y							Irregular rainfall	Strong wind	
	Faturilau		Y	Y							Irregular rainfall		
Remexio	Maumeta		Y	Y	Y						Pests	Unstable price	
	Tulataqueo		Y	Y							Pests	Unstable price	
	Faturasa		Y		Y	Y					Pests	Farming practice	
	Acumau		Y	Y							Lack of rainfall	Strong wind	Animal damage
	Hautoho		Y	Y				Y			Plant diseases		
	Fadabloco		Y	Y	Y	Y		Y			Plant diseases		
	Suco Liurai		Y	Y	Y			Y			Plant diseases		
	Fahisoi			Y	Y			Y			Plant diseases		
Laclubar	Batara		Y	Y							Low productivity	Low soil fertility	
	Manelima	Y	Y	Y							Lack of seed	Low productivity	Soil infertility
	Oralalan		Y	Y	Y								
	Funar	Y	Y								Pests & diseases	Seasonal changes	Soil infertility
	Fatumaquerec	Y	Y	Y		Y			Y		Wind	Seasonal changes	Rat attack
	Sanana'in	Y	Y								Long drought	Seasonal changes	
Laclo	Lacomesac	Y	Y	Y							Lack of input	Low soil fertility	Plant diseases
	Uma Naruc	Y	Y	Y							Pests & diseases	Seasonal changes	
	Umacaduac	Y	Y	Y					Y		Pests & diseases	Seasonal changes	
	Hohorai		Y	Y		Y		Y			Rat attack	Strong wind	Lack of rainfall
Manatuto	Aiteas	Y	Y	Y							Low soil fertility	Irregular rainfall	
	Ailili	Y	Y				Y				Lack of rainfall		
	Iliheu	Y	Y	Y							Low soil fertility		
	Cribas	Y	Y								Lack of irrigation		
Aileu	11 sucos	11	11	7	11	7	7	1	4	0	Plant diseases	Lack of ranfall	Lack of seed
Liquidoe	7 sucos	0	7	5	4	1	4	3	0	0	Limited rainfall	Pests & diseases	Soil erosion
Remexio	8 sucos	0	7	7	5	2	0	4	0	0	Pests & diseases	Unstable price	Others
Laclubar	6 sucos	4	6	4	1	1	0	0	1	0	Seasonal changes	Pests & diseases	Low production
Laclo	4 sucos	3	4	4	0	1	0	1	1	0	Pests & diseases	Seasonal changes	Low soil fertility
Manatuto	4 sucos	4	4	2	0	0	1	0	0	0	Low soil fertility	Limited rainfall	Lack of irrigation
Total of Laclo		22	39	29	21	12	12	9	6	0			

Note: *1: Others include rice, maize, vanila, clove, etc.

"Y" means "Yes"; therefore crops with "Y" are major crops produced in suco.

Source: Village Profile Survey (2006), JICA Study Team

Table 3.7 Current Situations of Sucos in and around the Comoro Watershed

(1) Comoro Watershed

Code	Name	No. of Aldeia	No. of house holds	Area for herding		No of Animals <1										Issues on animal husbandry	
				Area of Suco	Herding area *1	Cattle	Buffalo	Goat	Sheep	Horse	Pig	Animal Unit (A.U.)*2	Estimated animal density	A.U./No. of Aldeia	A.U./No.of households	Problem 1	Problem 2
Ailei				(ha)	(ha)	(heads)	(heads)	(heads)	(heads)	(heads)	(heads)	(units)	(units/ha)	(heads)	(heads)		
1101	Aisirimou	5	238	2,971.53	172.62	320	123	48	3	45	29	498	2.9	100	2.09	-	-
1108	Saboria	3	155	2,208.60	107.19	250	52	13	0	13	31	318	3.0	106	2.05	-	-
1109	Seloi Craic	10	495	1,347.93	51.12	747	244	155	8	98	282	1,122	21.9	112	2.27	-	-
Laulara																	
1201	Cotolau	5	106	626.67	66.24	14	0	58	0	13	161	39	0.6	8	0.36	-	-
1204	Talitu	4	395	928.44	65.79	55	31	27	0	7	183	98	1.5	25	0.25	-	-
1203	Madabeno	6	287	1,155.15	178.74	79	8	115	0	20	161	130	0.7	22	0.45	-	-
1205	Tohumeta	3	126	766.98	405.36	43	9	123	0	14	217	91	0.2	30	0.72	-	-
1202	Fatisi	5	167	1,178.46	333.90	55	0	51	0	13	219	78	0.2	16	0.47	-	-
Remexio																	
1401	Acumau	3	315	2,576.16	340.92	42	23	61	0	31	210	108	0.3	36	0.34	-	-
Railaco																	
4103	Lihu	4	211	1,848.60	239.13	328	93	97	0	48	462	488	2.0	122	2.31	Lack of treatment	-
4104	Matata	4	256	100.80	14.31	129	32	98	1	36	235	217	15.2	54	0.85	Lack of treatment	-
4109	Tocoluli	3	168	480.33	82.44	127	127	104	0	23	144	298	3.6	99	1.77	Lack of treatment	-
4102	Fatuquero	2	292	747.90	44.46	62	38	74	0	29	267	144	3.2	72	0.49	Lack of treatment	-
4106	Railaco Leten	5	205	1,336.77	126.90	300	48	118	1	54	383	426	3.4	85	2.08	Lack of herding area	Diseases
4105	Railaco Craic	4	210	1,150.47	92.16	418	21	82	0	55	224	510	5.5	128	2.43	Lack of herding area	Lack of treatment
4107	Samalete	3	209	994.23	291.15	269	35	31	0	23	230	333	1.1	111	1.59	Lack of treatment	-
4101	Deleco	2	57	332.10	9.45	132	29	7	0	12	161	174	18.5	87	3.06	Lack of treatment	-
4108	Taraço	2	112	1,072.35	239.13	170	42	17	0	8	185	223	0.9	112	1.99	Lack of treatment	Raising system
Bazartete																	
5102	Leorema	10	829	1,187.82	371.34	469	40	283	0	130	3,180	696	1.9	70	0.84	Lack of herding area	-
5104	Ulmera	9	463	895.41	84.60	547	44	940	9	98	1,316	879	10.4	98	1.90	-	-
5103	Tibar	4	467	979.20	251.64	343	162	828	0	121	1,897	792	3.1	198	1.70	-	-
5101	Fahilebo	3	196	1,850.67	406.26	450	46	94	0	43	567	558	1.4	186	2.85	Lack of herding area	Diseases
Ailei	3 sucos/ 18 aldeias			6,528.1	330.9	1,317	419	216	11	156	342	1,937	5.9	108	-		
Laulara	5 sucos/ 23 aldeias			4,655.7	1,050.0	246	374	0	67	941	436	1,574	1.5	68	-		
Remexio	1 sucos/ 3 aldeias			2,576.2	340.9	42	23	61	0	31	210	108	0.3	36	-		
Riilaco	9 sycos/ 29 aldeias			8,063.6	1,139.1	1,935	465	628	2	288	2,291	2,814	2.5	97	-		
Bazartet	4 sycos/ 26 aldeias			4,913.1	1,113.8	1,809	292	2,145	9	392	6,960	2,924	2.6	112	-		
Total				28,467	3,975	5,349	1,247	3,424	22	934	10,744	8,219	-	-	-		
Average				1,186	181	243	57	156	1	42	488	374	2.1	85	1.8		
Max				2,972	406	747	244	940	9	130	3,180	1,122	21.94	198	3.1		
Min				101	9	14	0	7	0	7	29	39	0.22	8	0.5		

Note: 1.The JICA Study Team assumes that "Sparse forests" and "Grasslands" are presently used for herding places for animals.

2. Animal units are presumed by ruminants and horses, considering five small ruminants as one animal units.

Source: Village Profile Survey (2005), JICA (except <1: No. of Animals.)

Data related to the number of animals are from "Livestock Population in Timor Leste 2004-2005, MAFF

Table 3.7 Current Situations of Sucos in and around the Laclo Watershed

(2) Laclo Watershed

Code	Name	No. of Aldeia	No. of households	Area for herding		No. of Animals *1										Issues on animal husbandry	
				Area of Suco	Herding area *1	Cattle	Buffalo	Goat	Sheep	Horse	Pig	Animal Unit (A.U.) *2	Estimated animal density	A.U./No. of Aldeia	A.U./No. of households	Problem 1	Problem 2
Aileu Vila				(ha)	(ha)	(heads)	(heads)	(heads)	(heads)	(heads)	(heads)	(units)	(units/ha)				
1101	Aisirimou	5	238	2,971.5	172.6	320	123	48	3	45	29	498	2.89	100	2.09	Dieases	Land & water
1104	Fatubosa	7	474	2,905.7	957.4	177	28	17	0	24	13	232	0.24	33	0.49	Dieases	-
1106	Lahae	5	131	1,348.6	453.7	415	165	78	0	34	47	630	1.39	126	4.81	Dieases	Lack of medicine
1108	Saboria	3	155	2,208.6	107.2	250	52	13	0	13	31	318	2.96	106	2.05	Dieases	-
1103	Fahiria	6	162	4,361.7	326.0	433	63	39	0	20	13	524	1.61	87	3.23	Dieases	-
1107	Lau-si	4	120	515.6	193.3	172	28	35	0	7	9	214	1.11	54	1.78	Dieases	-
1111	Suco Liurai	8	893	6,166.4	816.3	457	85	107	0	102	34	665	0.82	83	0.75	Dieases	-
1102	Bandudato	3	220	3,055.9	366.8	432	93	28	0	18	22	549	1.50	183	2.49	Dieases	Lack of medicine
1105	Hoholau	5	156	100.6	22.2	282	26	123	0	85	49	418	18.79	84	2.68	-	
1110	Seloi Malere	6	448	1,293.3	126.3	99	38	23	0	17	14	159	1.26	26	0.35	Dieases	-
1109	Seloi Craic	10	495	1,347.9	51.1	747	244	155	8	98	282	1,122	21.94	112	2.27	Dieases	-
Laulara																	
1201	Cotolau	5	106	626.7	66.2	14	0	58	0	13	161	39	0.58	8	0.36	-	-
1203	Madabeno	5	287	1,155.2	178.7	79	8	115	0	20	161	130	0.73	26	0.45	-	-
1204	Talitu	4	395	928.4	65.8	55	31	27	0	7	183	98	1.50	25	0.25	-	-
Liquidoe																	
1302	Bereleu	5	90	1,261.7	477.3	177	13	27	0	133	75	328	0.69	66	3.65	Diseases	Lack of grasses
1307	Namoleso	4	279	1,037.4	248.3	23	8	91	0	31	133	80	0.32	20	0.29	Diseases	-
1301	Acubilitho	3	228	1,261.7	253.6	85	40	52	24	24	61	164	0.65	55	0.72	Drought	-
1303	Betulau	3	90	839.3	161.3	-	-	-	-	-	-		0.00		0.00	Lack of grasses	-
1306	Manucasa	2	103	777.9	105.9	24	0	20	0	13	32	41	0.39	21	0.40	Diseases	Lack of grasses
1304	Fahisoi	3	325	798.9	128.1	57	11	88	3	53	96	139	1.09	46	0.43	Diseases	-
1305	Faturilau	2	136	7,738.3	1,773.2	300	80	100	0	200	90	600	0.34	300	4.41	Diseases	-
Remexio																	
1406	Maumeta	3	87	529.7	110.5	42	5	44	0	38	93	94	0.85	31	1.08	Animal death	-
1408	Tulataqueo	7	38	4,356.8	693.4	14	4	0	0	26	65	44	0.06	6	1.16	Animal death	-
1404	Faturasa	4	295	4,822.9	881.8	33	14	6	0	45	34	93	0.11	23	0.32	Diseases	Price setting
1401	Acumau	3	315	2,576.2	340.9	42	23	61	0	31	210	108	0.32	36	0.34	Diseases	-
1405	Hautoho	3	302	1,522.3	347.9	74	0	60	0	38	100	124	0.36	41	0.41	Diseases	Free herding
1402	Fadabloko	7	186	1,763.6	440.3	70	0	29	0	37	85	113	0.26	16	0.61	Diseases	-
1407	Suco-Liurai	3	58	2,370.4	85.3	37	0	17	0	37	205	77	0.91	26	1.33	Diseases	Free herding
1403	Fahisoi	3	249	1,394.3	295.0	68	12	51	6	51	85	142	0.48	47	0.57	Diseases	Free herding
Maubisse																	
2101	Fatu-Besi	6	165	1,356.6	242.1	304	20	267	0	318	590	695	2.87	116	4.21	-	-
-	Manelobas	4	192	69.8	9.0	0	49	77	0	145	156	209		52	1.09	-	-
-	Maubisse	12	1,044	46.4	4.2	70	289	570	81	619	1,588	1,108		92	1.06	-	-
2104	Maulau	10	548	4,039.5	753.1	570	201	240	45	815	1,263	1,643	2.18	164	3.00	-	-
2105	Suco Liurai	4	127	928.9	331.9	37	105	265	0	301	100	496	1.49	124	3.91	-	-

Table 3.7 Current Situations of Sucos in and around the Laclo Watershed

(2) Laclo Watershed

Code	Name	No. of Aldeia	No. of households	Area for herding		No. of Animals *1										Issues on animal husbandry	
				Area of Suco	Herding area *1	Cattle	Buffalo	Goat	Sheep	Horse	Pig	Animal Unit (A.U.) *2	Estimated animal density	A.U./No. of Aldeia	A.U./No. of households	Problem 1	Problem 2
Metinaro																	
-	Duyung (Sere	10	507	692.3	-	-	-	-	-	-	-	-	-	-	-	-	-
-	Sabuli	4	260	16.7	-	156	24	246	4	18	201	248	-	62	0.95	-	-
Laclo																	
6102	Lacomesac	5	514	12,433.0	5,746.1	296	381	367	39	40	832	798	- 0.14	160	1.55	-	
6103	Uma Naruc	4	113	8,805.7	3,274.7	286	297	281	0	50	690	689	0.21	172	6.10	Less grasslands	
6104	Uma Caduac	3	782	4,661.1	1,325.6	116	316	122	36	18	299	482	0.36	161	0.62	Diseases	
6101	Hohorai	4	365	5,104.3	2,319.5	277	81	124	0	83	265	466	0.20	116	1.28	Diseases	
Laclubar																	
6201	Batara	4	341	6,482.3	926.6	250	55	100	0	200	200	525	0.57	131	1.54	-	
-	Manelima	6	377	97.0	12.0	300	110	300	0	300	480	770	-	128	2.04	Diseases	
6205	Oralalan	8	472	1,288.3	230.1	455	50	100	0	395	490	920	4.00	115	1.95	-	
6203	Funar	4	232	7,168.4	1,172.5	152	48	180	0	205	500	441	0.38	110	1.90	Diseases	Lack of pens
6202	Hatumaquerec	3	107	1,825.8	95.4	250	75	195	0	400	600	764	8.01	255	7.14	Diseases	
6206	Sananain	4	145	4,014.0	1,333.6	200	100	95	0	105	320	424	0.32	106	2.92	Less grasslands	
Manatuto													-				
6302	Aiteas	4	175	325.6	51.2	160	880	895	1,980	27	937	1,642	32.06	411	9.38	-	
6301	Ailili	2	75	992.3	233.7	103	469	600	501	30	616	822	3.52	411	10.96	-	
6304	Iliheu	4	314	1,579.6	500.1	175	155	545	35	84	1,060	530	1.06	133	1.69	Lack of grasslands	Animal diseases
6303	Cribas	5	449	2,290.1	356.5	1,399	984	196	0	136	444	2,558	7.18	512	5.70	-	
Turiscai																	
7101	Caimauc	5	112	824.0	175.9	142	57	54	14	296	204	509	2.89	102	4.54	-	
7102	Fatucalo	2	51	2,852.6	163.6	46	38	40	0	25	50	117	0.72	59	2.29	-	
7103	Lesuata	4	105	1,697.9	222.2	50	72	9	0	110	73	234	1.05	58	2.23	-	
7104	Liurai	6	83	1,411.8	370.2	139	101	59	0	262	137	514	1.39	86	6.19	-	
7105	Manumera	4	231	160.9	75.8	99	92	44	33	205	105	411	5.43	103	1.78	-	
-	Matorec	4	100	59.7	0.0	105	34	30	0	93	70	238	-	60	2.38	-	
Aileu Vila	11 sucos / 62 aldias			26,275.8	3,593.0	3,784	945	666	11	463	543	5,327	1.48	86	-		
Laurala	3 sucos / 14 aldeia			2,710.3	310.8	148	39	200	0	40	505	267	0.86	19	-		
Liquidoe	7 sucos / 22 aldeia			13,715.2	3,147.7	666	152	378	27	454	487	1,353	0.43	62	-		
Remexio	8 sucos / 33 aldeias			19,336.1	3,195.2	380	58	268	6	303	877	796	0.25	24	-		
Maubisse	5 sucos / 36 aldeias			6,441.2	1,340.4	981	664	1,419	126	2,198	3,697	2,834	2.11	79	-		
Laclo	4sucos/ 16 aldeas			31,004.0	12,665.9	975	1,075	894	75	191	2,086	2,435	0.19	152	-		
Laclubar	6 sucos/ 29 aldeas			20,875.8	3,770.2	1,607	438	970	0	1,605	2,590	3,844	1.02	133	-		
Manatuto	4 sucos/ 15 aldeas			5,187.6	1,141.6	1,837	2,488	2,236	2,516	277	3,057	5,552	4.86	370	-		
Turiscai	6 sucos/ 25 aldeas			7,007.0	1,007.6	581	394	236	47	991	639	2,023	2.01	81	-		
Total				**133,262**	**30,172**	**11,115**	**6,277**	**7,513**	**2,812**	**6,540**	**14,682**	#####	**-**	**-**	**-**		
Average				**2,380**	**559**	**206**	**116**	**139**	**52**	**121**	**272**	**481**	**2.80**	**107.12**	**2.33**		
Max				**12,433**	**5,746**	**1,399**	**984**	**895**	**1,980**	**815**	**1,588**	**2,558**	**32.06**	**512**	**10.96**		
Min				**17**	**0**	**0**	**0**	**0**	**0**	**7**	**9**	**39**	**0**	**6**	**0.00**		

Note: 1.The JICA Study Team assumes that "Sparse forests" and "Grasslands" are presently used for herding places for animals.
2. Animal units are presumed by ruminants and horses, considering five small ruminants as one animal units.

Source: Village Profile Survey (2005), JICA (except <1: No. of Animals.)
Data related to the number of animals are from "Livestock Population in Timor Leste 2004-2005, MAFF

Table 3.8 Estimation of Food Balance Conditions in the Districts concerned

(1) Rice

District	2003/2004				2004/2005				2007/2008			
	Population*1	Min.Require -ment *2 (ton)	Production*3 (ton)	Gap (ton)	Population*1	Min.Require -ment *2 (ton)	Production*3 (ton)	Gap (ton)	Population*4	Min.Require -ment *2 (ton	Production*3 (ton)	Gap (ton)
Aileu	36,657	2,431	566	-1,865	37,926	2,515	860	-1,655	44,283	2,937	605	-2,332
Ainaro	50,932	3,378	1,219	-2,159	52,467	3,479	1,300	-2,179	54,677	3,626	1909	-1,717
Dili	160,761	10,661	60	-10,601	173,541	11,509	91	-11,418	189,034	12,536	0	-12,536
Ermera	99,503	6,599	723	-5,876	103,199	6,844	1,131	-5,713	118,860	7,882	891	-6,991
Liquica	52,525	3,483	385	-3,098	54,834	3,636	629	-3,007	61,679	4,090	302	-3,788
Manatuto	37,050	2,457	3,793	1,336	36,719	2,435	7,165	4,730	44,407	2,945	3,364	419
Manufahi	43,495	2,884	975	-1,909	44,950	2,981	4,807	1,826	49,112	3,257	2,438	-819

(2) Maize

District	2003/2004				2004/2005				2007/2008			
	Population*1	Min.Require -ment *5 (ton)	Production (ton)	Gap (ton)	Population*1	Min.Require -ment *5 (ton)	Production (ton)	Gap (ton)	Population*3	Min.Require -ment *5 (ton	Production (ton)	Gap (ton)
Aileu	36,657	3,079	2325	-754	37,926	3,186	3055	-131	44,283	3,720	753	-2,967
Ainaro	50,932	4,278	2,925	-1,353	52,467	4,407	3,330	-1,077	54,677	4,593	1,221	-3,372
Dili	160,761	13,504	1088	-12,416	173,541	14,577	1260	-13,317	189,034	15,879	1,886	-13,993
Ermera	99,503	8,358	2445	-5,913	103,199	8,669	1,120	-7,549	118,860	9,984	1,586	-8,398
Liquica	52,525	4,412	2378	-2,034	54,834	4,606	3690	-916	61,679	5,181	1,436	-3,745
Manatuto	37,050	3,112	3,525	413	36,719	3,084	6,900	3,816	44,407	3,730	8,550	4,820
Manufahi	43,495	3,654	5363	1,709	44,950	3,776	8,574	4,798	49,112	4,125	6,130	2,005

Note: *1: The population is estimated based on the data of the 2001 Survey of Suco and those of the 2004 Census of Population and Housing.

*2: Minimum per capita consumption of milled rice is estimated at 66 kg based on the estimation by Directorate of National Statistics (DNS) and World Bank (2008) with the addition of the proportionally estimated amount for post harvest loss.

*3: Milling rate of 65% is applied.

*4: Registration of Annual Population 2007

*5: Minimum per capita consumption of milled rice to avoid food poverty is estimated at 84 kg, including the post harvest loss of 25%, based on the estimation by DNS and World Bank (2008) with the adjustment of the consumption of corn flour to grains on calorie basis and with the addition of the proportionally estimated amount for post

Source: The 2001 Survey of Suco
The 2004 Census of Population and Housing.
Registration of Annual Population 2007
Directorate of National Statistics and World Bank (2008): Timor-Leste Poverty in a Young Nation
FAO/WFP: Crop and Food Supply Assessment Special Report (2003)
MAF Crop Production Directorate & National Directorate for Policy and Planning

Table 3.9 Forest and Non-Timber Forest Products in and around the Watersheds

Sub-district	Name	Forest Products for Cash		NTFPs for Cash		Firewood Collection		Tara Bandu
		Product 1 for cash	Product 2 for cash	NTFP1 for cash	NTFP2 for cash	HH collecting	HH consuming	Effective-ness
Bazartete	Leorema	Ai ru		-		50	50	Effective
	Ulmera	Ai ru, Ai na	Ai nitas, Ai sarina	Rattan		100	100	Effective
	Tibar	Ai ru, Ai na	Ai nitas, Ai sarina	Honey	Flower	100	100	Effective
	Fahilebo	Mahogany	Mangustao	Honey	Rattan	50	50	Effective
Railaco	Lihu	Ai bubur, Ai ru	Samtuku	Bamboo, Honey	Resin, Rattan	95	100	Effective
	Matata	Ai bubur, Ai ru	Samtuku	Bamboo	Honey	95	100	Effective
	Tocoluli	Ai ru	Ai bubur, Casuarina	Bamboo	Honey	95	100	Effective
	Fatuquero	-		Bamboo	Honey	80	80	Effective
	Railaco Leten	-		Tua metan		100	100	Effective
	Railaco Craic	-		Tua metan		100	100	Effective
	Samalete	-		Honey	Tua metan	100	100	Effective
	Deleco	-		Honey		100	100	Effective
	Taraco	-		Tua metan		100	100	Effective
Laulara	Cotalau	Ai ru		Tua metan		100	100	Effective
	Talitu	Ai ru	Ai bubur	Tua metan	Flower, Bamboo	100	100	Not Effective
	Madabeno	Ai ru, Ai sarina	Ai bubur, Casuarina	Tua metan	Bamboo	100	100	Not Effective
	Tohumeta	Ai ru, Samtuku	Ai bubur, Casuarina	Tua metan	Bamboo	100	100	Effective
	Fatisi	Ai ru, Casuarina	Ai bubur, Falcata	Tua metan	Bamboo	100	100	Effective
Aileu	Seloi Craic	-		Bamboo		100	100	Effective
Bazartete	4 sucos	Airu	Ai na, nitas, sarina	Rattan	Flower	75	75	100%
Riilaco	9 sucos	Airu	Ai bubur	Honey	Bamoo, Tua	96	98	100%
Laulara	5 sucos	Airu	Ai bubur	Tua metan	Bamboo	100	100	75%
Aileu	1 suco	-		Bamboo		100	100	100%
Total of Comoro						**92.9**	**93.7**	89%
Aileu	Asirimou	Ai ru	Ai bubur			100.0	100.0	Effective
	Fatubosa	Ai ru	Samtuku ,	Bamboo	Honey	100.0	100.0	Effective
	Lahae	Ai ru	Ai bubur	Bamboo	Honey	100.0	100.0	Effective
	Saboria	-		Honey		100.0	100.0	Effective
	Fahiria	Ai ru	Ai bubur, Casuarina	-		100.0	100.0	Effective
	Lausi	Ai ru, Ai bubur	Samtuku ,	Bamboo	Honey	100.0	100.0	Effective
	Sucu Liurai	Ai ru	Ai bubur, Casuarina	Bamboo	Honey	100.0	100.0	Effective
	Bandudato	Ai ru	Ai bubur	Honey		100.0	100.0	Effective
	Hoholau	Ai ru	Casuarina	Honey	Flower	100.0	100.0	Effective
	Seloi Malere	Ai ru		-		100.0	100.0	Effective
	Seloi Craic	-		Bamboo		100.0	100.0	Effective
Liquidoe	Bereleu	Ai ru		Bamboo	Honey	75.0	100.0	Effective
	Namoleso	Ai bubur		-		100.0	100.0	Effective
	Acubilitoho	-		Honey		100.0	100.0	Effective
	Betulau	-		Honey		100.0	100.0	Effective
	Manucassa	-		-		100.0	100.0	Effective
	Fahisoi	-		Bamboo	Honey	100.0	100.0	Effective
	Faturilau	Tamarind		Honey		100.0	100.0	Effective
Remexio	Maumeta	-		-		100.0	100.0	Effective
	Tulataqueo	Ai ru		Honey		100.0	100.0	Effective
	Faturasa	Ai ru		Honey	Flower	100.0	100.0	Effective
	Acumau	Ai na, Teak	Ai bubur	Bamboo, Tua	Hoeny, Flower	100.0	100.0	Effective
	Hautoho	Ai ru		Bamboo	Honey	100.0	100.0	Effective
	Fadabloco	-		Honey		100.0	100.0	Effective
	Suco Liurai	Ai ru		Bamboo	Honey	100.0	100.0	NA
	Fahisoi	Ai ru		Bamboo	Honey	100.0	100.0	Effective
Laclubar	Batara	Ai ru		-		100.0	100.0	Effective
	Manelima	Candlenut	Avocado	-		100.0	100.0	Not Exist
	Oralalan	Teak		Honey		100.0	100.0	Effective
	Funar	-		-		100.0	100.0	Not Exist
	Fatumaquerec	-		Honey		100.0	100.0	Effective
	Sanana'in	Ai nitas	Aibubur	Honey		100.0	100.0	Effective
Laclo	Lacomesac	-		-		100.0	100.0	Effective
	Uma Naruc	-		-		100.0	100.0	Not effective
	Umacaduac	Ai bubur		Honey	Sagc	100.0	100.0	Not effective
	Hohorai	-		-		100.0	100.0	Effective
Manatuto	Aiteas	Teak, Gewan	Tali tahan,	Honey		95.0	95.0	Not effective
	Ailili	Palm	Tamarind	-		95.0	95.0	Not effective
	Iliheu	Tamarind		Honey		100.0	100.0	Effective
	Cribas	-		-		100.0	100.0	Effective
Aileu	11 sucos	Ai ru	Ai bubur	Honey	Bamboo	100.0	100.0	100%
Liquidoe	7 sucos	Ai ru	Ai bubur	Honey	Bamboo	96.4	100.0	100%
Remexio	8 sucos	Ai ru	Ai bubur, na, teak	Honey	Bamboo	100.0	100.0	100%
Laclubar	6 sucos	Ai ru, Ai nitas, Ai bubur, teak, Candlenut		Honey		100.0	100.0	67%
Laclo	4 sucos	Ai bubur		Honey	Sagc	100.0	100.0	50%
Manatuto	4 sucos	Tamarind	Teak, Gewanm	Honey		97.5	97.5	50%
Total of Laclo						**99.1**	**99.8**	85%

Note: *1: Others include rice, maize, vanila, clove, etc.

Source: Village Profile Survey (2006), JICA Study Team

Table 3.10 Accessibility, Remoteness and Average Income of Sucos in and around the Watersheds

Sub-district	Name	Remoteness & Accessibili			Ave income
		Distance to district capital (kı	Distance to Dili (kn	Time to get topassable road (mi	(US$/HH/mo
Bazartete	Leorema	12.0	53.0	15.0	1.7
	Ulmera	25.0	18.0	5.0	3.5
	Tibar	40.0	16.0	5.0	0.8
	Fahilebo	4.0	45.0	5.0	0.7
Railaco	Lihu	0.3	35.0	2.0	22.5
	Matata	8.0	47.0	2.0	21.5
	Tocoluli	6.0	43.0	10.0	34.8
	Fatuquero	10.0	44.0	5.0	45.0
	Railaco Leten	6.0	48.0	5.0	44.5
	Railaco Craic	5.0	42.0	5.0	40.0
	Samalete	6.0	50.0	15.0	28.5
	Deleco	6.0	48.0	5.0	30.8
	Taraco	10.0	44.0	5.0	40.3
Laulara	Cotalau	0.2	13.0	4.0	6.0
	Talitu	5.0	17.0	4.0	7.1
	Madabeno	15.5	31.0	32.5	19.9
	Tohumeta	20.0	8.0	60.0	10.1
	Fatisi	22.5	7.0	3.0	9.3
Aileu	Seloi Craic	12.0	42.0	3.0	77.5
Bazartete	4 sucos	20.3	33.0	7.5	1.7
Riilaco	9 sucos	6.4	44.6	6.0	34.2
Laulara	5 sucos	10.2	17.3	25.1	10.8
Aileu	1 suco	12.0	42.0	3.0	77.5
Total of Comoro		**11.2**	**34.3**	**10.0**	**23.4**
Aileu	Asirimou	0.0	49.0	15.0	65.0
	Fatubosa	36.0	67.0	61.0	19.6
	Lahae	11.0	59.0	5.0	92.5
	Saboria	3.0	48.0	50.0	44.0
	Fahiria	2.0	49.0	5.0	100.0
	Lausi	11.3	49.0	42.7	20.5
	Sucu Liurai	21.8	51.2	25.6	86.5
	Bandudato	2.0	49.0	3.0	61.8
	Hoholau	16.0	64.0	3.0	390.0
	Seloi Malere	0.1	47.0	3.0	30.0
	Seloi Craic	12.0	42.0	3.0	77.5
Liquidoe	Bereleu	8.0	46.0	180.0	8.3
	Namoleso	0.1	40.0	180.0	4.7
	Acubilitoho	3.0	41.0	40.0	20.8
	Betulau	14.0	45.0	300.0	6.8
	Manucassa	1.5	40.0	5.0	7.4
	Fahisoi	7.5	40.0	180.0	3.0
	Faturilau	12.0	40.0	5.0	7.9
Remexio	Maumeta	22.0	33.0	150.0	13.3
	Tulataqueo	15.0	38.0	10.0	21.0
	Faturasa	25.0	40.0	180.0	25.8
	Acumau	5.0	33.0	50.0	19.5
	Hautoho	14.0	46.0	180.0	13.5
	Fadabloco	14.0	38.0	90.0	13.5
	Suco Liurai	12.0	12.0	3.0	12.5
	Fahisoi	15.0	33.0	240.0	16.3
Laclubar	Batara	2.0	115.0	15.0	2.8
	Manelima	14.0	130.0	1.0	1.7
	Oralalan	15.0	143.0	180.0	4.6
	Funar	17.0	130.0	120.0	2.3
	Fatumaquerec	40.0	143.0	180.0	2.5
	Sanana'in	24.0	87.0	50.0	1.8
Laclo	Lacomesac	7.5	84.0	2.0	3.0
	Uma Naruc	0.5	83.0	1.0	1.5
	Umacaduac	3.5	84.0	120.0	2.1
	Hohorai	30.0	111.0	300.0	30.0
Manatuto	Aiteas	0.2	66.0	5.0	13.5
	Ailili	0.3	66.0	3.0	10.0
	Iliheu	10.0	81.0	3.0	4.8
	Cribas	25.0	83.0	45.0	1.9
Aileu	11 sucos	10.5	52.2	19.7	89.8
Liquidoe	7 sucos	6.6	41.7	127.1	8.4
Remexio	8 sucos	15.3	34.1	112.9	16.9
Laclubar	6 sucos	18.7	124.7	91.0	2.6
Laclo	4 sucos	10.4	90.5	105.8	9.1
Manatuto	4 sucos	8.9	74.0	14.0	7.5
Total of Laclo		11.8	63.6	75.9	31.6

Source: Village Profile Survey (2006), JICA Study Team

Table 3.11 Trends of Occurrence of Natural Disasters in and around the Watersheds

(1) Comoro Watershed

Sub-district	Name	Flood	Landslide	Land degradation	Forest fire
Bazartete	Leorema	Class 3	Class 2	n.a.	Class 3
	Ulmera	Class 2	**Class 1**	Class 3	**Class 1**
	Tibar	**Class 1**	**Class 1**	**Class 1**	**Class 1**
	Fahilebo	Class 3	**Class 1**	Class 3	**Class 1**
Railaco	Lihu	Class 2	Class 3	Class 3	Class 3
	Matata	Class 4	Class 3	Class 3	Class 3
	Tocoluli	Class 3	Class 4	n.a.	Class 4
	Fatuquero	Class 3	Class 3	Class 2	Class 3
	Railaco Leten	Class 4	Class 3	Class 4	Class 3
	Railaco Craic	Class 4	Class 3	Class 4	Class 4
	Samalete	Class 4	**Class 1**	Class 4	Class 3
	Deleco	Class 4	Class 3	Class 4	Class 3
	Taraco	Class 4	Class 3	Class 4	Class 3
Laulara	Cotalau	Class 4	Class 3	**Class 1**	Class 3
	Talitu	Class 4	Class 3	Class 2	Class 3
	Madabeno	Class 4	Class 3	Class 3	Class 3
	Tohumeta	**Class 1**	**Class 1**	Class 3	Class 3
	Fatisi	Class 3	Class 3	**Class 1**	Class 3
Aileu	Seloi Craic	Class 4	Class 3	Class 3	Class 3
Bazartete	Class 1	1	3	1	3
	Class 2	1	1	0	0
	Class 3	2	0	2	1
	Class 4	0	0	0	0
Railaco	Class 1	0	1	0	0
	Class 2	1	0	1	0
	Class 3	2	7	2	7
	Class 4	6	1	5	2
Laulara	Class 1	1	1	2	0
	Class 2	0	0	1	0
	Class 3	1	4	2	5
	Class 4	3	0	0	0
Aileu	Class 1	0	0	0	0
	Class 2	0	0	0	0
	Class 3	0	1	1	1
	Class 4	1	0	0	0
Total of Comoro	Class 1	**2**	**5**	**3**	**3**
	Class 2	**2**	**1**	**2**	**0**
	Class 3	**5**	**12**	**7**	**14**
	Class 4	**10**	**1**	**5**	**2**

Source: Village Profile Survey (2005), JICA

Note: The classes used indicate the potential/severity of the respective disasters, namely,
Class 1: Occurrence of event is "frequent and increasing".
Class 2: Occurrence of event is "frequent" or "less frequent but increasing".
Class 3: Occurrence of event is "less frequent" or "frequent but decreasing"..
Class 4: No event has occurred.

Table 3.11 Trends of Occurrence of Natural Disasters in and around the Watersheds

(2) Laclo Watershed

Sub-district	Name	Flood	Landslide	Land degradation	Forest fire
Aileu	Asirimou	**Class 1**	Class 3	Class 3	Class 3
	Fatubosa	Class 2	Class 2	Class 3	Class 3
	Lahae	Class 3	Class 3	Class 3	Class 3
	Saboria	Class 4	Class 3	Class 3	Class 4
	Fahiria	**Class 1**	**Class 1**	**Class 1**	Class 4
	Lausi	Class 4	**Class 1**	Class 3	Class 3
	Sucu Liurai	Class 4	**Class 1**	**Class 1**	**Class 1**
	Bandudato	Class 4	Class 4	Class 4	Class 2
	Hoholau	Class 4	Class 2	Class 2	Class 2
	Seloi Malere	Class 4	Class 2	Class 3	Class 3
	Seloi Craic	Class 4	Class 3	Class 3	Class 4
Liquidoe	Bereleu	Class 4	Class 3	Class 3	Class 3
	Namoleso	Class 4	Class 4	Class 2	Class 4
	Acubilitoho	**Class 1**	**Class 1**	Class 2	Class 4
	Betulau	Class 3	Class 2	Class 3	Class 3
	Manucassa	Class 3	Class 3	**Class 1**	Class 3
	Fahisoi	Class 4	Class 2	Class 3	Class 4
	Faturilau	Class 4	Class 2	Class 2	Class 4
Remexio	Maumeta	Class 4	Class 3	Class 3	Class 4
	Tulataqueo	Class 4	Class 4	Class 3	Class 3
	Faturasa	Class 4	Class 4	Class 3	Class 3
	Acumau	Class 4	Class 3	Class 3	Class 2
	Hautoho	Class 4	Class 4	Class 3	Class 3
	Fadabloco	Class 4	Class 4	Class 3	Class 3
	Suco Liurai	Class 4	Class 4	**Class 1**	Class 3
	Fahisoi	Class 4	Class 4	Class 3	Class 3
Laclubar	Batara	Class 3	**Class 1**	Class 3	**Class 1**
	Manelima	Class 2	**Class 1**	**Class 1**	Class 3
	Oralalan	Class 4	Class 2	Class 4	Class 3
	Funar	Class 4	Class 3	**Class 1**	Class 3
	Fatumaquerec	Class 4	Class 2	Class 4	**Class 1**
	Sanana'in	**Class 1**	Class 3	**Class 1**	Class 3
Laclo	Lacomesac	**Class 1**	Class 2	**Class 1**	Class 3
	Uma Naruc	**Class 1**	**Class 1**	**Class 1**	**Class 1**
	Umacaduac	**Class 1**	**Class 1**	**Class 1**	**Class 1**
	Hohorai	Class 4	**Class 1**	Class 4	Class 4
Manatuto	Aiteas	Class 3	Class 3	**Class 1**	Class 2
	Ailili	Class 2	Class 2	Class 2	**Class 1**
	Iliheu	Class 3	Class 2	Class 4	**Class 1**
	Cribas	Class 4	**Class 1**	Class 3	**Class 1**
Aileu	Class 1	2	3	2	1
	Class 2	1	3	1	2
	Class 3	1	4	7	5
	Class 4	7	1	1	3
Liquidoe	Class 1	1	1	1	0
	Class 2	0	3	3	0
	Class 3	2	2	3	3
	Class 4	4	1	0	4
Remexio	Class 1	0	0	1	0
	Class 2	0	0	0	1
	Class 3	0	2	7	6
	Class 4	8	6	0	1
Laclubar	Class 1	1	2	3	2
	Class 2	1	2	0	0
	Class 3	1	2	1	4
	Class 4	3	0	2	0
Laclo	Class 1	3	3	3	2
	Class 2	0	1	0	0
	Class 3	0	0	0	1
	Class 4	1	0	1	1
Manatuto	Class 1	0	1	1	3
	Class 2	1	2	1	1
	Class 3	2	1	1	0
	Class 4	1	0	1	0
Total of Comoro	Class 1	**7**	**10**	**11**	**8**
	Class 2	**3**	**11**	**5**	**4**
	Class 3	**6**	**11**	**19**	**19**
	Class 4	**24**	**8**	**5**	**9**

Source: Village Profile Survey (2006), JICA Study Team

Note: The classes used indicate the potential/severity of the respective disasters, namely,
Class 1: Occurrence of event is "frequent and increasing".
Class 2: Occurrence of event is "frequent" or "less frequent but increasing".
Class 3: Occurrence of event is "less frequent" or "frequent but decreasing"..
Class 4: No event has occurred.

Table 4.1 Result of Zoning

Unit : ha

District	SubDistric	Suco	District				Total
			Protection	Special Management	Sustainable Zone	Production/Community	
Aileu	Aileu	Asirimou	227	794	1,380	571	2,972
		Bandudato	197	829	1,455	574	3,056
		Fahiria	477	1,424	1,856	605	4,362
		Fatubosa	464	724	1,458	260	2,906
		Hoholau	1	8	63	30	103
		Lahae	75	229	827	218	1,349
		Lausi	44	104	292	75	516
		Saboria	227	791	912	280	2,209
		Seloi Craic	363	385	519	81	1,348
		Seloi Malere	92	250	614	337	1,293
		Suco Liurai	869	1,390	2,770	1,141	6,170
		Sub Total	3,035	6,927	12,147	4,172	26,282
	Laulara	Cotolau	181	225	192	30	628
		Fatisi	357	503	277	42	1,178
		Madabeno	671	212	247	25	1,155
		Talitu	293	343	260	32	928
		Tohumeta	246	274	238	10	767
		Sub Total	1,748	1,556	1,213	139	4,657
	Liquidoe	Acubilitoho	159	365	618	120	1,262
		Bereleu	214	801	1,382	263	2,660
		Betulau	63	157	386	233	839
		Fahisoi	169	131	434	65	799
		Faturilau	739	2,425	3,862	711	7,738
		Manucasa	126	244	335	73	778
		Namoleso	207	265	497	69	1,037
		Sub Total	1,677	4,389	7,513	1,534	15,113
	Remexio	Acumau	212	720	1,268	376	2,576
		Fadabloco	222	473	968	101	1,764
		Fahisoi	149	326	819	100	1,394
		Faturasa	477	1,940	2,047	359	4,823
		Hautoho	250	628	585	59	1,522
		Maumeta	69	168	256	37	530
		Suco Liurai	104	927	971	369	2,371
		Tulataqueo	569	1,539	1,961	288	4,357
		Sub Total	2,052	6,722	8,874	1,688	19,336
	Total		8,513	19,595	29,747	7,533	65,388
Ainaro	Maubisse	Fatu Besi	243	374	610	130	1,357
		Manelobas	34	25	8	2	70
		Maubisse	14	8	16	9	46
		Maulau	835	1,220	1,645	340	4,040
		Suco Liurai	680	101	134	17	932
	Total		1,805	1,728	2,413	498	6,445
Dili	Dom Aleixo	Comoro	37	94	140	56	326
		Sub Total	37	94	140	56	326
	Metinaro	Duyung (Sereia)	20	257	277	139	692
		Sabuli	2	7	7	0	17
		Sub Total	22	264	284	139	709
	Vera Cruz	Dare	426	626	293	62	1,407
		Sub Total	426	626	293	62	1,407
	Total		485	983	716	257	2,442
Ermera	Railaco	Deleco	95	115	111	11	332
		Fatuquero	129	317	261	41	748
		Lihu	157	478	840	374	1,849
		Matata	13	33	48	7	101
		Railoco Craic	274	304	507	66	1,150
		Railoco Leten	400	364	506	67	1,337
		Samalete	262	257	434	41	994
		Taraco	225	390	381	76	1,072
		Tocoluli	37	78	287	79	480
	Total		1,592	2,335	3,375	762	8,064
Liquica	Bazartete	Fahilebo	80	367	900	506	1,852
		Leorema	127	348	645	68	1,188
		Tibar	375	365	209	32	981
		Ulmera	83	244	435	134	896
	Total		664	1,324	2,189	740	4,917

Table 4.1 Result of Zoning

Unit : ha

District	SubDistric	Suco	District				Total
			Protection	Special Management	Sustainable Zone	Production/Community	
Manatuto	Laclo	Hohorai	624	1,452	2,628	400	5,104
		Lacumesac	779	1,637	6,597	3,420	12,433
		Uma Naruc	1,244	2,025	3,903	1,634	8,806
		Umacaduac	865	1,442	1,647	707	4,661
		Sub Total	3,511	6,555	14,776	6,162	31,004
	Laclubar	Batara	1,275	2,704	1,575	928	6,482
		Fatumaquerec	545	794	427	60	1,826
		Funar	1,325	2,984	1,753	1,107	7,168
		Manelima	33	40	21	2	97
		Orlalan	234	416	411	227	1,288
		Sanana'in	312	1,112	2,018	571	4,014
		Sub Total	3,724	8,050	6,206	2,895	20,876
	Manatuto	Ailili	15	45	515	417	992
		Aiteas	4	63	196	63	326
		Cribas	107	654	842	687	2,291
		Iliheu	86	133	578	782	1,580
		Sub Total	212	896	2,131	1,950	5,188
	Total		7,447	15,501	23,113	11,007	57,068
Manufahi	Turiscai	Caimauc	267	256	267	34	824
		Fatucalo	1,162	1,188	426	76	2,853
		Lesuata	379	665	520	134	1,698
		Liurai	421	385	513	93	1,412
		Manumera	21	28	99	13	161
		Matorec	9	40	11	0	60
	Total		2,259	2,562	1,836	349	7,007
Grand Total			22,765	44,029	63,389	21,147	151,330

Table 5.1 SWOT Analysis of the Agricultural Management Types

ype		Major potentials and constraints
Ⅰ	Paddy Complex	Strengths: - There are existing paddy fields that could be used for grazing after harvesting rice. - Surface water is available for irrigation in the downstream of the Laclo river. - There is a plenty of ruminants in and around the area. Weaknesses: - Hills surrounding paddy fields are overgrazed. - There is no or little consideration/custom on the use of animal wastes - Yield of paddy is low due to poor quality of seeds (incl. mixing varieties), lack of irrigation, and low input - Labor force is limited. Opportunities: -Government and some agencies/NGOs are interested in natural resource management. -Government is now putting priority on rice production. -Irrigation development project in the surrounding area. Threats: - Rainfall especially in the downstream of the Laclo river is unstable (sometimes less than 1,000mm/y) - Drought frequently occurs. - Poisonous weeds have invaded and expanded in farms and grasslands
Ⅱ	Coffee Complex	Strengths: - There is an assured market for coffee. - Part of the produce in the country is certified as organic coffee. - Coffee farmers often tie animals with rope to protect coffee plantations. - Coffee grown areas have rather stable rainfall. Weaknesses: - Many coffee trees are overage. - Productivity of coffee is low. - Sources of income other than coffee are limited. - Yield of upland crops is low due to poor quality or shortage of seeds, lack of irrigation, and low input. - Labor force is limited. Opportunities: - Demand of organic coffee has expanded. - Other crops (vegetables, fruits, cash crops) could be introduced. - Government and some agencies/NGOs have been introducing technologies to improve coffee production. - Rejuvenated overage coffee trees and replaced shade trees can be a source of firewood or timber. - Agricultural production of upland crops can be improved by introducing quality seeds that could be obtained from other districts and/or MAF/Seed of Life. Threats: - A gall rust disease of Albizia shade trees has expanded. - Land degradation is progressing in upland field. - A poisonous weed have invaded and expanded in farms and grasslands.
Ⅲ	Upland	Strengths: - There are ruminant animal with less pressure to natural resources as compared to lowland area. - There are still extensive land resources. Weaknesses: - Outcome/yield of crops is heavily dependent on weather conditions. - Soil erosion has often taken place due to no application of soil conservation measures in the fields. - Yield of upland crops is low due to poor quality or shortage of seeds, lack of irrigation, and low input. - There are little sources of income. - Accessibility to the area is generally poor. - Labor force is limited. Opportunities: - Other crops (vegetables, fruits, cash crops) can be introduced. - Government and some agencies/NGOs have been introducing technologies for upland farming - Agricultural production of upland crops can be improved by introducing quality seeds that could be obtained from other districts and MAF/Seed of Life. Threats: - Land degradation is progressing. - A poisonous weed have invaded and expanded in farms and grasslands.

Source: JICA Study Team (2007)

Table 6.1 Prioritization of Sub-watersheds in the Laclo and Comoro Watersheds

Watershed Name	Sub Watersheds		Type of Zoning						Soil erosion rate		Accesibility to Dili	Est. Average Income		Total Score
	No.	Name	Protection		Special Management		P + SM							
			ha	%	ha	%	%	Scoring	t/ha/year	Scoring	Scoring	USD / Month	Scoring	
	1	Bemos River	1,519	35%	1,562	36%	70%	**4**	713	**4**	**5**	24.7	**3**	**16**
	2	Balele River	2,084	22%	2,905	31%	53%	**3**	593	**3**	**3**	29.7	**3**	**12**
	3	Anggou River	193	8%	579	25%	33%	**2**	320	**2**	**3**	33.1	**4**	**11**
	4	Buamara River	636	18%	993	29%	47%	**3**	496	**3**	**3**	37.6	**4**	**13**
	5	Ue Coi River	1,268	14%	2,563	29%	44%	**3**	402	**3**	**3**	9.1	**5**	**14**
	6	Sumasse River	633	10%	943	15%	25%	**2**	427	**3**	**3**	4.0	**5**	**13**
	7	Lihubani River	1,730	10%	5,028	30%	40%	**3**	577	**3**	**3**	8.4	**5**	**14**
	8	Daisoli River	2,097	17%	2,948	24%	40%	**3**	703	**4**	**2**	49.3	**1**	**10**
	9	Monofunihun River	1,575	11%	4,356	30%	41%	**3**	862	**5**	**3**	25.1	**3**	**14**
	10	Manotahe River	891	14%	1,553	24%	38%	**2**	678	**4**	**3**	49.8	**1**	**10**
	11	Noru River	1,491	12%	4,210	33%	44%	**3**	786	**4**	**3**	8.9	**5**	**15**
	12	Eraibanaubere River	2,758	20%	4,652	34%	55%	**3**	885	**5**	**1**	6.1	**5**	**14**
	13	Malikan River	1,334	24%	1,848	33%	57%	**3**	723	**4**	**1**	8.1	**5**	**13**
	14	Lohun River	2,043	12%	4,787	28%	40%	**3**	625	**4**	**3**	19.6	**4**	**14**

Class of propotion of Protection and Spe		Class of scoring for soil potential of soil er			Class of Accesibility		Class of Average Income		
1	0-20%	1	0-200	t/ha/yr	1	> 4 hours	1	40-50	USD/month/HH
2	20-40%	2	200-400	t/ha/yr	2	3 - 4 hours	2	30-40	USD/month/HH
3	40-60%	3	400-600	t/ha/yr	3	2 - 3 hours	3	20-30	USD/month/HH
4	60-80%	4	600-800	t/ha/yr	4	1 - 2 hours	4	10-20	USD/month/HH
5	80-100%	5	800-	t/ha/yr	5	< 1 hour	5	0-10	USD/month/HH

Table 6-2 Potential and Suitable Sucos for Sub-programs

District	SubDistric	Suco	Sub-programs																	
			Landuse/Management Program	Afforestation/Forest Management Program			Farm and Livestock Management Program			Agroforestry and Silvo-Pastoral Land Management Program			Slope Protection and Sediment Control Program				Community/Livelihood Development Program		Information Dissemination/Awareness Raising Program	
			Participatory Land Use	Tree Planting Promotion	Seedling Production Promotion	Forest Management Planning	Community-based Seed Extension	Home Garden	Animal Feed Preservation	Sustainable Upland Farming Promotion	Coffee Plantation Rehabilitation	Grazing Control with Protein Bank	Slope Protection Works	Sediment Flow Control	Initial Gully Control	Riverbank Protection	Alternative Rural Energy Development	Income Generating	Public Awareness Raising	Environmental Education
AILEU	AILEU	AISIRIMOU	2	4	4	5	4	4	3	2	4	3	3	3	3	5	2	4	3	3
		BANDUDATO	2	4	4	5	2	2	4	2	5	4	4	4	4	5	3	2	2	4
		FAHIRIA	1	3	3	4	2	2	4	2	5	4	1	1	1	5	3	2	4	3
		FATUBOSA	1	3	3	4	3	3	5	2	1	5	2	2	3	5	2	3	3	5
		HOHOLAU	3	5	5	5	4	4	4	2	5	4	2	2	2	5	2	4	2	5
		LAHAE	2	5	5	5	4	4	4	2	4	4	3	3	3	5	2	4	3	5
		LAUSI	2	5	5	5	2	2	4	2	4	4	1	1	3	5	1	2	3	5
		SABORIA	1	4	4	4	3	3	3	2	5	3	3	3	3	5	3	3	4	3
		SELOI CRAIC	1	5	5	3	3	3	2	2	4	2	3	3	3	5	2	3	4	4
		SELOI MALERE	2	5	5	5	3	3	4	2	4	4	2	2	3	5	1	3	3	5
		SUCO LIURAI	2	3	3	4	3	3	4	2	4	4	1	1	1	5	3	3	1	1
	LAULARA	COTOLAU	1	5	5	3	3	3	4	2	4	4	3	3	1	5	1	3	3	4
		FATISI	1	4	4	3	2	2	4	2	5	4	3	3	1	1	1	2	3	4
		MADABENO	1	4	4	2	2	2	4	4	3	4	3	3	3	5	1	2	3	4
		TALITU	1	5	5	3	4	4	4	2	3	4	3	3	2	5	2	4	3	3
		TOHUMETA	1	3	3	3	3	3	2	2	5	2	1	1	3	5	2	3	3	5
	LIQUIDOE	ACUBILITOHO	1	4	4	4	3	3	4	2	5	4	1	1	2	5	2	3	4	4
		BERELEU	2	3	3	5	3	3	4	1	5	4	3	3	3	5	3	3	3	4
		BETULAU	2	5	5	5	4	4	5	2	5	5	2	2	3	5	2	4	3	5
		FAHISOI	2	5	5	3	2	2	4	2	3	4	2	2	3	5	1	2	4	3
		FATURILAU	1	4	4	5	3	3	5	1	5	5	2	2	2	5	4	3	2	4
		MANUCASA	1	5	5	4	3	3	4	2	5	4	3	3	1	5	2	3	3	4
		NAMOLESO	1	4	4	4	3	3	5	2	5	5	4	4	2	5	1	3	4	3
	REMEXIO	ACUMAU	2	4	4	5	4	4	5	2	4	5	3	3	3	5	3	4	2	4
		FADABLOCO	2	4	4	4	3	3	5	1	4	5	4	4	3	5	1	3	3	4
		FAHISOI	2	4	4	4	2	2	4	1	5	4	4	4	3	5	1	2	3	4
		FATURASA	1	3	3	5	3	3	5	1	5	5	4	4	3	5	3	3	3	3
		HAUTOHO	1	4	4	4	2	2	4	2	5	4	4	4	3	5	2	2	3	3
		MAUMETA	1	5	5	4	2	2	4	1	5	4	3	3	3	5	1	2	4	5
		SUCO-LIURAI	1	5	5	5	3	3	4	1	5	4	4	4	1	5	4	3	3	5
		TULATAQUEO	1	4	4	4	4	4	5	1	4	5	4	4	3	5	3	4	3	3
AINARO	MAUBISSE	FATU-BESI	1	4	4	4	4	4	3	2	5	3	N.A.	N.A.	N.A.	5	2	4	N.A.	5
		MANELOBAS	1	5	5	2	4	4	5	3	5	5	N.A.	N.A.	N.A.	5	4	4	N.A.	5
		MAUBISSE	1	5	5	3	2	2	5	3	5	5	N.A.	N.A.	N.A.	5	4	2	N.A.	5
		MAULAU	1	4	4	3	4	4	3	2	5	3	N.A.	N.A.	N.A.	5	2	4	N.A.	3
		SUCO LIURAI	1	3	3	1	3	3	2	4	4	2	N.A.	N.A.	N.A.	5	2	3	N.A.	4
DILI	DOM ALEIXO	COMORO	2	5	5	4	3	3	5	2	5	5	N.A.	N.A.	N.A.	1	4	3	N.A.	5
	METINARO	DUYUNG (SEREIA)	2	5	5	5	1	1	5	2	5	5	N.A.	N.A.	N.A.	5	4	1	N.A.	5
		SABULI	1	5	5	4	3	3	5	1	5	5	N.A.	N.A.	N.A.	5	4	3	N.A.	5
	VERA CRUZ	DARE	1	4	4	3	2	2	5	2	3	5	N.A.	N.A.	N.A.	1	4	2	N.A.	3
ERMERA	RAILACO	DELECO	1	5	5	3	3	3	1	2	3	1	3	3	4	5	1	3	3	4
		FATUQUERO	1	4	4	4	3	3	2	2	4	2	3	3	2	5	1	3	3	4
		LIHU	2	5	5	5	2	2	4	2	1	4	3	3	3	5	3	2	3	4
		MATATA	1	5	5	5	2	2	4	1	3	4	3	3	3	5	1	2	3	5
		RAILACO CRAIC	1	4	4	3	2	2	1	2	1	1	3	3	4	5	2	2	4	3
		RAILACO LETEN	1	4	4	3	3	3	2	2	1	2	3	3	4	5	2	3	3	4
		SAMALETE	1	4	4	3	2	2	3	2	4	3	1	1	4	5	1	2	3	3
		TARACO	1	4	4	3	2	2	3	2	4	3	3	3	4	5	2	2	3	4
		TOCOLULI	2	5	5	5	3	3	3	2	4	3	4	4	N.A.	5	1	3	4	5
LIQUICA	BAZARTETE	FAHILEBO	2	5	5	5	3	3	4	2	4	4	1	1	3	5	3	3	1	5
		LEOREMA	2	5	5	4	3	3	4	1	1	4	2	2	N.A.	5	1	3	3	5
		TIBAR	1	4	4	3	2	2	4	3	5	4	1	1	1	1	1	2	1	3
		ULMERA	2	5	5	5	2	2	3	2	4	3	1	1	3	5	1	2	1	5
MANATUTO	LACLO	HOHORAI	1	1	1	4	3	3	5	2	5	5	1	1	4	1	4	3	4	4
		LACUMESAC	3	1	1	5	2	2	5	2	5	5	2	2	1	1	4	2	3	5
		UMA NARUC	2	1	1	4	3	3	5	2	5	5	1	1	1	1	4	3	1	5
		UMACADUAC	1	3	3	4	3	3	5	2	5	5	1	1	1	1	3	3	1	4
	LACLUBAR	BATARA	1	4	4	4	2	2	4	2	4	4	1	1	3	5	3	2	1	1
		FATUMAQUEREC	1	3	3	3	4	4	2	2	5	2	2	2	4	5	4	4	1	3
		FUNAR	1	4	4	4	3	3	5	2	5	5	3	3	1	5	4	3	3	4
		MANELIMA	1	5	5	3	3	3	5	2	5	5	1	1	1	5	4	3	3	5
		ORLALAN	1	5	5	4	3	3	4	2	4	4	2	2	4	5	2	3	3	3
		SANANA'IN	2	4	4	5	3	3	5	2	5	5	3	3	1	1	4	3	3	5
	MANATUTO	AILILI	3	5	5	5	1	1	4	3	5	4	2	2	2	1	2	1	1	5
		AITEAS	2	5	5	5	3	3	4	2	5	4	3	3	1	5	3	3	2	5
		CRIBAS	2	5	5	5	3	3	4	2	5	4	1	1	3	5	4	3	1	5
		ILIHEU	3	5	5	5	2	2	5	3	5	5	2	2	4	1	1	2	1	5
MANUFAHI	TURISCAI	CAIMAUC	1	4	4	3	4	4	2	2	5	2	N.A.	N.A.	N.A.	5	2	4	N.A.	5
		FATUCALO	1	4	4	2	3	3	4	3	5	4	N.A.	N.A.	N.A.	5	4	3	N.A.	4
		LESUATA	1	4	4	3	3	3	4	2	5	4	N.A.	N.A.	N.A.	5	4	3	N.A.	4
		LIURAI	1	4	4	3	3	3	4	2	4	4	N.A.	N.A.	N.A.	5	2	3	N.A.	5
		MANUMERA	2	5	5	4	4	4	4	2	5	4	N.A.	N.A.	N.A.	5	1	4	N.A.	5
		MATOREC	1	5	5	4	3	3	5	1	4	5	N.A.	N.A.	N.A.	5	4	3	N.A.	5

*1 : Class 1 Highly Suitable, Class 2 Moderate Suitable, Class 3 Marginal Suitable, Class 4 Limited Suitable, Class 5: Not Suitable

N.A.: Data not available

Table 6.3 Suitable and Possible Combinations of Sub-programs

Main Program	Main Sub-program	Combined Sub-programs																					
		Participatory Land Use Planning	Tree Plantating Promotion	Seedling Production Promotion	Forest Management Planning	Community-based Seed Extension	Home Garden	Animal Feed Preservation	Sustainable Upland Farming Promotion	Coffee Plantation Rehabilitation	Grazing Control with Protein Bank	Slope Protection Works along Roads and in Hillsides	Sediment Flow Control	Initial Gully Control	Riverbank Protection Works	Alternative Rural Energy Development	Income-Generating	Public Awareness Raising	Environmental Education	watershed-related Institutional Development	Capacity Development for Government Staff	Capacity Development for Local NGOs and Facilitators	Mobility/Communication System Improvement
Land Use/Management	Participatory Land Use Planning	–	2	2	2	2	1	1	2	1	2	1	1	2	1	2	2	2	1	2	2	2	2
Reforestation/Forest Management	Tree Planting Promotion	2	–	2	1	2	2	1	2	2	1	1	1	1	1	2	2	2	1	1	2	1	2
	Seedling Production Promotion	2	2	–	1	2	2	1	2	2	1	1	1	1	1	2	2	2	1	1	2	1	2
	Forest Management Planning	2	1	1	–	1	1	1	1	1	1	1	1	1	1	2	2	2	1	2	2	2	2
Farm and Livestock Management	Community-based Seed Extension	2	2	2	1	–	2	1	2	1	1	1	1	2	1	1	2	1	1	1	2	2	2
	Home Garden	1	2	2	1	2	–	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2
	Animal Feed Preservation	1	1	1	1	1	1	–	1	1	2	1	1	1	1	1	1	1	1	1	2	2	2
Agro-forestry and Silvo-Pastoral Land Management	Sustainable Upland Farming Promotion	2	2	2	1	2	1	1	–	1	1	1	1	2	1	1	1	1	1	1	2	2	2
	Coffee Plantation Rehabilitation	1	2	2	1	1	1	1	1	–	1	1	1	1	1	1	2	2	1	1	2	2	2
	Grazing Control with Protein Bank	2	1	1	1	1	1	2	1	1	–	1	1	2	1	1	1	2	1	1	2	2	2
Slope Protection and Sediment Control	Slope Protection Works along Roads and in Hillsides	1	1	1	1	1	1	1	1	1	1	–	2	2	2	1	2	2	1	1	2	2	2
	Sediment Flow Control	1	1	1	1	1	1	1	1	1	1	2	–	2	2	1	2	2	1	1	2	2	2
	Initial Gully Control	1	1	1	1	2	1	1	2	1	2	2	2	–	2	1	1	1	1	1	2	2	2
	Riverbank Protection Works	1	1	1	1	1	1	1	1	1	1	2	2	2	–	1	2	2	1	1	2	2	2
Community/Livelihood Development	Alternative Rural Energy Development	2	2	2	2	1	1	1	1	1	1	1	1	1	1	–	2	2	2	1	2	2	2
	Income-Generating	2	2	2	1	2	1	1	2	2	1	2	2	1	2	2	–	1	1	1	2	2	2
Information Dissemination and Awareness Raising	Public Awareness Campaign	2	2	2	2	1	1	1	1	2	2	2	2	2	2	2	1	–	2	2	2	2	2
	Environmental Education	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	–	1	2	2	1
Capacity Development	watershed-related Institutional Development	2	1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	2	1	–	2	2	1
	Capacity Development for Government Staff	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	–	2	1
	Capacity Development for Local NGOs and Facilitators	2	1	1	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	–	1
	Mobility/Communication System Improvement	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	1	1	1	1	–

Note): 0: Not always necessary to combine /alternative to each other, 1: Possible to combine, and 2: Suitable to combine

Table 7.1 Scopes of the Major Works for the Five-year Management Plan

Works	Sub-activities	Outlines of the works
Preparatory Work	Procurement of NGOs or experts	a. Preparation of TOR for the works b. Recruitment of experts or NGOs c. Evaluation and selection of experts or NGOs
	Guidance to the project staff	a. Definition of roles and responsibilities of the government staff involved b. Organization of 2~3 days guidance sessions to the government staff involved and experts/NGOs recruited, respectively
	Consultation with communities	a. Organization of meetings with suco leaders of the target sucos to explain the purpose and outlines of the watershed management plan and to sound their willingness to take part in the sub-programs b. Organization of consultation meetings with communities of the target sucos to explain the purpose and outlines of the sub-programs
	Participatory situation analysis	a. Organization of a series of workshops/meetings with local communities of the target sucos to survey the following aspects of the village using PRA/RRA survey tools. - History and background of suco - Socio-economic conditions and social structure - Seasonal agricultural and economic activities - Present land and resource use - Available resources and present marketing practices - Existing customary rules on natural resource use - Analyses of data and information collected through the workshops and meetings organized
	Guidance to local communities on overall work plan	a. Organization of meetings with local communities to explain the overall work plan in the target villages
PLUP-SP	Group organization	a. Identification/Selection of participating members of the working group b. Determination of roles and responsibilities of members
	Exposure visit	a. Organization of an exposure visit to suco where similar activities have been implemented successfully (such as suco Faturasa) for the members b. Organization of a feedback meeting among the members so as to share their finding in the trip and ideas on the sub-program
	Work planning	a. Organization of a participatory planning workshop with the working group and development of a work plan for the entire sub-program period a. Re-estimation of the necessary budget for implementation of the work plan
	Workshops / Meetings	a. Organization of a series of workshops/meetings with the working group to discuss the following topics: - Present land use of suco - Past and present land and natural resource use rules - Future land and resource use options - Future land use of suco - Village regulations/by-laws b. Organization of plenary meetings of the target sucos to have endorsement on the village regulations/by-laws from local communities in the sucos.
	Tara Bandu ceremony	a. Organization of a Tara Bandu ceremony inviting all the local communities in the sucos, village leaders of the neighboring sucos, representatives of sub-district and district administrative offices, representatives of PNTL in sub-district, representatives of NDF and MAF, and other relevant organizations b. Consultation with NDF/MAF and the sub-district and district administration offices concerned to obtain endorsement on the village regulations/by-laws from those offices
	Monitoring of implementation	a. Organization of a monitoring meetings with the suco leaders every month to discuss any issues and cases that have taken place in the village for a month and find solution for the issues
	Revision of the regulations	a. Revision of the village regulations/by-laws when needs arise (e.g., change in suco leaders, change in land use, etc.)
TPP-SP	Group organization	a. Identification/Selection of core members and other participating members b. Determination of roles and responsibilities of members
	Exposure visit	a. Organization of an exposure visit to suco where similar activities have been implemented successfully for core members with selected regular members b. Organization of a feedback meeting with all the group members so as to share the findings of the exposure visit to other members

Works	Sub-activities	Outlines of the works
TPP-SP	Work planning	a. Organization of a participatory planning workshop with group members and development of a work plan for the entire sub-program period b. Re-estimation of the necessary budget for implementation of the work plan c. Review of the work plan once a year and revise it when necessary
	Hands-on training	a. Organization of a series of hands-on training courses including, but not limited to, the following topics: - Land preparation - Designing of plantation and sticking - Hole digging and back filling - Planting seedlings - Tending activities (weeding, cultivation, etc.) b. Provision of farm tools for the group members to replicate the techniques learned through the training courses
	Monitoring and evaluation	a. Monitoring and evaluation of the growth conditions of seedlings planted.
SP-SP	Group organization	Same as those for TPP-SP
	Exposure visit	Same as those for TPP-SP
	Work planning	Same as those for TPP-SP
	Hands-on training	a. Organization of a series of hands-on training courses including, but not limited to, the following topics: - Identification of community nurseries - Installation of water systems - Establishment of community nurseries - Collection seeds - Compost making - Sowing seeds in seedbeds - Filling soils mixed with compost into poly bags - Transplanting of germinated seedlings - Maintenance of seedlings and nurseries b. Provision of materials and farm tools necessary for the group members to produce seedlings and work for nursery operations
	Distribution of seedlings	a. Distribution of seedlings among the members and sale of seedlings to the neighboring sucos if need arises.
CBSE-SP	Group organization	Same as those for TPP-SP
	Exposure visit	Same as those for TPP-SP
	Work planning	Same as those for TPP-SP
	Hands-on training	a. Organization of a series of hands-on training courses including, but not limited to, the following topics: - Identification of locations for demonstration plots - Selection of seeds - Land preparation - Sowing seeds - Maintenance of farms - Harvesting and seed collection - Storage of seeds (Post-harvesting) - Maintenance of seedlings and nurseries b. Provision of farm tools for the group members to replicate the techniques learned through the training courses
HG-SP	Group organization	Same as those for TPP-SP
	Exposure visit	Same as those for TPP-SP
	Work planning	Same as those for TPP-SP
	Hands-on training	a. Organization of a series of hands-on training courses including, but not limited to, the following topics: - Identification of locations for demonstration plots - Establishment of vegetable farms (or demonstration plots) - Compost making - Establishment of seedbeds - Sowing seeds (including treatment of seeds) - Transplanting germinated seedlings - Maintenance of seedlings - Preparation and use of liquid fertilizer - Preparation and use of natural pesticide - Harvesting and collection of seeds b. Provision of materials and farm tools necessary for the group members to replicate the techniques learned through the training courses

Works	Sub-activities	Outlines of the works
SUFP-SP	Group organization	Same as those for TPP-SP
	Exposure visit	Same as those for TPP-SP
	Work planning	Same as those for TPP-SP
	Hands-on training	a. Organization of a series of hands-on training courses including, but not limited to, the following topics: - Identification of locations for demonstration plots - Compost making - How to make and use an A-frame - Application of bench terrace and contour composting - Land preparation and application of compost - Sowing seeds - Maintenance of crops - Harvesting and seed collection - Maintenance of bench terrace and contour composting b. Provision of materials and farm tools necessary for the group members to replicate the techniques learned through the training courses
CRP-SP	Group organization	Same as those for TPP-SP
	Exposure visit	Same as those for TPP-SP
	Work planning	Same as those for TPP-SP
	Hands-on training	a. Organization of a series of hands-on training courses including, but not limited to, the following topics: - Identification of locations for demonstration plots - Pruning of coffee trees - Rejuvenation of aged coffee trees - Planting new coffee seedlings - Maintenance of coffee plantation - Harvesting of coffee cherries - Post-harvesting or processing of cherries b. Provision of materials and farm tools necessary for the group members to replicate the techniques learned through the training courses
GCPB-SP	Group organization	Same as those for TPP-SP
	Exposure visit	Same as those for TPP-SP
	Work planning	Same as those for TPP-SP
	Meetings with the working group	a. Discussion among the working group on how to control grazing activities in the village b. Development of countermeasures to control grazing activities in the village c. Implementation and monitoring of countermeasures developed
	Hands-on training and development of protein banks	a. Conducts of hands-on training courses on development of protein banks - Identification of locations for protein banks - Land preparation - Designing of protein banks - Planting seedlings/seeds - Maintenance of seedlings
	Provision of seedlings of fodder crops	a. Provision of seedlings of fodder crops to the group members
IG/CS-SP	Group organization	Same as those for TPP-SP
	Exposure visit	Same as those for TPP-SP
	Work planning	Same as those for TPP-SP
	Hands-on training	a. Organization of a series of hands-on training courses on income generative activities identified such as: - Vegetable production; - Clothes mending; - Food processing; and - Tais making. b. Provision of materials and tools necessary for the group to implement the income generating / cost saving activities
	Daily coaching	a. Provision of daily coaching to core and other members in implementation of income generating/cost saving activities b. Provision of daily coaching to core members in management, especially financial management, of the activities

Works	Sub-activities	Outlines of the works
CDC-IGC-SP	Group organization	a. Identification/Selection of participating members of the working group b. Determination of roles and responsibilities of members
	Exposure visit	a. Organization of an exposure visit to suco where similar activities have been implemented successfully (such as suco Faturasa) for the members b. Organization of a feedback meeting among the members so as to share their finding in the trip and ideas on the sub-program
	Work planning	Same as those for TPP-SP
	Hands-on training	a. Organization of a series of hands-on training courses on small scale check dam construction such as: - wattling; - Planting vegetative strips; and - Maintenance b. Provision of materials and tools necessary for the group to construct small scale check dams
PAC-SP	Development of materials	a. Determination of topics or themes to be discussed b. Development of a scenario and materials (e.g., picture story books and films) for both children and adult target groups
	Conduct of 1st round tour	a. Presentation of PAC material for children b. Organization of a drawing session with children and a dialogue session between adult and children
	Conduct of 2nd round tour	a. Presentation of PAC material for adults b. Organization of a meeting among participating adults to discuss their daily activities and to realize the future land use plan developed in PULP-SP
	Conduct of 3rd round tour	a. Presentation of PAC material for adults b. Organization of a meeting among participating adults to discuss their daily activities and to realize the future land use plan developed in PULP-SP
CD-SP	Development of training program	a. Development of training programs for the district MAF staff (DOF, DOC, etc.), extensionists and forest guards b. Identification and arrangement of potential resource persons for training for the district MAF staff (DOF, DOC, etc.), extensionists and forest guards
	Seminar-type Training for District level staff	a. Organization of guidance/oritenation for the district MAF staff (DOF, DOC, etc.), extensionists and forest guards concerned on the five-year management plan and the sub-programs proposed b. Organization of seminar type technical training for extensionists and forest guards concerned on the sub-programs proposed
	OJT for district level staff	a. Involvement of extensionists and forest guards concerned in the implementation of the sub-programs as co-implementers
Evaluation of the sub-program	Organization of an evaluation workshop	a. Evaluate the effectiveness of the activities conducted in the sub-programs b. Evaluate the level of achievement of the expected outputs of the sub-programs c. Issues found in the course of the sub-programs c. Lessons learned and good practices
	Interviews to the members and non-members	a. Impacts made by the sub-programs b. Accomplishments made by the individual members by applying the techniques in their own farms/plots

Figure 7.2 Cost Disbursement Schedule for the Five-Year Management Plan

Work Items	2011	2012	2013	2014	2015	Total
I. Bemos Sub-watershed						
1. Preparatory Work						
1.1 Orientation/Guidance to the Staff	525					525
1.2 Socilization/Consultation with Target Villages	2,700	1,800	0	0	0	4,500
1.3 Situation Analysis	1,950	1,300	0	0	0	3,250
2. Implementation of the Identified Sub-programs						
2.1 Implementatoin of CD-SP						
2.1.1 Capacity Development Sub-program	28,185	0	0	0	0	28,185
2.2 Implementatoin of the sub-programs in sucos of Group 1 (Suco Tohumeta, Suco Talitu, and Suco Cotulau)						
2.2.1 Implementatoin of PLUP and PAC						
(1) Participatory Land Use Planning Sub-program	13,710	0	0	0	0	13,710
(2) Public Awareness Campaign Sub-program	4,450	3,525	0	0	0	7,975
2.2.2 Implementatoin of the Other Sub-programs						
(1) Sustainable Upland Farming Sub-program (in 3 sucos)	0	16,800	18,450	7,950	0	43,200
(2) Initial Gully Control Sub-progam (in 2 sucos)	0	5,380	800	0	0	6,180
(3) Treee Planting Promotion/Seedling Production Promotion Sub-program (in 1 suc	0	12,390	10,547	1,000	0	23,937
(4) Grazing Control & Protain Bank Sub-program (in 1 suco)	0	37,525	9,038	1,763	0	48,325
(5) Coffee Plantation Rehabilitation Sub-program (in 1 suco)	0	18,110	15,300	5,300	0	38,710
(6) Community Based Seed Extension Sub-program (in 1 suco)	0	9,088	5,288	1,413	0	15,788
2.3 Implementatoin of the sub-programs in sucos of Group 2 (Suco Dare and Suso Madabeno)						
2.3.1 Implementatoin of PLUP and PAC						
(1) Participatory Land Use Planning Sub-program	0	9,140	0	0	0	9,140
(2) Public Awareness Campaign Sub-program	0	2,760	2,320	0	0	5,080
2.3.2 Implementatoin of the Other Sub-programs						
(1) Community Based Seed Extension Sub-program (in 2 sucos)	0	0	13,775	11,775	2,825	28,375
(2) Home Garden Sub-program (in 2 sucos)	0	0	20,760	6,475	0	27,235
(2) Sustainable Uplan Farming Promotion Sub-program (1 suco)	0	0	6,200	6,150	2,650	15,000
(4) Income Generating/Cost Saving Sub-program	0	0	10,929	8,609	467	20,005
3. Evaluation						
3.1 Annual Evaluation and Monitoring	0	575	575	575	0	1,725
3.2 Final Evaluation	0	0	0	0	1,250	1,250
Total Cost for BemosSub-watershed	**51,520**	**118,392**	**113,981**	**51,009**	**7,192**	**342,094**
II. Noru Sub-watershed						
1. Preparatory Work						
1.1 Orientation/Guidance to the Staff	525	0	0	0	0	525
1.2 Socilization/Consultation with Target Villages	2,700	2,700	0	0	0	5,400
1.3 Situation Analysis	1,950	1,950	0	0	0	3,900
2. Implementation of the Identified Sub-programs						
2.1 Implementatoin of CD-SP						
2.1.1 Capacity Development Sub-program	28,185	0	0	0	0	28,185
2.2 Implementatoin of the sub-programs in sucos of Group 1 (Suco Tohumeta, Suco Talitu, and Suco Cotulau)						
2.2.1 Implementatoin of PLUP and PAC						
(1) Participatory Land Use Planning Sub-program	14,190	0	0	0	0	14,190
(2) Public Awareness Campaign Sub-program	4,450	3,525	0	0	0	7,975
2.2.2 Implementatoin of the Other Sub-programs						
(1) Sustainable Upland Farmng Sub-program	0	16,200	18,450	7,950	0	42,600
(2) Community Based Seed Extension Sub-program	0	20,663	17,663	4,238	0	42,563
(3) Income Generation / Cost Saving Sub-program	0	33,088	26,728	1,400	0	61,215
2.3 Implementatoin of the sub-programs in sucos of Group 2 (Suco Hautoho, Suco Fahisoi (Liquidoe), and Suco Maumeta)						
2.3.1 Implementatoin of PLUP and PAC						
(1) Participatory Land Use Planning Sub-program	0	14,190	0	0	0	14,190
(2) Public Awareness Campaign Sub-program	0	4,450	3,525	0	0	7,975
2.3.2 Implementatoin of the Other Sub-programs						
(1) Sustainable Upland Farmng Sub-program	0	0	16,200	18,450	7,950	42,600
(2) Community Based Seed Extension Sub-program	0	0	20,663	17,663	4,238	42,563
(3) Income Generation / Cost Saving Sub-program	0	0	33,088	26,728	1,400	61,215
3. Evaluation						
3.1 Annual Evaluation and Monitoring	0	575	575	575	0	1,725
3.2 Final Evaluation	0	0	0	0	1,250	1,250
Total Cost for Noru Sub-watershed	**52,000**	**96,765**	**136,315**	**76,428**	**13,588**	**375,095**
Grand Total for the Five-Year Plan	**103,520**	**215,157**	**250,296**	**127,437**	**20,779**	**717,189**